Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

STEM | Exam Builder

Properties of waves

Time allowed: 1 hour 10 minutes

Subject code **0625**

Physics

Questions from Paper 3 and Paper 4

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.

Total marks

/ 71

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.

Information

- This paper has 10 questions worth 71 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

Advice

- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

STEM | Exam Builder

Print at 100% (Actual size) so diagrams keep their real measurements.

1 Fig. 4.1 represents a wave on the surface of water.

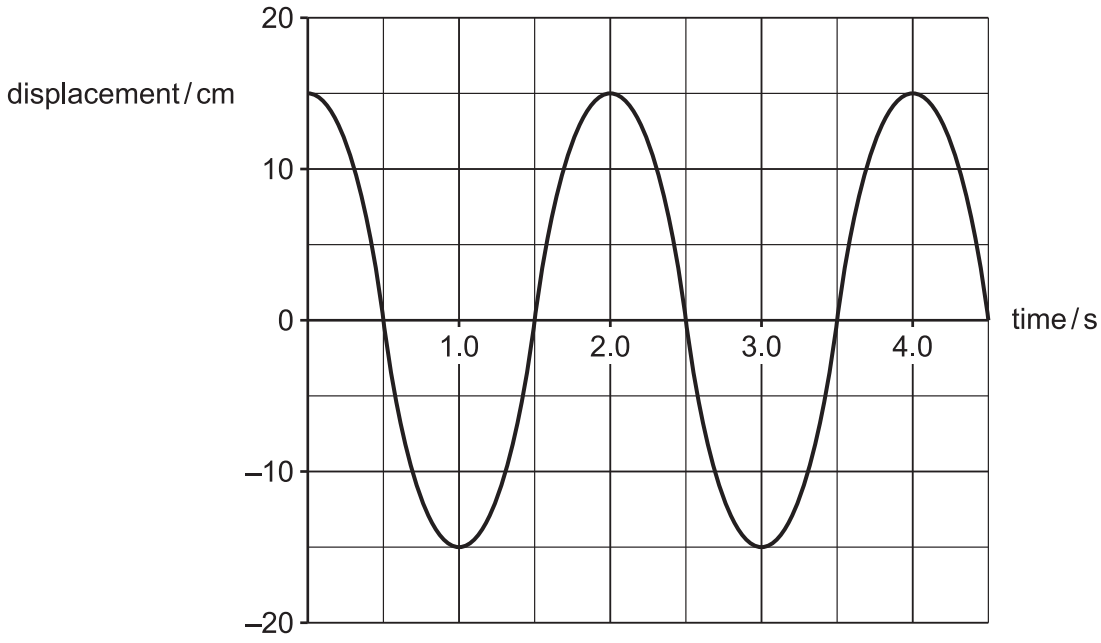


Fig. 4.1

(a) (i) Determine the amplitude of the wave in Fig. 4.1.

amplitude = ... cm [1]

(ii) Determine the frequency of the wave in Fig. 4.1.

frequency = ... Hz [2]

STEM | Exam Builder

(b) Fig. 4.2 shows wavefronts passing through a small gap in a barrier.
The arrows on the diagram show the directions of propagation of the wavefronts.

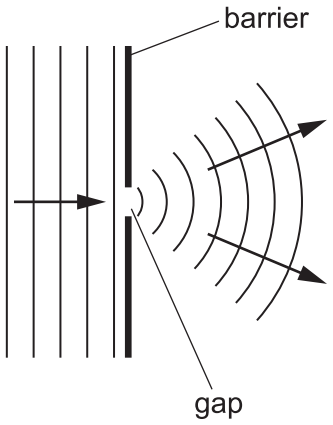


Fig. 4.2

State the name of the wave property shown in Fig. 4.2.

..... [1]

(c) Fig. 4.3 shows wavefronts changing direction as they pass from shallow water to deep water.
The arrows on the diagram show the directions of propagation of the wavefronts.

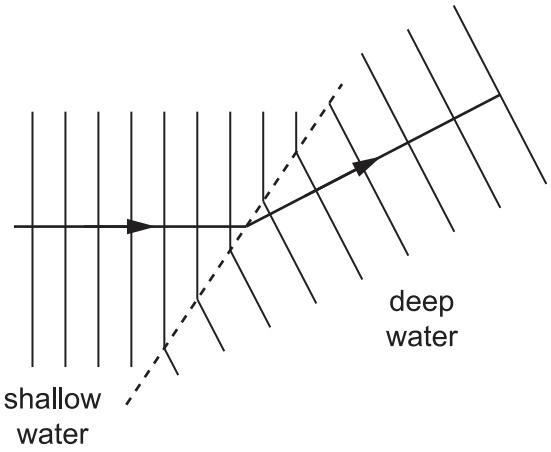


Fig. 4.3

(i) State the name of the wave property shown in Fig. 4.3.

