EXAM CONCEPT BUILDER

■ Class 8 Science

Chapter 13

■ SOUND

Complete Study Notes

■ Full Notes	■ 30 MCQs	■ True / False	■ Assertion-Reason	■ Case Studies	■ Q&A; Practice

■ CBSE / NCERT Board | ■ Academic Year 2025–26 | ■ examconceptbuilder.com

■ Quick-Fire Key Facts

- **Sound source:** Any vibrating object
- **Medium needed?:** Yes — Solid, Liquid, or Gas (NOT vacuum)
- **Speed order:** Solids > Liquids > Gases
- **Frequency unit:** Hertz (Hz) | 1 Hz = 1 vibration per second
- **Loudness unit:** Decibel (dB)
- **Human hearing:** 20 Hz – 20,000 Hz
- **Infrasound:** Below 20 Hz (elephants, earthquakes)
- **Ultrasound:** Above 20,000 Hz (bats, dolphins, medical imaging)
- **Larynx:** Produces human voice via vibrating vocal cords
- **Pain threshold:** 80 dB and above

1. How is Sound Produced?

Sound originates from **vibrating objects**. Any rapid back-and-forth motion creates disturbances in the surrounding medium that travel outward as a sound wave.

Source	Vibrating Part
School bell	Metal body of the bell
Guitar / Sitar	Plucked strings
Tabla / Drum	Stretched membrane
Flute / Trumpet	Air column inside the tube
Human voice	Vocal cords in the larynx
Tuning fork	Prongs of the fork

■ **Voice Box (Larynx):** Two vocal cords stretch across the larynx. When lungs force air through the slit, cords vibrate. Tight/thin → higher pitch; loose/thick → lower pitch.

2. Propagation of Sound

Sound requires a **medium** to travel. Particles vibrate and pass disturbance to neighbours. The particles themselves barely move — only the disturbance travels.

Medium	Approx. Speed
Air (20°C)	343 m/s
Water	1,480 m/s
Steel	5,960 m/s

■ **Vacuum:** Sound CANNOT travel — no particles to vibrate. Space is completely silent!

3. Characteristics of Sound Waves

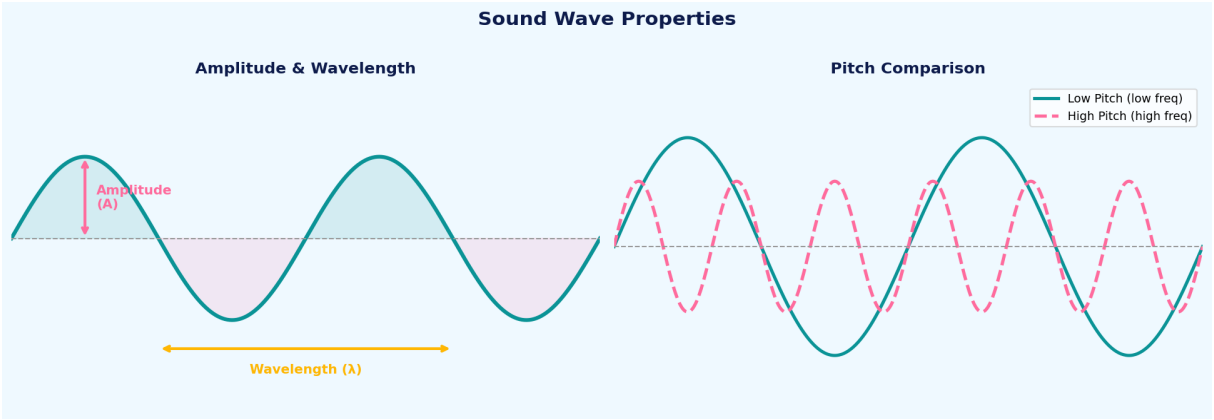

Fig. 1 — Amplitude, wavelength, and pitch comparison

Term	Definition	Unit	Affects
Frequency (f)	Number of vibrations per second	Hz	Pitch
Amplitude (A)	Max displacement from rest	—	Loudness
Time Period (T)	Time for one complete vibration; T=1/f	s	Frequency
Wavelength (λ)	Distance between consecutive crests	m	Pitch/speed

4. Loudness and Pitch

Depends on **amplitude**	Depends on **frequency**
Louder ↔ larger amplitude	Higher ↔ higher frequency
Loudness ∝ Amplitude²	Whistle = high; Drum = low

