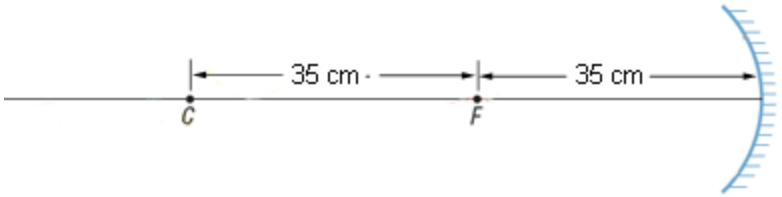
SNC2D Optics Unit Test

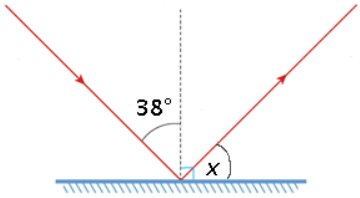
Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. The focus of a concave mirror is 35 cm from the vertex, and its centre is 70 cm from the vertex. Where would you place an object in order to have the mirror reflect a virtual image rather than a real image?



a. 30 cm from the vertex
b. 45 cm from the vertex
c. 70 cm from the vertex
d. 75 cm from the vertex

____ 2. You are holding a flashlight so the beam strikes a plane mirror at an incident angle of 38?. What is the measure of angle *x* between the reflected light ray and the mirror?



a. 38?
b. 52?
c. 90?
d. 155?

____ 3. Magnifying mirrors are usually concave because concave mirrors
a. can form either a virtual or a real image
b. form a virtual image that is in front of the mirror
c. form a virtual image that is smaller than the actual object
d. form a virtual image that is larger than the actual object

____ 4. How is visible light different from all other forms of electromagnetic radiation?
a. It has shorter wavelengths.
b. It has longer wavelengths.
c. It is made up of waves of many different wavelengths.
d. It can be detected by the human eye.

____ 5. What must happen to an object in order for incandescence to occur?
a. It must absorb radiation.
b. It must be placed inside a light bulb.
c. It must get very hot.
d. It must have electricity put through it.

____ 6. Which kind of mirror would you put at the end of your driveway in order to let you see as wide a view of the street as possible?
a. converging mirror
b. diverging mirror
c. plane mirror
d. combination of mirrors

____ 7. Where would you place an object in order to get an image that was upright and larger than the object itself?

a. at C
b. between F and V
c. between F and C
d. at F

____ 8. A mirror company wants to create a mirror that does not reverse images. Which idea would work?
a. Reflect the image in a curved mirror.
b. Reflect the image upside down.
c. Reflect the image twice to reverse the reversed image.
d. Reflect the image three times to reverse the reversed image.

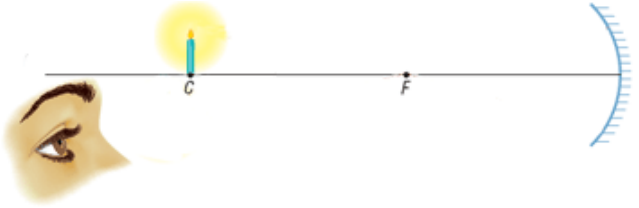
____ 9. How are the sparks that fly off a grinder different from those produced by triboluminescence?
a. They are glowing because they are hot.
b. They are glowing because of electricity.
c. They are glowing because of phosphorescence.
d. They are glowing because of fluorescence.

____ 10. How are chemiluminescence and triboluminescence similar?
a. They both occur in living organisms.
b. They both involve minerals.
c. Neither one produces much heat.
d. They both involve chemical reactions.

____ 11. Which of the following is luminous?
a. a tree
b. the Moon
c. a pond
d. a flame

____ 12. Which is an example of incandescence?
a. a firefly's light
b. a laser
c. a glowing piece of charcoal
d. an LED

____ 13. An object is placed at C. What kind of image will this situation produce?

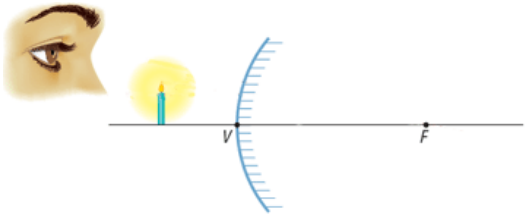


a. real, upright, same size as the original
b. real, inverted, smaller the original
c. real, inverted, same size as the original
d. virtual, upright, same size as the original

____ 14. What is a *normal* line?
a. A line that is perpendicular to the angle of incidence,
b. A line that is perpendicular to the angle of reflection.
c. A line that is perpendicular to the reflecting surface.
d. A line that is parallel to the angle of incidence.

