phere filters practically all of the high frequency components of ultraviolet radiation from the sun, but the inner atmosphere readily transmits the remaining lower frequency ultraviolet radiation. Some commercial skin lotions are designed to absorb ultraviolet rays to prevent them from affecting the skin.

X rays are used as diagnostic tools by physicians. Living tissues and organisms can be destroyed by X rays, so precautions should be taken to avoid overexposure.

Gamma rays are emitted by radioactive nuclei. This electromagnetic radiation is harmful to living tissues.

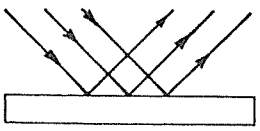
Review Questions

72. How long does it take light to travel a distance of 100. meters? (1) 3.00×10^{10} s (2) 3.00×10^{8} s (3) 3.33×10^{-7} s (4) 3.33×10^{7} s

73. Determine the wavelength in a vacuum of a light wave having a frequency of 5.3×10^{14} hertz. Express your answer in nanometers to the proper number of significant digits. 5.66×10^{-7} m

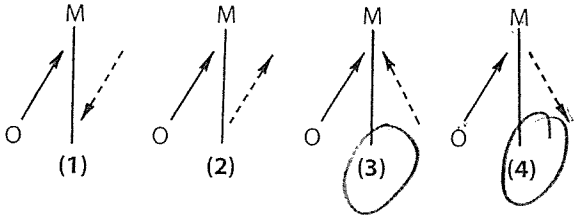
74. What is the frequency of a light wave having a wavelength of 5.00×10^{-7} meter in a vacuum?
(1) 6.00×10^{-14} Hz (2) 6.00×10^{14} Hz
(3) 6.00×10^{15} Hz (4) 6.00×10^{16} Hz

75. The following diagram shows parallel rays of light interacting with a barrier. Which phenomenon of light is illustrated?

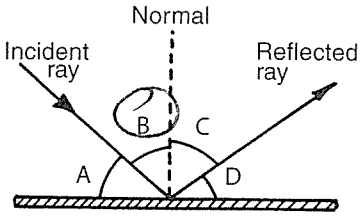


Law of Reflect

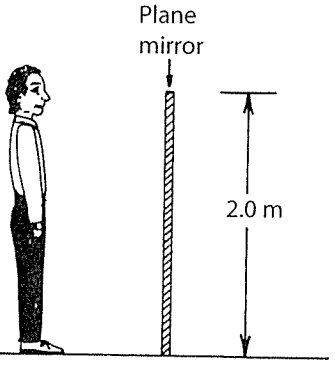
76. Which diagram best represents the reflection of object O in plane mirror M?



77. A ray is reflected from a surface, as shown in the diagram that follows. Which letter represents the angle of incidence?



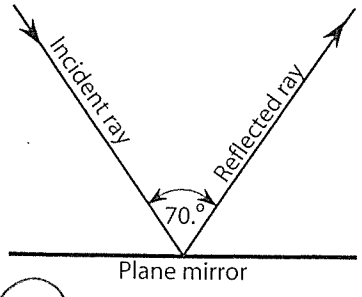
78. A tall person stands in front of a vertical plane mirror 2.0 meters high, as shown in the following diagram. A ray of light reflects off the mirror, allowing him to see his foot. Approximately how far up the mirror from the floor does this ray strike the mirror?



(1) 1.0 m (2) 2.0 m (3) 0.25 m (4) 0 m

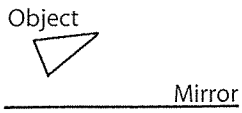
79. The image of an object is viewed in a plane mirror. What is the ratio of the object size to the image size?
(1) 1:1 (2) 2:1 (3) 1:2 (4) 1:4

80. The following diagram represents a light ray being reflected from a plane mirror. The angle between the incident and reflected ray is 70.° What is the angle of incidence for this ray?