..... [1]

(ii) State **one** property of the water wave, other than direction, that changes as it moves from shallow water to deep water.

..... [1]

[Total: 6]

STEM | Exam Builder

Properties of waves Click for more variations

1(a)(i)	(amplitude =) 15 (cm)	**B1**
1(a)(ii)	(frequency =) 0.5 (Hz)	**A2**
	(frequency =) number of waves sent out / emitted in one second OR 1 wave in 2.0 (s) OR frequency = 1 ÷ 2(0)	(C1)
1(b)	diffraction	**B1**
1(c)(i)	refraction	**B1**
1(c)(ii)	(change of) wavelength OR (wave) speed OR velocity	**B1**

STEM | Exam Builder

2 A teacher uses a ripple tank to demonstrate the properties of waves.

(a) When a wave travels on the surface of the water in the ripple tank, the water particles vibrate at right angles to the direction of travel of the wave.
State the term for a wave in which particles vibrate at right angles to the direction of travel.

..... [1]

(b) The teacher demonstrates waves moving from deep water into shallow water.
Fig. 6.1 shows the crests of the waves, viewed from above. The arrows show the direction of wave travel.

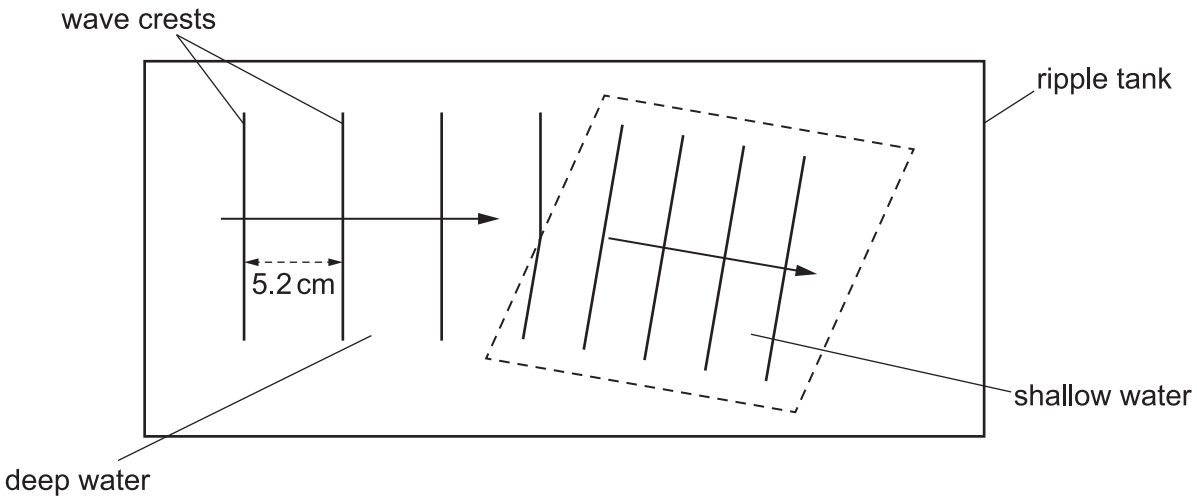


Fig. 6.1

(i) Complete the sentence about the wave property shown in Fig. 6.1.

The change of direction of the wave is called ..... . [1]

(ii) Fig. 6.1 shows that the direction of the wave changes as the wave enters the shallow water.
State why the wave changes direction.

..... [1]

(iii) The speed of the wave in the deep water is 35 cm / s.
Determine the frequency of the wave. Use the information in Fig. 6.1.

frequency = ...Hz [3]

[Total: 6]

STEM | Exam Builder

Properties of waves Click for more variations

Reduced to 78% to fit the page (wider than A4).

2(a)	transverse	**B1**
2(b)(i)	refraction	**B1**
2(b)(ii)	speed (of wave) changes	**B1**
2(b)(iii)	6.7 (Hz)	**A3**
	35 ÷ 5.2	(C2)
	$v = f \times \lambda$ OR (frequency =) (wave) speed ÷ wavelength	(C1)

STEM | Exam Builder

3 **(a)** The direction of vibration in a type of wave is parallel to the direction in which the wave is moving.
State the name of this type of wave.

type of wave ..... [1]

(b) Fig. 7.1 represents a ripple tank showing diffraction. The ripple tank is viewed from above. The wavefronts move from left to right until they reach a barrier. They are diffracted at a gap in the barrier.

