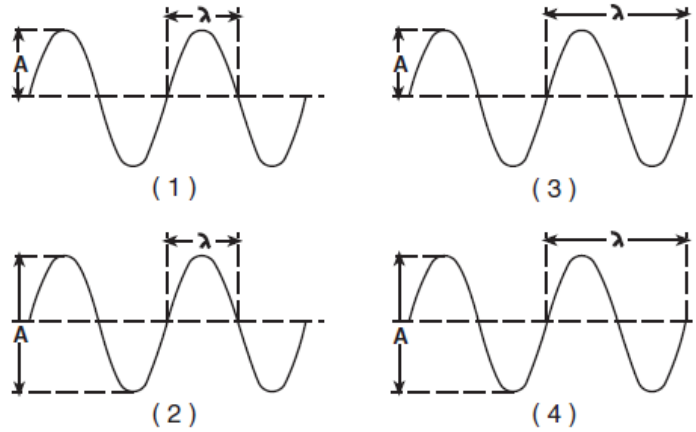
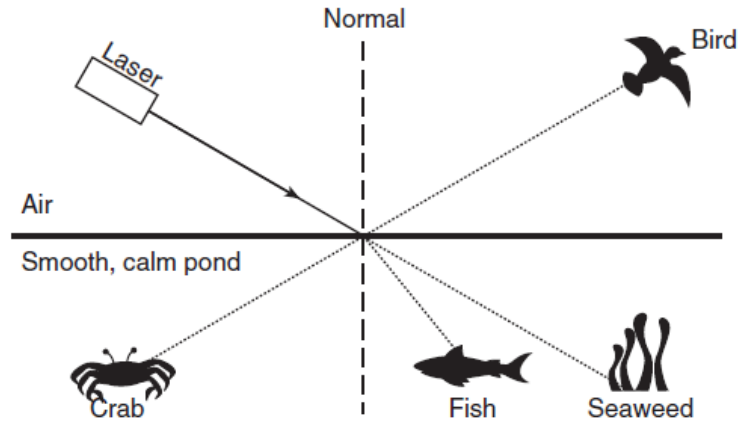


- 28 As a sound wave passes from water, where the speed is 1.49×10^3 meters per second, into air, the wave's speed
- (1) decreases and its frequency remains the same
 - (2) increases and its frequency remains the same
 - (3) remains the same and its frequency decreases
 - (4) remains the same and its frequency increases
- 29 Which phenomenon occurs when an object absorbs wave energy that matches the object's natural frequency?
- (1) reflection
 - (2) diffraction
 - (3) resonance
 - (4) interference
- 30 A ray of monochromatic light ($f = 5.09 \times 10^{14}$ hertz) in air is incident at an angle of $30.^\circ$ on a boundary with corn oil. What is the angle of refraction, to the nearest degree, for this light ray in the corn oil?
- (1) $6.^\circ$
 - (2) $20.^\circ$
 - (3) $30.^\circ$
 - (4) $47.^\circ$
- 31 A wave is diffracted as it passes through an opening in a barrier. The amount of diffraction that the wave undergoes depends on both the
- (1) amplitude and frequency of the incident wave
 - (2) wavelength and speed of the incident wave
 - (3) wavelength of the incident wave and the size of the opening
 - (4) amplitude of the incident wave and the size of the opening
- 32 A source of waves and an observer are moving relative to each other. The observer will detect a steadily increasing frequency if
- (1) he moves toward the source at a constant speed
 - (2) the source moves away from him at a constant speed
 - (3) he accelerates toward the source
 - (4) the source accelerates away from him

33 Which wave diagram has *both* wavelength (λ) and amplitude (A) labeled correctly?



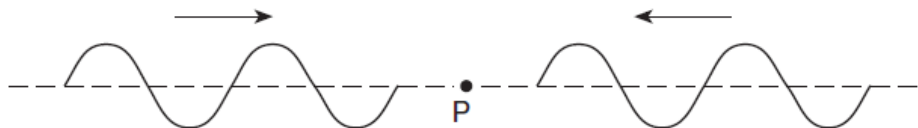
34 A laser beam is directed at the surface of a smooth, calm pond as represented in the diagram below.



Which organisms could be illuminated by the laser light?

- (1) the bird and the fish
- (2) the bird and the seaweed
- (3) the crab and the seaweed
- (4) the crab and the fish

35 The diagram below represents two waves of equal amplitude and frequency approaching point P as they move through the same medium.

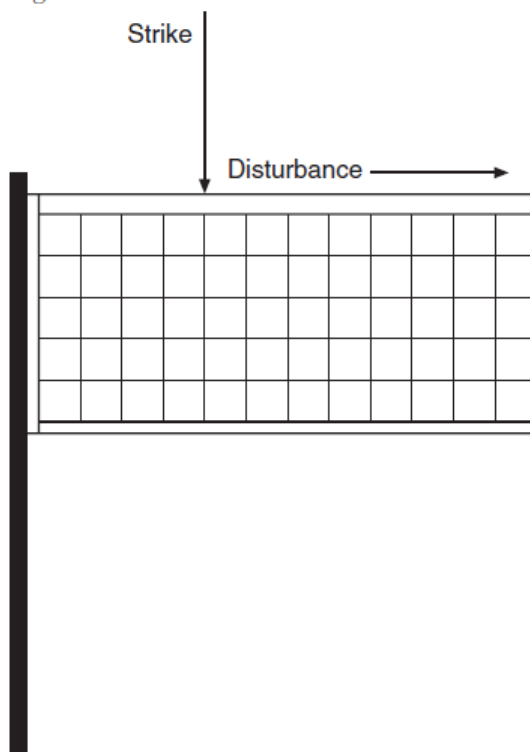


As the two waves pass through each other, the medium at point P will

- (1) vibrate up and down
- (2) vibrate left and right
- (3) vibrate into and out of the page
- (4) remain stationary

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22 A student strikes the top rope of a volleyball net, sending a single vibratory disturbance along the length of the net, as shown in the diagram below.