____ 15. The image formed by a converging mirror when the object is closer than *F* is
a. virtual because the reflecting rays intersect
b. virtual because the reflecting rays diverge
c. real because the reflecting rays diverge
d. real because the reflecting rays intersect

____ 16. The image in this mirror will be



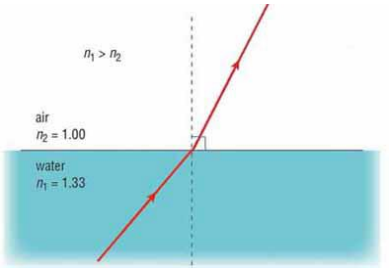
a. upright, smaller than the original, and virtual
b. inverted, smaller than the original, and virtual
c. upright, larger than the original, and virtual
d. upright, smaller than the original, and real

____ 17. A convex mirror has a wider field of view than a plane mirror because the reflected image
   a. is virtual
   b. appears to be behind the mirror
   c. is not inverted, as images in concave mirrors are
   d. is reduced, which allows more of it to fit into the mirror

____ 18. Water's index of refraction is 1.33. The speed of light in water is
   a. 2.26×10^8 m/s
   b. 1.33×10^8 m/s
   c. 4.43×10^8 m/s
   d. 3.24×10^8 m/s

____ 19. The speed of light in vegetable oil is 2.04×10^8 m/s. What is the index of refraction of vegetable oil?
   a. 1.47
   b. 2.42
   c. 1.49
   d. 2.01

____ 20. What would you do to make this diagram more accurate?



   a. Redraw the refracted ray so it bends away from the normal.
   b. Reverse the values for n_1 and n_2.
   c. Redraw the refracted ray so it bends toward the normal.
   d. Redraw the refracted ray so it reflects back into the water.

____ 21. Glass's index of refraction is 1.52. The speed of light in glass is
   a. 5.07×10^8 m/s
   b. 1.97×10^8 m/s
   c. 3.34×10^8 m/s
   d. 5.07×10^7 m/s

____ 22. A company has developed a new material for making optical fibre. The critical angle of this material is much greater than that of glass, Lucite, or any other material currently being used. Will this new product be successful?
   a. No, because any materials used to make optical fibres should have a small critical angle.
   b. No, because the materials currently in use work just fine.
   c. There is not enough information here to tell.
   d. Yes, because any materials used to make optical fibres should have a large critical angle.

____ 23. While driving with a friend you see a shiny patch in the road ahead, and you think it might be ice. Your friend says it's a mirage. From a weather report, you know that the ground is colder than the air just above it. Should you slow down for the ice ahead, or is the road clear?
   a. The road is clear; ice can't form on a busy highway.
   b. Slow down; mirages only occur in the middle of the day.
   c. The road is clear; the air near the ground is too cold for ice to form.
   d. Slow down; mirages form only when the air close to the ground is warmer than the air above it. Since the air close to the ground is colder, the shiny patch must be ice.

____ 24. Two of your friends are arguing. Pat says that the index of refraction is the ratio of the speed of light in a vacuum to the speed of light in a given medium. Chris says that the index of refraction equals the sine of the angle of refraction divided by the sine of the angle of incidence. Who is correct?
   a. Chris
   b. Pat
   c. all of the above
   d. none of the above

____ 25. Which statement is true of light entering a container from air?
   a. When a beam of light enters a container of water, its path bends toward the normal.
   b. When a beam of light enters a container of water, its path bends away from the normal.
   c. When a beam of light exits a container of water, its path bends toward the normal.
   d. none of the above

____ 26. An incident light beam strikes the edge of its medium at an angle of 42°. The beam refracts at an angle of 90°. Now you know that
   a. The critical angle of the medium is 42?.
   b. If you decrease the incident angle, the refracted beam will exit the medium.
   c. If you increase the incident angle, the refracted beam will not exit the medium.
   d. all of the above

____ 27. The sparkle of a diamond is an effect of
   a. refraction
   b. partial refraction and reflection
   c. total internal reflection
   d. none of the above

____ 28. What happens to the refracted ray if the angle of incidence is greater than the critical angle of the medium?
   a. It is bent toward the normal.
   b. It is bent along the normal.
   c. It exits the medium.
   d. It does not exit the medium.