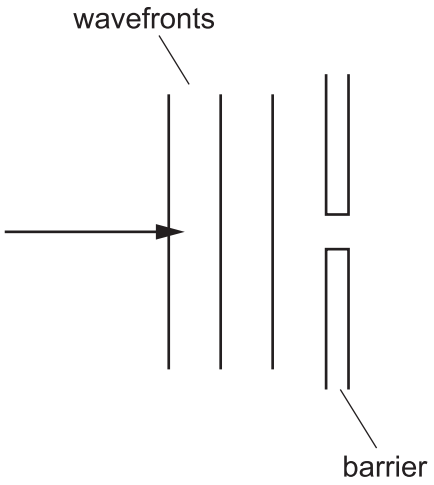


Fig. 7.1

On Fig. 7.1:

(i) draw **three** wavefronts to the right of the barrier [2]

(ii) indicate and label **one** wavelength. [1]

(c) The wavelength of the wave is 4.6 cm.
The speed of the wave is 38 cm / s.
Determine the frequency of the wave.

frequency = ...Hz [3]

[Total: 7]

Properties of waves Click for more variations

STEM | Exam Builder

3(a)	longitudinal	**B1**
3(b)(i)	(at least) 3 semi-circular wavefronts after gap showing diffraction	**B1**
	wavefronts with same wavelength as before gap	**B1**
3(b)(ii)	one wavelength drawn on diagram	**B1**
3(c)	8.3 (Hz)	**A3**
	38 ÷ 4.6	(C2)
	$v = f \times \lambda$ OR (frequency =) speed ÷ wavelength OR (f =) $v \div \lambda$	(C1)

STEM | Exam Builder

4 A teacher demonstrates the behaviour of waves by using water waves in a ripple tank.

Fig. 5.1 shows a cross-section through part of the water waves.

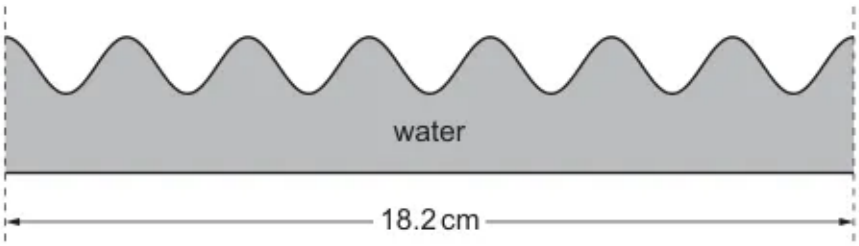


Fig. 5.1 (not to scale)

(a) Calculate the wavelength of the water waves. Use the information in Fig. 5.1.

wavelength = ... cm [2]

(b) The teacher places a pointer above the water waves as shown in Fig. 5.2.

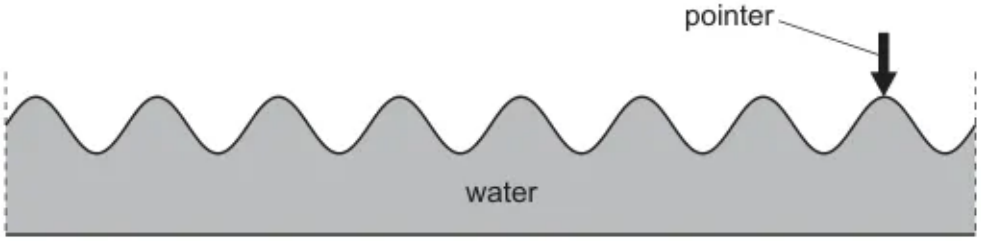


Fig. 5.2 (not to scale)

Three students use stop-watches to measure the time taken for 50 peaks to pass the pointer. Fig. 5.3 shows the measurements.



time = ... s time = ... s time = ... s

Fig. 5.3

(i) On the line below each stop-watch, state the time measurement, in seconds. [1]

(ii) Calculate the average of the three time measurements in **(b)(i)**.

average time = ... s [2]

(iii) Calculate the frequency of the water waves using your result in **(b)(ii)**.

frequency = ... Hz [2]

(c) The teacher repeats the demonstration using a different ripple tank and obtains these results for the waves.

wavelength = 0.025 m
frequency = 2.4 Hz

Calculate the speed of the wave.

speed of wave = ... m/s [3]

[Total: 10]

Properties of waves Click for more variations

Reduced to 77% to fit the page (wider than A4).

4(a)	18.2 ÷ 7	**C1**
	2.6 (cm)	**A1**
4(b)(i)	17.24 **AND** 17.14 **AND** 17.16 (s)	**B1**
4(b)(ii)	(17.24 + 17.14 + 17.16) ÷ 3 **OR** 51.54 ÷ 3	**C1**
	17.18 (s)	**A1**
4(b)(iii)	50 ÷ 17.18	**C1**
	2.9 (Hz)	**A1**
4(c)	(speed =) frequency × wavelength in any form	**C1**
	2.4 × 0.025	**C1**
	0.06(0) (m/s)	**A1**

STEM | Exam Builder

5 **(a)** Fig. 5.1 shows a wave on the sea approaching a harbour.

