

Waves, Sound and Light

Comparing sound and light, describing waves, reflection, refraction, colour and echoes.

Name _____ Date _____ Class _____

Learning objective: I can compare sound and light waves and use wave ideas to explain everyday effects.

✓ I can compare sound and light ✓ I can describe amplitude and frequency ✓ I can calculate echo distances

1 Sound and light Complete the table.

	Sound	Light
Can it travel through a vacuum?		
Speed in air (approximately)	340 m/s	
Type of wave		
Detected by		

2 Describing waves Use the word bank.

Word bank: frequency 20 000 wavelength energy ultrasound amplitude

- Waves transfer _____ without transferring matter.
- A larger _____ means a louder sound.
- A higher _____ means a higher-pitched sound. It is measured in hertz (Hz).
- Humans can usually hear sounds from about 20 Hz to _____ Hz.
- Sound above the range of human hearing is called _____.

3 Light quiz Circle the correct answer.

- When light reflects, the angle of incidence is...
 (A) equal to the angle of reflection (B) always 90° (C) smaller than the angle of reflection
- Light bends when it passes from air into glass. This is called...
 (A) reflection (B) refraction (C) absorption
- A red filter...
 (A) lets only red light through (B) turns light red by adding red (C) absorbs red light

Waves, Sound and Light

Echoes: sound travels to the wall and back, so distance to the wall = speed $\times$ time $\div$ 2. Use speed of sound in air = 340 m/s.

4 Echo calculations Show your working.

1 An echo is heard 1 s after a shout. How far away is the cliff?

Answer

2 An echo is heard 4 s after a shout. How far away is the cliff?

Answer

3 Thunder is heard 3 s after lightning is seen. Roughly how far away is the storm?

Answer

5 Angles of reflection Light hits a plane mirror. Find the angle of reflection.

1 incidence 30°

2 incidence 45°

3 incidence 62°

6 Explain it

1 Why do you see lightning before you hear thunder? [2 marks]

2 Explain why there is no sound in space. [2 marks]

3 A blue T-shirt is seen in white light and then in red light. Explain what colour it looks in red light. [2 marks]

Answer Key

Waves, Sound and Light

Question	Answers
1 Sound and light	Can it travel through a vacuum? – Sound: no , Light: yes Speed in air (approximately) – Light: 300 000 000 m/s (300 000 km/s) Type of wave – Sound: longitudinal , Light: transverse Detected by – Sound: the ear , Light: the eye (retina)
2 Describing waves	1 energy; 2 amplitude; 3 frequency; 4 20 000; 5 ultrasound
3 Light quiz	1 A (equal to the angle of reflection); 2 B (refraction); 3 A (lets only red light through)
4 Echo calculations	1 $340 \times 1 \div 2 = 170 \text{ m}$; 2 $340 \times 4 \div 2 = 680 \text{ m}$; 3 $340 \times 3 = 1020 \text{ m}$ (about 1 km)
5 Angles of reflection	1 30° ; 2 45° ; 3 62°
6 Explain it	1. Light travels much faster than sound (about 300 000 km/s compared with 340 m/s), so the light reaches you first. 2. Sound needs a medium (particles) to travel through; space is a vacuum with almost no particles to vibrate. 3. Black – the blue dye absorbs red light and there is no blue light to reflect.

Teaching note: the speed of sound in air varies with temperature; 340 m/s is used throughout. Angles are measured from the normal.