



# **Chemical Management Handbook**

## **FOR AUSTRALIAN SCHOOLS**

### **EDITION 1**

## Acknowledgements

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This handbook has been developed by Dr Virginia Ward.

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# Chemical Management Handbook

The Chemical Management Handbook was developed by Science ASSIST in recognition of a need for guidance on the safe handling, storage and waste disposal of chemicals in schools. The Handbook provides information on most<sup>i</sup> of the chemicals in the Science ASSIST List of Recommended Chemicals in the form of a one-page summary per chemical, which covers safe handling, storage and first aid, and waste disposal procedures.

For a few of the chemicals, an additional Laboratory Notes page is included, giving more detailed directions for solution preparation and/or waste disposal. For the enzymes, the individual summaries are in abbreviated form with other information provided as generic for the group.

The summary pages are arranged alphabetically in the document, and can also be accessed via the bookmarks which are ordered according to chemical group.

## Explanatory Notes

### IDENTIFIERS, DESCRIPTIVE, PHYSICAL AND REGULATORY DATA

Each summary page is headed by the **chemical name**, which corresponds to the chemical's main identifier in the List of Recommended Chemicals. Under this chemical name up to three of the more commonly used synonyms are given in italics.

Descriptive, Physical data and Regulatory information was drawn from a range of sources which are listed in the General References section (see below).

The **User Group** codes are defined as in the List of Recommended Chemicals as follows:

| User Group    | Definition   |
|---------------|--|
| <b>F-12</b>   | Recommended for use by students in Foundation (Reception, Kindergarten) to Year 12 as well as staff.   |
| <b>7-12</b>   | Recommended for use by students in Year 7 to Year 12, as well as staff.  |
| <b>7-12S</b>  | Recommended for use in dilute solution by students in year 7 to year 12 and recommended for use as a solid by qualified staff.   |
| <b>11-12</b>  | Recommended for use by students in Year 11 and Year 12, as well as staff.  |
| <b>11-12S</b> | Recommended for use in dilute solution by students in Year 11 and Year 12 and recommended for use as a solid by qualified staff  |
| <b>Staff</b>  | Recommended for use in dilute solution by students in year 11 and year 12 and recommended for use as a solid by qualified staff. (Qualified Staff: A technician or teacher with tertiary-level chemistry training and/or experience such that they understand the chemistry and hazards involved with handling the chemical) |

<sup>i</sup> The remaining chemicals not covered in this edition of the Chemical Management Handbook will be added early in 2017, thus covering the entire List

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## SAFE HANDLING

The main hazards of the substance and relevant notes for safe handling are summarised in this section.

### Glove selection

Factors to consider when choosing protective gloves include not only whether the glove material is suitable, but also the thickness of the glove and length of the cuff. There is no glove type which provides protection from every chemical. A glove type may be unsuitable due to degradation through contact with the chemical and/or because the chemical can easily permeate the material. Degradation is a change to the structure of the material and may be obvious to the wearer as the glove may swell and feel tacky, or harden and crack. Permeation of the glove by the chemical occurs at the molecular level and may go undetected. Once the chemical has permeated through the glove, it has the potential to harm or be absorbed by the skin. If gloves are unsuitable or used beyond the limit of their protective capability, they may increase the risk of harm to the user. The glove material itself may be harmful; for example, latex may trigger an allergic reaction.

Gloves made from heavy, highly chemical-resistant material can be expensive and can limit the dexterity of the user, thus contributing to the hazard of chemical handling. Disposable gloves provide a lower level of protection, but offer convenience and less reduction in dexterity. Choosing a glove type can therefore be a compromise between chemical resistance, dexterity, economy and convenience.

The Handbook suggests the appropriate glove material(s) suitable for the chemical, based on information in safety data sheets and the glove resistance guides listed as references. As glove performance can vary between brands, the glove manufacturer's chemical resistance guide should also be consulted to check the level of protection offered by a specific type of glove for the chemical being used.

If gloves of a suitable type are unavailable, then disposable gloves can still provide protection from splash contact. Two pairs of disposable gloves (double gloves) can also be worn to provide an extra protective barrier. If the gloves being used are not ones recommended for the chemical, they should be removed immediately in the event of splash contact.

Cotton-lined gloves and powdered gloves are not recommended for handling chemicals as they have poor chemical resistance properties. However, cotton gloves worn under outer, chemically resistant gloves can protect the skin from an allergic reaction to the glove material.

### Safety notes for glove use

- Before use, gloves should be checked for damage or tears.
- When removing disposable gloves, the correct technique should be used so that the skin is not contaminated with the chemical (see General References for links to instructions in this technique).
- Disposable gloves should be disposed of after a single use and not reused.
- Reusable gloves should be washed before they are removed.
- Hands should be washed with soap and water immediately after removing gloves.

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## STORAGE

### Storage Categories

Safe storage of chemicals is integral to ensuring the health and safety of school laboratory technicians, science teachers and students as well as preventing structural damage to school facilities. Hazardous chemicals need to be stored safely with appropriate segregation in order to minimise the potential for dangerous reactions between incompatible substances.

The Australian Dangerous Goods Code provides a good basis for the organisation of chemical storage according to the physical hazards of chemicals, such as flammability, corrosivity and oxidising properties. Further consideration is required for incompatibilities within a Dangerous Goods class and where a chemical belongs to more than one class.

Ideally, chemicals with more than one Dangerous Goods class should be segregated from all other chemicals. However, if space is limited, then storage along with chemicals in the main DG class, with secondary containment, is acceptable.

General Requirements for chemical storage can be found in AS/NZS 2243 Safety in Laboratories, Part 10: 2004 Storage of chemicals. This Standard covers the basic principles of storage, required features in a laboratory, storeroom or space, the use and storage of chemicals within a laboratory and storage of chemicals in a separate store. This standard also specifies the quantities of chemicals which may be stored in a laboratory outside of a storage cabinet.

### Separation and segregation

In the context of chemical storage, the term 'separation' refers to physical distance between chemical storage areas. The term is generally used in relation to storage of large quantities of dangerous goods and is not so relevant to schools where smaller quantities of chemicals are involved. Barriers such as a fire-proof walls are an acceptable substitute for separation distances.

The term 'segregation' refers to the storage of chemicals within one storeroom, laboratory or storage cabinet. Chemicals can be segregated vertically by means of walls, cupboard partitions or storage cabinets, and horizontally by means of shelves, either open or within a cupboard or cabinet.

Ideally, incompatible chemicals will be segregated through vertical segregation or storage in separate cabinets. Vertical segregation has the advantage that it avoids the mixing of incompatible chemicals in the event of a shelf collapse.

Secondary containment can provide a sufficient segregation barrier where quantities of chemicals are small.

### Secondary containment

A secondary container should be large enough to contain 1.1 times the volume of the bottle it holds and should be resistant to the chemical being contained. Suitable chemically resistant secondary containers include sturdy polypropylene (PP) or high density polyethylene (HDPE) tubs. A layer of sand in the bottom of the container is a good measure for absorbing any spills and keeping the bottle in a stable, upright position.

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### General guidelines for safe chemical storage

- Label all containers of chemicals according to the relevant legislation.
- Each chemical container should have a designated storage location to where it is replaced after use. Shelves can be labelled accordingly or the locations of chemicals recorded on a diagram.
- Store chemicals away from sunlight. Sunlight can damage lids and containers as well as promote the decomposition of chemicals.
- Store chemicals away from extremes of heat.
- Store liquids below solids.
- Store concentrated solutions on low shelves, below dilute solutions and solids.
- Store concentrated corrosives with secondary containment. Other liquids and toxic substances should preferably be stored with secondary containment/spill trays.
- Ensure good ventilation where volatile chemicals are stored.
- Check stock, lids and containers regularly for damage or deterioration.
- Store chemicals securely, with access restricted to authorised staff, and particularly for toxic and security-sensitive chemicals.
- Purchase chemicals in small quantities. Mark the date received on new chemicals.
- Mark the date opened on peroxidisable chemicals.
- Do not store chemicals in alphabetical order except within their storage class.
- Do not use food containers for laboratory chemicals.
- Do not store chemicals on shelves which are incompatible with the chemical, such as metal shelves for corrosives or wooden shelves for oxidising agents.
- Do not store containers of chemicals on the floor.

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### SPILLS

For many liquid spills the use of an absorbent mixture of equal volumes of sodium carbonate, vermiculite or bentonite (clay cat litter), and dry sand has been suggested. This recipe was developed by Armour *et al.*<sup>1</sup> as a general, inexpensive absorbent mixture which could be pre-prepared and stored as part of a spill response kit. The sodium carbonate is included to help to neutralise the spill. The cat litter or vermiculite absorbs the liquid and helps to eliminate fumes. The sand 'moderates and smothers any reaction that may occur'.<sup>1</sup>

Commercial spill absorbents are also available and dry sand can be used in the absence of an alternative.

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## WASTE DISPOSAL

School science activities in general do not produce large volumes of chemical waste and do not generate the same type of waste on a continual basis. Nevertheless, managing chemical waste in schools can be challenging as there may be limited resources to treat and store waste. Hazards also arise from the need to store waste for long periods of time until there is sufficient to justify a collection by a licenced waste contractor.

The Handbook includes procedures for the treatment of chemical waste where the procedure is straightforward and within the usual expected capacity of schools. Treating chemical waste can minimise the volume of waste, remove or reduce the hazard and reduce the cost of disposal. Such treatments include evaporation of water from an aqueous solution, neutralisation of acids and bases, controlled destruction of reactive chemicals, reduction of oxidising substances to give a less reactive product, and precipitation of heavy metal ions as stable salts.

The accepted pH for waste water varies between regions, with the wider range of pH 6-10 accepted by some water authorities. The Handbook specifies neutralising acids and base to within the range pH 6-8 in order to accommodate the variation between regions. Modern schools usually have settling or neutralisation tanks installed in line from the science area. These tanks usually contain lime and therefore will contribute to the neutralisation of acid and the precipitation of insoluble carbonates, and enable the settling of suspended solids.

The waste water acceptance limit for a particular analyte can be found on the relevant water authority website. In determining whether a concentration complies with the waste water acceptance standard, dilution due to the school's total output of waste water should be taken into consideration.

The following categories of waste must not be discharged to sewer:

**Heavy metal waste:** hazardous for the environment. Sludge from waste water treatment plants is ultimately returned to the environment, often as fertiliser for agriculture. For this reason only very low levels of heavy metal ions are acceptable in waste water.

**Halogenated solvent**

**Fats and oils:** can affect waste water processing operations

**Flammable or volatile liquids, water-immiscible liquids which float on water:** can cause a fire or explosion and create hazards for water authority workers.

**Aqueous solutions with high or low pH:** can corrode pipes and present hazards for workers.

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## REFERENCE

1. Armour, M-A., Ashick, D., Konrad, J. 1999. 'Tested methods for the handling of small-scale spills', Chemical Health and Safety, 6: 24-27

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## GENERAL REFERENCES

### Physical Data, Safe Handling, First Aid

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Sigma-Aldrich product safety data sheets, <https://www.sigmaaldrich.com/australia.html>

Merck product safety data sheets, <http://www.merckmillipore.com/AU/en>

Gestis Substance Database, Institute for Occupational Safety and Health of the German Social Accident Insurance, [www.dguv.de/ifa/gestis-database](http://www.dguv.de/ifa/gestis-database)

U.S. National Library of Medicine, Pubchem Substance and Compound Databases, <https://pubchem.ncbi.nlm.nih.gov/#>

Hazardous Substances Databank, U.S. National Library of Medicine Toxicology Data Network, <https://toxnet.nlm.nih.gov/newtoxnet/hsdb.htm>

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Ellis, Roy C. & Perry, Donald I. & Gormley, Barry M. & Adelaide Medical Centre for Women and Children. Educational Resource Centre. 1991, The ABC of safe practices for the biological sciences laboratory : an easy to use reference manual for laboratory personnel Educational Resource Centre, Adelaide Medical Centre for Women and Children Adelaide

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### Regulatory Data

National Transport Commission. 2016. Australian Code for the Transport of Dangerous Goods by Road & Rail, Edition 7.4, National Transport Commission website, <http://www.ntc.gov.au/heavy-vehicles/safety/australian-dangerous-goods-code/> (December 2016)

Therapeutic Goods Administration, Australian Government Department of Health. 2016. Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP) No. 15, Federal Register of Legislation website, <https://www.legislation.gov.au/Details/F2016L01638> (November 2016)

'Code of Practice for Supply Diversion into Illicit Drug Manufacture', Plastic and Chemicals Industries Association website, <http://www.pacia.org.au/reports/drugs> (Accessed January 2017)



## **Glove selection guides**

'GloveSelection Tool', Kimberly-Clark website, <http://www.kcproductselector.com/Gloves.aspx> (Accessed January 2017)

Kimberley-Clark, Kimtech Brand Nitrile Gloves Chemical Resistance Guide, [http://www.na.kccustomerportal.com/Documents/Upload/Application/2811/Learning%20Center/Article/K4556\\_10\\_01%20Ntrl\\_Chem\\_pstr\\_v3.pdf](http://www.na.kccustomerportal.com/Documents/Upload/Application/2811/Learning%20Center/Article/K4556_10_01%20Ntrl_Chem_pstr_v3.pdf)

Ansell. n.d. Chemical Resistance Guide: Permeation & Degredation Data 8th Edition, AnsellPro website, [http://ansellpro.com/download/Ansell\\_8thEditionChemicalResistanceGuide.pdf](http://ansellpro.com/download/Ansell_8thEditionChemicalResistanceGuide.pdf) (Accessed January 2017)

## **Glove removal technique**

Circle Safety & Health Consultants. n.d. The Proper Way to Remove Disposable Gloves, Central Washington University website, [https://www.cwu.edu/chemistry/sites/cts.cwu.edu.chemistry/files/documents/Glove\\_Removal\\_1.pdf](https://www.cwu.edu/chemistry/sites/cts.cwu.edu.chemistry/files/documents/Glove_Removal_1.pdf) (accessed January 2017)

'Skin at work: Removing single-use gloves without contaminating your hands', Health and Safety Executive (UK) website, <http://www.hse.gov.uk/skin/videos/gloves/removegloves.htm> (Accessed January 2017)

University of Wollongong. 2016. Selection and use of gloves guidelines, Science, Medicine and Health, University of Wollongong, <http://smah.uow.edu.au/content/groups/public/@web/@ohs/documents/doc/uow136685.pdf> (June 2016)

## **Storage**

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Standards Australia Ltd/Standards New Zealand. 2007. AS/NZ 3833, The storage and handling of mixed classes of dangerous goods, in packages and intermediate bulk containers, Standards Australia: Sydney

## **Spills and waste disposal**

Lunn, G., Sansone, E.B., 2012, 'Destruction of Hazardous Chemicals in the Laboratory', Third edition, John Wiley and Sons, Hoboken, New Jersey.

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Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards (Updated Version), 2011, National Research Council (US) Committee on Prudent Practices in the Laboratory, Washington (DC): National Academies Press (US); <https://www.ncbi.nlm.nih.gov/books/NBK55878/>



# 1-bromobutane

*n*-butyl bromide; bromobutane

**DANGER**



**Formula** C<sub>4</sub>H<sub>9</sub>Br  
**CAS No.** 109-65-9  
**User Group** 11-12

## DESCRIPTION

Clear, colourless, volatile liquid. Heavier than water.

## SOLUBILITY

Very slightly soluble in water. Soluble in ethanol, diethyl ether and acetone.

**Solubility in water** 0.87 g/L (25°C)

## PHYSICAL DATA

**Molar mass** 137.03  
**Melting point** -112°C  
**Boiling point** 102°C  
**Specific gravity** 1.28 (20°C)  
**Flammability** Highly flammable

## REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** II  
**UN Number** 1126  
**Poisons Schedule** -  
**Security** -

## HAZARD STATEMENTS

H225 Highly flammable liquid and vapour  
H315 Causes skin irritation  
H319 Causes serious eye irritation  
H335 May cause respiratory irritation  
H411 Toxic to aquatic life with long lasting effects

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Viton® gloves are recommended; nitrile or butyl rubber gloves provide limited splash protection). Exposure may cause irritation of the skin, eyes and respiratory tract. Symptoms of overexposure include cough, headache, dizziness and nausea. Handle in an operating fume cupboard or well-ventilated area. Avoid breathing vapour or mist. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Open the bottle with care to avoid inhaling the headspace vapour. Keep away from heat and ignition sources. Vapour is heavier than air and may accumulate in low-lying areas. Vapours may form explosive mixture with air. Vapours may travel to an ignition source and flash back. This solvent may dissolve some plastics.

## STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Ensure container is kept upright to prevent leakage. Store away from heat and any sources of ignition. Store away from oxidising agents, strong bases, alkali metals, alkaline earth metals. Store with flammable liquids in an AS compliant cabinet.

## APPLICATIONS

**Senior organic chemistry:** substitution/elimination reactions and reaction rates

## SPILLS

Wear PPE. Ensure good ventilation. Remove all sources of ignition. Absorb spill with inert material such as dry sand, vermiculite or bentonite (clay cat litter). Scoop up with a non-sparking tool, place in a suitable labelled container and arrange for collection.

## WASTE DISPOSAL

Substance is insoluble in water and is harmful for the aquatic environment; its release to the environment should be avoided. Store waste in a suitable labelled container such as for halogenated organic waste. Arrange for collection by a licenced waste disposal contractor.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.  
**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical advice/attention.  
**IF ON SKIN:** Remove immediately all contaminated clothing and wash before reuse. Rinse skin with water/shower. If skin irritation occurs: Get medical advice/attention.  
**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26



**Formula** C<sub>4</sub>H<sub>9</sub>Cl  
**CAS No.** 109-69-3  
**User Group** 11-12

## DESCRIPTION

Clear, colourless, volatile liquid with a chloroform-like odour. Lighter than water.

## SOLUBILITY

Very slightly soluble in water. Soluble in ethanol, methanol, and diethyl ether.

**Solubility in water** 0.5 g/L (20°C)

## PHYSICAL DATA

**Molar mass** 92.57  
**Melting point** -123°C  
**Boiling point** 78°C  
**Specific gravity** 0.89 (20°C)  
**Flammability** Highly flammable

## REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** II  
**UN Number** 1127  
**Poisons Schedule** -  
**Security** -

## HAZARD STATEMENTS

H225 Highly flammable liquid and vapour

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (fluorinated rubber or Viton gloves are recommended; nitrile or butyl rubber gloves provide limited splash protection). Exposure may cause irritation of the skin, eyes and respiratory tract. Symptoms of overexposure include cough, headache, dizziness and nausea.

Handle in an operating fume cupboard or well-ventilated area. Keep away from heat and ignition sources. Avoid breathing vapour or mist. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Open the bottle with care to avoid inhaling the headspace vapour.

Vapour is heavier than air and may accumulate in low-lying areas. Vapours may form explosive mixture with air. Vapours may travel to an ignition source and flash back. This solvent may dissolve some plastics.

## SPILLS

Wear PPE. Ensure good ventilation. Remove all sources of ignition. Absorb spill with inert material such as dry sand, vermiculite or bentonite (clay cat litter). Scoop up with a non-sparking tool and place in a suitable labelled container. Arrange for collection by a licenced waste disposal contractor.

## WASTE DISPOSAL

Substance is insoluble in water and is harmful for the aquatic environment; its release to the environment should be avoided.

Store waste in a suitable labelled container such as for halogenated organic waste. Arrange for collection by a licenced waste disposal contractor.

## STORAGE

Substance is air- and light-sensitive. Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Ensure container is kept upright to prevent leakage. Store away from heat and any sources of ignition. Store away from oxidising agents, strong bases, alkali metals, alkaline earth metals, light metal powders. Store with flammable liquids in an AS compliant cabinet.

## APPLICATIONS

**Senior organic chemistry:** substitution/elimination reactions and reaction rates

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin with water/shower. If skin irritation occurs, seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing.

POISONS CENTRE: 13 11 26



**WARNING**



**Formula** C<sub>4</sub>H<sub>9</sub>I  
**CAS No.** 542-69-8  
**User Group** 11-12

**DESCRIPTION**

Clear, colourless liquid with an ethereal odour. Heavier than water.

**SOLUBILITY**

Slightly soluble in water. Soluble in ethanol and diethyl ether.

**Solubility in water** 0.2 g/L (20°C)

**PHYSICAL DATA**

**Molar mass** 184.02  
**Melting point** -103°C  
**Boiling point** 130°C  
**Specific gravity** 1.615 (20°C)  
**Flammability** Flammable

**REGULATORY INFORMATION**

**ADG Class** 3  
**Packing Group** III  
**UN Number** 1993  
**Poisons Schedule** -  
**Security** -

**HAZARD STATEMENTS**

H226 Flammable liquid and vapour  
H312 Harmful if swallowed  
H332 Harmful if inhaled  
H315 Causes skin irritation  
H319 Causes serious eye irritation  
H335 May cause respiratory irritation

**SAFE HANDLING**

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Viton® gloves are recommended; nitrile or butyl rubber gloves provide limited splash protection). Exposure may cause irritation of the skin, eyes and respiratory tract. Symptoms of overexposure include cough, headache, dizziness and nausea. Handle in an operating fume cupboard or well-ventilated area. Avoid breathing vapour or mist. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Keep away from heat and ignition sources. Vapour is heavier than air and may collect in low-lying areas. Vapours may form explosive mixture with air. Vapours may travel to an ignition source and flash back. This solvent may dissolve some plastics.

**STORAGE**

Substance is air- and light-sensitive. Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Ensure container is kept upright to prevent leakage. Store away from heat and any sources of ignition. Store away from oxidising agents, strong bases and alkali metals. Store with flammable liquids in an AS compliant cabinet.

**APPLICATIONS**

**Senior organic chemistry:** substitution/elimination reactions and reaction rates

**SPILLS**

Wear PPE. Ensure good ventilation. Remove all sources of ignition. Absorb spill with inert material such as dry sand, vermiculite or bentonite (clay cat litter). Scoop up with a non-sparking tool, place in a suitable labelled container and arrange for collection.

**WASTE DISPOSAL**

Substance is insoluble in water and is harmful for the aquatic environment; its release to the environment should be avoided. Store waste in a suitable labelled container such as for halogenated organic waste. Arrange for collection by a licenced waste disposal contractor.

**FIRST AID**

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.  
**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical advice/attention.  
**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin with water/shower. If skin irritation occurs: Get medical advice/attention.  
**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor.

POISONS CENTRE: 13 11 26



## 2-chloro-2-methylpropane

*tert-butyl chloride; trimethylchloromethane*

**DANGER**



**Formula** C<sub>4</sub>H<sub>9</sub>Cl  
**CAS No.** 507-20-0  
**User Group** 11-12

### DESCRIPTION

Clear, colourless, volatile liquid with an ethereal odour. Lighter than water.

### SOLUBILITY

Slightly soluble in water. Soluble in ethanol and diethyl ether.

**Solubility in water** 2.9 g/L (15°C)

### PHYSICAL DATA

**Molar mass** 92.57  
**Melting point** -27°C  
**Boiling point** 51°C  
**Specific gravity** 0.84 (20°C)  
**Flammability** Highly flammable

### REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** II  
**UN Number** 1127  
**Poisons Schedule** -  
**Security** -

### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour  
H302 Harmful if swallowed  
H412 Harmful to aquatic life with long lasting effects

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Viton® gloves are recommended; nitrile or butyl rubber gloves provide limited splash protection). Exposure may cause irritation of the skin, eyes and respiratory tract. Symptoms of overexposure include headache, dizziness, tiredness and nausea.

Handle in an operating fume cupboard or well-ventilated area. Avoid breathing vapour or mist. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Open the bottle with care to avoid inhaling the headspace vapour.

Keep away from heat and ignition sources. Vapour is heavier than air and may collect in low-lying areas. Vapours may form explosive mixture with air. Vapours may travel to an ignition source and flash back.

This solvent may dissolve some plastics.

### STORAGE

Substance is hygroscopic. Store in a tightly closed container in a cool, dry well-ventilated place away from heat and light; protect from moisture. Ensure container is kept upright to prevent leakage. Store away from heat and any sources of ignition.

Store away from strong oxidising agents, strong bases, powdered metals.

Store with flammable liquids in an AS compliant cabinet.

### APPLICATIONS

**Senior organic chemistry:** substitution/elimination reactions and reaction rates

### SPILLS

Wear PPE. Ensure good ventilation. Remove all sources of ignition. Absorb spill with inert material such as dry sand, vermiculite or bentonite (clay cat litter). Scoop up with a non-sparking tool, place in a suitable labelled container and arrange for collection.

### WASTE DISPOSAL

Substance is insoluble in water and is harmful for the aquatic environment; its release to the environment should be avoided.

Store waste in a suitable labelled container such as for halogenated organic waste. Arrange for collection by a licenced waste disposal contractor.

### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical attention.

**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin with water/shower. If skin irritation occurs, seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing.





## 2-methyl-butan-2-ol

*tert-amyl alcohol; tert-pentyl alcohol*

**ANGER**

**Formula** C<sub>5</sub>H<sub>12</sub>O

**CAS No.** 75-85-4

**User Group** 11-12



### DESCRIPTION

Clear, colourless, volatile liquid with a disagreeable odour and burning taste.

### SOLUBILITY

Soluble in water, ethanol, diethyl ether, acetone and glycerol.

**Solubility in water** 118 g/L (20°C)

### PHYSICAL DATA

**Molar mass** 88.15

**Melting point** -8°C

**Boiling point** 102°C

**Specific gravity** 0.81 (20°C)

**Flammability** Highly flammable

### REGULATORY INFORMATION

**ADG Class** 3

**Packing Group** II

**UN Number** 1105

**Poisons Schedule** -

**Security** -

### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour

H332 Harmful if inhaled

H315 Causes skin irritation

H335 May cause respiratory irritation

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Butyl, Viton®, neoprene; nitrile for splash protection). Exposure may cause irritation to the skin, eyes and respiratory tract.

Symptoms of exposure include nausea, headache, dizziness and CNS depression. Prolonged or repeated skin contact can lead to dryness and cracking. Eye exposure may cause transient corneal clouding.

Handle in an operating fume cupboard. Avoid inhaling vapour or mist. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.

### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition.

Store away from oxidising agents, strong acids, alkali metals and alkali earth metals.

Store with flammable liquids in an AS compliant cabinet.

### APPLICATIONS

**Senior chemistry:** to observe the reactivity of a tertiary alcohol.

### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation.

**Small Spill:** Treat as for Waste Disposal.

**Large spill:** Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection.

Wash the spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

### WASTE DISPOSAL

**Small quantity:** Absorb onto paper towel and allow alcohol to evaporate in an operating fume cupboard. Dispose of paper towel as general waste.

**Large quantity:** Store in the original container or other suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek immediate medical attention.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Rinse skin thoroughly with plenty of water. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26



## 2-methyl-propan-1-ol

*isobutyl alcohol; isobutanol*

**DANGER**



**Formula** C<sub>4</sub>H<sub>10</sub>O

**CAS No.** 78-83-1

**User Group** 11-12

### DESCRIPTION

Clear, colourless liquid with a sweet, musty odour.

### SOLUBILITY

Soluble in water, ethanol, acetone and diethyl ether.

**Solubility in water** 85 g/L (20°C)

### PHYSICAL DATA

**Molar mass** 74.12

**Melting point** -108°C

**Boiling point** 106-108°C

**Specific gravity** 0.803 (25°C)

**Flammability** Flammable

### REGULATORY INFORMATION

**ADG Class** 3

**Packing Group** III

**UN Number** 1212

**Poisons Schedule** -

**Security** -

### HAZARD STATEMENTS

H226 Flammable liquid and vapour

H315 Causes skin irritation

H318 Causes serious eye damage

H335 May cause respiratory irritation

H336 May cause drowsiness or dizziness

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Butyl, Viton®, neoprene; nitrile for splash protection). Exposure may cause irritation to the skin, eyes and respiratory tract. Symptoms of inhalation or ingestion include nausea, headache, dizziness and CNS depression. Prolonged or repeated skin contact can lead to dryness and cracking. Eye exposure to the liquid may cause severe irritation and eye damage.

Handle in an operating fume cupboard. Avoid generating and inhaling vapour or mist. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.

### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place. Protect from light and moisture. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition.

Store away from oxidising agents, strong acids, strong alkalis, alkali metals, alkaline earth metals and aluminium. Store with flammable liquids in an AS compliant cabinet.

### APPLICATIONS

**Senior chemistry:** to observe the reactivity of a primary alcohol; preparation of esters.

### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation.

**Small Spill:** Treat as for Waste Disposal.

**Large spill:** Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection.

Wash the spill area thoroughly with water. Wash any contaminated clothing before reuse.

### WASTE DISPOSAL

**Small quantity:** Absorb onto paper towel and allow alcohol to evaporate in an operating fume cupboard. Dispose of paper towel as general waste.

**Large quantity:** Store in the original container or other suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek immediate medical attention.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Rinse skin thoroughly with plenty of water. Seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26



## 2-methyl-propan-2-ol

*tert-butyl alcohol; tert-butanol*

**DANGER**



**Formula**  $C_4H_{10}O$

**CAS No.** 75-65-0

**User Group** 11-12

### DESCRIPTION

Clear, colourless, hygroscopic crystals or liquid with a camphor-like odour.

### SOLUBILITY

Miscible with water, alcohols, diethyl ether, esters, ketones and aromatic and aliphatic hydrocarbons.

**Solubility in water** Miscible

### PHYSICAL DATA

**Molar mass** 74.12

**Melting point** 24-26°C

**Boiling point** 81-83°C

**Specific gravity** 0.79 (20°C)

**Flammability** Highly flammable

### REGULATORY INFORMATION

**ADG Class** 3

**Packing Group** II

**UN Number** 1120

**Poisons Schedule** -

**Security** -

### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour

H332 Harmful if inhaled

H319 Causes serious eye irritation

H335 May cause respiratory irritation

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Butyl, Viton®, neoprene; nitrile for splash protection). Exposure may cause irritation to the skin, eyes and respiratory tract. Symptoms of inhalation or ingestion include nausea, headache, dizziness and CNS depression. Prolonged or repeated skin contact can lead to dryness, cracking and allergic dermatitis. Eye exposure to the liquid may cause conjunctivitis.

Handle in an operating fume cupboard. Avoid generating and inhaling vapour or mist. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition. In cool weather, if the alcohol freezes, it can be melted by placing the bottle within a plastic bag into a warm water bath.

### STORAGE

The alcohol is hygroscopic. With prolonged storage, and on exposure to air and sunlight, the alcohol may form peroxides. Store in a tightly closed container in a cool, dry, well-ventilated place. Protect from light and moisture. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition.

Store away from oxidising agents, strong acids, alkali metals, alkaline earth metals and aluminium.

Store with flammable liquids in an AS compliant cabinet.

### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool.

**Small spill:** Add material to a large volume of water and allow to stand until the solids have settled. Decant the solution down the sink with further dilution. Dispose of the absorbent material as general waste.

**Large spill:** Place material into a suitable labelled container and store for collection.

Wash the spill area thoroughly with water. Wash any contaminated clothing before reuse.

### WASTE DISPOSAL

Store waste or surplus 2-methyl-propan-2-ol in a suitable labelled container and arrange for collection by a licenced waste disposal contractor.

The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical attention.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Rinse skin thoroughly with plenty of water. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26

### APPLICATIONS

**Senior chemistry:** to observe the reactivity of a tertiary alcohol.





## 3-methyl-butan-1-ol

*isoamyl alcohol; isopentyl alcohol*

**WARNING**



**Formula**  $C_5H_{12}O$   
**CAS No.** 123-51-3  
**User Group** 11-12

### DESCRIPTION

Clear, colourless liquid with a disagreeable odour.

### SOLUBILITY

Sparingly soluble in water. Miscible with ethanol, diethyl ether, petroleum ether and glacial acetic acid.

**Solubility in water** 25 g/L (20°C)

### PHYSICAL DATA

**Molar mass** 88.15  
**Melting point** -117°C  
**Boiling point** 131°C  
**Specific gravity** 0.81 (20°C)  
**Flammability** Flammable

### REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** III  
**UN Number** 1105  
**Poisons Schedule** -  
**Security** -

### HAZARD STATEMENTS

H226 Flammable liquid and vapour  
H332 Harmful if inhaled  
H315 Causes skin irritation  
H319 Causes serious eye irritation  
H335 May cause respiratory irritation

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Butyl, Viton®, neoprene; nitrile for splash protection). Exposure may cause irritation to the skin, eyes, nose, throat and respiratory tract. Symptoms of inhalation or ingestion include nausea, headache, dizziness and CNS depression. Prolonged or repeated skin contact can lead to dryness and cracking. Eye contact with the liquid may cause severe irritation.

Handle in an operating fume cupboard or well-ventilated area. Avoid generating and inhaling vapour or mist. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.

### STORAGE

Store in a tightly closed container in a cool, dry well-ventilated place away from light. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition.

Store away from oxidising agents, acids, acid chlorides, halogens, reducing agents, alkali metals and aluminium. Store with flammable liquids in an AS compliant cabinet.

### APPLICATIONS

**Senior chemistry:** to observe the reactivity of a primary alcohol; preparation of esters.

### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection. Wash the spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

### WASTE DISPOSAL

Store waste or surplus 3-methyl-butan-1-ol in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek immediate medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek immediate medical attention.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Rinse skin thoroughly with plenty of water. If skin irritation occurs, seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26



## 4-methyl-pentan-2-one

*isobutyl methyl ketone; MIBK*

**DANGER**

**Formula**  $C_6H_{12}O$   
**CAS No.** 108-10-1  
**User Group** 11-12



### DESCRIPTION

Clear, colourless, highly volatile, highly flammable liquid with a sharp, agreeable, mint-like odour.

### SOLUBILITY

Slightly soluble in water. Soluble in ethanol, acetone and diethyl ether.

**Solubility in water** 19 g/L (20°C)

### PHYSICAL DATA

**Molar mass** 100.16  
**Melting point** -84°C  
**Boiling point** 116°C  
**Specific gravity** 0.80 (20°C)  
**Flammability** Highly flammable

### REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** II  
**UN Number** 1245  
**Poisons Schedule** S5  
**Security** -

### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour  
H332 Harmful if inhaled  
H319 Causes serious eye irritation  
H335 May cause respiratory irritation  
AUH066 Repeated exposure may cause skin dryness and cracking

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (butyl rubber). Exposure may cause irritation of the skin, eyes and respiratory tract. Ingestion or inhalation may cause CNS depression, drowsiness and dizziness. Eye contact may result in severe irritation. Prolonged or repeated skin contact may have a degreasing effect and may lead to dermatitis.

Handle in an operating fume cupboard or well-ventilated area. Avoid inhaling fumes, vapour or mist. Avoid contact with skin and eyes. Avoid prolonged or repeated exposure. Handle away from heat and other sources of ignition. There is potential for the vapour to collect in low-lying, confined areas. The vapour can form explosive mixtures with air and can travel to an ignition source and flash back. Test for peroxides before use. Heating to over 30°C may promote the formation of peroxides.

### STORAGE

The ketone is hygroscopic and may form explosive peroxides when heated or on exposure to air. Store in a tightly closed container in a cool, dry well-ventilated place away from heat and light. Ensure container is kept upright to prevent leakage. Store away from heat and any sources of ignition. Store away from oxidising agents, reducing agents, metals, acids, alkalis, plastics and rubber. Store with flammable liquids in an AS compliant cabinet.

### APPLICATIONS

**Senior chemistry:** solvent for extraction of natural products; sample compound for gas chromatography.

### SPILLS

Wear PPE. Ensure good ventilation. Remove all sources of ignition. Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand.

**Small quantity:** Place spill material in a shallow vessel in an operating fume cupboard and allow the ketone to evaporate from the absorbent. Dispose of the absorbent material as general waste.

**Large quantity:** Place in a suitable labelled container and store for collection.

Ventilate the spill area to evaporate any residual ketone and wash thoroughly with water. Wash any contaminated clothing before reuse.

### WASTE DISPOSAL

Isobutyl methyl ketone is not toxic for aquatic life and is expected to biodegrade in the environment and not bioaccumulate.

**Small quantity:** Place in a shallow vessel in an operating fume cupboard and allow to evaporate.

**Large quantity:** Store in a suitable labelled bottle such as for 'waste non-halogenated organic liquid'. Arrange for collection by a licenced waste disposal contractor. The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose empty bottles to heat, open flames or other sources of ignition.

### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical advice/attention.

**IF ON SKIN:** Remove immediately contaminated clothing. Rinse skin with water/shower. If irritation occurs, seek medical advice.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26



**Formula** C<sub>8</sub>H<sub>9</sub>NO  
**CAS No.** 103-84-4  
**User Group** 11-12

#### DESCRIPTION

White, shiny crystalline leaflets or powder with a faint acetic acid odour and slightly burning taste.

#### SOLUBILITY

Slightly soluble in water. Soluble in ethanol, acetone, diethyl ether and glycerol.

**Solubility in water** 6.1 g/L (25°C)

#### PHYSICAL DATA

**Molar mass** 135.17  
**Melting point** 114°C  
**Boiling point** 305°C  
**Specific gravity** 1.21 (20°C)  
**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

H302 Harmful if swallowed

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation to the skin, eyes and respiratory tract. Symptoms of inhalation or ingestion include headache, cough, shortness of breath and dizziness.

Handle in a well-ventilated area. Avoid generating dust. Avoid inhalation and ingestion and contact with skin, eyes and clothing. Handle away from heat and sources of ignition.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Store away from heat and any sources of ignition.

Store away from strong oxidising agents and strong bases. Store with general organic solids.

#### APPLICATIONS

**Senior chemistry:** investigating the properties of amides; aromatic substitution reactions.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Scoop up with a non-sparking tool, transfer to a suitable labelled container and store for collection.

Wipe down spill area with paper towel dampened with 60-70% ethanol/methylated spirits then wash area thoroughly with detergent and water. Store contaminated paper towel in a sealed plastic bag or in container with spill material. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Store in a suitable labelled container and arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation occurs, seek medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Call a POISONS CENTRE or doctor if you feel unwell.

**IF ON SKIN:** Remove immediately contaminated clothing. Rinse skin with water/shower. If irritation occurs, seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical advice/attention.

POISONS CENTRE: 13 11 26



**Formula**  $C_2H_4O_2$

**CAS No.** 64-19-7

**User Group** 11-12



#### DESCRIPTION

Clear, colourless, hygroscopic liquid or clear crystalline solid (in cold weather) with a characteristic pungent, vinegar-like odour.

#### SOLUBILITY

Miscible with water, ethanol, diethyl ether and acetone.

**Solubility in water** 602.9 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 60.05

**Melting point** 16.7°C

**Boiling point** 118°C

**Specific gravity** 1.05 (20°C)

**Flammability** Flammable

#### REGULATORY INFORMATION

**ADG Class** 8 (3)

**Packing Group** II

**UN Number** 2789

**Poisons Schedule** S6

**Security** IDM Cat 3

#### HAZARD STATEMENTS

H226 Flammable liquid and vapour

H314 Causes severe skin burns and eye damage

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Viton®, butyl rubber; nitrile gloves provide splash protection). Exposure may cause irritation of the skin, eyes and respiratory tract. Eye contact may result in burns and permanent eye damage.

Handle in an operating fume cupboard. Avoid breathing vapour or mist. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Vapour is heavier than air and may collect in low-lying areas. Vapours may form explosive mixture with air. Vapours may travel to an ignition source and flash back. Handle away from heat and ignition sources.

#### STORAGE

The concentrated acid is hygroscopic. Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Protect from moisture. Ensure container is kept upright to prevent leakage. Store away from heat and any sources of ignition.

Store away from oxidising agents, bases, alkali metals and alkaline earth metals.

Store with separately from other chemicals, on a low shelf, with secondary containment.

#### APPLICATIONS

**General science:** diluted, an example of an organic acid.

**Senior chemistry:** titration of a weak acid; ester preparation.

#### SPILLS

Wear PPE. Ensure good ventilation. Eliminate all ignition sources. Cover spill with sodium carbonate or a 1:1:1 mixture of sand, sodium carbonate and vermiculite or bentonite (clay cat litter). Collect spilled material with a non-sparking tool. Add slowly to a large volume of water with stirring. Neutralise the solution to within pH 6-8 by addition of sodium carbonate in portions (test with pH paper). Decant the neutral solution down the sink with further dilution. Dispose of the residual solids as general waste. Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Dilute waste to a concentration of about 5% by slowly adding the acid to water with stirring. Neutralise the solution to within pH 6-8 by addition of sodium carbonate in portions (test with pH paper). Flush the neutral solution down the sink with further dilution.

**Large quantity:** Store in the original container or other suitable labelled container. Arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. Seek immediate medical attention.

**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin thoroughly with water/shower. If skin irritation occurs, seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26



**Formula**  $C_3H_6O$   
**CAS No.** 67-64-1  
**User Group** 7-12



#### DESCRIPTION

Clear, colourless, highly volatile, highly flammable liquid with a characteristic sweet odour.

#### SOLUBILITY

Soluble in water, ethanol and diethyl ether.

**Solubility in water** Miscible

#### PHYSICAL DATA

**Molar mass** 58.08  
**Melting point** -95°C  
**Boiling point** 56°C  
**Specific gravity** 0.79 (20°C)  
**Flammability** Highly flammable

#### REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** II  
**UN Number** 1090  
**Poisons Schedule** S5  
**Security** IDM Cat 3

#### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour  
H319 Causes serious eye irritation  
H336 May cause drowsiness or dizziness  
AUH066 Repeated exposure may cause skin dryness and cracking

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (butyl rubber). Exposure may cause irritation of the skin and respiratory tract. Ingestion or inhalation may cause CNS depression, drowsiness and dizziness. Eye contact may result in severe irritation. Repeated or prolonged skin contact may have a degreasing effect and may lead to dermatitis. There is a risk of aspiration into the lungs if ingested. Handle in an operating fume cupboard or well-ventilated area. Avoid inhaling fumes, vapour or mist. Avoid contact with skin and eyes. Handle away from heat and other sources of ignition. There is potential for the vapour to collect in low-lying, confined areas. The vapour can form explosive mixtures with air and can travel to an ignition source and flash back.

#### STORAGE

Acetone is hygroscopic. Store in a tightly closed container in a cool, dry well-ventilated place away from heat and light. Ensure container is kept upright to prevent leakage. Store away from heat and any sources of ignition. Store away from oxidising agents, reducing agents, metals, acids, alkalis, plastics and rubber. Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** in the reaction rate experiment, the iodination of propanone.  
**Technical:** solvent for many organic compounds and some inorganic substances; for welding plastics (acrylic, ABS).

#### SPILLS

Wear PPE. Ensure good ventilation. Remove all sources of ignition. Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand. Place spill material in a shallow vessel in an operating fume cupboard and allow acetone to evaporate from the absorbent. Dispose of the absorbent material as general waste.

Ventilate the spill area to evaporate any residual acetone and wash thoroughly with water.

#### WASTE DISPOSAL

Acetone is readily biodegradable and is not expected to bioaccumulate.

**Small quantity:** Place in a shallow vessel in an operating fume cupboard and allow to evaporate.

**Large quantity:** Store in a suitable labelled bottle such as for 'waste non-halogenated organic liquid'. Arrange for collection by a licenced waste disposal contractor.

The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose empty bottles to heat, open flames or other sources of ignition. Rinse empty bottles thoroughly with water to remove any residual solvent.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical advice/attention.

**IF ON SKIN:** Remove immediately contaminated clothing. Rinse skin thoroughly with water/shower. If irritation occurs, seek medical advice.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26





**Formula**  $C_2H_3ClO$

**CAS No.** 75-36-5

**User Group** 11-12



## DESCRIPTION

Colourless fuming liquid with a pungent odour.

## SOLUBILITY

Miscible with diethyl ether, glacial acetic acid and petroleum ether. Soluble in acetone.

**Solubility in water** Decomposes

## PHYSICAL DATA

**Molar mass** 78.5

**Melting point**  $-112^{\circ}C$

**Boiling point**  $51^{\circ}C$

**Specific gravity** 1.1 ( $20^{\circ}C$ )

**Flammability** Highly flammable

## REGULATORY INFORMATION

**ADG Class** 3 (8)

**Packing Group** II

**UN Number** 1717

**Poisons Schedule** -

**Security** -

## HAZARD STATEMENTS

H225 Highly flammable liquid and vapour

H314 Causes severe skin burns and eye damage

AUH014 Reacts violently with water

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (butyl rubber; nitrile for splash contact). Acetyl chloride is corrosive and a lachrymator. Exposure may cause irritation and burns to the skin, eyes, respiratory tract and on ingestion. Prolonged or repeated skin contact may cause dermatitis. Eye contact may cause permanent eye damage. Handle in an operating fume cupboard. Avoid breathing vapour and contact with skin and eyes. Handle away from heat and sources of ignition.

The acid chloride reacts violently with water, giving acetic acid and corrosive fumes of hydrogen chloride.

## STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Protect from moisture.

Store away from alcohols, oxidising agents, strong bases, alkali hydroxides, alkali metals and alkaline earth metals. Store separated from other chemicals, with secondary containment.

## APPLICATIONS

**Senior chemistry:** preparation of esters, amides.

## SPILLS

Wear PPE. Ensure good ventilation. Remove all sources of ignition. Cover spill with a mixture of sodium carbonate or sodium bicarbonate and non-combustible absorbent such as sand, vermiculite or bentonite (clay cat litter). Scoop up with a non-sparking tool into a bucket of water. Test the pH (pH paper) and neutralise the solution by addition of dilute HCl (1-2M) or sodium carbonate as necessary. Flush the neutral solution down the sink. Dispose of residual absorbent material as general waste.

Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

## WASTE DISPOSAL

The acid chloride can be decomposed by its reaction with aqueous base to give a non-hazardous water-soluble salt. Acetyl chloride requires 2 equivalents of base for neutralisation.

**Small quantity:** Add the waste acid chloride to sodium hydroxide solution (2M) or sodium carbonate solution (2M) at the rate of 1 mL of acid chloride to 20 mL of aqueous base. Carbon dioxide gas will evolve from the reaction with sodium carbonate. Neutralise the solution to pH ~7 by addition of HCl (1-2M) and flush down the sink.

**Large quantity:** Store in a suitable labelled container and arrange for collection by a licenced waste contractor.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin with plenty of water. Call a POISONS CENTRE or doctor.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor.

POISONS CENTRE: 13 11 26.



## adipoyl chloride

*adipoyl dichloride; adipic acid dichloride*

**DANGER**

**Formula**  $C_6H_8Cl_2O_2$

**CAS No.** 111-50-2

**User Group** 11-12



### DESCRIPTION

Colourless to yellow liquid with a pungent odour.

### SOLUBILITY

Soluble in ethyl acetate and petroleum ether.

**Solubility in water** Decomposes

### PHYSICAL DATA

**Molar mass** 183.03

**Melting point** -

**Boiling point** 105-107°C

**Specific gravity** 1.259 (25°C)

**Flammability** Combustible

### REGULATORY INFORMATION

**ADG Class** 8

**Packing Group** II

**UN Number** 3265

**Poisons Schedule** -

**Security** -

### HAZARD STATEMENTS

H314 Causes severe skin burns and eye damage

H302 Harmful if swallowed

H332 Harmful if inhaled

AUH014 Reacts violently with water

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (butyl rubber, Viton®; nitrile for splash contact). Adipoyl chloride is corrosive and a lachrymator. Exposure may cause irritation and burns to the skin, eyes, respiratory tract and on ingestion. Eye contact may cause permanent eye damage.

Handle only in an operating fume cupboard. Avoid breathing vapour and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Handle away from heat and sources of ignition.

The reaction with water is violent, giving adipic acid and corrosive fumes of hydrogen chloride.

### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Protect from moisture.

Store away from alcohols, oxidising agents, bases, alkali hydroxides, amines, alkali metals and alkaline earth metals. Store with corrosive liquids (organic acids).

### APPLICATIONS

**Senior chemistry:** a reagent in the preparation of nylon.

### SPILLS

Wear PPE. Ensure good ventilation. Remove all sources of ignition. Cover spill with a mixture of sodium carbonate or sodium bicarbonate and non-combustible absorbent such as sand, vermiculite or bentonite (clay cat litter). Scoop up with a non-sparking tool into a bucket of water. Test the pH (pH paper) and neutralise the solution by addition of HCl (1-2M) or sodium carbonate as necessary. Flush the neutral solution down the sink. Dispose of residual absorbent material as general waste.

Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

### WASTE DISPOSAL

The acid chloride can be decomposed by its reaction with aqueous base to give a non-hazardous water-soluble salt. Note that adipoyl chloride requires 4 equivalents of base for neutralisation.

**Small quantity:** Add the waste acid chloride to sodium hydroxide solution (2M) or sodium carbonate solution (2M) at the rate of 1mL of acid chloride to 20 mL of aqueous base. Carbon dioxide gas will evolve from the reaction with sodium carbonate. Neutralise the solution to pH ~7 by addition of HCl (1-2M) and flush down the sink.

**Large quantity:** Store in a suitable labelled container and arrange for collection by a licenced waste disposal contractor.

### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin with plenty of water. If irritation occurs, seek medical attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If effects persist, seek medical attention.

POISONS CENTRE: 13 11 26.