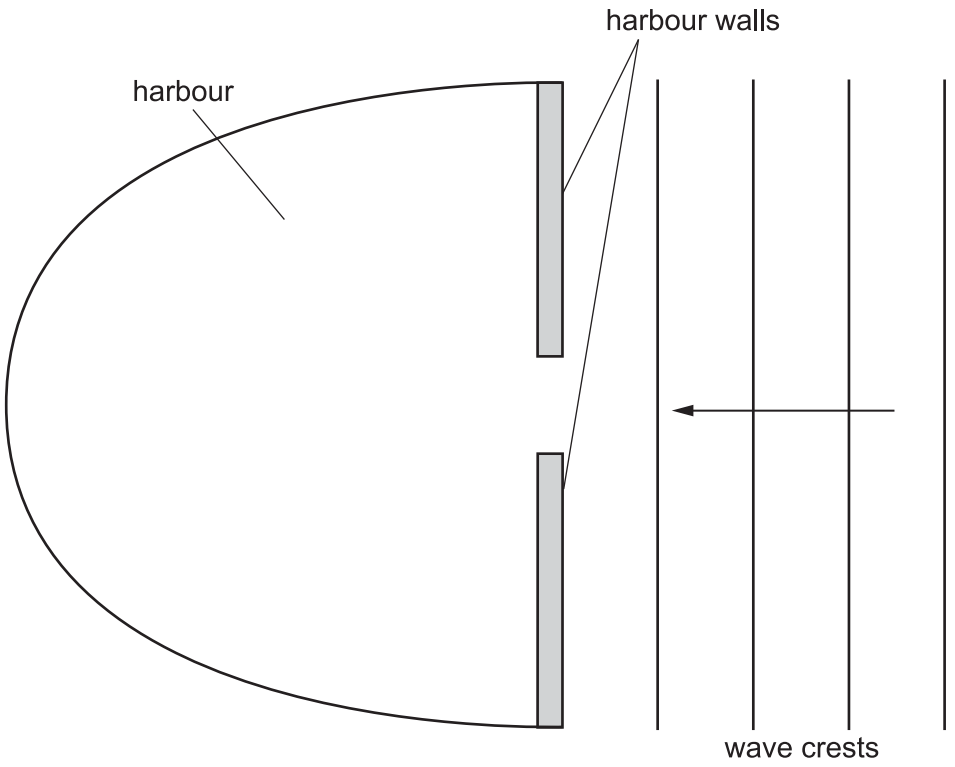


Fig. 5.1

(i) On Fig. 5.1, draw **three** wave crests in the harbour. [2]

(ii) Another harbour has a much wider gap between its walls.

Describe and explain how the pattern of wave crests in this harbour is different from the pattern you have drawn in **(i)**.

description .....

.....

explanation .....

..... [2]

STEM | Exam Builder

(b) A sound wave of frequency 850 Hz travels through sea water. The speed of sound in sea water is 1500 m / s.

Calculate the wavelength of this sound wave in sea water.

wavelength = ... [2]

[Total: 6]

Properties of waves Click for more variations

Reduced to 77% to fit the page (wider than A4).

5(a)(i)	part of a circle, at least quarter of a circle, centred on centre of gap	**B1**
	waves same wavelength as incident waves	**B1**
5(a)(ii)	waves pass through gap remaining straight	**B1**
	less / no diffraction occurs	**B1**
5(b)	1.8 m	**A2**
	$\lambda = v/f$ OR 1500/850 in any form	**C1**

STEM | Exam Builder

6 **(a)** State the name of the reflection of a sound wave or ultrasound wave.

..... [1]

(b) Fig. 5.1 shows an ultrasound wave being used to scan an internal organ of a human body.

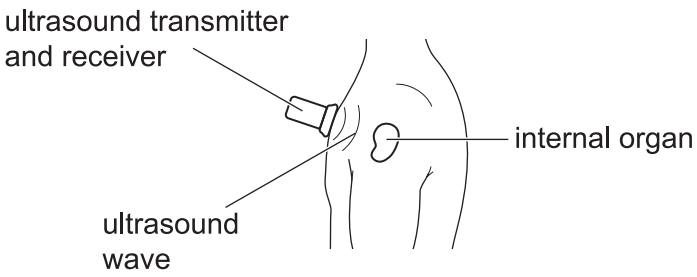


Fig. 5.1

The ultrasound wave has a frequency of 2.0 MHz and passes through human tissue at a speed of 1500 m/s.
Calculate the wavelength of the ultrasound wave in human tissue.

wavelength = ... [3]

(c) Fig. 5.2 shows crests of a wave from a point source S approaching a straight barrier.