Unit: **decibels (dB)**	Unit: **Hertz (Hz)**
>80 dB harmful	Bird=high; Lion=low pitch

5. The Human Ear

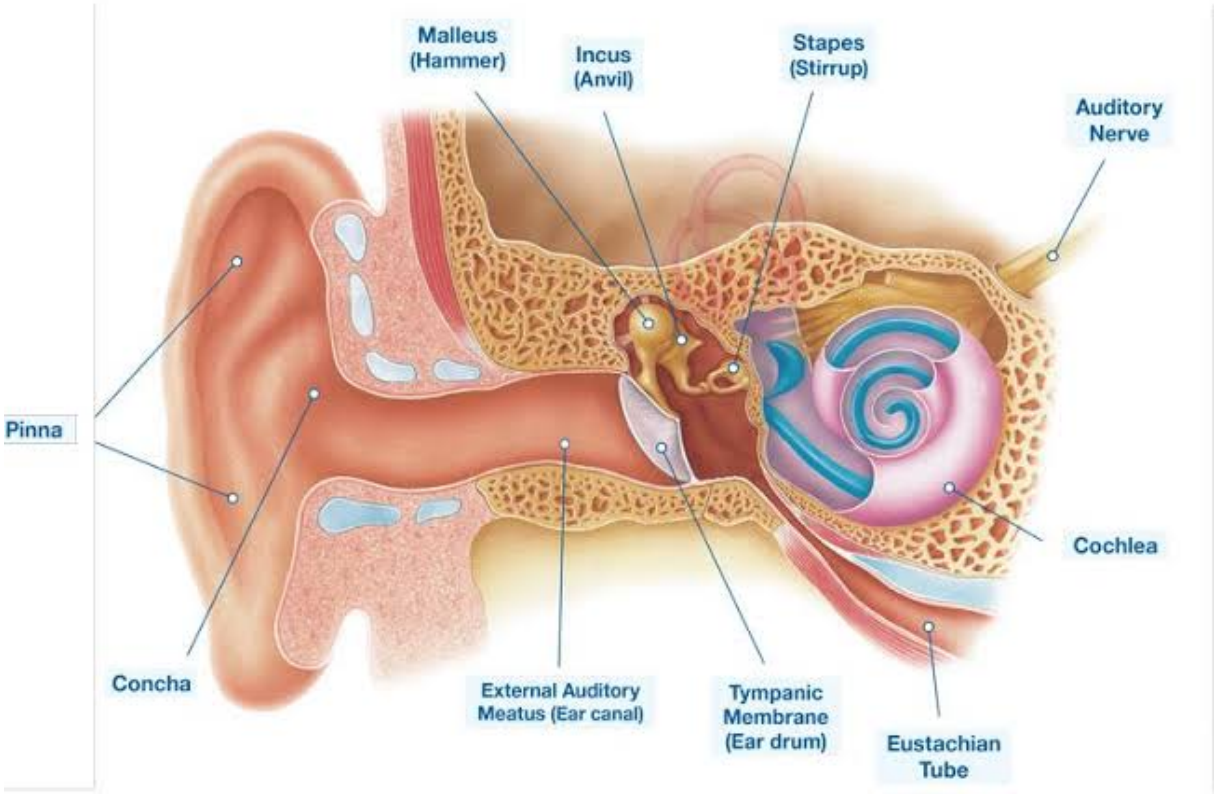

Fig. 2a — Detailed anatomy of the human ear (cross-section illustration)