## ammonia, 10-32% solutions

*ammonium hydroxide solution*

**DANGER**



**Formula**  $\text{NH}_4\text{OH}$   
**CAS No.** 1336-21-6  
**User Group** 11-12

### DESCRIPTION

Clear to slightly turbid liquid with a strong pungent odour.

### SOLUBILITY

Miscible with water. Soluble in ethanol and diethyl ether.

**Solubility in water** Miscible

### PHYSICAL DATA

**Molar mass** 35.1 ( $\text{NH}_4\text{OH}$ )  
**Melting point** -8°C (8%)  
-69°C (28%)  
**Boiling point** 24.7°C (32%)  
**Specific gravity** 0.898 (20°C, 28%)  
**Flammability** Non-combustible

### REGULATORY INFORMATION

**ADG Class** 8  
**Packing Group** III  
**UN Number** 2672  
**Poisons Schedule** S6  
**Security** -

### HAZARD STATEMENTS

H314 Causes severe skin burns and eye damage  
H400 Very toxic to aquatic life

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (butyl-rubber, nitrile). The solution is strongly alkaline. Exposure may cause irritation and burns to the skin, eyes and respiratory tract and on ingestion. Eye contact may result in severe eye damage and permanent injury. Handle only in an operating fume cupboard. Avoid inhaling mist or vapour. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. The pressure in the bottle may build up, particularly at elevated temperatures. Bottles should therefore be opened cautiously, in an operating fume cupboard.

### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Ensure container is kept upright to avoid leakage. Store away from heat and sources of ignition.

Storage at or below room temperature (25°C) is recommended. Over time, the concentration will decrease as ammonia evolves from the solution.

Store away from acids, alkalis, oxidising agents and metals. Store segregated from other chemicals, on a low shelf with secondary containment.

### APPLICATIONS

**General science:** diluted, in investigations of acids and bases.

**Senior chemistry:** reagent for qualitative inorganic analysis.

**Technical:** preparation of buffer solutions.

### SPILLS

Wear PPE. Ensure good ventilation. Cover spill with absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up into a plastic container. In a fume cupboard, add the material slowly to a bucket of cold water and neutralise as for Waste Disposal. Decant neutral solution down the sink with further dilution. Dispose of residual solid material as general waste. Ventilate spill area and wash thoroughly with water. Wash any contaminated clothing before reuse.

### WASTE DISPOSAL

**Small quantity:** Wear PPE and work in a fume cupboard. Add waste ammonia solution slowly, with stirring, to a large volume of cold water. Neutralise the solution to within pH 6 - 8 by addition of 5% hydrochloric acid, with stirring. Flush the neutral solution down the sink.

**Large quantity:** Store in the original bottle or other suitable labelled container. Arrange for collection by a licenced waste disposal contractor.

### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin thoroughly with water/shower. Seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISONS CENTRE or doctor.

POISONS CENTRE: 13 11 26



**Formula**  $\text{NH}_4\text{OH}$   
**CAS No.** 1336-21-6  
**User Group** 7-12



#### DESCRIPTION

Cloudy white liquid with a pungent, irritating odour. An aqueous solution of ammonium hydroxide (generally, <5%) with added soap or surfactant.

#### SOLUBILITY

Miscible with water. Soluble in ethanol and diethyl ether.

**Solubility in water** Miscible

#### PHYSICAL DATA

**Molar mass** 35.05 ( $\text{NH}_4\text{OH}$ )  
**Melting point** -2.9°C (4%)  
-8°C (8%)  
**Boiling point** ca. 100°C  
**Specific gravity** 0.981 (20°C, 4%)  
0.965 (20°C, 8%)  
**Flammability** Non-combustible

#### REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** S5 (≤5%)  
S6 (>5%)  
**Security** -

#### HAZARD STATEMENTS

H315 Causes skin irritation  
H318 Causes serious eye damage

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (butyl-rubber, nitrile). The solution is strongly alkaline. Exposure may cause moderate irritation to the skin and respiratory tract. Eye contact may cause severe irritation, redness and pain. Ingestion may result in ulceration and burns to the mouth and throat. Handle in an operating fume cupboard or well-ventilated area. Avoid inhaling mist or vapour. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. As the pressure in the bottle may build up, particularly at elevated temperatures, bottles should be opened cautiously.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Ensure container is kept upright to avoid leakage. Store away from heat and sources of ignition. Storage at or below room temperature (25°C) is recommended. Over time, the concentration becomes lower as ammonia evolves from the solution. Store away from acids, oxidising agents, alkalis and metals. Store with dilute aqueous solutions.

#### APPLICATIONS

**General science:** investigations of the acidity/basicity of household substances.

**Senior chemistry:** titrimetric determination of ammonia in a commercially available product.

#### SPILLS

Wear PPE. Ensure good ventilation. Cover spill with absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up into a plastic container. In a fume cupboard, add the material slowly to a bucket of cold water and neutralise as for Waste Disposal. Decant the neutral solution down the sink with further dilution. Dispose of the residual solid material as general waste. Ventilate spill area and wash thoroughly with water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Wear PPE and work in a fume cupboard. Add waste ammonia solution slowly, with stirring, to 2-3 times its volume of cold water. Neutralise the solution to within pH 6-8 by addition of 5% hydrochloric acid, with stirring. Flush the neutral solution down the sink.

**Large quantity:** Store in the original bottle or other suitable labelled container. Arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. Call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing and wash before reuse. Rinse skin thoroughly with water/shower. If skin irritation occurs, seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms persist, seek medical attention.

POISONS CENTRE: 13 11 26



**ANGER**

**Formula** (NH<sub>4</sub>)<sub>2</sub>S<sub>2</sub>O<sub>8</sub>

**CAS No.** 7727-54-0

**User Group** Staff



#### DESCRIPTION

Odourless, white crystals or powder.

#### SOLUBILITY

Soluble in water.

**Solubility in water** 620 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 228.2

**Melting point** 120°C (decomposes)

**Boiling point** -

**Specific gravity** 1.98 (20°C)

**Flammability** Non-combustible  
oxidising solid

#### REGULATORY INFORMATION

**ADG Class** 5.1

**Packing Group** III

**UN Number** 1444

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

H272 May intensify fire; oxidizer

H302 Harmful if swallowed

H315 Causes skin irritation

H319 Causes serious eye irritation

H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled

H317 May cause an allergic skin reaction

H335 May cause respiratory irritation

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (neoprene, nitrile). Exposure may cause severe irritation and corrosive injury to the skin, eyes and respiratory tract. Chronic exposure may lead to allergic dermatitis or asthma. Handle in an operating fume cupboard. Avoid generating or inhaling dust. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Handle away from heat and ignition sources and combustible materials. Use only clean, dry plastic or stainless steel tools and utensils when transferring persulfate from the stock bottle. In case of fire or runaway decomposition, flooding quantities of water should be used as the extinguishing agent.

#### STORAGE

Store in a tightly closed container in a cool, dry well-ventilated place. Over time, ammonium persulfate slowly decomposes, releasing oxygen and oxides of sulfur and nitrogen. Decomposition is accelerated by heat, moisture, sunlight or contamination. Protect from air, moisture and direct sunlight. Store away from heat and ignition sources. Store away from acids, alkalis, halogens, reducing agents, organic substances, combustible materials, hydrogen peroxide and metals. Store with oxidising substances (DG Class 5.1). Store with secondary containment (e.g. in a clear, lidded polyethylene bottle). Bottles of aqueous solutions must have a vented lid to avoid overpressurisation.

#### APPLICATIONS

**Senior chemistry:** iodine clock reaction kinetics

#### SPILLS

Wear PPE. Remove all sources of ignition and any combustible materials from the spill area. Ensure good ventilation. **Solid spill:** Collect material with a non-sparking tool and treat as for Waste Disposal.

**Solution spill:** Absorb with non-combustible material such as sand, vermiculite or bentonite (clay cat litter). Collect material with a non-sparking tool and add slowly to a large volume of water. Reduce the persulfate and neutralise the solution as for Waste Disposal. Decant the supernatant down the sink and dispose of solid residue as general waste. Wash spill area thoroughly with water; ensure no persulfate residues remain in contact with combustible material. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Solid persulfates must not be disposed of with general waste and not mixed with other waste. Store waste or surplus ammonium persulfate in the original container or other suitable labelled container. Arrange for disposal via a licenced contractor. Persulfate which has been exposed to water or other contaminant should be disposed of.

**Small quantity of solution:** Solutions of concentration <1%: wash down the sink. Higher concentrations: Dilute to <10%, then add H<sub>2</sub>SO<sub>4</sub> (1M) until the pH is < 3. Cautiously add a reducing agent. 350mL of 10% sodium thiosulfate solution will reduce 500mL of 10% persulfate solution. Neutralise the resulting solution to within pH 6-8 by addition of sodium carbonate and wash down the sink.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Give water to drink. Seek immediate medical attention.

**IF ON SKIN:** Remove immediately all contaminated clothing. Wash skin with soap and plenty of water. If skin irritation or rash occurs: Get medical advice/attention

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If experiencing respiratory symptoms: Call a POISONS CENTRE or doctor.

POISONS CENTRE: 13 11 26



# barium hydroxide, octahydrate

*caustic baryta*

**ANGER**

**Formula** Ba(OH)<sub>2</sub>·8H<sub>2</sub>O

**CAS No.** 12230-71-6

**User Group** 11-12



## DESCRIPTION

Colourless, odourless crystals.

## SOLUBILITY

Soluble in water, and dilute hydrochloric acid and dilute nitric acid. Slightly soluble in ethanol and methanol. Insoluble in acetone.

**Solubility in water** 72 g/L

## PHYSICAL DATA

**Molar mass** 315.47

**Melting point** 78°C

**Boiling point** 780°C

**Specific gravity** 2.18 (20°C)

**Flammability** Non-combustible

## REGULATORY INFORMATION

**ADG Class** 8 (6.1)

**Packing Group** II

**UN Number** 2923

**Poisons Schedule** S6

**Security** -

## HAZARD STATEMENTS

H302 Harmful if swallowed

H332 Harmful if inhaled

H314 Causes severe skin burns and eye damage

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). The solid and solution are highly corrosive; aqueous solutions are strongly basic. Exposure may cause irritation and burns to the skin, eyes and respiratory tract and on ingestion. Eye contact may result in severe eye damage and permanent injury. Symptoms of ingestion include headache, nausea, vomiting and muscle weakness. Handle in a well-ventilated area. Avoid generating dust. Avoid inhalation and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

## STORAGE

The hydroxide reacts with carbon dioxide from the air to form barium carbonate. Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Protect from air and moisture.

Store away from acids, oxidising agents, metals and organic materials.

Store with corrosive solids.

## APPLICATIONS

**General science:** to demonstrate its endothermic reaction with ammonium salts.

**Senior chemistry:** diluted, in acid-base titrations; a source of soluble barium ion in displacement reactions.

## SPILLS

Wear PPE. Ensure good ventilation. Scoop up and place into a suitable labelled container. Store for collection. Wash spill area thoroughly with water. Residual barium salts can be dissolved with dilute hydrochloric acid (0.01M) followed by rinsing with water. Wash any contaminated clothing before reuse.

## WASTE DISPOSAL

Store waste or surplus barium hydroxide in the original container or other suitable labelled container. Arrange for collection by a licenced chemical waste contractor.

**Waste solution:** Neutralise the solution to within pH 6-8 by addition of sulfuric acid (1M). Allow the mixture to stand for 3-4 days, then test with a few drops of 10% sodium sulfate solution. If further precipitation of barium sulfate occurs, add sodium sulfate solution until there is no further precipitation. Collect the white solid by filtration and allow to dry. Small quantities of barium sulfate can be disposed of as general waste. Large quantities: place in a suitable labelled container such as for waste inorganic solids and store for collection. Dispose of the neutral filtrate down the sink.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical attention.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Rinse skin thoroughly with water/shower. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Seek medical attention. POISONS CENTRE: 13 11 26



**Formula**  $C_7H_6O_2$

**CAS No.** 65-85-0

**User Group** 11-12



#### DESCRIPTION

Colourless crystalline powder with a faint odour.

#### SOLUBILITY

Slightly soluble in water. Soluble in ethanol, diethyl ether and acetone.

**Solubility in water** 2.9 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 122.12

**Melting point** 121-123°C

**Boiling point** 249°C

**Specific gravity** 1.27 (20°C)

**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

H315 Causes skin irritation

H318 Causes serious eye damage

H372 Causes damage to organs (lungs) through prolonged or repeated exposure if inhaled

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation to the skin, eyes and respiratory tract. An allergic reaction may result from skin contact or ingestion.

Handle in an operating fume cupboard or well-ventilated area. Avoid generating dust. Avoid breathing dust or aerosols. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light.

Store away from oxidising agents, bases and reducing agents.

Store with general organic solids.

#### APPLICATIONS

**Senior chemistry:** melting point determinations; to practise recrystallisation technique; ester preparation.

#### SPILLS

Wear PPE. Ensure good ventilation. Eliminate all ignition sources.

**Solid spill:** Scoop up with a non-sparking tool. Treat as for waste acid.

**Liquid spill:** Cover spill with sodium carbonate or a 1:1:1 mixture of sand, sodium carbonate and vermiculite or bentonite (clay cat litter). Scoop up and add to a large volume of water. Neutralise the solution as for Waste Disposal. Decant neutral solution down the sink. Dispose of residual solids as general waste.

Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Dissolve waste by adding to 5% sodium carbonate solution. Test the pH with pH paper and neutralise the solution to within pH 6-8 by addition of sodium carbonate or dilute hydrochloric acid (0.5M) in portions as necessary. Flush the neutral solution down the sink.

**Large quantity:** Store in the original container or other suitable labelled container, such as for waste dry organic solids. Arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. Seek medical attention.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin thoroughly with plenty of water and mild soap. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Get medical advice/attention if you feel unwell.

POISONS CENTRE: 13 11 26



# benzoyl chloride

*benzoic acid chloride*

**DANGER**



**Formula** C<sub>7</sub>H<sub>5</sub>ClO

**CAS No.** 98-88-4

**User Group** 11-12

## DESCRIPTION

Colourless fuming liquid with a disagreeable, pungent odour.

## SOLUBILITY

Miscible with diethyl ether and oils.

**Solubility in water** Decomposes

## PHYSICAL DATA

**Molar mass** 140.57

**Melting point** -1°C

**Boiling point** 197°C

**Specific gravity** 1.22 (20°C)

**Flammability** Combustible

## REGULATORY INFORMATION

**ADG Class** 8

**Packing Group** II

**UN Number** 1736

**Poisons Schedule** -

**Security** -

## HAZARD STATEMENTS

H227 Combustible liquid

H302 Harmful if swallowed

H312 Harmful in contact with skin

H332 Harmful if inhaled

H314 Causes severe skin burns and eye damage

H317 May cause an allergic skin reaction

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Viton®; neoprene for splash contact). Benzoyl chloride is corrosive and a lachrymator. Exposure may cause irritation and burns to the skin, eyes, respiratory tract and on ingestion. Eye exposure may cause permanent damage. Skin contact may lead to an allergic reaction. Handle only in an operating fume cupboard. Avoid breathing vapour and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Handle away from heat and sources of ignition. Benzoyl chloride decomposes in water to give benzoic acid and hydrochloric acid.

## STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Protect from moisture. Ensure container is kept upright to prevent leakage. Store away from heat and sources of ignition. Store away from alcohols, oxidising agents, bases, alkali hydroxides, amines, alkali metals and alkaline earth metals. Store with corrosive liquids (organic acids).

## APPLICATIONS

**Senior chemistry:** preparation of esters, amides.

## SPILLS

Wear PPE. Ensure good ventilation. Remove all sources of ignition. Cover spill with a mixture of sodium carbonate or sodium bicarbonate and non-combustible absorbent such as sand, vermiculite or bentonite (clay cat litter). Scoop up with a non-sparking tool into a bucket of water. Allow the mixture to stand overnight. Test the pH (pH paper) and neutralise the solution by addition of HCl (1-2M) or sodium carbonate as necessary. Flush the neutral solution down the sink. Dispose of residual absorbent material as general waste. Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

## WASTE DISPOSAL

The acid chloride can be decomposed by its reaction with aqueous base to give a non-hazardous water-soluble salt. Benzoyl chloride requires 2 equivalents of base for neutralisation.

**Small quantity:** Add the waste acid chloride to sodium hydroxide solution (2M) or sodium carbonate solution (2M) at the rate of 1mL of acid chloride to 20 mL of aqueous base. Carbon dioxide gas will evolve from the reaction with sodium carbonate. Allow the mixture to stand overnight. Neutralise the solution to pH ~7 by addition of HCl (1-2M) and flush down the sink.

**Large quantity:** Store in a suitable labelled container and arrange for collection by a licenced waste contractor.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Take off immediately all contaminated clothing. Wash skin with plenty of water. If skin irritation or rash occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISONS CENTRE or doctor.  
POISONS CENTRE: 13 11 26.



**Formula**  $\text{H}_3\text{BO}_3$   
**CAS No.** 10043-35-3  
**User Group** 7-12

#### DESCRIPTION

Colourless, odourless crystals or powder with a faintly bitter taste.

#### SOLUBILITY

Soluble in water, ethanol, methanol, glycerol, ethylene glycol. Slightly soluble in acetone, ethyl acetate.

**Solubility in water** 49.2 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 61.83  
**Melting point** 168-171°C  
**Boiling point** 300°C  
**Specific gravity** 1.489 (23°C)  
**Flammability** Non-combustible

#### REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** S5  
**Security** -

#### HAZARD STATEMENTS

H360FD May damage fertility.  
May damage the unborn child.

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). The aqueous solution is a weak acid. Exposure may cause irritation to the skin, eyes and respiratory tract and on ingestion. May be harmful by ingestion, inhalation or by absorption through abraded skin or open wounds.

Handle in an operating fume cupboard or well-ventilated area. Avoid generating and inhaling dust and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

The reaction with alkali metals or metal hydrides generates flammable hydrogen gas. In the presence of water, the acid is corrosive to metals.

Boric acid should not be handled by pregnant staff.

#### STORAGE

Boric acid is moisture sensitive. Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Protect from moisture.

Store away from strong oxidising agents, strong reducing agents, strong bases, alkali metals.

Store with general inorganic solids.

#### APPLICATIONS

**General science:** flame test activities.

**Senior biology:** a component of pollen germination media.

**Senior chemistry:** glass making.

**Technical:** preparation of buffer solutions.

#### SPILLS

Wear PPE. Ensure good ventilation.

**Solid spill:** Scoop up with a non-sparking tool. Solution spill: Absorb spill with non-combustible absorbent such as a 1:1:1 mixture of sodium carbonate, bentonite (clay cat litter) and sand. Scoop up with a non-sparking tool.

**Small spill:** Add material to a large volume of water.

Neutralise as for waste disposal. Decant the neutral solution down the sink. Dispose of solid material as general waste.

**Large spill:** Place material in a suitable labelled container and arrange for collection. Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

The acid is harmful to the aquatic environment due to the pH shift. Boron can bioaccumulate in plants but is not expected to bioaccumulate in aquatic food chains.

**Small quantity:** Wear PPE and work in a fume cupboard.

Add the waste acid slowly to a large volume of water.

Neutralise the solution to between pH 6 and 8 with sodium carbonate, adding the base cautiously in portions until there is no further evolution of  $\text{CO}_2$ . Dispose of the neutral solution down the sink.

**Large quantity:** Store in a suitable labelled container.

Arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists, seek medical advice.

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. If irritation or discomfort persist, seek medical advice/attention.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Rinse skin thoroughly with water/shower. If skin irritation persists, seek medical advice.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms persist, seek medical advice. If exposed or concerned: Get medical advice/attention.



**Formula** Br<sub>2</sub>  
**CAS No.** 7726-95-6 (bromine)  
**User Group** 11-12 (Note L)



#### DESCRIPTION

Clear, dark orange liquid with a pungent odour.

#### SOLUBILITY

Miscible with water.

*Bromine is soluble in ethanol, diethyl ether, non-polar solvents and halogenated solvents.*

**Solubility in water** Miscible

#### PHYSICAL DATA

**Molar mass** 79.904 (bromine)

**Melting point** -

**Boiling point** ca. 100°C

**Specific gravity** ca. 1.0

**Flammability** Non-combustible

#### REGULATORY INFORMATION

**ADG Class** 8 (6.1)

**Packing Group** I

**UN Number** 1744

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

H315 Causes skin irritation

H318 Causes serious eye damage

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Viton®, neoprene). Exposure may cause severe irritation and burns to the skin, eyes and respiratory tract and on ingestion.

Bromine vapour is toxic by inhalation. Symptoms of inhalation of low concentrations of the vapour include cough, nose bleed, and CNS effects. Eye contact with the solution may result in permanent damage.

Handle only in an operating fume cupboard. Avoid inhaling fumes, vapour or mist. Avoid contact with skin, eyes and clothing. Open the bottle cautiously as pressure may have developed.

#### STORAGE

Bromine water is light-sensitive; sunlight accelerates the disproportionation of bromine to hydrobromic acid and hypobromous acid. Store in a tightly closed amber glass bottle in a cool, dry, well-ventilated place. Protect from sunlight. Inspect the lid periodically for damage. Consider bundling in a secondary lidded container. Do not store in the refrigerator, as bromine vapour may build up and can corrode refrigerator components.

Store away from combustible material, organic substances, reducing agents and metals.

Store with corrosive substances.

Solutions of bromine in water have a concentration of less than 5%. The concentration of the solution will reduce over time due to loss of the volatile bromine from the solution.

#### APPLICATIONS

**Senior chemistry:** test for unsaturation of organic compounds; qualitative properties of the element.

#### SPILLS

Wear PPE. Ensure good ventilation. Cover spill with a mixture of sodium thiosulfate and sand or other non-combustible material. Collect material and add to a large volume of water. Allow the mixture to stand for several minutes. Stir the mixture and if bromine still remains in solution (indicated by its colour), treat with further thiosulfate solution as for Waste Disposal. Decant the solution down the sink and dispose of solid residue as general waste. Wash the spill area with dilute sodium thiosulfate solution (<0.1M) and then with water. Rinse any contaminated clothing immediately with water, and wash before reuse.

#### WASTE DISPOSAL

**Small quantity:** To the waste bromine water, slowly add a dilute solution of sodium thiosulfate (0.1-0.2 M) until the resulting solution becomes clear. Wash the solution down the sink with further dilution.

**Large quantity:** Store in the original bottle or a labelled amber glass bottle and arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Give water to drink. Seek immediate medical attention.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Rinse skin thoroughly with plenty of water. Seek medical attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Seek immediate medical attention.

POISONS CENTRE: 13 11 26



**Formula** C<sub>4</sub>H<sub>10</sub>O

**CAS No.** 71-36-3

**User Group** 11-12



#### DESCRIPTION

Clear, colourless, volatile liquid with a sweet, ethanol-like odour.

#### SOLUBILITY

Soluble in water, ethanol, diethyl ether and other organic solvents.

**Solubility in water** 77 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 74.12

**Melting point** -89°C

**Boiling point** 118°C

**Specific gravity** 0.81 (20°C)

**Flammability** Flammable

#### REGULATORY INFORMATION

**ADG Class** 3

**Packing Group** III

**UN Number** 1120

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

H226 Flammable liquid and vapour

H302 Harmful if swallowed

H315 Causes skin irritation

H318 Causes serious eye damage

H335 May cause respiratory irritation

H336 May cause drowsiness or dizziness

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Butyl, Viton®; nitrile for splash protection). Exposure may cause irritation to the skin, eyes, nose, throat and respiratory tract. Symptoms of inhalation, ingestion or skin absorption include nausea, headache, dizziness and CNS depression. Prolonged or repeated skin contact can lead to dryness and cracking. Eye exposure to the liquid may cause severe irritation and serious eye damage.

Handle in an operating fume cupboard or well-ventilated area. Avoid generating and inhaling vapour or mist. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.

#### STORAGE

Store in a tightly closed container in a cool, dry well-ventilated place away from heat and light. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition.

Store away from oxidising agents, acids, acid chlorides, bases, halogens, reducing agents, alkali metals and aluminium.

Store with flammable liquids in an AS compliant cabinet.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation.

**Small spill:** Treat as for Waste Disposal.

**Large spill:** Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection.

Wash the spill area thoroughly with water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Absorb onto paper towel and allow alcohol to evaporate in an operating fume cupboard. Dispose of paper towel as general waste.

**Large quantity:** Store in the original container or other suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor. The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Call a POISONS CENTRE or doctor if you feel unwell.

**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin thoroughly with water/shower. Wash contaminated clothing before reuse. If irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26

#### APPLICATIONS

**Senior chemistry:** to observe the reactivity of a primary alcohol; preparation of esters; heat of combustion investigations.





**WARNING**

**Formula** C<sub>4</sub>H<sub>10</sub>O

**CAS No.** 78-92-2

**User Group** 11-12



**DESCRIPTION**

Clear, colourless volatile liquid with a sweet, alcohol-like odour.

**SOLUBILITY**

Miscible with ethanol and diethyl ether.  
Soluble in water and acetone.

**Solubility in water** 125 g/L (20°C)

**PHYSICAL DATA**

**Molar mass** 74.12

**Melting point** -115°C

**Boiling point** 99°C

**Specific gravity** 0.81 (20°C)

**Flammability** Flammable

**REGULATORY INFORMATION**

**ADG Class** 3

**Packing Group** III

**UN Number** 1120

**Poisons Schedule** -

**Security** -

**HAZARD STATEMENTS**

H226 Flammable liquid and vapour

H319 Causes serious eye irritation

H335 May cause respiratory irritation

H336 May cause drowsiness or dizziness

**SAFE HANDLING**

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Butyl, Viton®; nitrile for splash protection). Exposure may cause irritation to the eyes, nose, throat and respiratory tract and on ingestion. Exposure to high concentrations of the vapour may cause CNS depression, nausea, headache and dizziness. Prolonged or repeated skin contact can lead to dryness, cracking and dermatitis. Eye exposure to the liquid may cause severe irritation and serious eye damage. Handle in an operating fume cupboard or well-ventilated area. Avoid generating and inhaling vapour or mist. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.

Test for peroxides before use, particularly if intending to heat or distill the alcohol.

**STORAGE**

With prolonged storage, and on exposure to air and sunlight, the alcohol may form peroxides, which may become explosive if they are concentrated. Store in a tightly closed container in a cool, dry well-ventilated place away from sunlight. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition. Store away from oxidising agents, acids, acid chlorides, bases, halogens, reducing agents, alkali metals and aluminium. Store with flammable liquids in an AS compliant cabinet. Mark the bottle with the date received and date opened.

**SPILLS**

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool.

**Small spill:** Add material to a large volume of water and allow to stand until the solids have settled. Decant the solution down the sink with further dilution. Dispose of the absorbent material as general waste.

**Large spill:** Place material into a suitable labelled container and store for collection.

Wash the spill area thoroughly with water. Wash any contaminated clothing before reuse.

**WASTE DISPOSAL**

Store waste or surplus butan-2-ol in a suitable labelled container and arrange for collection by a licenced waste disposal contractor. As the alcohol is a peroxide former, waste or surplus butan-2-ol should not be stored with any other waste.

The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

**FIRST AID**

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Call a POISONS CENTRE or doctor if you feel unwell.

**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin thoroughly with water/shower. Wash contaminated clothing before reuse. If irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26

**APPLICATIONS**

**Senior chemistry:** to observe the reactivity of a secondary alcohol.



**Formula** C<sub>4</sub>H<sub>8</sub>O  
**CAS No.** 78-93-3  
**User Group** 11-12



#### DESCRIPTION

Colourless, highly volatile, highly flammable liquid with a sweet, sharp odour.

#### SOLUBILITY

Soluble in water, ethanol, diethyl ether and acetone.

**Solubility in water** 292 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 72.11  
**Melting point** -86°C  
**Boiling point** 80°C  
**Specific gravity** 0.805 (20°C)  
**Flammability** Highly flammable

#### REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** II  
**UN Number** 1193  
**Poisons Schedule** S5  
**Security** IDM Cat 3

#### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour  
H319 Causes serious eye irritation  
H336 May cause drowsiness or dizziness  
AUH066 Repeated exposure may cause skin dryness and cracking

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (butyl rubber). Exposure may cause irritation of the skin, eyes and respiratory tract. Ingestion or inhalation may cause CNS depression, drowsiness and dizziness. Prolonged or repeated skin contact may have a degreasing effect. Handle in an operating fume cupboard or well-ventilated area. Avoid inhaling fumes, vapour or mist. Avoid contact with skin and eyes. Handle away from heat and other sources of ignition.

There is potential for the vapour to collect in low-lying, confined areas. The vapour can form explosive mixtures with air and can travel to an ignition source and flash back. Test for peroxides before use, particularly if intending to heat the substance.

#### STORAGE

The liquid is hygroscopic, becoming yellow over time. May form explosive peroxides over time and on exposure to air, light or oxidising agents. Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Ensure container is kept upright to prevent leakage. Store away from heat and any sources of ignition. Store away from oxidising agents, reducing agents, metals, acids, alkalis, plastics and rubber. Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** solvent for extraction of natural products; sample compound for gas chromatography.

#### SPILLS

Wear PPE. Ensure good ventilation. Remove all sources of ignition. Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand.

**Small quantity:** Place spill material in a shallow vessel in an operating fume cupboard and allow the ketone to evaporate from the absorbent. Dispose of the absorbent material as general waste.

**Large quantity:** Place in a suitable labelled container and store for collection.

Ventilate the spill area to evaporate any residual ketone and wash thoroughly with water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Butan-2-one is expected to biodegrade in the environment and is not expected to bioaccumulate.

**Small quantity:** Place in a shallow vessel in an operating fume cupboard and allow to evaporate.

**Large quantity:** Store in a suitable labelled bottle such as for 'waste non-halogenated organic liquid'. Arrange for collection by a licenced waste disposal contractor.

The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose empty bottles to heat, open flames or other sources of ignition.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical advice/attention.

**IF ON SKIN:** Remove immediately contaminated clothing. Rinse skin thoroughly with water/shower. If irritation occurs, seek medical advice.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26



**Formula**  $C_4H_8O_2$   
**CAS No.** 107-92-6  
**User Group** 11-12



#### DESCRIPTION

Colourless, oily liquid with disagreeable, rancid odour.

#### SOLUBILITY

Miscible with water. Soluble in ethanol and diethyl ether.

**Solubility in water** Miscible

#### PHYSICAL DATA

**Molar mass** 88.11  
**Melting point** -8 to -5°C  
**Boiling point** 163.5°C  
**Specific gravity** 0.96 (20°C)  
**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** 8  
**Packing Group** III  
**UN Number** 2820  
**Poisons Schedule** S6  
**Security** -

#### HAZARD STATEMENTS

H302 Harmful if swallowed  
H314 Causes severe skin burns and eye damage

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Viton®, butyl rubber; latex or nitrile gloves provide splash protection). Exposure may cause irritation to the skin, eyes and respiratory tract. Eye contact may result in burns and permanent eye damage.

Handle only in an operating fume cupboard. Avoid generating and inhaling vapour or mist. Avoid ingestion and contact with skin, eyes and clothing.

Substance is combustible; vapours may form explosive mixtures with air.

Contact with reactive metals such as aluminium, iron, tin, and zinc may generate flammable hydrogen gas.

#### SPILLS

Wear PPE. Ensure good ventilation. Eliminate all ignition sources. Cover spill with sodium carbonate or a 1:1:1 mixture of sand, sodium carbonate and vermiculite or bentonite (clay cat litter). Collect spilled material with a non-sparking tool. Add slowly to a large volume of water with stirring. Neutralise the solution to within pH 6-8 by addition of sodium carbonate in portions (test with pH paper). Decant the neutral solution down the sink with further dilution. Dispose of the residual solids as general waste. Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Dilute waste to a concentration of about 5% by slowly adding the acid to water with stirring. Neutralise the solution to within pH 6-8 by addition of sodium carbonate in portions (test with pH paper). Flush the neutral solution down the sink with further dilution.

**Large quantity:** Store in the original container or other suitable labelled container. Arrange for collection by a licenced waste disposal contractor.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Ensure container is kept upright to prevent leakage. Store away from heat and any sources of ignition.

Store away from oxidising agents, strong bases and reactive metals.

Store with corrosives liquids (organic acids).

#### APPLICATIONS

**Senior chemistry:** preparation of esters

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. Seek immediate medical attention.

**IF ON SKIN:** Remove immediately contaminated clothing. Rinse skin thoroughly with water/shower. Seek medical attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISONS CENTRE or doctor.

POISONS CENTRE: 13 11 26



**Formula**  $C_6H_{12}O_2$

**CAS No.** 123-86-4

**User Group** 11-12



#### DESCRIPTION

Clear, colourless, volatile liquid with a pleasant banana-like odour.

#### SOLUBILITY

Slightly soluble in water. Miscible with ethanol and diethyl ether. Soluble in acetone and most hydrocarbons.

**Solubility in water** 4.3 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 116.16

**Melting point** -77°C

**Boiling point** 127°C

**Specific gravity** 0.88 (20°C)

**Flammability** Highly flammable

#### REGULATORY INFORMATION

**ADG Class** 3

**Packing Group** II

**UN Number** 1123

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour

H336 May cause drowsiness or dizziness

AUH066 Repeated exposure may cause skin dryness and cracking

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (PE/EVAL; nitrile for splash contact). Exposure may cause irritation to the skin, eyes and respiratory tract. Inhalation or ingestion may cause dizziness or drowsiness. Handle in an operating fume cupboard or well-ventilated area. Avoid breathing vapour and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition. The ester may attack/dissolve some plastics.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place. Protect from light, especially direct sunlight. Store away from heat and all sources of ignition. Ensure container is kept upright to prevent leakage. Store away from strong oxidising agents, strong acids, strong bases, alkali metals and alkali hydroxides. Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** product of the esterification reaction between acetic acid and *n*-butanol.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Absorb spill with paper towel, or cover with inert absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool.

**Small spill:** Evaporate as for Waste Disposal.

**Large spill:** Place material into a suitable labelled container and store for collection.

Wash the spill area with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Absorb onto paper towel or other absorbent and allow the solvent to evaporate in an operating fume cupboard. Dispose of absorbent material as general waste.

**Large quantity:** Store in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical attention.

**IF ON SKIN:** Take off immediately all contaminated clothing. Wash skin thoroughly with plenty of soap and water.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26.



**Formula**  $C_8H_{16}O_2$   
**CAS No.** 109-21-7  
**User Group** 11-12

#### DESCRIPTION

Colourless liquid with a pineapple-like odour.

#### SOLUBILITY

Very slightly soluble in water. Miscible with ethanol and diethyl ether.

**Solubility in water** 0.5 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 144.21  
**Melting point** -92°C  
**Boiling point** 166°C  
**Specific gravity** 0.87 (20°C)  
**Flammability** Flammable

#### REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** III  
**UN Number** 3272  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

H226 Flammable liquid and vapour

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (PE/EVAL; butyl rubber for splash contact). Exposure may cause skin, eye or respiratory irritation. Inhalation or ingestion may cause headache, dizziness or drowsiness. Handle in an operating fume cupboard or well-ventilated area. Avoid breathing vapour and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Store away from heat and any sources of ignition. Ensure container is kept upright to prevent leakage.  
Store away from strong oxidising agents and strong bases.  
Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** product of the esterification reaction between butyric acid and *n*-butanol.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Absorb spill with paper towel, or cover with inert absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool.

**Small spill:** Evaporate as for Waste Disposal.

**Large spill:** Place material into a suitable labelled container and store for collection.

Wash the spill area with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Absorb onto paper towel or other absorbent and allow the solvent to evaporate in an operating fume cupboard. Dispose of absorbent material as general waste.

**Large quantity:** Store in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Seek medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical advice/attention.

**IF ON SKIN:** Take off immediately all contaminated clothing. Wash skin thoroughly with plenty of soap and water.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26.





## butyl propanoate

*n*-butyl propionate; propionic acid, butyl ester

**WARNING**



**Formula**  $C_7H_{14}O_2$   
**CAS No.** 590-01-2  
**User Group** 11-12

### DESCRIPTION

Clear, colourless liquid with an apple-like odour.

### SOLUBILITY

Slightly soluble in water. Miscible with ethanol and diethyl ether.

**Solubility in water** 1.5 g/L (20°C)

### PHYSICAL DATA

**Molar mass** 130.19  
**Melting point** -90°C  
**Boiling point** 146°C  
**Specific gravity** 0.87 (20°C)  
**Flammability** Flammable

### REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** III  
**UN Number** 1914  
**Poisons Schedule** -  
**Security** -

### HAZARD STATEMENTS

H226 Flammable liquid and vapour  
H315 Causes skin irritation  
H318 Causes serious eye damage

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (PE/EVAL; neoprene for splash contact). Exposure may cause skin, eye or respiratory irritation. Inhalation or ingestion may cause dizziness or drowsiness. Handle in an operating fume cupboard or well-ventilated area. Avoid breathing vapour and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Vapours will form explosive mixtures with air. There is potential for the vapour to collect in low-lying, confined areas. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.

### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Store away from heat and any sources of ignition. Ensure container is kept upright to prevent leakage. Store away from strong oxidising agents, strong acids, strong bases, alkali metals and reducing agents. Store with flammable liquids in an AS compliant cabinet.

### APPLICATIONS

**Senior chemistry:** product of the esterification reaction between propionic acid and *n*-butanol.

### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Absorb spill with paper towel, or cover with inert absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool.

**Small spill:** Evaporate as for Waste Disposal.

**Large spill:** Place material into a suitable labelled container and store for collection.

Wash the spill area with detergent and water. Wash any contaminated clothing before reuse.

### WASTE DISPOSAL

**Small quantity:** Absorb onto paper towel or other absorbent and allow the solvent to evaporate in an operating fume cupboard. Dispose of absorbent material as general waste.

**Large quantity:** Store in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do.

Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical advice/attention.

**IF ON SKIN:** Take off immediately all contaminated clothing. Wash skin thoroughly with plenty of soap and water.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26.



**Formula**  $\text{CaCO}_3$   
**CAS No.** 471-34-1  
**User Group** F-12

#### DESCRIPTION

Colourless, odourless crystals or powder with a chalky taste.

#### SOLUBILITY

Sparingly soluble in water. Insoluble in ethanol. Dissolves in dilute acids, with evolution of carbon dioxide.

**Solubility in water** 14 mg/L (20°C)

#### PHYSICAL DATA

**Molar mass** 100.09  
**Melting point** 825°C decomposes  
**Boiling point** -  
**Specific gravity** 2.7-2.95  
**Flammability** Non-combustible

#### REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

Not classified as hazardous

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Exposure may cause irritation to the skin, eyes and respiratory tract.  
Handle in a well ventilated area. Avoid generating and inhaling dust. Avoid contact with skin and eyes. Avoid prolonged or repeated exposure.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light.  
Store away from acids and oxidising agents.  
Store with general inorganic solids.

#### APPLICATIONS

**General science:** acid-base chemistry; to investigate its thermal decomposition to form calcium oxide.

#### SPILLS

Wear PPE. Ensure good ventilation. Scoop up and treat as for Waste Disposal.  
Wash spill area thoroughly with water. A weak solution of acid (0.01M HCl) can be used to dissolve any residues, followed by rinsing with water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Seal in a plastic bag and dispose of as general waste.  
**Large quantity:** Store in the original container or other suitable labelled container such as for dry inorganic solid waste. Arrange for collection via a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists, seek medical attention.  
**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical advice/attention if feeling unwell.  
**IF ON SKIN:** Remove contaminated clothing. Wash skin thoroughly with plenty of water and mild soap. If skin irritation occurs, seek medical advice.  
**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical advice/attention.



# calcium chloride, anhydrous

*calcium dichloride*

**WARNING**



**Formula**  $\text{CaCl}_2$   
**CAS No.** 10043-52-4  
**User Group** 7-12

## DESCRIPTION

Colourless, odourless, hygroscopic crystals, granules, flake, prills or powder.

## SOLUBILITY

Soluble in water and ethanol. Dissolution in water generates heat.

**Solubility in water** 740 g/L (20°C)

## PHYSICAL DATA

**Molar mass** 110.98  
**Melting point** 772°C  
**Boiling point** 1670°C  
**Specific gravity** 2.15 (20°C)  
**Flammability** Non-combustible

## REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** -  
**Security** -

## HAZARD STATEMENTS

H319 Causes serious eye irritation

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Exposure may cause severe irritation and burns to the skin, eyes and respiratory tract and on ingestion. Prolonged or repeated skin contact may cause dermatitis.

Handle in an operating fume cupboard or well ventilated area. Avoid generating and inhaling dust. Avoid contact with skin, eyes and clothing.

Use cool water when preparing solutions of calcium chloride as dissolution liberates much heat.

## STORAGE

The anhydrous salt is hygroscopic and deliquescent. Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Protect from moisture.

Store away from strong oxidising agents, strong acids, zinc, aluminium and ferrous metals.

Store with general inorganic solids.

## APPLICATIONS

**General science:** to demonstrate exothermicity on dissolution and melting of ice; flame test solutions; a source of calcium ions in solution.

**Senior chemistry:** qualitative inorganic analysis; drying agent/desiccant.

**Technical:** desiccant

## SPILLS

Wear PPE. Ensure good ventilation. Cover spill with dry sand.

**Small spill:** Scoop up material with a non-sparking tool and add to a large volume of water. Decant the solution down the sink with further dilution. Dispose of solid residue as general waste.

**Large spill:** Scoop up material and place into a suitable labelled container. Arrange for collection. Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

## WASTE DISPOSAL

**Small quantity:** Add to a large volume of water. Flush down the sink with dilution.

**Large quantity:** Store waste or surplus calcium chloride in the original container or other suitable labelled container. Arrange for collection by a licenced waste disposal contractor.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek immediate medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Give water to drink. Seek medical attention.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin with plenty of water. If skin irritation occurs, seek medical attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical advice/attention.





**Formula**  $\text{Ca}_3(\text{C}_6\text{H}_5\text{O}_7)_2 \cdot 4\text{H}_2\text{O}$

**CAS No.** 5785-44-4

**User Group** 7-12

#### DESCRIPTION

White to off-white, odourless, fine powder.

#### SOLUBILITY

Very slightly soluble in water. Insoluble in alcohol.

**Solubility in water** 1 g/L (18°C)

#### PHYSICAL DATA

**Molar mass** 570.51

**Melting point** 120°C (-4H<sub>2</sub>O)

**Boiling point** decomposes

**Specific gravity** 2.0

**Flammability** Non-combustible

#### REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

Not classified as hazardous

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Calcium citrate may cause mild irritation to the skin, eyes and respiratory tract.

Handle in a well ventilated area. Avoid generating and breathing dust. Avoid contact with skin and eyes.

#### SPILLS

Wear PPE. Ensure good ventilation. Scoop up and treat as for Waste Disposal.

Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Seal in a plastic bag and dispose of as general waste.

**Large quantity:** Place in a suitable labelled container such as for dry organic solid waste and arrange for collection by a licenced waste disposal contractor.

#### STORAGE

Store in a tightly closed container in a cool, dry place away from heat and light.

Store away from strong oxidising agents.

Store with general organic solids.

#### APPLICATIONS

**General science:** food chemistry; precipitated from citrus juice by addition of limewater.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. If large amount ingested, seek medical advice/attention.

**IF ON SKIN:** Remove contaminated clothing. Wash skin thoroughly with soap and plenty of water.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing.



**Formula**  $\text{Ca(OH)}_2$   
**CAS No.** 1305-62-0  
**User Group** 11-12

## DESCRIPTION

White to off-white, odourless powder with a bitter taste.

## SOLUBILITY

Slightly soluble in water. Soluble in acids, glycerol and ammonium salt solutions. Insoluble in alcohol.

**Solubility in water** 1.79 g/L (25°C)

## PHYSICAL DATA

**Molar mass** 74.09  
**Melting point** 580°C decomposes  
**Boiling point** -  
**Specific gravity** 2.24 (20°C)  
**Flammability** Non-combustible

## REGULATORY INFORMATION

**ADG Class** 8  
**Packing Group** III  
**UN Number** 3262  
**Poisons Schedule** -  
**Security** -

## HAZARD STATEMENTS

H290 May be corrosive to metals  
H314 Causes severe skin burns and eye damage  
H318 Causes serious eye damage

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Exposure may cause irritation and corrosive effects to the skin, eyes and respiratory tract and on ingestion. Eye contact may result in severe eye damage and permanent injury.

Handle in an operating fume cupboard or well ventilated area. Avoid breathing dust and contact with skin and eyes.

## STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Protect from air and moisture. Calcium hydroxide absorbs carbon dioxide from the air, forming calcium carbonate.

Store away from acids and light metals.

Store with corrosive solids.

## APPLICATIONS

**General science:** investigations of acids and bases; heat of solution investigations.

**Senior chemistry:** small-scale preparation of ammonia gas from the reaction with ammonium chloride.

**Technical:** preparation of limewater.

## SPILLS

Wear PPE. Ensure good ventilation. Scoop up into a plastic container. Treat as for Waste Disposal.

Wash spill area thoroughly with water. Residual calcium salts can be dissolved with dilute hydrochloric acid (0.01M) followed by rinsing with water. Wash any contaminated clothing before reuse.

## WASTE DISPOSAL

**Small quantity:** Wear PPE and work in a fume cupboard.

Add waste calcium hydroxide slowly to a large volume of water. Neutralise the solution to within pH 6 - 8 by addition of 5% hydrochloric acid, with stirring. Flush the neutral solution down the sink.

**Large quantity:** Place in a suitable labelled container. Arrange for collection by a licenced waste contractor.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical attention.

**IF ON SKIN:** Remove contaminated clothing. Wash skin thoroughly with soap and plenty of water. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26



**Formula** n/a

**CAS No.** n/a

**User Group** 7-12

## DESCRIPTION

Clear, colourless, odourless liquid. Turns cloudy on absorption of carbon dioxide.

## SOLUBILITY

Soluble in water.

**Solubility in water** Soluble

## PHYSICAL DATA

|                         |                 |
|-------------------------|-----------------|
| <b>Molar mass</b>       | -               |
| <b>Melting point</b>    | -               |
| <b>Boiling point</b>    | ca. 100°C       |
| <b>Specific gravity</b> | -               |
| <b>Flammability</b>     | Non-combustible |

## REGULATORY INFORMATION

|                         |      |
|-------------------------|------|
| <b>ADG Class</b>        | 8    |
| <b>Packing Group</b>    | III  |
| <b>UN Number</b>        | 1719 |
| <b>Poisons Schedule</b> | -    |
| <b>Security</b>         | -    |

## HAZARD STATEMENTS

H290 May be corrosive to metals  
H314 Causes severe skin burns and eye damage  
H318 Causes serious eye damage

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Exposure may cause mild irritation to the skin, eyes and respiratory tract. Dust can be generated in the preparation of limewater.

Handle in an operating fume cupboard or well-ventilated area. Avoid breathing dust or vapour and contact with skin and eyes.

## SPILLS

Wear PPE. Ensure good ventilation. Cover spill with absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up into a plastic container. Add material to a large volume of water. Neutralise as for Waste Disposal. Decant the neutral solution down the sink. Dispose of residual solid material as general waste. Wash spill area thoroughly with water. Residual calcium salts can be dissolved with dilute hydrochloric acid (0.01M) followed by rinsing with water. Wash any contaminated clothing before reuse.

## WASTE DISPOSAL

Wear PPE and work in a fume cupboard. Neutralise the solution to within pH 6 - 8 by addition of dilute hydrochloric acid (1-2M). Flush the neutral solution down the sink. The concentration of a saturated solution of calcium hydroxide is approximately 0.2%, or 0.02M. Waste solutions are likely to be cloudy due to the formation of poorly soluble calcium carbonate. Theoretically, 20mL of 2M hydrochloric acid is sufficient to neutralise 1L of saturated calcium hydroxide solution.

## STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. The solution absorbs carbon dioxide from the air, forming poorly soluble calcium carbonate. Storage under a tube of soda lime may extend the life of the solution. Store away from acids and oxidising agents. Store with corrosive liquids (non-acids).

## APPLICATIONS

**General science/Senior chemistry:** test for the presence of carbon dioxide.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Call a POISONS CENTRE or doctor if you feel unwell.

**IF ON SKIN:** Remove contaminated clothing. Wash skin thoroughly with soap and plenty of water. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26



## calcium hypochlorite

*pool chlorine; hypochlorous acid, calcium salt*

**DANGER**

**Formula**  $\text{Ca}(\text{OCl})_2$   
**CAS No.** 7778-54-3  
**User Group** 11-12



### DESCRIPTION

White to greyish-white powder, crystalline granules or tablets with a strong odour of chlorine. A component of swimming pool 'chlorine'.

### SOLUBILITY

Soluble in water, decomposing and releasing chlorine.

**Solubility in water** 200 g/L (20°C)

### PHYSICAL DATA

**Molar mass** 142.98  
**Melting point** 100°C  
**Boiling point** 177°C (decomposes)  
**Specific gravity** 2.35 (20°C)  
**Flammability** Non-combustible  
oxidising solid

### REGULATORY INFORMATION

**ADG Class** 5.1  
**Packing Group** II  
**UN Number** 1748  
**Poisons Schedule** S6  
**Security** -

### HAZARD STATEMENTS

H272 May intensify fire; oxidizer  
H302 Harmful if swallowed  
H314 Causes severe skin burns and eye damage  
H400 Very toxic to aquatic life  
H410 Very toxic to aquatic life with long lasting effects

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Viton®, nitrile). Calcium hypochlorite is a strong oxidising agent. Exposure may cause irritation and corrosive injury to the skin, eyes and respiratory tract and on ingestion. Eye contact with the solid or concentrated solution may cause burns and permanent damage. Repeated or prolonged exposure can cause skin sensitisation.

