Combustion reaction

Posted by Anonymous on Tue, 2015-11-24 12:05

Combustion reaction: Is there any danger in getting students to burn steel wool in the school laboratory? I'm thinking of Year 10 students. I can think of one problem... What surface should they burn it on? Is a wooden heat mat okay? What is the best way to light it? I've seen it done holding the base of a Bunsen burner, angling it towards the wool to ignite it. Is this okay for students to do? I know the wool needs to be fluffed up to allow enough oxygen to circulate within it.

The reason I ask, is that I need an alternative to burning magnesium. Any help would be greatly appreciated.

Voting:
No votes yet

Australian Curriculum:
Different types of chemical reactions are used to produce a range of products and can occur at different rates
Year Level:
10
Laboratory Technicians:
Laboratory Technicians

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Combustion reaction

Submitted by sat on 15 December 2015

Answer reviewed 22 February 2023

There are hazards associated with students burning steel wool. The main danger of this experiment is the high temperatures that are created in the oxidation process, so students should not touch the hot steel wool. Consideration must also be given to the ignition method, as it is difficult to maintain the burning and collection of all of the resulting products, if this is to be a quantitative activity.

Ignition of steel wool

For the steel wool to “burn”, you are correct that it is better if it is fluffed up to allow sufficient oxygen to encourage the continued combustion of the iron into the middle of the sample. This often requires repeated ignition and rotating the ball of steel wool.

Here are a few methods of ignition that have been used.

- Using a gas lighter—the type designed for lighting barbeques, not cigarettes. There is no moving of burning steel wool and no risk of the wool sticking to the lighter. The lighter is designed to be handheld, the risk here is of the students using it to ignite other items in the room.
- Holding the iron wool with tongs in a Bunsen burner flame until it ignites, and then transferring the sample to a heatproof surface. This has the danger that the student may “flick” the sample, if they get a surprise when it ignites, the moving of the wool will also most likely lose some of the product in transit.
- Touching the steel wool with a 9 volt battery. The short circuiting of the terminals across the steel wool produces sufficient heat to ignite it. One possible risk here is that the steel wool melts onto the battery terminal.

Science ASSIST does not recommend ignition with a Bunsen burner by lifting and pointing the flame at the steel wool. Holding the Bunsen burner has its problems and is not the recommended method of use for the Bunsen.

Conducting an on-site risk assessment looking at the options outlined above will determine your preferred method.

Collection of resulting products

We suggest the use of a crucible or tin lid on a non-combustible protective bench mat (e.g., a cement sheet). It is best to use a course-grade steel wool, which will burn with less sparking and has no loss from pieces flying off that may not be included in the final mass after combustion. Ensure that the steel wool is uncoated and does not contain soap.

For this experiment to give meaningful results, it is important that all the resulting material is collected. The evaporating basin or tin lid should be pre-weighed to determine its mass. The steel wool, once fluffed out, is placed in the evaporating basin or on the tin lid and the total mass is noted and the steel wool mass determined. Allow the evaporating basin or tin lid to cool before re-weighing to determine the change in mass due to the oxide formation.

Alternatives to using magnesium and steel wool

We have considered other metals, however they are either too hazardous to use in schools or do not burn. We recommend that you search for examples on the internet to show them, if required.

References

Royal Society of Chemistry. (nd) *The combustion of iron wool*. Retrieved from the Royal Society of Chemistry website: https://edu.rsc.org/experiments/the-combustion-of-iron-wool/717.article

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