Grade 8 SCIENCE CHATER 6 QUESTIONS

6.1 A page 215

What Did You Find Out? Answers

1. The **convex lens** will **magnify** the print, **provided the object is not placed beyond 2F**, While the **concave lens** will **shrink** the print image.

2. A **convex lens** should be used as a **magnifying glass** because **images cast through it look larger than they really are.**

3. Students' answers could include the **concave lens being used to get a wide-angle view**, such as with a **peephole in a door or the viewfinder in a camera.**

Reading Check Answers, p. 216

1. Convex lens concave lens

2. When two parallel rays pass from air into a concave lens, the normals to the surface at which they enter are at different angles from each other, so the light rays themselves will bend at different angles.

Refer students to Figure 6.4 (B) on page 216 of the student textbook.
Optics 6 • MHR TR 2-53
3. A concave lens makes parallel rays spread apart (diverge).

Reading Check Answers, p. 221

1. The **focal point of a convex lens** is where the **parallel light rays meet after passing through the lens.**

2. The amount of curvature on a convex lens determines the location of the focal point.

   The **greater the curvature**, the **closer** the focal point is to the lens.
   The **shorter the curvature**, the farther the focal point is from the lens.

3. A lens has two focal points because you can shine light on either side of the lens.

4. The image characteristics of an object that is exactly two focal lengths from a convex mirror are the following:
• same size as the object
• same distance from lens
• inverted
• real
convex lens
2F F F 2F image
Object

Reading Check Answers, p. 223

1. In order to find the focal point of a concave lens, extend the refracted rays backward to the point at which they will meet.

2. The curvature of a concave lens determines the location of the focal point.

   The greater the curvature, the closer the focal point is to the lens.
   The smaller the curvature, the farther the focal point is from the lens.

2F F F 2F
image
The characteristics of the image include the following:
• The image is smaller than the object.
• The image is closer to the lens than the object.
• The image is upright.
• The image is virtual.

6-1B page 218 What Did You Find Out? Answers

1. Students' answers will vary, depending on the curvature of the convex lens.

2. The distance measured is the focal length of the lens because that is where all the parallel light rays converged to form an image after passing through the lens.

3. Students' answers will vary, depending on whether the convex lens has the same curvature on both sides.
   If it does, then the focal point on the other side of the lens would be the same distance from the lens.

6-1C page 224

What Did You Find Out? Answers

1. (a) If the paper was held close to the beaker of water, the image had the same orientation up and down and side to side.
   If the paper was held far from the beaker, the image had the same orientation up and down, but reversed orientation side to side.
   (This result is because the beaker is cylindrical and convex side to side, so it only acts as a convex lens only in that direction.)

(b) If the paper was held close to the beaker of water, the image was larger.
If the paper was held far from the beaker, the image was smaller.

2. (a) The projected image of the filament is reversed side to side as well as inverted top to bottom.
(b) The projected image of the filament could be larger or smaller than the actual filament depending on the distance the light bulb is from the lens.
If the light bulb is between the focal point and twice the focal length, then the image of the filament will be larger than the actual filament.
If the light bulb is more than twice as far from the lens as the focal point, then the image of the filament will be smaller than the actual filament.

2. The beaker of water is like a **double convex lens** because the round shape of the beaker can be thought of as two semicircular convex lenses placed back to back.

Analyze Answers

1. The letter *d* would appear as the letter *p*, since the image is reversed left to right and inverted.
2.
pinhole
screen
image is
inverted

Conclude and Apply Answers

1. Tiny holes in the leaves can act like pinholes to cast images of the Sun onto the ground.

Section 6.1 A ssessment, p. 227
Check Your Understanding A nswers

Checking Concepts

1. convex lens concave lens

2. A **concave lens** causes **parallel light rays to diverge.**

3. **Lenses have two focal** points because **you can shine light on either side of the lens.**

4. A **convex lens** should be used in **a magnifying glass** because **images** cast through it can **look larger than they really are.**

   Images seen through a **concave lens** are **always smaller.**

5. The location of the focal point of a convex lens depends on its curvature.
   The greater the curvature of the lens, the closer the focal point is to the lens.

2F F F 2F
image
The image is larger than the object, farther
from the lens than the object, upright, and
virtual.
2F F F 2F
image
The image is smaller than the object, closer to
the lens than the object, upright, and virtual.