Handle in an operating fume cupboard or well-ventilated area. Avoid generating and inhaling dust. Avoid contact with skin, eyes and clothing. Handle away from heat and sources of ignition.

Mixing hypochlorite with acid generates toxic chlorine gas. In case of fire, use flooding quantities of water as the extinguishing agent.

### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place. The hypochlorite decomposes slowly, releasing oxygen and chlorine gases. Decomposition is accelerated with exposure to heat, sunlight, air, moisture, metal oxides or other impurities. A small amount of water or other contaminant can generate sufficient heat to cause a runaway decomposition which can lead to an explosion or fire. Protect from air, moisture and sunlight. Store away from heat and all sources of ignition. Inspect container and lid periodically for damage or deterioration. Do not store for prolonged periods.

Store away from reducing agents, acids, organic substances, combustible materials, powdered metals and amines.

Store with oxidising substances (DG Class 5.1).

### APPLICATIONS

**Senior chemistry:** swimming pool chemistry investigations

### SPILLS

Wear PPE. Remove all sources of ignition and any combustible materials from the spill area. Ensure good ventilation.

**Solid spill:** Collect material with a non-sparking tool and treat as for Waste Disposal.

**Solution spill:** Absorb with non-combustible material such as sand, vermiculite or bentonite (clay cat litter). Collect with a non-sparking tool. Add material slowly to a large volume of water and reduce the hypochlorite and neutralise the solution as for Waste Disposal. Decant the supernatant down the sink and dispose of solid residue as general waste. Wash spill area thoroughly with water; ensure no hypochlorite residues remain in contact with combustible material. Wash any contaminated clothing before reuse.

### WASTE DISPOSAL

Solid calcium hypochlorite must not be disposed of with general waste. Store waste or surplus solid in the original container or other suitable labelled container. Arrange for collection by a licenced waste disposal contractor.

**Small quantity of solution:** For concentrations < 0.5%, flush down the sink. Higher concentrations: Treat with a reducing agent. 75mL of 10% sodium bisulfite or sodium metabisulfite solution will reduce 100 mL of 5% calcium hypochlorite solution. Neutralise the resulting solution to within pH 6-8 and wash down the sink.

### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Give water to drink. Seek immediate medical attention.

**IF ON SKIN:** Remove immediately all contaminated clothing and wash before reuse. Rinse skin thoroughly with water/shower. If skin irritation occurs, seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical advice/attention.

POISONS CENTRE: 13 11 26



## calcium nitrate, tetrahydrate

*calcium saltpeter; nitric acid, calcium salt, tetrahydrate*

**WARNING**



**Formula**  $\text{Ca}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$

**CAS No.** 13477-34-4

**User Group** 7-12

### DESCRIPTION

Colourless, odourless, hygroscopic crystals.

### SOLUBILITY

Soluble in water, methanol, ethanol and acetone.

**Solubility in water** 1470 g/L (0°C)

### PHYSICAL DATA

**Molar mass** 236.149

**Melting point** 45°C  
>130°C (-4H<sub>2</sub>O)

**Boiling point** 225°C decomposes

**Specific gravity** 1.82 (20°C)

**Flammability** Non-combustible  
oxidising solid

### REGULATORY INFORMATION

**ADG Class** 5.1

**Packing Group** III

**UN Number** 1454

**Poisons Schedule** -

**Security** -

### HAZARD STATEMENTS

H272 May intensify fire; oxidizer

H319 Causes serious eye irritation

H315 Causes skin irritation

H335 May cause respiratory irritation

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation to the skin, eyes and respiratory tract and on ingestion. Symptoms of inhalation or ingestion include nausea and vomiting.

Handle in an operating fume cupboard or well ventilated area. Avoid generating and inhaling dust. Avoid ingestion and contact with skin, eyes and clothing. Handle away from heat and sources of ignition.

There is a risk of fire or explosion if calcium nitrate is mixed with oxidisable or combustible substances, exposed to heat or subjected to friction or mechanical shock. The preparation of explosive mixtures is not recommended.

### STORAGE

The salt is hygroscopic. Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Protect from moisture.

Store away from combustible material, organic substances, reducing agents, strong acids and ammonium compounds.

Avoid storage on shelves made from wood or other combustible material.

Store with oxidising substances.

### APPLICATIONS

**Senior chemistry:** source of calcium ions for qualitative inorganic analysis.

### SPILLS

Wear PPE. Ensure good ventilation. Cover spill with dry sand. Scoop up material with a dry, non-sparking tool and place into a suitable labelled container. Store for collection. Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

### WASTE DISPOSAL

Store waste or surplus calcium nitrate in the original container or other suitable labelled container. Arrange for collection by a licenced waste disposal contractor.

### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Call a POISONS CENTRE or doctor if you feel unwell.

**IF ON SKIN:** Remove contaminated clothing. Wash skin thoroughly with plenty of water and mild soap. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26





**Formula** CaO  
**CAS No.** 1305-78-8  
**User Group** 7-12



#### DESCRIPTION

White or grey, odourless, hygroscopic powder or granules.

#### SOLUBILITY

Reacts with water. Soluble in acids, glycerol and sugar solution. Practically insoluble in ethanol.

**Solubility in water** 1.65 g/L (20°C)  
rapid hydrolysis

#### PHYSICAL DATA

**Molar mass** 56.08  
**Melting point** 2580°C  
**Boiling point** 2850°C  
**Specific gravity** 3.37 (20°C)  
**Flammability** Non-combustible

#### REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

H315 Causes skin irritation  
H318 Causes serious eye damage  
H335 May cause respiratory irritation

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation and corrosive burns to the skin, eyes, respiratory tract and on ingestion. Prolonged or repeated skin contact may cause dermatitis. Handle in an operating fume cupboard or well ventilated area. Avoid generating and inhaling dust. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

The reaction of calcium oxide with water, giving calcium hydroxide, generates much heat. Avoid inhaling mists or fumes if carrying out this reaction.

#### STORAGE

Calcium oxide is hygroscopic and becomes 'air-slaked', forming calcium hydroxide and calcium carbonate, with absorption of moisture and carbon dioxide from the air. Store in a tightly closed container in a cool, dry, well-ventilated place. Protect from moisture. Store away from acids, alcohols, acids, light metals, and halogenated compounds. Do not store in an aluminium container. Store with general inorganic solids.

#### APPLICATIONS

**General science:** to investigate its exothermic reaction with water.

#### SPILLS

Wear PPE. Ensure good ventilation. Cover spill with dry sand. Scoop up material with a dry, non-sparking tool and place into a suitable labelled container. Store for collection. Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Store waste or surplus calcium oxide in the original container or other suitable labelled container. Arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove contaminated clothing. Wash skin thoroughly with plenty of water and mild soap. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.  
POISONS CENTRE 13 11 26



# calcium phosphate, dibasic, dihydrate

*calcium hydrogen phosphate dihydrate*

**Formula**  $\text{CaHPO}_4 \cdot 2\text{H}_2\text{O}$

**CAS No.** 7789-77-7

**User Group** 7-12

## DESCRIPTION

Colourless, odourless powder or granules.

## SOLUBILITY

Practically insoluble in water and alcohol.  
Soluble in dilute hydrochloric, nitric and acetic acids.

**Solubility in water** 0.2 g/L (25°C)

## PHYSICAL DATA

**Molar mass** 172.09

**Melting point** ca. 100°C (-2H<sub>2</sub>O)  
370°C decomposes

**Boiling point** -

**Specific gravity** 2.89 (20°C; anhydrous)

**Flammability** Non-combustible

## REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** -

**Security** -

## HAZARD STATEMENTS

Not classified as hazardous

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause mild irritation to the skin, eyes and respiratory tract.

Handle in a well ventilated area. Avoid generating and inhaling dust. Avoid contact with skin and eyes.

## SPILLS

Wear PPE. Ensure good ventilation. Scoop up and treat as for Waste Disposal.

Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

## WASTE DISPOSAL

**Small quantity:** Seal in a plastic bag and dispose of as general waste.

**Large quantity:** Store in the original container or other suitable labelled container such as for dry inorganic solid waste. Arrange for collection via a licenced waste disposal contractor.

## STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place.

Store away from strong oxidising agents.

Store with general inorganic solids.

## APPLICATIONS

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation occurs, seek medical attention.

**IF SWALLOWED:** Give water to drink. Seek medical advice/attention if feeling unwell.

**IF ON SKIN:** Remove contaminated clothing. Wash skin with soap and plenty of water.

**IF INHALED:** Move patient to fresh air. If respiratory symptoms develop, seek medical advice/attention.



# calcium phosphate, monobasic, monohydrate

*calcium dihydrogen phosphate monohydrate*

**WARNING**



**Formula**  $\text{Ca}(\text{H}_2\text{PO}_4)_2 \cdot \text{H}_2\text{O}$

**CAS No.** 10031-30-8

**User Group** 11-12

## DESCRIPTION

Colourless, odourless powder or crystals with a strong acid taste.

## SOLUBILITY

Sparingly soluble in water. Soluble in the dilute acids hydrochloric, nitric and acetic.

## Solubility in water

18 g/L (30°C) (anhydrous)

## PHYSICAL DATA

**Molar mass** 252.065

**Melting point** 100°C (-H<sub>2</sub>O)  
200°C decomposes

**Boiling point** -

**Specific gravity** 2.22 (18°C)

**Flammability** Non-combustible

## REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** -

**Security** -

## HAZARD STATEMENTS

H315 Causes skin irritation

H319 Causes serious eye irritation

H335 May cause respiratory irritation

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation to the skin, eyes and respiratory tract.

Handle in an operating fume cupboard or well ventilated area. Avoid generating and inhaling dust. Avoid contact with skin, eyes and clothing.

## SPILLS

Wear PPE. Ensure good ventilation. Scoop up and treat as for Waste Disposal.

Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

## WASTE DISPOSAL

**Small quantity:** Seal in a plastic bag and dispose of as general waste. Alternatively, if the salt is not contaminated, it can be applied to soil as a fertiliser.

**Large quantity:** Store in the original container or other suitable labelled container such as for dry inorganic solid waste. Arrange for collection via a licenced waste disposal contractor.

## STORAGE

The salt is hygroscopic. Store in a tightly closed container in a cool, dry, well-ventilated place. Protect from moisture.

Store away from strong oxidising agents.

Store with general inorganic solids.

## APPLICATIONS

**General science/Biology:** investigations of the effect of nutrients on plant growth.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. If symptoms persist, seek medical advice/attention.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin thoroughly with soap and plenty of water. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26



## calcium phosphate, tribasic

*tricalcium phosphate; bone phosphate*

**Formula**  $\text{Ca}_3(\text{PO}_4)_2$

**CAS No.** 7758-87-4

**User Group** 7-12

### DESCRIPTION

Colourless, odourless powder or crystals.  
Two crystalline forms:  $\beta$ -form transforms into  $\alpha$ -form at 110°C.

### SOLUBILITY

Practically insoluble in water, alcohol and acetic acid. Soluble in dilute hydrochloric acid and dilute nitric acid.

**Solubility in water** 0.02 g/L (20°C)

### PHYSICAL DATA

**Molar mass** 310.18

**Melting point** 1670°C

**Boiling point** -

**Specific gravity** 3.14 (20°C)

**Flammability** Non-combustible

### REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** -

**Security** -

### HAZARD STATEMENTS

Not classified as hazardous

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile).

Handle in a well ventilated area. Avoid generating and inhaling dust. Avoid contact with skin and eyes.

### SPILLS

Wear PPE. Ensure good ventilation. Scoop up and treat as for Waste Disposal.

Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

### WASTE DISPOSAL

**Small quantity:** Seal in a plastic bag and dispose of as general waste.

**Large quantity:** Store in the original container or other suitable labelled container such as for dry inorganic solid waste. Arrange for collection via a licenced waste disposal contractor.

### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place.

Store away from strong oxidising agents.

Store with general inorganic solids.

### APPLICATIONS

**General science/Biology:** investigations of the minerals found in bones and teeth.

### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

**IF SWALLOWED:** Give water to drink. Seek medical advice/attention if feeling unwell.

**IF ON SKIN:** Remove contaminated clothing. Wash skin with plenty of soap and water.

**IF INHALED:** Move patient to fresh air. If respiratory symptoms develop, seek medical advice/attention.



**Formula**  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$

**CAS No.** 10101-41-4

**User Group** 7-12

#### DESCRIPTION

Colourless, odourless powder or crystals.

#### SOLUBILITY

Slightly soluble in water. Soluble in ammonium salt solutions and acids. Insoluble in organic solvents.

**Solubility in water** ca. 2 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 172.17

**Melting point** 1450°C  
130°C ( $-\frac{3}{2}\text{H}_2\text{O}$ )  
163°C ( $-\frac{1}{2}\text{H}_2\text{O}$ )

**Boiling point** -

**Specific gravity** 2.32 (20°C)

**Flammability** Non-combustible

#### REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

Not classified as hazardous

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation to the eyes and respiratory tract.

Handle in a well ventilated area. Avoid generating and inhaling dust. Avoid contact with skin and eyes. Avoid prolonged or repeated exposure.

#### SPILLS

Wear PPE. Ensure good ventilation. Scoop up and treat as for Waste Disposal.

Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Seal in a plastic bag and dispose of as general waste.

**Large quantity:** Store in the original container or other suitable labelled container such as for dry inorganic solid waste. Arrange for collection via a licenced waste disposal contractor.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place.

Store away from strong oxidising agents and acids.

Store with general inorganic solids.

#### APPLICATIONS

**General science/Biology:** flocculating agent for soil testing; investigations of the effect of nutrients on plant growth.

**Senior chemistry:** inorganic displacement reactions; dehydration/rehydration reactions.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If effects persist, seek medical attention.

**IF SWALLOWED:** Rinse mouth. Give water to drink. Seek medical attention if feeling unwell.

**IF ON SKIN:** Remove contaminated clothing. Wash skin thoroughly with plenty of water. If irritation occurs, seek medical advice/attention.

**IF INHALED:** Move patient to fresh air. If respiratory symptoms develop, seek medical advice/attention.





**Formula**  $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$

**CAS No.** 10034-76-1

**User Group** 7-12

#### DESCRIPTION

Colourless, odourless fine powder.

#### SOLUBILITY

Very slightly soluble in water.

**Solubility in water** 0.30 g/L (25°C)

#### PHYSICAL DATA

**Molar mass** 290.296

**Melting point** 1450°C  
163°C ( $-\frac{1}{2}\text{H}_2\text{O}$ )

**Boiling point** -

**Specific gravity** 2.5

**Flammability** Non-combustible

#### REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

Not classified as hazardous

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation to the eyes and respiratory tract. If ingested, Plaster of Paris may harden and lead to an obstruction in the stomach.

Handle in a well ventilated area. Avoid generating and inhaling dust. Avoid contact with skin and eyes. Avoid prolonged or repeated exposure.

The salt reacts vigorously with water and acids, generating much heat. Do not attempt to use Plaster of Paris to encase or make a cast of any body part as serious burns may result.

#### STORAGE

The salt is hygroscopic. Store in a tightly closed container in a cool, dry, well-ventilated place. Protect from moisture.

Store away from strong oxidising agents and acids.

Store with general inorganic solids.

#### APPLICATIONS

**General science:** preparation of moulds and casts.

#### SPILLS

Wear PPE. Ensure good ventilation. Scoop up and treat as for Waste Disposal.

Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Seal in a plastic bag and dispose of as general waste. Alternatively, react with water in a disposable container, allow to set, and dispose of as general waste.

**Large quantity:** Store in the original container or other suitable labelled container such as for dry inorganic solid waste. Arrange for collection via a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention. Do not attempt to remove hardened plaster particles by mechanical means.

**IF SWALLOWED:** Rinse mouth. Drinking glycerin or gelatine solution or large volume of water may delay setting. Seek medical attention.

**IF ON SKIN:** Remove contaminated clothing. Wash skin thoroughly with plenty of water. If irritation occurs, seek medical advice/attention.

**IF INHALED:** Move patient to fresh air. If respiratory symptoms develop, seek medical advice/attention.



**Formula** C

**CAS No.** 7440-44-0

**User Group** 7-12

#### DESCRIPTION

Black, odourless blocks (ca. 100 x 25 x 25 mm) or rods (ca. 6 mm dia, 100 mm long).

#### SOLUBILITY

Insoluble in water, acids or alkalis.

**Solubility in water** Insoluble

#### PHYSICAL DATA

**Molar mass** 12.01

**Melting point** 3550°C

**Boiling point** -

**Specific gravity** 18.21

**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

Not classified as hazardous

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure to dust or small particles may cause irritation to the skin, eyes and respiratory tract.

Handle in a well-ventilated area. Avoid generating and inhaling dust. Avoid contact with skin, eyes and clothing.

Avoid prolonged or repeated exposure.

The dust can form explosive mixtures with air. Handle away from heat and sources of ignition.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Collect material with a non-sparking tool and treat as for Waste Disposal.

Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Carbon in bulk form can be disposed of as general waste. Store waste or surplus carbon powder or granules in a suitable labelled container and arrange for collection by a licenced waste disposal contractor.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place. Store in a container made from non-combustible material. Ensure that blocks are cool and dry before packing away for storage. Store away from sources of heat or ignition.

Store away from oxidising agents, strong acids, reducing agents, oils and other hydrocarbons, halogens and peroxides.

Store with general inorganic solids.

#### APPLICATIONS

**Senior chemistry:** blocks: redox reaction to extract a metal from the metal oxide; rods: inert electrode in electrochemical cell.

#### FIRST AID

**IF IN EYES:** (dust/small particles) Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Give water to drink. Seek medical advice/attention if feeling unwell.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin with soap and plenty of water. If skin irritation occurs, seek medical advice/attention.

**IF INHALED:** (of dust) Move patient to fresh air and keep at rest in a position comfortable for breathing. If effects persist, seek medical advice/attention.



**Formula** C  
**CAS No.** 7440-44-0  
**User Group** 7-12

#### DESCRIPTION

Black, odourless, amorphous powder.

#### SOLUBILITY

Insoluble in water, acids or alkalis.

**Solubility in water** Insoluble

#### PHYSICAL DATA

**Molar mass** 12.01  
**Melting point** 3550°C  
**Boiling point** -  
**Specific gravity** 18.21  
**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

Not classified as hazardous

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation to the skin, eyes and respiratory tract, and on ingestion.

Handle in a well-ventilated area. Avoid generating and inhaling dust. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

The dust can form explosive mixtures with air. Charcoal will burn if exposed to a flame. Burning may produce toxic gases including carbon monoxide from incomplete combustion.

Handle away from heat and sources of ignition. Charcoal can ignite spontaneously in air. The more finely divided the charcoal, the greater the potential for spontaneous ignition. Exposure to heat, oxygen or moisture also increases the chance of spontaneous ignition.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place. Protect from moisture. Store away from sources of heat or ignition.

Store away from oxidising agents, reducing agents, oils and other hydrocarbons, halogens and peroxides. Store with general inorganic solids.

#### APPLICATIONS

**Senior chemistry:** redox reaction to extract a metal from the metal oxide

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Collect material with a non-sparking tool into a suitable labelled container and store for collection. Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Store waste or surplus carbon powder in a suitable labelled container and arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Give water to drink. Seek medical advice/attention if feeling unwell.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin with soap and plenty of water. If skin irritation occurs, seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If effects persist, seek medical advice/attention.



**Formula** C

**CAS No.** 64365-11-3

**User Group** 7-12

#### DESCRIPTION

Black, odourless, amorphous powder or granules.

#### SOLUBILITY

Insoluble in water, acids or alkalis.

**Solubility in water** Insoluble

#### PHYSICAL DATA

**Molar mass** 12.01

**Melting point** 3550°C

**Boiling point** -

**Specific gravity** 18.21

**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

Not classified as hazardous

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation to the skin, eyes and respiratory tract, and on ingestion.

Activated carbon, particularly when wet, absorbs oxygen from the air; a sufficient quantity can deplete the air of oxygen in a confined space.

Handle in a well-ventilated area. Avoid generating and inhaling dust. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

The dust can form explosive mixtures with air. Handle away from heat and sources of ignition.

Steam activated carbon is not classified as spontaneously combustible (DG Class 4.2).

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Collect material with a non-sparking tool into a suitable labelled container and store for collection. Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Store waste or surplus carbon in a suitable labelled container and arrange for collection by a licenced waste disposal contractor.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place. Store away from sources of heat or ignition. Protect from moisture.

Store away from oxidising agents, reducing agents, oils and other hydrocarbons, halogens and peroxides.

Store with general inorganic solids.

#### APPLICATIONS

**General science:** investigations water purification methods; construction of an air battery.

**Senior chemistry:** removal of coloured impurities from organic products

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Give water to drink. Seek medical advice/attention if feeling unwell.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin with soap and plenty of water. If skin irritation occurs, seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If effects persist, seek medical advice/attention.



**Formula**  $C_9H_8O_2$   
**CAS No.** 621-82-9  
**User Group** 11-12

#### DESCRIPTION

Colourless crystalline powder with slight balsamic odour.

#### SOLUBILITY

Very slightly soluble in water. Soluble in ethanol, diethyl ether and acetone.

**Solubility in water** 500 mg/L

#### PHYSICAL DATA

**Molar mass** 148.16  
**Melting point** 134°C  
**Boiling point** decomposes  
**Specific gravity** 1.2475 (4°C)  
**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

Not classified as hazardous

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause mild irritation to the skin, eyes and respiratory tract.

Handle in a well-ventilated area. Avoid generating and inhaling dust. Avoid ingestion and contact with skin, eyes and clothing.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light.

Store away from oxidising agents.

Store with general organic solids.

#### APPLICATIONS

**Senior chemistry:** a substrate for bromination; ester preparation; to practise recrystallisation technique.

#### SPILLS

Wear PPE. Ensure good ventilation. Eliminate all ignition sources.

**Solid spill:** Scoop up with a non-sparking tool. Treat as for waste acid.

**Liquid spill:** Cover spill with sodium carbonate or a 1:1:1 mixture of sand, sodium carbonate and vermiculite or bentonite (clay cat litter). Scoop up and add to a large volume of water. Neutralise the solution as for Waste Disposal. Decant neutral solution down the sink. Dispose of residual solids as general waste.

Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Wrap well in paper and dispose of as general waste.

Alternatively, dissolve waste by adding to 5% sodium carbonate solution. Test the pH with pH paper and neutralise the solution to within pH 6-8 by addition of sodium carbonate or dilute hydrochloric acid (0.5M) in portions as necessary. Flush the neutral solution down the sink.

**Large quantity:** Store in the original container or other suitable labelled container, such as for waste dry organic solids. Arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If symptoms occur, seek medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical advice/attention if you feel unwell.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin with plenty of water and mild soap. If symptoms occur, seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical attention.





## citric acid, monohydrate

2-hydroxypropanetricarboxylic acid monohydrate

**WARNING**



**Formula**  $C_6H_8O_7 \cdot H_2O$

**CAS No.** 5949-29-1

**User Group** 7-12

### DESCRIPTION

Colourless, odourless, slightly deliquescent crystals.

### SOLUBILITY

Soluble in water, ethanol and diethyl ether.

**Solubility in water** 750 g/L (20°C)

### PHYSICAL DATA

**Molar mass** 210.14

**Melting point** 135-152°C

**Boiling point** 175°C (decomposes)

**Specific gravity** 1.54 (20°C)

**Flammability** Combustible

### REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** -

**Security** -

### HAZARD STATEMENTS

H319 Causes serious eye irritation

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation to the skin and respiratory tract. Skin contact may cause an allergic reaction and dermatitis in some individuals.

Handle in an operating fume cupboard or well-ventilated area. Avoid generating and inhaling dust. Avoid ingestion and contact with skin, eyes, and clothing. Avoid prolonged or repeated exposure.

### STORAGE

The monohydrate is efflorescent in dry air. Store in a tightly closed container in a cool, dry well-ventilated place away from heat and light.

Store away from oxidising agents, metals, bases and reducing agents.

Store with general organic solids.

### APPLICATIONS

**General science:** an ingredient (food grade) in sherbet.

**Senior chemistry:** titration of a triprotic acid.

**Technical:** preparation of buffer solutions; in spill kit - a neutralising agent for spills of alkaline solutions.

### SPILLS

Wear PPE. Ensure good ventilation. Eliminate all ignition sources.

**Solid spill:** Collect spilled material with a non-sparking tool. Add slowly to a large volume of water with stirring. Neutralise the solution to within pH 6-8 by addition of sodium carbonate in portions (test with pH paper). Flush the neutral solution down the sink with further dilution.

**Liquid spill:** Cover spill with sodium carbonate or a 1:1:1 mixture of sand, sodium carbonate and vermiculite or bentonite (clay cat litter). Neutralise as for solid spill. Decant neutral solution down the sink with further dilution. Dispose of residual solids as general waste.

Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

### WASTE DISPOSAL

**Small quantity:** Dilute waste to a concentration of about 5% by slowly adding the acid to water with stirring. Neutralise the solution to within pH 6-8 by addition of sodium carbonate in portions (test with pH paper). Flush the neutral solution down the sink with further dilution.

**Large quantity:** Store in the original container or other suitable labelled container, such as for waste dry organic solids. Arrange for collection by a licenced waste disposal contractor.

### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. Seek medical attention if feeling unwell.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Rinse skin thoroughly with water/shower. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26



## copper (I) chloride

*cuprous chloride; copper monochloride*

**ANGER**

**Formula** CuCl  
**CAS No.** 7758-89-6  
**User Group** 7-12



### DESCRIPTION

White to grey, odourless, hygroscopic crystals. In the presence of moisture, turns blue-green when exposed to air.

### SOLUBILITY

Practically insoluble in water. Insoluble in alcohol and acetone. Soluble in aqueous acids, aqueous ammonia and ether.

**Solubility in water** <0.01 g/L (20°C)

### PHYSICAL DATA

|                         |                 |
|-------------------------|-----------------|
| <b>Molar mass</b>       | 98.99           |
| <b>Melting point</b>    | 430°C           |
| <b>Boiling point</b>    | ca. 400°C       |
| <b>Specific gravity</b> | 4.140 (25°C)    |
| <b>Flammability</b>     | Non-combustible |

### REGULATORY INFORMATION

|                         |      |
|-------------------------|------|
| <b>ADG Class</b>        | 8    |
| <b>Packing Group</b>    | III  |
| <b>UN Number</b>        | 2802 |
| <b>Poisons Schedule</b> | S6   |
| <b>Security</b>         | -    |

### HAZARD STATEMENTS

H302 Harmful if swallowed  
H315 Causes skin irritation  
H318 Causes serious eye damage  
H410 Very toxic to aquatic life with long lasting effects

### STORAGE

Copper (I) chloride is sensitive to air and light. On exposure to air, the salt becomes blue-green with formation of basic copper (II) chloride. Store in a tightly closed container in a cool, dry place away from heat and light; protect from air and moisture. Store away from oxidising agents and alkali metals. Store with corrosive solids.

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Exposure may cause skin, eye and respiratory irritation. Eye contact can lead to eye surface injury. Copper salts are toxic by ingestion; symptoms of ingestion include nausea and vomiting. Handle in an operating fume cupboard or well-ventilated area. Avoid breathing dust and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

### SPILLS

Wear PPE. Ensure good ventilation.

**Solid spill:** Scoop up and place in a container and store for collection.

**Solution spill:** Cover with sand or other inert absorbent such as a 1:1:1 mixture of sodium carbonate, sand and bectonite (cat litter). Scoop up and place in a container and store for collection.

Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

### WASTE DISPOSAL

Release of copper salts to the environment should be avoided. Store waste or surplus copper (I) chloride in a suitable labelled container such as for copper waste or heavy metal waste. Arrange for collection by a licenced waste disposal contractor.

### APPLICATIONS

**Senior chemistry:** to demonstrate the formation of stable chloro- complexes in concentrated hydrochloric acid solution; in investigations of the oxidation states of copper and the preparation of cuprous chloride; to demonstrate the absorption of carbon monoxide into cuprous chloride solution.

### PREPARATIONS

In aqueous solution, if not in a stable complex, copper (I) chloride disproportionates to copper (II) and elemental copper:



### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Call a POISONS CENTRE or doctor if you feel unwell.

**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin with water/shower. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing.  
POISONS CENTRE: 13 11 26



## copper (I) oxide

*cuprous oxide; copper oxide red*

### WARNING



**Formula** Cu<sub>2</sub>O

**CAS No.** 1317-39-1

**User Group** 7-12

#### DESCRIPTION

Yellow, orange, red, or reddish-brown odourless crystals or powder.

#### SOLUBILITY

Practically insoluble in water. Soluble in dilute hydrochloric acid, and in aqueous solutions of ammonia and its salts. Insoluble in ethanol.

**Solubility in water** <0.007 mg/L (25°C)

#### PHYSICAL DATA

**Molar mass** 143.09

**Melting point** 1232°C

**Boiling point** 1800°C (decomposes)

**Specific gravity** 6.00 (25°C)

**Flammability** Non-combustible

#### REGULATORY INFORMATION

**ADG Class** 9

**Packing Group** III

**UN Number** 3077

**Poisons Schedule** S6

**Security** -

#### HAZARD STATEMENTS

H302 Harmful if swallowed

H400 Very toxic to aquatic life

H410 Very toxic to aquatic life with long lasting effects

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Exposure may cause irritation to the skin, eyes, nose and throat, and respiratory tract. Copper compounds are toxic by ingestion; symptoms include nausea and vomiting. Handle in an operating fume cupboard or well-ventilated area. Avoid generating and inhaling dust. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

#### APPLICATIONS

**Senior chemistry:** investigations of the oxidation states of copper and the preparation of cuprous oxide.

#### PREPARATIONS

In dilute sulfuric or nitric acid, copper (I) oxide disproportionates to copper (II) and elemental copper:  
$$2\text{Cu}^+ \rightarrow \text{Cu}^0 + \text{Cu}^{2+}$$

#### STORAGE

With exposure to moist air, copper (I) oxide will gradually become oxidised to black copper (II) oxide. Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light; protect from moisture.

Do not store in an aluminium container as copper (I) oxide is corrosive to aluminium.

Store away from oxidising agents.

Store with general inorganic solids.

#### SPILLS

Wear PPE. Ensure good ventilation.

Scoop up and place in a suitable labelled container and store for collection.

Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Release of copper compounds to the environment should be avoided.

Store waste copper (I) oxide in a suitable labelled container such as for copper or heavy metal waste. Arrange for collection by a waste disposal contractor.

Residual copper (I) oxide can be removed from glassware by rinsing with a minimal quantity of warm dilute acetic acid.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove contaminated clothing. Wash area thoroughly with water and mild soap.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If irritation or other symptoms occur: Get medical advice/attention.

POISONS CENTRE: 13 11 26



# copper (II) acetate, monohydrate

*cupric diacetate monohydrate; copper diacetate hydrate*

**ANGER**

**Formula**  $C_4H_6CuO_4 \cdot H_2O$

**CAS No.** 6046-93-1

**User Group** 11-12



## DESCRIPTION

Dark green crystals or powder with a faint odour of acetic acid.

## SOLUBILITY

Soluble in water and ethanol. Slightly soluble in glycerol and ether. Slowly soluble in aqueous solutions of ammonia.

**Solubility in water** 72 g/L (20°C)

## PHYSICAL DATA

**Molar mass** 199.65

**Melting point** 115°C

**Boiling point** 240°C (decomposes)

**Specific gravity** 1.88 (20°C)

**Flammability** Non-combustible

## REGULATORY INFORMATION

**ADG Class** 8

**Packing Group** II

**UN Number** 1759

**Poisons Schedule** S6

**Security** -

## HAZARD STATEMENTS

H302 Harmful if swallowed

H314 Causes severe skin burns and eye damage

H410 Very toxic to aquatic life with long lasting effects.

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Copper acetate is irritating to the skin, eyes, nose and throat and respiratory tract. Copper salts are toxic by ingestion; symptoms include nausea and vomiting. Handle in an operating fume cupboard or well-ventilated area. Avoid breathing dust and contact with skin, eyes and clothing.

## STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light.  
Store away from oxidising agents and strong acids.  
Store with corrosive solids.

## APPLICATIONS

**General science:** crystal growing; flame tests

**Senior chemistry:** electroplating.

**Food science:** for the determination of tannins in tea.

## PREPARATIONS

A concentration 0.5-1M is suitable for flame test solutions.  
A concentration of 0.1M is suitable for qualitative inorganic analysis.

## SPILLS

Wear PPE. Ensure good ventilation.

**Solid spill:** Scoop up and place in a container and store for collection.

**Solution spill:** Cover with sand or other inert absorbent such as a 1:1:1 mixture of sodium carbonate, sand and bentonite (clay cat litter). Scoop up and place in a container and store for collection.

Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

## WASTE DISPOSAL

Release of copper salts to the environment should be avoided. Store waste copper acetate in a suitable labelled container such as for copper or heavy metal waste. Arrange for collection by a licenced waste disposal contractor.

**Waste solutions:** waste treatment options:

- Evaporate the water from the solution and store the residue as for solid waste.
- Immerse steel wool in the solution, and thus displace the copper ions. Decant the supernatant from the precipitated copper and flush down the sink. Dispose of the copper metal residue as general waste.
- Recrystallise the salt and recycle.
- Precipitate the copper ions as basic copper carbonate by adding the solution to a slight excess of sodium carbonate in solution. Allow the mixture to age over a few days. Collect the precipitate by filtration, allow to dry and store for collection. Dispose of the filtrate down the sink.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Call a POISONS CENTRE or doctor if you feel unwell.

**IF ON SKIN:** Remove contaminated clothing. Wash skin with plenty of water and mild soap. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing.

POISONS CENTRE: 13 11 26



## copper (II) carbonate hydroxide

*basic copper carbonate; dicopper carbonate dihydroxide*

**WARNING**



**Formula**  $\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$

**CAS No.** 12069-69-1

**User Group** 7-12

### DESCRIPTION

Green, odourless powder.

### SOLUBILITY

Practically insoluble in water. Soluble in dilute solutions of acids, sodium bicarbonate solution and ammonium hydroxide solution. Insoluble in ethanol.

**Solubility in water** Practically insoluble

### PHYSICAL DATA

**Molar mass** 221.12

**Melting point** 200°C (decomposes)

**Boiling point** -

**Specific gravity** 4.0

**Flammability** Non-combustible

### REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** S6

**Security** -

### HAZARD STATEMENTS

H302 Harmful if swallowed

H332 Harmful if inhaled

H315 Causes skin irritation

H319 Causes serious eye irritation

H410 Very toxic to aquatic life with long lasting effects

### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light.

Store away from strong acids and oxidising agents.

Store with general inorganic solids.

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Exposure may cause skin, eye and respiratory irritation. Copper salts are toxic by ingestion; symptoms of ingestion include nausea and vomiting. Handle in an operating fume cupboard or well-ventilated area. Avoid generating and inhaling dust. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Strong heating will generate irritating fumes of copper oxides.

### SPILLS

Wear PPE. Solid spill: Sweep up and place in a container (see Waste Disposal).

Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

### WASTE DISPOSAL

Release of copper salts to the environment should be avoided. Store waste copper carbonate in a suitable labelled container such as for copper or heavy metal waste. Arrange for collection by a licenced waste disposal contractor.

### APPLICATIONS

**General science:** an example of a carbonate in the reactions of carbonates with acid; to simulate the extraction of copper ore.

**Senior chemistry:** demonstration of its thermal decomposition to copper (II) oxide.

### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Call a POISONS CENTRE or doctor if you feel unwell.

**IF ON SKIN:** Remove contaminated clothing. Wash skin with plenty of water and mild soap. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing.

POISONS CENTRE: 13 11 26





## copper (II) chloride, dihydrate

*cupric chloride dihydrate; copper dichloride dihydrate*

**ANGER**

**Formula**  $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$

**CAS No.** 10125-13-0

**User Group** 7-12S



### DESCRIPTION

Green-blue, odourless, hygroscopic powder.

### SOLUBILITY

Soluble in water, ethanol, methanol and acetone. Insoluble in ether.

**Solubility in water** 1150 g/L (20°C)

### PHYSICAL DATA

**Molar mass** 170.48

**Melting point** 100°C (decomposes)

**Boiling point** -

**Specific gravity** 2.51

**Flammability** Non-combustible

### REGULATORY INFORMATION

**ADG Class** 8

**Packing Group** III

**UN Number** 2802

**Poisons Schedule** S6

**Security** -

### HAZARD STATEMENTS

H302 Harmful if swallowed

H312 Harmful in contact with skin

H315 Causes skin irritation

H318 Causes serious eye damage

H400 Very toxic to aquatic life

H411 Toxic to aquatic life with long lasting effects

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Copper chloride is irritating to the skin, eyes, nose and throat and respiratory tract. Contact with eyes can cause eye surface injury. Copper salts are toxic by ingestion; symptoms of ingestion include nausea and vomiting.

Handle in an operating fume cupboard or well-ventilated area. Avoid generating and inhaling dust. Avoid contact with skin, eyes and clothing.

Copper (II) chloride is a mild oxidant; handle away from combustible materials.

Heating to the decomposition temperature generates irritating fumes of hydrogen chloride.

### SPILLS

Wear PPE. Ensure good ventilation.

**Solid spill:** Scoop up and place in a container and store for collection.

**Solution spill:** Cover with sand or other inert absorbent such as a 1:1:1 mixture of sodium carbonate, sand and bectonite (clay cat litter). Scoop up and place in a container and store for collection.

Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

### WASTE DISPOSAL

Store waste copper(II) chloride in a suitable labelled container such as for copper or heavy metal waste. Arrange for collection by a licenced waste disposal contractor.

**Waste solutions:** waste treatment options:

(i) Evaporate the water from the solution and store the residue as for solid waste.

(ii) Immerse steel wool in the solution, and thus displace the copper ions. Decant the supernatant from the precipitated copper and flush down the sink. Dispose of the copper metal residue as general waste.

(iii) Precipitate the copper ions as basic copper carbonate by adding the solution to a slight excess of sodium carbonate in solution. Allow the mixture to age over a few days. Collect the precipitate by filtration, allow to dry and store for collection. Dispose of the filtrate down the sink.

### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light.

Store away from alkali metals and strong oxidising agents.

Stored with corrosive solids.

### APPLICATIONS

**General science:** a source of copper ions for flame tests.

**Senior chemistry:** qualitative inorganic analysis; copperplating; demonstration of the equilibrium between the hexaaquacopper(II) and tetrachlorocopper(II) ions in solution.

### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin with water/shower. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If experiencing respiratory symptoms: Get medical advice/attention. POISONS CENTRE: 13 11 26



## copper (II) nitrate, trihydrate

*cupric nitrate trihydrate; copper dinitrate trihydrate*

**ANGER**

**Formula**  $\text{Cu}(\text{NO}_3)_2 \cdot 3\text{H}_2\text{O}$

**CAS No.** 10031-43-3

**User Group** 7-12



### DESCRIPTION

Blue, odourless, deliquescent crystals.

### SOLUBILITY

Soluble in water and ethanol. Practically insoluble in ethyl acetate.

**Solubility in water** 2670 g/L (20°C)

### PHYSICAL DATA

**Molar mass** 241.6

**Melting point** 114°C

**Boiling point** 170°C (decomposes)

**Specific gravity** 2.05 (20°C)

**Flammability** Non-combustible  
oxidising solid

### REGULATORY INFORMATION

**ADG Class** 5.1

**Packing Group** II

**UN Number** 1477

**Poisons Schedule** S6

**Security** -

### HAZARD STATEMENTS

H272 May intensify fire; oxidizer  
H302 Harmful if swallowed  
H315 Causes skin irritation  
H318 Causes serious eye damage  
H400 Very toxic to aquatic life

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Exposure may cause severe skin, eye and respiratory irritation. Contact with eyes can cause severe eye surface injury. Copper salts are toxic by ingestion; symptoms of ingestion include nausea and vomiting. Handle in an operating fume cupboard or well-ventilated area. Avoid generating or inhaling dust. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

Copper (II) nitrate is a strong oxidant. Handle away from combustible materials, heat and sources of ignition.

### STORAGE

Copper (II) nitrate trihydrate is hygroscopic. Store in a tightly closed container in a cool, dry, well-ventilated place away from light; protect from moisture. Store away from sources of heat or ignition.

Store away from reducing agents, combustible materials, organic substances, finely powdered metals, ammonium compounds, amides and cyanide complexes. There is a risk of explosion when mixed with potassium ferrocyanide. Store with oxidising substances (DG Class 5.1).

### APPLICATIONS

**Senior chemistry:** a source of soluble copper (II) ion for qualitative inorganic analysis; in displacement and precipitation reactions; in electrochemical cells.

### SPILLS

Wear PPE. Remove any combustible material from the spill area. Do not use combustible materials (paper, cloth) to clean up spill. Solid spill: Scoop up with non-sparking tool and place in a container. Store for collection.

Solution spill: Cover with sand or other non-combustible absorbent such as a 1:1:1 mixture of sodium carbonate, sand and bectonite (clay cat litter). Scoop up with a non-sparking tool into a container. Store for collection. Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

### WASTE DISPOSAL

Store waste copper nitrate in a suitable labelled container such as for copper or heavy metal waste. Arrange for collection by a licenced waste disposal contractor.

**Waste solutions:** waste treatment options:

- Allow the water to evaporate from the solution and store the residue as for solid waste.
- Immerse steel wool in the solution, and thus displace the copper ions. Decant the supernatant from the precipitated copper and flush down the sink. Dispose of the copper metal residue as general waste.
- Precipitate the copper ions as basic copper carbonate by adding the solution to a slight excess of sodium carbonate in solution. Allow the mixture to age over a few days. Collect the precipitate by filtration, allow to dry and store for collection. Dispose of the filtrate down the sink.

### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin with water/shower. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If experiencing respiratory symptoms: Get medical advice/attention.

POISONS CENTRE: 13 11 26



## copper (II) oxide

*cupric oxide; copper oxide black*

**WARNING**

**Formula** CuO  
**CAS No.** 1317-38-0  
**User Group** 7-12



### DESCRIPTION

Fine, black to brownish-black, odourless, amorphous or crystalline powder.

### SOLUBILITY

Practically insoluble in water. Soluble in solutions of acids and of ammonium chloride or ammonium carbonate. Dissolves slowly in solutions of ammonia. Insoluble in alcohols.

**Solubility in water** Practically insoluble

### PHYSICAL DATA

**Molar mass** 79.55  
**Melting point** 1326°C  
**Boiling point** -  
**Specific gravity** 6.3 - 6.5  
**Flammability** Non-combustible

### REGULATORY INFORMATION

**ADG Class** 9  
**Packing Group** III  
**UN Number** 3077  
**Poisons Schedule** S6  
**Security** -

### HAZARD STATEMENTS

H302 Harmful if swallowed  
H410 Very toxic to aquatic life with long lasting effects

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Exposure may cause irritation of the skin, eyes, nose and throat and respiratory irritation. Copper compounds are toxic by ingestion; early symptoms include nausea and vomiting.

Handle in an operating fume cupboard or well-ventilated area. Avoid breathing dust and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Heating copper (II) oxide to its decomposition temperature will produce copper (I) oxide and oxygen.

### APPLICATIONS

**Senior chemistry:** in investigations of the oxidation states of copper; as a reagent in redox demonstrations.

### PREPARATIONS

In the presence of hydrogen, copper (II) oxide is reduced to copper (I) oxide at 150°C and to elemental copper at 250°C. Demonstrations of the reversible reduction-oxidation of CuO-Cu are more safely conducted as microscale experiments.

### STORAGE

Copper (II) oxide is sensitive to air and moisture. With exposure to moist air and absorption of carbon dioxide, copper (II) oxide will gradually form copper (II) carbonate. Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light; protect from moisture.

Store away from reducing agents, aluminium, alkali metals and finely powdered metals.  
Store with general inorganic solids.

### SPILLS

Wear PPE. Solid spill: Sweep up and place in a container and store for collection.  
Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

### WASTE DISPOSAL

Release of copper compounds to the environment should be avoided. Store waste copper (II) oxide in a suitable labelled container such as for copper or heavy metal waste. Arrange for collection by a licenced waste disposal contractor.

Residual copper (II) oxide can be removed from glassware by rinsing with a minimal quantity of warm dilute acetic acid.

### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Call a POISONS CENTRE or doctor if you feel unwell.

**IF ON SKIN:** Remove contaminated clothing. Wash skin with plenty of water and mild soap. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing.

POISONS CENTRE: 13 11 26



## copper (II) sulfate, anhydrous

*cupric sulfate anhydrous; copper sulphate, anhydrous*

**WARNING**



**Formula**  $\text{CuSO}_4$   
**CAS No.** 7758-98-7  
**User Group** 7-12

### DESCRIPTION

Greyish-white to greenish-white, odourless, hygroscopic powder.

### SOLUBILITY

Soluble in water and methanol. Soluble in solutions of ammonia. Insoluble in ethanol.

**Solubility in water** 203 g/L (20°C)

### PHYSICAL DATA

**Molar mass** 159.61  
**Melting point** 200°C  
(slight decomposition)  
**Boiling point** 560°C (decomposes)  
**Specific gravity** 3.60 (20°C)  
**Flammability** Non-combustible

### REGULATORY INFORMATION

**ADG Class** 9  
**Packing Group** III  
**UN Number** 3077  
**Poisons Schedule** S6  
**Security** -

### HAZARD STATEMENTS

H302 Harmful if swallowed  
H315 Causes skin irritation  
H319 Causes serious eye irritation  
H410 Very toxic to aquatic life with long lasting effects

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Exposure may cause skin, eye and respiratory irritation. Copper salts are toxic by ingestion; symptoms of ingestion include nausea and vomiting.  
Handle in an operating fume cupboard or well-ventilated area. Avoid breathing dust and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.  
The anhydrous salt can be prepared from copper sulfate pentahydrate by heating carefully. Take care not to heat to its decomposition temperature of 560°C; decomposition gives toxic and irritating fumes of copper and sulfur oxides.

### STORAGE

Anhydrous copper (II) sulfate is hygroscopic and will gradually turn blue with absorption of water from the air. Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light; protect from moisture.  
Store away from alkalis, phosphates, magnesium, strong reducing agents and powdered metals.  
Store with general inorganic solids.

### APPLICATIONS

**Senior chemistry:** Investigations of the reversible dehydration-hydration reaction; determination of the number of molecules of water of crystallisation in the hydrate; demonstration of an exothermic hydration reaction.

### SPILLS

Wear PPE. Ensure good ventilation.  
Scoop up spill material and place into a suitable labelled container. Store for collection.  
Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

### WASTE DISPOSAL

Store waste anhydrous copper sulfate in a suitable labelled container such as for copper or heavy metal waste. Arrange for collection by a licenced waste disposal contractor.  
Alternatively, the salt can be purified by recrystallisation as the pentahydrate and recycled.

### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Call a POISONS CENTRE or doctor if you feel unwell.

**IF ON SKIN:** Remove immediately all contaminated clothing. Wash area thoroughly with water. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur: Get medical advice/attention.

POISONS CENTRE: 13 11 26





## copper (II) sulfate, pentahydrate

*cupric sulfate pentahydrate; blue vitriol*

**WARNING**



**Formula**  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

**CAS No.** 7758-99-8

**User Group** 7-12

### DESCRIPTION

Blue, odourless, efflorescent crystals or powder with an unpleasant metallic taste.

### SOLUBILITY

Soluble in water, methanol and glycerol.  
Slightly soluble in ethanol.

**Solubility in water** 317 g/L (20°C)

### PHYSICAL DATA

|                         |   |
|-------------------------|---|
| <b>Molar mass</b>       | 249.68  |
| <b>Melting point</b>    | 30°C (-2H <sub>2</sub> O)<br>110°C (-4H <sub>2</sub> O)<br>250°C (-5H <sub>2</sub> O) |
| <b>Boiling point</b>    | 560°C (decomposes)  |
| <b>Specific gravity</b> | 2.286 (15.6°C)  |
| <b>Flammability</b>     | Non-combustible   |

### REGULATORY INFORMATION

|                         |      |
|-------------------------|------|
| <b>ADG Class</b>        | 9    |
| <b>Packing Group</b>    | III  |
| <b>UN Number</b>        | 3077 |
| <b>Poisons Schedule</b> | S6   |
| <b>Security</b>         | -    |

### HAZARD STATEMENTS

H302 Harmful if swallowed  
H315 Causes skin irritation  
H319 Causes serious eye irritation  
H410 Very toxic to aquatic life with long lasting effects

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Exposure may cause skin, eye and respiratory irritation. Copper salts are toxic by ingestion; symptoms of ingestion include nausea and vomiting.

Handle in an operating fume cupboard or well-ventilated area. Avoid breathing dust and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Heating or burning the salt may give rise to toxic fumes of oxides of copper and sulfur which can cause respiratory irritation.

### STORAGE

Copper sulfate pentahydrate is efflorescent, slowly losing its water of crystallisation to the air. Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light.

Store away from finely divided metals, steel, strong oxidising agents and strong reducing agents.  
Store with general inorganic solids.

