Purchasing and maintaining microscopes

Posted by Anonymous on Thu, 2020-05-21 11:28

Purchasing and maintaining microscopes: Can you recommend school microscope suppliers, repairers and servicers in Australia? What are some strategies to maintain school microscopes in good working order? Such as, protocols for cleaning microscopes, disinfecting microscopes and microscope lens-care techniques?

Voting:
No votes yet

Year Level:
7
8
9
10
Senior Secondary
Laboratory Technicians:
Laboratory Technicians

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Disinfecting microscopes

Submitted by sat on 21 May 2020

Answer reviewed 30 Jan 2023

Microscope purchase, repair and servicing

Microscopes used in school science laboratories have traditionally been of two basic types; compound or bright field (high power), and stereo or dissecting (low power). Technology has advanced over the last few decades to produce digital microscopes and affordable options for capturing images and videos.

When choosing a microscope consideration needs to be given to the application, skill level of staff and students and budget. Microscopes range in quality and price and are used for different purposes.

See our information sheet AIS: Microscope choices for schools

Other considerations for purchasing new microscopes are:

- consider purchasing quality microscopes that are robust enough to suit school conditions and can be supported by companies that service and repair.
- consider recent technologies such as microscopes with digital imaging and capture that can download images using a USB port or similar.
- choose a modern microscope with LED lighting, superior optics and light control.
- in humid environments like Darwin in the wet season, where the microscope optics may be prone to microbial (fungal) growth, seek out optics which have antifungal-treated components.

Microscopes are precision instruments. The vital parts are fragile lenses, lamps and fine optics. Microscopes used in schools are exposed to different rigours than industry or medical laboratories. It is vital microscopes are treated gently and kept maintained. Routine maintenance is best carried out annually. Further details for simple maintenance is available from SOP: Use and care of the compound light microscope. However, from time to time, repairs are required. Microscopes that are not working or are difficult to focus result in students quickly losing interest in microscopy or biology.

Schools should consider if repairs of microscopes are worth the cost, or if replacing them is a better option.

- Microscopes that are worthy of repair are generally of good quality, not too old, and importantly, have spare and replacement parts readily available. Alternatively, good quality microscopes that are no longer usable can be used for parts for future repairs.
- If schools have old traditional models of microscopes, it is sometimes possible to salvage the parts of some of them to repair others. For example, you may start with 6 non-working units and end up with 3 that work. Repairs may not be the best option for cheaper models. If schools have microscopes that use nylon (plastic) gears in the rack and pinion assemblies instead of brass, they may find that these soon strip out and the microscope cannot be focused or cannot stay in focus without drifting. If this is a repair problem, then the manufacturing of brass replacements is probably not economic and therefore should not be considered.
- If it is not possible to have a repairer come to the Northern Territory or other remote areas, then the cost of repair may need to take into account the possibly considerable freight costs involved in shipping to and from the repairer. If considering this, then suitable packaging such as the original delivery boxes, if you still have them, would be required to protect the microscopes in transit.

Science ASSIST recognises the difficulties of schools located in regional and remote areas. Therefore, we have compiled a list of microscope service providers, which can be found on our site under School science suppliers They were contacted to see if they were able to repair microscopes in the Northern Territory (for example). Responses received indicate that these companies generally service their own states and perhaps an adjoining state and that they would be prepared to travel to service and repair microscopes in the Northern Territory if the cost of a trip was feasible.

Therefore, if you have a number of microscopes which need repairing, we suggest that you do the following.

1. List makes, models and quantity of microscopes that need repairs.

2. Contact the supplier or manufacturer of the microscopes, if possible, to see if they have a repair and service department, or an agreement with an Australian provider. If this is not possible:
    1. See our list of School science suppliers for companies that provide microscope servicing adjacent to your state; and
    2. Consider approaching other schools to see if there is a larger need for this service, which may help create a sufficient demand for a microscope repair company to travel to your state. (We suggest that you approach other schools via your teacher's or technician's network).