____ 29. Your friend has set up a converging lens with a focal length of 22 cm. On one side of the lens, 22 cm from its center, she has an object. She is holding a white card on the opposite side of the lens, but she can't get an image to form. What might be the problem?
   a. She is using a card instead of paper.
   b. She has the card on the wrong side of the lens.
   c. She has set the object at *F',* a position where the lens will not form an image.
   d. She has set the object at *F,* a position where the lens will not form an image.

____ 30. A converging lens has a focal length of 5 cm. An object is located 12 cm from the lens. How far from the lens is the image that is formed?
   a. about 8.6 cm
   b. about 6.4 cm
   c. about 4.7 cm
   d. about 7.8 cm

____ 31. A diverging lens has a focal length of 35 cm. The virtual image of an object is located 10 cm from the lens. The actual object is on the same side as the image, how far from the lens?
   a. about 0.14 cm
   b. about 140 cm
   c. about 14 cm
   d. about 1.4 cm

____ 32. Which light rays converge through a single point on the principal axis called the principal focus?
   a. light rays that are parallel to the principal axis
   b. light rays that pass through the principal focus
   c. light rays that pass through the secondary principal focus
   d. light rays that pass through the optical centre of the lens

____ 33. How do you define the principal focus of a diverging lens?
   a. the place where incident rays parallel to the principal axis converge after they are refracted
   b. the place where incident rays appear to have emanated from
   c. the place where refracted rays parallel to the principal axis converge after they are refracted
   d. the place where refracted rays appear to have emanated from

____ 34. You have a converging lens. You want to produce a virtual image. Where do you need to place the object?
   a. closer than F'
   b. between F' and $2F'$
   c. beyond $2F'$
   d. You cannot produce a real image closer to the lens than F.

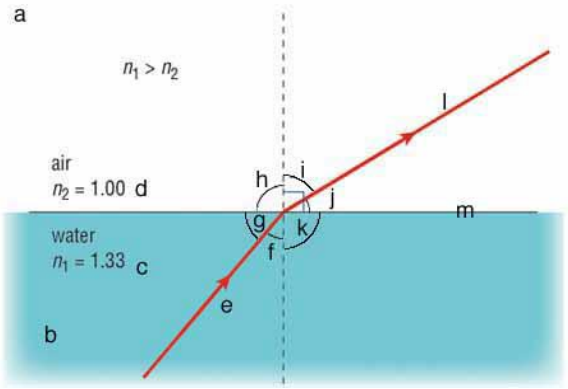
____ 35. If you were trapped on a desert island, what kind of lens could you use to make a fire?
   a. diverging
   b. converging
   c. Not enough information is given.
   d. none of the above

Matching

Match each method of producing light with an example of it.
   a. incandescence
   b. electric discharge
   c. phosphorescence
   d. fluorescence
   e. chemiluminescence

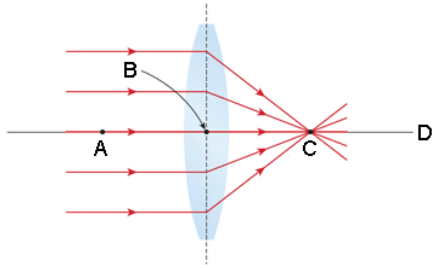
____ 36. sparks from a car battery
____ 37. CFLs
____ 38. lava
____ 39. glow-in-the-dark paint
____ 40. oxidizing oxalyl chloride

Match each item to its description.