### APPLICATIONS

**General science:** a source of copper (II) ions for precipitation reactions; crystal growing; copper plating.

**Senior chemistry:** In dilute solution, as a reagent in qualitative inorganic analysis; a component in Fehling's solution and Benedict's solution.

### SPILLS

Wear PPE. Ensure good ventilation.

**Solid spill:** Scoop up and place in a container. Store for collection.

**Solution spill:** Cover with sand or other non-combustible absorbent such as a 1:1:1 mixture of sodium carbonate, sand and bectonite (clay cat litter). Scoop up into a container. Store for collection.

Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

### WASTE DISPOSAL

Store waste copper sulfate in a suitable labelled container such as for copper or heavy metal waste. Arrange for collection by a licenced waste disposal contractor.

**Waste solutions:** waste treatment options:

- Evaporate the water from the solution and store the residue as for solid waste.
- Immerse steel wool in the solution, and thus displace the copper ions. Decant the supernatant from the precipitated copper and flush down the sink. Dispose of the copper metal residue as general waste.
- Recrystallise the salt and recycle.
- Precipitate the copper ions as basic copper carbonate by adding the solution to a slight excess of sodium carbonate in solution. Allow the mixture to age over a few days. Collect the precipitate by filtration, allow to dry and store for collection. Dispose of the filtrate down the sink.

### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Call a POISONS CENTRE or doctor if you feel unwell.

**IF ON SKIN:** Remove immediately all contaminated clothing. Wash area thoroughly with water. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur: Get medical advice/attention.

POISONS CENTRE: 13 11 26





**Formula** C<sub>6</sub>H<sub>12</sub>  
**CAS No.** 110-82-7  
**User Group** 11-12



#### DESCRIPTION

Clear, colourless, highly volatile liquid with a sweetish odour. Less dense than water.

#### SOLUBILITY

Practically insoluble in water. Miscible with ethanol, diethyl ether, acetone and petroleum ether. Moderately soluble in methanol.

**Solubility in water** 0.06 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 84.16  
**Melting point** 7°C  
**Boiling point** 81°C  
**Specific gravity** 0.78 (20°C)  
**Flammability** Highly flammable

#### REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** II  
**UN Number** 1145  
**Poisons Schedule** S5  
**Security** -

#### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour  
H315 Causes skin irritation  
H336 May cause drowsiness or dizziness  
H304 May be fatal if swallowed and enters airways

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation to the skin, eyes and respiratory tract. Symptoms of exposure include CNS depression, headache, drowsiness and dizziness. Repeated skin contact may have a degreasing effect. There is a risk of aspiration into the lungs if ingested.

Handle only in an operating fume cupboard or well-ventilated area. Avoid inhaling vapour or mist. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Handle away from heat and other sources of ignition.

There is potential for the vapour to collect in low-lying, confined areas. The vapour can form explosive mixtures with air and can travel to an ignition source and flash back.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Ensure container is kept upright to prevent leakage. Store away from heat and any sources of ignition.

Store away from oxidising agents, acids and bases.  
Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** comparing the properties of saturated and unsaturated hydrocarbons; solvent for extracting halogens from aqueous solution, in the preparation of nylon and in thin-layer chromatography; a component of synthetic 'crude oil'; extraction solvent for natural products.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation.

**Small spill:** Absorb with paper towel. Place paper towel in an operating fume cupboard and allow the solvent to evaporate. Dispose of paper towel as general waste.

**Large spill:** Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection.

Ventilate spill area and allow the solvent to evaporate. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Cyclohexane is highly toxic for aquatic life, does not readily biodegrade and can bioaccumulate. Avoid release to the environment. Do not dispose of down the sink.

**Small quantity:** Place in a shallow vessel in an operating fume cupboard and allow the solvent to evaporate.

**Large quantity:** Store in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing and wash before reuse. Wash skin with plenty of soap and water. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical advice/attention.

POISONS CENTRE: 13 11 26



**Formula**  $C_6H_{12}O$   
**CAS No.** 108-93-0  
**User Group** 11-12

#### DESCRIPTION

Clear colourless crystals or viscous liquid with a faint camphor-like odour.

#### SOLUBILITY

Soluble in water, ethanol, diethyl ether, acetone, ethyl acetate and petroleum solvents.

**Solubility in water** 40 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 100.16  
**Melting point** 24°C  
**Boiling point** 161°C  
**Specific gravity** 0.95 (20°C)  
**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

H302 Harmful if swallowed  
H332 Harmful if inhaled  
H315 Causes skin irritation

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Butyl, Viton®, neoprene; nitrile for splash protection). Exposure may cause irritation to the eyes, nose, throat and respiratory tract and on ingestion. Exposure to high concentrations of the vapour may cause nausea, headache, dizziness and CNS depression. Prolonged or repeated skin contact can lead to dryness, cracking and dermatitis. Handle in an operating fume cupboard or well-ventilated area. Avoid generating and inhaling vapour or mist. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air if strongly heated. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition. Test for peroxides before use, particularly if intending to heat or distill the alcohol.

#### STORAGE

The alcohol is hygroscopic. With prolonged storage, and on exposure to air and sunlight, the alcohol may form peroxides, which may become explosive if they are concentrated. Store in a tightly closed container in a cool, dry well-ventilated place away. Protect from moisture and sunlight. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition. Store away from oxidising agents, nitric acid, alkali metals. Store with flammable and combustible liquids in an AS compliant cabinet. Mark the bottle with the date received and date opened.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection. Wash the spill area thoroughly with water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Store waste or surplus cyclohexanol in a suitable labelled container and arrange for collection by a licenced waste disposal contractor. As the alcohol is a peroxide former, waste or surplus cyclohexanol should not be stored with any other waste. The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek immediate medical attention.  
**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek immediate medical attention.  
**IF ON SKIN:** Remove immediately all contaminated clothing. Wash skin with plenty of soap and water. Wash contaminated clothing before reuse. If irritation occurs, seek medical attention.  
**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.  
POISONS CENTRE 13 11 26

#### APPLICATIONS

**Senior chemistry:** to observe the reactivity of a secondary alcohol.

**Formula** C<sub>6</sub>H<sub>10</sub>  
**CAS No.** 110-83-8  
**User Group** 11-12



#### DESCRIPTION

Clear, colourless, highly volatile liquid with an aromatic odour. Less dense than water.

#### SOLUBILITY

Very slightly soluble in water. Soluble in ethanol, acetone, diethyl ether and petroleum ether.

**Solubility in water** 0.21 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 82.15  
**Melting point** -104°C  
**Boiling point** 83°C  
**Specific gravity** 0.81 (20°C)  
**Flammability** Highly flammable

#### REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** II  
**UN Number** 2256  
**Poisons Schedule** S5  
**Security** -

#### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour  
H302 Harmful if swallowed  
H312 Harmful in contact with skin  
H304 May be fatal if swallowed and enters airways  
H411 Toxic to aquatic life with long lasting effects

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation to the skin, eyes and respiratory tract. Symptoms of exposure include CNS depression, headache, drowsiness and dizziness. Repeated skin contact may have a degreasing effect. There is a risk of aspiration into the lungs if ingested.

Handle only in an operating fume cupboard or well-ventilated area. Avoid inhaling vapour or mist. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Handle away from heat and other sources of ignition.

There is potential for the vapour to collect in low-lying, confined areas. The vapour can form explosive mixtures with air and can travel to an ignition source and flash back. Test for peroxides periodically and before use. If crystals or a precipitate of peroxide is present, do NOT attempt to open the bottle; arrange for its disposal via a licenced contractor.

#### STORAGE

May polymerise or form peroxides over time and/or on exposure to air or sunlight. Store in a tightly closed container in a cool, dry, well-ventilated place. Protect from light and moisture. Ensure container is kept upright to prevent leakage. Store away from heat and all sources of ignition. Store away from oxidising agents, acids, bases, halogens. Store with flammable liquids in an AS compliant cabinet. Mark the bottle with the date received and the date opened.

#### APPLICATIONS

**Senior chemistry:** observing the properties of saturated and unsaturated hydrocarbons; organic addition reactions.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection. Ventilate spill area then wash area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Cyclohexene is toxic for aquatic life on an acute basis. It is expected to biodegrade slowly under environmental conditions and has a moderate potential for bioaccumulation. Avoid release to the environment. Do not dispose of down the sink.

Store surplus or waste cyclohexene in a suitable labelled container such as for non-halogenated organic liquid waste and dispose of via a licenced waste disposal contractor. Glassware contaminated with cyclohexene can be rinsed with a minimal amount of ethanol/methylated spirits into the waste bottle.

The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing. Wash skin with plenty of soap and water. Call a POISONS CENTRE or doctor if you feel unwell.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical advice/attention.

POISONS CENTRE: 13 11 26



**Formula** CH<sub>2</sub>Cl<sub>2</sub>  
**CAS No.** 75-09-2  
**User Group** 11-12

#### DESCRIPTION

Clear, colourless, volatile liquid with a pleasant, sweet odour. Heavier than water.

#### SOLUBILITY

Sparingly soluble in water. Soluble in ethanol and diethyl ether.

**Solubility in water** 13 g/L (25°C)

#### PHYSICAL DATA

**Molar mass** 84.93  
**Melting point** -97°C  
**Boiling point** 40°C  
**Specific gravity** 1.33 (20°C)  
**Flammability** Non-combustible

#### REGULATORY INFORMATION

**ADG Class** 6.1  
**Packing Group** III  
**UN Number** 1593  
**Poisons Schedule** S5  
**Security** -

#### HAZARD STATEMENTS

H351 Suspected of causing cancer

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Viton® gloves are recommended; nitrile or butyl rubber gloves provide limited splash protection). Dichloromethane is classed as *Group 2A probably carcinogenic to humans*. Exposure may cause irritation of the skin, eyes and respiratory tract. Symptoms of overexposure include headache, dizziness and nausea. Detection of dichloromethane odour occurs above the TWA (odour threshold: 205-307ppm; TWA: 50ppm). Handle in an operating fume cupboard or well-ventilated area. Avoid breathing vapour or mist. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Open the bottle with care to avoid inhaling the headspace vapour. Forms a flammable air/vapour mixture above 100°C; handle away from ignition sources. This solvent may dissolve some plastics.

#### STORAGE

Substance is heat- and light-sensitive. Store in a tightly closed container in a cool, dry well-ventilated place away from heat and light. Ensure container is kept upright to prevent leakage. Store away from heat and any sources of ignition. Store away from alkali metals, alkaline earth metals, aluminium, strong acids and bases, strong oxidising agents, amines, vinyl compounds. Store with general organic liquids.

#### APPLICATIONS

**Senior chemistry:** solvent used in ester preparation and extraction of natural products.

#### SPILLS

Wear PPE. Ensure good ventilation. Remove all sources of ignition. Absorb spill with inert material such as dry sand, vermiculite or bentonite (clay cat litter). Scoop up with a non-sparking tool, place in a suitable labelled container and arrange for collection.

#### WASTE DISPOSAL

Substance is insoluble in water and is harmful for the aquatic environment; its release to the environment should be avoided. Store waste in a suitable labelled container such as for halogenated organic waste. Arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.  
**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical attention.  
**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin with water/shower. If skin irritation occurs, seek medical advice/attention.  
**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26



**WARNING**



**Formula**  $C_{12}H_{26}O$   
**CAS No.** 112-53-8  
**User Group** 11-12

**DESCRIPTION**

Colourless liquid or crystals with a sweet odour.

**SOLUBILITY**

Practically insoluble in water. Soluble in ethanol and diethyl ether.

**Solubility in water** 4 mg/L (25°C)

**PHYSICAL DATA**

**Molar mass** 186.33  
**Melting point** 24°C  
**Boiling point** 261°C  
**Specific gravity** 0.83 (24°C)  
**Flammability** Combustible

**REGULATORY INFORMATION**

**ADG Class** 9  
**Packing Group** III  
**UN Number** 3077  
**Poisons Schedule** -  
**Security** -

**HAZARD STATEMENTS**

H319 Causes serious eye irritation  
H400 Very toxic to aquatic life  
H410 Very toxic to aquatic life with long lasting effects

**SAFE HANDLING**

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation to the skin, eyes and respiratory tract. Absorption of a large amount by ingestion, inhalation or via the skin may lead to narcosis. Avoid generating and inhaling dust, mists or vapours. Avoid contact with skin and eyes. Vapours may form explosive mixtures with air if heated strongly. Handle away from heat and sources of ignition.

**STORAGE**

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition. Store away from oxidising agents, acids and acid chlorides. Store with general organic liquids.

**APPLICATIONS**

**Senior chemistry:** preparation of a detergent (sodium lauryl sulfate).

**SPILLS**

Wear PPE. Eliminate all ignition sources. Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand. Collect spill material with a non-sparking tool. Place in a suitable labelled container and arrange for collection. Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

**WASTE DISPOSAL**

Store waste or surplus alcohol in a suitable labelled container and arrange for collection by a licenced waste disposal contractor.

**FIRST AID**

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical advice if effects persist.  
**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical advice if effects persist.  
**IF ON SKIN:** Remove contaminated clothing. Wash skin with plenty of soap and water. If skin irritation occurs: Get medical advice/attention.  
**IF INHALED:** Move patient to fresh air.





**Formula**  $\text{H}_2\text{O}_2$

**CAS No.** 7722-84-1 ( $\text{H}_2\text{O}_2$ )

**User Group** 7-12

#### DESCRIPTION

Clear colourless, odourless liquid.

#### SOLUBILITY

Miscible with water and alcohols. Can react explosively with organic solvents.

#### Solubility in water

Miscible in all proportions

#### PHYSICAL DATA

**Molar mass** 34.01 ( $\text{H}_2\text{O}_2$ )

**Melting point**  $-1.6^\circ\text{C}$

**Boiling point**  $100.4^\circ\text{C}$  (decomposes)

**Specific gravity** 1.007 ( $25^\circ\text{C}$ )

**Flammability** Non-combustible  
oxidising liquid

#### REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** -

**Poisons Schedule** -

**Security CSC**

#### HAZARD STATEMENTS

Not classified as hazardous.

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex, PVC). Exposure may cause skin and respiratory irritation.

Handle in a well-ventilated area. Avoid breathing vapour and contact with skin, eyes and clothing. Handle away from heat and sources of ignition.

Bottles may develop pressure over time and therefore the cap should be opened carefully to release any build up of pressure.

Use glass or plastic vessels and pipettes when handling, rather than metal implements and vessels, as the decomposition reaction may be catalysed in contact with a metal surface.

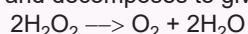
#### APPLICATIONS

**General science, Senior biology:** to demonstrate the activity of catalase in animal and plant tissue.

**Senior chemistry:** as an oxidising agent in organic and inorganic reactions.

#### PREPARATIONS

Hydrogen peroxide is sensitive to heat and light, especially direct sunlight, and decomposes to give oxygen and water:



Decomposition is also accelerated by soluble and insoluble impurities, contact with metals, and a pH above 4.

Commercial solutions of hydrogen peroxide contain stabilisers which slow their decomposition. However, if the commercial solution is diluted, decomposition is likely to be more rapid due to exposure to catalysts and dilution of the stabilising agent. Solutions are therefore best prepared as required.

#### STORAGE

Store in an opaque container in a dark, cool and dry place away from heat and light. The container should be stored upright and must have a vented lid to prevent a build up of pressure. The recommended storage temperature is  $2-8^\circ\text{C}$ ; however, if storing under refrigeration, the refrigerator must be spark-proofed.

Store away from powdered metals, zinc, copper, iron, reducing agents, oxidising agents, combustible or organic materials, acids and bases. Do not store on shelves made from combustible material.

#### SPILLS

See Laboratory Notes for details of spill treatment methods. Hydrogen peroxide spilt on combustible material can lead to spontaneous combustion, especially if concentrated by evaporation of the water. Therefore, spills of hydrogen peroxide on combustible materials should be diluted with water immediately. Contaminated clothing should be removed and rinsed thoroughly before reuse.

#### WASTE DISPOSAL

Dilute to 0.5% and dispose of down the sink. Empty hydrogen peroxide containers should be rinsed well with water and disposed of in the general waste. They should not be used for the storage of other substances.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing. Wash area thoroughly with water. If irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If cough or other symptoms occur: Get medical advice/attention.

POISONS CENTRE: 13 11 26



# hydrogen peroxide 6%

*dihydrogen peroxide*

**WARNING**



**Formula**  $\text{H}_2\text{O}_2$   
**CAS No.** 7722-84-1 ( $\text{H}_2\text{O}_2$ )  
**User Group** 7-12

## DESCRIPTION

Clear, colourless liquid with a weak acrid odour.

## SOLUBILITY

Miscible with water and alcohols. Can react explosively with organic solvents.

## Solubility in water

Miscible in all proportions

## PHYSICAL DATA

**Molar mass** 34.01 ( $\text{H}_2\text{O}_2$ )  
**Melting point**  $-6.4^\circ\text{C}$  (10%)  
**Boiling point**  $101.5^\circ\text{C}$   
(10%, decomposes)  
**Specific gravity** 1.03 ( $25^\circ\text{C}$ , 10%)  
**Flammability** Non-combustible  
oxidising liquid

## REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** -  
**Poisons Schedule** S5  
**Security** CSC

## HAZARD STATEMENTS

H319 Causes serious eye irritation

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex, PVC). Exposure may cause skin irritation and burns, and respiratory irritation. Contact with eyes can cause severe burns.

Handle in an operating fume cupboard or well-ventilated area. Avoid breathing vapour and contact with skin, eyes and clothing. Handle away from heat and sources of ignition. Open the bottle cautiously in case of a build up of pressure. Use glass or plastic vessels and pipettes when handling, rather than metal implements and vessels, as the decomposition reaction may be catalysed in contact with a metal surface.

## APPLICATIONS

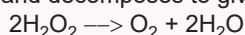
**General science:** for the preparation of oxygen gas.

**Senior biology:** to demonstrate the activity of catalase in animal and plant tissue.

**Senior chemistry:** as an oxidising agent in organic and inorganic reactions.

## PREPARATIONS

Hydrogen peroxide is sensitive to heat and light, especially direct sunlight, and decomposes to give oxygen and water.



Decomposition is also accelerated by soluble and insoluble impurities, contact with metals, and a pH above 4.

Commercial solutions of hydrogen peroxide contain stabilisers which slow their decomposition. However, if the commercial solution is diluted, decomposition is likely to be more rapid due to exposure to catalysts and dilution of the stabilising agent. Solutions are therefore best prepared as required.

## STORAGE

Store in an opaque container in a dark, cool and dry place away from heat and light. The container should be stored upright and must have a vented lid to prevent a build up of pressure. The recommended storage temperature is  $2-8^\circ\text{C}$ ; however, if storing under refrigeration, the refrigerator must be spark-proofed.

Store away from powdered metals, zinc, copper, iron, reducing agents, oxidising agents, combustible or organic materials, acids and bases. Do not store on shelves made of combustible material.

## SPILLS

See Laboratory Notes for details of spill treatment methods. Hydrogen peroxide spilt on combustible material can lead to spontaneous combustion, especially if concentrated by evaporation of the water. Therefore, spills of hydrogen peroxide on combustible materials should be diluted with water immediately. Contaminated clothing should be removed and rinsed thoroughly before reuse.

## WASTE DISPOSAL

Dilute to 0.5% and dispose of down the sink. Empty hydrogen peroxide containers should be rinsed well with water and disposed of in the general waste. They should not be used for the storage of other substances.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Call a POISONS CENTRE or doctor.

**IF ON SKIN:** Wash area thoroughly with water. Remove immediately all contaminated clothing and rinse thoroughly with water before reuse. If irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If cough or other symptoms occur: Get medical advice/attention.  
POISONS CENTRE: 13 11 26



# hydrogen peroxide 35%

dihydrogen peroxide

**ANGER**

**Formula**  $\text{H}_2\text{O}_2$   
**CAS No.** 7722-84-1 ( $\text{H}_2\text{O}_2$ )  
**User Group** Staff



## DESCRIPTION

Colourless liquid with a slightly acrid odour.

## SOLUBILITY

Miscible with water and alcohols, glycols and acetone. Can react explosively with organic solvents.

## Solubility in water

Miscible in all proportions

## PHYSICAL DATA

**Molar mass** 34.01 ( $\text{H}_2\text{O}_2$ )  
**Melting point**  $-33^\circ\text{C}$   
**Boiling point**  $107^\circ\text{C}$  (decomposes)  
**Specific gravity** 1.13 ( $20^\circ\text{C}$ )  
**Flammability** Non-combustible  
oxidising liquid

## REGULATORY INFORMATION

**ADG Class** 5.1 (8)  
**Packing Group** II  
**UN Number** 2014  
**Poisons Schedule** S6  
**Security CSC**

## HAZARD STATEMENTS

H272 May intensify fire; oxidizer  
H290 May be corrosive to metals  
H302 Harmful if swallowed  
H314 Causes severe skin burns and eye damage

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex, PVC). Substance is corrosive. Exposure can cause severe burns to skin and eyes, and respiratory irritation. Handle only in an operating fume cupboard or well-ventilated area. Avoid breathing vapour and contact with skin, eyes and clothing. Handle away from heat and sources of ignition.

Open the bottle cautiously in case of a build up of pressure. Use glass or plastic vessels and pipettes when handling, rather than metal implements and vessels, as the decomposition reaction may be catalysed in contact with a metal surface.

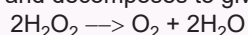
There is a risk of fire or explosion if concentrated hydrogen peroxide solution is mixed with incompatible materials.

## APPLICATIONS

**General science:** in the demonstration of the rapid decomposition of hydrogen peroxide in the presence of a catalyst such as potassium iodide or manganese dioxide (the 'Elephant's Toothpaste' reaction); in the preparation of oxygen gas.

## PREPARATIONS

Hydrogen peroxide is sensitive to heat and light, especially direct sunlight, and decomposes to give oxygen and water.



Decomposition is also accelerated by soluble and insoluble impurities, contact with metals, and a pH above 4. Commercial solutions of hydrogen peroxide contain stabilisers which slow their decomposition. However, if the commercial solution is diluted, decomposition is likely to be more rapid due to exposure to catalysts and dilution of the stabilising agent. Solutions are therefore best prepared as required.

## STORAGE

Store in an opaque container in a dark, cool and dry, well-ventilated place away from heat and light. The container should be stored upright and must have a vented lid to prevent a build up of pressure. The recommended storage temperature is  $2-8^\circ\text{C}$ ; however, if storing under refrigeration, the refrigerator must be spark-proofed. Store away from powdered metals, zinc, copper, iron, reducing agents, oxidising agents, combustible or organic materials, acids and bases. Do not store on shelves made of combustible material.

## SPILLS

See Laboratory Notes for details of spill treatment methods. Hydrogen peroxide spilt on combustible material can lead to spontaneous combustion, especially if concentrated by evaporation of the water. Therefore, spills of hydrogen peroxide on combustible materials should be diluted with water immediately. Contaminated clothing should be removed and rinsed thoroughly before reuse.

## WASTE DISPOSAL

Small quantities: Dilute to 0.5% and dispose of down the sink. Large quantities: See Laboratory Notes for disposal procedure. Empty hydrogen peroxide containers should be rinsed well with water and disposed of in the general waste, and not used for the storage of other substances.

## FIRST AID

**Immediately call a POISONS CENTRE or doctor.**

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting.

**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin with water/shower.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing.

POISONS CENTRE: 13 11 26

# hydrogen peroxide

Formula  $\text{H}_2\text{O}_2$   
CAS No. 7722-84-1 ( $\text{H}_2\text{O}_2$ )  
MW 34.01 ( $\text{H}_2\text{O}_2$ )

## LABORATORY NOTES

**Solubility in water** Miscible in all proportions

### Units of Concentration

The concentration of hydrogen peroxide solutions is usually specified as weight %, or wt%, which is the mass of hydrogen peroxide in grams per 100 g of aqueous solution. The concentration is also expressed as volume strength or 'volumes', which is the volume of oxygen gas liberated per unit volume of solution. For a 3%, or 10 volume solution, this means that complete decomposition of 5 mL of the solution will liberate 50 mL (10 x 5 mL) of oxygen gas.

The concentration of a hydrogen peroxide solution can be determined by titration with a dilute solution of potassium permanganate.

### Procedure for the treatment of hydrogen peroxide spills<sup>1</sup>

Wear PPE. Cover the spill with inert, non-combustible material such as a 1:1:1 mixture of sodium carbonate, sand and cat litter. Dampen the mixture with water and transfer it to a plastic container using a plastic scoop. In an operating fume cupboard, add the mixture to a large volume of water.

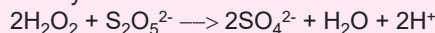
With spills of low  $\text{H}_2\text{O}_2$  concentration, dilute further as necessary, so that the  $\text{H}_2\text{O}_2$  concentration is 0.5% or less. Decant the solution down the sink and dispose of the solid residue in the general waste.

With larger spills of more concentrated solutions which cannot easily be diluted to 0.5%, ensure that the  $\text{H}_2\text{O}_2$  is diluted to approximately 5% and treat with sodium metabisulfite as for waste solutions (see below). Decant the treated solution down the sink and dispose of the solid residue in the general waste.

Rinse the spill area and any contaminated materials thoroughly with water.

### Procedure for the treatment of waste concentrated hydrogen peroxide solutions<sup>1</sup>

**Principle:** Hydrogen peroxide is reduced by its reaction with metabisulfite:



**Procedure:** Wear PPE and work in a fume cupboard. Dilute the hydrogen peroxide solution to a concentration of 5% by careful addition of the peroxide solution to a large volume of water. Prepare a solution of an excess (1.5 x) of sodium metabisulfite ( $\text{Na}_2\text{S}_2\text{O}_5$ ) and to this, add the hydrogen peroxide solution slowly and with stirring. Monitor the temperature of the reaction; a rise in temperature indicates that the reaction has started. If no temperature increase occurs, acidify the mixture with dilute sulfuric acid. Neutralise the mixture to a pH of 6-8 by addition of sodium carbonate solution and dispose of down the sink.

Example: To treat 100 mL of 35% hydrogen peroxide, dilute the hydrogen peroxide solution by adding it to 600 mL of water. Prepare a metabisulfite solution by dissolving 147 g of sodium metabisulfite in 350 mL of water. Slowly add the peroxide solution to the metabisulfite solution, as described above.

### Reference

1. Armour, M.A., Hazardous Laboratory Chemicals Disposal Guide, Third Edition, CRC Press, 2005, Florida, p 297.

## Laboratory Notes

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### INTRODUCTION

Enzymes are biologically active proteins which act as catalysts within cells of living organisms. A catalyst is a substance which increases the rate of a chemical reaction but is not itself changed in the process and does not form part of the final product. Enzymes catalyse biochemical reactions so that they proceed at a rate which is useful to the organism.

The substance on which an enzyme acts is called the substrate. Enzymes bind to the reacting substrate molecule so that the molecule is oriented in a way which will lower the energy barrier to the reaction and increase the chances of it occurring.

An enzyme is usually highly specific for a particular substrate and the reaction it catalyses. This specificity is often explained using the 'lock and key' model wherein the active site on the enzyme is represented as a lock which allows the specific substrate (the key) to fit perfectly.

Environmental conditions affect the activity of an enzyme. For each enzyme, there is a temperature and pH at which it is most active. These optimal conditions vary depending on the source of the enzyme, its structure and form.

Due to the high demand for enzymes and the limitations of extracting enzymes from their natural sources, many enzymes are now produced from genetically modified fungi or bacteria using recombinant DNA techniques. These products are expected to be free from GM material. The following should indicate the conditions required. This may mean that the enzyme is dissolved in a dilute acid or buffer solution, rather than water.

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### HAZARDS OF ENZYMES

Enzymes may cause non-allergic irritation to the eyes, respiratory system, mucous membranes and skin. Proteolytic enzymes (those which act on proteins and polypeptides) are more likely to cause irritation than other enzymes.

Many enzymes are respiratory sensitisers and are classified as Respiratory Sensitiser Category 1 under the Globally Harmonised System of Classification and Labelling of Chemicals, (the GHS). Repeated inhalation of dust or mist containing these enzymes may lead to a respiratory allergy in some individuals.

The hazard classification of an enzyme may vary with the manufacturer and will depend on such factors as the source of the enzyme, its form (solid or in solution) and the particle size, if a solid. Fine powders will be present a higher level of hazard than granulated solids or enzymes in solution.

Under the GHS, the cut-off concentration which will trigger the classification of Respiratory Sensitiser Category 1 is 0.1% w/v, i.e. below a concentration of 0.1%, the substance would not meet the criteria for this classification.



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## SAFE HANDLING

Safe handling of enzyme preparations can be accomplished through proper work practices, engineering controls, and use of personal protective equipment. Always wear safety glasses and gloves (nitrile). Always use practices which do not generate dust or aerosols. Avoid inhalation of enzyme dust or aerosols, so as to avoid sensitisation and allergic reactions.

Many enzymes in powder form are hazardous substances, however in dilute aqueous solution they are considered to be of low hazard. When working with powdered enzymes, wear a dust mask or work in a fume cupboard that is not turned on to minimise exposure to any dust. If working outside a fume cupboard, make sure you are in a draft free area.

### Weighing enzyme powders:

- If the enzyme powder has been stored in the refrigerator or freezer, allow it to warm to room temperature before opening the bottle. This will minimise condensation forming inside the bottle.
- Wear PPE. Wear a dust mask, or work in a fume cupboard that is not turned on, with the sash lowered, to minimise exposure to any dust. Position an electronic balance in the fume cupboard. If working outside a fume cupboard, make sure you work in a draft free area.
- Carry out any transfers of the powder in a shallow tray in the fume cupboard. The tray will contain any spills of the powder.
- After the solution has been prepared, switch the fume cupboard on. With damp paper towel, wipe down any surfaces which may be contaminated with the powder.
- Wash the paper towel thoroughly with water and dispose of as general waste. Wash any tools and glassware thoroughly with water and/or dilute bleach to remove any traces of enzyme powder.

A site-specific risk assessment should be conducted to assess and control the risks and to determine how to safely prepare, handle and dispose of the solution.

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## PREPARATION

Enzymes are usually made up as a percentage concentration. A 0.5% to 1% w/v solution is generally suitable for enzyme digestion practicals carried out in schools. It is always best to use the lowest concentration and smallest amount possible.

Enzyme activity is affected by concentration, temperature, pH, substrate concentration, the presence of inhibitors or activators and the age of the reagents. The conditions for optimum activity can be different for each enzyme. The protocol for the procedure that you are following should indicate the conditions required. This may mean that the enzyme is dissolved in a dilute acid or buffer solution, rather than water.

It is always advisable to check that the enzyme reaction is working as required and make adjustments to the conditions and concentrations as necessary before any practical class.

It is important to keep enzymes stable and prevent them from denaturing. Never froth an enzyme solution as it can denature. It is best to use the lowest concentration and smallest amount possible.

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## SENSITISATION

The process of sensitisation occurs in two stages. In the first stage, an individual is initially exposed to the enzyme. If a sufficient amount of the enzyme is inhaled, the body produces antibodies in response to the enzyme. In the second stage, the individual is re-exposed to the enzyme. The body may then exhibit an inflammation response, with symptoms similar to hayfever. When exposure to the enzyme ceases, so should the symptoms.

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## STORAGE

Most enzymes need to be stored at cool or cold temperatures, in the fridge or freezer. Some enzymes lose their activity rapidly, even under optimal conditions, and may have a shelf life of only a few months. More thermally stable enzymes may remain active indefinitely when stored at room temperature. The manufacturer's safety data sheet should be consulted for the storage requirements of a specific product.

In general, enzymes in solution are less stable than in solid form and can lose their activity in a matter of hours. Solutions should be freshly prepared as required and kept on ice during practical activities.

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## SPILLS

**Powder spill:** Wear PPE. Take measures to reduce air circulation. Use a fine mist spray of water to dampen powder. Wipe up the powder with a damp paper towel into a bucket of water. Flush solution down the drain. Rinse the paper towel thoroughly in water and dispose of as general waste. Do not sweep up an enzyme powder spill with a broom or brush as this risks generating dust.

**Dilute solution spill:** Clean up spill as soon as practicable to avoid the solution drying out. Wear PPE. Absorb spill with paper towel and dilute with water. Flush down the drain. Rinse paper towel thoroughly and dispose of as general waste.

**Concentrated solution spill:** Cover spill with absorbent material such as sand or vermiculite. Scoop up and transfer to a suitable labelled container. Arrange for collection by a licenced waste disposal contractor.

Wash spill area with dilute bleach. Wash any contaminated clothing before reuse.

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## WASTE DISPOSAL

**Small quantity:** Dissolve in a large volume of water and flush down the sink.

**Large quantity:** Store bottles of hazardous enzymes for collection by a licenced waste disposal contractor.

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## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Give water to drink. Call a POISON CENTER/doctor if you feel unwell.

**IF INHALED:** Remove person to fresh air and keep comfortable for breathing. If experiencing respiratory symptoms: Call a POISON CENTER/doctor.

**IF ON SKIN:** Wash with plenty of soap and water. Remove contaminated clothing and wash it before reuse. If skin irritation occurs: Get medical advice/attention.

POISONS CENTRE: 13 11 26

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## REFERENCES

- The Comprehensive Enzyme Information System, BRENDA, <http://www.brenda-enzymes.org/>
- Worthington Enzyme Manual, Worthington Biochemical Corporation website, <http://www.worthington-biochem.com/index/manual.html>
- Working Safely with Enzymes, Enzyme Technology Association website, <http://www.enzymeassociation.org/wp-content/uploads/2013/09/Working-Safely-With-Enzymes-English.pdf>
- Guidelines for the safe handling of enzymes in detergent manufacturing, Enzyme Technology Association website, <http://www.enzymeassociation.org/wp-content/uploads/2012/04/AISE-Allegren-Guidance-Documents-8-February-2002.pdf>
- Enzyme overview, Southern Biological website, <http://file.southernbiological.com/Assets/Products/Chemicals/Enzymes/EnzymeOverview.pdf>
- Enzyme FAQ, Southern Biological website, <http://www.southernbiological.com/page/enzyme-faq>

## amylase

*diastase;  $\alpha$ -amylase;  $\beta$ -amylase;  $\gamma$ -amylase*

**DANGER**



**CAS No's** 9000-92-4 (diastase);  
9000-92-2 ( $\alpha$ -amylase);  
9000-91-3 ( $\beta$ -amylase)

### DESCRIPTION

White or tan, hygroscopic powder, or brown aqueous solution.

### NATURAL OCCURRENCE

$\alpha$ -Amylase is produced in the pancreas of animals and in the saliva of some mammals, including humans.

$\beta$ -Amylase is found in germinating seeds and sweet potatoes. Both  $\alpha$ - and  $\beta$ -amylases are found in honey.

### ACTION

Hydrolyses linkages in amylopectin and amylose in starch, and in glycogen.  $\alpha$ -Amylase produces maltose and dextrins.  $\beta$ -Amylase produces maltose.

### NOTES

Diastase is a generic name and can refer to any of  $\alpha$ -,  $\beta$ - or  $\gamma$ -amylase. Amylases often require Ca and/or Cl ions for stability.

### HAZARD STATEMENTS

H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled

### APPLICATIONS

Investigations of the effect of amylase on starch, breaking it down into simple sugars detectable with Benedict's solution. Extend the investigation by varying the pH, temperature and/or substrate concentration.

## catalase

**CAS No.** 9001-05-2

### DESCRIPTION

Available in solution. Can be sourced from plant and animal cells (liver, capsicum, potato).

### NATURAL OCCURRENCE

Found in most animals and many plants and micro-organisms. Liver has a high concentration of the enzyme.

### ACTION

An oxidoreductase; catalyses the decomposition of hydrogen peroxide to give oxygen and water.

### NOTES

Most forms of catalase are tetramers, with each subunit incorporating a heme (Fe-containing) group. Inhibited by the presence of Na or K ions.

### HAZARD STATEMENTS

Not classified as hazardous

### APPLICATIONS

Investigations of the action of the enzyme in liver or potato on hydrogen peroxide, detecting the presence of the oxygen gas formed. Extend the investigation by varying the pH, temperature and/or substrate concentration.



## cellulase

**DANGER**



**CAS No.** 9012-54-8

### DESCRIPTION

Powder or amber, aqueous solution.

### NATURAL OCCURRENCE

Fungi and micro-organisms; termites; symbiotic bacteria in the gut of herbivorous animals.

### ACTION

Catalyses the hydrolysis of cellulose, a polysaccharide in plant cell walls, to give glucose.

### NOTES

'Cellulase' refers to several enzymes which, acting together, decompose cellulose.

### HAZARD STATEMENTS

H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled

### APPLICATIONS

Investigations of the effect of cellulase on cellulose fibres (e.g. in filter paper), breaking it down into simple sugars detectable with Benedict's solution.

## invertase

*saccharase; invertin; sucrase*

**DANGER**



**CAS No.** 9001-57-4

### DESCRIPTION

White to tan powder.

### NATURAL OCCURRENCE

Produced by a range of microorganisms and fungi which utilise sucrose as a nutrient source; bees.

### ACTION

Catalyses the hydrolysis of sucrose, to give an equimolar mixture of fructose and glucose. This mixture is called 'invert sugar'.

### NOTES

Optimum pH of 4.5.

### HAZARD STATEMENTS

H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled

### APPLICATIONS

Investigations of the action of invertase (from yeast) on sucrose to produce fructose and glucose, detectable with Benedict's solution.





## lipase

*triacylglycerol lipase; pancreatic lipase*

**WARNING**



**CAS No.** 9001-62-1

### DESCRIPTION

Off-white powder.

### NATURAL OCCURRENCE

Pancreas, liver and stomach of animals; yeast; fungi; bacteria.

### ACTION

Catalyses the hydrolysis of triacylglycerides, giving diacylglycerides, monoglycerides, and carboxylic acids.

### NOTES

Requires Ca ions for activity.

### HAZARD STATEMENTS

H335 May cause respiratory irritation

### APPLICATIONS

Investigations of the action of lipase on fats in food (e.g. milk). The course of the reaction is followed by observing the lowering of the pH as fatty acids are produced.

## pectinase

*polygalacturonase*

**DANGER**



**CAS No.** 9032-75-1

### DESCRIPTION

Pale brown, hygroscopic powder or clear to light brown aqueous solution.

### NATURAL OCCURRENCE

Fungi; bacteria; ripening fruit

### ACTION

Hydrolyses and depolymerises plant pectins (polysaccharides).

### NOTES

Three main types of pectinases, based on their mode of action: polygalacturonase, pectinesterase and pectin lyase.

### HAZARD STATEMENTS

H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled

### APPLICATIONS

Investigations of the action of pectinase on the production of juice from fruit.

## pepsin

*digestive enzyme; digestive protease*

**DANGER**



**CAS No.** 9001-75-6

### DESCRIPTION

Off-white, hygroscopic powder.

### NATURAL OCCURRENCE

Found in many organisms. Pepsin A is the main proteolytic enzyme in vertebrates. The proenzyme, pepsinogen, is produced in the stomach mucosa.

### ACTION

Hydrolyses peptide linkages in proteins, giving amino acids.

### NOTES

Four forms of pepsin: A, B, C and D. Pepsin A is the predominantly-occurring enzyme.

### HAZARD STATEMENTS

H315 Causes skin irritation  
H319 Causes serious eye irritation  
H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled  
H335 May cause respiratory irritation

### APPLICATIONS

Investigations of the action of pepsin on albumin protein in a coagulated egg white suspension.

## rennin

*chymosin; rennet*

**DANGER**



**CAS No.** 9001-98-3

### DESCRIPTION

Yellow, hygroscopic powder.

### NATURAL OCCURRENCE

Produced in the stomach of infant mammals for the digestion of milk.

### ACTION

Clots milk by cleaving a peptide bond of the  $\kappa$ -chain of casein (milk protein).

### NOTES

Secreted as the proenzyme, prochymosin, which is activated by acid in the stomach. 'Rennet' is a generic name which refers to any preparation of proteases which clots milk.

### HAZARD STATEMENTS

H315 Causes skin irritation  
H319 Causes serious eye irritation  
H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled  
H335 May cause respiratory irritation

### APPLICATIONS

Investigations of the action of the enzyme in coagulating the milk protein casein. Compare the rate of reaction at different temperatures and rennin concentrations.



## trypsin

*serine protease; proteolytic enzyme*

**DANGER**



**CAS No.** 9002-07-7

### DESCRIPTION

Off-white to yellow powder.

### NATURAL OCCURRENCE

A digestive enzyme of many vertebrates. The proenzyme, trypsinogen, forms in the pancreas and is activated in the small intestine.

### ACTION

A serine protease. Catalyses the cleavage of proteins to give amino acids.

### NOTES

Stabilised by Ca ions.

### HAZARD STATEMENTS

H315 Causes skin irritation

H319 Causes serious eye irritation

H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled

H335 May cause respiratory irritation

### APPLICATIONS

Investigations of the action of trypsin in breaking down the milk protein, casein, into amino acids.

## urease

*urea amidohydrolase*

**DANGER**



**CAS No.** 9002-13-5

### DESCRIPTION

Off-white to yellow powder.

### NATURAL OCCURRENCE

Bacteria; yeast; higher plants.

### ACTION

Catalyses the hydrolysis of urea to give ammonia and carbon dioxide.

### NOTES

The progress of the reaction can be observed by monitoring the increase of the pH with the production of ammonia.

### HAZARD STATEMENTS

H315 Causes skin irritation

H319 Causes serious eye irritation

H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled

H335 May cause respiratory irritation

### APPLICATIONS

Investigations of the action of urease on a urea solution to produce ammonia.



**Formula**  $C_2H_6O$   
**CAS No.** 64-17-5  
**User Group** 7-12



#### DESCRIPTION

Colourless highly volatile liquid with a sweet, fragrant odour.

#### SOLUBILITY

Miscible with water, methanol, diethyl ether and acetone.

**Solubility in water** Miscible

#### PHYSICAL DATA

**Molar mass** 46.07  
**Melting point** -117°C (100%)  
-114°C (95%)  
**Boiling point** 78°C  
**Specific gravity** 0.79 (20°C)  
**Flammability** Highly flammable

#### REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** II  
**UN Number** 1170  
**Poisons Schedule** -  
**Security** IDM Cat 3

#### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour  
H319 Causes serious eye irritation

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Butyl, Viton®; neoprene for splash protection). Exposure may cause irritation to the skin, eyes and respiratory tract. Symptoms of ingestion include inebriation, dizziness, headache, nausea and narcosis. Prolonged or repeated skin contact can lead to dryness and cracking. Handle in a well-ventilated area. Avoid inhalation of vapour. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.

#### STORAGE

Ethanol (100%) is hygroscopic. Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition. Store away from oxidising agents, strong acids, acid chlorides and alkali metals. Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** to observe the reactivity of a primary alcohol; preparation of esters; heat of combustion investigations; solvent for chromatography or extraction of organic compounds.

**Technical:** solvent for preparation of solutions; cleaning and disinfecting agent.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool.

**Small spill:** Add material to a large volume of water and allow to stand until the solids have settled. Decant the solution down the sink with further dilution. Dispose of the absorbent material as general waste. Alternatively, treat as for Waste Disposal of a small quantity.

**Large spill:** Place material into a suitable labelled container and store for collection.

Wash the spill area thoroughly with water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Absorb onto paper towel and allow alcohol to evaporate in an operating fume cupboard. Dispose of paper towel as general waste.

**Large quantity:** Store in the original container or other suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Give water to drink. Seek medical advice.

**IF ON SKIN:** Remove contaminated clothing. Rinse skin with plenty of water. If irritation occurs, seek medical advice.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms develop, seek medical attention.



**DANGER**

**Formula** C<sub>2</sub>H<sub>6</sub>O  
**CAS No.** 64-17-5  
**User Group** 7-12



#### DESCRIPTION

Colourless highly volatile liquid with an ethereal odour.

#### SOLUBILITY

Miscible with water, methanol, diethyl ether and acetone.

**Solubility in water** Miscible

#### PHYSICAL DATA

**Molar mass** 46.07 (ethanol)  
**Melting point** -114°C (ethanol)  
**Boiling point** 78°C (ethanol)  
**Specific gravity** 0.79 (20°C) (ethanol)  
**Flammability** Highly flammable

#### REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** II  
**UN Number** 1170  
**Poisons Schedule** S5  
**Security** IDM Cat 3

#### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour  
H319 Causes serious eye irritation

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Butyl, Viton®; neoprene for splash protection). Exposure may cause irritation to the skin, eyes and respiratory tract. Ingestion may lead to inebriation, dizziness, headache, nausea, narcosis and blindness. Prolonged or repeated skin contact can cause dryness and cracking. Handle in a well-ventilated area. Avoid inhalation of vapour. Avoid contact with skin, eyes and clothing. Do not ingest. Avoid prolonged or repeated exposure. There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition. Denaturing agents, present in low concentration, may include methyl isobutyl ketone, methanol and denatonium benzoate (a bitterant).

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition.  
Store away from oxidising agents, strong acids, acid chlorides and alkali metals.  
Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**General science:** disinfecting agent; solvent for chromatography.  
**Technical:** solvent for preparation of solutions; cleaning and disinfecting agent.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation.

**Small spill:** Treat as for Waste Disposal.

**Large spill:** Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection. Wash the spill area thoroughly with water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Absorb onto paper towel and allow alcohol to evaporate in an operating fume cupboard. Dispose of paper towel as general waste.

**Large quantity:** Store in the original container or other suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Give water to drink. Seek immediate medical attention.

**IF ON SKIN:** Remove contaminated clothing. Rinse skin with plenty of water. If irritation occurs, seek medical attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms develop, seek medical attention.





**Formula**  $C_4H_8O_2$   
**CAS No.** 141-78-6  
**User Group** 11-12



#### DESCRIPTION

Clear, colourless, highly volatile liquid with a fruity odour.

#### SOLUBILITY

Miscible with ethanol and diethyl ether.  
Soluble in water and acetone.

**Solubility in water** 85.3 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 88.11  
**Melting point** -83°C  
**Boiling point** 77°C  
**Specific gravity** 0.90 (20°C)  
**Flammability** Highly flammable

#### REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** II  
**UN Number** 1173  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour  
H319 Causes serious eye irritation  
H336 May cause drowsiness or dizziness  
AUH066 Repeated exposure may cause skin dryness and cracking

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (butyl rubber). Exposure may cause irritation to the skin, eyes, nose and throat and respiratory tract. Inhalation or ingestion may cause headache, dizziness or drowsiness. Prolonged or repeated skin exposure may lead to dermatitis. Handle in an operating fume cupboard. Avoid breathing vapour and contact with skin and eyes. There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition. The ester may attack/dissolve some plastics.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Ensure container is kept upright to prevent leakage.  
Store away from oxidising agents, strong acids, strong alkalis and alkali metals.  
Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** solvent for extraction of organic compounds and thin layer chromatography; a product of the esterification reaction between acetic acid and ethanol.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Absorb spill with paper towel, or cover with inert absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool.

**Small spill:** Evaporate as for Waste Disposal.

**Large spill:** Place material into a suitable labelled container and store for collection.

Wash the spill area with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Absorb onto paper towel or other absorbent and allow the solvent to evaporate in an operating fume cupboard. Dispose of absorbent material as general waste.

**Large quantity:** Store in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek immediate medical advice.

**IF ON SKIN:** Remove contaminated clothing. Wash skin thoroughly with plenty of water.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26.



**Formula**  $C_9H_{10}O_2$

**CAS No.** 93-89-0

**User Group** 11-12

#### DESCRIPTION

Clear, colourless liquid with a fruity odour.

#### SOLUBILITY

Very slightly soluble in water. Miscible with ethanol, diethyl ether and petroleum ether.

**Solubility in water** 0.5 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 150.18

**Melting point** -34°C

**Boiling point** 213°C

**Specific gravity** 1.05 (20°C)

**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

H315 Causes skin irritation

H319 Causes serious eye irritation

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (butyl rubber, Viton®). Exposure may cause irritation to the skin, eyes, nose and throat and respiratory tract. Inhalation or ingestion may cause headache, dizziness or drowsiness. Handle in an operating fume cupboard or well-ventilated area. Avoid breathing vapour and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. The vapour is heavier than air and will collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Handle away from heat and sources of ignition.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Store away from heat and any sources of ignition. Ensure container is kept upright to prevent leakage.

Store away from strong oxidising agents and bases.

Store with flammable and combustible liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** hydrolysis of an ester; product of the esterification reaction between benzoic acid and ethanol.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Absorb spill with paper towel, or cover with inert absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection.

Wash the spill area with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Store waste or surplus ester in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical attention if feeling unwell.

**IF ON SKIN:** Take off immediately all contaminated clothing and wash before reuse. Wash skin thoroughly with plenty of soap and water. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur: Seek medical advice/attention.



**Formula**  $C_6H_{12}O_2$

**CAS No.** 105-54-4

**User Group** 11-12

#### DESCRIPTION

Clear, colourless, highly volatile liquid with a pineapple-like odour.

#### SOLUBILITY

Slightly soluble in water. Miscible with ethanol, diethyl ether and petroleum ether.

