Name: _____

___ 1) What occurs when light passes from water into flint glass?

A) Its speed increases, its wavelength becomes longer, and its frequency decreases.
B) Its speed increases, its wavelength becomes longer, and its frequency remains the same.
C) Its speed decreases, its wavelength becomes shorter, and its frequency increases.
D) Its speed decreases, its wavelength becomes shorter, and its frequency remains the same.

___ 2) Which phenomena cause chromatic aberration to occur when polychromatic light passes through a lens?

A) dispersion and reflection
B) diffraction and refraction
C) dispersion and refraction
D) diffraction and reflection

___ 3) The focal length of a lens is *not* dependent on the

A) shape or curvature of the lens
B) material from which the lens is made
C) distance of an object from the lens
D) color of the light incident on the lens

___ 4) Which optical device causes parallel light rays to diverge?

A) convex mirror
B) convex lens
C) concave mirror
D) plane mirror

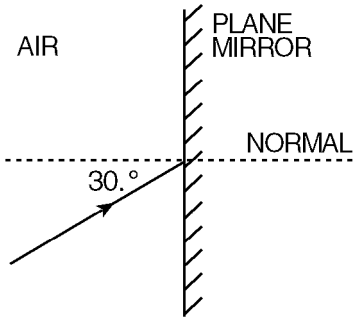
___ 5) The speed of light ($f = 5.09 \times 10^{14}$ Hz) in a transparent material is 0.75 times its speed in air. The absolute index of refraction of the material is approximately

A) 0.75
B) 4.0
C) 1.3
D) 2.3

___ 6) Compared to wavelengths of visible light, the wavelengths of ultraviolet light are

A) longer
B) the same
C) shorter

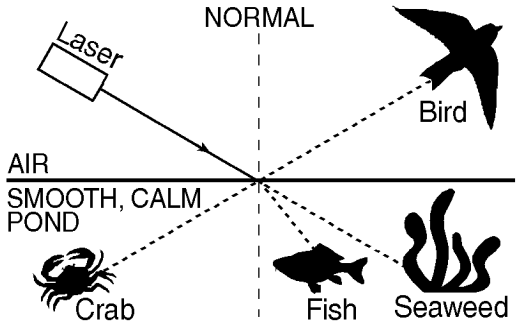
___ 7) A ray of monochromatic light traveling in air is incident on a plane mirror at an angle of 30.D, as shown in the diagram below.



What is the angle of reflection for the light ray?

A) 90.D
B) 15D
C) 60.D
D) 30.D

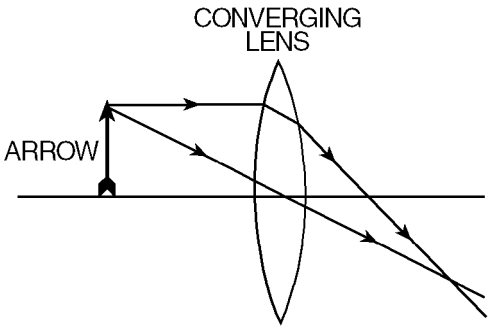
___ 8) A laser beam is directed at the surface of a smooth, calm pond as represented in the diagram below.



Which organisms could be illuminated by the laser light?

A) the crab and the fish
B) the bird and the seaweed
C) the bird and the fish
D) the crab and the seaweed

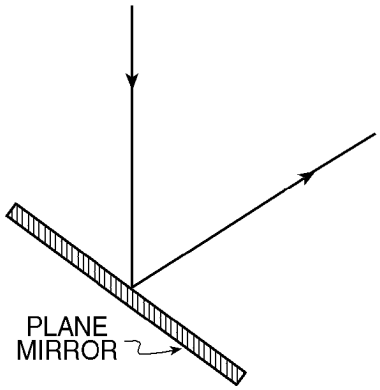
___ 9) The diagram below shows an arrow placed in front of a converging lens.



What type of image of the arrow does the lens form?

A) virtual and erect
B) real and erect
C) virtual and inverted
D) real and inverted

___ 10) The diagram below shows a light ray being reflected from a plane mirror.



What is the angle of incidence?

