

UNIT E

Review

SUGGESTED ANSWERS

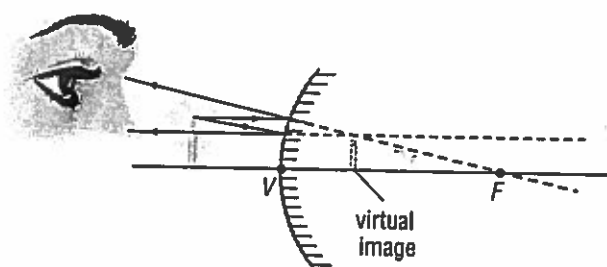
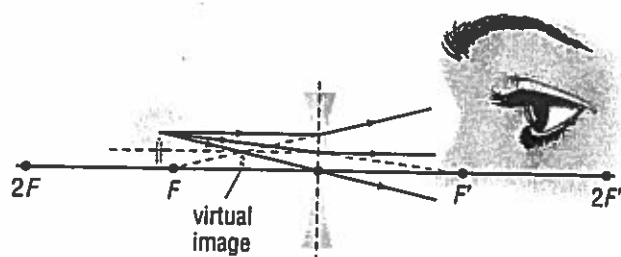
WHAT DO YOU REMEMBER?

1. (c)
2. (a)
3. (c)
4. (a)
5. (c)
6. (c)
7. (d)
8. (a)
9. True
10. True
11. False. Light can travel in a vacuum.
12. False. A light ray undergoes partial reflection and transmission when it strikes a surface such as a piece of glass.
13. False. The centre of a lens is called the optical centre.
14. False. A converging lens brings light rays closer together after refraction.
15. True
16. False. A light ray that is parallel to the principal axis is refracted to either pass through the principal focus or in a direction that can be traced back to the principal focus.
17. True
18. False. Film is similar to the retina.
19. False. An object on the secondary principal focus does not produce an image.
20. luminous
21. light
22. gamma
23. smaller, upright
24. converging
25. 90°
26. diverging
27. focus
28. critical
29. myopia
30. (a) (ii)
- (b) (iii)
- (c) (i)
- (d) (v)
- (e) (iv)
31. (a) transparent
- (b) transparent
- (c) translucent
- (d) opaque
- (e) opaque
- (f) translucent
- (g) transparent
32. A converging lens is thickest in the middle, while a diverging lens is thinnest in the middle.
33. (a) Angle of incidence is the angle between an incident ray and the normal.
- (b) Angle of refraction is the angle between a refracted ray and the normal.
- (c) Focus is the point to which incident rays travelling parallel to the principal axis of a mirror or lens are converged after reflection (mirror) or refraction (lens), or the point from which such incident rays appear to originate after they have been reflected or refracted.

- (d) Magnification is the ratio of the height of an image to the height of an object or the negative ratio of the image distance to the object distance.
- (e) A mirage is a virtual image that forms as a result of refraction and total internal reflection in Earth's atmosphere.
- (f) A virtual image is an image formed by light that is not arriving at or coming from the actual image location.

WHAT DO YOU UNDERSTAND?

- 34. (a) Sample answer: rock
- (b) Sample answer: window
- (c) Sample answer: amber
- 35. (a) Sample answer: WOW
- (b) Sample answer: MAT
- 36. (a) Electric discharge is the production of light by electric current passing through a gas, such as in a neon light.
- (b) Bioluminescence is the production of light by chemical reactions in a living thing.
- (c) Chemiluminescence is light that is a direct by-product of a chemical reaction.
- 37. The word will be reversed.
- 38. All electromagnetic waves travel at the speed of light in a vacuum and need no medium for transmission.
- 39. (a) Incandescence is the emission of light due to high temperature. Fluorescence occurs when ultraviolet light is absorbed by a material, and some of the energy is re-emitted as visible light.
- (b) In triboluminescence, the scratching, rubbing, or crushing of certain crystals causes light to be emitted. Phosphorescence, on the other hand, occurs when a material absorbs ultraviolet light and then re-emits visible light over a period of time.
- 40. (a) specular: The floor could be shiny enough to produce a mirror-like image.
- (b) diffuse: If the foil is very crumpled, the tiny flat portions will reflect light in many different directions, thus scattering the light.
- (c) diffuse: The carpet scatters light in all directions and is not shiny at all.
- (d) specular: A flat piece of foil can act like a mirror.
- 41. A laser would only direct light in a single direction. To illuminate a room, light must travel in all directions.
- 42. A diverging lens or mirror cannot redirect light rays from a point on an object through a common crossing at a point on an image and thus cannot form real images. The human brain creates the illusion that diverging light from these lenses or mirrors comes from a single focus point and we see a virtual image.

