

Name: Key

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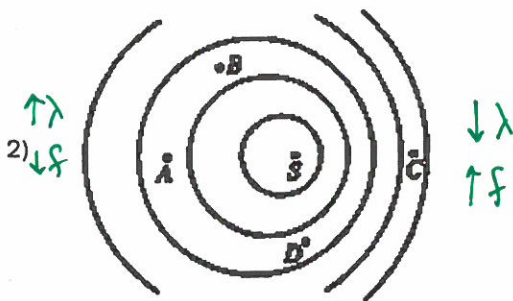
AP Physics

Wave Phenomena

1) Two fire trucks have sirens that emit waves of the same frequency. As the fire trucks approach a person, the person hears a higher frequency from truck X than from truck Y. Which of the following statements about truck X can be correctly inferred from this information?

- I. It is traveling faster than truck Y.
  - II. It is closer to the person than truck Y.
  - III. It is speeding up, and truck Y is slowing down.
- d not factor, just relative*

- A) I and II only
- B) I, II, and III
- C) I only**
- D) III only
- E) II and III only



A small vibrating object on the surface of a ripple tank is the source of waves of frequency 20 Hz and speed 60 cm/s. If the source S is moving to the right, as shown above, with speed 20 cm/s, at which of the labeled points will the frequency measured by a stationary observer be greatest?

- A) C**
- B) D
- C) B
- D) A
- E) It will be the same at all four points.

3) A diffraction grating is illuminated by light of wavelength 600 nm. On a screen 100 cm away is a series of bright spots spaced 10 cm apart. If the screen is now placed 30 cm from the diffraction grating, the new spacing between adjacent bright spots on the screen is most nearly

- A) 3 mm
- B) 3 cm**
- C) 30 cm
- D) 1 cm
- E) 10 cm

$$x = \frac{\lambda L}{d}$$

$\lambda = \text{constant}$   
 $m = \text{constant}$   
 $d = \text{constant}$

$$\frac{x_1}{L_1} = \frac{x_2}{L_2}$$

$$\frac{10 \text{ cm}}{100 \text{ cm}} = \frac{x}{30 \text{ cm}}$$

4) A source S of sound and a listener L each can be at rest or can move directly toward or away from each other with speed  $v_0$ . In which of the following situations will the observer hear the lowest frequency of sound from the source?

- A)  $\begin{matrix} S \\ \bullet \\ v=0 \end{matrix} \quad \begin{matrix} L \\ \bullet \\ v=v_0 \end{matrix} \rightarrow$  *low f*
- B)  $\begin{matrix} S \\ \bullet \\ v=0 \end{matrix} \quad \begin{matrix} L \\ \bullet \\ v=0 \end{matrix}$  *no  $\Delta f$*
- C)  $\begin{matrix} S \\ \bullet \\ v=v_0 \end{matrix} \leftarrow \quad \begin{matrix} L \\ \bullet \\ v=v_0 \end{matrix} \rightarrow$**  *greatest relative speed*
- D)  $\begin{matrix} S \\ \bullet \\ v=v_0 \end{matrix} \leftarrow \quad \begin{matrix} L \\ \bullet \\ v=0 \end{matrix}$  *low f*
- E)  $\begin{matrix} S \\ \bullet \\ v=v_0 \end{matrix} \rightarrow \quad \begin{matrix} L \\ \bullet \\ v=v_0 \end{matrix} \leftarrow$  *↑f*

5) Wave polarization can occur

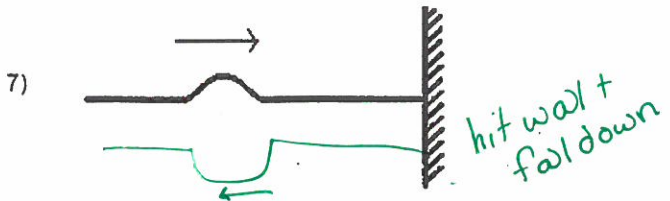
- A) for neither transverse nor longitudinal waves.
- B) only for longitudinal waves.
- C) only for light waves.
- D) for both transverse and longitudinal waves.
- E) only for transverse waves.** *(light is transverse)*

*transverse not longitudinal*

6) When light passes from air into water, the frequency remains the same. What happens to the speed and the wavelength of light as it crosses the boundary in going from air into water?

- A) Speed: remains the same  
Wavelength: remains the same
- B) Speed: decreases  
Wavelength: increases
- C) Speed: decreases  
Wavelength: decreases**
- D) Speed: increases  
Wavelength: remains the same
- E) Speed: remains the same  
Wavelength: decreases

$\uparrow n$   
 $\downarrow v$   
 $\downarrow \lambda$



7) One end of a horizontal string is fixed to a wall. A transverse wave pulse is generated at the other end, moves toward the wall as shown above, and is reflected at the wall. Properties of the reflected pulse include which of the following?

- ~~I. It has a greater speed than that of the incident pulse.~~
- ~~II. It has a greater amplitude than that of the incident pulse.~~
- III. It is on the opposite side of the string from the incident pulse.

*fixed end hard reflection*

- A) I only
- B) I, II, and III
- C) II and III only
- D) III only
- E) II only

8) Sound in air can best be described as which of the following types of waves?

- A) longitudinal
- B) polarized
- C) electromagnetic
- D) transverse
- E) torsional

*pressure waves*

9) A radar operates at a wavelength of 3 centimeters. The frequency of these waves is

- A)  $3 \times 10^8$  Hz
- B)  $10^6$  Hz
- C)  $10^{-10}$  Hz
- D)  $10^{10}$  Hz
- E)  $10^8$  Hz

*EM wave*

$$v = 3 \times 10^8 \text{ m/s}$$

$$\lambda = 3 \times 10^{-2} \text{ m}$$

$$f = \frac{v}{\lambda} = \frac{3 \times 10^8 \text{ m/s}}{3 \times 10^{-2} \text{ m}}$$

10) In the Doppler effect for sound waves, factors that affect the frequency that the observer hears include which of the following?

- I. The speed of the source
- II. The speed of the observer
- ~~III. The loudness of the sound~~ *Amplitude*

- A) III only
- B) I and II only
- C) I, II, and III
- D) II and III only
- E) I only

11) A train whistle has a frequency of 100 hertz as heard by the engineer on the train. Assume that the velocity of sound in air is 330 meters per second. If the train is approaching a stationary listener on a windless day at a velocity of 30 meters per second, the whistle frequency that the listener hears is most nearly

- A) 110 Hz
- B) 240 Hz
- C) 300 Hz
- ~~D) 120 Hz~~
- ~~E) 90 Hz~~

12) Which of the following statements are true for both sound waves and electromagnetic waves?

- I. They undergo refraction. *Bend in material*
- II. They undergo diffraction. *spread circular*
- III. They can produce a two-slit interference pattern.
- IV. They can produce standing waves.

- A) II, III, and IV only
- B) I and II only
- C) I, II, III, and IV
- D) III and IV only
- E) I, II, and III only

13) Which of the following is true of a double-slit diffraction pattern?

- ~~A) It can be produced only if the slit width is less than one wavelength.~~
- ~~B) It can be produced only if the slit width is exactly one wavelength.~~
- C) It can be produced only if the slit width is an integral number of wavelengths.
- D) It has a relatively strong central maximum.
- E) It has equally spaced fringes of equal intensity.

*light split + diffract*

13)	12)	<del>11)</del>	10)	9)	8)	7)	6)	5)	4)	3)	2)	1)
D	C	<del>A</del>	B	D	A	D	C	E	C	B	A	C