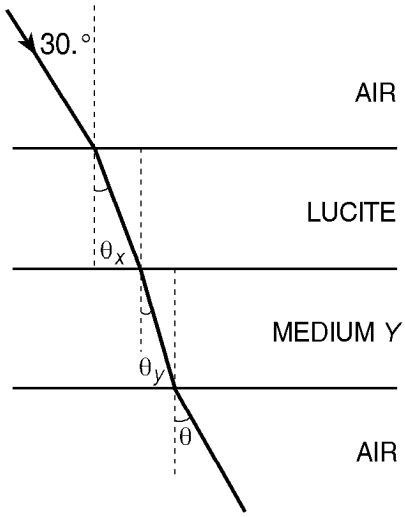
A) 70.D
B) 20D
C) 55D
D) 35D

___ 11) When a student 1.5 meters tall stands 5.0 meters in front of a lens, his image forms on a screen located 0.50 meter behind the lens. What is the height of the student's image?

A) 15 m
B) 1.5 m
C) 0.15 m
D) 0.015 m

Questions 12 and 13 refer to the following:

The diagram below represents a light ray traveling from air to Lucite to medium *Y* and back into air.



___ 12) Light travels *slowest* in which substance in the given diagram?

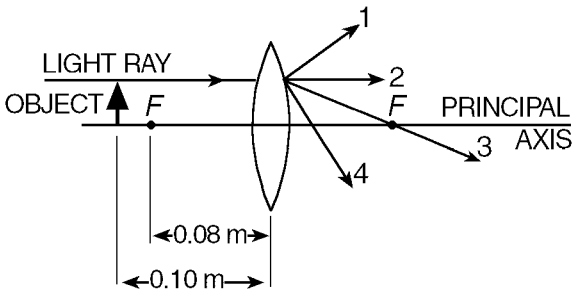
A) air, Lucite, and medium *Y*
B) air, only
C) medium *Y*, only
D) Lucite, only

___ 13) What is the sine of angle t_x in the given diagram?

A) 0.333
B) 0.707
C) 0.886
D) 0.500

Questions 14 through 18 refer to the following:

A converging lens has a focal length of 0.080 meter. A light ray travels from the object to the lens parallel to the principal axis.



___ 14) How far from the lens is the image formed?

A) 0.40 m
B) 0.020 m
C) 0.80 m
D) 0.18 m

___ 15) If the lens is made of crown glass, the speed of light in the lens is *closest* to

A) 4.0×10^8 m/s
B) 1.5×10^8 m/s
C) 2.0×10^8 m/s
D) 3.0×10^8 m/s

___ 16) Which line *best* represents the path of the ray after it leaves the lens?

A) 1 C) 3
B) 2 D) 4

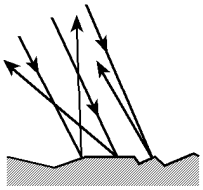
___ 17) Which phenomenon *best* explains the path of the light ray through the lens?

A) dispersion C) reflection
B) refraction D) diffraction

___ 18) If the lens were placed in water, its focal length would

A) remain the same
B) increase
C) decrease

___ 19) The diagram below shows parallel rays of light incident on an irregular surface.



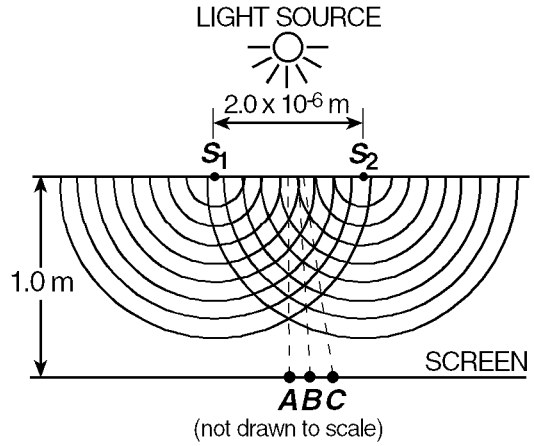
Which phenomenon of light is illustrated by the diagram?

A) diffraction
B) refraction
C) diffuse reflection
D) regular reflection

___ 20) Spherical aberration is a defect associated with

A) spherical mirrors, only
B) both plane mirrors and lenses
C) both spherical mirrors and lenses
D) plane mirrors, only

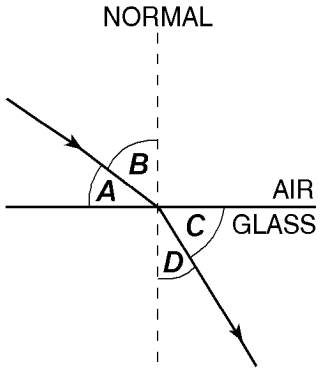
___ 21) The diagram below represents monochromatic light incident on a pair of slits, S_1 and S_2, that are separated by a distance of 2.0×10^{-6} meter. *A*, *B*, and *C* are adjacent antinodal areas that appear on a screen 1.0 meter from the slits. The distance from *A* to *B* is 0.34 meter.