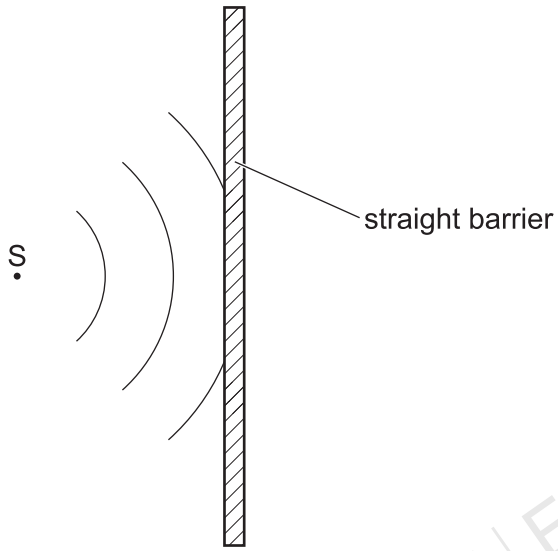


Fig. 5.2

GTEM | Exam Builder

(i) On Fig. 5.2, indicate and label **one** wavelength.

(ii) On Fig. 5.2, draw **three** crests of the wave reflected from the barrier.

[3]

[Total: 7]

Properties of waves Click for more variations

6(a)	echo	**B1**
6(b)	(λ=) 7.5×10^{-4} m	**A3**
	(λ=) v / f OR $v = f\lambda$ in any form	C1
	(λ=) 1.5×10^{3} / 2×10^{6}	C1
6(c)(i),(ii)	labelled wavelength of incident wave	**B1**
	3 part circles to the left of the barrier and centred to right of the barrier	**B1**
	wavelengths of reflected and incident waves same	**B1**

STEM | Exam Builder

7 A water wave in a tank travels from a region where the speed of the wave is faster into a region where it is slower.

Fig. 6.1 is a one-quarter scale diagram that shows the wavefronts in the region where the speed is faster.

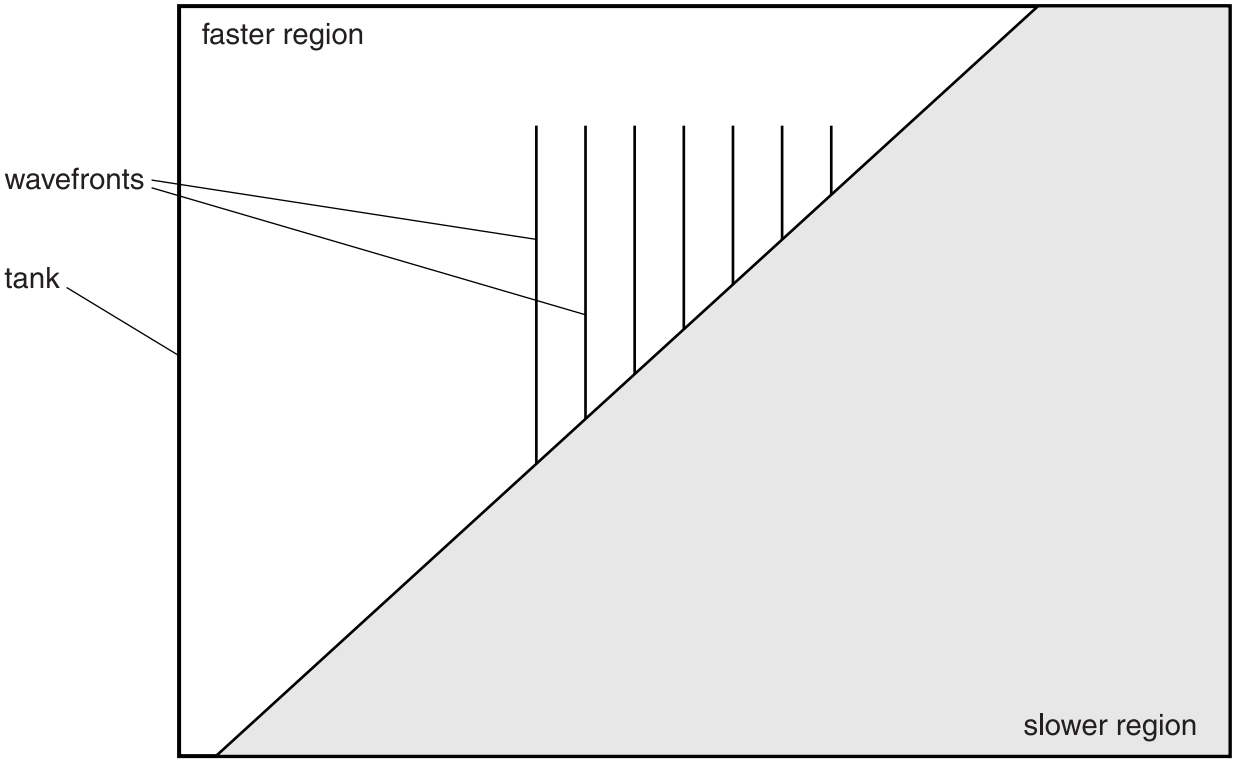


Fig. 6.1 (scale: 1.0 cm represents 4.0 cm)

(a) (i) Take measurements from the scale diagram in Fig. 6.1 to determine the wavelength of the water wave as it travels in the faster region.

wavelength = ... [2]

(ii) The speed of the wave in the faster region is 0.39 m/s.