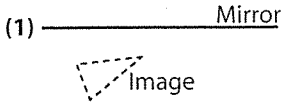


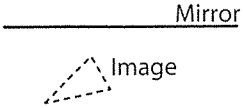
(1) 20.° (2) 35° (3) 55° (4) 70.°

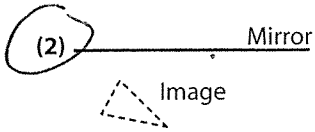
81. An object is placed in front of a plane mirror as shown in the following diagram.

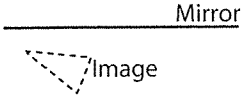


Which diagram best represents the image that is formed?

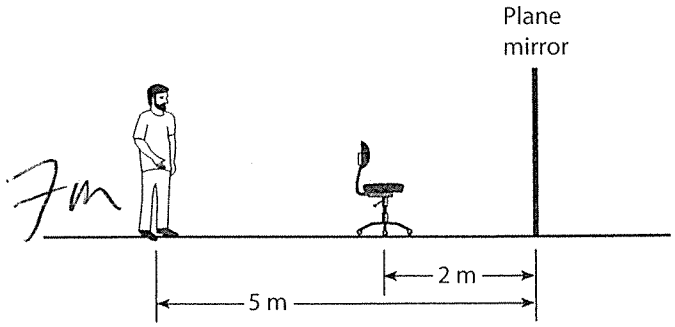
(1)


(3)


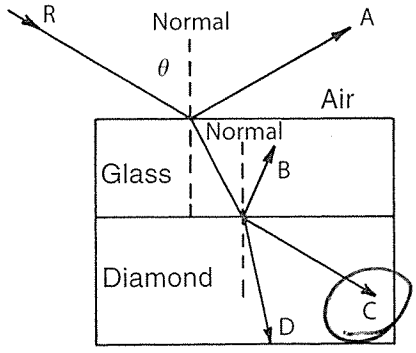
(2)


(4)


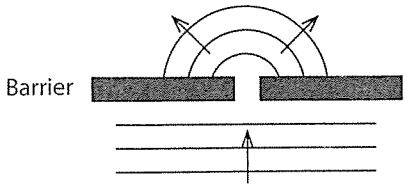
82. In the following diagram, a person is standing 5 meters from a plane mirror. The chair in front of the person is located 2 meters from the mirror. What is the distance between the person and the image he observes of the chair?

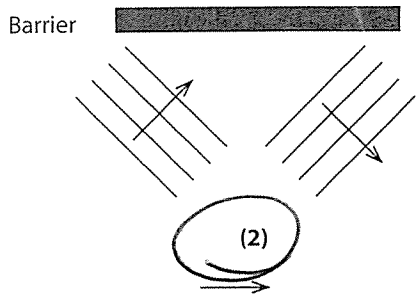


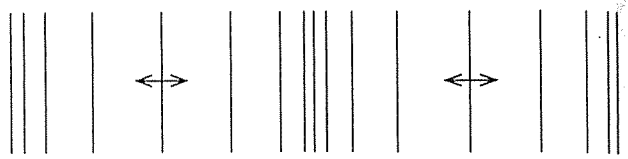
83. In the diagram that follows, ray R of monochromatic yellow light is incident upon a glass surface at an angle θ. Which resulting ray is *not* possible?

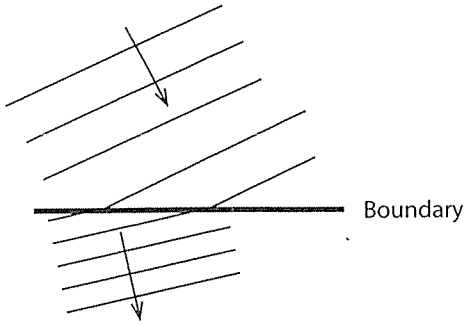


84. Which diagram best represents wave reflection?

(1)


(2)


(3)