This disturbance is best described as

- (1) a pulse
- (2) a periodic wave
- (3) a longitudinal wave
- (4) an electromagnetic wave

25 If the frequency of a periodic wave is doubled, the period of the wave will be

- (1) halved
- (2) doubled
- (3) quartered
- (4) quadrupled

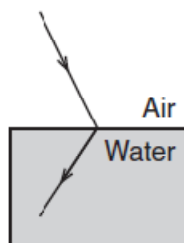
26 How much time does it take light from a flash camera to reach a subject 6.0 meters across a room?

- (1) $5.0 \times 10^{-9} \text{ s}$ (3) $5.0 \times 10^{-8} \text{ s}$
(2) $2.0 \times 10^{-8} \text{ s}$ (4) $2.0 \times 10^{-7} \text{ s}$

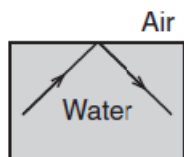
27 What happens to the frequency and the speed of an electromagnetic wave as it passes from air into glass?

- (1) The frequency decreases and the speed increases.
(2) The frequency increases and the speed decreases.
(3) The frequency remains the same and the speed increases.
(4) The frequency remains the same and the speed decreases.

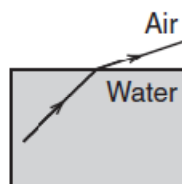
28 Which ray diagram best represents the phenomenon of refraction?



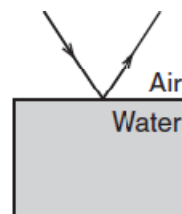
(1)



(2)



(3)

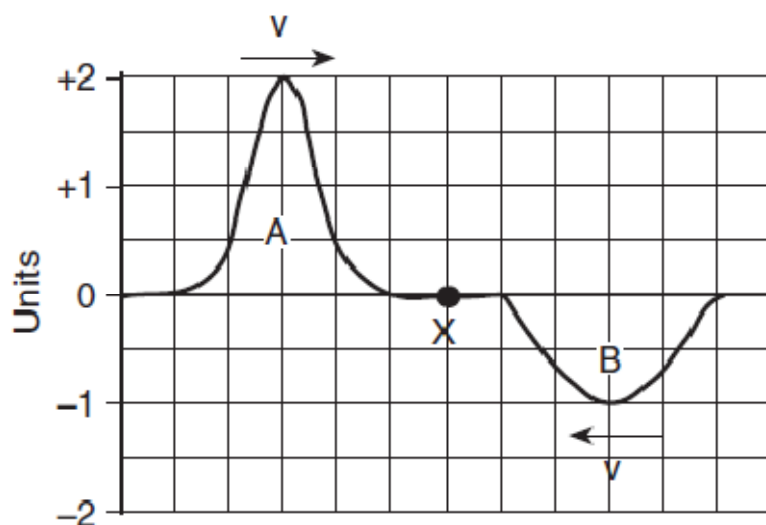


(4)

29 Which wave phenomenon makes it possible for a player to hear the sound from a referee's whistle in an open field even when standing behind the referee?

- (1) diffraction (3) reflection
(2) Doppler effect (4) refraction

- 30 Two pulses, A and B, travel toward each other along the same rope, as shown below.



When the centers of the two pulses meet at point X, the amplitude at the center of the resultant pulse will be

- (1) +1 unit (3) 0
(2) +2 units (4) -1 unit
- 32 The superposition of two waves traveling in the same medium produces a standing wave pattern if the two waves have
- (1) the same frequency, the same amplitude, and travel in the same direction
 - (2) the same frequency, the same amplitude, and travel in opposite directions
 - (3) the same frequency, different amplitudes, and travel in the same direction
 - (4) the same frequency, different amplitudes, and travel in opposite directions

25 A tuning fork oscillates with a frequency of 256 hertz after being struck by a rubber hammer. Which phrase best describes the sound waves produced by this oscillating tuning fork?

- (1) electromagnetic waves that require no medium for transmission
- (2) electromagnetic waves that require a medium for transmission
- (3) mechanical waves that require no medium for transmission
- (4) mechanical waves that require a medium for transmission

26 In a vacuum, all electromagnetic waves have the same

- (1) wavelength
- (2) frequency
- (3) speed
- (4) amplitude

27 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

- (1) 0.75
- (2) 1.3
- (3) 2.3
- (4) 4.0

28 Waves pass through a 10.-centimeter opening in a barrier without being diffracted. This observation provides evidence that the wavelength of the waves is

- (1) much shorter than 10. cm
- (2) equal to 10. cm
- (3) longer than 10. cm, but shorter than 20. cm
- (4) longer than 20. cm

A change in the speed of a wave as it enters a new medium produces a change in

- (1) frequency
- (2) period
- (3) wavelength
- (4) phase

29 Standing waves in water are produced most often by periodic water waves

- (1) being absorbed at the boundary with a new medium
- (2) refracting at a boundary with a new medium
- (3) diffracting around a barrier
- (4) reflecting from a barrier