What is the wavelength of the incident light?

A) 6.8×10^{-7} m
B) 6.8×10^{7} m
C) 5.9×10^{-6} m
D) 1.7×10^{5} m

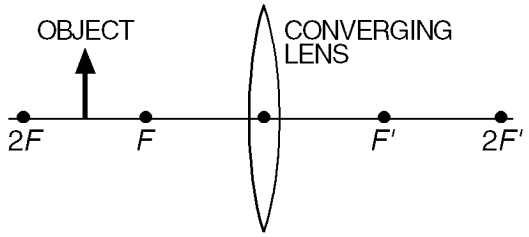
___ 22) A light ray passes from air into glass as shown in the diagram below.



Which relationship represents the index of refraction of the glass?

A) $\frac{\sin B}{\sin C}$ C) $\frac{\sin A}{\sin D}$
B) $\frac{\sin B}{\sin D}$ D) $\frac{\sin A}{\sin C}$

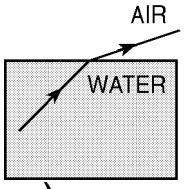
___ 23) The diagram below shows an object placed between 1 and 2 focal lengths from a converging lens.

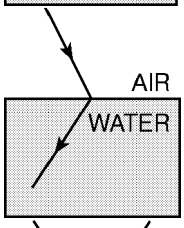


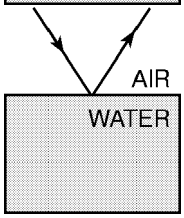
The image of the object produced by the lens is

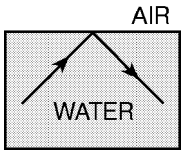
A) real and erect
B) virtual and erect
C) real and inverted
D) virtual and inverted

___ 24) Which ray diagram *best* represents the phenomenon of refraction?

A)


B)


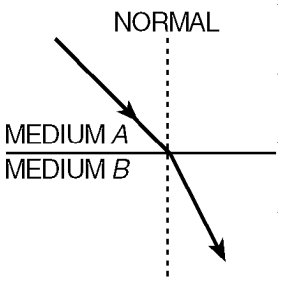
C)


D)


___ 25) Which optical devices in air can *both* form real images?

A) concave mirror and convex lens
B) concave mirror and concave lens
C) plane mirror and concave lens
D) plane mirror and convex lens

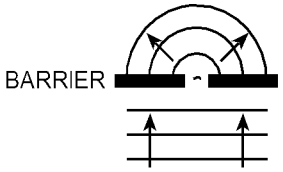
___ 26) The diagram below shows a ray of light passing through two media.

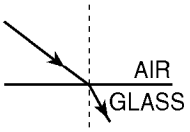


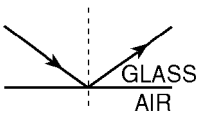
When the wave travels from medium *A* into medium *B*, its speed

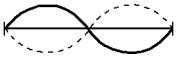
A) remains the same
B) increases
C) decreases

___ 27) Which diagram below *best* represents the phenomenon of diffraction?

A)


B)


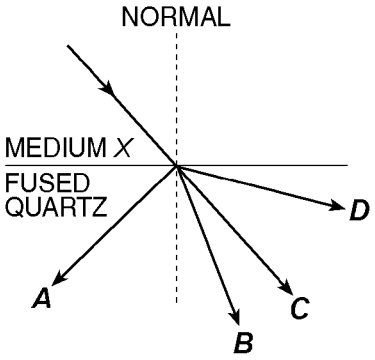
C)


D)


___ 28) A ray of monochromatic light ($f = 5.09 \times 10^{14}$ hertz) in air is incident at an angle of 30.D on a boundary with corn oil. What is the angle of refraction, to the nearest degree, for this light ray in the corn oil?

A) 6D
B) 47D
C) 20.D
D) 30.D

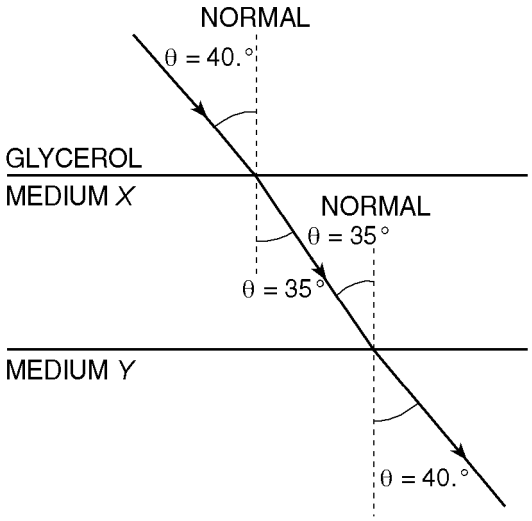
___ 29) The diagram below represents a ray of monochromatic light ($f = 5.09 \times 10^{14}$ Hz) passing from medium *X* ($n = 1.46$) into fused quartz.



