

## ## Physics Question Paper - Sound

**\*\*Instructions:\*\*** Answer all questions. Show all working.

**\*\*Section A: Multiple Choice Questions (1 mark each)\*\***

1. The speed of sound in air is approximately:
  - a) 339 m/s
  - b) 343 m/s
  - c) 340 m/s
  - d) 350 m/s
2. Which of the following is NOT a characteristic of sound waves?
  - a) They are longitudinal waves.
  - b) They require a medium to travel.
  - c) They are electromagnetic waves.
  - d) They can be reflected and refracted.
3. The unit of frequency is:
  - a) Hertz (Hz)
  - b) Meter (m)
  - c) Second (s)
  - d) Decibel (dB)
4. Reverberation is caused by:
  - a) The absorption of sound waves.
  - b) The reflection of sound waves.
  - c) The diffraction of sound waves.
  - d) The interference of sound waves.

5. Loudness of sound is determined by:

- a) The frequency of the sound wave.
- b) The amplitude of the sound wave.
- c) The wavelength of the sound wave.
- d) The speed of the sound wave.

**\*\*Section B: Short Answer Questions (2 marks each)\*\***

- 6. What is the relationship between frequency, wavelength, and speed of a wave?
- 7. Explain how sound waves are produced.
- 8. What is the difference between infrasound and ultrasound?
- 9. How does reverberation affect the quality of sound in a concert hall?
- 10. Give two examples of how ultrasound is used in medical imaging.

**\*\*Section C: Long Answer Questions (4 marks each)\*\***

- 11. A sound wave travels at a speed of 339 m/s. If its wavelength is 1.5 cm, what is the frequency of the wave? Will it be audible?
- 12. Explain how reverberation can be reduced in a concert hall.
- 13. What are the factors that affect the loudness of sound? Explain how each factor influences loudness.
- 14. Explain the principle behind using ultrasound for cleaning.
- 15. Describe how ultrasound can be used to detect defects in a metal block.

**\*\*Answer Key\*\***

**\*\*Section A:\*\***

1. (b) 343 m/s
2. (c) They are electromagnetic waves.
3. (a) Hertz (Hz)
4. (b) The reflection of sound waves.
5. (b) The amplitude of the sound wave.

**\*\*Section B:\*\***

6. The speed of a wave is equal to the product of its frequency and wavelength.
7. Sound waves are produced by vibrations. Vibrations create pressure waves that travel through a medium.
8. Infrasound refers to sound waves with frequencies below the range of human hearing (less than 20 Hz). Ultrasound refers to sound waves with frequencies above the range of human hearing (greater than 20 kHz).
9. Reverberation can make sound muddy and unclear, making it difficult to understand speech or appreciate music.
10. Ultrasound is used for prenatal imaging and for examining internal organs.

**\*\*Section C:\*\***

11. Frequency = Speed / Wavelength

$$\text{Frequency} = 339 \text{ m/s} / 0.015 \text{ m} = 22,600 \text{ Hz}$$

This frequency is higher than the upper limit of human hearing (20 kHz), so it is not audible.

12. Reverberation can be reduced by using sound-absorbing materials on walls and ceilings, as

well as by creating irregular shapes in the room to scatter sound waves.

13. Loudness of sound is affected by the amplitude of the sound wave, the distance from the source, and the properties of the medium. A larger amplitude results in a louder sound. Sound intensity decreases with distance from the source. The density and elasticity of the medium also influence how well sound travels and its loudness.

14. Ultrasonic cleaning uses high-frequency sound waves to create cavitation bubbles. These bubbles collapse and generate shock waves that dislodge dirt and debris from surfaces.

15. Ultrasound waves can be used to detect defects in metal blocks because sound waves travel through solid materials at different speeds depending on the material's density. When an ultrasound wave encounters a crack or other defect, it is reflected back. The time it takes for the reflected wave to return to the source can be used to locate and characterize the defect.