Understanding Key Ideas

7. A concave lens affects light more like a convex mirror because both cause parallel light rays to diverge.

8. The first ray is drawn parallel to the principal axis until it meets the centre of the lens, where the refracted ray travels through the focal point on the opposite side of the lens.

The second ray passes through the near focal point, and the refracted ray runs parallel to the principal axis.

The third ray travels straight through the optical centre and the refracted ray continues in a straight line on the other side of the lens.

For an object between the focal point and the lens, these rays will need to be extended backward to the point where they meet to find the image.

9. A convex lens will not produce a magnified image of the object if the object is located more than twice as far from the lens as the focal point.

10. The image produced by a concave lens is always virtual. That is, the image is always located on the same side of the lens as the object.

6.2A Page 228

What Did You Find Out? Answers

1. (a) If the effect works for the viewer, the Canadian flag will appear in its normal red and white colours.

(b) The eye adapts to the colour it is looking at by becoming less sensitive to it. When looking at a white page, which contains all the colours, the other colours are detected more readily.

2. As lighting conditions change between bright sunlight and twilight, the sensitivity of the colour vision increases to allow a scene to continue to be viewed with comfort.

Reading Check Answers, p. 231

1. Light rays passing through the pupil have already moved through the cornea and some watery fluid. They then move through the lens, more watery fluid, and finally fall onto the retina, where they are absorbed.
2. Most of the **focussing in the eye** is done by the **cornea.**

3. The lens becomes thicker when the eye is focussing on objects that are close.

4. The lens becomes thinner when the eye is focussing on objects that are distant.

5. The focal point of the lens is inside the middle of the eye, in the watery fluid. At this point, all light rays come to one point, and then begin to diverge. This process causes the crossover of light rays that results in an inverted image when it strikes the retina.

Reading Check Answers, p. 236

1. As children grow, different parts of the eye can change shape at different rates and temporarily make it more difficult to focus.

As people age, the lens begins to harden, making it more difficult to become thicker. This result makes it more difficult to see close objects.

2. The eye of a person who **is near-sighted** causes **light rays to converge too soon, forming an image in front of the retina instead of on it.**
This result makes it especially difficult to focus on distant objects because the light from them is almost parallel when it enters the eye and needs the least amount of converging.

Light rays from nearby objects are diverging as they enter the eye and need the most amount of converging to bring them into focus. This process is easy for a person who **is nearsighted.**

3. The eye of a person who **is far-sighted** cannot cause light rays to converge enough, and an image is formed behind the retina instead of on it.
This result makes it especially difficult to focus on nearby objects because the light from them is diverging when it enters the eye and needs the most amount of converging.

Light rays from distant objects are nearly parallel as they enter the eye and need the least amount of converging to bring them into focus. This **process is easy for a person who is far-sighted.**

4. **Astigmatism** is the formation of multiple blurry images instead of a single clear one.
It is caused by an irregularly-shaped cornea which causes light to be focussed in several places at one time.

5. A person who is **legally blind** might see clearly only in a tiny part of the middle of a whole scene, or see on the edges of their vision (but not in the centre). Others can detect only light and darkness.

6. **Malnutrition and lack of vision** care can both cause **blindness**.
These types of vision problems tend to affect people who are financially disadvantaged, or people without vision clinics nearby, such as children in developing countries.

7. **Snow blindness** can be prevented with the use of close-fitting sunglasses or goggles with only thin slits.

What to Do Answers

Part 1

2. **Rod cells** are more useful for **night vision** because they are **very sensitive to all light.**
Their **greater amount of pigment** allows them to **detect light even at a very low level.**

3. **Cone cells** are more useful for **colour vision** because **they have three types of pigments.**
The three types **allow different colours to be perceived separately from one another.**

Part 2

5. (a) **Red-sensitive cone cells** detect most effectively at about **560 nm (their sensitivity peaks at 564 nm).**

(b) You might wish to refer students to page 150, Figure 4.21 in the student textbook.
Green/yellow corresponds to 560 nm.

(c) The **red-sensitive cone cells** can actually **detect green better than red.**

(d) The **red-sensitive cone** cells are **better at detecting red** than either of the other two kinds of cones.

6. (a**) Black- and white-sensitive rod cells** detect most efficiently **at about 490 nm (they peak at 498 nm).**

(b) Refer to page 150, Figure 4.21 in the student textbook.
The wavelength 490 nm corresponds to green.