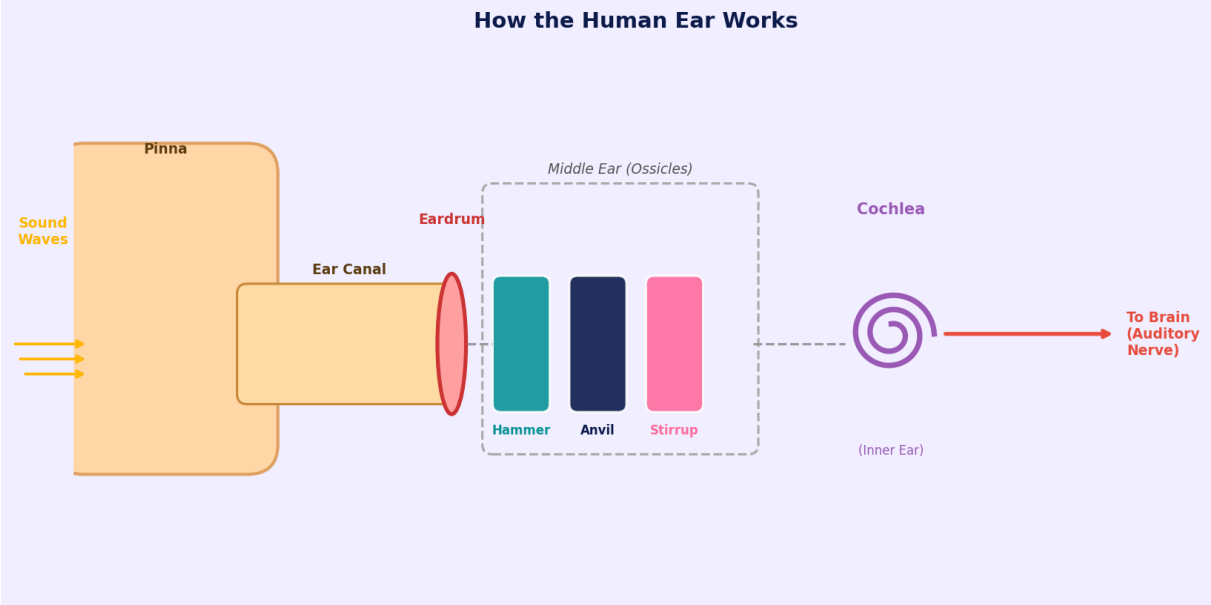

Fig. 2b — How sound travels through the ear to the brain

Step 1: Pinna collects sound waves.

Step 2: Waves travel through ear canal → eardrum vibrates.

Step 3: Ossicles (Hammer→Anvil→Stirrup) amplify and pass vibrations to cochlea.

Step 4: Cochlea converts vibrations → electrical signals.

Step 5: Auditory nerve carries signals → brain interprets as sound.

6. Audible & Inaudible Sounds

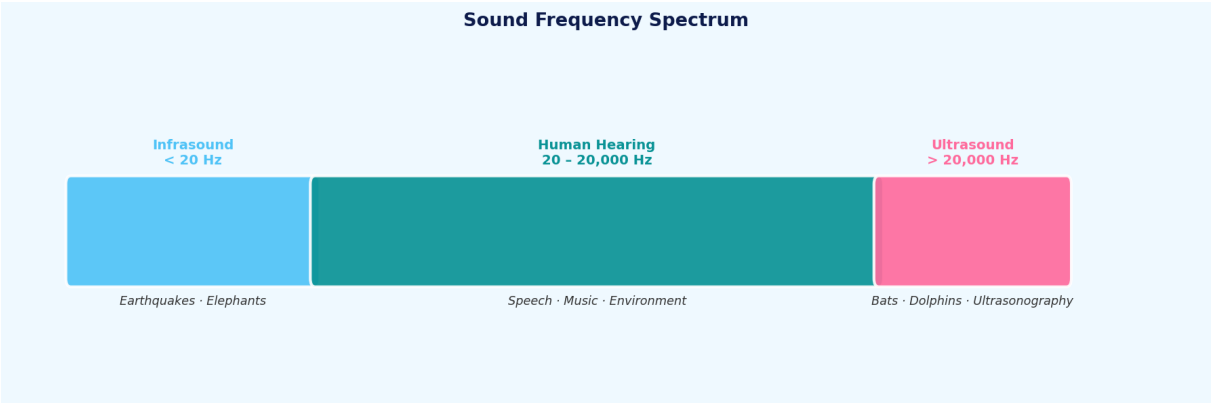

Fig. 3 — Sound frequency spectrum

Type	Frequency	Examples & Uses
Infrasound	< 20 Hz	Earthquakes, elephants, rhinos
Audible	20 – 20,000 Hz	Human speech, music
Ultrasound	> 20,000 Hz	Bats, SONAR, ultrasonography, breaking kidney stones