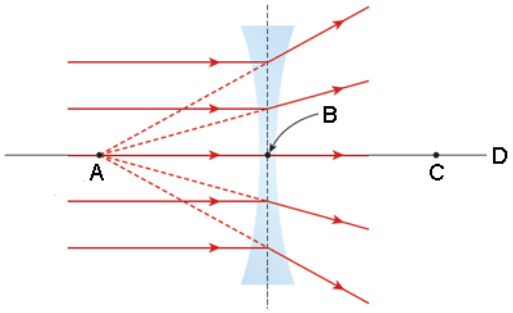
____ 41. angle of incidence
____ 42. angle of refraction
____ 43. medium in which light travels more slowly
____ 44. index of refraction of the "slow" medium
____ 45. boundary between media
____ 46. medium in which light travels faster
____ 47. index of refraction of the "fast" medium
____ 48. incident ray
____ 49. refracted ray

Match each feature with its name.



____ 50. principal axis
____ 51. principal focus
____ 52. secondary principal focus
____ 53. optical centre

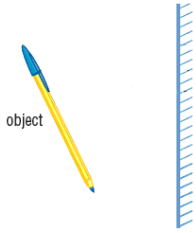
Match each feature with its name.



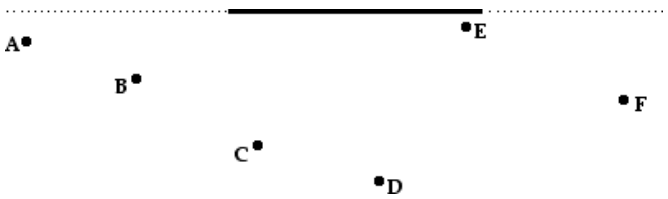
____ 54. optical centre
____ 55. secondary principal focus
____ 56. principal focus
____ 57. principal axis

Short Answer: ***Answer the following questions on a separate piece of paper (except for diagrams). Make sure to read the question carefully and provide a detailed answer.***

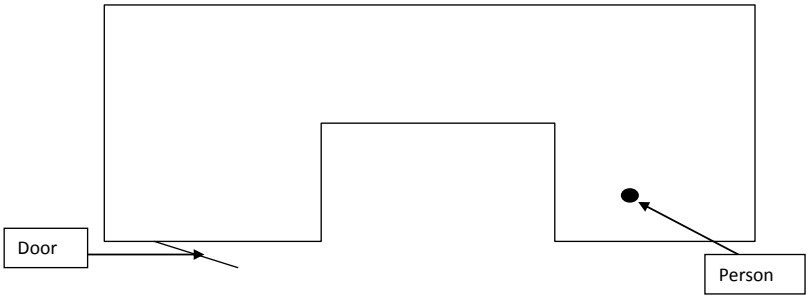
58. How can light travel through the vacuum of space?
59. How are the light produced by a glow stick and the light produced by a firefly similar?
60. State the laws of reflection.
61. Explain why you can see a reflection in a mirror but not on the cover of a cloth-bound book.
62. How would you explain how to find the virtual image of an object in a plane mirror using this diagram?



63. How could you prove that in a plane mirror the angle of incidence is equal to the angle of reflection?
64. Your friend has built a periscope out of a cardboard tube and two mirrors. When she uses it to look at signs, the letters appear to be normal. Why aren't the letters reversed? Explain your answer.
65. Six people are located in front of a plane mirror. Who can see whom? List all possible combinations.

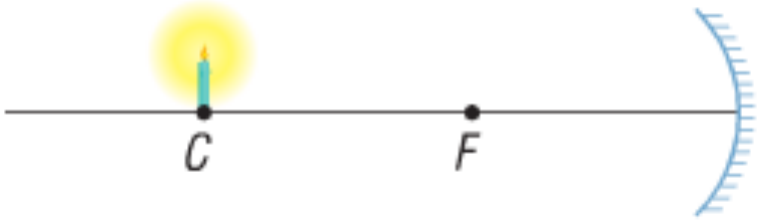


66. Where must plane mirrors be placed in the room below to allow the person to see the door? Use the fewest number of mirrors possible. Draw the mirrors and the path of the light.