**Solubility in water** 6.2 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 116.16

**Melting point** -93°C

**Boiling point** 120-121°C

**Specific gravity** 0.88 (20°C)

**Flammability** Flammable

#### REGULATORY INFORMATION

**ADG Class** 3

**Packing Group** III

**UN Number** 1180

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

H226 Flammable liquid and vapour

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (PE/EVAL; butyl for splash contact). Exposure may cause irritation to the skin, eyes, nose and throat and respiratory tract. Inhalation or ingestion may cause headache, dizziness or drowsiness.

Handle in an operating fume cupboard or well-ventilated area. Avoid breathing vapour and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.

The ester may attack/dissolve some plastics.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Store away from heat and any sources of ignition. Ensure container is kept upright to prevent leakage.

Store away from oxidising agents, bases and acids.

Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** product of the esterification reaction between butyric acid and ethanol.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Absorb spill with paper towel, or cover with inert absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool.

**Small spill:** Evaporate as for Waste Disposal.

**Large spill:** Place material into a suitable labelled container and store for collection.

Wash the spill area with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Absorb onto paper towel or other absorbent and allow the solvent to evaporate in an operating fume cupboard. Dispose of absorbent material as general waste.

**Large quantity:** Store in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical attention if feeling unwell.

**IF ON SKIN:** Take off immediately all contaminated clothing. Wash skin thoroughly with plenty of soap and water. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur: Seek medical advice/attention.



**Formula**  $C_{11}H_{12}O_2$

**CAS No.** 103-36-6

**User Group** 11-12

#### DESCRIPTION

Colourless, oily liquid with a fruity, balsamic odour.

#### SOLUBILITY

Very slightly soluble in water. Soluble in ethanol and diethyl ether.

**Solubility in water** 178 mg/L (25°C)

#### PHYSICAL DATA

**Molar mass** 176.21

**Melting point** 6..8°C

**Boiling point** 271°C

**Specific gravity** 1.049 (20°C)

**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

Not classified as hazardous

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves. Exposure may cause irritation to the skin, eyes and respiratory tract.

Handle in an operating fume cupboard or well-ventilated area. Avoid breathing vapour and contact with skin, eyes and clothing. Handle away from heat and sources of ignition.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Absorb spill with paper towel, or cover with inert absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection.

Wash the spill area with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Store waste or surplus ester in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Store away from heat and any sources of ignition. Ensure container is kept upright to prevent leakage.

Store away from oxidising agents, bases, acids and reducing agents.

Store with flammable and combustible liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** product of the esterification reaction between cinnamic acid and ethanol.

#### FIRST AID

**IF IN EYES:** Rinse eyes cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting.

**IF ON SKIN:** Take off immediately all contaminated clothing. Wash skin thoroughly with plenty of soap and water. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If symptoms occur or if feeling unwell, seek medical attention.



**Formula** C<sub>2</sub>H<sub>6</sub>O<sub>2</sub>  
**CAS No.** 107-21-1  
**User Group** 7-12

#### DESCRIPTION

Clear, colourless, viscous liquid with a sweet taste.

#### SOLUBILITY

Miscible with water. Soluble in alcohol, acetic acid, acetone and diethyl ether.

**Solubility in water** Miscible

#### PHYSICAL DATA

**Molar mass** 62.07  
**Melting point** -13°C  
**Boiling point** 197°C  
**Specific gravity** 1.11 (20°C)  
**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** S6  
**Security** -

#### HAZARD STATEMENTS

H302 Harmful if swallowed

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Inhalation of vapour or mist from the heated glycol may cause respiratory irritation. Symptoms of ingestion or inhalation include nausea, vomiting, headache and CNS effects. Repeated or prolonged skin contact may cause mild irritation and may have a degreasing effect. Eye contact may lead to irritation and eye damage.

Avoid generating and inhaling vapour or mist. If mists or vapours are being generated, work in an operating fume cupboard or well-ventilated area. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

Vapours may form explosive mixtures with air if heated strongly. Handle away from heat and sources of ignition.

#### STORAGE

The glycol is hygroscopic and light sensitive. With prolonged storage, explosive peroxides may form. Store in a tightly closed container in a cool, dry well-ventilated place. Protect from light and moisture. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition. Store away from oxidising agents, alkalis, aldehydes and aluminium.

Store with flammable and combustible liquids in an AS compliant cabinet.

#### APPLICATIONS

**General science/Senior physics:** to observe its physical properties (density, viscosity, refractive index, 'antifreeze' properties).

#### SPILLS

Wear PPE. Eliminate all ignition sources. Cover spill with sand, or other inert material such as vermiculite or bentonite. Scoop up with a non-sparking tool. Place in a suitable labelled container and store for collection. Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Store waste or surplus ethylene glycol in a suitable labelled container and arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek immediate medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Call a POISONS CENTRE or doctor if you feel unwell.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin thoroughly with plenty of soap and water. If irritation occurs, seek medical attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms develop, seek medical attention.

POISONS CENTRE 13 11 26





**Formula**  $C_5H_{10}O_2$

**CAS No.** 105-37-3

**User Group** 11-12

#### DESCRIPTION

Colourless, highly volatile liquid with a pineapple-like odour.

#### SOLUBILITY

Sparingly soluble in water. Soluble in acetone. Miscible with ethanol and diethyl ether.

**Solubility in water** 17 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 102.13

**Melting point** -73.9°C

**Boiling point** 99°C

**Specific gravity** 0.89 (20°C)

**Flammability** Highly flammable

#### REGULATORY INFORMATION

**ADG Class** 3

**Packing Group** II

**UN Number** 1195

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (PE/EVAL; nitrile for splash contact). Exposure may cause skin, eye or respiratory irritation. Inhalation or ingestion may cause headache, dizziness or drowsiness.

Handle in an operating fume cupboard or well-ventilated area. Avoid breathing vapour and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Store away from heat and any sources of ignition. Ensure container is kept upright to prevent leakage.

Store away from oxidising agents, bases and acids.

Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** product of the esterification reaction between propionic acid and ethanol.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Absorb spill with paper towel, or cover with inert absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool.

**Small spill:** Evaporate as for Waste Disposal.

**Large spill:** Place material into a suitable labelled container and store for collection.

Wash the spill area with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Absorb onto paper towel or other absorbent and allow the solvent to evaporate in an operating fume cupboard. Dispose of absorbent material as general waste.

**Large quantity:** Store in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical attention.

**IF ON SKIN:** Take off immediately all contaminated clothing. Wash skin thoroughly with plenty of soap and water.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms appear: Seek medical advice/attention.



**Formula**  $C_4H_4O_4$   
**CAS No.** 110-17-8  
**User Group** 11-12

#### DESCRIPTION

Colourless, odourless powder or crystals.  
Geometric isomer of maleic acid.

#### SOLUBILITY

Slightly soluble in water. Soluble in ethanol, diethyl ether, acetone and concentrated sulfuric acid.

**Solubility in water** 4.9 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 116.07  
**Melting point** 287°C (decomposes)  
**Boiling point** -  
**Specific gravity** 1.64 (20°C)  
**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

H319 Causes serious eye irritation

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation to the skin, eyes and respiratory tract.

Handle in an operating fume cupboard or well-ventilated area. Avoid generating and inhaling dust. Avoid ingestion and contact with skin, eyes and clothing.

#### STORAGE

Store in a tightly closed container in a cool, dry well-ventilated place away from heat and light. Protect from moisture. Store away from heat and any sources of ignition. Store away from oxidising agents, reducing agents and bases. Store with general organic solids.

#### APPLICATIONS

**Senior chemistry:** investigations of the properties of the *cis,trans*-isomers, maleic and fumaric acid.

#### SPILLS

Wear PPE. Ensure good ventilation. Eliminate all ignition sources.

**Solid spill:** Collect spilled material with a non-sparking tool. Add slowly to a large volume of water with stirring. Neutralise the solution to within pH 6-8 by addition of sodium carbonate in portions (test with pH paper). Flush the neutral solution down the sink with further dilution.

**Liquid spill:** Cover spill with sodium carbonate or a 1:1:1 mixture of sand, sodium carbonate and vermiculite or bentonite (clay cat litter). Neutralise as for solid spill. Decant neutral solution down the sink with further dilution. Dispose of residual solids as general waste.

Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Dilute the waste by adding slowly to a large volume of water with stirring. Neutralise the solution to within pH 6-8 by addition of sodium carbonate in portions (test with pH paper). Flush the neutral solution down the sink with further dilution.

**Large quantity:** Store in the original container or other suitable labelled container, such as for waste dry organic solids. Arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. Seek medical attention.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin thoroughly with plenty of water and mild soap.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical attention.



**Formula**  $C_3H_8O_3$

**CAS No.** 56-81-5

**User Group** F-12

#### DESCRIPTION

Oily, colourless, odourless, hygroscopic liquid with a sweet taste.

#### SOLUBILITY

Miscible with water and alcohol. Insoluble in diethyl ether.

**Solubility in water** Miscible

#### PHYSICAL DATA

**Molar mass** 92.09

**Melting point** 18°C

**Boiling point** 290°C

**Specific gravity** 1.26 (20°C)

**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

Not classified as hazardous

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Eye contact may cause mild irritation. Inhalation of vapour or mist from the heated substance may cause respiratory irritation. Repeated or prolonged skin contact may lead to irritation and dermatitis. Ingestion of a large amount may cause gastric irritation and CNS effects. Avoid generating and inhaling vapour or mist. If mists or vapours are being generated, work in an operating fume cupboard or well-ventilated area. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Vapours may form explosive mixtures with air if heated strongly. Handle away from heat and sources of ignition.

#### STORAGE

Glycerol is hygroscopic. With prolonged storage, explosive peroxides may form. Store in a tightly closed container in a cool, dry well-ventilated place. Protect from light and moisture. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition. Store away from oxidising agents, strong bases, halogens and acetic anhydride. Store with flammable and combustible liquids in an AS compliant cabinet.

#### APPLICATIONS

**General science/Senior physics:** to observe its physical properties (density, viscosity, refractive index, 'antifreeze' properties).

**Senior chemistry:** demonstration of its exothermic reaction with permanganate; surfactant in electroplating activities.

**Technical:** heating bath medium.

#### SPILLS

Wear PPE. Eliminate all ignition sources. Cover spill with sand, or other inert material such as vermiculite or bentonite. Scoop up with a non-sparking tool.

**Small spill:** Seal material in a plastic bag and dispose of as general waste.

**Large spill:** Place in a suitable labelled container and store for collection.

Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Absorb with non-combustible material. Seal in a plastic bag and dispose of as general waste.

**Large quantity:** Store in a suitable labelled container and arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical advice.

**IF ON SKIN:** Remove contaminated clothing. Wash skin thoroughly with plenty of water. If irritation occurs, seek medical advice.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms develop, seek medical attention.



**Formula** C<sub>7</sub>H<sub>16</sub>O  
**CAS No.** 111-70-6  
**User Group** 11-12

#### DESCRIPTION

Clear, colourless liquid with a fragrant odour.

#### SOLUBILITY

Slightly soluble in water. Miscible with ethanol and diethyl ether.

**Solubility in water** 1 g/L (18°C)

#### PHYSICAL DATA

**Molar mass** 116.2  
**Melting point** -34°C  
**Boiling point** 175°C  
**Specific gravity** 0.82 (20°C)  
**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

H319 Cause serious eye irritation

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Butyl, Viton®, neoprene; nitrile for splash protection). Exposure may cause irritation to the eyes and respiratory tract and mild skin irritation. Symptoms of exposure include cough, nausea, headache, dizziness and drowsiness. Prolonged or repeated skin contact can lead to dryness and cracking. Eye exposure to the liquid may cause severe irritation. Handle in an operating fume cupboard. Avoid generating and inhaling vapour or mist. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air if heated strongly. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition. Store away from oxidising agents, acids and acid halides. Store with flammable and combustible liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** to observe the reactivity of a primary alcohol; preparation of esters; heat of combustion investigations.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection. Wash the spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Heptan-1-ol is harmful to aquatic life. Avoid release to the environment. Store waste or surplus heptan-1-ol in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor. The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek immediate medical attention.  
**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek immediate medical attention.  
**IF ON SKIN:** Remove immediately all contaminated clothing. Wash skin thoroughly with soap and plenty of water. Wash contaminated clothing before reuse. If irritation occurs, seek medical advice/attention.  
**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical advice/attention.



**Formula** C<sub>7</sub>H<sub>16</sub>  
**CAS No.** 142-82-5  
**User Group** 11-12



#### DESCRIPTION

Clear, colourless, volatile liquid with a petrol-like odour. Less dense than water.

#### SOLUBILITY

Practically insoluble in water. Miscible with diethyl ether, and petroleum ether. Soluble in ethanol. Immiscible with methanol.

**Solubility in water** 2.2 mg/L (25°C)

#### PHYSICAL DATA

**Molar mass** 100.2  
**Melting point** -91°C  
**Boiling point** 98°C  
**Specific gravity** 0.68 (20°C)  
**Flammability** Highly flammable

#### REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** II  
**UN Number** 1206  
**Poisons Schedule** S5  
**Security** -

#### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour  
H315 Causes skin irritation  
H336 May cause drowsiness or dizziness  
H304 May be fatal if swallowed and enters airways  
H410 Very toxic to aquatic life with long lasting effects

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation to the skin, eyes and respiratory tract. Ingestion or inhalation may cause CNS depression, headache, drowsiness and dizziness. Repeated skin contact may have a degreasing effect. There is a risk of aspiration into the lungs if ingested. Handle only in an operating fume cupboard or well-ventilated area. Avoid inhaling vapour or mist. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Handle away from heat and other sources of ignition. There is potential for the vapour to collect in low-lying, confined areas. The vapour can form explosive mixtures with air and can travel to an ignition source and flash back.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Ensure container is kept upright to prevent leakage. Store away from heat and any sources of ignition. Store away from oxidising agents. Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** comparing the properties of saturated and unsaturated hydrocarbons; solvent for extracting halogens from aqueous solution, in the preparation of nylon and in thin-layer chromatography; a component of synthetic 'crude oil'.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation.

**Small spill:** Absorb with paper towel. Place paper towel in an operating fume cupboard and allow the solvent to evaporate. Dispose of paper towel as general waste.

**Large spill:** Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection.

Ventilate spill area and allow the solvent to evaporate. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Heptane is highly toxic for aquatic life and can bioaccumulate. Avoid release to the environment. Do not dispose of down the sink.

**Small quantity:** Place in a shallow vessel in an operating fume cupboard and allow the solvent to evaporate.

**Large quantity:** Store in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing and wash before reuse. Wash skin with plenty of soap and water. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26





**Formula** C<sub>6</sub>H<sub>12</sub>  
**CAS No.** 592-41-6  
**User Group** 11-12



#### DESCRIPTION

Clear, colourless, volatile liquid with a petrol-like odour. Less dense than water.

#### SOLUBILITY

Practically insoluble in water. Soluble in ethanol, diethyl ether and petroleum ether.

**Solubility in water** 0.05 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 84.16  
**Melting point** -140°C  
**Boiling point** 63°C  
**Specific gravity** 0.67 (20°C)  
**Flammability** Highly flammable

#### REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** II  
**UN Number** 2370  
**Poisons Schedule** S5  
**Security** -

#### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour  
H304 May be fatal if swallowed and enters airways

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation to the skin, eyes and respiratory tract. Symptoms of exposure include cough, headache, drowsiness and dizziness. Repeated skin contact may have a degreasing effect. There is a risk of aspiration into the lungs if ingested.

Handle only in an operating fume cupboard or well-ventilated area. Avoid inhaling vapour or mist. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Handle away from heat and other sources of ignition.

There is potential for the vapour to collect in low-lying, confined areas. The vapour can form explosive mixtures with air and can travel to an ignition source and flash back. Test for peroxides periodically and before use. If crystals or a precipitate is present, do NOT attempt to open the bottle; arrange for its disposal via a licenced contractor.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection. Ventilate spill area, then wash area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Hexene is toxic for aquatic life on an acute basis. It is expected to biodegrade slowly under environmental conditions and has a moderate potential for bioaccumulation. Avoid release to the environment. Do not dispose of down the sink.

Store surplus or waste hexene in a suitable labelled container such as for non-halogenated organic liquid waste and dispose of via a licenced waste disposal contractor. Glassware contaminated with hexene can be rinsed with a minimal amount of ethanol/methylated spirits into the waste bottle.

The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

#### STORAGE

May polymerise or form peroxides over time and/or on exposure to air or sunlight. Store in a tightly closed container in a cool, dry, well-ventilated place. Protect from light and moisture. Ensure container is kept upright to prevent leakage. Store away from heat and all sources of ignition. Store away from oxidising agents, acids and halogens. Store with flammable liquids in an AS compliant cabinet. Mark the bottle with the date received and the date opened.

#### APPLICATIONS

**Senior chemistry:** comparing the properties of saturated and unsaturated hydrocarbons; organic addition reactions.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing. Wash skin with plenty of soap and water. If skin irritation occurs, seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical advice/attention.

POISONS CENTRE: 13 11 26



**WARNING**



**Formula**  $C_{16}H_{34}O$   
**CAS No.** 36653-82-4  
**User Group** 11-12

**DESCRIPTION**

White, waxy solid with a faint, rancid odour and bland taste.

**SOLUBILITY**

Practically insoluble in water. Soluble in diethyl ether and acetone. Slightly soluble in ethanol.

**Solubility in water** <0.1 mg/L (25°C)

**PHYSICAL DATA**

**Molar mass** 242.44  
**Melting point** 49°C  
**Boiling point** 344°C  
**Specific gravity** 0.82 (50°C)  
**Flammability** Combustible

**REGULATORY INFORMATION**

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** -  
**Security** -

**HAZARD STATEMENTS**

H319 Causes serious eye irritation  
H315 Causes skin irritation  
H413 May cause long lasting harmful effects to aquatic life

**SAFE HANDLING**

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation to the skin, eyes and respiratory tract. Absorption of a large amount by ingestion, inhalation or via the skin may lead to narcosis. Avoid generating and inhaling dust, mists or vapours. Avoid contact with skin and eyes. Vapours may form explosive mixtures with air if heated strongly. Handle away from heat and sources of ignition.

**STORAGE**

Store in a tightly closed container in a cool, dry well-ventilated place away from light. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition. Store away from oxidising agents and strong acids. Store with general organic liquids or with flammable and combustible liquids in an AS compliant cabinet.

**APPLICATIONS**

**General science:** surfactant used in the preparation of hand cream; to test its efficacy as an evaporation-reducing film over water.  
**Senior physics:** preparing a heating/cooling curve.

**SPILLS**

Wear PPE. Eliminate all ignition sources. Collect spill with a non-sparking tool. Seal material in a plastic bag or place in a suitable labelled container such as for organic solid waste and arrange for collection. Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

**WASTE DISPOSAL**

Store waste or surplus alcohol in a suitable labelled container and arrange for collection by a licenced waste disposal contractor.

**FIRST AID**

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical advice if effects persist.  
**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical advice if effects persist.  
**IF ON SKIN:** Remove contaminated clothing. Wash skin with plenty of soap and water.  
**IF INHALED:** Move patient to fresh air.



**Formula**  $C_6H_{12}N_4$   
**CAS No.** 100-97-0  
**User Group** Staff



#### DESCRIPTION

White hygroscopic powder or crystals with a mild ammonia odour.

#### SOLUBILITY

Soluble in water, ethanol and acetone.  
Slightly soluble in diethyl ether.

**Solubility in water** 490 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 140.19  
**Melting point** 280°C  
**Boiling point** 263°C (sublimes, with partial decomposition)  
**Specific gravity** 1.33 (20°C)  
**Flammability** Flammable

#### REGULATORY INFORMATION

**ADG Class** 4.1  
**Packing Group** III  
**UN Number** 1328  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

H228 Flammable solid  
H317 May cause an allergic skin reaction

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation to the skin, eyes and respiratory tract and on ingestion. Prolonged exposure to the vapour or solid can lead to respiratory allergies and dermatitis.

Handle in an operating fume cupboard or well-ventilated area. Avoid generating dust. Avoid inhalation and ingestion and contact with skin, eyes and clothing. Handle away from heat and sources of ignition.

The reaction with acid generates formaldehyde (a sensitiser and probable human carcinogen).

#### STORAGE

Hexamine is moisture-sensitive and decomposes slowly to ammonia and formaldehyde when wet. Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Protect from moisture. Store away from heat and any sources of ignition. Store in the original unopened packaging until required for use.

Store away from oxidising agents, acids, halogenated hydrocarbons, nitric acid, acetic anhydride and iodine. Store with flammable solids (DG Class 4.1).

#### APPLICATIONS

**General science:** fuel for model steam engines.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Scoop up with a non-sparking tool. Treat as for Waste Disposal.

Wash spill area thoroughly with detergent and water. Wash contaminated clothing before reuse.

#### WASTE DISPOSAL

Hexamine is biodegradable and is not expected to bioaccumulate.

**Small quantity:** Dissolve in a large volume of water and flush down the sink.

Alternatively, place in a steel crucible or similar fireproof vessel, in an operating fume cupboard. Set alight and allow to burn until consumed.

**Large quantity:** Store in a suitable labelled container. Arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical advice/attention.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin with plenty of soap and water. If skin irritation or rash occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical advice/attention.



**Formula** C<sub>6</sub>H<sub>14</sub>O

**CAS No.** 111-27-3

**User Group** 11-12



#### DESCRIPTION

Clear, colourless flammable liquid with a sweet, fruity odour.

#### SOLUBILITY

Slightly soluble in water. Miscible with diethyl ether. Soluble in ethanol and acetone.

**Solubility in water** 5.9 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 102.18

**Melting point** -45°C

**Boiling point** 157°C

**Specific gravity** 0.82 (20°C)

**Flammability** Flammable

#### REGULATORY INFORMATION

**ADG Class** 3

**Packing Group** III

**UN Number** 2282

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

H226 Flammable liquid and vapour

H319 Cause serious eye irritation

H302 Harmful if swallowed

H312 Harmful in contact with skin

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Butyl, Viton®; neoprene, nitrile for splash protection). Exposure may cause irritation to the eyes, nose, throat and respiratory tract and on ingestion. Symptoms of exposure include nausea, headache, dizziness and CNS effects. Prolonged or repeated skin contact may cause irritation and dermatitis. Eye exposure to the liquid may cause severe irritation and burns.

Handle in an operating fume cupboard. Avoid generating and inhaling vapour or mist. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition.

Store away from oxidising agents, acids, halogens, alkali metals, alkaline earth metals and aluminium.

Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** to observe the reactivity of a primary alcohol; heat of combustion investigations.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection. Wash the spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Hexan-1-ol is slightly toxic for aquatic life. The alcohol is readily biodegradable and bioaccumulation is not expected. However, the degradation products may be more toxic. Avoid release to the environment. Store waste or surplus hexan-1-ol in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor. The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek immediate medical attention.

**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin thoroughly with water/shower. Wash contaminated clothing before reuse. If irritation occurs, seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical advice/attention.



**Formula**  $C_6H_{14}$   
**CAS No.** 110-54-3  
**User Group** 11-12



#### DESCRIPTION

Clear, colourless, volatile liquid with a petrol-like odour. Less dense than water.

#### SOLUBILITY

Practically insoluble in water. Soluble in ethanol, diethyl ether and petroleum ether. Immiscible with methanol.

**Solubility in water** 10 mg/L (20°C)

#### PHYSICAL DATA

**Molar mass** 86.18  
**Melting point** -95°C  
**Boiling point** 69°C  
**Specific gravity** 0.66 (20°C)  
**Flammability** Highly flammable

#### REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** II  
**UN Number** 1208  
**Poisons Schedule** S5  
**Security** -

#### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour  
H315 Causes skin irritation  
H361 Suspected of damaging fertility or the unborn child  
H336 May cause drowsiness or dizziness  
H373 May cause damage to organs through prolonged or repeated exposure  
H304 May be fatal if swallowed and enters airways  
H411 Toxic to aquatic life with long lasting effects

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation to the skin, eyes and respiratory tract. Ingestion or inhalation may cause CNS depression, headache, drowsiness and dizziness. Repeated skin contact may have a degreasing effect. There is a risk of aspiration into the lungs if ingested.

Handle only in an operating fume cupboard or well-ventilated area. Avoid inhaling vapour or mist. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Handle away from heat and other sources of ignition.

There is potential for the vapour to collect in low-lying, confined areas. The vapour can form explosive mixtures with air and can travel to an ignition source and flash back.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Ensure container is kept upright to prevent leakage. Store away from heat and any sources of ignition.

Store away from oxidising agents and halogens.  
Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** comparing properties of saturated and unsaturated hydrocarbons; solvent for extracting halogens from aqueous solution, in thin-layer chromatography, in the preparation of nylon; a component of synthetic 'crude oil'.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation.

**Small spill:** Absorb with paper towel. Place paper towel in an operating fume cupboard and allow the solvent to evaporate. Dispose of paper towel as general waste.

**Large spill:** Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection.

Ventilate spill area and allow the solvent to evaporate. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Hexane is toxic for aquatic life. Avoid release to the environment. Do not dispose of down the sink.

**Small quantity:** Place in a shallow vessel in an operating fume cupboard and allow the solvent to evaporate.

**Large quantity:** Store in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing and wash before reuse. Wash skin with plenty of soap and water. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Get medical advice/attention if you feel unwell.

POISONS CENTRE: 13 11 26





**ANGER**

**Formula**  $C_6H_{16}N_2$   
**CAS No.** 124-09-4  
**User Group** 11-12



#### DESCRIPTION

White hygroscopic crystalline solid with a strong amine odour.

#### SOLUBILITY

Soluble in water and ethanol.

**Solubility in water** 800 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 116.21  
**Melting point** 41°C  
**Boiling point** 204°C  
**Specific gravity** 0.89 (25°C)  
**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** 8  
**Packing Group** III  
**UN Number** 2280  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

H302 Harmful if swallowed  
H312 Harmful in contact with skin  
H314 Causes severe skin burns and eye damage  
H335 May cause respiratory irritation

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (neoprene, butyl rubber; nitrile for splash protection). Exposure may cause severe irritation and burns to the skin, eyes and respiratory tract and on ingestion. Eye contact may result in permanent eye damage. Skin contact may result in an allergic response and dermatitis in some individuals.  
Handle only in an operating fume cupboard or well-ventilated area. Avoid generating dust. Avoid inhalation and ingestion and contact with skin, eyes and clothing. Handle away from heat and sources of ignition.

#### STORAGE

The substance is sensitive to air and light, is hygroscopic and absorbs water and carbon dioxide from the air. Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Protect from moisture; storage in a desiccator is preferable. Store away from heat and any sources of ignition.  
Store away from oxidisers, acids, acid chlorides, acid anhydrides and acid halides.  
Store with corrosive solids.

#### APPLICATIONS

**Senior chemistry:** a reagent in the preparation of nylon.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Scoop up with a non-sparking tool. Treat as for Waste Disposal.  
Wash spill area thoroughly with detergent and water. Wash contaminated clothing before reuse.

#### WASTE DISPOSAL

Hexane-1,6-diamine is biodegradable and is not expected to bioaccumulate. Forms a corrosive mixture with water.  
**Small quantity:** Dissolve in a large volume of water. Neutralise the solution to within pH 6-8 by addition of dilute (0.5M or ~2%) hydrochloric acid (test with pH paper) and flush down the sink.  
**Large quantity:** Store in a suitable labelled container. Arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.  
**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical advice/attention.  
**IF ON SKIN:** Remove immediately contaminated clothing. Rinse skin with water/shower. If skin irritation occurs, seek medical advice/attention.  
**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISONS CENTRE or doctor.

POISONS CENTRE: 13 11 26



**Formula**  $C_6H_{12}O_2$

**CAS No.** 142-62-1

**User Group** 11-12



## DESCRIPTION

Clear, colourless to pale yellow, oily liquid with characteristic unpleasant odour.

## SOLUBILITY

Slightly soluble in water. Soluble in ethanol and diethyl ether.

**Solubility in water** 9.7 g/L (20°C)

## PHYSICAL DATA

**Molar mass** 116.16

**Melting point** -4°C

**Boiling point** 206°C

**Specific gravity** 0.9212 (25°C)

**Flammability** Combustible

## REGULATORY INFORMATION

**ADG Class** 8

**Packing Group** III

**UN Number** 2829

**Poisons Schedule** -

**Security** -

## HAZARD STATEMENTS

H290 May be corrosive to metals

H302 Harmful if swallowed

H312 Harmful in contact with skin

H332 Harmful if inhaled

H314 Causes severe skin burns and eye damage

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation to the skin, eyes and respiratory tract. Eye contact may result in burns and permanent eye damage.

Handle only in an operating fume cupboard. Avoid inhaling vapour or mist. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

## SPILLS

Wear PPE. Ensure good ventilation. Eliminate all ignition sources. Cover spill with sodium carbonate or a 1:1:1 mixture of sand, sodium carbonate and vermiculite or bentonite (clay cat litter). Collect spilled material with a non-sparking tool. Add slowly to a large volume of water with stirring. Neutralise the solution to within pH 6-8 by addition of sodium carbonate in portions (test with pH paper). Decant the neutral solution down the sink with further dilution.

Dispose of the residual solids as general waste.

Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

## WASTE DISPOSAL

**Small quantity:** Dilute the waste by adding slowly to a large volume of water with stirring. Neutralise the solution to within pH 6-8 by addition of sodium carbonate in portions (test with pH paper). Flush the neutral solution down the sink with further dilution.

**Large quantity:** Store in the original container or other suitable labelled container. Arrange for collection by a licenced waste disposal contractor.

## STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Ensure container is kept upright to prevent leakage.

Store away from oxidising agents.

Store with corrosive liquids (organic acids).

## APPLICATIONS

**Senior chemistry:** ester preparation.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. Call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing. Wash skin with plenty of water and mild soap. Immediately call a POISONS CENTRE or doctor. Wash contaminated clothing before reuse.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26.



**Formula** HCl  
**CAS No.** 7647-01-0  
**User Group** 11-12



#### DESCRIPTION

Clear to light yellow, fuming, corrosive liquid with a sharp, suffocating odour. An aqueous solution of hydrogen chloride gas, available in concentrations of up to 36% w/w.

#### SOLUBILITY

Soluble in water, alcohols and diethyl ether. Insoluble in hydrocarbons.

**Solubility in water** Miscible

#### PHYSICAL DATA

**Molar mass** 34.46  
**Melting point** -42°C (32%)  
-30°C (36%)  
**Boiling point** 79°C (32%)  
61°C (36%)  
**Specific gravity** 1.159 (32%)  
1.179 (36%)  
**Flammability** Non-combustible

#### REGULATORY INFORMATION

**ADG Class** 8  
**Packing Group** II  
**UN Number** 1789  
**Poisons Schedule** S6  
**Security** CSC IDM Cat 3

#### HAZARD STATEMENTS

H290 May be corrosive to metals  
H314 Causes severe skin burns and eye damage  
H335 May cause respiratory irritation

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (latex, nitrile, neoprene, butyl, Viton®). The concentrated acid is highly corrosive and should be handled with care. Exposure can cause severe irritation and burns to the skin, eyes and respiratory tract and on ingestion. Eye contact may result in severe eye damage and permanent injury. Handle only in an operating fume cupboard. Do not breathe vapour or mist. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. When diluting, add the concentrated acid slowly to water. Never add water to the concentrated acid.

#### STORAGE

Store in a tightly closed, labelled container in a cool, dry, well-ventilated place away from heat and light. Ensure the container is kept upright to prevent leakage. Store away from heat and any ignition sources. Store away from oxidising agents, alkalis, metals, organic substances. Store with corrosive liquids (inorganic acids).

#### APPLICATIONS

**General science:** in dilute solution as an example of a strong inorganic acid; for the preparation of the gases hydrogen and carbon dioxide.  
**Senior chemistry:** acid-base titrations; inorganic analysis.  
**Technical:** to remove rust from glassware.

#### SPILLS

Wear PPE. Ensure good ventilation. Absorb spill with non-combustible absorbent such as a 1:1:1 mixture of sodium carbonate, bentonite (clay cat litter) and sand. Scoop up with a non-sparking tool.

**Small spill:** Add material to a large volume of water. Neutralise as for waste disposal. Decant the neutral solution down the sink. Dispose of solid material as general waste.

**Large spill:** Place material in a suitable labelled container. Arrange for collection by a licenced contractor. Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

The acid is harmful to the aquatic environment due to the pH shift.

**Small quantity:** Wear PPE and work in a fume cupboard. Add the waste acid slowly to a large volume of water. Neutralise the solution to between pH 6 and 8 with sodium carbonate, adding the base cautiously in portions until there is no further evolution of CO<sub>2</sub>. Dispose of the neutral solution down the sink.

**Large quantity:** Store in a suitable labelled container. Arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin thoroughly with water/shower. Seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Seek medical advice/attention.

POISONS CENTRE: 13 11 26

**Formula**  $I_2$   
**CAS No.** 7553-56-2  
**User Group** 11-12



#### DESCRIPTION

Heavy, violet-black crystals or granules with a metallic lustre and a pungent odour.

#### SOLUBILITY

Very slightly soluble in water. Soluble in ethanol, diethyl ether, cyclohexane, glycerol and aqueous alkaline iodide solutions.

**Solubility in water** 340 mg/L (20°C)

#### PHYSICAL DATA

**Molar mass** 253.81  
**Melting point** 114°C  
**Boiling point** 184°C  
**Specific gravity** 4.93 (25°C)  
**Flammability** Non-combustible

#### REGULATORY INFORMATION

**ADG Class** 8 (6.1)  
**Packing Group** III  
**UN Number** 3495  
**Poisons Schedule** S6  
**Security** IDM Cat 2

#### HAZARD STATEMENTS

H312 Harmful in contact with skin  
H332 Harmful if inhaled  
H400 Very toxic to aquatic life

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Iodine is corrosive and readily sublimates to a violet vapour. Exposure to the vapour may cause irritation to the skin, eyes and respiratory tract. Symptoms of ingestion or high inhalation exposure include severe irritation, metallic taste, headache, fever and gastric upset. Skin or eye contact with the solid or concentrated solution may result in severe irritation and burns. Sensitive individuals may show symptoms of iodism on exposure to small amounts.

Handle in an operating fume cupboard or well-ventilated area. Avoid generating and inhaling dust, vapour or mist. Avoid contact with skin, eyes and clothing.

#### STORAGE

Iodine is hygroscopic and light-sensitive. Store in a tightly closed container in a cool, dry, well-ventilated place. Protect from sunlight and moisture. Inspect lid periodically for damage. Consider bunding in a secondary lidded container. Do not stored in the refrigerator as the vapours may build up and corrode refrigerator components. Store away from alkali metals, alkali oxide, metal powders, ammonia, ammonium compounds.

Store the solid and solutions with Class 8 Corrosive substances (acids).

The concentration of iodine solution will change over time due to (i) loss of the volatile iodine from the solution, and (ii) air-oxidation of iodide ion to iodine, a reaction promoted by heat and light.

#### SPILLS

**Small spill:** Collect material and treat as for Waste Disposal.

**Solution spill:** Treat spills of iodine solution, and iodine stains on benches/floors, with a minimal quantity of dilute sodium thiosulfate solution (0.1-0.2 M) and wash residues down the sink with dilution.

**Large spill:** Cover with dry sand or other non-combustible material. Collect material and place in a plastic bag contained within another plastic bag. Place into a labelled plastic container and store for collection. Wash the spill area with dilute thiosulfate solution and then with water.

#### WASTE DISPOSAL

**Small quantity:** Treat small quantities of waste iodine or iodine solution by dropwise/portionwise addition of dilute sodium thiosulfate solution (0.1-0.2 M) until the brown colour of the iodine is discharged. Flush the solution down the sink with further dilution.

**Large quantity:** Large amounts of waste or surplus solid iodine and large volumes of concentrated aqueous or ethanolic iodine should be stored for collection by a licenced waste disposal contractor.

Residual iodine on instruments and glassware can be removed by treating with sodium thiosulfate solution (0.1-0.2M) prior to washing.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek immediate medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical attention.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin with soap and plenty of water. If skin irritation occurs, seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26

#### APPLICATIONS

**General science:** demonstration of sublimation.

**Biology:** (in solution) to indicate the presence of starch.

**Forensic science:** visualisation agent for fingerprinting.

**Senior chemistry:** (in solution) iodometric titrations; visualisation agent for thin layer chromatography; Iodine-Clock reaction.



**Formula**  $C_7H_{14}O_2$   
**CAS No.** 123-92-2  
**User Group** 11-12

#### DESCRIPTION

Colourless to yellow liquid with a banana- or pear-like odour.

#### SOLUBILITY

Slightly soluble in water. Miscible with ethanol and diethyl ether. Soluble in acetone.

**Solubility in water** 2.19 g/L (19.4°C)

#### PHYSICAL DATA

**Molar mass** 130.19  
**Melting point** -79°C  
**Boiling point** 142°C  
**Specific gravity** 0.87 (20°C)  
**Flammability** Flammable

#### REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** III  
**UN Number** 1104  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

H226 Flammable liquid and vapour  
AUH066 Repeated exposure may cause skin dryness and cracking

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (PE/EVAL; nitrile for splash contact). Exposure may cause skin, eye or respiratory irritation. Inhalation or ingestion may cause headache, dizziness or drowsiness.  
Handle in an operating fume cupboard or well-ventilated area. Avoid breathing vapour and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Store away from heat and any sources of ignition. Ensure container is kept upright to prevent leakage.  
Store away from strong oxidising agents, strong acids, strong bases, alkali metals and alkali hydroxides.  
Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** product of the esterification reaction between acetic acid and isoamyl alcohol.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Absorb spill with paper towel, or cover with inert absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool.

**Small spill:** Evaporate as for Waste Disposal.

**Large spill:** Place material into a suitable labelled container and store for collection.

Wash the spill area with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Absorb onto paper towel or other absorbent and allow the solvent to evaporate in an operating fume cupboard. Dispose of absorbent material as general waste.

**Large quantity:** Store in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical attention.

**IF ON SKIN:** Take off immediately all contaminated clothing. Wash skin thoroughly with plenty of soap and water.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26.



**Formula** n/a  
**CAS No.** 8008-20-6  
**User Group** 7-12



#### DESCRIPTION

Clear, blue or colourless liquid with a strong odour. Mixture of aliphatic and aromatic hydrocarbons, mainly with carbon number in the range C9-C16. Less dense than water.

#### SOLUBILITY

Miscible with other petroleum solvents.

**Solubility in water** Insoluble

#### PHYSICAL DATA

**Molar mass** -  
**Melting point** -  
**Boiling point** 175-325°C  
**Specific gravity** ca. 0.80  
**Flammability** Flammable

#### REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** III  
**UN Number** 1223  
**Poisons Schedule** S5  
**Security** -

#### HAZARD STATEMENTS

H226 Flammable liquid and vapour  
H315 Causes skin irritation  
H336 May cause drowsiness or dizziness  
H304 May be fatal if swallowed and enters airways  
H411 Toxic to aquatic life with long lasting effects

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Kerosene is flammable and has a low flash point. Exposure may cause irritation to the skin, eyes, respiratory tract and on ingestion. Symptoms of inhalation or ingestion include drowsiness, dizziness and nausea. Prolonged or repeated skin exposure can lead to dryness, cracking and dermatitis. There is a risk of aspiration into the lungs if ingested.

Handle in an operating fume cupboard or well-ventilated area. Avoid inhalation of vapour or mist. Avoid contact with skin, eyes and clothing.

There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition.

Store away from oxidising agents, acids, bases and amines. Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**General science:** solvent for extracting non-polar substances.

#### SPILLS

Wear PPE. Ensure good ventilation. Remove all sources of ignition.

**Small spill:** Absorb with paper towel. Allow the solvent to evaporate in an operating fume cupboard. Dispose of paper towel as general waste.

**Large spill:** Cover with non-combustible absorbent such as sand, vermiculite or bentonite (clay cat litter). Place material in a suitable labelled container and store for collection. Ventilate the spill area and wash with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Kerosene is toxic to aquatic life and should not be released to drains or waterways.

**Small quantity:** Absorb onto paper towel or place in a shallow vessel. Allow the solvent to evaporate in an operating fume cupboard.

**Large quantity:** Store in original container or other suitable labelled container, such as for non-halogenated organic liquid waste, and arrange for collection by a licenced waste disposal contractor.

Empty containers can contain explosive vapours. Empty containers should be rinsed thoroughly with water and the rinsings absorbed onto inert material and treated as for spills. Washed empty containers can be disposed of as general waste.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin with plenty of soap and water. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26



# lactic acid, aqueous solution

2-hydroxypropionic acid; milk acid

**DANGER**



**Formula**  $C_3H_6O_3$

**CAS No.** 50-21-5 (n.o.s.); 598-82-3 (DL)

**User Group** 11-12

## DESCRIPTION

Colourless or yellowish, odourless, hygroscopic, syrupy liquid. Available as an 85-90%w/w aqueous solution.

## SOLUBILITY

Soluble in water, ethanol and diethyl ether.

**Solubility in water** Soluble

## PHYSICAL DATA

**Molar mass** 90.078

**Melting point** 16.8°C (DL)

**Boiling point** 122°C (DL)

**Specific gravity** 1.2060 (21°C, DL)

**Flammability** Combustible

## REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** -

**Security** -

## HAZARD STATEMENTS

H315 Causes skin irritation

H318 Causes serious eye damage

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Exposure may cause irritation to the skin, eyes and respiratory tract. Eye contact may result in burns and permanent eye damage.

Handle in a well-ventilated area. Avoid inhaling vapour or mist. Avoid ingestion and contact with skin, eyes, and clothing. Avoid prolonged or repeated exposure.

## STORAGE

The acid is hygroscopic. Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Protect from moisture. Ensure container is kept upright to prevent leakage. Store away from heat and any sources of ignition.

Store away from oxidising agents, reducing agents, bases and iodides.

Store with corrosive liquids (organic acids).

## APPLICATIONS

**General science:** preparation of polylactic acid.

## SPILLS

Wear PPE. Ensure good ventilation. Eliminate all ignition sources. Cover spill with sodium carbonate or a 1:1:1 mixture of sand, sodium carbonate and vermiculite or bentonite (clay cat litter). Collect spilled material with a non-sparking tool. Add slowly to a large volume of water with stirring. Neutralise the solution to within pH 6-8 by addition of sodium carbonate in portions (test with pH paper). Decant the neutral solution down the sink with further dilution.

Dispose of the residual solids as general waste.

Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

## WASTE DISPOSAL

**Small quantity:** Dilute waste to a concentration of about 5% by slowly adding the acid to water with stirring. Neutralise the solution to within pH 6-8 by addition of sodium carbonate in portions (test with pH paper). Flush the neutral solution down the sink with further dilution.

**Large quantity:** Store in the original container or other suitable labelled container. Arrange for collection by a licenced waste disposal contractor.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. Seek medical advice/attention.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin with plenty of water and soap. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing.

POISONS CENTRE: 13 11 26

**Formula** Li

**CAS No.** 7439-93-2

**User Group** Staff



#### DESCRIPTION

Silvery-white, ductile, light, soft metal; becomes yellowish on exposure to air and moisture.

#### SOLUBILITY

Reacts readily with water, releasing flammable hydrogen gas. Soluble in liquid ammonia, giving a blue solution.

**Solubility in water** Reacts with water

#### PHYSICAL DATA

**Molar mass** 6.94

**Melting point** 180.5°C

**Boiling point** 1342°C

**Specific gravity** 0.534 (20°C)

**Flammability** Flammable solid

#### REGULATORY INFORMATION

**ADG Class** 4.3

**Packing Group** I

**UN Number** 1415

**Poisons Schedule**

**Security** IDM Cat 2

#### HAZARD STATEMENTS

H260 In contact with water releases flammable gases which may ignite spontaneously.  
H314 Causes severe skin burns and eye damage.  
AUH014 Reacts violently with water.

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Lithium is corrosive and a strong reducing agent. Contact with lithium can cause severe irritation and burns to the skin and eyes. Fumes of burning lithium are highly irritating. The reaction with water generates flammable hydrogen gas and caustic lithium hydroxide.

Avoid contact with skin and eyes. Ensure that all tools used in handling are dry. Handle away from open flames and other ignition sources.

In case of fire, smother with dry sand or use approved Class D extinguisher; do not use water, foam or CO<sub>2</sub> extinguisher.

#### STORAGE

Lithium is air and moisture sensitive. Store in a tightly closed container in a cool, dry place away from heat and light. Ensure that metal is stored under paraffin oil. Lithium is less dense than paraffin oil, however a thin film of oil will cover the surface of the metal and protect it from the air. Alternatively, lithium can be stored covered in petroleum jelly (petrolatum). Lithium reacts readily with water; keep away from contact with water. Store away from heat and sources of ignition.

Store away from acids, heavy metals, halogenated hydrocarbons, oxidising agents and phosphorus.

Store with DG Class 4.3 Dangerous When Wet substances.

#### SPILLS

See Laboratory Notes

#### WASTE DISPOSAL

**Small quantity:** See Laboratory Notes

**Large quantity of waste:** Store under mineral oil in a suitable container and arrange for collection by a licenced waste disposal contractor.

#### APPLICATIONS

**Senior chemistry:** In the demonstration of the reaction of an alkali metal with water.

#### PREPARATIONS

For detailed safety notes and procedure, see Science ASSIST Standard Operating Procedure: Demonstrating the reaction of alkali metals with water.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing. Brush off loose particles from skin. Rinse skin with water/shower. If skin irritation or a rash occurs: Get medical advice/attention.

**IF INHALED- metal oxide fumes (unlikely) or hydrogen gas:** Move patient to fresh air and keep at rest in a position comfortable for breathing.

POISONS CENTRE: 13 11 26

**Formula** LiOH  
**CAS No.** 1310-66-3  
**User Group** 11-12



## DESCRIPTION

Colourless, odourless crystals.

## SOLUBILITY

Soluble in water.

**Solubility in water** 124 g/L (20°C)

## PHYSICAL DATA

**Molar mass** 23.95  
**Melting point** 4.71°C  
**Boiling point** 924°C decomposes  
**Specific gravity** 2.54  
**Flammability** Non-combustible

## REGULATORY INFORMATION

**ADG Class** 8  
**Packing Group** II  
**UN Number** 2680  
**Poisons Schedule** -  
**Security** -

## HAZARD STATEMENTS

H302 Harmful if swallowed  
H314 Causes severe skin burns and eye damage

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). The solid and solutions are highly corrosive; aqueous solutions are strongly basic. Exposure may cause irritation and burns to the skin, eyes and respiratory tract and on ingestion. Eye contact may result in severe eye damage and permanent injury.

Handle in a well-ventilated area. Avoid generating dust. Avoid inhalation and contact with skin, eyes and clothing. Dissolution of the hydroxide in water generates much heat. Carry out solution preparation in an operating fume cupboard. Place the mixing vessel in an ice-bath and add the solid cautiously to water. Avoid inhaling mist or fumes from the hot solution.

## STORAGE

The salt is hygroscopic and absorbs carbon dioxide from the air, forming lithium carbonate. Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light; protect from air and moisture. Store away from acids, oxidising agents and metals. Store with corrosive solids.

## APPLICATIONS

**Senior chemistry:** an example of a strong base.

## SPILLS

Wear PPE. Ensure good ventilation. Scoop up into a suitable labelled container and store for collection. Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

## WASTE DISPOSAL

**Waste solid:** Store in original container or other suitable labelled container and arrange for collection by a licenced chemical waste contractor.

**Small quantity of waste solution:** Wear PPE and work in a fume cupboard. Neutralise to within pH 6 - 8 by addition of 5% hydrochloric acid, with stirring. Flush the neutral solution down the sink with further dilution.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin thoroughly with water/shower. Seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26



**Formula**  $C_4H_4O_4$   
**CAS No.** 110-16-7  
**User Group** 11-12

#### DESCRIPTION

Colourless crystals with a faint acidulous odour and a characteristic astringent taste. Geometric isomer of fumaric acid.

#### SOLUBILITY

Soluble in water, ethanol, acetone, diethyl ether and glacial acetic acid.

**Solubility in water** 441 g/L (25°C)

#### PHYSICAL DATA

**Molar mass** 116.07  
**Melting point** 138-139°C (from water)  
**Boiling point** -  
**Specific gravity** 1.59 (20°C)  
**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** 8  
**Packing Group** III  
**UN Number** 3261  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

H302 Harmful if swallowed  
H315 Causes skin irritation  
H319 Causes serious eye irritation  
H317 May cause an allergic skin reaction  
H335 May cause respiratory irritation

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Exposure may cause irritation to the skin, eyes and respiratory tract. Skin contact may cause an allergic reaction and dermatitis in some individuals. Handle in an operating fume cupboard or well-ventilated area. Avoid generating and inhaling dust. Avoid ingestion and contact with skin, eyes, and clothing. Avoid prolonged or repeated exposure. When heated to above 287°C, maleic acid is partially transformed into its isomer, fumaric acid.

#### STORAGE

Store in a tightly closed container in a cool, dry well-ventilated place away from heat and light. Protect from moisture. Store away from heat and any sources of ignition. Store away from oxidising agents, reducing agents and bases. Store with corrosive solids.

#### APPLICATIONS

**Senior chemistry:** to demonstrate its isomerisation to fumaric acid and observe the properties of the two isomers.  
**Technical:** preparation of buffer solutions

#### SPILLS

Wear PPE. Ensure good ventilation. Eliminate all ignition sources.