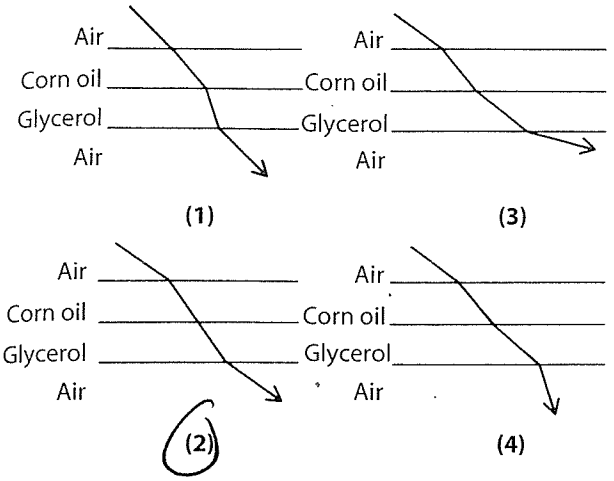
(4)


85. When a ray of light strikes a mirror perpendicular to its surface, what is the angle of reflection?

86. The change in the direction of a wave when it passes obliquely from one medium to another is called
(1) diffraction (2) interference (3) refraction
(4) superposition

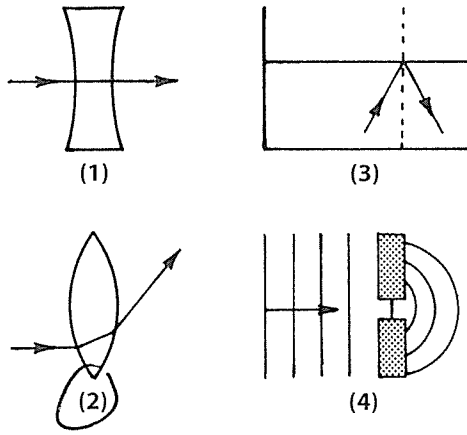
87. As a wave enters a new medium, there may be a change in the wave's (1) frequency (2) speed
(3) period (4) phase

88. Which arrow best represents the path that a monochromatic ray of light travels as it passes through air, corn oil, glycerol and back into air?

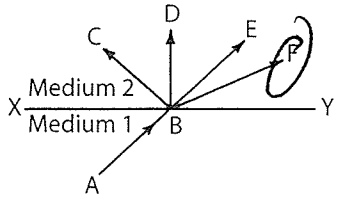


89. What occurs when light passes from water into flint glass? (1) Its speed decreases, its wavelength becomes shorter, and its frequency remains the same. (2) Its speed decreases, its wavelength becomes shorter, and its frequency increases. (3) Its speed increases, its wavelength becomes longer, and its frequency remains the same. (4) Its speed increases, its wavelength becomes longer, and its frequency decreases.

90. Which ray diagram best illustrates refraction?



91. In the following diagram, ray AB is incident on surface XY at point B. If medium 2 has a lower index of refraction than medium 1, through which point will the ray most likely pass?



92. A beam of monochromatic red light passes obliquely from air into water. Which characteristic of the light does *not* change? (1) direction (2) velocity (3) frequency (4) wavelength

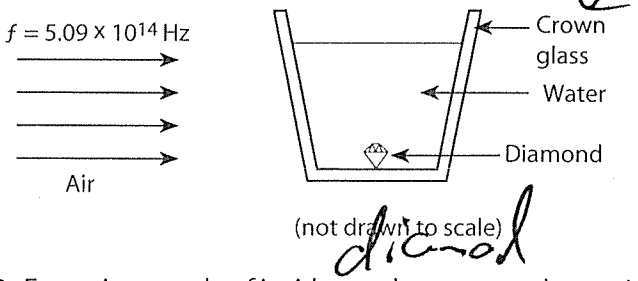
93. The speed of light in corn oil is the same as the speed of light in (1) diamond (2) flint glass (3) air (4) glycerol

94. If the speed of light in a medium is 2.00×10^8 meters per second, what is the absolute index of refraction for the medium?

95. In which medium is the wavelength of red light the shortest? (1) flint glass (2) crown glass (3) diamond (4) zircon

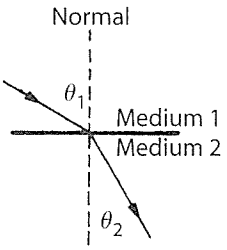
95. The frequency of a ray of light is 5.09×10^{14} hertz. What is the ratio of the speed of this ray in diamond to its speed in zircon?

