Physics Exam Answer Key - Sound

Grade: VII
Duration: 2 hours
Maximum Marks: 80

SECTION A (Objective & Short Answer)

Q1. Choose the correct answers from the given options: [10]

1. **Sound waves are:**
   Answer: (ii) Longitudinal waves
2. **The speed of sound is maximum in:**
   Answer: (iii) Steel
3. **The unit of frequency is:**
   Answer: (i) Hertz (Hz)
4. **The amplitude of a sound wave determines its:**
   Answer: (ii) Loudness
5. **The minimum distance between two points which are in phase is called:**
   Answer: (i) Wavelength
6. **Infrasonic sounds have frequencies:**
   Answer: (i) Less than 20 Hz
7. **Which of the following cannot transmit sound?**
   Answer: (iv) Vacuum
8. **The phenomenon responsible for the reflection of sound is:**
   Answer: (iii) Echo
9. **The time taken for one complete vibration is called:**
   Answer: (ii) Time period
10. **The SI unit of sound intensity is:**
    Answer: (ii) Decibel

Q2. Fill in the blanks with appropriate terms: [5]

1. **The speed of sound in air is approximately** 343 **m/s.**
2. **Sound waves require a** medium **to propagate.**

3. **The reflection of sound waves causes** echoes.
4. **The human ear can hear sounds in the frequency range** 20 Hz - 20 kHz.
5. **Timbre** is the property of sound that enables us to distinguish between two sounds of the same pitch and loudness.

Q3. State whether the following statements are True or False: [5]

1. **Sound can travel through a vacuum.**
   Answer: False
2. **The loudness of a sound depends on its frequency.**
   Answer: False
3. **The speed of sound is the same in all mediums.**
   Answer: False
4. **A shorter wavelength results in a higher frequency.**
   Answer: True
5. **A tuning fork produces sound due to vibrations.**
   Answer: True

Q4. Name the following: [5]

1. **The SI unit of frequency.**
   Answer: Hertz (Hz)
2. **The type of wave in which particles vibrate parallel to the direction of wave propagation.**
   Answer: Longitudinal wave
3. **The phenomenon of multiple reflections of sound.**
   Answer: Reverberation
4. **The frequency range of audible sound for humans.**
   Answer: 20 Hz - 20 kHz
5. **The instrument used to measure sound level.**
   Answer: Sound level meter

Q5. Match the following: [5]

Column A	Column B
Unit of sound intensity	**Decibel**

Column A	Column B
Speed of sound in air	**343 m/s**
Human audible range	**20 Hz - 20 kHz**
Reflection of sound	**Echo**
High frequency sound waves	**Ultrasound**

SECTION B (Descriptive & Numerical)

Q6. Answer all the following questions: [10]

1. **Define sound and explain how it is produced.**
   Answer: Sound is a form of energy that travels through a medium as a longitudinal wave. It is produced when an object vibrates, creating compressions and rarefactions in the medium.
2. **What are the differences between transverse waves and longitudinal waves?**
   Answer:
   - Transverse waves: Particles move perpendicular to wave direction (e.g., light waves).
   - Longitudinal waves: Particles move parallel to wave direction (e.g., sound waves).
3. **Explain the factors affecting the speed of sound in different media.**
   Answer: The speed of sound depends on the medium's density, elasticity, and temperature. It is highest in solids, lower in liquids, and lowest in gases.
4. **Describe the working of the human ear in hearing sound.**
   Answer: The ear detects sound waves, which are funneled by the outer ear to the eardrum. Vibrations are transmitted through the middle ear bones and converted into nerve signals in the cochlea.
5. **Explain the phenomenon of an echo and its applications.**
   Answer: An echo occurs when sound reflects off a surface and returns to the listener. Applications include SONAR and measuring distances.
6. **Convert 50 dB into the logarithmic scale of sound intensity.**
   Answer: I = $10^{(50/10)}$ = 10^5 times the reference intensity.
7. **Discuss the applications of ultrasound in medicine and industry.**
   Answer: Ultrasound is used in medical imaging (e.g., sonography) and industrial applications like detecting cracks in metals.

Q7. Distinguish between the following: [10]

1. **Loudness vs. Pitch:** Loudness depends on amplitude; pitch depends on frequency.
2. **Echo vs. Reverberation:** Echo is distinct reflection; reverberation is multiple reflections.
3. **Sound waves in solids vs. gases:** Faster in solids due to tightly packed molecules.
4. **Infrasonic vs. Ultrasonic sounds:** Infrasonic <20 Hz, Ultrasonic >20 kHz.
5. **Noise vs. Musical sound:** Noise is irregular; music has harmony and pattern.

Q8. Solve the following numerical problems: [20]

1. **(a) Frequency = Speed / Wavelength = 340 / 2 = 170 Hz**
   (b) Time period = 1 / Frequency = 1 / 500 = 0.002 s
2. **(a) Distance = (Speed × Time) / 2 = (343 × 3) / 2 = 514.5 m**
   (b) Wavelength = Speed / Frequency = 340 / 256 = 1.33 m
3. **(a) SONAR uses reflected ultrasound waves to determine depth.**
   (b) Depth = (Speed × Time) / 2 = (1500 × 4) / 2 = 3000 m
4. **(a) Speed = Wavelength × Frequency =** $1.5 \times 400 = 600 m/s$
   (b)* $dB = 10 \log(10^{-6}/10^{-12}) = 60 dB$ *

End of the Answer Key