7. Humans are able to detect faint amounts of green light for two reasons:

   (i) Rod cells are the most sensitive kind of light-detecting cells and their pigment is more efficient at detecting green.
   9ii) all three types of cone cells are able to detect some green light.

Think A bout I t A ctivity 6-2C
Being B

What Did You Find Out? Answers

1. (a) Many people with vision impairment do not mind the use of words such as "see" and "watch" in everyday speech with their friends. If in doubt, just ask the person.

(b) Phrases such as "The book is over there" or "Come here" are meaningless to anyone who is blind. Instead, details of the specific location should be given.
i.e turn left in five paces
2. Students' answers could include the following:
A person who is visually impaired and who is new to the classroom would like to feel accepted and included in the class. You might begin by simply remembering to include and talk with him/her.

3. Students' answers could include the following:
People who are blind need to know where things are, so not moving objects around would be helpful. Also, it is important not to block walkways with items such as backpacks

Analyze Answers

1. Students' answers could include the following:
Sheep eye Human eye
4 muscles to move eye 6 muscles to move eye
oval iris circular iris
Iridescent layer under retina No iridescent layer
No black layer under retina Black layer under retina

2. The image cast on the retina is inverted.

3. The lens from the sheep eye may be hard, yellow, spherical or oval, smooth, and translucent.

Conclude and Apply Answers

1. Students' diagram should include the cornea, sclera, iris, pupil, lens, optic nerve, and retina.
cornea
lens
retina
sclera
optic nerve
iris
pupil

2. Students' answers could include the following:
Since processing of electrical signals begins right in the retina, it can be argued that the retina is an extension of the brain.

Section 6.2 A ssessment, p. 241
Check Your Understanding A nswers
Checking Concepts

1. Students' answers could include the following:

Part of Ey e	Function
Sclera	Surrounds and protects eye
Cornea	Protective outer surface; focussing
Pupil	Opening that allows light to pass through
Iris	Controls the amount of light entering eye
Lens	Focussing
Retina	Detects light; where image is formed
Optic nerve	Carries light signals from retina to brain

2. (a) The **cornea and the lens** are involved in **focussing an image.**

(b) The **cornea does most of the focussing**, but the **amount of focussing is not adjustable**.

The **lens does less focusing**, but **it can be adjusted (fine tuned) to bring the image into focus.**

3. (a) The vision problem shown by the illustration is **near-sightedness, because the image forms in front of the retina instead of on it.**

(b) **Corrective concave lenses** can be used to help with **near-sightedness.**

4. The **human colour vision system needs bright light to become activated**.
This result means colour is seen better in bright light.

5. Students' answers could include the following:

Blindness is any long term impairment that does not allow a person to see.

Understanding Key Ideas

6. If a person's lens was unable to change shape, then that person could not focus on objects located at different distances, but instead, would be able to see clearly at only one distance.

7. **All three kinds of cone cells** are necessary to **detect the three primary colours needed to construct all the colours.**

7. (a) In **sudden brightness**, the **iris contracts the pupil, reducing the amount of light striking the retina.**

(b) In **gradual dimming of light,** the **muscles of the iris dilate or enlarge the pupil, letting in more light.**

(c) Looking at **a kite**, the eye is focussing at a distant object **by relaxing muscles in the eye, which causes the lens to become thinner.**

Looking down at **your hand**, the **muscles tighten up, which causes the lens to thicken, allowing the close object to come into focus.**

8. Students' answers could include the following:

It is difficult to know for sure whether animals can see colour, or which colours they are able to see.
If they did not have cones in their retina, then they could not see colour.
If they had only one type of cone or two types of cones, then they could see only a few colours.

Find O ut A ctivity 6-3A Experimenting with a Simple Lens, p. 242

What Did You Find Out? Answers

1. With the test tube lens lying against the card, the letters are upright and magnified.
   As the test tube lens is lifted, the letters are still magnified, but become inverted.
   Continuing to raise the test tube lens higher makes the inverted image shrink.

2.
test tube lens
inverted letter T

Reading Check Answers, p. 249

1. The objective lens of a microscope collects light and focusses it into an enlarged image inside the body of the instrument.
   This image is then magnified again by the eyepiece lens, and directed into the eye of the microscope operator.

2. A reflecting telescope and a microscope both form an enlarged image inside the body of the instrument.
   This image is then magnified further using a convex lens.