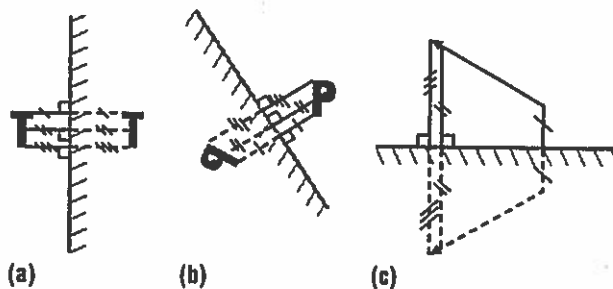


43.

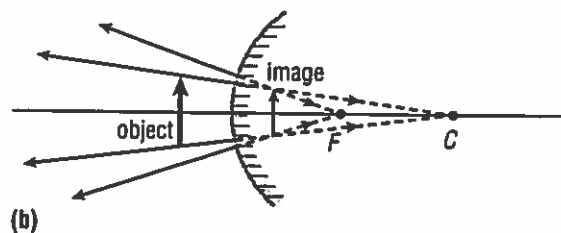
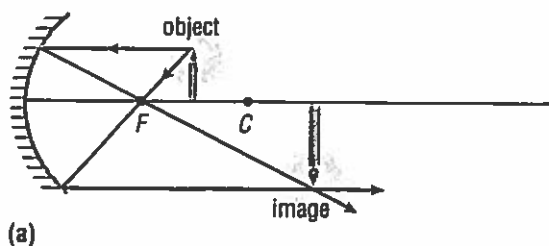
Table 1 Angles of Incidence and Reflection

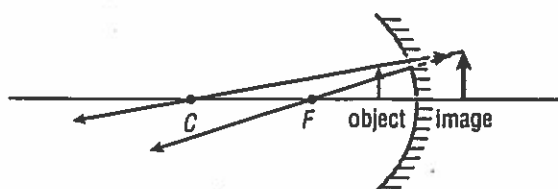
Description	Angle of incidence	Angle of reflection
angle between the incident ray and the normal is 38°	38°	38°
angle between the incident ray and the normal is 12°	12°	12°
angle between the reflected ray and the flat mirror surface is 43°	47°	47°
angle between the reflected ray and the normal is 23°	23°	23°
the incident ray is perpendicular to the flat mirror surface	0°	0°

44. (a) Each line must run from a point on the object to the corresponding point on the image and be of equal length on either side of the mirrored surface as well as perpendicular to the mirrored surface.
 (b) The images are the same size, reversed, the same distance from the other side of the mirrored surface, and virtual.



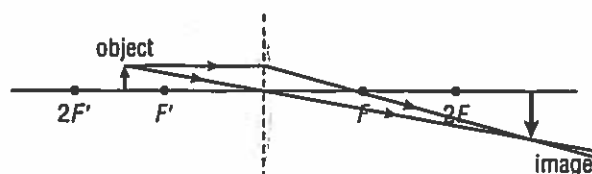
45. (a) A ray from the tip of the candle flame going parallel to the principal axis will reflect through F . A ray from the flame tip going through F will reflect parallel to the principal axis. These rays will meet at the image of the tip of the flame. The image is larger, inverted, beyond C , and real.
 (b) A ray from either the tip of the object arrow or its tail that is going parallel to the optical axis will reflect in alignment with F . A ray from either the tip of the object arrow or its tail that is going toward C will reflect back upon itself. These rays must be traced back to an apparent point of origin to locate a virtual image of either the arrow tip or its tail. The image is smaller, upright, between the mirror and F , and virtual.
 (c) A ray from the tip of the object arrow going parallel to the principal axis will reflect through F . A ray going in alignment with C will reflect back upon itself. These rays must be traced back to an apparent point of origin to locate a virtual image of the arrow tip. The image is larger, upright, on the other side of the mirror from the object, and virtual.



