

Two Lenses in One

Primary Audience: 3rd – 5th

NOTES: For the OHIO FUN card referred to in this activity, see the document entitled “Ohio Fun.doc”

LEARNING OBJECTIVES Participants will...

Make observations about how rounded vials filled with water act as magnifying lenses.

Make observations about the differences between convex and concave lenses.

Perform investigations with convex and concave lenses.

KEY POINTS

Lenses which curve outward (convex lenses) make objects appear larger.

Lenses which curve inward (concave lenses) make objects appear smaller.

KEYWORDS: Convex; concave

MATERIALS:

- Per Group:
 - Plastic vial with white lid
 - OHIO FUN cards
 - Pipette
 - Water in a small container
 - Small bottles with different clear liquids in them (such as baby oil, mineral oil, etc.)

PROCEDURES:

Let's do a little more investigating with lenses.

Please remove one plastic vial and one white lid from the bin. Lay those in front of you, and then remove one OHIO FUN card from the bin.

Look at the words OHIO FUN through the side of the vial. Do the letters look any different?

What do you think would happen if we added water to the vial and looked at the words through the water?

Let's try it! Take a pipette out of the bin, and use it to carefully fill the vial with water. Fill the vial completely full, until the water curves up above the top edge of the vial. Put the lid on tightly, and lay the vial on its side over the words OHIO FUN.

How do the letters look now? What do you think will happen if we raise the lens up above the letters about an inch?

Slowly raise the vial straight up. What do you see?

What's happening here?

Do you think the color of the type, with the word OHIO in red and the word FUN in black has any affect?

Let's look at another poster so I can show you what's happening to the light rays when you hold the lens above the words.

Look at the letters in OHIO. What can you tell me about them?

Now look at the letters in FUN. Are they symmetrical? *The word FUN will appear reversed, while OHIO will appear to remain the same.*

So, although both words are really being turned upside down, only the word FUN appears to have changed.

Now remove the lids from the vials and use the pipettes to remove about four drops of water. Replace the lids and lay the vials on their sides again over the words OHIO FUN. Look at the words through the air bubble. What do the letters look like? What type of lens have you created with the bubble? (Concave.)

Look at the printing on the piece of paper with words on it that you used in the last investigation. Compare the size of the printed words on the page, the printed words as they appear through the main part of the vial, and through the air bubble. What do you observe?

IF YOU HAVE TIME:

Now I want you to choose a partner to work with. Each group will need three bottles, one marked "A", one marked "B", and one marked "C". Look at the bottles. Turn them on their sides, maybe upside down. What do you observe?

Do you think each bottle contains the same liquid? If we use these bottles as magnifying lenses, do you think each one will magnify the same?

Try it!

Which bottle magnifies the letters the most? Which bottle do you think contains the most dense liquid? Does this bottle magnify more or less than the other bottles?

Does the less dense or more dense liquid refract more? Why? Try stacking the bottles. What happens?

What's going on?

Light rays change direction when they pass at an angle from one transparent substance to another. In Illustration A, light rays are reflected from the letters written on the paper. When the rays pass from the water in the vial to the curved inside wall of the vial, they are bent, or refracted. The curved vial acts as a concave lens, causing light rays to spread out. Hence, the image appears larger.

Further Exploration:

Are there other liquids that can act as a magnifier? Would a clear plastic pop bottle filled with water work as a magnifying lens? Continue exploring at home or school with the water lens!

Relevant Ohio Science Content Standards:

Physical Sciences: 5.5