

Exercise walk-through

6.2

Reflection, sound and waves for detection – physics only (4.6.1.3–4.6.1.5)

AQA · GCSE · Physics

Exercises 2.1·2.3

2.1 Draw the reflected ray for a ray hitting a plane mirror at 35° to the normal. State the reflection angle. [1]

2.2 State the frequency range of human hearing. [1]

2.3 Explain why an ultrasound scan is safer than an X-ray scan. [2]

3 Exam-style questions

Exercises 2.1·2.3

2.1 Draw the reflected ray for a ray hitting a plane mirror at 35° to the normal. State the reflection angle. [1]

2.1 35° – the angle of reflection equals the angle of incidence.

2.2 State the frequency range of human hearing. [1]

2.2 20 Hz to 20 kHz.

2.3 Explain why an ultrasound scan is safer than an X-ray scan. [2]

3 Exam-style questions

2.3 Ultrasound is non-ionising; X-rays ionise and can mutate genes, so ultrasound avoids that risk – it is why it is used for prenatal scans.

Exercise 3.1

3.1 A student investigates reflection with a ray box and a plane mirror.

- (a) Describe how they measure the angle of incidence. [2]
- (b) Give one source of error and one improvement. [2]
- (c) The mirror is replaced by rough paper. Describe what happens to the reflected light and name the effect. [2]

Exercise 3.1

3.1 A student investigates reflection with a ray box and a plane mirror.

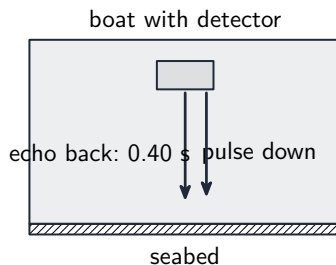
- (a) Describe how they measure the angle of incidence. [2]
- (b) Give one source of error and one improvement. [2]
- (c) The mirror is replaced by rough paper. Describe what happens to the reflected light and name the effect. [2]

3.1 (a) Draw the normal at 90° to the mirror at the point of incidence; measure the angle between the incident ray and the normal with a protractor. (b) Error: ray line too thick / mirror frame offset; improvement: use a thinner beam, mark ray points with crosses and join after, or repeat and average. (c) The light scatters in many directions; diffuse reflection.

Exercise 3.2

3.2 Ultrasound is used to find the depth of a seabed. The pulse returns in 0.40 s; the speed in water is 1500 m/s.

- (a) Explain why the distance is halved before reporting the depth. [1]
- (b) Calculate the depth. [3]
- (c) Explain why ultrasound reaches the seabed but a light beam does not. [1]



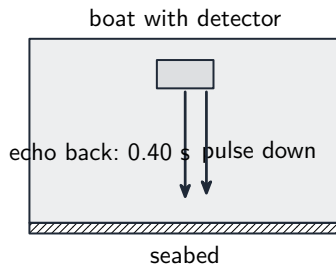
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3.2 (a) The pulse travels down and back – the time covers both legs. (b)

$$d = \frac{vt}{2} = \frac{1500 \times 0.40}{2} = \mathbf{300 \text{ m}}$$

(C1, C1, A1) (c) Water absorbs and scatters light quickly, while ultrasound (sound) travels far in water.

Exercise 3.3

3.3 After an earthquake, a detection station records P-waves but no S-waves from a region.

- (a) State the wave types of P-waves and S-waves. [2]
- (b) Explain what the missing S-waves show about the material the waves passed through. [2]
- (c) Explain how the difference in arrival time helps locate the earthquake. [2]

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3.3 (a) P-waves are longitudinal; S-waves are transverse. (b) S-waves cannot travel through liquid; the region they crossed must contain a liquid layer – the outer core. (c) P-waves travel faster and arrive first; the time gap grows with distance from the quake, so comparing gaps at several stations triangulates the source.