Which path will the ray follow in the quartz?

A) *A*
B) *B*
C) *C*
D) *D*

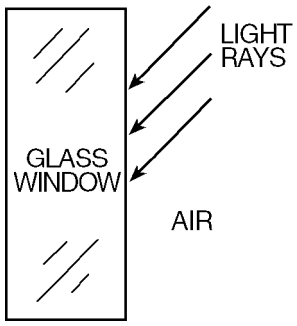
___ 30) A beam of monochromatic light ($f = 5.09 \times 10^{14}$ hertz) passes through parallel sections of glycerol, medium *X*, and medium *Y* as shown in the diagram below.



What could medium *X* and medium *Y* be?

A) *X* could be corn oil and *Y* could be flint glass.
B) *X* could be glycerol and *Y* could be water.
C) *X* could be flint glass and *Y* could be corn oil.
D) *X* could be water and *Y* could be glycerol.

___ 31) The diagram below shows light rays in air about to strike a glass window.



When the rays reach the boundary between the air and the glass, the light is

A) partially reflected and partially refracted
B) totally refracted
C) partially reflected and partially diffracted
D) totally reflected

___ 32) An object is located 0.15 meter from a converging lens with focal length 0.10 meter. How far from the lens is the image formed?

A) 0.10 m
B) 0.15 m
C) 0.30 m
D) 0.060 m

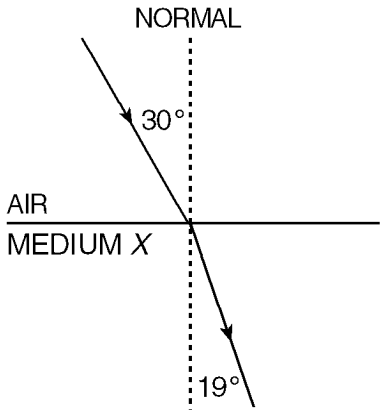
___ 33) Orange light has a frequency of 5.0×10^{14} hertz in a vacuum. What is the wavelength of this light?

A) 6.0×10^{-7} m
B) 1.5×10^{23} m
C) 2.0×10^{-15} m
D) 1.7×10^{6} m

___ 34) A beam of monochromatic light travels through flint glass, crown glass, Lucite, and water. The speed of the light beam is *slowest* in

A) water
B) crown glass
C) Lucite
D) flint glass

___ 35) The diagram below shows a ray of light ($\lambda = 5.9 \times 10^{-7}$ meter) traveling from air into medium *X*.



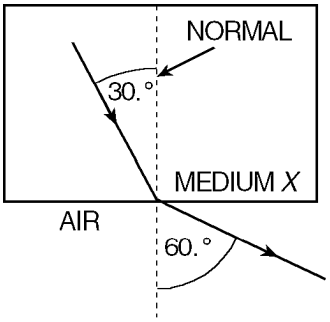
If the angle of incidence is 30.° and the angle of refraction is 19°, medium *X* could be

A) glycerol
B) alcohol
C) Canada balsam
D) air

___ 36) Compared to the wavelength of red light, the wavelength of yellow light is

A) the same
B) shorter
C) longer

___ 37) The diagram below shows a ray of light passing from medium *X* into air.



What is the absolute index of refraction of medium *X*?

A) 0.577
B) 0.500
C) 2.00
D) 1.73

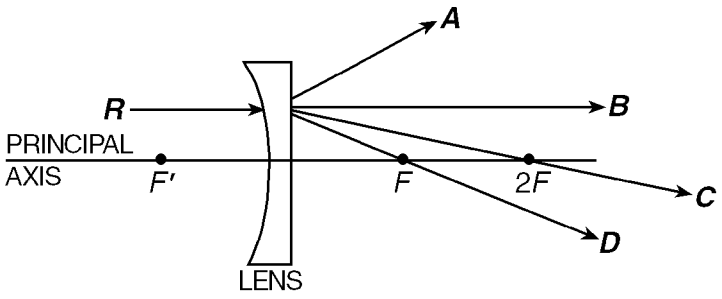
___ 38) In a vacuum, *all* electromagnetic waves have the same

A) speed
B) wavelength
C) amplitude
D) frequency

___ 39) A beam of green light may have a frequency of

A) 6.0×10^{14} Hz
B) 5.0×10^{-7} Hz
C) 1.5×10^{2} Hz
D) 3.0×10^{8} Hz

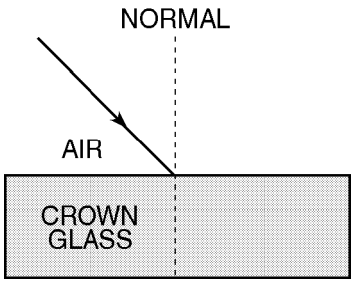
___ 40) The diagram below shows light ray *R* incident on a glass lens in air.



