CLASS IX – SCIENCE PRACTICE PAPER (2026-27)

Step-by-Step Solutions and Marking Scheme

Chapter 10: Sound Waves – Characteristics and Applications | Max. Marks: 40

SECTION A – Objective Questions (1 mark each)

Q1 **[1 mark]**

Sound is a mechanical wave and needs a material medium (solid, liquid or gas). It cannot travel through a vacuum.

Answer: (D)

Q2 **[1 mark]**

P and R are crowded with particles (higher density): compressions. Q and S have few particles (lower density): rarefactions. So Q is a rarefaction and R is a compression.

Answer: (B)

Q3 **[1 mark]**

Air particles vibrate parallel to the direction of the wave, and a medium is needed: a longitudinal mechanical wave.

Answer: (A)

Q4 **[1 mark]**

Frequency = oscillations ÷ time = 40 ÷ 8 = 5 Hz.

Answer: (C)

Q5 **[1 mark]**

Frequencies above 20 kHz are ultrasonic; below 20 Hz are infrasonic.

Answer: (B)

Q6 **[1 mark]**

From the graph, crests are at 1 cm, 5 cm and 9 cm, so the wavelength λ = 4 cm = 0.04 m.

$v = f\lambda \Rightarrow f = 340 \div 0.04 = 8500$ Hz.

Answer: (A)

Q7 **[1 mark]**

$f = 1 \div T = 1 \div 0.004 = 250$ Hz.

Answer: (C)

Q8 **[1 mark]**

The echo must reach the ear at least 0.1 s later. Distance there and back = 340 × 0.1 = 34 m, so the wall is at 34 ÷ 2 = 17 m.

Answer: (B)

Q9 **[1 mark]**

Both true; R explains A, since there is almost no medium in space to carry the sound.

Answer: (A)

Q10 **[1 mark]**

Assertion: true (loudness is the perception of amplitude). Reason: false, because loudness depends on the amplitude, not only on frequency.

Answer: (C)

SECTION B – Very Short Answer Questions (2 marks each)

Q11 **[2 marks]**

(a) (1 mark) Frequency is the number of density oscillations at a fixed point per unit time. SI unit: hertz (Hz) = s^{-1}.

(b) (1 mark) T = 1 ÷ f = 1 ÷ 50 = **0.02 s**.

Q12 **[2 marks]**

(a) (1 mark) Wave (b). It has more oscillations in the same distance, so a shorter wavelength; at the same speed (v = fλ) a shorter wavelength means a higher frequency.

(b) (1 mark) Wave (b). It has the larger amplitude, and larger amplitude is heard as louder sound.

Q13 **[2 marks]**

(1 mark) Bat: λ = v ÷ f = 340 ÷ 50000 = 0.0068 m = **6.8 mm**.

(1 mark) Elephant: λ = 340 ÷ 10 = **34 m**.

Q14 **[2 marks]**

Option A:

(1 mark) Echo: the reflected sound heard as a separate sound at least 0.1 s after the original (reflecting surface at least 17 m away).

(1 mark) Reverberation: persistence of sound caused by repeated reflections that reach the ear within 0.05 s of each other, so they merge with the original sound.

Option B (any two):

(1 mark each) Ultrasonography (imaging internal organs); breaking kidney stones; cleaning delicate machine parts / ultrasonic welding; detecting defects in metal blocks; sonar and echolocation.

SECTION C – Short Answer Questions (3 marks each)

Q15 **[3 marks]**

(i) (1 mark) The statement is wrong. Air particles only vibrate to and fro about their mean positions; they do not travel from the fork to the ear.

(ii) (1 mark) The **energy** (the pattern of compressions and rarefactions) travels, through collisions between neighbouring particles.

(iii) (1 mark) A longitudinal mechanical wave.

Q16 **[3 marks]**

(i) (1 mark) Distance = v × t = 1500 × 2.4 = **3600 m** (to the wreck and back).

(ii) (1 mark) Depth d = 3600 ÷ 2 = **1800 m**.

(iii) (1 mark) Echolocation: bats emit ultrasonic waves and use the reflected echoes to locate obstacles and prey.

Q17 **[3 marks]**

Option A:

• (1 mark) An electric bell is hung inside a sealed bell jar connected to a vacuum pump; the bell is switched on and its loudness noted.

• (1 mark) As air is pumped out, the sound becomes fainter and, in near vacuum, almost inaudible, though the bell is still seen vibrating. Letting air back makes the sound loud again.

• (1 mark) Conclusion: sound needs a material medium to propagate; it cannot travel through a vacuum.

Option B:

• (1 mark) In steel: λ = v ÷ f = 5000 ÷ 250 = **20 m**.

• (1 mark) In air: λ = 340 ÷ 250 = **1.36 m**.

• (1 mark) The **frequency** (250 Hz) stays the same; it is fixed by the source.

SECTION D – Case-Based Questions (4 marks each)

Q18 **[4 marks]**

(i) (1 mark) T = 1 ÷ f. For 200 Hz: T = 1 ÷ 200 = **0.005 s**. For 400 Hz: T = 1 ÷ 400 = **0.0025 s**.

(ii) (1 mark) The higher note has **double** the frequency of the lower note (400 = 2 × 200); this interval is an octave.

(iii) (1 mark) λ = v ÷ f = 340 ÷ 400 = **0.85 m**.

(iv) (1 mark) Timbre. It depends on the combination and strength of the overtones, which is set by the shape, material and construction of the instrument.

Q19 **[4 marks]**

(i) (1 mark) The sound travels 2 × 85 = 170 m. t = 170 ÷ 340 = **0.5 s**.

(ii) (1 mark) Yes. The echo returns after 0.5 s, which is more than 0.1 s, and the cliff is farther than the minimum 17 m.

(iii) (1 mark) Distance for 0.1 s: 340 × 0.1 = 34 m there and back, so he is **17 m** from the cliff.

(iv) (1 mark) Thick curtains are soft surfaces that absorb sound instead of reflecting it, so very little sound returns.

SECTION E – Long Answer Question (5 marks)

Q20 **[5 marks]**

Option A: v = 1500 m s^{-1}.

(i) (1 mark) Crests are at 0 m and 0.75 m, so λ = **0.75 m**.

(ii) (1 mark) f = v ÷ λ = 1500 ÷ 0.75 = **2000 Hz**.

(iii) (1 mark) T = 1 ÷ f = 1 ÷ 2000 = **0.0005 s**.

(iv) (1 mark) The frequency is fixed by the source (2000 Hz). λ = 340 ÷ 2000 = **0.17 m**.

(v) (1 mark) A **longitudinal** wave; particles of the medium vibrate back and forth parallel to the direction of propagation (about their mean positions).

Option B:

(i) (1 mark) Distance = v × t = 340 × 4 = **1360 m**.

(ii) (1 mark) Light travels much faster than sound, so the flash reaches us almost instantly while the thunder takes longer.

(iii) (1 mark) 340 × 0.1 = 34 m for the round trip, so the minimum distance is **17 m**.

(iv) (1 mark) Reverberation is the persistence of sound due to multiple reflections. It is reduced by sound-absorbing panels, curtains, upholstered seats and porous surfaces.

(v) (1 mark) Distance = (340 × 0.6) ÷ 2 = 204 ÷ 2 = **102 m**.

***** END *****