Calculate the frequency of the wave.

STEM | Exam Builder

frequency = ... [2]

(b) On Fig. 6.1, draw lines that indicate the positions of the wavefronts of the water wave in the slower region. [2]

(c) State what happens to the frequency of the water wave as it passes into the slower region.

.....

..... [1]

[Total: 7]

Properties of waves Click for more variations

7 **(a)** **(i)** any value between 6 and 7 mm seen C1

26 ± 2 mm OR 2.6 ± 0.2 cm A1

(ii) $v = f\lambda$ in any form OR $(f =) v \div \lambda$ OR $0.39 \div 0.026$ C1
= 15 Hz ecf **(i)** A1

(b) at least 4 wavefronts showing refraction in correct direction B1
7 parallel wavefront lines continuous with those in fast region B1

(c) unchanged / nothing B1

[Total: 7]

STEM | Exam Builder

8 **(a)** Fig. 5.1 is a scale diagram of wavefronts of red light approaching a gap in a barrier.

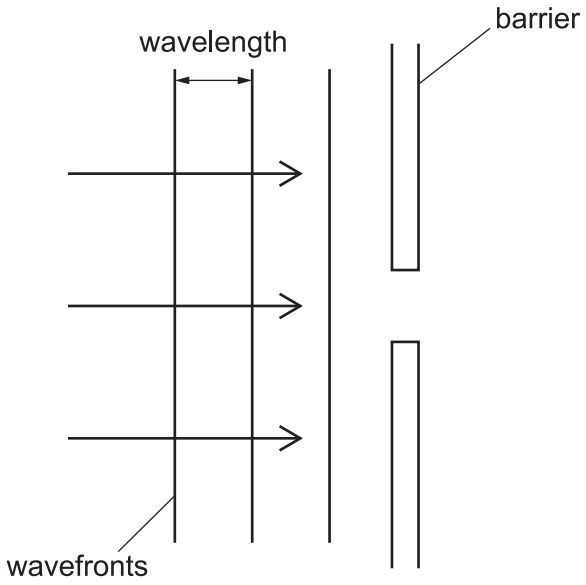


Fig. 5.1

On Fig. 5.1, draw **three** wavefronts after the wave has passed through the gap. [3]

(b) Fig. 5.2 shows the same barrier and gap. A wave of blue light approaches this barrier.

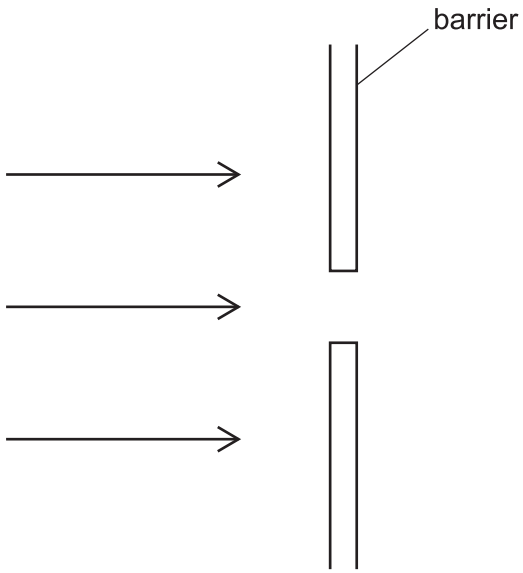


Fig. 5.2

On Fig. 5.2:

- draw **three** wavefronts of this wave before it reaches the barrier
- draw **three** wavefronts after the wave passes through the gap.

[3]

[Total: 6]

Properties of waves Click for more variations

STEM | Exam Builder

8(a)	3 wavecrests same wavelength as original	**B1**
	3 arcs	**B1**
	3 semi-circular wavecrests centred on middle of gap	**B1**
8(b)	3 parallel wavecrests on left, reduced wavelength	**B1**
	angular spread must be less / reduced divergence	**B1**
	3 wavecrests on right with reduced curvature compared with **(a)** no reverse curvature anywhere	**B1**

