

SUGGESTED ANSWERS

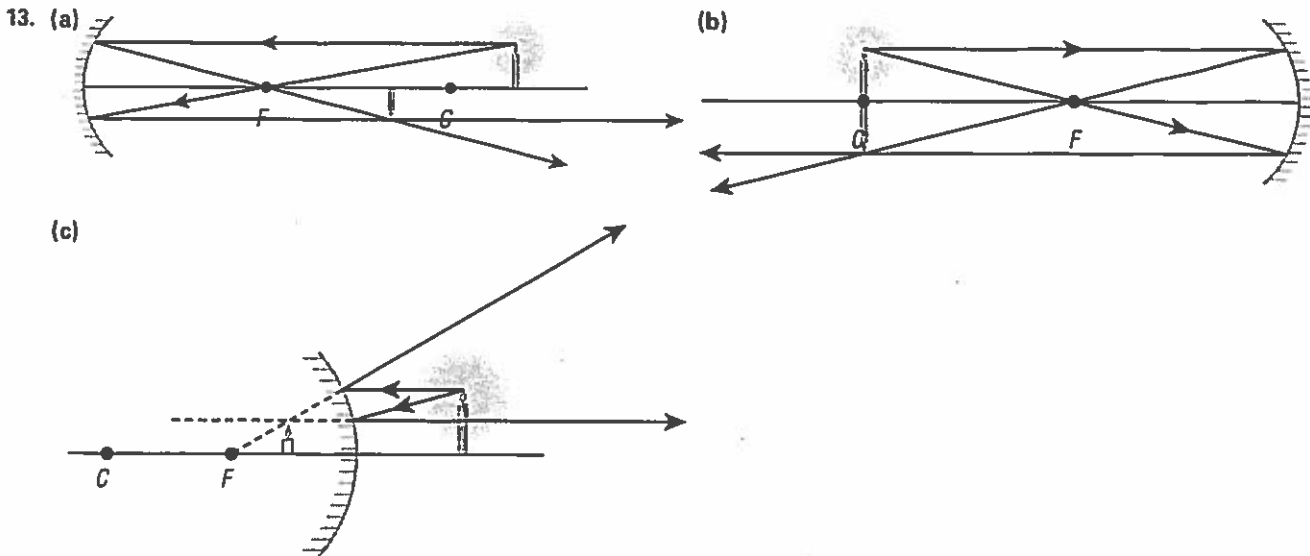
WHAT DO YOU REMEMBER?

1. luminous: produces its own light
transparent: transmits all incident light
white light: visible electromagnetic waves
concave mirror: converging mirror
real image: seen on a screen
normal: 90° to a surface
virtual image: from an apparent light source
convex mirror: diverging mirror
2. They travel at the speed of light and do not require a medium to travel through.
3. An image in a plane mirror is the same size as the original; upright; reversed; there is an equal distance between the object and mirror and image; and the image is virtual.
4. The angle between an incoming light ray and the normal is the same as the angle between the normal and the reflected ray. The incoming ray, the normal, and the reflected ray all lie on a single plane.
5. (a) In phosphorescence, UV light is absorbed by a material and re-emitted as visible light over a period of time.
(b) In electric discharge, light is produced by passing an electric current through a gas.
(c) In triboluminescence, light is produced by scratching, crushing, or rubbing certain crystals.
6. radio waves, microwaves, infrared light, red light, green light, ultraviolet light, X-rays

WHAT DO YOU UNDERSTAND?

7. The word will appear reversed.
8. The light ray concept is a useful model because light sources give off light in all directions (except for lasers). Light rays allow us to use only a few parts of the light to describe where all of the light will go.
9. Rays reflecting from a convex mirror diverge and will never converge, so the image cannot be real.
10. For a real image to form, the object should be in any location farther away from the mirror than its focus. For a virtual image to form, the object should be in any location between the mirror's surface and its focus.
11. (a) Dry asphalt exhibits diffuse reflection; the surface is rough and dull.
(b) A car windshield producing glare in your eyes exhibits specular reflection; glare is a reflection of light with little scattering.
(c) A sweater exhibits diffuse reflection; the sweater is fuzzy and it scatters light in many directions.
(d) High-gloss paint exhibits specular reflection. High-gloss means shiny, and shiny surfaces produce specular reflections.