97. In the diagram that follows, monochromatic light having a frequency of 5.09×10^{14} hertz in air is about to travel through crown glass, water, and diamond. In which substance does the light travel at the slowest speed?



98. For a given angle of incidence, the greatest change in the direction of a light ray is produced when the light ray passes obliquely from air into (1) Lucite (2) glycerol (3) fused quartz (4) crown glass

99. The following diagram represents a wave traveling from medium 1 to medium 2.

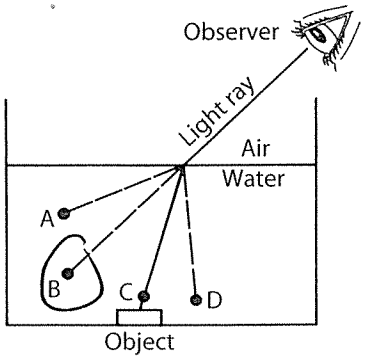


The relative index of refraction may be determined by calculating the ratio of (1) $\frac{\theta_1}{\theta_2}$ (2) $\frac{\sin\theta_2}{\sin\theta_1}$ (3) $\frac{\sin\theta_1}{\sin\theta_2}$ (4) $\frac{n_1}{n_2}$

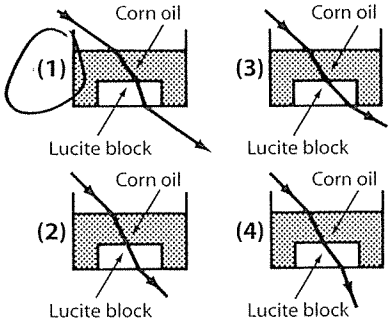
100. A ray of light in air is incident on a block of Lucite at an angle of 60.° from the normal. The angle of refraction of this ray in Lucite is closest to (1) 35° (2) 45° (3) 60.° (4) 75°

101. A beam of monochromatic yellow light passes from air into a tank of salt water. As more salt is dissolved in the water, the index of refraction of the liquid increases and the speed of the light in the liquid (1) decreases (2) increases (3) remains the same

102. In the following diagram, a person observes an object resting on the bottom of a tank of water. To the observer, the object appears to be at which point?



103. Which diagram shows the path that a monochromatic ray of light will travel as it passes through air, corn oil, Lucite, and back into air?



104. Which electromagnetic radiation has the shortest wavelength? (1) infrared (2) radio (3) gamma (4) ultraviolet

105. Which are *not* in the electromagnetic spectrum? (1) light waves (2) radio waves (3) sound waves (4) X rays

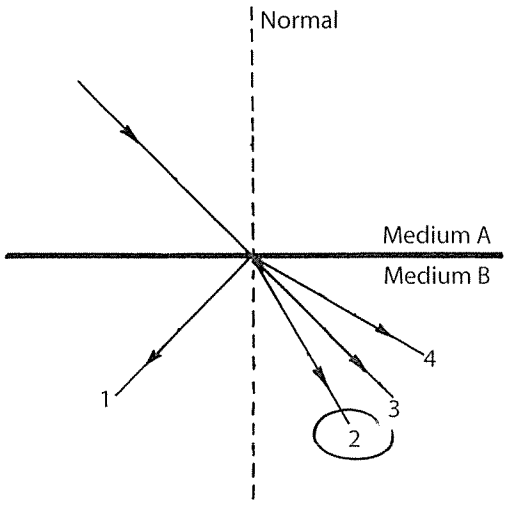
106. In a vacuum, all electromagnetic waves have the same (1) frequency (2) wavelength (3) speed (4) energy

107. A monochromatic beam of light with a frequency of 5.45×10^{14} hertz travels in a vacuum. What is the color of the light? Green

108. The wavelength of a typical AM radio wave is 3×10^3 meters. Determine the order of magnitude of its frequency. $V = f\lambda$ 10^5 Hz

Base your answers to questions 109 through 112 on the information and diagram that follow.

When a ray of monochromatic light passes from medium A to medium B, its speed decreases.