7. Noise Pollution

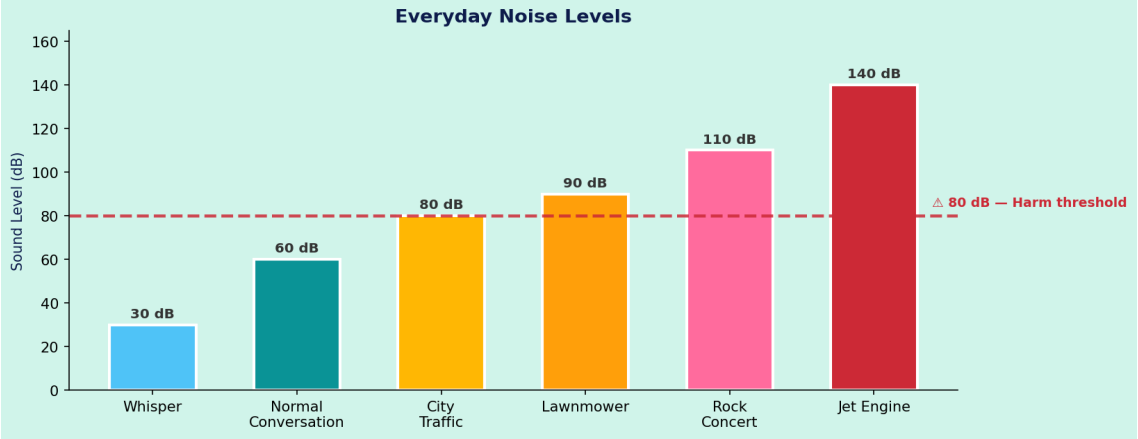

Fig. 4 — Everyday noise levels in decibels

Definition: Presence of excessive or unwanted sound in the environment.

- Road/air traffic
- Industrial machinery & construction
- Loudspeakers & crackers
- Home appliances at high volume

Harmful Effects: Sleep deprivation · Hypertension · Anxiety · Hearing loss

■ **Control:** Mufflers on machines · Restrict horn use · Plant trees · Ear protection · Legal noise limits

■ Answer in Brief (1–2 sentences)

Q1. What is sound?

■ Sound is a form of energy produced by vibrating objects that travels through a medium as a wave.

Q2. Can sound travel in vacuum?

■ No. Sound needs particles to propagate; vacuum has none.

Q3. What is frequency?

■ Frequency is the number of vibrations per second (Hz). Higher frequency = higher pitch.

Q4. What determines loudness?

■ Amplitude determines loudness. Larger amplitude = louder sound (unit: dB).

Q5. Name the three ossicles.

■ Hammer, anvil, and stirrup — they amplify vibrations in the middle ear.

Q6. What is infrasound?

■ Sound below 20 Hz, inaudible to humans; used by elephants and rhinos.

Q7. Define noise pollution.

■ Excessive or unwanted sound in the environment causing health hazards.

Q8. Relate T and f.

■ T = 1/f — time period and frequency are reciprocals.

■ Answer in Short (3–4 sentences)

Q1. How does the human ear work?

Sound waves enter through the pinna and travel down the ear canal, causing the eardrum to vibrate. Three ossicles (hammer, anvil, stirrup) amplify vibrations and transmit them to the cochlea. The cochlea converts vibrations to electrical signals, which the auditory nerve carries to the brain.

Q2. Distinguish loudness from pitch.

Loudness depends on amplitude and is measured in decibels (dB); larger amplitude = louder sound. Pitch depends on frequency (Hz); higher frequency = higher (shriller) pitch. A drum has low pitch; a whistle has high pitch.

Q3. Why does sound travel faster in solids?

Particles in solids are tightly packed and strongly bonded, so vibrations transfer rapidly. In gases, particles are far apart, slowing transfer. Hence speed: solids > liquids > gases.

Q4. What is ultrasound and its uses?

Ultrasound is sound above 20,000 Hz, beyond human hearing. Uses: medical imaging (ultrasonography), breaking kidney stones without surgery, SONAR for detecting underwater objects, and cleaning delicate instruments.

Q5. Causes and control of noise pollution.

Causes: traffic, industrial machines, construction, loudspeakers, crackers. Effects: sleeplessness, hypertension, hearing loss. Controls: silencers on machines, restricted horn use, tree planting, ear protection, and legal noise-level limits.