**Solid spill:** Collect spilled material with a non-sparking tool. Add slowly to a large volume of water with stirring. Neutralise the solution to within pH 6-8 by addition of sodium carbonate in portions (test with pH paper). Flush the neutral solution down the sink with further dilution.

**Liquid spill:** Cover spill with sodium carbonate or a 1:1:1 mixture of sand, sodium carbonate and vermiculite or bentonite (clay cat litter). Neutralise as for solid spill. Decant neutral solution down the sink with further dilution. Dispose of residual solids as general waste.

Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Dilute waste to a concentration of about 5% by slowly adding the acid to water with stirring. Neutralise the solution to within pH 6-8 by addition of sodium carbonate in portions (test with pH paper). Flush the neutral solution down the sink with further dilution.

**Large quantity:** Store in the original container or other suitable labelled container, such as for waste dry organic solids. Arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. Call a POISONS CENTRE or doctor if you feel unwell.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin thoroughly with plenty of water and mild soap. If skin irritation or rash occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.  
POISONS CENTRE: 13 11 26





**Formula**  $C_3H_4O_4$   
**CAS No.** 141-82-2  
**User Group** 11-12



#### DESCRIPTION

Colourless crystals or crystalline powder.

#### SOLUBILITY

Soluble in water, ethanol and diethyl ether.

**Solubility in water** 1390 g/L 20°C)

#### PHYSICAL DATA

**Molar mass** 104.06  
**Melting point** 135°C (decomposes)  
**Boiling point** -  
**Specific gravity** 1.63 (20°C)  
**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

H302 Harmful if swallowed  
H318 Causes serious eye damage

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation to the skin, eyes and respiratory tract.

Handle in a well-ventilated area. Avoid generating and inhaling dust. Avoid ingestion and contact with skin, eyes and clothing.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Protect from moisture. Store away from heat and any sources of ignition. Store away from oxidising agents, reducing agents and bases. Store with general organic solids.

#### APPLICATIONS

**Senior chemistry:** a reagent in the Briggs-Rauscher oscillating reaction; titration of a diprotic acid.

#### SPILLS

Wear PPE. Ensure good ventilation. Eliminate all ignition sources.

**Solid spill:** Collect spilled material with a non-sparking tool. Add slowly to a large volume of water with stirring. Neutralise the solution to within pH 6-8 by addition of sodium carbonate in portions (test with pH paper). Flush the neutral solution down the sink with further dilution.

**Liquid spill:** Cover spill with sodium carbonate or a 1:1:1 mixture of sand, sodium carbonate and vermiculite or bentonite (clay cat litter). Neutralise as for solid spill. Decant neutral solution down the sink with further dilution. Dispose of residual solids as general waste.

Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Dilute waste to a concentration of about 5% by slowly adding the acid to water with stirring. Neutralise the solution to within pH 6-8 by addition of sodium carbonate in portions (test with pH paper). Flush the neutral solution down the sink with further dilution.

**Large quantity:** Store in the original container or other suitable labelled container, such as for waste dry organic solids. Arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. Seek medical attention if you feel unwell.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin thoroughly with plenty of water.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing.

POISONS CENTRE: 13 11 26



**Formula** CH<sub>4</sub>O  
**CAS No.** 67-56-1  
**User Group** 11-12



#### DESCRIPTION

Clear, colourless, highly volatile liquid with a mild alcohol odour.

#### SOLUBILITY

Miscible with water, alcohols, diethyl ether, esters, ketones and most other organic solvents. Immiscible with hexane, heptane and cyclohexane.

**Solubility in water** Miscible

#### PHYSICAL DATA

**Molar mass** 32.04  
**Melting point** -98°C  
**Boiling point** 65°C  
**Specific gravity** 0.79 (20°C)  
**Flammability** Highly flammable

#### REGULATORY INFORMATION

**ADG Class** 3 (6.1)  
**Packing Group** II  
**UN Number** 1230  
**Poisons Schedule** S6  
**Security** -

#### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour  
H301 Toxic if swallowed  
H311 Toxic in contact with skin  
H331 Toxic if inhaled  
H370 Causes damage to organs

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Butyl, Viton®; neoprene for splash protection). Exposure may cause mild to moderate irritation to the skin, eyes and respiratory tract. Methanol is toxic by all routes of exposure. Symptoms of exposure include CNS depression, nausea, headache and dizziness. In severe cases, exposure may lead to potentially irreversible CNS effects, vision disturbances and blindness. Symptoms may be delayed. Prolonged or repeated skin contact can lead to dryness and cracking.

Handle in an operating fume cupboard. Avoid generating and inhaling vapour or mist. Avoid contact with skin and eyes. Do not ingest. Avoid prolonged or repeated exposure. There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition.

Store away from oxidising agents, acids, acid chlorides, reducing agents, alkali metals and metal powders. Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** preparation of esters; heat of combustion investigations.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool.

**Small spill:** Add material to a large volume of water and allow to stand until the solids have settled. Decant the solution down the sink with further dilution. Dispose of the absorbent material as general waste. Alternatively, treat as for Waste Disposal of a small quantity.

**Large spill:** Place material into a suitable labelled container and store for collection.

Wash the spill area thoroughly with water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Absorb onto paper towel and allow alcohol to evaporate in an operating fume cupboard. Dispose of paper towel as general waste.

**Large quantity:** Store in the original container or other suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin thoroughly with water/shower. Wash contaminated clothing before reuse. Call a POISONS CENTRE or doctor if you feel unwell.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor.

POISONS CENTRE: 13 11 26



**Formula**  $C_3H_6O_2$

**CAS No.** 79-20-9

**User Group** 11-12



#### DESCRIPTION

Clear, colourless, highly volatile liquid with a fruity odour.

#### SOLUBILITY

Soluble in water. Miscible with ethanol and diethyl ether.

**Solubility in water** 240-250 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 74.08

**Melting point** -98°C

**Boiling point** 57°C

**Specific gravity** 0.93 (20°C)

**Flammability** Highly flammable

#### REGULATORY INFORMATION

**ADG Class** 3

**Packing Group** II

**UN Number** 1231

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour

H319 Causes serious eye irritation

H336 May cause drowsiness or dizziness

AUH066 Repeated exposure may cause skin dryness and cracking

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (butyl rubber). Exposure may cause skin, eye or respiratory irritation. Inhalation or ingestion may cause headache, dizziness or drowsiness.

Handle in an operating fume cupboard or well-ventilated area. Avoid breathing vapour and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.

The ester may attack/dissolve some plastics.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Store away from heat and any sources of ignition. Ensure container is kept upright to prevent leakage.

Store away from strong oxidising agents, strong acids and strong bases.

Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** product of the esterification reaction between acetic acid and methanol.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Absorb spill with paper towel, or cover with inert absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool.

**Small spill:** Evaporate as for Waste Disposal.

**Large spill:** Place material into a suitable labelled container and store for collection.

Wash the spill area with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Absorb onto paper towel or other absorbent and allow the solvent to evaporate in an operating fume cupboard. Dispose of absorbent material as general waste.

**Large quantity:** Store in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical attention.

**IF ON SKIN:** Take off immediately all contaminated clothing. Rinse skin thoroughly with water/shower.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26.



**Formula**  $C_8H_8O_2$

**CAS No.** 93-58-3

**User Group** 11-12

#### DESCRIPTION

Clear, colourless, oily liquid with a fragrant odour.

#### SOLUBILITY

Slightly soluble in water. Miscible with ethanol, methanol and diethyl ether.

**Solubility in water** 2 g/L (25°C)

#### PHYSICAL DATA

**Molar mass** 136.15

**Melting point** -12°C

**Boiling point** 199°C

**Specific gravity** 1.09 (20°C)

**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

H227 Combustible liquid

H302 Harmful if swallowed

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (butyl rubber, Viton®; nitrile for splash contact). Exposure may cause skin, eye or respiratory irritation. Inhalation or ingestion may cause headache, dizziness or drowsiness. Handle in an operating fume cupboard or well-ventilated area. Avoid breathing vapour and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Handle away from heat and sources of ignition.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Store away from heat and any sources of ignition. Ensure container is kept upright to prevent leakage.

Store away from strong oxidising agents, strong acids and strong bases.

Store with flammable and combustible liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** hydrolysis of an ester; product of the esterification reaction between benzoic acid and methanol.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Absorb spill with paper towel, or cover with inert absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection.

Wash the spill area with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Store waste or surplus ester in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Call a POISONS CENTRE or doctor if you feel unwell..

**IF ON SKIN:** Take off immediately all contaminated clothing. Wash skin thoroughly with plenty of soap and water.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical advice/attention.

POISONS CENTRE: 13 11 26.



**Formula**  $C_5H_{10}O_2$

**CAS No.** 623-42-7

**User Group** 11-12

#### DESCRIPTION

Clear, colourless, highly volatile liquid with an apple-like odour.

#### SOLUBILITY

Sparingly soluble in water. Miscible with ethanol and diethyl ether.

**Solubility in water** 16 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 102.13

**Melting point** -85.8°C

**Boiling point** 103°C

**Specific gravity** 0.90 (20°C)

**Flammability** Highly flammable

#### REGULATORY INFORMATION

**ADG Class** 3

**Packing Group** II

**UN Number** 1237

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (PE/EVAL; butyl for splash contact). Exposure may cause irritation to the skin, eyes, nose and throat and respiratory tract. Inhalation or ingestion may cause headache, dizziness or drowsiness.

Handle in an operating fume cupboard or well-ventilated area. Avoid breathing vapour and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition. The ester may attack/dissolve some plastics.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Store away from heat and any sources of ignition. Ensure container is kept upright to prevent leakage.

Store away from oxidising agents, bases, acids, alkali metals and acid halides.

Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** product of the esterification reaction between butyric acid and methanol.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Absorb spill with paper towel, or cover with inert absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool.

**Small spill:** Evaporate as for Waste Disposal.

**Large spill:** Place material into a suitable labelled container and store for collection.

Wash the spill area with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Absorb onto paper towel or other absorbent and allow the solvent to evaporate in an operating fume cupboard. Dispose of absorbent material as general waste.

**Large quantity:** Store in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical attention if feeling unwell.

**IF ON SKIN:** Take off immediately all contaminated clothing. Wash skin thoroughly with plenty of soap and water. Wash contaminated clothing before reuse. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26.





**Formula**  $C_8H_8O_3$   
**CAS No.** 119-36-8  
**User Group** 11-12

#### DESCRIPTION

Colourless or yellow to red, oily liquid with an odour of wintergreen.

#### SOLUBILITY

Very slightly soluble in water. Soluble in diethyl ether. Miscible with ethanol and glacial acetic acid.

**Solubility in water** 0.74 g/L (30°C)

#### PHYSICAL DATA

**Molar mass** 152.15  
**Melting point** -8°C  
**Boiling point** 223°C  
**Specific gravity** 1.18 (20°C)  
**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** S6  
**Security** -

#### HAZARD STATEMENTS

H302 Harmful if swallowed  
H315 Causes skin irritation

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (butyl rubber, Viton®; nitrile for splash contact). Exposure may cause skin, eye or respiratory irritation. Prolonged or repeated skin contact may lead to sensitisation and dermatitis.

Handle in an operating fume cupboard or well-ventilated area. Avoid breathing vapour and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Store away from heat and any sources of ignition. Ensure container is kept upright to prevent leakage.

Store away from strong oxidising agents and strong bases. Store with flammable and combustible liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** hydrolysis of an ester; product of the esterification reaction between salicylic acid and methanol.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Absorb spill with paper towel, or cover with inert absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection.

Wash the spill area with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Store waste or surplus ester in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Call a POISONS CENTRE or doctor if you feel unwell.

**IF ON SKIN:** Take off immediately all contaminated clothing. Wash skin thoroughly with plenty of soap and water. If symptoms develop, seek medical attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical advice/attention.

POISONS CENTRE: 13 11 26.



**Formula** n/a

**CAS No.** mixture: 64742-82-1, 64742-95-6

**User Group** 7-12



#### DESCRIPTION

Clear, colourless liquid with an aromatic odour. A mixture of aliphatic and aromatic hydrocarbons. Less dense than water.

#### SOLUBILITY

Miscible with other petroleum solvents.

**Solubility in water** Insoluble

#### PHYSICAL DATA

**Molar mass** -

**Melting point** -

**Boiling point** 135-210°C

**Specific gravity** ca. 0.78-0.82 (25°C)

**Flammability** Flammable

#### REGULATORY INFORMATION

**ADG Class** 3

**Packing Group** III

**UN Number** 1300

**Poisons Schedule** S5

**Security** -

#### HAZARD STATEMENTS

H226 Flammable liquid and vapour

H304 May be fatal if swallowed and enters airways

H336 May cause drowsiness or dizziness

H412 Harmful to aquatic life with long lasting effects

AUH066 Repeated exposure may cause skin dryness or cracking

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Mineral turpentine is highly flammable and has a low flash point. Inhalation exposure may cause respiratory irritation, drowsiness and dizziness. Skin or eye contact may cause mild irritation. Prolonged or repeated skin exposure can cause dryness, cracking and dermatitis. Prolonged or repeated exposure may lead to hearing loss. There is a risk of aspiration into the lungs if ingested.

Handle in an operating fume cupboard or well-ventilated area. Avoid inhalation of vapour or mist. Avoid contact with skin, eyes and clothing.

There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition.

Store away from oxidising agents, acids and bases.

Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**General science:** solvent for extracting non-polar substances; solvent for chromatography.

#### SPILLS

Wear PPE. Ensure good ventilation. Remove all sources of ignition.

**Small spill:** Absorb with paper towel or cover with non-combustible absorbent such as sand, vermiculite or bentonite (clay cat litter), collect with a non-sparking tool and place in a shallow vessel. Allow the solvent to evaporate in an operating fume cupboard. Dispose of the absorbent material as general waste.

**Large spill:** Cover with non-combustible absorbent (see above). Scoop up with a non-sparking tool. Place in a suitable labelled container and store for collection. Ventilate the spill area and wash with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Absorb onto paper towel or place in a shallow vessel. Allow the solvent to evaporate in an operating fume cupboard.

**Large quantity:** Store in original container or other suitable labelled container, such as for non-halogenated organic liquid waste, and arrange for collection by a licenced waste disposal contractor.

Empty containers can contain explosive vapours. Empty containers should be rinsed thoroughly with water and the rinsings absorbed onto inert absorbent material and treated as for spills. Washed empty containers can be disposed of as general waste.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek immediate medical attention.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin with plenty of soap and water. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26



**Formula** C<sub>10</sub>H<sub>8</sub>  
**CAS No.** 91-20-3  
**User Group** 11-12



#### DESCRIPTION

Colourless to yellow or brown, volatile, crystalline flakes, powder or pellets with an unpleasant mothball odour.

#### SOLUBILITY

Practically insoluble in water. Soluble in ethanol, methanol, diethyl ether and acetone.

**Solubility in water** 32 mg/L (25°C)

#### PHYSICAL DATA

**Molar mass** 128.17  
**Melting point** 80.3°C  
**Boiling point** 218°C  
**Specific gravity** 1.14 (20°C)  
**Flammability** Flammable

#### REGULATORY INFORMATION

**ADG Class** 4.1  
**Packing Group** III  
**UN Number** 1334  
**Poisons Schedule** S6  
**Security** -

#### HAZARD STATEMENTS

H228 Flammable solid  
H302 Harmful if swallowed  
H351 Suspected of causing cancer  
H410 Very toxic to aquatic life with long lasting effects

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Naphthalene is a volatile solid which will sublime at room temperature. Naphthalene is classified by the IARC as possibly carcinogenic to humans (Group 2B). Exposure may cause irritation to the skin, eyes, nose, throat and respiratory tract. Symptoms of ingestion and inhalation include headache, nausea and dizziness. Chronic skin exposure may lead to dermatitis in sensitive individuals. Handle only in an operating fume cupboard or well-ventilated area. Avoid generating dust. Avoid ingestion and inhalation of dust or vapour. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. The vapour or dust can form explosive mixtures with air. Handle away from heat and other sources of ignition.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light; protect from moisture. Store away from heat and all sources of ignition. Store away from oxidising agents and halogens. Store with flammable solids (DG Class 4.1).

#### APPLICATIONS

**Senior chemistry:** an example of a low-melting solid; in qualitative analysis and melting point determinations.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Cover spill with non-combustible absorbent material such as bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection. Wipe down spill area with paper towel wetted with ethanol/methylated spirits. Allow the solvent to evaporate from the paper towel, then transfer to the waste container. Ventilate the spill area, then wash thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Naphthalene is toxic for aquatic life, is biodegradable and has a moderate potential for bioaccumulation. Avoid release to the environment. Do not dispose of down the sink. Store waste naphthalene in a suitable labelled container and arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Call a POISONS CENTRE or doctor if you feel unwell.

**IF ON SKIN:** Remove contaminated clothing. Wash skin with plenty of soap and water. If skin irritation occurs, seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If concerned: Get medical advice/attention.

POISONS CENTRE: 13 11 26

**Formula** HNO<sub>3</sub>  
**CAS No.** 7697-37-2  
**User Group** Staff



#### DESCRIPTION

Clear, colourless to slightly yellow liquid with a sharp, pungent, suffocating odour. Concentrated nitric acid usually refers to a 68% w/w aqueous solution.

#### SOLUBILITY

Miscible with water. Reacts with many organic solvents.

**Solubility in water** Miscible

#### PHYSICAL DATA

**Molar mass** 63.01  
**Melting point** -47°C (65%)  
**Boiling point** 122°C (69%)  
**Specific gravity** 1.4 (20°C, 65%)  
**Flammability** Non-combustible  
oxidising liquid

#### REGULATORY INFORMATION

**ADG Class** 8 (5.1)  
**Packing Group** II  
**UN Number** 2031  
**Poisons Schedule** S6  
**Security** CSC

#### HAZARD STATEMENTS

H272 May intensify fire; oxidizer  
H290 May be corrosive to metals  
H314 Causes severe skin burns and eye damage

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Viton®, butyl, neoprene). The concentrated acid is highly corrosive and a powerful oxidant and should be handled with care. Exposure may cause severe irritation and burns to the skin, eyes and respiratory tract and on ingestion. Eye contact may result in severe eye damage and permanent injury.

Handle only in an operating fume cupboard. Do not breathe vapour or mist. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Handle away from heat and sources of ignition.

When diluting, add the concentrated acid slowly to water. Never add water to the concentrated acid.

#### STORAGE

Store in a tightly closed, labelled amber glass bottle in a cool, dry, well-ventilated place away from heat and light. Store on a low shelf, and ensure container is kept upright to prevent leakage. Check container and lid periodically for damage.

Nitric acid becomes yellow with exposure to light due to the formation of toxic nitrogen dioxide; discard solutions which are markedly yellow in colour.

Store away from reducing agents, organic acids, combustible materials, oxidising agents, alkalis, metals and organic substances.

Concentrated nitric acid should be stored separately from all other chemicals, on a low shelf, with secondary containment.

#### APPLICATIONS

**General science:** an example of a strong inorganic acid.

**Senior chemistry:** to demonstrate oxidation of Cu to Cu(II).

**Technical:** cleaning glassware, eg removal of silver mirrors.

#### SPILLS

Wear PPE. Ensure good ventilation. Absorb spill with non-combustible absorbent such as a 1:1:1 mixture of sodium carbonate, bentonite (clay cat litter) and sand. Scoop up with a non-sparking tool.

**Small spill:** Add material to a large volume of water. Neutralise as for waste disposal. Decant the neutral solution down the sink. Dispose of solid material as general waste.

**Large spill:** Place material in a suitable labelled container. Arrange for collection by a licenced contractor.

Wash spill area thoroughly with water.

Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

The acid is harmful to the aquatic environment due to the pH shift.

**Small quantity:** Wear PPE and work in a fume cupboard. Add the waste acid slowly to a large volume of water.

Neutralise the solution to between pH 6 and 8 with sodium carbonate, adding the base cautiously in portions until there is no further evolution of CO<sub>2</sub>. Dispose of the neutral solution down the sink.

**Large quantity:** Store in a suitable labelled container. Arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing and wash before reuse. Rinse skin thoroughly with water/shower. Immediately call a POISONS CENTRE or doctor.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISONS CENTRE or doctor.

POISONS CENTRE: 13 11 26



**Formula** C<sub>8</sub>H<sub>16</sub>  
**CAS No.** 111-66-0  
**User Group** 11-12



#### DESCRIPTION

Colourless, volatile liquid with a petrol-like odour. Less dense than water.

#### SOLUBILITY

Practically insoluble in water. Miscible with ethanol. Soluble in diethyl ether, acetone and petroleum ether.

**Solubility in water** 4.1 mg/L (25°C)

#### PHYSICAL DATA

**Molar mass** 112.22  
**Melting point** -102°C  
**Boiling point** 121°C  
**Specific gravity** 0.71 (20°C)  
**Flammability** Highly flammable

#### REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** II  
**UN Number** 3295  
**Poisons Schedule** S5  
**Security** -

#### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour  
H304 May be fatal if swallowed and enters airways  
H410 Very toxic to aquatic life with long lasting effects

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation to the skin, eyes and respiratory tract. Symptoms of inhalation include cough, headache, drowsiness and dizziness. Repeated skin contact may have a degreasing effect. There is a risk of aspiration into the lungs if ingested.

Handle only in an operating fume cupboard or well-ventilated area. Avoid inhaling vapour or mist. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Handle away from heat and other sources of ignition.

There is potential for the vapour to collect in low-lying, confined areas. The vapour can form explosive mixtures with air and can travel to an ignition source and flash back. Test for peroxides periodically and before use. If crystals or a precipitate is present, do NOT attempt to open the bottle; arrange for its collection via a licenced waste contractor.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Cover spill with non-combustible absorbent material such as vermiculite or bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection.

Ventilate spill area, then wash area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Octene is toxic for aquatic life on an acute basis. It is expected to biodegrade slowly under environmental conditions and has a moderate-to-high potential for bioaccumulation. Avoid release to the environment. Do not dispose of down the sink.

Store surplus or waste octene in a suitable labelled container such as for non-halogenated organic liquid waste and dispose of via a licenced waste disposal contractor. Glassware contaminated with octene can be rinsed with a minimal amount of ethanol/methylated spirits into the waste bottle.

The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

#### STORAGE

May polymerise or form peroxides over time and/or on exposure to air or sunlight. Store in a tightly closed container in a cool, dry, well-ventilated place away from light; protect from moisture. Ensure container is kept upright to prevent leakage. Store away from heat and all sources of ignition. Store away from oxidising agents, acids and halogens. Store with flammable liquids in an AS compliant cabinet. Mark the bottle with the date received and date opened.

#### APPLICATIONS

**Senior chemistry:** observing the properties of saturated and unsaturated hydrocarbons; organic addition reactions.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing. Wash skin with plenty of soap and water. If skin irritation occurs, seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical advice/attention.

POISONS CENTRE: 13 11 26





**Formula**  $C_{18}H_{38}O$

**CAS No.** 112-92-5

**User Group** 11-12

#### DESCRIPTION

White flakes or granules with a mild, soapy odour.

#### SOLUBILITY

Practically insoluble in water. Soluble in ethanol, methanol, diethyl ether and acetone.

**Solubility in water** <0.01 g/L

#### PHYSICAL DATA

**Molar mass** 270.5

**Melting point** 59°C

**Boiling point** 340-355°C

**Specific gravity** 0.81 (59°C)

**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

Not classified as hazardous

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation to the skin, eyes and respiratory tract. Absorption of a large amount by ingestion, inhalation or via the skin may lead to narcosis.

Avoid generating and inhaling dust, mists or vapours. Avoid contact with skin and eyes.

Vapours may form explosive mixtures with air if heated strongly. Handle away from heat and sources of ignition.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition.

Store away from oxidising agents and strong acids.

Store with general organic liquids or with flammable and combustible liquids in an AS compliant cabinet.

#### APPLICATIONS

**General science:** surfactant used in the preparation of hand cream; to test its efficacy as an evaporation-reducing film over water.

**Senior physics:** preparing a heating/cooling curve.

#### SPILLS

Wear PPE. Eliminate all ignition sources. Collect spill with a non-sparking tool.

**Small spill:** Seal material in a plastic bag and dispose of as general waste.

**Large spill:** Place in a suitable labelled container and arrange for collection.

Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Seal in a plastic bag and dispose of as general waste.

**Large quantity:** Store in a suitable labelled container and arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical advice if effects persist.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical advice if effects persist.

**IF ON SKIN:** Remove contaminated clothing. Wash skin with plenty of soap and water.

**IF INHALED:** Move patient to fresh air.



**Formula**  $C_8H_{18}O$   
**CAS No.** 111-87-5  
**User Group** 11-12

#### DESCRIPTION

Clear, colourless oily liquid with an orange-rose odour.

#### SOLUBILITY

Very slightly soluble in water. Miscible with ethanol, diethyl ether and mineral oil.

**Solubility in water** 0.3 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 102.18  
**Melting point** -16°C  
**Boiling point** 195°C  
**Specific gravity** 0.82 (20°C)  
**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

H319 Causes serious eye irritation

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Butyl, Viton®, neoprene; nitrile for splash protection). Exposure may cause irritation to the eyes and respiratory tract and mild skin irritation. Symptoms of exposure include cough, headache, dizziness and drowsiness. Prolonged or repeated skin contact can lead to dryness and cracking. Eye exposure to the liquid may cause severe irritation and burns. Handle in an operating fume cupboard. Avoid generating and inhaling vapour or mist. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air if heated strongly. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place. Protect from sunlight. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition. Store away from oxidising agents, acids, bases and acid halides. Store with flammable and combustible liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** to observe the reactivity of a primary alcohol; preparation of esters; heat of combustion investigations.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection. Wash the spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Store waste or surplus octan-1-ol in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor. The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If irritation persists or if concerned, seek medical attention.  
**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical advice.  
**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin thoroughly with water/shower. Wash contaminated clothing before reuse. If irritation occurs, seek medical advice/attention.  
**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical advice/attention.



**Formula**  $C_8H_{18}O$   
**CAS No.** 123-96-6  
**User Group** 11-12

#### DESCRIPTION

Clear, colourless, oily liquid with a disagreeable aromatic odour.

#### SOLUBILITY

Slightly soluble in water. Soluble in ethanol, diethyl ether, acetone and aromatic and aliphatic hydrocarbons.

**Solubility in water** 1.12 g/L (25°C)

#### PHYSICAL DATA

**Molar mass** 130.23  
**Melting point** -32°C  
**Boiling point** 180°C  
**Specific gravity** 0.82 (20°C)  
**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

H318 Causes serious eye damage

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Butyl, Viton®, neoprene; nitrile for splash protection). Exposure may cause irritation to the eyes and respiratory tract and mild skin irritation. Symptoms of exposure include cough, headache, dizziness and drowsiness. Prolonged or repeated skin contact can lead to dryness and cracking. Eye exposure to the liquid may cause severe irritation and burns.

Handle in an operating fume cupboard. Avoid generating and inhaling vapour or mist. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air if heated strongly. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition. Test for peroxides before use, particularly if intending to heat or distill the alcohol.

#### STORAGE

With prolonged storage, and on exposure to air and sunlight, the alcohol may form peroxides, which may become explosive if they are concentrated. Store in a tightly closed container in a cool, dry, well-ventilated place. Protect from sunlight. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition. Store away from oxidising agents, acids, bases and acid halides. Store with flammable and combustible liquids in an AS compliant cabinet. Mark the bottle with the date received and date opened.

#### APPLICATIONS

**Senior chemistry:** to observe the reactivity of a secondary alcohol; heat of combustion investigations.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection. Wash the spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Octan-2-ol is harmful to aquatic life. Avoid release to the environment. Store waste or surplus octan-2-ol in a suitable labelled container and arrange for collection by a licenced waste disposal contractor. As the alcohol is a peroxide former, waste or surplus octan-2-ol should not be stored with any other waste.

The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical advice.

**IF ON SKIN:** Remove immediately all contaminated clothing. Wash skin thoroughly with plenty of soap and water. Wash contaminated clothing before reuse. If irritation occurs, seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical advice/attention.

POISONS CENTRE: 13 11 26

**Formula**  $C_8H_{18}$   
**CAS No.** 111-65-9  
**User Group** 11-12



#### DESCRIPTION

Colourless, volatile liquid with a petrol-like odour. Less dense than water.

#### SOLUBILITY

Practically insoluble in water. Miscible with ethanol and acetone and petroleum ether.

**Solubility in water** 0.7 mg/L (20°C)

#### PHYSICAL DATA

**Molar mass** 114.23  
**Melting point** -57°C  
**Boiling point** 126°C  
**Specific gravity** 0.70 (20°C)  
**Flammability** Highly flammable

#### REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** II  
**UN Number** 1262  
**Poisons Schedule** S5  
**Security** -

#### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour  
H315 Causes skin irritation  
H336 May cause drowsiness or dizziness  
H304 May be fatal if swallowed and enters airways  
H410 Very toxic to aquatic life with long lasting effects

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause irritation to the skin, eyes and respiratory tract. Symptoms of exposure include CNS depression, headache, drowsiness and dizziness. Repeated skin contact may have a degreasing effect. There is a risk of aspiration into the lungs if ingested. Handle only in an operating fume cupboard or well-ventilated area. Avoid inhaling vapour or mist. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Handle away from heat and other sources of ignition. There is potential for the vapour to collect in low-lying, confined areas. The vapour can form explosive mixtures with air and can travel to an ignition source and flash back.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light; protect from moisture. Ensure container is kept upright to prevent leakage. Store away from heat and all sources of ignition. Store away from oxidising agents. Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** comparing the properties of saturated and unsaturated hydrocarbons; a component of synthetic 'crude oil'.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation.

**Small spill:** Absorb with paper towel. Place paper towel in an operating fume cupboard and allow the solvent to evaporate. Dispose of paper towel as general waste.

**Large spill:** Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection.

Ventilate the spill area and allow any residual solvent to evaporate. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Octane is highly toxic for aquatic life, does not readily biodegrade and can bioaccumulate. Avoid release to the environment. Do not dispose of down the sink.

**Very small quantities** can be evaporated in an operating fume cupboard.

**Larger quantities:** Store in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose empty bottles to heat, open flames or other sources of ignition.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing and wash before reuse. Wash skin with plenty of soap and water. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26



## oxalic acid, dihydrate

*ethanedioic acid dihydrate*

**DANGER**

**Formula**  $C_2H_2O_4 \cdot 2H_2O$

**CAS No.** 6153-56-6

**User Group** 11-12



### DESCRIPTION

Colourless, crystalline solid. Occurs naturally in many plants (rhubarb leaves, spinach, parsley).

### SOLUBILITY

Soluble in water, alcohol, diethyl ether and glycerol.

**Solubility in water** 102 g/L (20°C)

### PHYSICAL DATA

**Molar mass** 126.07

**Melting point** 101.5°C

**Boiling point** 149-160°C

**Specific gravity** 1.653 (18.5°C)

**Flammability** Combustible

### REGULATORY INFORMATION

**ADG Class** 8

**Packing Group** III

**UN Number** 3261

**Poisons Schedule** S6

**Security** -

### HAZARD STATEMENTS

H302 Harmful if swallowed

H312 Harmful in contact with skin

H318 Causes serious eye damage

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Oxalic acid is a strong acid. Exposure may cause irritation to the skin, eyes and respiratory tract. Eye contact may result in burns and permanent eye damage. Handle in an operating fume cupboard or well-ventilated area. Avoid generating and inhaling dust. Avoid ingestion and contact with skin, eyes, and clothing. Avoid prolonged or repeated exposure.

Oxalic acid in solution is corrosive to metals.

### STORAGE

The substance is hygroscopic. Store in a tightly closed container in a cool, dry well-ventilated place away from heat and light. Protect from moisture.

Store away from heat and any sources of ignition. Store away from metals, alkali metals, bases, ammonia, mercury, oxidising agents, silver and silver compounds. Store with corrosive solids.

### APPLICATIONS

**Senior chemistry:** a reducing agent.

**Technical:** preparation of buffer solutions; removing iron or manganese residues from glassware.

### SPILLS

Wear PPE. Ensure good ventilation. Eliminate all ignition sources.

**Solid spill:** Collect spilled material with a non-sparking tool. Add slowly to a large volume of water with stirring. Neutralise the solution to within pH 6-8 by addition of sodium carbonate in portions (test with pH paper). Flush the neutral solution down the sink with further dilution.

**Liquid spill:** Cover spill with sodium carbonate or a 1:1:1 mixture of sand, sodium carbonate and vermiculite or bentonite (clay cat litter). Neutralise as for solid spill. Decant neutral solution down the sink with further dilution. Dispose of residual solids as general waste.

Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

### WASTE DISPOSAL

**Small quantity:** Dilute waste to a concentration of about 5% by slowly adding the acid to water with stirring. Neutralise the solution to within pH 6-8 by addition of sodium carbonate in portions (test with pH paper). Flush the neutral solution down the sink with further dilution.

**Large quantity:** Store in the original container or other suitable labelled container, such as for waste dry organic solids. Arrange for collection by a licenced waste disposal contractor.

### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. Call a POISONS CENTRE or doctor if you feel unwell.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin with plenty of water and mild soap. Call a POISONS CENTRE or doctor if you feel unwell.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing.

POISONS CENTRE: 13 11 26





**Formula** n/a  
**CAS No.** 8012-95-1; 8042-47-5  
**User Group** 7-12

#### DESCRIPTION

Colourless, odourless viscous liquid.  
A mixture of saturated hydrocarbons with carbon number predominantly in the range C15-C50. Less dense than water.

#### SOLUBILITY

Practically insoluble in water. Soluble in petroleum ether, oils and diethyl ether.  
Insoluble in ethanol.

**Solubility in water** ca. 1mg/L

#### PHYSICAL DATA

**Molar mass** -  
**Melting point** ca. -20°C  
**Boiling point** -  
**Specific gravity** 0.83-0.90  
**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** S5  
**Security** -

#### HAZARD STATEMENTS

H304 May be fatal if swallowed and enters airways

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure to mist or fumes may cause eye or respiratory irritation. Prolonged or repeated skin contact may cause irritation and dermatitis. May cause gastric irritation if a large amount is ingested. There is a risk of aspiration into the lungs if ingested.  
Avoid generation and inhalation of mist, aerosol or fumes.  
Avoid contact with skin and eyes. Handle away from sources of ignition.  
Pharmaceutical grade or food grade white mineral oil is not a Schedule 5 poison.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Store away from sources of heat or ignition.  
Store away from oxidising agents, strong acids and strong bases.  
Store with general organic liquids.

#### APPLICATIONS

**General science:** comparison of physical properties of liquids (density, viscosity, thermal or electrical conductivity, refractive index).

**Senior chemistry:** to demonstrate the cracking of hydrocarbons.

**Technical:** storage medium for alkali metals; heating bath medium.

#### SPILLS

Wear PPE. Ensure good ventilation. Eliminate all ignition sources. Cover spill with sand, or other inert material such as vermiculite or bentonite. Scoop up with a non-sparking tool.

**Small quantity:** Seal material in a plastic bag and dispose of as general waste.

**Large quantity:** Place material in a suitable labelled container and arrange for collection.

Residual oil can be removed from spill area by wiping down with paper towel wetted with petroleum solvent. The area should then be ventilated the area to allow any residual solvent to evaporate. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Paraffin oil floats on water and is slow to biodegrade. Do not release to waterways or waste water.

**Small quantity:** Absorb with non-combustible material. Seal in a plastic bag and dispose of as general waste.

**Large quantity:** Store in a suitable labelled container and arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation occurs, seek medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. If large amount ingested, seek medical advice/attention.

**IF ON SKIN:** Remove contaminated clothing. Wash skin with plenty of soap and water. If skin irritation occurs, seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing.

**Formula** n/a  
**CAS No.** 8002-74-2  
**User Group** F-12

#### DESCRIPTION

Colourless, translucent or white, waxy solid with a faint odour. A mixture of predominantly straight chain hydrocarbons with carbon number >C20.

#### SOLUBILITY

Soluble in petroleum ether, warm alcohol, diethyl ether, oils and some esters.

**Solubility in water** Insoluble

#### PHYSICAL DATA

**Molar mass** -  
**Melting point** 45 - 95°C  
**Boiling point** >300°C  
**Specific gravity** ca. 0.90 (20°C)  
**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

Not classified as hazardous

#### SPILLS

As for Waste Disposal.

#### WASTE DISPOSAL

Take up with absorbent material. Seal in a plastic bag and dispose of as general waste.

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure to dust (room temperature) or fumes (molten wax) may cause irritation to the eyes, skin, nose, throat and respiratory tract. Repeated or prolonged skin contact may cause irritation and dermatitis. May cause gastric irritation if a large amount is ingested. Skin or eye contact with molten wax may cause burns.

Avoid contact with skin and eyes. Avoid generating and inhaling dust.

When using hot molten wax, work in an operating fume cupboard or well-ventilated area away from any sources of ignition. Avoid inhalation of fumes from molten material.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Store away from sources of heat or ignition.

Store away from oxidising agents, strong acids and strong bases.

Store with general organic solids.

#### APPLICATIONS

**General science:** candle making; melting point investigations.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation occurs, seek medical advice/attention.

**Eye contact with hot, molten wax:** treat as for skin contact.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. If large amount ingested, seek medical advice/attention.

**IF ON SKIN:** Remove contaminated clothing. Wash skin with plenty of soap and water. If skin irritation occurs, seek medical advice/attention.

**Skin contact with hot, molten wax:** Irrigate with plenty of cool running water. Cover or wrap area with a clean dressing. Do not attempt to remove adhered wax from skin. Seek urgent medical attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical advice/attention.



**Formula** C<sub>5</sub>H<sub>12</sub>O

**CAS No.** 71-41-0

**User Group** 11-12



#### DESCRIPTION

Clear, colourless liquid with a mild, sweet, fusel-like odour.

#### SOLUBILITY

Sparingly soluble in water. Miscible with ethanol and diethyl ether. Soluble in acetone.

**Solubility in water** 22 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 88.15

**Melting point** -78°C

**Boiling point** 138°C

**Specific gravity** 0.81 (20°C)

**Flammability** Flammable

#### REGULATORY INFORMATION

**ADG Class** 3

**Packing Group** III

**UN Number** 1105

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

H226 Flammable liquid and vapour

H332 Harmful if inhaled

H315 Causes skin irritation

H319 Causes serious eye irritation

H335 May cause respiratory irritation

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Butyl, Viton®; nitrile for splash protection) Exposure may cause irritation to the eyes, nose, throat and respiratory tract and on ingestion. Symptoms of exposure include nausea, headache, dizziness and CNS effects. Prolonged or repeated skin contact may cause irritation and dermatitis. Eye exposure to the liquid may cause severe irritation and burns.

Handle in an operating fume cupboard. Avoid generating and inhaling vapour or mist. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition.

Store away from oxidising agents, acids, acid chlorides, bases, halogens, alkali metals and alkaline earth metals. Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** to observe the reactivity of a primary alcohol; preparation of esters; heat of combustion investigations.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation.

**Small spill:** Treat as for Waste Disposal.

**Large spill:** Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection. Wash the spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Absorb onto paper towel and allow alcohol to evaporate in an operating fume cupboard. Dispose of paper towel as general waste.

**Large quantity:** Store in the original container or other suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek immediate medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical attention.

**IF ON SKIN:** Remove immediately all contaminated clothing and wash before reuse. Rinse skin thoroughly with water/shower. If irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISONS CENTRE or doctor.

POISONS CENTRE: 13 11 26



**WARNING**



**Formula**  $C_5H_{12}O$   
**CAS No.** 6032-29-7  
**User Group** 11-12

**DESCRIPTION**

Clear, colourless, flammable, moderately volatile liquid with a strong, disagreeable odour.

**SOLUBILITY**

Soluble in water, ethanol and diethyl ether.

**Solubility in water** 166 g/L (20°C)

**PHYSICAL DATA**

**Molar mass** 88.15  
**Melting point** -50°C  
**Boiling point** 119°C  
**Specific gravity** 0.81 (20°C)  
**Flammability** Flammable

**REGULATORY INFORMATION**

**ADG Class** 3  
**Packing Group** III  
**UN Number** 1105  
**Poisons Schedule** -  
**Security** -

**HAZARD STATEMENTS**

H226 Flammable liquid and vapour  
H332 Harmful if inhaled  
H315 Causes skin irritation  
H319 Causes serious eye irritation

**SAFE HANDLING**

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Butyl, Viton®; nitrile for splash protection). Exposure may cause irritation to the eyes, nose, throat and respiratory tract and on ingestion. Symptoms of exposure include nausea, headache, dizziness and narcotic effects. Prolonged or repeated skin contact can lead to drying, cracking and dermatitis. Eye exposure to the liquid may cause redness, pain and possible eye damage.

Handle in an operating fume cupboard. Avoid generating and inhaling vapour or mist. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.

Test for peroxides before use, particularly if intending to heat or distill the alcohol.

**STORAGE**

With prolonged storage, and on exposure to air and sunlight, the alcohol may form peroxides, which may become explosive if they are concentrated. Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition. Store away from oxidising agents, halogens, alkali metals and alkaline earth metals.

Store with flammable liquids in an AS compliant cabinet. Mark the bottle with the date received and date opened.

**SPILLS**

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool. Place material into a suitable labelled container and store for collection. Wash the spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

**WASTE DISPOSAL**

Store waste or surplus 2-pentanol in a suitable labelled container and arrange for collection by a licenced waste disposal contractor. As the alcohol is a peroxide former, it should not be stored with any other waste.

The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

**FIRST AID**

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek immediate medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical attention.

**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin thoroughly with water/shower. Wash contaminated clothing before reuse. If irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISONS CENTRE or doctor.  
POISONS CENTRE: 13 11 26

**APPLICATIONS**

**Senior chemistry:** to observe the reactivity of a secondary alcohol.

**Formula** n/a  
**CAS No.** 8009-03-8  
**User Group** F-12

#### DESCRIPTION

Colourless, odourless semi-solid. A mixture of mainly saturated crystalline and liquid hydrocarbons with carbon number >C25. Less dense than water.

#### SOLUBILITY

Soluble in petroleum ether, oils and diethyl ether. Practically insoluble in glycerol and alcohol.

**Solubility in water** Insoluble

#### PHYSICAL DATA

**Molar mass** -  
**Melting point** ca. 38-60°C  
**Boiling point** -  
**Specific gravity** ca. 0.815-0.865 (25°C)  
**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

Not classified as hazardous

#### SPILLS

As for Waste Disposal.

#### WASTE DISPOSAL

Take up with absorbent material. Seal in a plastic bag and dispose of as general waste.

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Eye contact may cause mild irritation. Inhalation of mist may cause respiratory irritation. May cause gastric irritation if a large amount is ingested. May cause skin irritation or dermatitis in sensitive individuals.

Avoid inhalation of mist. Avoid contact with skin and eyes. Handle away from sources of ignition.

Purchase of pharmaceutical grade petrolatum is recommended to avoid toxic contaminants which may be present in less refined products.

#### STORAGE

Store in a tightly closed container in a cool, dry well-ventilated place away from heat and light. Store away from sources of heat or ignition.

Store away from oxidising agents.

Store with general organic solids.

#### APPLICATIONS

**General science:** activities exploring its fluorescent properties; a release agent for moulds and casts.

**Technical:** to seal wet mount slides; lubricant for microscope mechanism.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation occurs, seek medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. If large amount ingested, seek medical advice/attention.

**IF ON SKIN:** Remove contaminated clothing. Wash skin with plenty of soap and water. If skin irritation occurs, seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing.





**Formula**  $\text{H}_3\text{PO}_4$   
**CAS No.** 7664-38-2  
**User Group** Staff

## DESCRIPTION

Colourless, odourless, viscous, clear liquid. Commercially available as an 85% w/w aqueous solution.

## SOLUBILITY

Soluble in water and ethanol.

**Solubility in water** Miscible

## PHYSICAL DATA

|                         |                   |
|-------------------------|-------------------|
| <b>Molar mass</b>       | 98                |
| <b>Melting point</b>    | 21°C (85%)        |
| <b>Boiling point</b>    | 158°C (85%)       |
| <b>Specific gravity</b> | 1.685 (25°C, 85%) |
| <b>Flammability</b>     | Non-combustible   |

## REGULATORY INFORMATION

|                         |      |
|-------------------------|------|
| <b>ADG Class</b>        | 8    |
| <b>Packing Group</b>    | III  |
| <b>UN Number</b>        | 1805 |
| <b>Poisons Schedule</b> | S6   |
| <b>Security</b>         | -    |

## HAZARD STATEMENTS

H290 May be corrosive to metals  
H314 Causes severe skin burns and eye damage

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (latex, nitrile, neoprene). The concentrated acid is corrosive and should be handled with care.

Exposure can cause irritation and severe burns to the skin, eyes and respiratory tract and on ingestion. Eye contact may result in severe eye damage and permanent injury. Repeated or prolonged skin contact can cause dermatitis. Handle only in an operating fume cupboard or well-ventilated area. Avoid breathing vapour or mist and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

When diluting, add the concentrated acid slowly to water. Never add water to the concentrated acid.

## STORAGE

The acid is hygroscopic. Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Protect from moisture. Ensure container is kept upright to prevent leakage. Protect from freezing.

Store away from heat and source of ignition.

Store away from alkalis, metals, powdered metals, organic substances.

Store with corrosive liquids (acids).

## APPLICATIONS

**General science:** to simulate the corrosive properties of phosphoric acid-containing softdrinks.

**Senior chemistry:** an example of a polyprotic, inorganic acid in titrations.

**Technical:** preparation of phosphate buffer solutions; removal of rust from glassware.

## SPILLS

Wear PPE. Ensure good ventilation. Absorb spill with non-combustible absorbent such as a 1:1:1 mixture of sodium carbonate, bentonite (clay cat litter) and sand. Scoop up with a non-sparking tool.

**Small spill:** Add material to a large volume of water. Neutralise as for waste disposal. Decant the neutral solution down the sink. Dispose of solid material as general waste.

**Large spill:** Place material in a suitable labelled container. Arrange for collection by a licenced contractor.

Wash spill area thoroughly with water.

Wash any contaminated clothing before reuse.

## WASTE DISPOSAL

The acid is harmful to the aquatic environment due to the pH shift.

**Small quantity:** Wear PPE and work in a fume cupboard.

Add the waste acid slowly to a large volume of water.

Neutralise the solution to between pH 6 and 8 with sodium carbonate, adding the base cautiously in portions until there is no further evolution of  $\text{CO}_2$ . Dispose of the neutral solution down the sink.

**Large quantity:** Store in a suitable labelled container.

Arrange for collection by a licenced waste disposal contractor.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. Call a POISONS CENTRE or doctor if you feel unwell.

**IF ON SKIN:** Remove immediately all contaminated clothing and wash before reuse. Rinse skin thoroughly with water/shower. Seek medical advice/attention if concerned.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISONS CENTRE or doctor.

POISONS CENTRE: 13 11 26



**Formula**  $K_2CO_3$   
**CAS No.** 6381-79-9  
**User Group** 7-12

#### DESCRIPTION

Colourless, odourless, hygroscopic, granular powder.

#### SOLUBILITY

Soluble in water. Insoluble in alcohol.

**Solubility in water** 112 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 138.21  
**Melting point** 891°C  
**Boiling point** decomposes  
**Specific gravity** 2.43 (20°C)  
**Flammability** Non-combustible

#### REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** S5  
**Security** -

#### HAZARD STATEMENTS

H302 Harmful if swallowed  
H315 Causes skin irritation  
H319 Causes serious eye irritation  
H335 May cause respiratory irritation

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Aqueous solutions are strongly basic. Exposure may cause irritation to the skin, eyes and respiratory tract. May be corrosive, causing burns, at high concentrations or with prolonged or repeated exposure. Eye contact may result in severe eye damage and permanent injury. Prolonged or repeated skin contact may cause dermatitis and skin sensitization. Handle in a well-ventilated area. Avoid generating dust. Avoid inhalation and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

#### STORAGE

The salt is hygroscopic. Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Protect from moisture. Store away from acids and oxidising agents. Store with general inorganic solids.

#### APPLICATIONS

**General science:** example of a weak base.  
**Technical:** preparation of buffers.

#### SPILLS

Wear PPE. Ensure good ventilation. Scoop spill material into a plastic container.

**Small spill:** Treat as for Waste Disposal.

**Large spill:** Place into a suitable labelled container and store for collection.

Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Wear PPE and work in a fume cupboard. Add waste potassium carbonate slowly to a large volume of cold water. Neutralise the solution to within pH 6 - 8 by addition of 5% hydrochloric acid, with stirring. Flush the neutral solution down the sink.

**Large quantity:** Place in a suitable labelled container. Arrange for collection by a licenced waste contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. Seek medical attention.

**IF ON SKIN:** Remove contaminated clothing. Rinse skin thoroughly with water/shower. If irritation occurs, seek medical advice.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical advice/attention.



**Formula** KCl  
**CAS No.** 7447-40-7  
**User Group** 7-12

## DESCRIPTION

Colourless, odourless crystals or powder with a saline taste. Hygroscopic. Occurs naturally as sylvite.

## SOLUBILITY

Soluble in water. Soluble in glycerol. Slightly soluble in alcohol. Insoluble in ether and acetone.