9 Fig. 6.1 shows wave crests and the direction of travel for a water wave approaching a barrier in a large ripple tank.

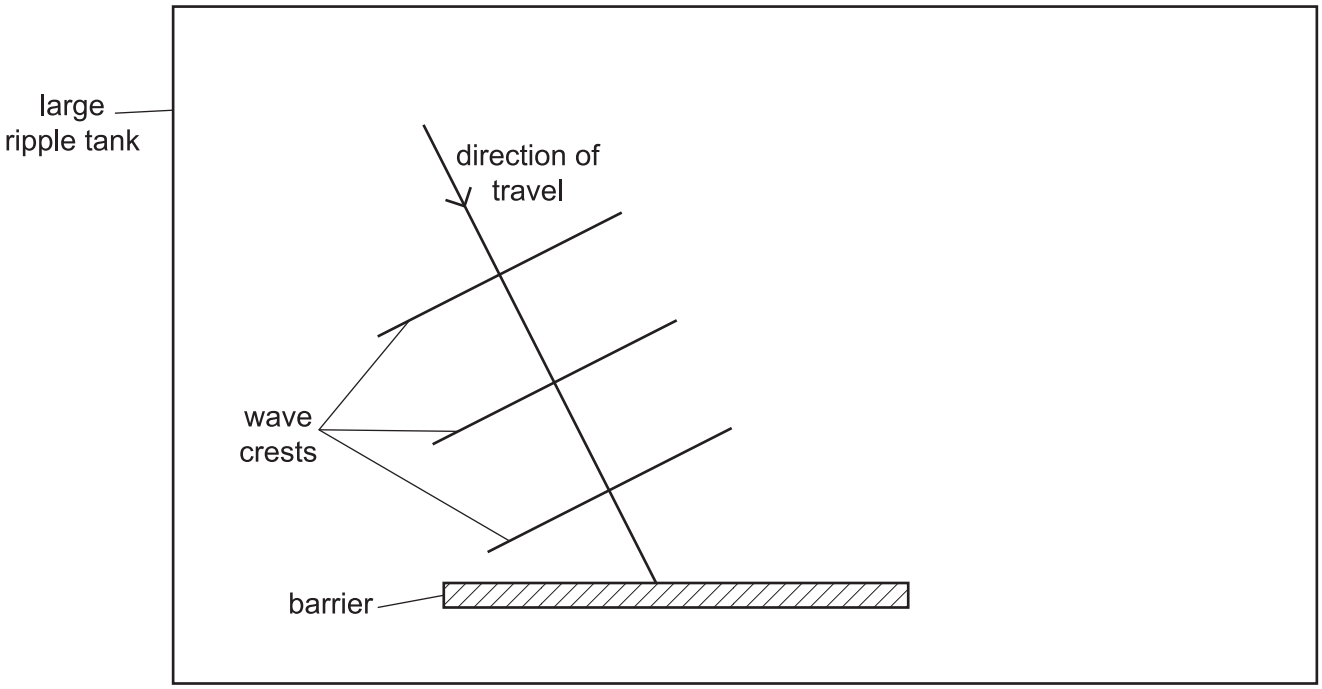


Fig. 6.1

The wavelength of the wave is 1.6 cm.

(a) On Fig. 6.1, draw:

(i) the direction of travel of the reflected wave [1]

(ii) **three** successive reflected wave crests. [2]

STEM | Exam Builder

(b) Fig. 6.2 shows an identical wave approaching a barrier with a gap of 1.3 cm.