■ Multiple Choice Questions — 30 MCQs

1. Sound is produced by:

(a) Stationary objects
(b) Vibrating objects
(c) Transparent objects
(d) Dense objects

✔ **Answer: (B) Vibrating objects**

2. Which cannot transmit sound?

(a) Air
(b) Water
(c) Vacuum
(d) Steel

✔ **Answer: (C) Vacuum**

3. Unit of frequency:

(a) Decibel
(b) Metre
(c) Hertz
(d) Second

✔ **Answer: (C) Hertz**

4. Loudness depends on:

(a) Frequency
(b) Wavelength
(c) Amplitude
(d) Speed

✔ **Answer: (C) Amplitude**

5. Pitch is determined by:

(a) Amplitude
(b) Frequency
(c) Loudness
(d) Wavelength

✔ **Answer: (B) Frequency**

6. Sound travels fastest in:

(a) Air
(b) Water
(c) Vacuum
(d) Steel

✔ **Answer: (D) Steel**

7. Human hearing range:

(a) 2–2,000 Hz
(b) 20–20,000 Hz
(c) 200–200,000 Hz

(d) 0–10,000 Hz

✔ **Answer: (B) 20–20,000 Hz**

8. Sounds below 20 Hz are called:

(a) Ultrasound
(b) Supersonic
(c) Infrasound
(d) Megasound

✔ **Answer: (C) Infrasound**

9. Which uses ultrasound for navigation?

(a) Elephant
(b) Tiger
(c) Bat
(d) Horse

✔ **Answer: (C) Bat**

10. Unit of loudness:

(a) Hertz
(b) Decibel
(c) Newton
(d) Pascal

✔ **Answer: (B) Decibel**

11. Voice box is called:

(a) Cochlea
(b) Trachea
(c) Larynx
(d) Pinna

✔ **Answer: (C) Larynx**

12. Which part converts vibrations to electrical signals?

(a) Eardrum
(b) Pinna
(c) Hammer
(d) Cochlea

✔ **Answer: (D) Cochlea**

13. T = 1/f means:

(a) T equals f
(b) Time period is reciprocal of frequency
(c) T equals f^2
(d) T equals 2f

✔ **Answer: (B) Time period is reciprocal of frequency**

14. Increasing amplitude makes sound:

(a) Higher pitched
(b) Lower pitched
(c) Louder
(d) Softer

✔ **Answer: (C) Louder**

15. Sound waves are:

(a) Transverse
(b) Electromagnetic
(c) Longitudinal
(d) Light waves

✔ **Answer: (C) Longitudinal**

16. SONAR uses:

(a) Light waves
(b) Ultrasound
(c) Infrasound
(d) Radio waves

✔ **Answer: (B) Ultrasound**

17. Noise pollution causes:

(a) High blood pressure
(b) Better sleep
(c) Improved hearing
(d) Lower stress

✔ **Answer: (A) High blood pressure**

18. Trees along roads help by:

(a) Increasing noise
(b) Absorbing sound
(c) Speeding up sound
(d) Reflecting light

✔ **Answer: (B) Absorbing sound**

19. High-pitched sound has:

(a) Low frequency
(b) High frequency
(c) Low amplitude
(d) High wavelength

✔ **Answer: (B) High frequency**

20. Speed of sound in air (20°C):

(a) 5,960 m/s
(b) 1,480 m/s
(c) 343 m/s
(d) 0 m/s

✔ **Answer: (C) 343 m/s**

21. Middle ear bones are:

(a) Tibia, fibula, femur
(b) Hammer, anvil, stirrup
(c) Pinna, cochlea, eardrum
(d) Radius, ulna, humerus

✔ **Answer: (B) Hammer, anvil, stirrup**

22. Pain threshold in dB:

(a) 40
(b) 60
(c) 80
(d) 20

✔ **Answer: (C) 80**

23. Tuning fork produces sound because:

(a) It is hot
(b) Prongs vibrate
(c) It emits light
(d) It rotates

✔ **Answer: (B) Prongs vibrate**

24. Pinna function:

(a) Amplify sound
(b) Convert to signals
(c) Collect sound waves
(d) Filter noise

✔ **Answer: (C) Collect sound waves**

25. Infrasound is produced by:

(a) Bat
(b) Dog whistle
(c) Earthquake
(d) Ultrasonic cleaner

✔ **Answer: (C) Earthquake**

26. Loudness is proportional to:

(a) Amplitude
(b) Frequency
(c) Amplitude²
(d) Frequency²

✔ **Answer: (C) Amplitude²**

27. Sound cannot travel through vacuum because:

(a) Vacuum is hot
(b) No particles to vibrate
(c) Vacuum absorbs sound
(d) Light blocks it

✔ **Answer: (B) No particles to vibrate**

28. Tighter vocal cords produce:

(a) Lower pitch
(b) Higher pitch
(c) More loudness
(d) Less loudness

✔ **Answer: (B) Higher pitch**

29. SONAR stands for:

(a) Sound Navigation and Ranging
(b) Solar Navigation Radio
(c) Sound Noise Radar
(d) Signal Output Array