3. The primary light-gathering device in a **reflecting telescope** is a **concave mirror**, whereas in a **refracting telescope**, it is a **convex lens**.

4. The Hubble Space Telescope is above Earth's atmosphere, which allows it to get a much clearer image of objects in space than Earthbound telescopes.

5. Prisms in binoculars are used to shorten the two reflecting telescopes that make up binoculars.

   The prisms reflect the light back and forth, which increases the length of the light ray's path, simulating a longer telescope.

6. Telephoto lenses have a long focal length, while wide-angle lenses have a very short focal length.

7. Students' answers could include the following:

   The lens cap and the eyelid both provide protection.

The diaphragm in the camera and the iris in the eye both control the amount of light that can enter.
The image is inverted by the time it reaches the CCD detector in the camera or the retina in the eye.

8. Students' answers could include the following:

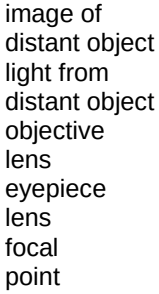
The cornea is used in the eye to accomplish most of the focussing.
There is no similar structure in a camera, which does all of its focussing with the lens.
Some cameras have several lenses, while an eye has only one lens.

Section 6.3 A ssessment, p. 251
Check Your Understanding A nswers
Checking Concepts

1. Students' answers could include the following:

Camera Part	Function
Lens cover	Protection
Lens	Collects light and magnifies image
Focussing ring	Moves lens in order to focus image
Diaphragm	Controls amount of light entering camera
Shutter	Controls whether light can reach the CCD
CCD	Detects light and converts it into an electrical signal

2. (a) and (b)



3. (a) The **objective lens in a microscope** produces a **magnified image that is not seen directly.**

(b) Forming a magnified image inside the body of the microscope gives an opportunity to use a **second lens to magnify the image even further.**

4. A **refracting telescope** uses two convex lenses to produce a large image: **an objective lens and an eyepiece lens**.

A **reflecting telescope** uses **two mirrors (a concave mirror and a plane mirror)** to create an image, which is then **magnified by a convex lens.**

4. A **wide-angle lens** has a :
   (i) short focal length,
   (ii) produces a small image of the object,
   (iii) has a wide field of view.

   A **telephoto lens** has a :
   (i) Longer focal length
   (ii) produces an enlarged image that seems closer than it actually is
   (iii) has a small field of view.

Understanding Key Ideas

6. (a) **Light from distant galaxies** is extremely **faint**. To detect as much of this light as possible, large mirrors are used.

(b) A large lens is inferior to a large mirror because it is extremely heavy, is costly and difficult to make, and even the best lenses change shape (if they are too large) and absorb some of the light, removing it from the formation of an image.

7. The **final image of the object produced by a microscope is virtual**.

The **compound microscope** involves magnification of the object **using two lenses**.

The objective lens forms a real image of the object inside the body of the microscope, which then becomes the object for the eyepiece lens to magnify.
The eyepiece lens produces a virtual image which can be seen by the eye when looking through this lens.

F_2
F_2
F_1
virtual image
formed by eyepiece
eyepiece
objective lens
specimen
real image
formed by
objective lens
F_1 F_2

8. Modern research telescopes are large in order to be able to gather as much light as possible. As a result, objects such as distant galaxies appear much brighter, and their images can be magnified to a greater extent to reveal more detail.

9. Modern telescopes are very complex instruments. It is better for large groups of scientists and engineers to work together when designing and building modern telescopes so that experts are utilized in their area of expertise to create a technology in which every part works well.

Section 6.3 A ssessment, p. 251
Check Your Understanding A nswers

Checking Concepts

1. Students' answers could include the following:

Camera Part	Function
Lens cover	Protection
Lens	Collects light and magnifies image
Focussing ring	Moves lens in order to focus image
Diaphragm	Controls amount of light entering camera
Shutter	Controls whether light can reach the CCD
CCD	Detects light and converts it into an electrical signal

2. (a) and (b)
image of
distant object
light from
distant object
objective
lens
eyepiece
lens
focal
point

3. (a) The **objective lens in a microscope** produces a magnified image that is not seen directly.

(b) Forming a magnified image inside the body of the microscope gives an opportunity to use a second lens to magnify the image even further.