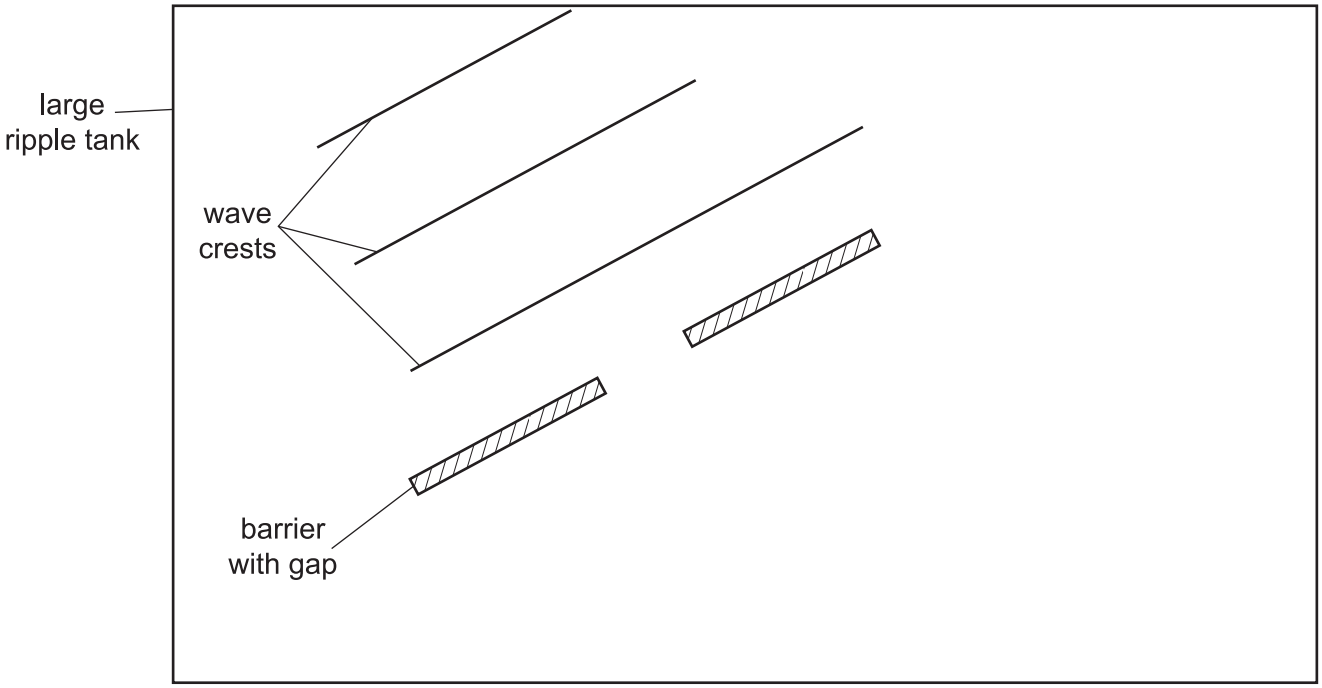


Fig. 6.2

On Fig. 6.2, draw **three** successive wave crests after they pass through the gap in the barrier. [3]

(c) The frequency of the wave is 4.0 Hz.

Calculate the speed of the wave.

speed = ... [2]

[Total: 8]

Properties of waves Click for more variations

Reduced to 77% to fit the page (wider than A4).

9(a)(i)	correct direction, with angle made with surface correct	**B1**
9(a)(ii)	three wavefronts perpendicular to their answer to **(a)(i)**	**B1**
	wavelength 1.6 cm / same as incident wave	**B1**
9(b)	at least two correct arcs (after the gap in the barrier)	**B1**
	three circular arcs (after the gap on the barrier) centred on gap	**B1**
	wavelength same as wavelength of incident wavefronts	**B1**
9(c)	6.4 cm / s **OR** 0.064 m / s	**A2**
	$v = f\lambda$ **OR** ($v =$) $f\lambda$ **OR** 4.0 × 1.6 **OR** 4.0 × 0.016	C1

STEM | Exam Builder

10 **(a)** Describe how a longitudinal wave differs from a transverse wave.

.....

.....

..... [2]

(b) Fig. 5.1 represents a seismic wave produced by an earthquake.

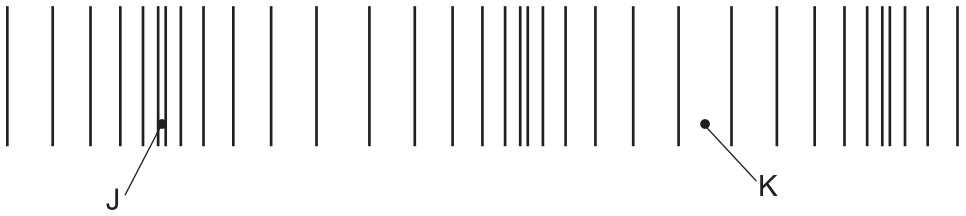


Fig. 5.1

(i) State whether this seismic wave is a P-wave (primary) or an S-wave (secondary). Justify your choice.

.....

..... [1]

(ii) The wave represented in Fig. 5.1 has a wavelength of 1.2×10^4 m.

Calculate the actual distance between point J and point K.

distance = ... [2]

(iii) The wave in **(ii)** travels through the ground at a speed of 4600 m / s.

As the wave passes a certain point, the ground completes 5 oscillations.

Calculate the time that it takes for the wave to pass. Show your working.

STEM | Exam Builder

time = ... [3]

[Total: 8]

Properties of waves Click for more variations

10(a)	any **two** from: • (**l**ongitudina**l**) vibration / oscil**l**ation in wave para**ll**e**l** to propagation direction / direction of trave**l** • transverse wave vibrates / oscil**l**ates perpendicu**l**ar to propagation direction / direction of trave**l** • (**l**ongitudina**l**) consists of compressions and rarefactions • transverse wave consists of crests / peaks and troughs • (**l**ongitudina**l**) needs a medium (to trave**l**)	**B2**
10(b)(i)	P-wave **AND** it is **l**ongitudina**l**	**B1**
10(b)(ii)	1.8×10^4 m **OR** 18 km	**A2**
	1.5λ **OR** $1.5 \times 1.2 \times 10^4$ **OR** 1.8×10^N	C1
10(b)(iii)	$v = f\lambda$ **OR** $v = \lambda / t$ **OR** ($t =$) λ / v **OR** $f = 4600 / 1.2 \times 10^4$ **OR** ($t / 5 =$) $1.2 \times 10^4 / 4600$ **OR** ($t =$) $6(.0) \times 10^4 / 4600$	**M1**
	13 s	**A2**
	$t = 1 / f$ **OR** (time for one wave =) 2.6 (s)	C1

STEM | Exam Builder