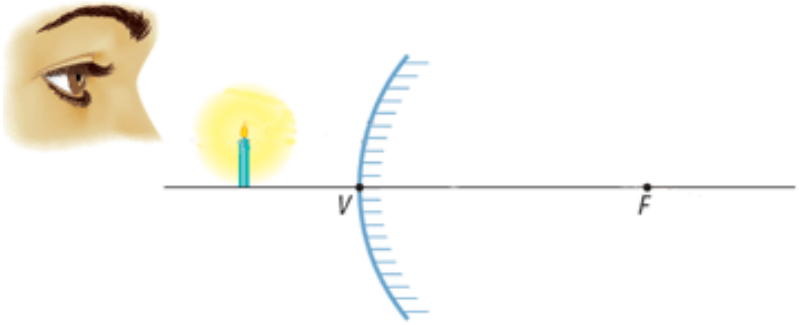


67. How could you find *F*, the focus of a converging mirror?
68. Use light rays to locate the focus and centre of curvature for the mirror below.

69. Use light rays to locate the image formed by the mirror below.



70. What is the difference between a real image and a virtual image?
71. How is an image in a plane mirror different from an image in a converging mirror?
72. How are the rules for locating an image in a diverging mirror different from those for a converging mirror?
73. Draw the image that would result from this reflection in a diverging mirror.

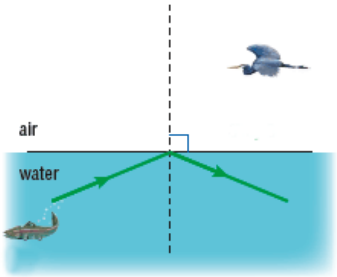


74. Complete the chart below comparing plane, concave, and convex mirrors.

	Diagram	**Characteristics of Images Formed**	**When to Use it**	**Examples**
Plane Mirror				
Concave Mirror (aka _____)				
Convex Mirror (aka _____)				

75. How would you explain to a friend why a soda straw in a container of water looks bent? Include a diagram in your explanation.

76. Describe in words what this diagram shows.



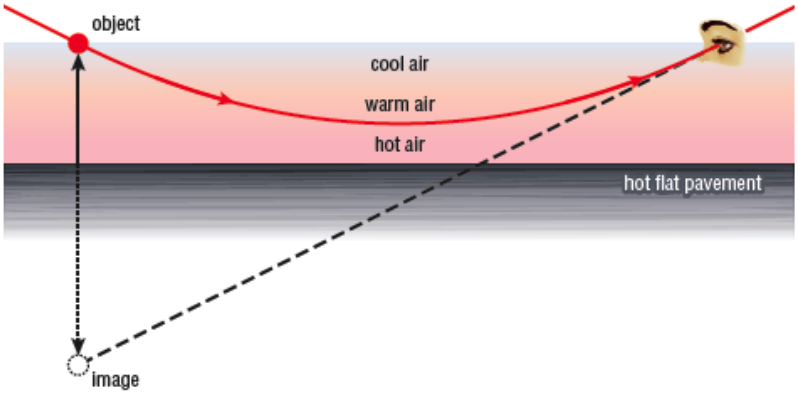
77. Explain why a glass prism splits white light.

78. Explain what the index of refraction is and how to calculate it.

79. Why can't we calculate the critical angle for a ray of light as it travels from air into water?

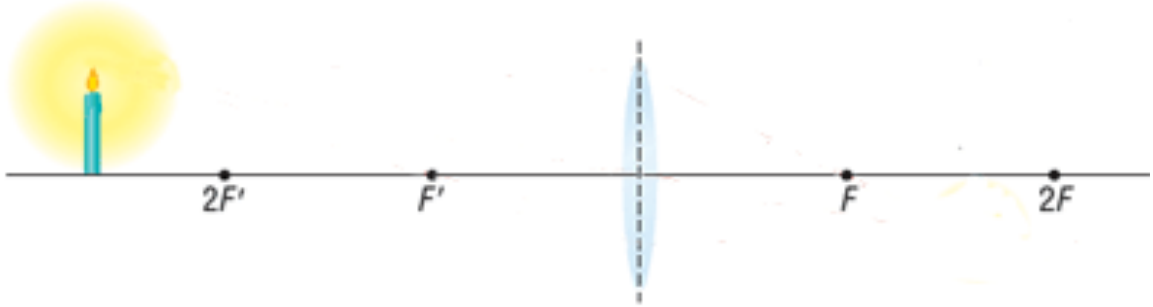
80. Use the diagram on the right to explain how a mirage forms.