4. A **refracting telescope** uses two convex lenses to produce a large image: an objective lens and an eyepiece lens.

A **reflecting telescope** uses two mirrors (a concave mirror and a plane mirror) to create an image, which is then magnified by a convex lens.

5. A **wide-angle lens** has a **short focal length, produces a small image of the object, and has a wide field of view**.

A **telephoto lens** has a longer focal length, produces an enlarged image that seems closer than it actually is, and has a small field of view.

Understanding Key Ideas

6. (a) Light from distant galaxies is extremely faint. To detect as much of this light as possible, large mirrors are used.

(b) A large lens is inferior to a large mirror because it is extremely heavy, is costly and difficult to make, and even the best lenses change shape (if they are too large) and absorb some of the light, removing it from the formation of an image.

7. The **final image** of the object produced by a microscope is virtual.

The **compound microscope** involves magnification of the object using two lenses.

The objective lens forms a real image of the object inside the body of the microscope, which then becomes the object for the eyepiece lens to magnify.

The eyepiece lens produces a virtual image which can be seen by the eye when looking through this lens.
F_2
F_2
F_1
virtual image
formed by eyepiece
eyepiece
objective lens
specimen
real image
formed by
objective lens
F_1 F_2

8. Modern research telescopes are large in order to be able to gather as much light as possible.
As a result, objects such as distant galaxies appear much brighter, and their images can be magnified to a greater extent to reveal more detail.

9. Modern telescopes are very complex instruments.
It is better for large groups of scientists and engineers to work together when designing and building modern telescopes so that experts are utilized in their area of expertise to create a technology in which every part works well.

Pause and R eflec

Visualizing Key Ideas

1. Students can use BLM 2-47, Light Concept Map to record their responses to question 1.

ray particle
model
spectrum
invisible
visible
ROYGBIV
lens mirror
convex
concave
plane
wave
light
optical
components
electromagnetic

Using Key Terms

2. (a) False. The amplitude of a wave is the distance between the wave crest and the *equilibrium position.*
(b) True
(c) False. An *opaque* material prevents light from penetrating the object.
(d) True
(e) False. *Diffuse reflection* scatters light, preventing the formation of an image.
(f) False. The angle of reflection is the angle between the reflected wave and the *normal*to the reflecting surface.
(g) True
(h) False. A *concave* mirror causes light rays to converge toward a focal point. Or, a convexmirror causes light rays to *diverge*.
(i) False. Concave mirrors always *converge* light rays and can form images that are real.
(j) False.
When a ray passes from a less dense medium to a more dense medium, the ray bends *toward* the normal.
When a ray passes from a *more* dense medium to a *less* dense medium, the ray bends away from the normal.
(k) False. Far-sighted vision results when light rays produce an image *behind* the retina.
N*ear-sighted* vision results when light rays produce an image before they reach the retina.
(l) False. *Concave* lenses always form virtual images.
(m) False. Microscopes and telescopes *both* have objective lens.
(n) False. A refracting telescope is made of a combination of *lenses*. Or, a *reflecting* telescope is made of a combination of lenses and mirrors.

Checking Concepts

3. Students' answers could include the following:

The invention of the microscope allowed scientists to study the microbial world. The development of the telescope allowed scientists to view the components of outer space in detail.

4. wavelength

wavelength
amplitude
trough amplitude
crest

5. A prism causes the white light to refract and separate into its component colours: red, orange, yellow, green, blue, indigo, and violet.

6. Transparent materials allow light to pass right through without any change in direction.

   Translucent materials allow light through but scatter it in every direction.

7. Light is electromagnetic radiation and can travel through a vacuum but sound waves depend on particles and cannot.

8. Students' answers could include the following:

Microwaves: microwave ovens, satellite communications (cell phone and television satellite dish), airport radar transmitters and receivers

X rays: medical imaging (dental, CT scan), airport security scanning machines

9. The law of reflection states that the angle of reflection is equal to the angle of incidence.

10. In specular reflection, all incident rays hit the flat, smooth surface with the same angle of incidence,

    so they all reflect at the same angle of reflection.

    In diffuse reflection, the angles of incidence for the rays are different because the surface is rough, so their corresponding angles of reflection are also different.

    Whether the surface is smooth or rough, each individual ray that strikes the surface obeys the law of reflection.

11. Waves travel more quickly through less dense materials. If a wave hits an interface between two materials of different densities, its speed will change. If it hits the interface at an angle, one side of the wave will slow down or speed up before the other, and the wave will change direction.

