

Building a Compound Light Microscope

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Subject: Physics

Grade Level: High School

Standards: *New York State*

- 3.1 Describe the effects of changes in scale on the functioning of physical, biological, or designed systems.
- S2.1 Devise ways of making observations to test proposed explanations.

Schedule: One lab (84 minutes)

Description:

Students will use several lens to build a compound microscope. In so doing they will gain an intimate knowledge of a compound microscope

Objectives:

- Build a compound microscope
- Calculate the lens power of a microscope
- Understand the focal length and focal plane of a lens

Vocabulary:

- 1) **Convex lens** – is thicker at the center and it converge light rays.
- 2) **Concave lens** – is thinner at the center and it diverge light rays.
- 3) **Compound microscope** – A microscope with more than one lens

Equation: $P = 1/f$

P is the power of the lens

f is the focal length

Materials:

- Sheet of cork
- Several lens (from magnifying glass)
- Duct tape
- Pre-prepared microscope slides
- Scissors
- 30 cm ruler
- Flashlight

Safety:

- Be very careful working with glass
- Inform your teacher if you have broken a lens
- Always follow safe laboratory procedures



Science Content for the Teacher:

In this lesson the students are going to build a compound light microscope. The materials for this project can be found at a dollar store, Michaels, and other hobby store. I recommend that the students build and keep their microscope. To help with the funds you can ask the children to buy the magnifying glass and bring them to class. You can provide the roll of cork, duct tape and the pre-prepared microscope slides. The magnifying glasses are just lens, and at the dollar store they are relatively inexpensive, less than \$2.00 for two.

You may need a wire cutter to remove the lens from the plastic, holding it in the magnifying glass.

Explain to the children that they will have to keep their lens as clean as possible (no finger prints). Instruct them to hold the lens by the edges.

The light source for the microscope is the ambient light in the room; this is called a reflective light source because it is reflected from the object you are viewing. There is also a transmission light source were the light is shine through the specimen.

To help with your understanding of the history of the microscope, you can read about it on the following web page. It is also a good idea to have your students read this article too. <http://www.microscope.com/education-center/general-knowledge/history-of-microscopes>



Classroom Procedure:

1. Take the biggest lens and roll it in the cork until the cork forms a tube around the lens.
2. Take the lens and look at a small object. Slowly move the lens until the object comes into sharp focus.
3. Take your ruler and measure this distance in centimeters. (This is your focal length for this lens, make a note of it.)
4. Cut the length of the cork that length and then use duct tape to cover both side of the cork (the duct tape will make the tube sturdy).
5. Put the lens in the cork covered with duct tape and form a tube around the lens.
6. To make your microscope more power full you can stock several lens and then place them at one end of the tube.
7. Look through the other end of the tube at a small object (The lens should be close to the object).
8. Move the entire assembly until the object is sharply focused. It should appear larger than it is. You have just completed the objective lens.
9. To make the eye piece, place another lens over the open end of the tube. This lens could be larger or of the same size as the objective lens.
10. Make a tube for this lens and secure it over the tube with the objective lens.
11. You have now created your very own compound light microscope.

Questions:

1. How powerful is your microscope, Knowing the power of a microscope is equal to one divided by its focal length? ($P = 1/f$)
2. How can you improve your microscope? What design change can you make?
3. Are there any limitations on a light microscope?
4. How can you copy the image you have seen with your microscope?
5. How can you better illuminate the specimen you are viewing?
6. What can you discover with your compound light microscope?



Assessment:

The objective of this lesson is to get the students to build and keep a compound light microscope. Either they build one or they did not.

Extension Activities:

Ask students to photograph what they have seen through their microscope and use these pictures to form a collage.

Ask students to draw what they have seen under their microscope and use these images to form a collage

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