81. Compare and contrast what happens when a light ray travelling through a pond strikes the surface at an angle (1) less than the critical angle of water, (2) equal to the critical angle of water, and (3) greater than the critical angle of water.



82. You are holding an object in front of a converging lens at a distance greater than $2F'$. The image is real, inverted, smaller than the object, and located between F and $2F$. Describe what happens to the image as you move the object closer and closer to the lens.

83. Show where the image will appear. Is the image real or virtual? Inverted or upright?



84. Explain how the concepts we studied in this unit apply to your everyday life.

Other

85. Try the following self quiz questions from the textbook:

i) **Transmission and Reflection**: pg. 508: #1 - 11, 14, 18, 24
ii) **Refraction**: Pg. 544: #1 - 8, 11, 12, 14 - 16, 18, 19, 22, 23
iii) **Lenses**: Pg. 584: #1, 3, 5 - 8, 12, 15
iv) **Everything**: Pg. 596: #1, 3 - 8, 10 - 12, 15, 17, 18, 20, 22

SNC2D Optics Unit Test
Answer Section

MULTIPLE CHOICE

1.	ANS: A	PTS: 1	REF: A	OBJ:	11.9 Images in Curved Mirrors
2.	ANS: B	PTS: 1	REF: A	OBJ:	11.7 Images in Plane Mirrors
3.	ANS: D	PTS: 1	REF: A	OBJ:	11.9 Images in Curved Mirrors
4.	ANS: D	PTS: 1	REF: T/I	OBJ:	11.1 What Is Light?
5.	ANS: C	PTS: 1	REF: K/U	OBJ:	11.2 How Is Light Produced?
6.	ANS: B	PTS: 1	REF: A	OBJ:	11.9 Images in Curved Mirrors
7.	ANS: B	PTS: 1	REF: A	OBJ:	11.9 Images in Curved Mirrors
8.	ANS: C	PTS: 1	REF: T/I	OBJ:	11.7 Images in Plane Mirrors
9.	ANS: A	PTS: 1	REF: A	OBJ:	11.2 How Is Light Produced?
10.	ANS: C	PTS: 1	REF: K/U	OBJ:	11.2 How Is Light Produced?
11.	ANS: D	PTS: 1	REF: K/U	OBJ:	11.2 How Is Light Produced?
12.	ANS: C	PTS: 1	REF: K/U	OBJ:	11.2 How Is Light Produced?
13.	ANS: C	PTS: 1	REF: T/I	OBJ:	11.9 Images in Curved Mirrors
14.	ANS: C	PTS: 1	REF: K/U	OBJ:	11.4 The Ray Model of Light
15.	ANS: B	PTS: 1	REF: T/I	OBJ:	11.9 Reflections in Curved Mirrors
16.	ANS: A	PTS: 1	REF: A	OBJ:	11.9 Reflections in Curved Mirrors
17.	ANS: D	PTS: 1	REF: T/I	OBJ:	11.9 Reflections in Curved Mirrors
18.	ANS: A	PTS: 1	REF: T/I	OBJ:	12.4 The Index of Refraction
19.	ANS: A	PTS: 1	REF: T/I	OBJ:	12.4 The Index of Refraction
20.	ANS: A	PTS: 1	REF: T/I	OBJ:	12.5 Total Internal Reflection
21.	ANS: B	PTS: 1	REF: T/I	OBJ:	12.4 The Index of Refraction
22.	ANS: A	PTS: 1	REF: T/I	OBJ:	12.5 Total Internal Reflection
23.	ANS: D	PTS: 1	REF: T/I		
24.	ANS: B	PTS: 1	REF: T/I	OBJ:	12.4 The Index of Refraction
25.	ANS: A	PTS: 1	REF: A	OBJ:	12.1 What Is Refraction?
26.	ANS: D	PTS: 1	REF: A	OBJ:	12.5 Total Internal Reflection
27.	ANS: C	PTS: 1	REF: A	OBJ:	12.5 Total Internal Reflection
28.	ANS: D	PTS: 1	REF: K/U	OBJ:	12.5 Total Internal Reflection
29.	ANS: C	PTS: 1	REF: A	OBJ:	13.3 Images in Lenses
30.	ANS: A	PTS: 1	REF: A	OBJ:	13.4 The Lens Equations
31.	ANS: C	PTS: 1	REF: A	OBJ:	13.4 The Lens Equations
32.	ANS: A	PTS: 1	REF: K/U		
33.	ANS: D	PTS: 1	REF: K/U		
34.	ANS: A	PTS: 1	REF: T/I	OBJ:	13.3 Images in Lenses
35.	ANS: B	PTS: 1	REF: A		