✔ **Answer: (A) Sound Navigation and Ranging**

30. Ultrasonography is used for:

(a) Measuring earthquake intensity
(b) Studying currents
(c) Medical imaging
(d) Breaking glass

✔ **Answer: (C) Medical imaging**

■ True or False

1. Sound is produced by vibrating objects.

TRUE ✔ *Vibration is the fundamental cause of all sound.*

2. Sound can travel through vacuum.

FALSE ✗ *Sound requires a medium; vacuum has no particles.*

3. Sound travels faster in water than in air.

TRUE ✔ *Speed in water ≈ 1,480 m/s vs 343 m/s in air.*

4. Loudness depends on the frequency of vibration.

FALSE ✗ *Loudness depends on amplitude, not frequency.*

5. Higher frequency produces a higher-pitched sound.

TRUE ✔ *Frequency directly determines pitch.*

6. The cochlea is part of the outer ear.

FALSE ✗ *Cochlea is in the inner ear.*

7. Infrasound has frequency below 20 Hz.

TRUE ✔ *By definition, infrasound is below the human audible range.*

8. Ultrasound is used in medical imaging.

TRUE ✔ *Ultrasonography uses high-frequency sound waves.*

9. Noise above 80 dB is harmless.

FALSE ✗ *Above 80 dB can cause hearing damage and health problems.*

10. The unit of frequency is decibel.

FALSE ✗ *Decibel (dB) measures loudness; frequency is measured in Hertz (Hz).*

11. Planting trees helps reduce noise pollution.

TRUE ✔ *Trees absorb and scatter sound waves effectively.*

12. The human ear can detect sounds from 20 Hz to 20,000 Hz.

TRUE ✔ *This is the standard audible range for humans.*

13. Time period and frequency are directly proportional.

FALSE ✗ *They are inversely proportional: T = 1/f.*

14. Bats use infrasound for echolocation.

FALSE ✗ *Bats use ultrasound (above 20,000 Hz) for echolocation.*

15. Loudness is proportional to the square of the amplitude.

TRUE ✔ *Loudness ∝ Amplitude², as per wave physics.*

■ Assertion–Reason Questions

Instructions: Choose the correct option:
(A) Both Assertion (A) and Reason (R) are true and R is the correct explanation of A.
(B) Both A and R are true but R is NOT the correct explanation of A.
(C) A is true but R is false.
(D) A is false but R is true.

Q1. Assertion (A): Sound cannot travel through vacuum.

Reason (R): Sound is a mechanical wave that needs a material medium for propagation.

Answer: (A) Both are true and R correctly explains A — sound is a mechanical wave requiring particles.

Q2. Assertion (A): A woman's voice is generally shriller than a man's voice.

Reason (R): Women's vocal cords are shorter and thinner, producing higher frequency vibrations.

Answer: (A) Both are true and R is the correct explanation — shorter/thinner cords → higher frequency → higher pitch.

Q3. Assertion (A): Loudness of sound depends on its frequency.

Reason (R): Larger amplitude of vibration produces a louder sound.

Answer: (D) A is false (loudness depends on amplitude, not frequency). R is true.

Q4. Assertion (A): Bats can navigate in complete darkness.

Reason (R): Bats emit ultrasound and use the reflected echoes to detect objects.

Answer: (A) Both are true and R correctly explains A — echolocation using ultrasound.

Q5. Assertion (A): Sound travels faster in steel than in water.

Reason (R): In solids, particles are closely packed and strongly bonded, enabling faster wave transfer.

Answer: (A) Both true; R correctly explains why solids transmit sound faster than liquids.

Q6. Assertion (A): Noise pollution can cause permanent hearing loss.

Reason (R): Prolonged exposure to sounds above 80 dB damages the delicate hair cells in the cochlea.

Answer: (A) Both true; R correctly explains the mechanism of noise-induced hearing damage.

Q7. Assertion (A): The eardrum is located in the inner ear.

Reason (R): The eardrum vibrates when sound waves reach it.

Answer: (D) A is false — the eardrum is at the junction of outer and middle ear. R is true.

Q8. Assertion (A): Time period and frequency are inversely proportional.

Reason (R): T = 1/f, so as frequency increases, time period decreases.

Answer: (A) Both true; R is the direct mathematical explanation of A.