Which ray *best* represents the path of light ray *R* after it passes through the lens?

A) *A*
B) *B*
C) *C*
D) *D*

___ 41) The diagram below shows a light ray in air incident on a crown glass block.



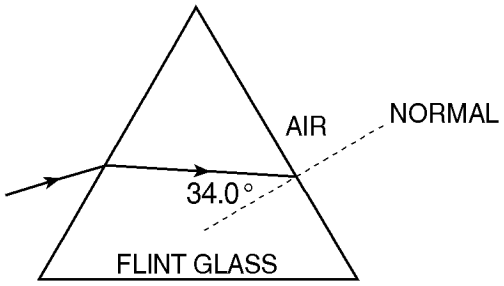
As the light ray enters the crown glass block, it will

A) slow down and bend toward the normal
B) speed up and bend away from the normal
C) speed up and bend toward the normal
D) slow down and bend away from the normal

___ 42) An object is placed 0.20 meter from a converging lens having a focal length of 0.040 meter. What is the distance of the image from the lens?

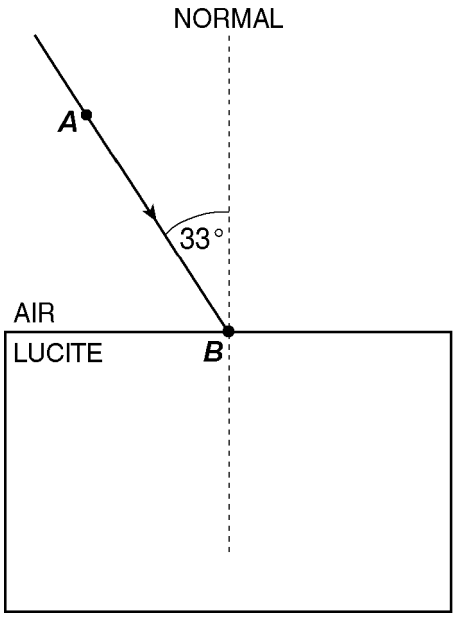
A) 0.050 m
B) 0.033 m
C) 0.20 m
D) 0.16 m

43) The diagram below shows a ray of monochromatic light ($f = 5.09 \times 10^{14}$ hertz) passing through a flint glass prism.



Using a protractor and a straightedge, construct the refracted light ray in the air on the given diagram.

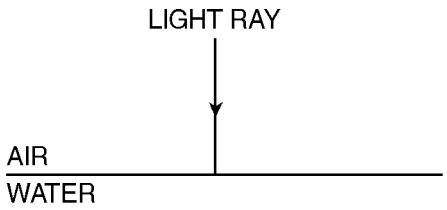
44) A monochromatic beam of yellow light, *AB*, is incident upon a Lucite block in air at an angle of 33D.



(a) Calculate the angle of refraction for incident beam *AB*. [*Show all work, including the equation and substitution with units.*]

(b) Using a straightedge and a protractor, draw an arrow on the given diagram to represent the path of the refracted beam.

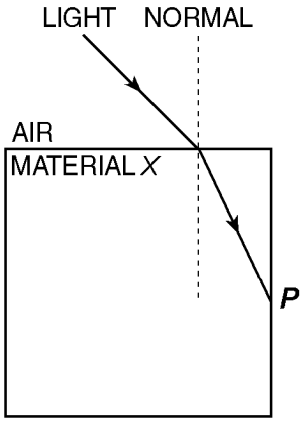
45) A ray of light traveling in air is incident on an air-water boundary as shown below.



On the diagram above, draw the path of the ray in the water.

Questions 46 and 47 refer to the following:

A ray of light passes from air into a block of transparent material *X* as shown in the diagram below.



46) The refracted light ray is reflected from the material *X*-air boundary at point *P*. Using a protractor and straightedge on the given diagram, draw the reflected ray from point *P*.

47) Measure the angles of incidence and refraction to the *nearest* degree for the given light ray at the air into material *X* boundary.