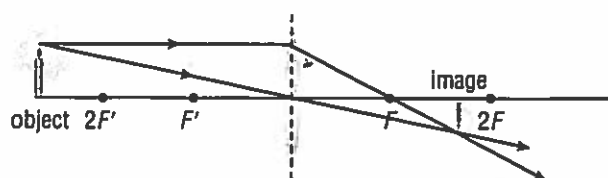


(c)

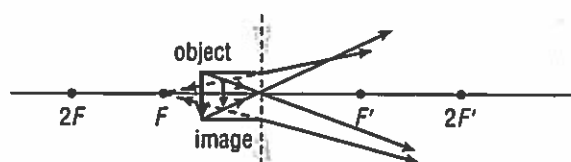
46. (a) Material B has the greater index of refraction.
 (b) Light will travel more slowly in Material B.
47. (a) A ray from the tip of the object arrow going parallel to the principal axis will refract through F. A ray from the arrow tip going through O will continue unreflected. Both rays will meet at the image of the tip of the arrow. The image is larger, inverted, beyond $2F$, and real.
- (b) A ray from the tip of the candle flame going parallel to the principal axis will refract through F. A ray from the flame tip going through O will continue unreflected. These two rays will meet at the image of the tip of the flame. The image is smaller, inverted, between $2F$ and F, and real.
- (c) A ray from either the tip of the object arrow or its tail that is going parallel to the principal axis will refract in alignment with F. A ray from the arrow tip or its tail that is going through O will continue unreflected. These rays must be traced back to an apparent point of origin to locate a virtual image of the arrow tip or its tail. The image is smaller, upright, between F and the lens, and virtual.



(a)



(b)



(c)

SOLVE A PROBLEM

48. Answers will vary, but students should explain that detergents may contain fluorescent dyes that glow slightly in daylight due to the ultraviolet light in sunshine. The clothes are not really cleaner, but they look whiter.
49. (a) Ultraviolet light, especially UVB, is the form of radiation from the Sun that causes skin damage.
 (b) Anything that reduces exposure to ultraviolet light helps skin to stay healthy. This includes wearing sunblock or sunscreen, wearing clothes that cover the skin more, wearing a hat with a wide brim, and staying indoors during the middle part of the day when the Sun's rays are strongest.
50. As the cat comes very close to the mirror, her virtual image will also come close to the other side of the mirrored surface. But the protective glass over the mirrored surface will keep her from completely reaching her image. She could not "touch" her image because it is virtual and there are no light rays at the image position.

51. (a) The image will be located beyond C .
 Yes, the image is there because light rays from points on the object are passing through the corresponding points in the image.
 You could place a small screen or piece of wax paper at the image location to see it by projection.
- (b) The image is now on the other side of the mirror and virtual. You must look into the mirror with the object in front of you to see its image.
52. 2.05×10^8 m/s
53. 1.47
54. The index of refraction (n) for the transparent medium must be found using the formula
 $\sin \angle 1 / \sin \angle 2$
 So, $45^\circ / \sin 30^\circ = 1.42$
 Then, use the formula $v = c/n$
 $v = 3.00 \times 10^8 / 1.42$
 $v = 2.1 \times 10^8$ m/s
55. Using the formula $1/d_o + 1/d_i = 1/f$
 So, $1/d_i = 1/f - 1/d_o$
 $1/d_i = 1/34 - 1/45$
 The image is located 142 cm behind the lens.
56. The image of the tree is on the other side of the lens at a distance of 139 cm from the optical centre. The image is larger, inverted, beyond $2F$, and real.
57. F is 13 cm from the lens.
58. (a) The image is 58 cm from the lens on the same side as the sea shell. The image is larger, upright, beyond $2F$ and virtual.
 (b) $M = 3.4$
59. (a) virtual
 (b) $f = -8.1$ cm
60. The fruit bowl is 22 cm from the centre of the lens.
61. $M = -3.1$

CREATE AND EVALUATE

62. Student answers should focus on the low efficiency of incandescent bulbs, the better efficiency of CFL's, but note also that the latter pose environmental problems because of mercury, and then suggest LEDs as the most environmentally friendly and energy efficient option.
63. These mirrors show a wide range of view, so they can be used to help see traffic around the sharp turn.
64. (a) The Sun provides energy to plankton in the ocean and plants on the land, providing the bases of food chains for almost all organisms on Earth.
 (b) Students' notices should explain that too much exposure to the Sun is a risk factor for skin cancer. Ways that people can protect themselves from the Sun's harmful rays include using sunscreen and wearing a hat.