Q9. Assertion (A): Ultrasound can be used to break kidney stones.

Reason (R): High-intensity ultrasound waves cause the stone to vibrate intensely until it fragments.

Answer: (A) Both true; R correctly explains the mechanism of lithotripsy using ultrasound.

Q10. Assertion (A): Infrasound is produced by earthquakes.

Reason (R): Infrasound consists of frequencies above 20,000 Hz.

Answer: (C) A is true (earthquakes produce infrasound). R is false — infrasound is BELOW 20 Hz.

■ Case-Based Questions

Case Study 1 — The Science Lab

Riya and her classmates are in the science lab. Their teacher strikes a tuning fork and holds it near a bowl of water — the surface ripples. The teacher then places the fork inside a vacuum jar; sound becomes inaudible even though the fork visibly vibrates. Finally, the teacher touches the vibrating fork stem to the wooden desk, and students nearby clearly hear the tone.

Q1. Why did water ripple when the fork was near it?

■ The vibrating fork disturbs surrounding air particles, which in turn disturb the water surface, creating ripples — demonstrating that sound is produced by vibration.

Q2. Why did sound disappear in the vacuum jar?

■ Sound is a mechanical wave needing a medium. Vacuum has no particles to carry vibrations, so no sound reaches the listener — proving sound cannot travel through vacuum.

Q3. Why was sound heard through the desk?

■ Solids are excellent conductors of sound. Vibrations transfer efficiently through the dense, tightly-bonded wood particles, reaching students' ears more clearly than through air.

Case Study 2 — Construction Site Noise

Mr Sharma lives near a construction site that operates heavy machinery 24 hours a day. He has been suffering from sleeplessness, irritability, and frequent headaches. The noise level outside his window was measured at 92 dB. The municipal council banned construction between 10 PM and 6 AM and required noise-dampening enclosures on all machines.

Q1. What type of pollution is Mr Sharma experiencing?

■ Noise pollution — excessive and unwanted sound at 92 dB, well above the 80 dB harm threshold.

Q2. List two harmful health effects shown in the passage.

■ 1) Sleep deprivation (sleeplessness and irritability). 2) Stress-related symptoms (headaches and potential hypertension).

Q3. How do the council's measures help?

■ Night ban prevents sleep disruption during rest hours. Dampening enclosures reduce the amplitude of sound waves, directly lowering dB levels experienced by residents.

Case Study 3 — Medical Ultrasound

Dr Meera uses an ultrasound machine to examine a patient. The machine emits sound waves above 20,000 Hz into the body. These reflect off internal organs and the echoes are converted into images on a screen. The same technology at higher intensity is used to break kidney stones non-surgically. Ships also use a similar technique called SONAR to detect underwater objects and measure ocean depth.

Q1. Why use ultrasound instead of audible sound for imaging?

■ Ultrasound's short wavelengths reflect cleanly off internal structures, producing detailed images. Audible sound's longer wavelengths cannot resolve fine internal details.

Q2. Which wave property enables imaging? Explain.

■ Reflection (echo): ultrasound waves bounce off organ boundaries. The time and intensity of returning echoes are processed to construct a cross-sectional image.

Q3. Explain how kidney stones are broken using ultrasound.

■ High-intensity ultrasound focuses vibrations precisely on the stone. The intense, rapid compressions cause the stone to crack into tiny fragments, which the body passes naturally — no surgery needed.

■ Last-Minute Revision Checklist

■ Sound is produced by vibrating objects.

■ Sound needs a medium — cannot travel through vacuum.

■ Speed: Solids > Liquids > Gases.

■ Frequency → Pitch | Amplitude → Loudness.

■ Human hearing range: 20 Hz – 20,000 Hz.

■ Infrasound < 20 Hz | Ultrasound > 20,000 Hz.

■ Ear: Pinna → Canal → Eardrum → Ossicles → Cochlea → Auditory Nerve → Brain.

■ Loudness ∝ Amplitude² | Unit: dB | > 80 dB harmful.

■ Ultrasound: SONAR · Ultrasonography · Breaking kidney stones.

■ Noise pollution: traffic, machines, crackers → sleeplessness, hypertension.

■ T = 1/f (time period and frequency are reciprocals).

■ True/False: Bats use ULTRASOUND, not infrasound.

■ Eardrum is at junction of OUTER & MIDDLE ear (not inner).

■ All the best for your exams! Stay consistent, stay confident.
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