

QUESTIONS FOR THOUGHT, DISCUSSION, AND FURTHER STUDY

1. Why is it that you can see your reflection in objects other than mirrors?
2. Why is your image sometimes distorted when you see your reflection on the side of a toaster or other shiny object?
3. What kinds of mirrors are used in amusement parks to distort the size and shape of your body? How do you think they work?
4. Is it possible to reflect an image from one mirror, to another mirror, and then to another? If so, explain how this might be done.
5. A reflecting telescope uses two kinds of mirrors. What are they?
6. Why do plants growing out of a pond, or a spoon sitting in a glass of water, sometimes look bent?
7. What kinds of lenses do you use occasionally? What kinds of lenses do you use everyday?
8. Are plastic lenses better than glass lenses for eyeglasses? What are the advantages and disadvantages of each?
9. A contact lens fits over a specific part of the eye. What is that part of the eye called?
10. Explain farsightedness and nearsightedness.
11. What devices around your home or school use a combination of lenses and mirrors?
12. Can you think of anyone who uses microscopes or telescopes in their work? What about just for fun?
13. Can you design a device that would use lenses and mirrors together?
14. Where does the Hubble telescope operate?
15. Is the Hale telescope a reflecting or refracting telescope? What makes it special?

SUGGESTED TEACHING STRATEGIES: INVESTIGATIONS & EXPERIMENTS

1. Do you have a hand mirror with two sides at home? If so, look into the mirror.
 - a) What does your image look like on both sides? Would you call the sides normal, concave, or convex? Write down your ideas.

2. Interview people you know who wear eyeglasses (corrective lenses). Ask them if you might carefully look through the eyeglasses.
 - a) What do you see? Do you think the lenses are made to correct farsightedness or nearsightedness? Explain.
3. When images are reflected in mirrors, do they appear to be two-dimensional or three-dimensional? Test this.
 - a) Look at your body in a full length mirror. Does your reflection appear to be two- or three-dimensional?
 - b) Place several objects on a flat surface. View them with a regular hand mirror. Do they appear to be two or three-dimensional? Move the objects around; view them again. Do they change in dimensions?
4. Imagine you are using a mirror to trick people into thinking that the image of a small stone is actually a boulder.
 - a) What kind of mirror are you using to enlarge the image? Does it curve outward or inward?
 - b) Draw a picture of the mirror; show its side view.
5. Imagine that you are driving a car and using one of your side mirrors for safety. you look into the round, bubble-shaped mirror located in the middle of the side mirror. you see cars behind you.
 - a) Do the cars in the bubble-shaped mirror look larger or smaller?
 - b) Do you think the bubble shaped mirror is concave or convex? Explain.
6. Have you ever used a microscope?
 - a) If so, what kinds of objects did you view? Is there anything you would like to share?
 - b) Would you like to use a microscope now? What would you like to see? Make a list.
7. Experiment with mirrors and light.
 - a) Go outside; take a small mirror with you. Direct the mirror toward the sun to capture its reflection. Now project the sun's reflection onto the ground, a wall, or some other object. Practice directing light from the sun.
 - b) Ask someone to stand in front of the light that you are projecting. What happens? Does the light bend or go around the person? Does it reflect? Is it absorbed into the persons image? Write down your observations.

Science In Action

Lenses & Mirrors

Students and Teachers Guide

GLOSSARY

Concave lens: A lens with a surface that curves inward.
Concave mirror: A mirror with a surface that curves inward to converge or bring together light; objects look larger when viewed up close.

Concentric: Having a common center.

Contact lens: A thin lens designed to correct a person's vision; it fits over the cornea of the eye.

Converge: To bring together or unite at one point.

Convex lens: A lens with a surface that curves outward.

Convex mirror: A mirror with a surface that curves outward to diverge or spread out light; objects look smaller and further away. Generally used to increase visibility for safety and security reasons.

Cornea: Transparent part of the eyeball's coating which covers the iris and pupil; it admits light to the interior.

Diameter: Length of a straight line through the center of a circle or sphere

Diverge: To spread out or draw apart.

Eyepiece lens: Convex lens in a refracting telescope; it magnifies an image so that it can be seen or recorded with a camera.

Farsightedness: When the eyeball is too short and the focused image falls behind the retina; this causes a person to see distant things more clearly than near ones.

Farsightedness correction: Eyeglasses with convex lenses will bring the focused image forward so that it falls on the retina.

Fresnel (Augustine): A scientist who designed the Fresnel lens in 1822. The lens was made of highly polished glass prisms, and set in a concentric, ring-shaped arrangement. Through a combination of reflection and refraction, a beam of light could be projected over greater distances.

Galileo: An Italian astronomer who designed a telescope to view the sky at night.

Hale telescope: Located on Mt. Palomar, California. This is one of the world's largest reflecting telescopes; its mirror is about 5 meters in diameter.

Hooke's microscope: A compound microscope designed by Hooke in the late 1600s. This microscope contained two convex lenses connected by a tube.

Hubble telescope: A reflecting telescope which operates in space; it is able to view objects that telescopes on earth cannot see.

Iris: Colored part of the eye that surrounds the pupil; it alters in size to control the amount of light entering the eye.

Leeuwenhoek's microscope: A simple microscope designed by Leeuwenhoek in the late 1600s. This microscope magnified objects to 250 times their size.

Lens (of eye): A transparent, nearly spherical body in the eye that focuses light rays.

Lenses: Specially shaped pieces of glass or plastic designed to take advantage of refraction; when light passes through them, it refracts because of their curved surfaces (convex or concave).

Microscope: An optical instrument made of a lens or combination of lenses. It is used to enlarge the images of very small objects.

Mirror: A smooth or polished surface that reflects an image.

Nearsightedness: When the eyeball is too long and the focused image falls in front of the retina; this causes a person to see near things more clearly than distant ones.

Nearsightedness correction: Eyeglasses with concave lenses will bring the focused image back so that it falls on the retina.

Newton (Sir Isaac): An English scientist and mathematician who designed the reflecting telescope in the late 1600s.

Objective lens: A convex lens in a refracting telescope. Closest to the sky, it gathers light and focuses it to form an image.

Observatory: An institution or controlled environment equipped for viewing or observing natural phenomena (as in astronomy).

Optical: Of, relating to, or using light.

Prism: A geometrically shaped piece of glass or other transparent material which scatters or deviates the path of a beam of light.

Pupil (of eye): The usually round opening in the iris of the eye that contracts and expands to control the amount of light falling on the retina. Light reflected on an object enters the eye here.

Reflecting telescope: A telescope which uses a concave mirror to reflect light. When light enters the telescope's open end, a concave mirror reflects the light to a flat mirror; the image is then reflected to the eye or a camera.

Reflection: When a wave of light is mirrored or thrown back from a surface.

Refracting telescope: A telescope which uses two convex lenses, one on each end of a long tube, to bend light (eyepiece lens and objective lens).

Refraction: When light bends.

Retina: The inner surface or sensory membrane of the eye which receives the image formed by the lens and transmits information about color to the brain.

Teleprompter: A device which presents a script in front of an actor or speaker on television.

Telescope: An instrument which helps us to see distant objects.

Yerkes Observatory: An observatory in Wisconsin. It contains the world's largest refracting telescope; its lens is about 1 meter in diameter.

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