MATCHING

36.	ANS: B	PTS: 1	REF: K/U	OBJ: 11.2 How Is Light Produced?
37.	ANS: D	PTS: 1	REF: K/U	OBJ: 11.2 How Is Light Produced?
38.	ANS: A	PTS: 1	REF: K/U	OBJ: 11.2 How Is Light Produced?
39.	ANS: C	PTS: 1	REF: K/U	OBJ: 11.2 How Is Light Produced?
40.	ANS: E	PTS: 1	REF: K/U	OBJ: 11.2 How Is Light Produced?
41.	ANS: F	PTS: 1	REF: K/U	OBJ: 12.1 What Is Refraction?
42.	ANS: I	PTS: 1	REF: K/U	OBJ: 12.1 What Is Refraction?
43.	ANS: B	PTS: 1	REF: K/U	OBJ: 12.1 What Is Refraction?
44.	ANS: C	PTS: 1	REF: K/U	OBJ: 12.1 What Is Refraction?
45.	ANS: M	PTS: 1	REF: K/U	OBJ: 12.1 What Is Refraction?
46.	ANS: A	PTS: 1	REF: K/U	OBJ: 12.1 What Is Refraction?
47.	ANS: D	PTS: 1	REF: K/U	OBJ: 12.4 The Index of Refraction
48.	ANS: E	PTS: 1	REF: K/U	OBJ: 12.1 What Is Refraction?
49.	ANS: L	PTS: 1	REF: K/U	OBJ: 12.1 What Is Refraction?
50.	ANS: D	PTS: 1	REF: K/U	
51.	ANS: C	PTS: 1	REF: K/U	
52.	ANS: A	PTS: 1	REF: K/U	
53.	ANS: B	PTS: 1	REF: K/U	
54.	ANS: B	PTS: 1	REF: K/U	
55.	ANS: C	PTS: 1	REF: K/U	
56.	ANS: A	PTS: 1	REF: K/U	
57.	ANS: D	PTS: 1	REF: K/U	

SHORT ANSWER

58. ANS:
As a form of radiation, light does not need a medium for transmission.

59. ANS:
Both are produced through chemiluminescence, light that appears as a result of a chemical reaction.

60. ANS:
.

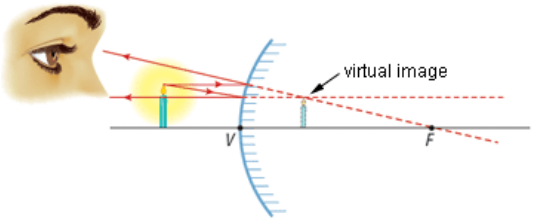
61. ANS:
Sample Answer: The surface of a book is rough, so light bounces off it in all directions. A mirror is smooth, so light rays that are parallel when they strike the mirror are parallel after they bounce off it, allowing you to see what you would see if your were standing where the mirror is.

62. ANS:
Sample answer: I would draw a series of object-to-mirror lines on the left side of the mirror that were perpendicular to the mirror. On the right side of the mirror I would draw image-to-mirror lines that were congruent to the lines above. Then I would use the lines to draw the virtual image.

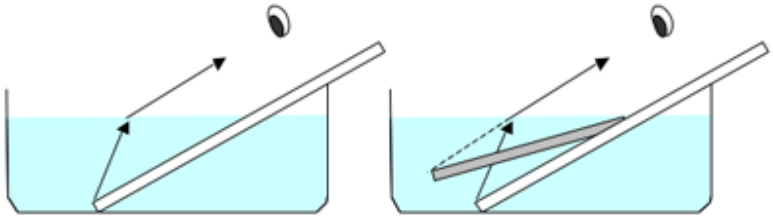
63. ANS:
Sample Answer: I would shine a narrow beam of light in a darkened room a plane mirror at various angles. I would measure these incoming incident angles, then compare them to the outgoing angles of reflection. This would show that the incident angle and reflection angle were congruent.