**Solubility in water** 347 g/L (20°C)

## PHYSICAL DATA

**Molar mass** 74.55  
**Melting point** 773°C  
**Boiling point** 1413°C  
**Specific gravity** 1.98 g/cm<sup>3</sup> (20°C)  
**Flammability** Non-combustible

## REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** -  
**Security** -

## HAZARD STATEMENTS

Not classified as hazardous

## STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Store away from strong acids and strong oxidising agents. Store with general inorganic solids.

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (latex, nitrile). Potassium chloride may cause irritation to the skin and eyes, and respiratory irritation. Avoid generating and inhaling dust. Avoid contact with skin and eyes.

## SPILLS

Wear PPE, sweep up and treat as for Waste Disposal.

## WASTE DISPOSAL

**Small quantity:** Dispose of as general waste or dilute to 5% and dispose of down the sink.

**Large quantity:** Place in a labelled bottle for waste dry chemicals and store for collection by a licenced waste disposal contractor.

## APPLICATIONS

**General science:** to demonstrate an endothermic process (dissolution in water); flame tests.

**Senior chemistry:** concentrated aqueous solution may be used to prepare salt bridges for electrochemistry.

## PREPARATIONS

The concentrated (3M) or saturated KCl solution can be used for the preparation of salt bridges from either strips of filter paper or agar gel in a tube.

A concentration of 0.5-1.0M is suitable for conducting a flame test.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Seek medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. If recovery is not rapid, seek medical advice/attention.

**IF ON SKIN:** Remove contaminated clothing. Wash skin thoroughly with plenty of water. If skin irritation occurs: Seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur: Seek medical advice/attention.

# Potassium chloride

Formula KCl

CAS No. 7447-40-7

MW 74.55

Solubility in water 347 g/L (20°C)

## LABORATORY NOTES

**TABLE 1: Quantity of potassium chloride required to prepare a solution of given volume and concentration**

| concentration      | final volume of solution |          |         |         |
|--------------------|--------------------------|----------|---------|---------|
|                    | 1000 mL                  | 500 mL   | 250 mL  | 100 mL  |
| 0.1 M <sup>a</sup> | 7.46 g                   | 3.73 g   | 1.86 g  | 0.74 g  |
| 0.5 M              | 37.28 g                  | 18.64 g  | 9.32 g  | 3.73 g  |
| 1.0 M              | 74.55 g                  | 37.28 g  | 18.64 g | 7.46 g  |
| 3.0 M              | 223.65 g                 | 111.83 g | 55.91 g | 22.37 g |
| Saturated (20°C)   | 347 g                    | 174 g    | 87 g    | 34.7 g  |

a alternatively, prepare by a 1 part in 10 dilution of a 1.0 M solution.

### Procedure

1. Weigh out the required mass of solid
2. Place distilled water to about one-half the final volume in a mixing vessel such as a beaker or conical flask.
3. Transfer the solid to the mixing vessel and stir until the solution is clear and all of the solid has dissolved.
4. Transfer the solution to a measuring cylinder or volumetric flask and make up to the final volume.
5. Transfer the solution to a labelled bottle.

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**VERSION**  
12 Dec 2016



## Potassium citrate, monohydrate

*tripotassium citrate hydrate; citric acid, tripotassium salt monohydrate*

**Formula**  $K_3C_6H_8O_7 \cdot H_2O$

**CAS No.** 6100-05-6

**User Group** 7-12

### DESCRIPTION

Colourless, odourless, hygroscopic crystals, granules or powder.

### SOLUBILITY

Soluble in water.

**Solubility in water** 640 g/L (20°C)

### PHYSICAL DATA

**Molar mass** 324.41

**Melting point** 180°C (-H<sub>2</sub>O)

**Boiling point** 230°C (decomposes)

**Specific gravity** 1.98 (20°C)

**Flammability** Combustible

### REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** -

**Security** -

### HAZARD STATEMENTS

Not classified as hazardous

### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Protect from moisture.

Store away from strong oxidising agents.

Store with general inorganic solids.

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Exposure may cause mild respiratory irritation. Handle in a well-ventilated area. Avoid generating and inhaling dust. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

### SPILLS

Wear PPE, sweep up and treat as for waste.

Wash spill area thoroughly with water.

### WASTE DISPOSAL

**Small quantity:** Dispose of as general waste or dilute to 1% and dispose of down the sink.

**Large quantity:** Place in a labelled bottle for waste dry chemicals and store for collection by a licenced waste disposal contractor.

### APPLICATIONS

**Senior biology:** preparation of buffer solutions.

### PREPARATIONS

The salt can be used for the preparation of buffer solutions from pH 3 to pH 6.

### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. If large amount ingested, seek medical advice/attention.

**IF ON SKIN:** Remove contaminated clothing. Wash skin thoroughly with plenty of water. If skin irritation occurs: Seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur: Seek medical advice/attention.



# Potassium citrate, monohydrate

Formula  $K_3C_6H_8O_7 \cdot H_2O$

CAS No. 6100-05-6

MW 324.41

Solubility in water 640 g/L (20°C)

## LABORATORY NOTES

**TABLE 1: Quantity of tripotassium citrate monohydrate required to prepare a solution of given volume and concentration**

| concentration    | final volume of solution |          |         |         |
|------------------|--------------------------|----------|---------|---------|
|                  | 1000 mL                  | 500 mL   | 250 mL  | 100 mL  |
| 0.1 M            | 32.44 g                  | 16.22 g  | 8.11 g  | 3.24 g  |
| 0.5 M            | 162.20 g                 | 81.10 g  | 40.55 g | 16.22 g |
| 1.0 M            | 324.41 g                 | 162.20 g | 81.10 g | 32.44 g |
| Saturated (20°C) | 640 g                    | 320 g    | 160 g   | 64 g    |

a alternatively, prepare by a 1 part in 10 dilution of a 1.0 M solution.

### Procedure

1. Weigh out the required mass of solid
2. Place distilled water to about one-half the final volume in a mixing vessel such as a beaker or conical flask.
3. Transfer the solid to the mixing vessel and stir until the solution is clear and all of the solid has dissolved.
4. Transfer the solution to a measuring cylinder or volumetric flask and make up to the final volume.
5. Transfer the solution to a labelled bottle.

**TABLE 2: Preparation of citric acid-tripotassium citrate buffer solution pH 3 to pH 6**

| pH  | Volume of component required for 100mL |                            |
|-----|--|----------------------------|
|     | 0.1M citric acid /mL                   | 0.1M potassium citrate /mL |
| 3.0 | 82.0                                   | 18.0                       |
| 4.0 | 59.0                                   | 41.0                       |
| 5.0 | 35.0                                   | 65.0                       |
| 6.0 | 11.5                                   | 88.5                       |

### Procedure

For 100mL of buffer solution at the required pH, mix the given volumes of 0.1M potassium citrate and 0.1M citric acid.



# potassium hydroxide

*caustic potash; potash lye*

**ANGER**

**Formula** KOH  
**CAS No.** 1310-58-3  
**User Group** 7-12



## DESCRIPTION

Colourless, hygroscopic pellets or flakes.

## SOLUBILITY

Soluble in water, alcohol and glycerol.

**Solubility in water** 1130 g/L (20°C)

## PHYSICAL DATA

**Molar mass** 56.11  
**Melting point** 360°C  
**Boiling point** 1327°C  
**Specific gravity** 2.04 (20°C)  
**Flammability** Non-combustible

## REGULATORY INFORMATION

**ADG Class** 8  
**Packing Group** II  
**UN Number** 1813  
**Poisons Schedule** S6  
**Security** -

## HAZARD STATEMENTS

H290 May be corrosive to metals  
H302 Harmful if swallowed  
H314 Causes severe skin burns and eye damage

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). The solid and solutions are highly corrosive; aqueous solutions are strongly basic. Exposure may cause irritation and burns to the skin, eyes and respiratory tract and on ingestion. Eye contact may result in severe eye damage and permanent injury.  
Handle in a well-ventilated area. Avoid generating dust. Avoid inhalation and contact with skin, eyes and clothing. Dissolution of the hydroxide in water generates much heat. Carry out solution preparation in an operating fume cupboard. Place the mixing vessel in an ice-bath and add the solid cautiously to water. Avoid inhaling mist or fumes from the hot solution.

## STORAGE

The salt is hygroscopic and absorbs carbon dioxide from the air, forming potassium carbonate. Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light; protect from air and moisture.  
Avoid storing solutions of the hydroxide in glass bottles, especially those with glass stoppers, as the hydroxide will react with the glass and the stopper may become fused. Store away from acids, oxidising agents and metals. Store with corrosive solids.

## APPLICATIONS

**General science:** an example of a strong base.

## SPILLS

Wear PPE. Ensure good ventilation.

**Small spill:** Scoop into a plastic container. Treat as for Waste Disposal.

**Large spill:** Scoop up and place into a suitable labelled container and store for collection.

Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

## WASTE DISPOSAL

**Small quantity:** Wear PPE and work in a fume cupboard. Add waste potassium hydroxide slowly, with stirring, to a large volume of ice-water. Neutralise the solution to within pH 6 - 8 by addition of 5% hydrochloric acid, with stirring. Flush the neutral solution down the sink.

**Large quantity:** Place in a suitable labelled container. Arrange for collection by a licenced waste contractor.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin thoroughly with water/shower. Seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor.

POISONS CENTRE: 13 11 26



**Formula**  $\text{KIO}_3$   
**CAS No.** 7758-05-6  
**User Group** 11-12



#### DESCRIPTION

White, odourless crystals or powder.

#### SOLUBILITY

Soluble in water and dilute sulfuric acid.  
Insoluble in alcohol and nitric acid.

**Solubility in water** 92 g/L (25°C)

#### PHYSICAL DATA

**Molar mass** 214.00  
**Melting point** 560°C (decomposes)  
**Boiling point** -  
**Specific gravity** 3.89  
**Flammability** Non-combustible  
oxidising solid

#### REGULATORY INFORMATION

**ADG Class** 5.1  
**Packing Group** II  
**UN Number** 1479  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

H272 May intensify fire; oxidizer  
H302 Harmful if swallowed  
H315 Causes skin irritation  
H319 Causes serious eye irritation  
H335 May cause respiratory irritation

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Potassium iodate is a moderately strong oxidising agent. Exposure may cause severe irritation and corrosive injury to the skin, eyes and respiratory and digestive tracts. Eye contact may cause permanent damage. Iodates are toxic to retinal cells by ingestion; uptake of a large amount may lead to visual impairment.  
Handle in a well-ventilated area. Avoid generating or inhaling dust. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Handle away from heat and other sources of ignition.  
In case of fire, use flooding quantities of water; do not use dry chemical,  $\text{CO}_2$  or foam extinguisher.

#### STORAGE

Store in a tightly closed container in a cool, dry well-ventilated place. Over time, potassium iodate can decompose on exposure to light, heat or air and moisture. Protect from air, moisture and direct sunlight. Store away from heat and all sources of ignition.  
Store away from reducing agents, flammable substances, combustible materials, acids and alkalis.  
Store with oxidising substances (DG Class 5.1).

#### APPLICATIONS

**Senior chemistry:** the iodine clock reaction; demonstration of the Briggs-Rauscher oscillating reaction; iodometric titrations.

**Technical:** a primary standard; preparation of standard iodine solution; standardisation of thiosulfate solution.

#### SPILLS

Wear PPE. Remove all sources of ignition and any combustible materials from the spill area. Ensure good ventilation.

**Solid spill:** Collect material with a non-sparking tool and treat as for Waste Disposal.

**Solution spill:** Absorb with non-combustible material such as sand, vermiculite or bentonite (clay cat litter). Collect with a non-sparking tool. Add material slowly to a large volume of water and reduce the iodate and neutralise the solution as for Waste Disposal. Decant the supernatant down the sink and dispose of solid residue as general waste.

Wash spill area thoroughly with water; ensure no iodate residue remains in contact with combustible material. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Solid sodium iodate must not be disposed of with general waste. Store surplus or waste sodium iodate in the original container or other suitable labelled container. Arrange for collection by licenced waste disposal contractor.

**Small quantity of solution:** Treat with a reducing agent: 18 mL of 10% w/v solution of either sodium bisulfite or sodium metabisulfite will reduce 10 mL of saturated (ca. 0.4M) sodium iodate solution or a solution containing 1g of the salt. Add the bisulfite or metabisulfite solution to the iodate solution until a persistent pale yellow colour is obtained. Neutralise the solution with sodium carbonate to within pH 6-8 and wash down the sink.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Give water to drink. Seek medical attention.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin with soap and plenty of water. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.  
POISONS CENTRE: 13 11 26



**Formula** KI

**CAS No.** 7681-11-0

**User Group** 7-12

## DESCRIPTION

Colourless, odourless, crystals, granules or powder with a bitter saline taste. Hygroscopic and sensitive to light.

## SOLUBILITY

Soluble in water, acetone and glycerol. Slightly soluble in ethanol.

**Solubility in water** 1430 g/L (20°C)

## PHYSICAL DATA

**Molar mass** 166.01

**Melting point** 681°C

**Boiling point** 1323°C

**Specific gravity** 3.13 (20°C)

**Flammability** Non-combustible

## REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** -

**Security** IDM Cat 2

## HAZARD STATEMENTS

H315 Causes skin irritation

H319 Causes serious eye irritation

H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled

H317 May cause an allergic skin reaction.

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, neoprene, latex). Exposure to potassium iodide may cause skin, eye or respiratory irritation. Exposure to small amounts may cause symptoms of iodism in sensitive individuals. Skin contact or inhalation may lead to allergic sensitisation in some individuals. Handle in an operating fume cupboard or well-ventilated area. Avoid generating and inhaling dust. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

## APPLICATIONS

**General science:** in the preparation of aqueous solutions of iodine; to catalyse the decomposition of hydrogen peroxide ('Elephant's Toothpaste'); in the reaction to precipitate lead iodide.

**Senior chemistry:** a source of iodide ion in qualitative analysis; in clock reactions (the Harcourt-Essen Reaction, the Persulfate-Iodide Clock Reaction).

## PREPARATIONS

Solutions of potassium iodide may become yellow with the oxidation of iodide ion to give iodine. One or two crystals of sodium thiosulfate or a small quantity of glucose can be added to the solution to reduce any generated iodine. Alternatively, solutions can be stabilised with addition of a small quantity of sodium carbonate or sodium bicarbonate which buffer the solution and thus render the pH less favourable for the oxidation of iodide.

## STORAGE

Store in a tightly closed container in a cool, dry place away from heat and light. Over time, potassium iodide, both as a solid and in solution, becomes yellow with the generation of molecular iodine. Exposure to air, light or moisture may accelerate the decomposition.

Store away from oxidising agents, reducing agents, acids and metals.

Store with general inorganic solids.

## SPILLS

Wear PPE, sweep up and treat as for waste. Wash spill area thoroughly with water.

## WASTE DISPOSAL

**Small quantity:** Dilute to 1% and dispose of down the sink.

**Large quantity:** Place in a labelled bottle and store for collection by a licenced waste disposal contractor.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical attention.

**IF ON SKIN:** Remove contaminated clothing. Wash skin thoroughly with plenty of water. If skin irritation occurs: Seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur: Seek medical advice/attention.

# Potassium iodide

Formula KI

CAS No. 7681-11-0

MW 166.01

Solubility in water 1430 g/L (20°C)

## LABORATORY NOTES

**TABLE 1: Quantity of potassium iodide required to prepare a solution of given volume and concentration**

| concentration      | final volume of solution |         |         |         |
|--------------------|--------------------------|---------|---------|---------|
|                    | 1000 mL                  | 500 mL  | 250 mL  | 100 mL  |
| 0.1 M <sup>a</sup> | 16.60 g                  | 8.30 g  | 4.15 g  | 1.66 g  |
| 0.5 M              | 83.00 g                  | 41.50 g | 20.75 g | 8.30 g  |
| 1.0 M              | 166.01 g                 | 83.00 g | 41.50 g | 16.60 g |

a alternatively, prepare by a 1 part in 10 dilution of a 1.0 M solution.

### Procedure

1. Weigh out the required mass of solid
2. Transfer solid to a mixing vessel such as a beaker or conical flask.
3. Add water to about two-thirds of the final volume and stir until the solution is clear and all of the solid has dissolved.
4. Transfer the solution to a measuring cylinder or volumetric flask and make up to the final volume.
5. Transfer the solution to a labelled bottle.
6. Potassium iodide solutions may become yellow over time, through oxidation of the iodide to molecular iodine. A small amount of dextrose or sodium thiosulfate may be added to the solution to reduce any generated iodine.

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**VERSION**  
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**Formula**  $\text{KNO}_3$   
**CAS No.** 7757-79-1  
**User Group** 7-12

#### DESCRIPTION

Colourless, odourless transparent prisms or crystalline powder with a cooling, pungent saline taste. Slightly hygroscopic.

#### SOLUBILITY

Soluble in water and glycerol. Slightly soluble in ethanol.

**Solubility in water** 316 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 101.1  
**Melting point** 334°C  
**Boiling point** 400°C (decomposes)  
**Specific gravity** 2.11 (20°C)  
**Flammability** Non-combustible  
oxidising solid

#### REGULATORY INFORMATION

**ADG Class** 5.1  
**Packing Group** III  
**UN Number** 1486  
**Poisons Schedule** -  
**Security CSC**

#### HAZARD STATEMENTS

H272 May intensify fire; oxidizer

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex, neoprene). Potassium nitrate is a strong oxidising agent. Exposure may cause irritation to the skin and eyes, and irritation and burns to the respiratory tract. Repeated or prolonged skin exposure may cause dermatitis. Handle in an operating fume cupboard or well-ventilated area. Avoid generating and inhaling dust. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. There is a risk of vigorous reaction, fire or explosion if potassium nitrate is mixed with combustible material or reducing agents, especially finely divided materials. Handle away from heat or any ignition source. The preparation of explosive mixtures is not recommended.

#### APPLICATIONS

**General science:** to demonstrate an endothermic process (dissolution in water); an example of a potassium salt in flame test activities.

**Botany:** investigations of the nutrient requirements of plants.

**Senior chemistry:** inorganic analysis; concentrated aqueous solution can be used to prepare salt bridges for electrochemistry.

#### PREPARATIONS

A concentration of 0.5-1M is suitable for conducting a flame test. The concentrated (2.5M), or saturated,  $\text{KNO}_3$  solution can be used for the preparation of salt bridges from strips of filter paper or agar gel in a tube.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. The salt is hygroscopic; protect from moisture. Store away from reducing agents, combustible materials, organic substances and metals. Do not store on shelves made of wood or other combustible material. Store with oxidising substances (DG Class 5.1).

#### SPILLS

Wear PPE. Sweep up with a non-sparking tool and transfer to a bucket of water. Dilute to 1% and disposed of down the sink. The spill area, contaminated clothing and any other contaminated combustible or organic materials should be washed thoroughly with water.

#### WASTE DISPOSAL

**Small quantity:** Dilute to 1% and dispose of down the sink. **Large quantity:** Place in a labelled container and store for collection by a licenced waste contractor. Alternatively, dilute and utilise as a fertilizer for lawn or ornamental plants. Concentrated solutions may be allowed to evaporate and the sludge stored in a labelled container for collection. Solutions of nitrates should not be heated to evaporate and should not be evaporated to dryness.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Seek medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Call a POISONS CENTRE or doctor if you feel unwell.

**IF ON SKIN:** Remove contaminated clothing. Wash skin thoroughly with plenty of water. If skin irritation occurs: Seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.  
POISONS CENTRE: 13 11 26.

# Potassium nitrate

Formula  $\text{KNO}_3$

CAS No. 7757-79-1

Molar mass 101.1

Solubility in water 316 g/L (20°C)

## LABORATORY NOTES

**TABLE 1: Quantity of potassium nitrate required to prepare a solution of given volume and concentration**

| Concentration     | Final volume of solution |         |         |         |
|-------------------|--------------------------|---------|---------|---------|
|                   | 1000 mL                  | 500 mL  | 250 mL  | 100 mL  |
| 0.1M <sup>a</sup> | 10.11 g                  | 5.05 g  | 2.53 g  | 1.01 g  |
| 0.5 M             | 50.55 g                  | 25.27 g | 12.64 g | 5.05 g  |
| 1.0 M             | 101.10 g                 | 50.55 g | 25.27 g | 10.11 g |
| 2.5 M             | 252.75 g                 | 126.4 g | 63.19 g | 25.28 g |
| Saturated (20°C)  | 316 g                    | 158 g   | 79 g    | 32 g    |

<sup>a</sup> alternatively, prepare by a 1 part in 10 dilution of a 1.0 M solution.

### Procedure

1. Weigh out the required mass of solid
2. Place distilled water to about one-half the final volume in a mixing vessel such as a beaker or conical flask.
3. Transfer the solid to the mixing vessel and stir until the solution is clear and all of the solid has dissolved.
4. Transfer the solution to a measuring cylinder or volumetric flask and make up to the final volume.
5. Transfer the solution to a labelled bottle.

**DISCLAIMER** While all care has been taken in compiling this information, Science ASSIST can not accept liability for the completeness or correctness of the information, nor for errors or omissions.

**VERSION**  
12 Dec 2016



## potassium permanganate

Condy's crystals; permanganate of potash

**DANGER**

**Formula**  $\text{KMnO}_4$   
**CAS No.** 7722-64-7  
**User Group** 7-12



### DESCRIPTION

Dark violet, odourless crystals.

### SOLUBILITY

Soluble in water. Decomposed by alcohol.

**Solubility in water** 64 g/L (20°C)

### PHYSICAL DATA

**Molar mass** 158.03  
**Melting point** > 240°C (decomposes)  
**Boiling point** -  
**Specific gravity** 2.70 (20°C)  
**Flammability** Non-combustible  
oxidising solid

### REGULATORY INFORMATION

**ADG Class** 5.1  
**Packing Group** II  
**UN Number** 1490  
**Poisons Schedule** S6  
**Security** IDM Cat 3

### HAZARD STATEMENTS

H272 May intensify fire; oxidizer  
H302 Harmful if swallowed  
H314 Causes severe skin burns and eye damage  
H400 Very toxic to aquatic life  
H410 Very toxic to aquatic life with long lasting effects

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Potassium permanganate is a strong oxidising agent. Exposure may cause severe irritation and corrosive injury to the skin, eyes and respiratory tract and on ingestion. Eye contact may cause burns and permanent damage. Symptoms of ingestion include gastrointestinal burns, nausea and vomiting.

Handle in a well-ventilated area. Avoid generating and breathing dust and aerosols. Avoid contact with skin, eyes and clothing. Handle away from combustible material and sources of heat and ignition.

In case of fire, flooding quantities of water should be used as the extinguishing agent.

### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light.

Store away from reducing agents, combustible materials, alcohols, peroxides, powdered metals, zinc, copper, strong acids, sulfuric acid and alkali metals.

Store with oxidising substances (DG Class 5.1).

Permanganate ion in aqueous solution decomposes to give solid manganese dioxide,  $\text{MnO}_2$ , which further catalyses the decomposition. The reaction is catalysed by light or impurities. To slow the decomposition reaction, store solutions in clean dark/opaque bottles and protect from light.

### APPLICATIONS

**General science:** reduction of  $\text{Mn(VII)}$  to observe the colours of the lower oxidation states.

**Senior chemistry:** redox titrations; oxidising agent in organic chemistry; demonstration of the exothermic reaction of  $\text{KMnO}_4$  with glycerol.

### SPILLS

Wear PPE. Remove all sources of ignition and any combustible materials from the spill area. Ensure good ventilation. **Solid spill:** Collect material with a non-sparking tool and treat as for Waste Disposal.

**Solution spill:** Absorb with non-combustible material such as sand, vermiculite or bentonite (clay cat litter). Collect with a non-sparking tool. Add material slowly to a large volume of water. Reduce the permanganate and neutralise the solution as for Waste Disposal. Decant the supernatant down the sink and dispose of solid residue as general waste. Wash spill area thoroughly with water; ensure no permanganate residues remain in contact with combustible material. Wash any contaminated clothing before reuse.

### WASTE DISPOSAL

Solid potassium permanganate must not be disposed of with general waste. Store surplus or waste solid in the original container or other suitable labelled container. Arrange for collection by licenced waste disposal contractor.

**Small quantity of solution:** Treat with a reducing agent under acidic conditions to give a solution containing  $\text{Mn(II)}$ . To treat 500mL of 0.1M  $\text{KMnO}_4$  solution: Acidify by adding 10mL of 2M  $\text{H}_2\text{SO}_4$ . In a fume cupboard, slowly add 300mL of 10% w/v sodium bisulfite or sodium metabisulfite solution. The resulting solution should be colourless to faint pink. If permanganate still remains, add a further portion of bisulfite solution. Neutralise by addition of sodium carbonate to within pH 6-8. Wash the solution down the sink.

### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Give water to drink. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin thoroughly with water/shower.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor.

POISONS CENTRE: 13 11 26



**ANGER**

**Formula**  $K_2S_2O_8$   
**CAS No.** 7727-21-1  
**User Group** 11-12S (Note D)



#### DESCRIPTION

White, odourless crystals or powder.

#### SOLUBILITY

Soluble in water. Insoluble in alcohol.

**Solubility in water** 50 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 270.32  
**Melting point** ca. 100°C (decomposes)  
**Boiling point** -  
**Specific gravity** 2.48 (20°C)  
**Flammability** Non-combustible  
oxidising solid

#### REGULATORY INFORMATION

**ADG Class** 5.1  
**Packing Group** III  
**UN Number** 1492  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

H272 May intensify fire; oxidizer  
H302 Harmful if swallowed  
H315 Causes skin irritation  
H319 Causes serious eye irritation  
H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled  
H317 May cause an allergic skin reaction  
H335 May cause respiratory irritation

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (neoprene, nitrile). Exposure may cause severe irritation and corrosive injury to the skin, eyes and respiratory tract. Chronic exposure may lead to allergic dermatitis or asthma. Handle in an operating fume cupboard. Avoid generating or inhaling dust. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Handle away from heat and ignition sources and combustible materials. Use only clean, dry plastic or stainless steel tools and utensils when transferring persulfate from the stock bottle. In case of fire or runaway decomposition, flooding quantities of water should be used as the extinguishing agent.

#### STORAGE

Store in a tightly closed container in a cool, dry well-ventilated place. Over time, potassium persulfate slowly decomposes, releasing oxygen and oxides of sulfur. Decomposition is accelerated by heat, moisture, sunlight or contamination. Protect from air, moisture and direct sunlight. Store away from heat and ignition sources. Store with secondary containment (e.g. in a clear, lidded polyethylene bottle). Bottles of aqueous solutions must have a vented lid to avoid overpressurisation. Store away from acids, alkalis, halogens, reducing agents, organic substances, combustible materials, hydrogen peroxide and metals. Store with oxidising substances (DG Class 5.1).

#### APPLICATIONS

**Senior chemistry:** iodine clock reaction kinetics

#### SPILLS

Wear PPE. Remove all sources of ignition and any combustible materials from the spill area. Ensure good ventilation. **Solid spill:** Collect material with a non-sparking tool and treat as for Waste Disposal.

**Solution spill:** Absorb with non-combustible material such as sand, vermiculite or bentonite (clay cat litter). Collect with a non-sparking tool. Add material slowly to a large volume of water. Reduce the persulfate and neutralise the solution as for Waste Disposal. Decant the supernatant down the sink and dispose of solid residue as general waste.

Wash spill area thoroughly with water; ensure no persulfate residues remain in contact with combustible material. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Solid persulfates must not be disposed of with general waste. Store waste or surplus potassium persulfate in the original container or other suitable labelled container. Arrange for disposal via a licenced contractor. Persulfate which has been exposed to water or other contaminant should be disposed of.

**Small quantity of solution:** Solutions of concentration <1%: wash down the sink. Higher concentrations: Dilute to <10%, then add  $H_2SO_4$  (1M) until the pH is < 3. Cautiously add a reducing agent. 350mL of 10% sodium thiosulfate solution will reduce 500mL of 10% persulfate solution. Neutralise the resulting solution to within pH 6-8 by addition of sodium carbonate and wash down the sink.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Give water to drink. Seek immediate medical attention.

**IF ON SKIN:** Remove immediately all contaminated clothing. Wash skin with soap and plenty of water. If skin irritation or rash occurs: Get medical advice/attention

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If experiencing respiratory symptoms: Call a POISONS CENTRE or doctor.

POISONS CENTRE: 13 11 26



# Potassium sodium tartrate, tetrahydrate

*Rochelle salt; Seignette salt*

**WARNING**

**Formula**  $\text{KNaC}_4\text{H}_4\text{O}_6 \cdot 4\text{H}_2\text{O}$

**CAS No.** 6381-59-5

**User Group** 7-12

## DESCRIPTION

Colourless, odourless, translucent crystals or white powder with a cooling, saline taste. Effloresces slightly in warm air.

## SOLUBILITY

Soluble in water. Insoluble in ethanol.

**Solubility in water** 630 g/L (20°C)

## PHYSICAL DATA

|                         |  |
|-------------------------|--|
| <b>Molar mass</b>       | 282.22   |
| <b>Melting point</b>    | 70-80°C  |
| <b>Boiling point</b>    | 100°C (-3H <sub>2</sub> O)<br>130-140°C (-4H <sub>2</sub> O)<br>220°C (decomposes) |
| <b>Specific gravity</b> | 1.79   |
| <b>Flammability</b>     | Non-combustible  |

## REGULATORY INFORMATION

|                         |      |
|-------------------------|------|
| <b>ADG Class</b>        | -    |
| <b>Packing Group</b>    | -    |
| <b>UN Number</b>        | None |
| <b>Poisons Schedule</b> | -    |
| <b>Security</b>         | -    |

## HAZARD STATEMENTS

Not classified as hazardous

## STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Store away from acids and strong oxidising agents. Store with general organic solids.

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Exposure may cause skin, eye or respiratory irritation. Handle in a well-ventilated area. Avoid generating and inhaling dust and contact with skin and eyes.

## SPILLS

Wear PPE, sweep up and treat as for waste.

## WASTE DISPOSAL

**Small quantity:** Dilute to 1% and dispose of down the sink.

**Large quantity:** Place in a labelled bottle for waste dry chemicals and store for collection by a licenced waste disposal contractor.

## APPLICATIONS

**General science:** for crystal growing activities; preparation of the salt from sodium hydrogen carbonate and cream of tartar.

**Senior biology:** a component of Fehling's solution.

**Senior physics:** crystals of the salt are used to demonstrate piezoelectricity.

## PREPARATIONS

Fehling's solution is used to test for aldehydes or to distinguish between a reducing sugar such as glucose, fructose, or galactose and a non-reducing sugar such as sucrose. A positive result is a brick red precipitate of  $\text{Cu}_2\text{O}$ .

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Seek medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. If recovery is not rapid, seek medical advice/attention.

**IF ON SKIN:** Remove contaminated clothing. Wash skin thoroughly with plenty of water. If skin irritation occurs: Seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur: Seek medical advice/attention.



# Potassium sodium tartrate, tetrahydrate

Formula  $\text{KNaC}_4\text{H}_4\text{O}_6 \cdot 4\text{H}_2\text{O}$

CAS No. 6381-59-5

MW 282.22

Solubility in water 630 g/L (20°C)

## LABORATORY NOTES

**TABLE 1: Quantity of potassium sodium tartrate tetrahydrate required to prepare a solution of given volume and concentration**

| concentration      | final volume of solution |          |          |         |
|--------------------|--------------------------|----------|----------|---------|
|                    | 1000 mL                  | 500 mL   | 250 mL   | 100 mL  |
| 0.1 M <sup>a</sup> | 28.22 g                  | 14.11 g  | 7.05 g   | 2.82 g  |
| 0.5 M              | 141.11 g                 | 70.55 g  | 35.28 g  | 14.11 g |
| 1.0 M              | 282.22 g                 | 141.11 g | 70.55 g  | 28.22 g |
| 2.0 M              | 564.44 g                 | 282.22 g | 141.11 g | 56.44 g |
| Saturated (20°C)   | 630 g                    | 315 g    | 157 g    | 63 g    |

a alternatively, prepare by a 1 part in 10 dilution of a 1.0 M solution.

### Procedure

1. Weigh out the required mass of solid
2. Place distilled water to about one-half the final volume in a mixing vessel such as a beaker or conical flask.
3. Transfer the solid to the mixing vessel and stir until the solution is clear and all of the solid has dissolved.
4. Transfer the solution to a measuring cylinder or volumetric flask and make up to the final volume.
5. Transfer the solution to a labelled bottle.

### Fehling's solution (test for aldehydes, reducing sugars)

Prepare Solution A and Solution B. Mix the two solutions together in a ratio of 1:1 just prior to use.

**Fehling's solution A:** Dissolve 34.66 g copper sulfate pentahydrate ( $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ) in approximately 300 mL of distilled water. Make up the solution to 500 mL.

**Fehling's solution B:** Mix 173 g potassium sodium tartrate tetrahydrate ( $\text{KNaC}_4\text{H}_4\text{O}_6 \cdot 4\text{H}_2\text{O}$ ) and 50 g sodium hydroxide ( $\text{NaOH}$ ) with approximately 350 mL of distilled water and stir until dissolved. Make up the solution to 500 mL.



**Formula** C<sub>3</sub>H<sub>8</sub>O  
**CAS No.** 71-23-8  
**User Group** 11-12



#### DESCRIPTION

Clear, colourless, highly volatile liquid with a sweet, pleasant odour.

#### SOLUBILITY

Miscible with water, ethanol and other alcohols, diethyl ether and propylene glycol. Soluble in acetone.

**Solubility in water** Miscible

#### PHYSICAL DATA

**Molar mass** 60.1  
**Melting point** -126°C  
**Boiling point** 97°C  
**Specific gravity** 0.8 (20°C)  
**Flammability** Highly flammable

#### REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** II  
**UN Number** 1274  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour  
H318 Causes serious eye damage  
H336 May cause drowsiness or dizziness

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Butyl, Viton®; neoprene, nitrile for splash protection). Exposure may cause irritation to the skin, eyes, nose, throat and respiratory tract. Symptoms of exposure include CNS depression, nausea, headache and dizziness. Prolonged or repeated skin contact can lead to dryness and cracking. Handle in an operating fume cupboard or well-ventilated area. Avoid generating and inhaling vapour or mist. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition. Store away from oxidising agents, acids, acid chlorides, halogens, alkali metals and aluminium. Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** to observe the reactivity of a primary alcohol; preparation of esters; heat of combustion investigations.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool.

**Small spill:** Add material to a large volume of water and allow to stand until the solids have settled. Decant the solution down the sink with further dilution. Dispose of the absorbent material as general waste. Alternatively, treat as for Waste Disposal of small quantity.

**Large spill:** Place material into a suitable labelled container and store for collection.

Wash the spill area thoroughly with water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Absorb onto paper towel and allow alcohol to evaporate in an operating fume cupboard. Dispose of paper towel as general waste.

**Large quantity:** Store in the original container or other suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek immediate medical advice.

**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin thoroughly with water/shower. Wash contaminated clothing before reuse. If symptoms develop, seek medical advice.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26



**ANGER**

**Formula** C<sub>3</sub>H<sub>8</sub>O  
**CAS No.** 67-63-0  
**User Group** 7-12



#### DESCRIPTION

Clear, colourless, volatile liquid with a musty odour of rubbing alcohol.

#### SOLUBILITY

Miscible with water. Soluble in ethanol, acetone and diethyl ether.

**Solubility in water** Miscible

#### PHYSICAL DATA

**Molar mass** 60.1  
**Melting point** -89°C  
**Boiling point** 82°C  
**Specific gravity** 0.78 (20°C)  
**Flammability** Highly flammable

#### REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** II  
**UN Number** 1219  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour  
H319 Causes serious eye irritation  
H336 May cause drowsiness or dizziness

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Butyl, Viton®; nitrile for splash protection). Exposure to the vapour may cause mild to moderate irritation to the skin, eyes, nose, throat and respiratory tract. Symptoms of exposure include nausea, headache, dizziness and CNS depression. Eye exposure to the liquid may cause severe irritation and possible eye damage. Prolonged or repeated skin contact can lead to dryness and cracking. Handle in an operating fume cupboard or well-ventilated area. Avoid generating and inhaling vapour or mist. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition. Test for peroxides before use, particularly if intending to heat or distill the alcohol.

#### STORAGE

2-Propanol is hygroscopic. With prolonged storage, and on exposure to air and sunlight, the alcohol may form peroxides, which may become explosive if they are concentrated. Store in a tightly closed container in a cool, dry, well-ventilated place. Protect from sunlight. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition. Store away from oxidising agents, acids, halogens, alkali metals and aluminium. Store with flammable liquids in an AS compliant cabinet. Mark the bottle with the date received and date opened.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Cover spill with non-combustible absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool.

**Small spill:** Add material to a large volume of water and allow to stand until the solids have settled. Decant the solution down the sink with further dilution. Dispose of the absorbent material as general waste.

**Large spill:** Place material into a suitable labelled container and store for collection.

Wash the spill area thoroughly with water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Add to a large volume of water and flush down the sink.

**Large quantity:** Store in a suitable labelled container and arrange for collection by a licenced waste disposal contractor. As the alcohol is a peroxide former, waste or surplus isopropanol should not be stored with any other waste.

The bottle may be hazardous when empty due to residual vapour or liquid. Do not expose the empty bottle to heat, open flames or other sources of ignition.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek immediate medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical advice.

**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin thoroughly with water/shower. Wash contaminated clothing before reuse. If irritation develops or persists, seek medical advice.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.  
POISONS CENTRE: 13 11 26

#### APPLICATIONS

**Senior chemistry:** to observe the reactivity of a secondary alcohol; heat of combustion investigations.



**Formula**  $C_3H_6O_2$

**CAS No.** 79-09-4

**User Group** 11-12



## DESCRIPTION

Colourless, oily liquid with a slightly pungent, disagreeable odour.

## SOLUBILITY

Soluble in water, ethanol and diethyl ether.

**Solubility in water** Miscible

## PHYSICAL DATA

**Molar mass** 74.08

**Melting point**  $-21^{\circ}C$

**Boiling point**  $141^{\circ}C$

**Specific gravity** 0.99 ( $20^{\circ}C$ )

**Flammability** Flammable

## REGULATORY INFORMATION

**ADG Class** 8 (3)

**Packing Group** II

**UN Number** 3463

**Poisons Schedule** S6

**Security** -

## HAZARD STATEMENTS

H226 Flammable liquid and vapour

H314 Causes severe skin burns and eye damage

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Viton®, butyl-rubber; neoprene gloves provide splash protection). Exposure may cause severe irritation to the skin, eyes and respiratory tract. Eye contact may result in burns and permanent eye damage. Inhalation exposure may lead to an asthma-like bronchitis.

Handle only in an operating fume cupboard or well-ventilated area. Avoid generating and inhaling vapour or mist. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Vapours may form explosive mixtures with air. Handle away from heat and ignition sources.

Contact with reactive metals such as aluminium, iron, tin and zinc may generate flammable hydrogen gas.

## SPILLS

Wear PPE. Ensure good ventilation. Eliminate all ignition sources. Cover spill with sodium carbonate or a 1:1:1 mixture of sand, sodium carbonate and vermiculite or bentonite (clay cat litter). Collect spilled material with a non-sparking tool. Add slowly to a large volume of water with stirring. Neutralise the solution to within pH 6-8 by addition of sodium carbonate in portions (test with pH paper). Decant the neutral solution down the sink with further dilution. Dispose of the residual solids as general waste. Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

## WASTE DISPOSAL

**Small quantity:** Dilute waste to a concentration of about 5% by slowly adding the acid to water with stirring. Neutralise the solution to within pH 6-8 by addition of sodium carbonate in portions (test with pH paper). Flush the neutral solution down the sink with further dilution.

**Large quantity:** Store in the original container or other suitable labelled container. Arrange for collection by a licenced waste disposal contractor.

## STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Ensure container is kept upright to prevent leakage. Store away from heat and any sources of ignition.

Store away from oxidising agents, bases and reactive metals.

Store separately from other chemicals, on a low shelf, with secondary containment.

## APPLICATIONS

**Senior chemistry:** ester preparation.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek immediate medical attention.

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. Seek immediate medical attention.

**IF ON SKIN:** Remove immediately all contaminated clothing and wash before reuse. Rinse skin thoroughly with water/shower. Seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical attention.



**Formula** C<sub>5</sub>H<sub>10</sub>O<sub>2</sub>

**CAS No.** 109-60-4

**User Group** 11-12



#### DESCRIPTION

Colourless, highly volatile liquid with a pear-like odour.

#### SOLUBILITY

Sparingly soluble in water. Miscible with ethanol and diethyl ether.

**Solubility in water** 21.2 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 102.13

**Melting point** -93°C

**Boiling point** 102°C

**Specific gravity** 0.89 (20°C)

**Flammability** Highly flammable

#### REGULATORY INFORMATION

**ADG Class** 3

**Packing Group** II

**UN Number** 1276

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

H225 Highly flammable liquid and vapour

H319 Causes serious eye irritation

H336 May cause drowsiness or dizziness

AUH066 Repeated exposure may cause skin dryness and cracking

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (butyl rubber). Exposure may cause skin, eye or respiratory irritation. Inhalation or ingestion may cause headache, dizziness or drowsiness.

Handle in an operating fume cupboard or well-ventilated area. Avoid breathing vapour and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.

The ester may attack/dissolve some plastics.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Absorb spill with paper towel, or cover with inert absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool.

**Small spill:** Evaporate as for Waste Disposal.

**Large spill:** Place material into a suitable labelled container and store for collection.

Wash the spill area with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Absorb onto paper towel or other absorbent and allow the solvent to evaporate in an operating fume cupboard. Dispose of absorbent material as general waste.

**Large quantity:** Store in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Store away from heat and any sources of ignition. Ensure container is kept upright to prevent leakage.

Store away from oxidising agents, acids, bases and alkali metal hydroxides.

Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**Senior chemistry:** product of the esterification reaction between acetic acid and *n*-propanol.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical attention.

**IF ON SKIN:** Take off immediately all contaminated clothing. Wash skin thoroughly with plenty of soap and water.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26.





**Formula** C<sub>7</sub>H<sub>14</sub>O<sub>2</sub>

**CAS No.** 105-66-8

**User Group** 11-12



## DESCRIPTION

Clear, colourless liquid with a sweet odour.

## SOLUBILITY

Slightly soluble in water. Miscible with ethanol and diethyl ether.

**Solubility in water** Slightly soluble

## PHYSICAL DATA

**Molar mass** 130.19

**Melting point** -95°C

**Boiling point** 143°C

**Specific gravity** 0.87 (20°C)

**Flammability** Flammable

## REGULATORY INFORMATION

**ADG Class** 3

**Packing Group** III

**UN Number** 3272

**Poisons Schedule** -

**Security** -

## HAZARD STATEMENTS

H226 Flammable liquid and vapour

H315 Causes skin irritation

H319 Causes serious eye irritation

H335 May cause respiratory irritation

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (PE/EVAL; butyl rubber for splash contact). Exposure may cause skin, eye or respiratory irritation. Inhalation or ingestion may cause headache, dizziness or drowsiness. Handle in an operating fume cupboard or well-ventilated area. Avoid breathing vapour and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition. The ester may attack/dissolve some plastics.

## STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Store away from heat and any sources of ignition. Ensure container is kept upright to prevent leakage. Store away from oxidising agents, acids and bases. Store with flammable liquids in an AS compliant cabinet.

## APPLICATIONS

**Senior chemistry:** product of the esterification reaction between butyric acid and *n*-propanol.

## SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Absorb spill with paper towel, or cover with inert absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool.

**Small spill:** Evaporate as for Waste Disposal.

**Large spill:** Place material into a suitable labelled container and store for collection.

Wash the spill area with detergent and water. Wash any contaminated clothing before reuse.

## WASTE DISPOSAL

**Small quantity:** Absorb onto paper towel or other absorbent and allow the solvent to evaporate in an operating fume cupboard. Dispose of absorbent material as general waste.

**Large quantity:** Store in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical attention if feeling unwell.

**IF ON SKIN:** Take off immediately all contaminated clothing. Wash skin thoroughly with plenty of soap and water. If skin irritation occurs: Get medical advice/attention. Wash contaminated clothing before reuse.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26.



**Formula**  $C_6H_{12}O_2$   
**CAS No.** 106-36-5  
**User Group** 11-12



## DESCRIPTION

Colourless liquid with a pear-like odour.

## SOLUBILITY

Slightly soluble in water. Miscible with ethanol and diethyl ether. Soluble in acetone.

**Solubility in water** 5 g/L (20°C)

## PHYSICAL DATA

**Molar mass** 116.16  
**Melting point** -76°C  
**Boiling point** 122°C  
**Specific gravity** 0.88 (20°C)  
**Flammability** Highly flammable

## REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** II  
**UN Number** 3272  
**Poisons Schedule** -  
**Security** -

## HAZARD STATEMENTS

H225 Highly flammable liquid and vapour  
H332 Harmful if inhaled

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (PE/EVAL; butyl rubber, nitrile for splash contact). Exposure may cause irritation to the skin, eyes, nose and throat and respiratory tract. Inhalation or ingestion may cause headache, dizziness or drowsiness.  
Handle in an operating fume cupboard or well-ventilated area. Avoid breathing vapour and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.  
There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.  
The ester may attack/dissolve some plastics.

## STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Store away from heat and any sources of ignition. Ensure container is kept upright to prevent leakage.  
Store away from oxidising agents, acids and bases.  
Store with flammable liquids in an AS compliant cabinet.

## APPLICATIONS

**Senior chemistry:** product of the esterification reaction between propionic acid and *n*-propanol.

## SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Absorb spill with paper towel, or cover with inert absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand and scoop up with a non-sparking tool.

**Small spill:** Evaporate as for Waste Disposal.

**Large spill:** Place material into a suitable labelled container and store for collection.

Wash the spill area with detergent and water. Wash any contaminated clothing before reuse.

## WASTE DISPOSAL

**Small quantity:** Absorb onto paper towel or other absorbent and allow the solvent to evaporate in an operating fume cupboard. Dispose of absorbent material as general waste.

**Large quantity:** Store in a suitable labelled container such as for non-halogenated organic liquid waste and arrange for collection by a licenced waste disposal contractor.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical attention if feeling unwell.

**IF ON SKIN:** Take off immediately all contaminated clothing. Wash skin thoroughly with plenty of soap and water. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.

POISONS CENTRE: 13 11 26.



**Formula**  $C_3H_8O_2$

**CAS No.** 57-55-6

**User Group** 7-12

#### DESCRIPTION

Clear, colourless, almost odourless, viscous liquid with a slightly acid taste.

#### SOLUBILITY

Miscible with water, ethanol and acetone. Soluble in diethyl ether. Sparingly soluble in petroleum ether.

**Solubility in water** Miscible

#### PHYSICAL DATA

**Molar mass** 76.1

**Melting point**  $-60^{\circ}\text{C}$

**Boiling point**  $188^{\circ}\text{C}$

**Specific gravity** 1.04 ( $20^{\circ}\text{C}$ )

**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

Not classified as hazardous

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Eye contact may cause mild irritation. Inhalation of vapour or mist from the heated substance may cause respiratory irritation. Repeated or prolonged skin contact may lead to irritation and dermatitis. Ingestion of a large amount may cause gastric irritation and CNS effects. Avoid generating and inhaling vapour or mist. If mists or vapours are being generated, work in an operating fume cupboard or well-ventilated area. Avoid ingestion and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Vapours may form explosive mixtures with air if heated strongly. Handle away from heat and sources of ignition. The glycol may attack/dissolve some plastics.

#### STORAGE

The glycol is hygroscopic and light sensitive. With prolonged storage, explosive peroxides may form. Store in a tightly closed container in a cool, dry well-ventilated place. Protect from light and moisture. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition. Store away from oxidising agents, reducing agents, acids, alkalis and acid chlorides. Store with flammable and combustible liquids in an AS compliant cabinet.

#### APPLICATIONS

**General science/Senior physics:** to observe its physical properties (density, viscosity, refractive index, 'antifreeze' properties).

#### SPILLS

Wear PPE. Eliminate all ignition sources. Cover spill with sand, or other inert material such as vermiculite or bentonite. Scoop up with a non-sparking tool.

**Small quantity:** Seal material in a plastic bag and dispose of as general waste.

**Large quantity:** Place in a suitable labelled container and arrange for collection.

Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Absorb with non-combustible material. Seal in a plastic bag and dispose of as general waste.

**Large quantity:** Store in a suitable labelled container and arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If symptoms persist, seek medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. If symptoms develop or if large amount ingested, seek medical attention.

**IF ON SKIN:** Remove contaminated clothing. Wash skin thoroughly with plenty of water. If irritation occurs, seek medical attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms develop, seek medical attention.



**Formula**  $C_{10}H_{16}Cl_2O_2$

**CAS No.** 111-19-3

**User Group** 11-12



## DESCRIPTION

Colourless, pale yellow liquid with a pungent odour.

## SOLUBILITY

Soluble in hydrocarbons and diethyl ether.