Microscope lenses and the use of immersion oil

Immersion oil and which one to use?

Immersion oil is utilised to increase the optical resolving power of the microscope. It is used by placing a small amount between the coverslip of a specimen and the front lens of an oil immersion objective. There are many different types of immersion oils, all with different properties and it is generally best to use the immersion oil recommended by the manufacturer of the objective. Immersion oil properties are usually matched to the objective lens properties to give optimal image quality. The refractive index of the immersion oil is an important parameter, and it is typically 1.515 at 23° C, close to that of glass to obtain optimal results. As the refractive index is similar to that of glass, light rays leaving the microscope slide and passing into the oil continue unrefracted or are refracted less than if they are passed from glass to air. Using immersion oil increases the resolution so that smaller objects can be seen.

As basic light microscopy is routinely used in school science laboratories, the difference in image quality will not be evident, so any manufacturer’s immersion oil will be suitable as long as the refractive index is correct. Immersion oil is available from many scientific suppliers, see the Science ASSIST School science suppliers list.

The choice of immersion oil for many years was Cedar Wood Oil, until the manufacture of synthetic alternatives in the 1940s. Cedar Wood oil is still available but has many disadvantages: it goes yellow with age, and if not cleaned up properly, will penetrate and damage the cement in the lens. The modern synthetic versions used today are inert, more colour stable and can be obtained in various viscosities.

Other fluids such as glycerine, and also mineral and vegetable oils work, but their refractive indices and dispersive powers vary somewhat from that of glass, and hence cannot be expected to elicit the best imagery from the specimen.

Immersion oil should only be used sparingly with an oil immersion objective lens. It should never be used with any of the other dry objectives, as it will damage them. Immersion oil is best stored at room temperature.

Microscope cleaning and disinfection

Shared equipment such as microscopes should be cleaned and disinfected between each use. If it is possible to allocate each student their own microscope in a lesson this will avoid the need for disinfecting during a lesson. Note that the use of safety glasses is not recommended, as they are not needed when using a microscope and they may introduce new risks such as additional face touching.

Here are some general guidelines formulated from the microscope manufacturer references noted below:

General

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Disinfection will not destroy all microorganisms as it is not a sterilisation process. Disinfection will eliminate many microorganisms on inanimate surfaces and often requires certain exposure times. Common disinfectants are 70% ethanol, 0.5-1% bleach and 3% hydrogen peroxide5. It appears that most of the major microscope manufacturers recommend 70% ethanol to clean and disinfect their microscopes. Correlations with similar enveloped viruses to the emerging coronavirus indicates that 70% ethanol is effective6.

- Caution is required as to the type of cleaning and disinfecting agent used as not all components of all microscope brands are able to withstand all disinfectants. There is the possibility of damage to the lenses and the cement used to hold them together. Generally, it is advised to use minimal cleaning or disinfecting solution. and never saturate the lens cleaning tissue. We recommend checking with the microscope manufacturer or user manual for the recommended disinfectant for your brand of microscope.
- To avoid scratching the lenses do not use regular tissues, paper towel or cotton swabs for cleaning. Always use specific lens cleaning tissue.
- It is recommended to wear gloves when cleaning and disinfecting the microscope. The gloves can be discarded into the regular bin after cleaning and hands should be washed with soap and water or sanitiser.

Body of microscope

- High touch areas of a microscope e.g., nosepiece, stage and slide holders and focus knobs should be wiped over with a soft cloth and mild detergent followed by a disinfectant.

Eyepiece (oculars) plus rubber eyepiece shades:

- It is recommended to initially blow any dust off with a blower brush. This is then followed by gentle cleaning and then disinfecting with 70% ethanol using lens tissue.
- Remember to never saturate the lenses with cleaning or disinfecting solution, just lightly blot the surface then allow to air dry.

Note: It is not recommended to clean the internal surfaces of lenses.

Microscope objectives

It is best to consult the manufacturer’s guidelines as to the best cleaning method and fluid for your particular microscope.