12. Images formed by plane mirrors are the same size as the object, the same distance from the mirror as the object, upright, and virtual.

13. The ray reflects off the mirror and travels parallel to the principal axis.

14. The characteristics of the image are the following: larger than the object, farther from the mirror than the object, inverted, and real.

2F F
principal
axis

15. The focal point for a convex mirror is behind the mirror. To find its location, draw incident rays parallel to the principal axis, and extend the reflected rays behind the mirror until they meet.

F

16. A real image is an image **formed when reflected rays meet**. If you put a screen at that location, the image would appear on the screen. A virtual image is an image formed by **the extension of the reflected rays**. The light rays only appear to be coming from the image.

17. The refracted ray travels through the focal point on the opposite side of the convex lens.

18. The object must be located more than twice as far from the lens as the focal point.

2F 2F
image
F F

19. As the object moves farther from a concave lens, its image becomes smaller and moves a little bit farther from the lens (but it is still closer to the lens than the object).

20. The lens is able to fine-tune our focus by changing its shape. When the eye focusses on a nearby object, the lens is very round. When the eye focusses on a distant object, the shape of the lens becomes flatter.

21. A **concave lens** is used to correct **nearsightedness**.

light reflected from distant object

Near-sighted vision: image falls short of retina (eye has longer shape than normal eye)

Vision corrected with concave lens: lens allows image to fall on retina concave lens

22. Four common defects in human vision include the following:

• **Near-sightedness**: the ability to see near objects clearly, but distant objects are fuzzy

• **Far-sightedness**: the ability to see distant objects clearly, but close objects are fuzzy

• **Astigmatism**: the inability to form a clear image or the tendency to form multiple blurry images

• **Colour blindness**: the ability to distinguish some colours but not others

TR 2-74 MHR • Optics 6

2 3.

objective lens
eyepiece
prisms
thumbscrew

24. Refracting telescopes and microscopes both use two lenses. In both devices, an objective lens collects the light and focusses it into an image, which is magnified by the eyepiece lens. However, the lens in a telescope has a longer focal length than in a microscope because the objects viewed are far from the lens.

Understanding Key Ideas

25. Students' answers could include the following:
• X rays are absorbed better by bone than by tissue, which allows an image of a skeleton to be formed. Very sensitive X-ray procedures can also differentiate between different types of tissues.

• Radio waves are used in conjunction with strong magnets to make an image of different tissues and bones. The technique is called MRI or magnetic resonance imaging.

26. Students' answers may include these facts:
Light and microwaves can both travel vast distances through a vacuum.
Light and ultraviolet radiation are both produced by the Sun.
Florescent materials can absorb ultraviolet radiation and emit light.
Light and infrared radiation can both be reflected.

27. When light shines on a white page of black print, the black ink absorbs the incident light that hits it. The light that hits the white parts of the page produces diffuse reflection and the reflected rays go out in all different directions, reaching your eyes and allowing you to see white on the uneven surface of the paper.

28. The smoothness of the surface determines whether or not an image will be produced.
An image is produced in a mirror because it is a smooth surface and produces specular reflection.
Under a microscope, you will see that a piece of paper is not actually smooth, so it does not produce an image. Reflection is diffuse.

29. A concave mirror can produce a real image that can be captured on a screen.
A convex mirror produces a virtual image that does not appear on a screen since light rays do not actually come from it.

30. Colour vision is detected by three kinds of cone cells, each of which detects a different part of the visible spectrum. When the three colours are received by the brain, the brain constructs a colour image from them.

Black and white vision is detected by rod cells, which are very sensitive to dim light but do not distinguish any differences between different colours.

31. The objective lens is a convex lens used to form an enlarged image of the object.
The eyepiece lens, which is another convex lens, then magnifies this image so that the final image can be hundreds of times larger than the actual object.

32. The green medium (A) is more dense than the blue medium
(B) because the light is refracted away from the normal as it travels from A to B.

33. You can find the focal point of a convex lens by shining parallel beams of light through the lens.
The rays will converge to a point and the distance from this point to the centre of the lens is called the focal length of the lens.

34. Mirrors have one focal point because light can pass only on one side.
Lenses, on the other hand, have two sides through which light can travel, so they have two focal points.

Thinking Critically

35. Since no refraction occurs, the speed of light must be the same in both the plastic and the liquid.