Guided Responses to TAKS Self-Check Exam Practice IPC TEKS 5A and 5B
TX BDOL p TX31

1. Light waves and X rays are traveling at the same speed. The wavelengths of light waves are longer than the wavelengths of X rays. How do the frequencies of light waves compare with the frequencies of X rays? **(IPC 5A)**
C) They are lower.

Solution Light waves and X rays are both electromagnetic waves. The wavelengths (λ) and frequencies (f) of all waves are related to the wave speed (v) according to the following equation:

$$v = f\lambda$$

Solving this equation for frequency gives:

$$f = v/\lambda$$

Since the wave speeds of the light waves and X rays are the same, increasing the wavelength means the frequency will decrease. So the longer-wavelength light waves have a lower frequency.

2. Which of the following best describes what happens when two waves interfere with each other? **(IPC 5B)**
H) The two waves combine and then pass through each other unchanged.

Solution When two waves meet at the same time and place, they momentarily interfere with each other and form a new wave as the amplitudes of the waves combine. When two crests overlap, constructive interference occurs and when a crest and a trough overlap, destructive interference occurs. However, after the waves overlap, they continue on their original paths unchanged.

3. A sound wave travels through air with a speed of 340 m/s. If the sound wave has a wavelength of 0.77 m, what is its frequency? **(IPC 5A)**
D) 442 Hz

Solution Use the equation for wave speed:

$$v = f\lambda$$

and solve this equation for frequency:

$$f = v/\lambda$$

Substituting 340 m/s for wave speed and 0.77 m for wavelength into this equation, you obtain a frequency of 442 Hz. The unit Hz (hertz) is the SI unit for frequency and is the same as 1/s or s^{-1}.

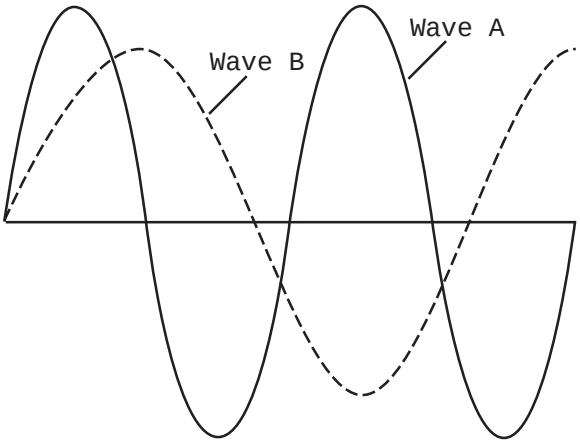
4. Which of the following lists two processes that cause a wave to change direction? **(IPC 5B)**
H) refraction—reflection

Solution Reflection is a change in a wave's direction as it bounces off an object. Refraction is a change in a wave's direction as it travels from one material to another. This change occurs because the speed of the wave differs in different materials.

5. Which of the following waves could travel through matter and a vacuum? **(IPC 5A)**
A) light waves

Solution Sound waves and water waves are mechanical waves. Energy from these types of waves is transferred by the interaction of atoms or molecules in matter. They cannot travel through a vacuum. Light waves are electromagnetic waves that consist of vibrating electric and magnetic fields. They can travel through either matter or through a vacuum.

6. The figure shows two waves, A and B, that travel at the same speed. Which of the following best compares the two waves? **(IPC 5A)**
J) Their wavelengths, amplitudes, and frequencies are different.



Solution The crests for wave A are farther apart than for wave B. As a result, the wavelength of wave B is longer. From the wave speed equation:

$$f = v/\lambda$$

According to this equation, if the two waves have different wavelengths, and the wave speed is the same, then the waves have different frequencies. Also the crests of wave A are higher than the crests of wave B. This means that the amplitude of wave A is greater than the amplitude of wave B.

7. A sound wave with a frequency of 900 Hz strikes a glass. The glass begins to vibrate at the same frequency, and continues to vibrate with an increasing amplitude until it shatters. Which of the following is this an example of? **(IPC 5B)**
B) resonance

Solution Every material has natural frequencies at which it tends to vibrate when it absorbs energy. Resonance occurs when an object absorbs energy at a frequency that is equal to one of its natural frequencies. A wave vibrating at a natural frequency of the object can supply this energy and cause the object to resonate. As long as the object keeps absorbing energy, the amplitude of its vibrations will increase. In this problem, the sound wave is providing energy to the glass at the natural frequency of the glass. The glass vibrates with an increasing amplitude until the amplitude of vibration becomes large enough to cause the glass to shatter.

8. Which of the following best describes electromagnetic waves? **(IPC 5A)**
J) transverse waves

Solution Electromagnetic waves can travel through a vacuum. Mechanical waves can travel only through matter. Their energy is transferred by the interaction of atoms or molecules in the medium through which they travel. Compressional waves also are mechanical waves. Refracted waves are any waves that change direction when they change speed traveling from one material to another. The best description of electromagnetic waves is transverse waves, because electromagnetic waves consist of electric and magnetic fields that vibrate back and forth at right angles to the direction the wave is moving.