

Make your own microscope

A simple way to observe objects in greater detail

INTRODUCTION

Microscopes are expensive pieces of equipment, but they are made of just three main parts: a light source, a stage (which holds the specimen and in this case, allows light to pass through) and at least one lens to magnify what you are looking at. With some patience and skill, a DIY microscope can be made using only simple (and low cost, or no cost) equipment, and by creating a lens from a droplet of water.

LEARNING INTENTIONS



- ☑ To make careful observations
- ☑ To notice that light is reflected from surfaces
- ☑ To demonstrate that light travels from a source to objects and then to our eyes

WHAT TO DO:

Today we are going to be optical engineers

Gather the items on the equipment list then follow these steps:

1. Carefully, cut out three pieces of flat transparent plastic from your recycled materials. Two pieces need to be approximately 3cm wide and 4cm long to sandwich the samples you want to view. The third piece should be approximately 4 cm wide and 7 cm long to hold your water lens.
2. Fold your piece of foil and place it on the lid of the jar so that it will reflect horizontal light upwards through the glass jar (photo 3).
3. Once you have attached the jar to its lid with the foil inside, investigate the best position to place your torch so that you have an upward light source which is not too dazzling. Then use mounting putty to attach your pens to the top of the jar. They need to be parallel to each other with a gap of approximately 4cm (photo 4).
4. Punch a hole in the middle of your larger piece of plastic (photo 5).
5. Run water over the hole (by immersing it or using a pipette/ tap). Use a pipette to create a rounded drop of water on the larger piece of plastic (photo 6). The water droplet should be the shape of a convex lens (not too big so it looks ready to drip!).
6. Choose a flat, translucent object to view, and cut a small piece so that it can be sandwiched between your pieces of plastic.
7. Place your slides on the 'stage' between your pens.
8. Place your water lens above the sample balanced on the pens.
9. Close one eye and focus the other through the water lens. You will need to be quite close to your microscope, so sitting in a comfortable position is important (photo 8).
10. To see the magnified object in focus, you will need to slowly move your eye up or down. Carefully, move the plastic piece holding the water droplet so that you can examine your whole specimen.

Note: Sometimes you may need to raise your water lens to get the best focus (if this is the case, you could try using slightly thicker pens to position it).

RESOURCES (PER GROUP)



- Clean glass jar
- Flat, transparent plastic (e.g. recycled fruit punnets)
- Foil
- Torch
- Mounting putty (e.g. Blu Tack)
- Two identical pens/pencils
- A selection of translucent flat objects to observe, e.g. leaf skeletons, feathers, paper towel, printed plastic/potato starch wrapping, bank notes or pond water
- Scissors
- Hole puncher
- Extra glass jars and pipettes if collecting water samples

Note: glass slides are optional

How to make your own no-cost microscope:



1. You will need



2. Cut out your flat, transparent plastic slides



3. Create an upward light source



4. Assemble your stage



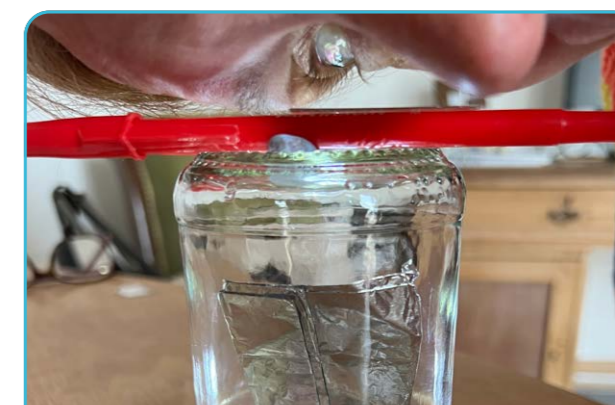
5. Make your water lens step 1



6. Make your water lens step 2



7. Gather some flat, translucent objects to observe

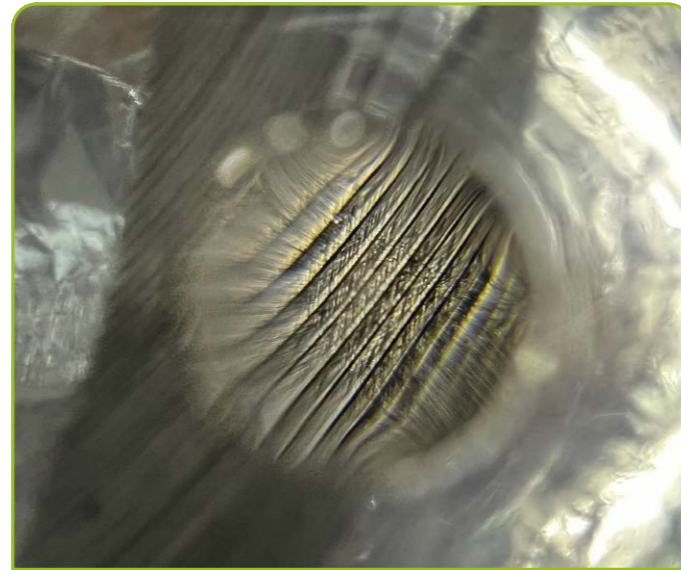


8. Close one eye, move close to and look through the lens. Slowly move up and down to focus

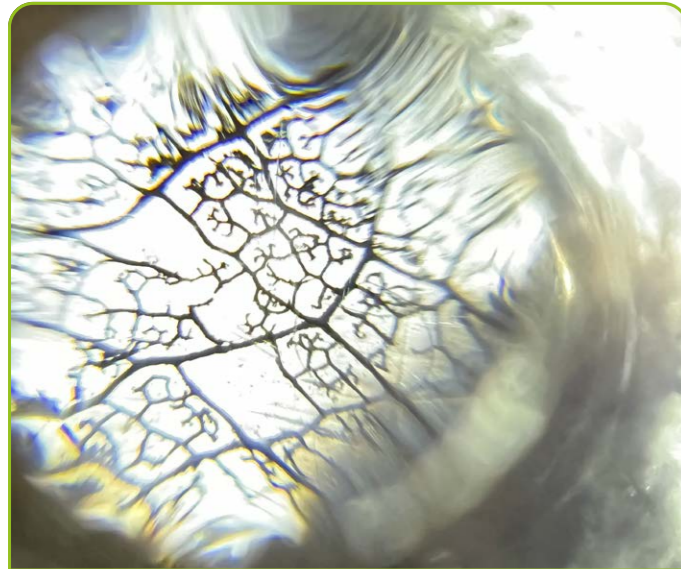
What could you look at? These examples might inspire you...



The transparent section of money



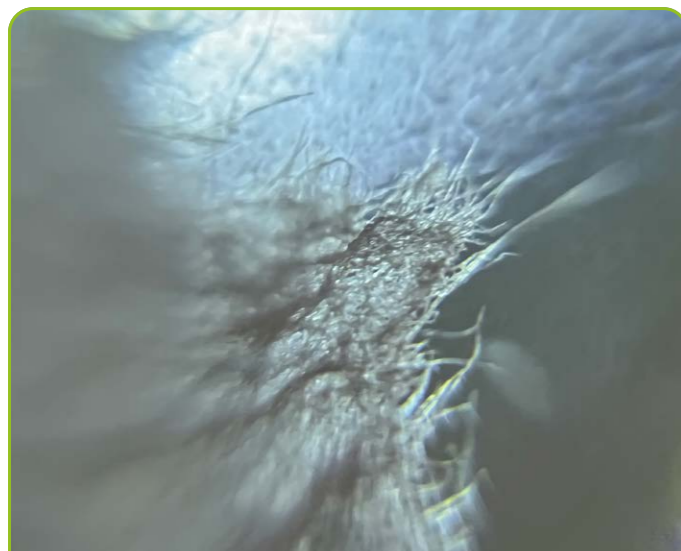
The barbules and hooklets of feathers



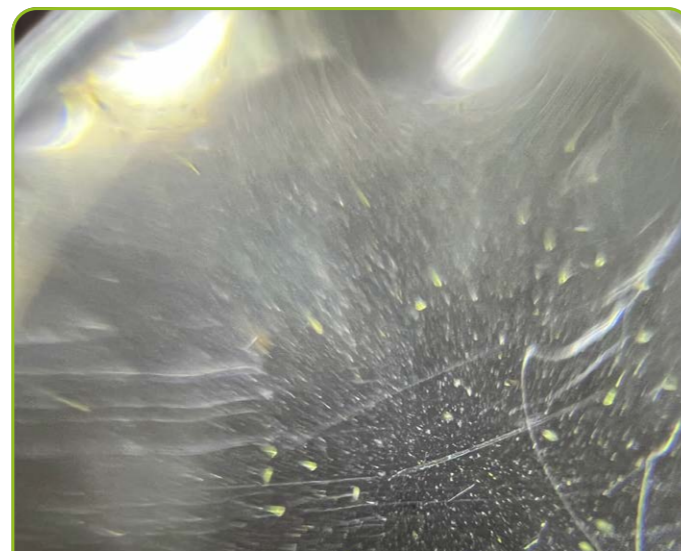
The structure of veins in a leaf skeleton



The surprising texture of potato starch wrapping



The fibres of kitchen roll or tissues



Pond water: algae (single celled, plant-like and not moving) and protozoans (single celled, animal-like and moving)

KEY QUESTIONS

1. Why is it important that we use a transparent glass jar to make the microscope?
2. How does the light travel from the light source to your eyes? Could you draw this in a diagram?
3. What happens to your view of the material you are looking at?
4. Can you think of something else that uses a lens to make it easier for people to see objects?
5. Why are lenses important to scientists?

KEY VOCABULARY

Transparent	Stage
Translucent	Magnify
Opaque	Refract
Reflected	Converge
Light source	Field of view
Lens	Resolution
Microscope	

EXTENSION / FOLLOW UP ACTIVITIES

Go on a walk outside to collect anything that you would like to observe. A smear of soil? An insect's wing? Remember translucent samples will work best.

Can you draw some of the samples seen through the water lens? This could be extended from observational drawings to a piece of art if you have time.

Learn about the history of microscopes with the [Science Museum](https://www.science-museum.org/).

ADDITIONAL RESOURCES (IF REQUIRED):

- tinyurl.com/yckmyyhj
- tinyurl.com/2b6dsbxt
- tinyurl.com/56cn4ffx

ANTICIPATED ACTIVITY TIME: 30 – 60 MINS, can be extended if desired