109. Which arrow best represents the path of the ray in medium B?

110. Compared to the frequency of the light in medium A, the frequency of the light in medium B is (1) lower (2) higher (3) the same

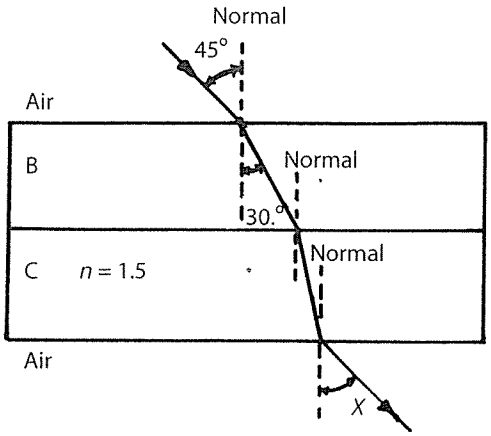
111. Compared to the wavelength of the light in medium A, the wavelength of the light in medium B is (1) shorter (2) longer (3) the same

112. According to information listed in the *Reference Tables for Physical Setting/Physics*, what could be the identity of substance B if medium A is corn oil?

Diamond or Crown Glass or Flint Glass or Lucite or Zirco-

Base your answers to questions 113 through 116 on the information and diagram that follow.

A ray of light having a frequency of 5.09×10^{14} hertz moves from air through substance B, through substance C, and back into air. The surfaces of substances B and C are parallel.



$1 \sin 45 = n_2 \sin 30^\circ$

113. Determine the index of refraction of substance B.

$n_2 = 1.41$

114. Determine the speed of light in substance C.

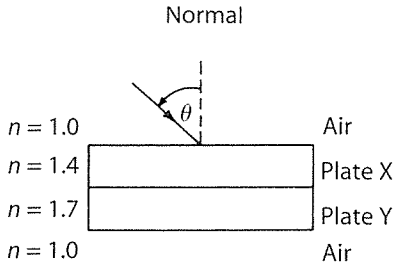
2×10^8 m/s $\quad n = \frac{c}{v} \quad 1.5 = \frac{3 \times 10^8}{v}$ ✓

115. If the angle of incidence of the light ray in air is increased, the angle of refraction in substance B will (1) decrease (2) increase (3) remain the same

116. The measure of angle X is (1) less than 45° (2) greater than 45° (3) equal to 45°

Base your answers to questions 117 through 120 on the information and diagram that follow.

A ray of monochromatic light traveling in air and having a frequency of 5.09×10^{14} hertz is incident upon the surface of plate X. The values of n in the diagram represent absolute indices of refraction.



117. What is the relative index of refraction of the light going from plate X to plate Y? (1) $\frac{1.0}{1.7}$ (2) $\frac{1.0}{1.4}$ (3) $\frac{1.7}{1.4}$ (4) $\frac{1.4}{1.7}$

118. Determine the speed of the light ray in plate X.

2.1×10^8 m/s

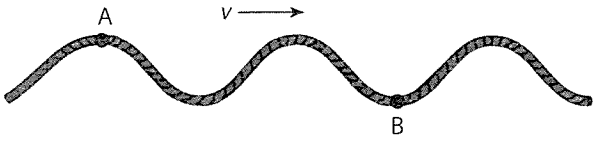
119. Compared to angle θ, the angle of refraction of the light ray in plate X is (1) smaller (2) greater (3) the same

120. Compared to angle θ, the angle of refraction of the ray emerging from plate Y into air is (1) smaller (2) greater (3) the same

Questions for Regents Practice

Part A

1. A periodic wave travels through a rope, as shown in the following diagram. As the wave travels, what is transferred between points A and B?



(1) mass only
(2) energy only
(3) both mass and energy
(4) neither mass nor energy

2. In which wave type is the disturbance parallel to the direction of wave travel?
(1) torsional
(2) longitudinal
(3) transverse
(4) circular

3. Which is an example of a longitudinal wave?
(1) gamma ray (3) sound wave
(2) X ray (4) water wave

4. A single pulse in a uniform medium transfers
(1) standing waves (3) mass
(2) energy (4) wavelength