Generally, the choice of cleaning method and fluid depends on the optical surface that requires cleaning and the substance to be removed. The surface of the optics of a microscope are easily damaged and therefore require extra care in their maintenance. Any cleaning fluid used should not damage any part of the microscope, including the lenses, and it should not leave any residue.

General advice for cleaning objectives:

- Treat lenses with great care, as they can be easily scratched.
- Solvents are not recommended for cleaning objective lenses as they have the potential to dissolve the cement in the lens assembly and harm other mechanical components, particularly in older microscopes.
- When cleaning lenses, first blow away any dust with a blower brush, then use a lint-free lens tissue and lens cleaning fluid to clean the objectives lenses and eyepieces.
- Do not use paper towel or regular tissues, as they will scratch the lens.
- Never dry wipe a lens, as this may also cause scratching.
- Remove immersion oil immediately after use with lens tissue and lens cleaning fluid.

- Do not remove eyepieces or objective lenses from their location and clean only their external surfaces. Internal surfaces should be cleaned by a professional.

Removal of immersion oil from the external surface of the oil immersion lens

Image quality is dependent on having clean, damage-free optics. Immersion oil should be removed immediately after use and not be allowed to remain on the objective lens. The risk of leaving immersion oil on an objective lens can result in the contamination of other parts of the microscope and the possibility of the oil moving into the objective itself causing irreversible damage.

- The oil should be removed immediately after use.
- Use clean, lint-free, lens cleaning tissue to gently blot the oil from the lens surface.
- Gently wipe the lens surface with fresh lens cleaning tissue until no oil residue is evident. This will require several changes of lens cleaning tissue.
- Any final traces of immersion oil can be removed using a small amount of lens cleaning fluid. Commercial glass cleaners such as Windex® can be used sparingly but they may have an effect on some coatings used on lens surfaces (4).
- Never use abrasive materials such as dry cotton swabs or facial tissues, as they are likely to scratch the lens.

Good hygiene

With regard to COVID-19: Good hygiene should be strictly observed such as is stated in the Australian Health Protection Principal Committee (AHPPC) statements, see https://www.health.gov.au/committees-and-groups/australian-health-protection-committee-ahpc

As the information is being frequently updated it is good to check the latest advice. As of (24th April 2020) the latest advice for schools can be found at https://www.health.gov.au/news/australian-health-protection-principal-committee-ahppc-advice-on-reducing-the-potential-risk-of-covid-19-transmission-in-schools-24-april-2020

In particular, see the sections on hygiene, routine care and environmental cleaning. The general hygiene advice is

- Staff and students should stay away from school if unwell
- Everyone should practice good hygiene: wash hands regularly, cough into elbows, minimise touching face
- Clean and disinfect frequently used high touch surfaces and frequently used objects such as computers, photocopiers etc.

Record keeping

This is not mandated; however, it is a good idea to keep records in a microscope maintenance log to demonstrate that disinfection has taken place. We don't have a proforma for you to use, but you could make one up to suit your school circumstances, which would include as a minimum the date; microscope identification, and which class (or student) used the microscope. It could also be used to identify where there is another issue with a specific microscope such as needing a replacement part (e.g., globe) or servicing (e.g., poor focusing or dirty lenses).

Microscope Alternatives

An eyepiece microscope camera can be used to view images projected from the microscope onto a smart board. or computer screen.

References

Nikon Instruments. (2009, April). Immersion oil and the microscope FAQs. Retrieved from MVI Micro video instruments, inc: http://www.mviservice.com/Images/Immersion%20Oil%20FAQs%202009.pdf (Accessed 30 Jan 2023)

James, P. (2002, March). The oil immersion objective. Retrieved from Microscopy UK: http://www.microscopy-uk.org.uk/mag/indexmag.html?http://www.microscopy-uk.org.uk/mag/artmar02/pjoil.html (Accessed 30 Jan 2023)