64. ANS:
Because there are two mirrors. The first mirror produces a reversed image, but the second mirror reverses it again, making it look normal.

65. ANS:
.
66. ANS:
.
67. ANS:
Sample Answer: Place an object on the principal axis outside of *C*. Then slowly move in watching the image get larger and larger until it suddenly disappears. The distance at which the image disappears marks the location of *F*.
68. ANS:
.
69. ANS:
.
70. ANS:
A real image is formed where light rays actually converge, which means it can be formed on a paper screen placed at that location. A virtual image is formed where light rays appear to be, usually behind the mirror, which means they cannot be formed on a paper screen placed there.
71. ANS:
The image in a plane mirror is virtual—it appears to be behind the mirror, but no light actually comes from the apparent location of the image to your eyes. The image in a converging mirror is real—if you held up a screen the image would appear on the screen.
72. ANS:
The rules are the same except for the fact that *F* is now a virtual focus, located behind the mirror, rather than an actual focus in front of the mirror.
73. ANS:



74. ANS:
.
75. ANS:
Sample answer:



I made a two-part diagram. The diagram on the left shows how light from the end of the straw is refracted as it leaves the water. The dotted line in the second diagram shows how the eye sees the path of light as coming from a different, more shallow angle than its actual position.
76. ANS:
Sample answer: The bird cannot see the fish because light rays from the fish that would reach the bird are instead refracted to the point of total internal reflection, which means they never reach the bird.

77. ANS:
Sample answer: When light enters the prism, it is refracted, but not all colours are refracted the same amount. Violet light slows down the most, so it refracts the most. Red light slows down the least, so it refracts the least. A ray of white light has become a spectrum of light of all different colours. The same thing happens when the light exits the prism, making the spectrum even easier to see.

78. ANS:
Sample answer: The index of refraction is an indication of the speed at which light travels through a given medium. To calculate it you divide the speed of light in a vacuum by the speed of light in that medium. The index of refraction can also be found by dividing the sine of the angle of incidence by the sine of the angle of refraction.

79. ANS:
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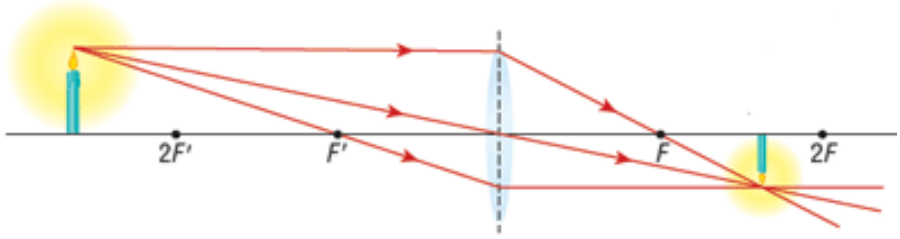
80. ANS:
Sample answer: Light from an object in the sky refracts more and more as it passes through warmer and warmer air close to the ground. Finally, total internal reflection occurs, and the light bends so it now actually moves upward. The eye sees a virtual image the light as if it were coming from the ground rather than the sky.

81. ANS:
Sample answer: When the angle is less than the critical angle of water, the light ray will emerge from the water bent away from the normal, closer to the surface of the pond. When the angle is equal to the critical angle, the light ray will be refracted along the surface of the pond. When the angle is greater than the critical angle, the light ray will be reflected back down into the water.

82. ANS:
As I move the object closer to the lens, the image gets larger and moves away from the lens. When the object reaches $2F'$, the image is at $2F$ and it is the same size as the object. It continues to get larger and move away from the lens until the object reaches F'. At that point, the image disappears. Once the object moves past F', a virtual image appears that is virtual, upright, larger than the object, and on the same side of the lens.

83. ANS:
The image is real and inverted.



84. ANS:
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OTHER

85. ANS:
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