

How sound travels and how we hear it

Grade 6 science (Year 7 · Class 6) · Worksheet answers

Each answer names the idea involved, shows the formula and substitution, and gives the final result with its unit in bold. When you explain, link every statement to vibrations, particles or frequency.

Level: Grade 6 science (Year 7 · Class 6) · **Curriculum:** MS-PS4-1

Problem 1 What vibrates?

1. The **string**.
2. The **drum skin**.
3. The **vocal cords**.
4. The **cone** of the loudspeaker.

Problem 2 Can sound travel?

Yes through air, water and a steel wall; **no** through empty space, because a vacuum has no particles to pass on the vibrations.

Problem 3 Units of sound

1. The **decibel, dB**.
2. The **hertz, Hz**.
3. $2 \times 1000 = \mathbf{2000 \text{ Hz}}$.

Problem 4 Loudness or pitch?

1. **Loudness** (bigger vibration).
2. **Pitch** (higher).
3. **Pitch** (higher, because a shorter string vibrates faster).

Problem 5 Comparing three traces

1. **B**, because its waves are the tallest.
2. **C**, because it has the most waves in the same time.
3. **A and B**, which have the same number of waves.

Problem 6 Ear safety

1. Wear **ear defenders** and take breaks away from the noise (or use a quieter machine).
2. Very loud sound can damage the delicate parts of the inner ear and cause permanent

hearing loss.

Problem 7 Thunder and lightning

1. $d = 340 \times 4 = \mathbf{1360 \text{ m}}$.
2. $1360 \div 1000 = \mathbf{1.36 \text{ km}}$.

Problem 8 Speed in three media

1. Air: $1500 \div 340 = \mathbf{4.4 \text{ s}}$. Water: $1500 \div 1500 = \mathbf{1.0 \text{ s}}$. Steel: $1500 \div 5000 = \mathbf{0.30 \text{ s}}$.
2. **Steel**, because its particles are closest together, so vibrations pass quickly.

Problem 9 An echo

1. $85 \times 2 = \mathbf{170 \text{ m}}$.
2. $t = 170 \div 340 = \mathbf{0.5 \text{ s}}$.

Problem 10 Bell in a jar

1. The bell becomes **quieter** and finally cannot be heard.
2. Sound needs particles to pass on the vibrations, and with fewer particles there is less to carry the sound.
3. Space is almost a vacuum, so sound cannot travel; radio waves can.

Problem 11 Frequency

1. $5120 \div 20 = \mathbf{256 \text{ Hz}}$.
2. $1650 \div 3 = \mathbf{550 \text{ Hz}}$.

Problem 12 Ranking pitches

1. **Bass drum, man speaking, flute, bat squeak**.
2. The **bat squeak**, because 50 000 Hz is above 20 000 Hz.

Problem 13 Noise levels

1. **Whisper, conversation and busy road** (all below 85 dB).
2. **Live concert and jet engine**.
3. Wear earplugs and stay away from the loudspeakers.

Problem 14 Spot the error

1. Pitch and loudness are different: pitch depends on frequency, loudness on the size of the vibration.
2. A **quiet whistle** has a high pitch but is not loud, and a **large drum** can be loud with a

low pitch.

Problem 15 Hitting a drum

1. A harder hit makes the drum skin vibrate with a **larger size**, so the sound carries more energy.
2. The skin still vibrates at the same number of vibrations each second, so the frequency and pitch stay the same.

Problem 16 Frequency from a trace

1. There are **4 waves**.
2. $20 \text{ ms} = \mathbf{0.020 \text{ s}}$.
3. $f = 4 \div 0.020 = \mathbf{200 \text{ Hz}}$.
4. It would show **8 waves** in the same 20 ms (a frequency of 400 Hz).

Problem 17 A moving storm

1. $340 \times 7.5 = 2550 \text{ m}$ and $340 \times 4.5 = 1530 \text{ m}$.
2. $2550 - 1530 = \mathbf{1020 \text{ m}}$ closer.
3. $1020 \div 60 = \mathbf{17 \text{ m/s}}$; $17 \times 3.6 = \mathbf{61.2 \text{ km/h}}$.

Problem 18 Sonar on a fishing boat

1. $d = 1500 \times 0.40 \div 2 = \mathbf{300 \text{ m}}$.
2. $d = 1500 \times 0.12 \div 2 = \mathbf{90 \text{ m}}$.
3. $300 - 90 = \mathbf{210 \text{ m}}$.

Problem 19 Noise in a factory

1. $95 - 25 = \mathbf{70 \text{ dB}}$.
2. It is **safe**, because 70 dB is below 85 dB.
3. Use quieter machines or sound-absorbing walls, and give workers breaks in a quiet room.

Problem 20 Planning an investigation

1. Change the **length of the vibrating rubber band**; measure the **pitch (frequency)**, for example with a phone frequency app.
2. Keep the same rubber band (thickness and tension) and the same force of plucking.
3. A shorter rubber band gives a higher pitch, because it vibrates faster.
4. Do not stretch a band so far that it can snap towards the eyes; wear safety glasses.