Rottenfusser, R., Wilson, E. Erin., & Davidson, W. Michael. (n.d.). Microscope cleaning and maintenance. Retrieved from ZEISS: http://zeiss-campus.magnet.fsu.edu/articles/basics/care.html (Accessed 30 Jan 2023)

Murphy, B. Douglas., & Davidson, W. Michael. (2013). Fundamentals of Light Microscopy and Electronic Imaging. Retrieved from Google Books: https://books.google.com.au/books?id=f8qhtqRjxQMC&pg=PT140&lpg=PT140&dq=can+windex+be+used+safely+to+c K5Uccn3sU0&hl=en&sa=X&ved=0CBsQ6AEwADgKahUKEwiG0cCcx5vJAhXi46YKHd8QBNQ#v=onepage&q=can%2 (Accessed 30 Jan 2023)

Christoph, Greb. (2020, April 3). How to Sanitize a Microscope. Retrieved from Leica Microsystems: https://www.leica-microsystems.com/science-lab/how-to-sanitize-a-microscope/ (Accessed 30 Jan 2023)

Government of South Australia, SA Health. (2022, December 23). COVID-19: Information for health professionals – COVID-19 Health System Response. Retrieved from Government of South Australia, SA Health: https://www.sahealth.sa.gov.au/wps/wcm/connect/public+content/sa+health+internet/clinical+resources/clinical+progra ncov%29+infection+information+for+health+professionals (Accessed 30 Jan 2023)

Abramowitz, Mortimer., & Davidson W. Michael. (n.d.). Immersion Media. Retrieved from Evident: https://evidentscientific.com/en/microscope-resource/knowledge-hub/anatomy/immersion (Accessed 30 Jan 2023)

Australian Government, Department of Health and Aged Care. (2023, January 17). Australian Health Protection Principal Committee (AHPPC). Retrieved from Australian Government, Department of Health and Aged Care: https://www.health.gov.au/committees-and-groups/australian-health-protection-committee-ahpc (Accessed 30 Jan 2023)

Cargille, J. John. (1985). Immersion oil and the microscope. New York Microscopical Society Yearbook, 1964, 1-6. https://cargille.com/wp-content/uploads/2018/03/Immersion_Oil_and_the_Microscope.pdf (Accessed 30 Jan 2023)

Evident. (n.d.). Microscopy Resource Center - Basic Concepts in Optical Microscopy. Retrieved from Evident: https://evidentscientific.com/ (Accessed 30 Jan 2023)

Nikon. (2020, April 16). Recommended Handling and Disinfecting Procedures for Nikon Microscope products to reduce spread of infectious agents including SARS-CoV-2 (Coronavirus). Retrieved from Nikon: https://www.microscope.healthcare.nikon.com/about/news/covid-disinfecting-for-nikon-microscope-products (Accessed 30 Jan 2023)

Ogama, Takeo. (2020, April 13). How to Clean and Sterilize Your Microscope. Retrieved from Evident Discovery Blog: https://evidentscientific.com/en/insights/how-to-clean-and-sterilize-your-microscope (Accessed 30 Jan 2023)

Rottenfusser, R., Dragoo, Tadja., & Davidson, W. Michael. (n.d.). Education in Microscopy and Digital Imaging, Oil Immersion and Refractive Index. Retrieved from Zeiss: https://zeiss-campus.magnet.fsu.edu/tutorials/basics/oilimmersionrefractiveindex/indexflash.html (Accessed 30 Jan 2023)

Science ASSIST. (2015). SOP: Use and care of the compound light microscope. Retrieved from Science ASSIST: https://assist.asta.edu.au/resource/2879/sop-use-and-care-compound-light-microscope (Accessed 30 Jan 2023)

Zeiss. (n.d.). Recommendations for Disinfection of Microscope Components and Objectives. Retrieved from Carl Zeiss Microscopy, LLC: https://www.zeiss.com/content/dam/Microscopy/us/img/2019-Template/literature/zeiss-disinfection-recommendations-2020.pdf (Accessed 30 Jan 2023)