**Solubility in water** Decomposes

## PHYSICAL DATA

**Molar mass** 239.14

**Melting point** -5--3°C

**Boiling point** 161°C

**Specific gravity** 1.12 (20°C)

**Flammability** Combustible

## REGULATORY INFORMATION

**ADG Class** 8

**Packing Group** II

**UN Number** 3265

**Poisons Schedule** -

**Security** -

## HAZARD STATEMENTS

H302 Harmful if swallowed

H314 Causes severe skin burns and eye damage

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (butyl rubber; nitrile for splash contact). Sebacoyl chloride is corrosive and a lachrymator. Exposure may cause irritation and burns to the skin, eyes, respiratory tract and on ingestion. Eye exposure to the liquid or vapour may cause permanent damage. Skin contact may lead to dermatitis. Handle only in an operating fume cupboard. Avoid breathing vapour and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Handle away from heat and sources of ignition.

The reaction with water gives sebacic acid and hydrogen chloride.

## STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Protect from moisture. Ensure container is kept upright to prevent leakage. Store away from heat and sources of ignition. Store away from alcohols, oxidising agents, bases, alkali hydroxides, amines, alkali metals and alkaline earth metals. Store with corrosive liquids (organic acids).

## APPLICATIONS

**Senior chemistry:** a reagent in the preparation of nylon.

## SPILLS

Wear PPE. Ensure good ventilation. Remove all sources of ignition. Cover spill with a mixture of sodium carbonate or sodium bicarbonate and non-combustible absorbent such as sand, vermiculite or bentonite (clay cat litter). Scoop up with a non-sparking tool into a bucket of water. Allow the mixture to stand overnight. Test the pH (pH paper) and neutralise the solution by addition of HCl (1-2M) or sodium carbonate as necessary. Flush the neutral solution down the sink. Dispose of residual absorbent material as general waste. Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

## WASTE DISPOSAL

The acid chloride can be decomposed by its reaction with aqueous base to give a non-hazardous water-soluble salt. Note that sebacoyl chloride requires 4 equivalents of base for neutralisation.

**Small quantity:** Add the waste acid chloride to sodium hydroxide solution (2M) or sodium carbonate solution (2M) at the rate of 1mL of acid chloride to 20 mL of aqueous base. Carbon dioxide gas will evolve from the reaction with sodium carbonate. Allow the mixture to stand overnight. Neutralise the solution to pH ~7 by addition of HCl (1-2M) and flush down the sink.

**Large quantity:** Store in a suitable labelled container and arrange for collection by a licenced waste contractor.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Take off immediately all contaminated clothing and wash before reuse. Wash skin thoroughly with plenty of water. If irritation occurs, seek medical attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If effects persist, seek medical attention.

POISONS CENTRE: 13 11 26.



**Formula** Si  
**CAS No.** 7440-21-3  
**User Group** 11-12

#### DESCRIPTION

Brittle, odourless, steel grey pieces or black to grey, lustrous needle-like crystals or platelets.

#### SOLUBILITY

Soluble in molten alkali oxides. Insoluble in organic solvents and mineral acids.

**Solubility in water** Insoluble

#### PHYSICAL DATA

**Molar mass** 28.09  
**Melting point** 1410°C  
**Boiling point** 2355°C  
**Specific gravity** 2.33 (20°C)  
**Flammability** Non-combustible

#### REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

Not classified as hazardous

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause mild irritation to the skin, eyes and respiratory tract.

Handle in a well-ventilated area. Avoid generating and inhaling dust. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

The flammability of silicon and its reactivity toward water increase as particle size decreases. Silicon in bulk form is considered non-flammable. However, silicon pieces can ignite if heated to high temperatures. Silicon dust can form explosive mixtures with air.

At room temperature on exposure to air, silicon develops a protective oxide layer. When heated, silicon will react with water, generating flammable hydrogen gas.

In case of fire, use dry sand or dry powder suitable for metal fires; do not use water, foam or CO<sub>2</sub> extinguisher.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Collect large pieces with a dry clean tool. Scoop up remaining material with a non-sparking tool into a suitable labelled container and store for collection. If the spill material is moist or wet, do not store in a closed container. Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Store waste or surplus silicon in the original container or other suitable, labelled container and arrange for collection by a licenced waste disposal contractor. If the material is wet or damp, do not store in a closed container as hydrogen may be slowly generated. Small quantities of bulk silicon can be disposed of as general waste; the expected environmental fate of elemental silicon is its slow oxidation to form silica.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place. Protect from moisture. Store away from sources of heat or ignition.

Store away from oxidising agents, acids, alkali carbonates, active metals and calcium.

Store with general inorganic solids.

#### APPLICATIONS

**General science:** qualitative properties of a metalloid element.

**Senior physics:** investigations of the change in electrical conductivity of silicon with temperature.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical attention

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin with plenty of soap and water. If skin irritation persists, seek medical attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical attention.





**Formula** Si  
**CAS No.** 7440-21-3  
**User Group** 11-12

## DESCRIPTION

Odourless, dark brown powder.

## SOLUBILITY

Soluble in molten alkali oxides. Insoluble in organic solvents and mineral acids.

**Solubility in water** Insoluble

## PHYSICAL DATA

**Molar mass** 28.09  
**Melting point** 1410°C  
**Boiling point** 2355°C  
**Specific gravity** 2.33 (20°C)  
**Flammability** Flammable

## REGULATORY INFORMATION

**ADG Class** 4.1  
**Packing Group** III  
**UN Number** 1346  
**Poisons Schedule** -  
**Security** -

## HAZARD STATEMENTS

H228 Flammable solid

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure may cause mechanical irritation to the skin, eyes and respiratory tract.

Handle in a well-ventilated area. Avoid generating and inhaling dust. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Handle away from heat and sources of ignition.

The flammability of silicon and its reactivity toward water increase as the particle size decreases. Silicon powder can form explosive mixtures with air. Silicon will react with water, generating flammable hydrogen gas; the reaction with silicon dust proceeding at room temperature but requiring heat for silicon of a larger particle size.

At room temperature on exposure to air, silicon develops a protective oxide layer.

In case of fire, use dry sand or dry powder suitable for metal fires; do not use water, foam or CO<sub>2</sub> extinguisher.

## SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation. Scoop up with a non-sparking tool into a suitable labelled container and store for collection. If the spill material is wet or damp, do not store in a closed container.

Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

## WASTE DISPOSAL

Store waste or surplus silicon powder in the original container or other suitable, labelled container and arrange for collection by a licenced waste disposal contractor. If the material is wet or damp, do not stored in a closed container as hydrogen may be slowly generated.

## STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Protect from moisture. Store away from sources of heat or ignition.

Store away from oxidising agents, acids, alkali carbonates, active metals and calcium.

Store with flammable solids (DG Class 4.1).

## APPLICATIONS

**Senior chemistry:** demonstration of the redox reaction between sand and magnesium powder, giving elemental silicon.

**Technical:** preparation of silicon tetrachloride.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical attention.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin with soap and plenty of water. If skin irritation persists, seek medical attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical attention.



**Formula** Na

**CAS No.** 7440-23-5

**User Group** Staff



#### DESCRIPTION

Silvery-white, ductile, light, soft metal; rapidly tarnishes on exposure to air, becoming greyish-white.

#### SOLUBILITY

Reacts violently with water, releasing flammable hydrogen gas. Soluble in liquid ammonia, giving a blue solution.

**Solubility in water** Reacts with water

#### PHYSICAL DATA

**Molar mass** 22.99

**Melting point** 97.8°C

**Boiling point** 881°C

**Specific gravity** 0.968 (20°C)

**Flammability** Flammable solid

#### REGULATORY INFORMATION

**ADG Class** 4.3

**Packing Group** I

**UN Number** 1428

**Poisons Schedule** -

**Security** IDM Cat 2

#### HAZARD STATEMENTS

H260 In contact with water releases flammable gases which may ignite spontaneously.

H314 Causes severe skin burns and eye damage.

AUH014 Reacts violently with water.

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Sodium is corrosive and a strong reducing agent. Exposure can cause severe irritation and burns to the skin, eyes and respiratory tract. Fumes of burning sodium are highly irritating. The reaction with water generates flammable hydrogen gas and caustic sodium hydroxide.

Avoid contact with skin and eyes. Ensure that all tools used in handling are dry. Handle away from open flames and other ignition sources.

In case of fire, use dry chemical, dry sand, soda ash, or lime; do not use water, foam or CO<sub>2</sub> extinguisher.

#### STORAGE

Sodium is air and moisture sensitive. Store in a tightly closed container in a cool, dry place away from heat and light. Ensure that metal is protected from moisture by storing under paraffin oil. Sodium reacts violently with water; keep away from contact with water. Store away from heat and sources of ignition.

Store away from acids, heavy metals, halogenated hydrocarbons, oxidising agents, halogens, alcohols and sulfur. Store with DG Class 4.3 Dangerous When Wet substances.

#### SPILLS

See Laboratory Notes

#### WASTE DISPOSAL

**Small quantity:** See Laboratory Notes

**Large quantity of waste:** Store under mineral oil in a suitable container and arrange for collection by a licenced waste disposal contractor.

#### APPLICATIONS

**Senior chemistry:** In the demonstration of the reaction of an alkali metal with water.

#### PREPARATIONS

For detailed safety notes and procedure, see Science ASSIST Standard Operating Procedure: Demonstrating the reaction of alkali metals with water.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing. Brush off loose particles from skin. Rinse skin with water/shower. If skin irritation or a rash occurs: Get medical advice/attention.

**IF INHALED- metal oxide fumes (unlikely) or hydrogen gas:** Move patient to fresh air and keep at rest in a position comfortable for breathing.

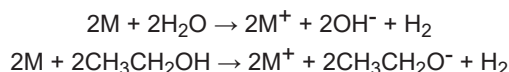
POISONS CENTRE: 13 11 26

# alkali metals

## LABORATORY NOTES

### PROCEDURES FOR THE TREATMENT OF WASTE ALKALI METALS: LITHIUM AND SODIUM

**Principle of destruction:** Lithium and sodium are destroyed by their reaction with either water or an alcohol to yield hydrogen gas and the metal hydroxide or metal alkoxide, respectively. The reaction with an alcohol is slower than the reaction with water.



**Wear PPE:** laboratory coat or apron, closed shoes, safety glasses, gloves (nitrile). Carry out the destruction procedure in an operating fume cupboard. Ensure that there are no ignition sources present. Having a fire blanket close to hand, to smother the reaction if necessary, is also advisable.

#### DESTRUCTION OF WASTE LITHIUM (up to 1g)

To 1-2L of iced water in a beaker or bucket, cautiously add small pieces of lithium, one piece at a time at such a rate that hydrogen evolves in a controlled manner and the reaction does not become violent. Allow each piece to react completely before adding the next. Neutralise the solution with dilute citric acid or hydrochloric acid (1M) to within pH 6-8 and dispose of down the sink.

The method for destruction of sodium by its reaction with ethanol can also be used with lithium.<sup>1</sup> Lithium reacts more slowly with ethanol than does sodium, and the lithium-ethanol mixture should be allowed to stand overnight to ensure complete reaction of the metal.

#### DESTRUCTION OF WASTE SODIUM<sup>1</sup> (up to 1g)

To 100mL of cold ethanol or methylated spirits in a beaker, cautiously add small pieces of sodium, one piece at a time at such a rate that hydrogen evolves in a controlled manner and the reaction does not become violent. Stir the mixture until all of the sodium has completely reacted. Cautiously add a few mL of water with stirring, and allow the mixture to stand for 1 hour, to ensure that there is no residual unreacted sodium. Dilute the solution with an equal volume of water, and neutralise with dilute citric acid or hydrochloric acid (1M) to within pH 6-8. Dilute ten-fold with water and flush down the sink.

Sodium can also be destroyed by reacting it with isopropanol (propan-2-ol). The reaction of sodium with isopropanol is slower than the reaction with ethanol, and the sodium-isopropanol mixture should be allowed to stand overnight to ensure complete reaction of the metal. A small quantity of ethanol is then added with stirring, and the mixture is allowed to stand for 1 hour. Water is then added, and so on as in the procedure using ethanol.

#### TREATMENT OF SPILLS OF LITHIUM OR SODIUM<sup>2</sup>

Wear PPE. Isolate spill area. Eliminate all sources of ignition. Using a dry tool, collect larger pieces of the metal and return them to the storage container. If water is present, cover the residual spill with a 1:1:1 mixture by weight of sodium carbonate, cat litter (bentonite) and dry sand. If no water is present, cover the residual spill with dry sand. Collect material into a corrosion-resistant container with a non-sparking tool. To a large volume of cold ethanol/methylated spirits in a beaker or bucket, slowly add the collected material in small portions with stirring. Allow each portion to react completely before adding the next. Allow the mixture to stand overnight. Add a small volume of water with stirring and allow to stand for 1 hour. Dilute the mixture with an equal volume of water and neutralise to within pH 6-8. Dilute the neutral solution further with water and decant the solution down the sink. Dispose of the solid material in the general waste. Wet the spill area with ethanol/methylated spirits and then rinse with water to ensure destruction of any metal residues.

#### REFERENCES

1. Adapted from Lunn, G., Sansone, E. B., Destruction of Hazardous Chemicals in the Laboratory, John Wiley & Sons, 2012, p 37.
2. Armour, M.A., Hazardous Laboratory Chemicals Disposal Guide, CRC Press, 2003, p. 325 and p. 535.



**Formula**  $\text{Na}_2\text{CO}_3$   
**CAS No.** 497-19-8  
**User Group** 7-12

#### DESCRIPTION

Colourless, odourless, hygroscopic powder with a bitter taste.

#### SOLUBILITY

Soluble in water and glycerol. Slightly soluble in alcohol. Insoluble in acetone.

**Solubility in water** 217 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 105.99  
**Melting point** 851°C  
**Boiling point** decomposes  
**Specific gravity** 2.53  
**Flammability** Non-combustible

#### REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** S5  
**Security** -

#### HAZARD STATEMENTS

H319 Causes serious eye irritation

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Aqueous solutions are strongly basic. Exposure may cause irritation to the skin, eyes and respiratory tract. May be corrosive, causing burns, at high concentrations or with prolonged or repeated exposure. Eye contact may result in severe eye damage. Prolonged or repeated skin contact may cause dermatitis and skin sensitization.

Handle in a well-ventilated area. Avoid generating dust. Avoid inhalation and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

To prepare a standard solution, absorbed water can be removed by heating the salt at 260-270°C for 30 minutes, then allowing it to cool in a desiccator.

#### STORAGE

The salt is hygroscopic. Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Protect from moisture.

Store away from acids and oxidising agents.  
Store with general inorganic solids.

#### APPLICATIONS

**Senior chemistry:** primary standard for acid-base titrations.  
**Technical:** preparation of buffers; neutralising agent.

#### SPILLS

Wear PPE. Ensure good ventilation. Scoop spill material into a plastic container.

**Small spill:** Treat as for Waste Disposal.

**Large spill:** Place into a suitable labelled container and store for collection. Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Wear PPE and work in a fume cupboard. Add waste potassium carbonate slowly to a large volume of cold water. Neutralise the solution to within pH 6 - 8 by addition of 5% hydrochloric acid, with stirring. Flush the neutral solution down the sink.

**Large quantity:** Place in a suitable labelled container. Arrange for collection by a licenced waste contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. Seek medical attention.

**IF ON SKIN:** Remove contaminated clothing. Rinse skin thoroughly with water/shower. If irritation occurs, seek medical advice

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical advice/attention.



# sodium hydrogen carbonate

*sodium bicarbonate; baking soda*

**Formula**  $\text{NaHCO}_3$

**CAS No.** 144-55-8

**User Group** F-12

## DESCRIPTION

Colourless, odourless crystals, granules or powder

## SOLUBILITY

Soluble in water. Slightly soluble in alcohol.

**Solubility in water** 96 g/L (20°C)

## PHYSICAL DATA

**Molar mass** 84.01

**Melting point** 270°C decomposes

**Boiling point** -

**Specific gravity** 2.22 (20°C)

**Flammability** Non-combustible

## REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** -

**Security** -

## HAZARD STATEMENTS

Not classified as hazardous

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Aqueous solutions are weakly basic.

Exposure may cause mild irritation to the skin, eyes and respiratory tract. Prolonged or repeated skin contact may cause drying and cracking.

Handle in a well-ventilated area. Avoid generating dust. Avoid inhalation and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

When heated above 50°C, the bicarbonate gradually decomposes to give sodium carbonate, water and carbon dioxide.

## STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Protect from moisture.

Store away from acids and oxidising agents.

Store with general inorganic solids.

## APPLICATIONS

**General science:** acid-base chemistry.

**Senior chemistry:** example of a weak base.

**Technical:** preparation of buffers; neutralising agent.

## SPILLS

Wear PPE. Ensure good ventilation. Scoop up spill material into a plastic container. Treat as for Waste Disposal.

Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

## WASTE DISPOSAL

**Small quantity:** (i) Seal in a plastic bag and dispose of as general waste. Alternatively, (ii) Wearing PPE and working in a fume cupboard, add waste sodium bicarbonate slowly to a large volume of water. Neutralise the solution to within pH 6 - 8 by addition of 5% hydrochloric acid, with stirring. Flush the neutral solution down the sink.

**Large quantity:** Place in a suitable labelled container. Arrange for collection by a licenced waste contractor.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If irritation occurs, seek medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Give water to drink. If effects persist, seek medical attention.

**IF ON SKIN:** Remove contaminated clothing. Rinse skin thoroughly with water. If symptoms occur, seek medical attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical advice/attention.





# sodium hydroxide

caustic soda; soda lye

**DANGER**



**Formula** NaOH  
**CAS No.** 1310-73-2  
**User Group** 11-12

## DESCRIPTION

Colourless, odourless, hygroscopic pellets or flakes.

## SOLUBILITY

Soluble in water, alcohol and glycerol.  
Insoluble in acetone and diethyl ether.

**Solubility in water** 1090 g/L (20°C)

## PHYSICAL DATA

**Molar mass** 40.00  
**Melting point** 318-323°C  
**Boiling point** 1390°C  
**Specific gravity** 2.13 (20°C)  
**Flammability** Non-combustible

## REGULATORY INFORMATION

**ADG Class** 8  
**Packing Group** II  
**UN Number** 1823  
**Poisons Schedule** S6  
**Security** IDM Cat 3

## HAZARD STATEMENTS

H290 May be corrosive to metals  
H314 Causes severe skin burns and eye damage

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). The solid and solutions are highly corrosive; aqueous solutions are strongly basic. Exposure may cause irritation and burns to the skin, eyes and respiratory tract and on ingestion. Eye contact may result in severe eye damage and permanent injury. Skin contact may cause irritant dermatitis.

Handle in a well-ventilated area. Avoid generating dust. Avoid inhalation and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Dissolution of the hydroxide in water generates much heat. Carry out solution preparation in an operating fume cupboard. Place the mixing vessel in an ice-bath and add the solid cautiously to water. Avoid inhaling mist or fumes from the hot solution.

## STORAGE

The hydroxide is hygroscopic and reacts with carbon dioxide from the air to form sodium carbonate. Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Protect from air and moisture. Avoid storing solutions of the hydroxide in glass bottles, especially those with glass stoppers, as the hydroxide will react with the glass and the stopper may become fused. Store away from acids, oxidising agents, metals, ammonium salts and organic materials. Store with corrosive solids.

## APPLICATIONS

**General science:** an example of a strong base; to demonstrate an exothermic dissolution process.  
**Senior chemistry:** diluted, in acid-base titrations.

## SPILLS

Wear PPE. Ensure good ventilation.

**Small spill:** Scoop into a plastic container. Treat as for Waste Disposal.

**Large spill:** Scoop up and place into a suitable labelled container and store for collection.

Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

## WASTE DISPOSAL

**Small quantity:** Wear PPE and work in a fume cupboard. Add waste sodium hydroxide slowly, with stirring, to a large volume of ice-water. Neutralise the solution to within pH 6 - 8 by slow addition of 5% hydrochloric acid, with stirring. Flush the neutral solution down the sink.

**Large quantity:** Place in a suitable labelled container. Arrange for collection by a licenced waste contractor.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin thoroughly with water/shower. Seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISONS CENTRE or doctor.

POISONS CENTRE: 13 11 26



## sodium hypochlorite, 5-9% solution

*bleach; hypochlorous acid, sodium salt*

**WARNING**



**Formula** NaOCl  
**CAS No.** 7681-52-9  
**User Group** 7-12S

### DESCRIPTION

Pale yellow liquid with a pungent chlorine-like odour.

### SOLUBILITY

Miscible with water. Reacts with organic solvents.

**Solubility in water** Miscible

### PHYSICAL DATA

**Molar mass** 77.44  
**Melting point** -6°C (5%)  
**Boiling point** decomposes  
**Specific gravity** 1.1 (6%)  
**Flammability** Non-combustible

### REGULATORY INFORMATION

**ADG Class** -  
**Packing Group** -  
**UN Number** None  
**Poisons Schedule** S5  
**Security** -

### HAZARD STATEMENTS

H315 Causes skin irritation  
H319 Causes serious eye irritation  
AUH031 Contact with acid liberates toxic gas

### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). The solution is a moderately strong oxidising agent and is strongly alkaline. Exposure may cause severe irritation to the skin, eyes and respiratory tract and on ingestion. Asthma, dermatitis or conjunctivitis can result from repeated or prolonged inhalation, skin or eye exposure (respectively).

Handle in an operating fume cupboard or well-ventilated area. Avoid breathing vapour or mist and contact with skin, eyes and clothing. Handle away from heat and sources of ignition. Take care when opening the bottle in case of overpressurisation.

Mixing bleach with acid, particularly hydrochloric acid, generates toxic chlorine gas.

### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Commercial bleach solutions are expected to be relatively stable but will decompose slowly over time, releasing low concentrations of oxygen and chlorine gases. Decomposition is accelerated with exposure to heat, sunlight, metal oxides or other impurities.

Store away from reducing agents, strong acids, organic substances, combustible materials, powdered metals, amines, ammonium salts.

Store with corrosive substances (non-acids).

### APPLICATIONS

**General science:** example of a household substance.

**Senior biology:** an antimicrobial agent.

**Senior chemistry:** determination of chlorine in bleach.

**Technical:** preparation of chlorine or bromine water; disinfectant.

### SPILLS

Wear PPE. Ensure good ventilation. Dilute spill with water and wash down the sink with further dilution.

Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

### WASTE DISPOSAL

Dilute to a concentration of  $\leq 0.5\%$  and wash down the sink. Alternatively, sodium hypochlorite solution can be treated with a reducing agent. 100mL of 10% sodium bisulfite or sodium metabisulfite will reduce 100 mL of 5% sodium hypochlorite solution. Work in a fume cupboard. Dilute the hypochlorite solution to a concentration  $\leq 5\%$ . Add the reducing agent slowly to the hypochlorite solution, with stirring. Neutralise the resulting solution to within pH 6-8 by cautious addition of hydrochloric acid (1M). Wash the neutral solution down the sink with further dilution.

**Large quantity** of surplus sodium hypochlorite: Arrange for collection by a licenced waste disposal contractor.

### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Give water to drink. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing and wash before reuse. Rinse skin thoroughly with water/shower. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical advice/attention.

POISONS CENTRE: 13 11 26



# sodium hypochlorite, 10-12.5% solution

bleach; hypochlorous acid, sodium salt

**ANGER**

**Formula** NaOCl  
**CAS No.** 7681-52-9  
**User Group** 7-12S



## DESCRIPTION

Pale yellow liquid with a pungent chlorine-like odour. Commercial products of this concentration are available as swimming pool 'chlorine' or industrial bleach.

## SOLUBILITY

Miscible with water. Reacts with organic solvents.

**Solubility in water** Miscible

## PHYSICAL DATA

**Molar mass** 77.44  
**Melting point** -25°C (8-12.5%)  
**Boiling point** decomposes  
**Specific gravity** 1.2 (14%)  
**Flammability** Non-combustible

## REGULATORY INFORMATION

**ADG Class** 8  
**Packing Group** III  
**UN Number** 1791  
**Poisons Schedule** S5  
**Security** -

## HAZARD STATEMENTS

H314 Causes severe skin burns and eye damage  
H400 Very toxic to aquatic life  
AUH031 Contact with acid liberates toxic gas

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). The solution is a moderately strong oxidising agent and is strongly alkaline. Exposure may cause severe irritation and corrosive injury to the skin, eyes and respiratory tract and on ingestion. Eye contact may cause burns and permanent damage. Asthma, dermatitis or conjunctivitis can result from repeated or prolonged inhalation, skin or eye exposure (respectively).

Handle in an operating fume cupboard or well-ventilated area. Avoid breathing vapour or mist and contact with skin, eyes and clothing. Handle away from heat and sources of ignition. Take care when opening the bottle in case of overpressurisation.

Mixing bleach with acid, particularly hydrochloric acid, generates toxic chlorine gas.

## STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Commercial bleach solutions are expected to be relatively stable but will decompose slowly over time, releasing low concentrations of oxygen and chlorine gases. Decomposition is accelerated with exposure to heat, sunlight, metal oxides or other impurities.

Store away from reducing agents, strong acids, organic substances, combustible materials, powdered metals, amines, ammonium salts.

Store with corrosive substances (non-acids).

## SPILLS

Wear PPE. Ensure good ventilation. Dilute spill with water and wash down the sink with further dilution.

Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

## WASTE DISPOSAL

Dilute to a concentration of  $\leq 0.5\%$  and wash down the sink. Alternatively, sodium hypochlorite solution can be treated with a reducing agent. 100mL of 10% sodium bisulfite or sodium metabisulfite will reduce 100 mL of 5% sodium hypochlorite solution. Work in a fume cupboard. Dilute the hypochlorite solution to a concentration  $\leq 5\%$ . Add the reducing agent slowly to the hypochlorite solution, with stirring. Neutralise the resulting solution to within pH 6-8 by cautious addition of hydrochloric acid (1M). Wash the neutral solution down the sink with further dilution.

**Large quantity** of surplus sodium hypochlorite: Arrange for collection by a licenced waste disposal contractor.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Give water to drink. Immediately call a POISONS CENTRE or doctor.

**IF ON SKIN:** Remove immediately all contaminated clothing and wash before reuse. Rinse skin thoroughly with water/shower. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical advice/attention.

POISONS CENTRE: 13 11 26

## APPLICATIONS

**General science:** (diluted) example of a household substance.

**Senior biology:** an antimicrobial agent.

**Senior chemistry:** determination of chlorine in bleach; pool chemistry investigations.

**Technical:** preparation of chlorine or bromine water; disinfectant.



**Formula**  $\text{NaIO}_3$   
**CAS No.** 7681-55-2  
**User Group** 11-12S (Note B)



#### DESCRIPTION

White, odourless crystals or powder.

#### SOLUBILITY

Soluble in water, acetone and acetic acid.  
Insoluble in methanol.

**Solubility in water** 81 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 197.89  
**Melting point** ca.560°C(decomposes)  
**Boiling point** -  
**Specific gravity** 4.28 (20°C)  
**Flammability** Non-combustible  
oxidising solid

#### REGULATORY INFORMATION

**ADG Class** 5.1  
**Packing Group** II  
**UN Number** 1479  
**Poisons Schedule** -  
**Security** -

#### HAZARD STATEMENTS

H272 May intensify fire; oxidizer  
H302 Harmful if swallowed  
H317 May cause an allergic skin reaction  
H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Sodium iodate is a moderately strong oxidising agent. Exposure may cause severe irritation and corrosive injury to the skin, eyes and respiratory and digestive tracts. Eye contact may cause permanent damage. Symptoms of allergic reaction may include rash, itching or breathing difficulty. Iodates are toxic to retinal cells by ingestion; ingestion of a large amount may lead to visual impairment. Handle in a well-ventilated area. Avoid generating or inhaling dust. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Handle away from heat and other sources of ignition. In case of fire, use flooding quantities of water; do not use dry chemical,  $\text{CO}_2$  or foam extinguisher.

#### STORAGE

Store in a tightly closed container in a cool, dry well-ventilated place. Over time, sodium iodate can decompose on exposure to light, heat or air and moisture. Protect from air, moisture and direct sunlight. Store away from heat and all sources of ignition. Store away from reducing agents, flammable substances, combustible materials, acids and alkalis. Store with oxidising substances (DG Class 5.1).

#### APPLICATIONS

**Senior chemistry:** the iodine clock reaction; demonstration of the Briggs-Rauscher oscillating reaction.  
**Technical:** preparation of haematoxylin microscopy stain.

#### SPILLS

Wear PPE. Remove all sources of ignition and any combustible materials from the spill area. Ensure good ventilation.

**Solid spill:** Collect material with a non-sparking tool and treat as for Waste Disposal.

**Solution spill:** Absorb with non-combustible material such as sand, vermiculite or bentonite (clay cat litter). Collect with a non-sparking tool. Add material slowly to a large volume of water and reduce the iodate and neutralise the solution as for Waste Disposal. Decant the supernatant down the sink and dispose of solid residue as general waste.

Wash spill area thoroughly with water; ensure no iodate residue remains in contact with combustible material. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

Solid sodium iodate must not be disposed of with general waste. Store surplus or waste sodium iodate in the original container or other suitable labelled container. Arrange for collection by licenced waste disposal contractor.

**Small quantity of waste solution:** Treat with a reducing agent: 18 mL of 10% w/v solution of either sodium bisulfite or sodium metabisulfite will reduce 10 mL of saturated (ca. 0.4M) sodium iodate solution or a solution containing 1g of the salt. Add the bisulfite or metabisulfite solution to the iodate solution until a persistent pale yellow colour is obtained. Neutralise the solution with sodium carbonate to within pH 6-8 and flush down the sink.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Give water to drink. Seek medical attention.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin with soap and plenty of water. If skin irritation or rash occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If experiencing respiratory symptoms: Call a POISON CENTER or doctor.

POISONS CENTRE: 13 11 26





**Formula**  $\text{H}_3\text{NSO}_3$   
**CAS No.** 5329-14-6  
**User Group** 11-12S

#### DESCRIPTION

Colourless, odourless crystals or powder.

#### SOLUBILITY

Soluble in water. Slightly soluble in acetone.  
Sparingly soluble in ethanol, methanol.  
Insoluble in diethyl ether.

**Solubility in water** 213 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 97.09  
**Melting point** 205°C (decomposes)  
**Boiling point** -  
**Specific gravity** 2.13 (20°C)  
**Flammability** Non-combustible

#### REGULATORY INFORMATION

**ADG Class** 8  
**Packing Group** III  
**UN Number** 2967  
**Poisons Schedule** S6  
**Security** -

#### HAZARD STATEMENTS

H315 Causes skin irritation  
H319 Causes serious eye irritation  
H412 Harmful to aquatic life with long lasting effects

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (latex, nitrile, neoprene). Sulfamic acid is a moderately strong acid.  
Exposure can cause irritation and severe burns to the skin, eyes and respiratory tract and on ingestion. Eye contact may result in corneal burns with permanent damage.  
Handle in an operating fume cupboard or well-ventilated area away from sources of ignition. Avoid generating and inhaling dust and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Store away from heat and source of ignition.  
In aqueous solution, the acid slowly hydrolyses to form ammonium sulfate and bisulfate. When mixed with water, the acid is corrosive to metals, with generation of flammable hydrogen gas.  
Store away from oxidising agents and alkalis.  
Store with corrosive solids.

#### APPLICATIONS

**General science:** diluted, an example of a fairly strong inorganic acid.  
**Senior chemistry:** a primary standard in the determination of basic solutions by titration.  
**Technical:** to remove limescale and rust from glassware.

#### SPILLS

Wear PPE. Ensure good ventilation.  
**Solid spill:** Scoop up with a non-sparking tool.  
**Solution spill:** Absorb spill with non-combustible absorbent such as a 1:1:1 mixture of sodium carbonate, bentonite (clay cat litter) and sand. Scoop up with a non-sparking tool.  
**Small spill:** Add material slowly to a large volume of water. Neutralise as for waste disposal. Decant the neutral solution down the sink. Dispose of solid material as general waste.  
**Large spill:** Place material in a suitable labelled container. Arrange for collection by a licenced contractor.  
Wash spill area thoroughly with water.  
Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

The acid is harmful to the aquatic environment due to the pH shift.  
**Small quantity:** Wear PPE and work in a fume cupboard. Add the waste acid slowly to a large volume of water. Neutralise the solution to between pH 6 and 8 with sodium carbonate, adding the base cautiously in portions until there is no further evolution of  $\text{CO}_2$ . Dispose of the neutral solution down the sink.  
**Large quantity:** Store in a suitable labelled container. Arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.  
**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical advice/attention.  
**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin with plenty of soap and water. If skin irritation occurs: Get medical advice/attention.  
**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical advice/attention.





**Formula** S  
**CAS No.** 7704-34-9  
**User Group** 7-12



#### DESCRIPTION

Yellow, odourless powder, granules, flakes or pastilles.

#### SOLUBILITY

Practically insoluble in water. Soluble in toluene. Slightly soluble in acetone, ethanol and diethyl ether.

**Solubility in water** Practically insoluble.

#### PHYSICAL DATA

|                         |                  |
|-------------------------|------------------|
| <b>Molar mass</b>       | 32.06            |
| <b>Melting point</b>    | 113-119°C        |
| <b>Boiling point</b>    | 444-445°C        |
| <b>Specific gravity</b> | 1.96-2.07 (20°C) |
| <b>Flammability</b>     | Flammable        |

#### REGULATORY INFORMATION

|                         |      |
|-------------------------|------|
| <b>ADG Class</b>        | 4.1  |
| <b>Packing Group</b>    | III  |
| <b>UN Number</b>        | 1350 |
| <b>Poisons Schedule</b> | -    |
| <b>Security</b>         | -    |

#### HAZARD STATEMENTS

H228 Flammable solid  
H315 Causes skin irritation  
H319 Causes serious eye irritation

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Exposure to dust or vapour may cause irritation to the skin, eyes, nose, throat and respiratory tract. Symptoms of exposure may include cough, shortness of breath, headache and nausea. Prolonged or repeated exposure can lead to skin sensitisation and dermatitis, and permanent eye damage. Handle in a well-ventilated area. Avoid generating and inhaling dust. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. The vapour or dust can form combustible mixtures with air. Handle away from heat and sources of ignition. Burning of sulfur generates harmful and irritating sulfur dioxide gas and should be conducted in an operating fume cupboard.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from light. Protect from moisture. Store away from sources of heat or ignition. Store away from oxidising agents, ammonia, ammonium nitrate, bases, amines, alkali metals, alkali earth metals, metals and halogens. Store with flammable solids (DG Class 4.1).

#### APPLICATIONS

**General science:** qualitative properties of the element; conductivity investigations.

**Senior chemistry:** demonstration simulating the formation of acid rain; demonstration of the formation of copper sulfide from the elements.

#### SPILLS

Wear PPE. Remove all sources of ignition. Ensure good ventilation.

**Solid spill:** Collect with a non-sparking tool and treat as for Waste Disposal.

**Molten sulfur:** Cover with sand or other non-combustible absorbent. Collect with a non-sparking tool and treat as for Waste Disposal.

Ventilate spill area and wash thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** If uncontaminated with hazardous material, waste or surplus sulfur can be applied to soil as a conditioner. The application of sulfur to soil has the effect of lowering the pH over time. Recommended application rates are in the range of 25 to 100 grams of sulfur per square metre, which is dug into the top 10 cm of soil.

**Large quantity:** Store in a suitable labelled container and arrange for collection by a licenced waste disposal contractor. Be careful not to mix sulfur waste with incompatible chemicals/materials.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical attention.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin with plenty of soap and water. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical attention.



**Formula**  $\text{H}_2\text{SO}_4$   
**CAS No.** 7664-93-9  
**User Group** 11-12

#### DESCRIPTION

Colourless to slightly yellow, oily, highly corrosive, hygroscopic liquid with a faint acid odour.

#### SOLUBILITY

Miscible with water and ethanol (mixing generates heat).

**Solubility in water** Miscible

#### PHYSICAL DATA

**Molar mass** 98.08  
**Melting point**  $-1.1^\circ\text{C}$  (98%)  
**Boiling point**  $327.2^\circ\text{C}$  (98%)  
**Specific gravity** 1.84 ( $20^\circ\text{C}$ , 98%)  
**Flammability** Non-combustible

#### REGULATORY INFORMATION

**ADG Class** 8  
**Packing Group** II  
**UN Number** 1830  
**Poisons Schedule** S6  
**Security** CSC IDM Cat 3

#### HAZARD STATEMENTS

H290 May be corrosive to metals  
H314 Causes severe skin burns and eye damage

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (Viton®, butyl, neoprene; nitrile for splash protection). The concentrated acid is highly corrosive and has powerful dehydrating properties. It should be handled with care. Exposure to both the liquid and mist can cause severe irritation and burns to the skin, eyes and respiratory tract and on ingestion. Eye contact may result in severe eye damage and permanent injury. Handle only in an operating fume cupboard. Do not breathe vapour or mist. Avoid contact with skin, eyes and clothing. Avoid prolonged or repeated exposure. Dilution of the concentrated acid generates much heat. When diluting, the mixing vessel should be cooled (ice-water bath) and the acid added cautiously to water. Never add water to the concentrated acid.

#### STORAGE

The concentrated acid is hygroscopic. Store in a tightly closed, labelled container in a cool, dry, well-ventilated place away from heat and light. Protect from moisture. Ensure container is kept upright to prevent leakage. Check container and lid periodically for damage. Store away from reducing agents, oxidising agents, alkalis, metals, organic substances and combustible materials. Concentrated sulfuric acid should be stored separately from all other chemicals, on a low shelf, with secondary containment.

#### APPLICATIONS

**General science:** an example of a strong inorganic acid.  
**Senior chemistry:** a catalyst in ester preparation; to demonstrate the dehydration of sugar.

#### SPILLS

Wear PPE. Ensure good ventilation. Absorb spill with non-combustible absorbent such as a 1:1:1 mixture of sodium carbonate, bentonite (clay cat litter) and sand. Scoop up with a non-sparking tool.

**Small spill:** Add material to a large volume of water. Neutralise as for waste disposal. Decant the neutral solution down the sink. Dispose of solid material as general waste.

**Large spill:** Place material in a suitable labelled container. Arrange for collection by a licenced contractor. Wash spill area thoroughly with water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

The acid is harmful to the aquatic environment due to the pH shift.

**Small quantity:** Wear PPE and work in a fume cupboard. Add the waste acid slowly to a large volume of water. Neutralise the solution to between pH 6 and 8 with sodium carbonate, adding the base cautiously in portions until there is no further evolution of  $\text{CO}_2$ . Dispose of the neutral solution down the sink.

**Large quantity:** Store in a suitable labelled container. Arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISONS CENTRE or doctor.

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. Seek immediate medical attention.

**IF ON SKIN:** Remove immediately all contaminated clothing. Rinse skin thoroughly with water/shower. Seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISONS CENTRE or doctor.

POISONS CENTRE: 13 11 26



**Formula**  $C_{18}H_{36}O_2$

**CAS No.** 57-11-4

**User Group** 11-12

#### DESCRIPTION

White to pale yellow waxy solid (flake, crystal or powder) with a light tallow-like odour.

#### SOLUBILITY

Practically insoluble in water. Soluble in alcohol, acetone, toluene and diethyl ether.

**Solubility in water** 0.597 mg/L (25°C)

#### PHYSICAL DATA

**Molar mass** 284.48

**Melting point** 69-70°C

**Boiling point** 350°C (decomposes)

**Specific gravity** 0.941 (20°C)

**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

Not classified as hazardous

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Exposure may cause irritation to the skin, eyes and respiratory tract. Ingestion of large amounts may cause gastric irritation.

Handle in a well-ventilated area. Avoid generating and inhaling dust. Avoid ingestion and contact with skin, eyes, and clothing.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light.

Store away from oxidising agents, reducing agents and bases.

Store with general organic solids.

#### APPLICATIONS

**General science:** to observe the melting and freezing points of stearic acid; to observe its emulsifying properties; preparation of hand cream.

#### SPILLS

Wear PPE. Ensure good ventilation. Eliminate all ignition sources.

**Solid spill:** Scoop up with a non-sparking tool. Treat as for waste acid.

**Liquid spill:** Cover spill with sodium carbonate or a 1:1:1 mixture of sand, sodium carbonate and vermiculite or bentonite (clay cat litter). Scoop up and add to a large volume of water. Neutralise the solution as for Waste Disposal. Decant neutral solution down the sink. Dispose of residual solids as general waste.

Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Wrap well in paper and dispose of as general waste.

Alternatively, dissolve waste by adding to 5% sodium carbonate solution. Test the pH with pH paper and neutralise the solution to within pH 6-8 by addition of sodium carbonate or dilute hydrochloric acid (0.5M) in portions as necessary. Flush the neutral solution down the sink.

**Large quantity:** Store in the original container or other suitable labelled container, such as for waste dry organic solids. Arrange for collection by a licenced waste disposal contractor.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If symptoms occur, seek medical advice/attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek medical advice/attention if you feel unwell.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin with plenty of water and mild soap. If symptoms occur, seek medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical attention.



**Formula**  $C_4H_6O_6$

**CAS No.** 87-69-4

**User Group** 7-12

#### DESCRIPTION

Colourless, odourless crystalline solid. L-tartaric acid is the naturally occurring isomer.

#### SOLUBILITY

Soluble in water, ethanol, methanol, propanol, diethyl ether, and glycerol.

**Solubility in water** 1390 g/L (20°C)

#### PHYSICAL DATA

**Molar mass** 150.09

**Melting point** 169°C

**Boiling point** decomposes

**Specific gravity** 1.76 (20°C)

**Flammability** Combustible

#### REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** -

**Security** -

#### HAZARD STATEMENTS

H315 Causes skin irritation

H319 Causes serious eye irritation

H335 May cause respiratory irritation

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile, latex). Exposure may cause irritation to the skin, eyes and respiratory tract.

Handle in a well-ventilated area. Avoid generating and inhaling dust. Avoid ingestion and contact with skin, eyes, and clothing.

In aqueous solution, tartaric acid is mildly corrosive to reactive metals such as aluminium, iron, tin and zinc.

#### SPILLS

Wear PPE. Ensure good ventilation. Eliminate all ignition sources.

**Solid spill:** Scoop up with a non-sparking tool. Treat as for waste acid.

**Liquid spill:** Cover spill with sodium carbonate or a 1:1:1 mixture of sand, sodium carbonate and vermiculite or bentonite (clay cat litter). Scoop up and add to a large volume of water. Neutralise the solution as for Waste Disposal. Decant neutral solution down the sink. Dispose of residual solids as general waste.

Wash spill area thoroughly with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Dilute waste to a concentration of about 5% by slowly adding the acid to water with stirring. Neutralise the solution to within pH 6-8 by addition of sodium carbonate in portions (test with pH paper). Flush the neutral solution down the sink with further dilution.

**Large quantity:** Store in the original container or other suitable labelled container, such as for waste dry organic solids. Arrange for collection by a licenced waste disposal contractor.

#### STORAGE

Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light.

Store away from oxidising agents, reducing agents, bases, hydrogen peroxide, silver and silver compounds.

Store with general organic solids.

#### APPLICATIONS

**General science:** crystal growing; an ingredient (food grade) in sherbet.

**Senior chemistry:** titration of a diprotic acid.

**Technical:** preparation of buffer solutions.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.

**IF SWALLOWED:** Rinse mouth. Give water to drink. Do NOT induce vomiting. Call a POISONS CENTRE or doctor if you feel unwell.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin thoroughly with water.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical attention.

POISONS CENTRE: 13 11 26



# tris(hydroxymethyl)aminomethane

*Tris base; THAM; trometamol*

**Formula**  $C_4H_{11}NO_3$

**CAS No.** 77-86-1

**User Group** 7-12

## DESCRIPTION

Colourless, odourless crystals.

## SOLUBILITY

Soluble in water and ethanol. Slightly soluble in acetone, ethyl acetate and ethyl acetate.

**Solubility in water** 800 g/L (20°C)

## PHYSICAL DATA

**Molar mass** 121.13

**Melting point** 168-172°C

**Boiling point** 219-220°C

**Specific gravity** 1.353 (23°C)

**Flammability** Combustible

## REGULATORY INFORMATION

**ADG Class** -

**Packing Group** -

**UN Number** None

**Poisons Schedule** -

**Security** -

## HAZARD STATEMENTS

Not classified as hazardous

## SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). Aqueous solutions are moderately alkaline. Exposure may cause irritation to the skin, eyes and respiratory tract.

Handle in a well-ventilated area. Avoid generating dust. Avoid inhalation and contact with skin, eyes and clothing. Avoid prolonged or repeated exposure.

## SPILLS

Wear PPE. Ensure good ventilation. Scoop up with a non-sparking tool. Place in a suitable labelled container and store for collection.

**Solution spill:** Cover with absorbent material such as vermiculite, bentonite (clay cat litter) and/or sand. Scoop up into a plastic container. Dilute with water, and neutralise as for Waste Disposal. Decant the neutral solution down the sink and dispose of residual solid material as general waste.

## WASTE DISPOSAL

**Waste solution:** Neutralise the solution to within pH 6 - 8 by addition of 5% hydrochloric acid, with stirring. Flush the neutral solution down the sink.

**Waste buffer solution (pH ~ 7):** Flush down the sink with further dilution.

**Waste solid:** Store in the original container or other suitable labelled container such as for waste organic solids. Arrange for collection by a licenced waste disposal contractor.

## STORAGE

The substance is hygroscopic. Store in a tightly closed container in a cool, dry, well-ventilated place away from heat and light. Protect from moisture. Store away from sources of heat or ignition.

Store away from acids, bases and oxidising agents.

Store with general organic solids.

## APPLICATIONS

**Senior biology/Technical:** preparation of buffer solutions.

## FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. If effects persist, seek medical attention.

**IF ON SKIN:** Remove contaminated clothing. Rinse skin thoroughly with water. If symptoms occur, seek medical advice.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. If respiratory symptoms occur, seek medical advice/attention.





**Formula** n/a  
**CAS No.** 64742-82-1  
**User Group** 7-12



#### DESCRIPTION

Clear colourless liquid with a paraffinic odour. A mixture of hydrocarbons with a carbon number predominantly in the range C7-C12. Less dense than water.

#### SOLUBILITY

Miscible with aromatic and aliphatic petroleum solvents.

**Solubility in water** Insoluble

#### PHYSICAL DATA

**Molar mass** -  
**Melting point** -  
**Boiling point** 90-230°C  
**Specific gravity** 0.78 (15°C)  
**Flammability** Flammable

#### REGULATORY INFORMATION

**ADG Class** 3  
**Packing Group** III  
**UN Number** 1300  
**Poisons Schedule** S5  
**Security** -

#### HAZARD STATEMENTS

H226 Flammable liquid and vapour  
H304 May be fatal if swallowed and enters airways  
H315 Causes skin irritation  
H412 Harmful to aquatic life with long lasting effects

#### SAFE HANDLING

**Maintain safe laboratory work practices. Wash hands before breaks and at the end of work.**

Wear PPE: safety glasses, closed shoes, lab coat, gloves (nitrile). White spirit is flammable and has a low flash point. Inhalation exposure may cause respiratory irritation, drowsiness and dizziness. Skin or eye contact may cause mild irritation. Prolonged or repeated skin contact may cause dryness, cracking and dermatitis. Prolonged or repeated exposure may lead to hearing loss. There is a risk of aspiration into the lungs if ingested. Handle in an operating fume cupboard or well-ventilated area. Avoid inhalation of vapour or mist. Avoid contact with skin, eyes and clothing. There is potential for the vapour to collect in low-lying, confined areas. Vapours will form explosive mixtures with air. Vapours will travel to the source of ignition and flash back. Handle away from heat and sources of ignition.

#### STORAGE

Store in a tightly closed container in a cool, dry well-ventilated place away from light. Ensure container is kept upright to prevent leakage. Store away from sources of heat or ignition. Store away from oxidising agents, acids and bases. Store with flammable liquids in an AS compliant cabinet.

#### APPLICATIONS

**General science:** solvent for extracting non-polar compounds; solvent for chromatography.

#### SPILLS

Wear PPE. Ensure good ventilation. Remove all sources of ignition.

**Small spill:** Absorb with paper towel or cover with non-combustible absorbent such as sand, vermiculite or bentonite (clay cat litter), collect with a non-sparking tool and place in a shallow vessel. Allow the solvent to evaporate in an operating fume cupboard. Dispose of the absorbent material as general waste.

**Large spill:** Cover with non-combustible absorbent (see above). Scoop up with a non-sparking tool. Place in a suitable labelled container and store for collection. Ventilate the spill area and wash with detergent and water. Wash any contaminated clothing before reuse.

#### WASTE DISPOSAL

**Small quantity:** Absorb onto paper towel or place in a shallow vessel. Allow the solvent to evaporate in an operating fume cupboard.

**Large quantity:** Store in original container or other suitable labelled container, such as for non-halogenated organic liquid waste, and arrange for collection by a licenced waste disposal contractor.

Empty containers can contain explosive vapours. Empty containers should be rinsed thoroughly with water and the rinsings absorbed onto inert material such as vermiculite or bentonite and treated as for spills. Washed empty containers can be disposed of as general waste.

#### FIRST AID

**IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.

**IF SWALLOWED:** Rinse mouth. Do NOT induce vomiting. Seek immediate medical attention.

**IF ON SKIN:** Remove contaminated clothing and wash before reuse. Wash skin with plenty of soap and water. If skin irritation occurs: Get medical advice/attention.

**IF INHALED:** Move patient to fresh air and keep at rest in a position comfortable for breathing. Call a POISONS CENTRE or doctor if you feel unwell.  
POISONS CENTRE: 13 11 26