Initial condition	Angle of incidence	Angle of reflection
angle between the reflected ray and the normal is 47°	47°	47°
angle between the incident ray and the normal is 52°	52°	52°
angle between the incident ray and a plane mirror is 14°	76°	76°
the incident ray comes in along the normal	0°	0°



SOLVE A PROBLEM

14. Sample answer: Brother: I don't think light is a form of energy.

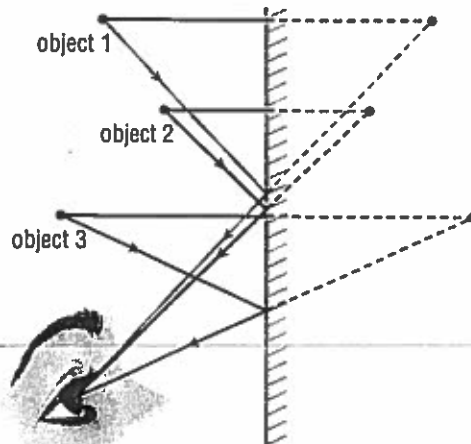
My response: What is energy?

Brother: The ability to do work, to power something.

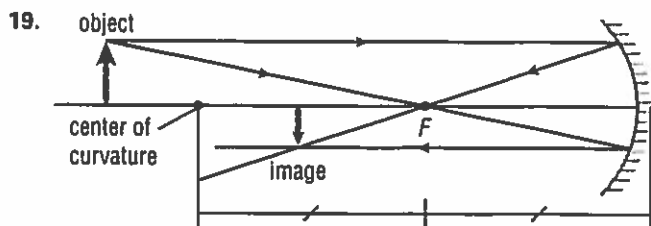
My response: Look at my solar-powered calculator. When I cover the sensors, keeping light out, the calculator won't turn on. But when I expose the sensors to light, the calculator turns on. The energy of the light is being converted and used to power the calculator. Light must be a form of energy!

15. The mirror is 4.2 m from me and the flashlight. The mirror lies halfway between the light source and the image of the light source.

16. All of the objects are visible.



17. Rough glass would scatter light in many directions and prevent specular reflection that could cause glare.
18. The image would be larger, upright, on the other side of the mirror from the object, and virtual.



CREATE AND EVALUATE

20. (a) incandescent: heating a filament with an electric current; fluorescent: electric discharge
 (b) incandescent: lower efficiency; fluorescent: higher efficiency
 (c) incandescent: lower initial cost; fluorescent: higher initial cost
 (d) incandescent: higher long-term cost; fluorescent: lower long-term cost
 (e) incandescent: uses more electricity, so electrical power plants create more air pollution; fluorescent: bulbs contain mercury, which is a health hazard and bad for the environment

REFLECT ON YOUR LEARNING

21. (a) Sample answer: I knew that lenses can project images on a screen, like a movie projector, but I didn't know that mirrors can project images, too.
 (b) Sample answer: I would show them with a diagram how their eyes follow light rays back to an image from which the rays seem to be coming, which is behind the mirror, not on the mirror's surface.

WEB CONNECTIONS

22. Students' answers should point out that incandescent bulbs have a low manufacturing cost, work equally well on DC or AC electricity, are less complex than fluorescent lamps (including their fixtures) and, for a long period of time, produced a more natural color of light than fluorescent lamps.
23. (a) The mirror is concave, probably with a parabolic shape.
 (b) The focus (blast furnace) is located in front of the mirror.
 (c) Advantages: When operating, it will produce no pollution in gathering energy, and it will help to conserve fossil fuels. Disadvantages: It cannot gather energy at night and on cloudy days; light is not as rich an energy source as fossil fuels.