



*Note: Show all formulae & working steps!*

1(a)

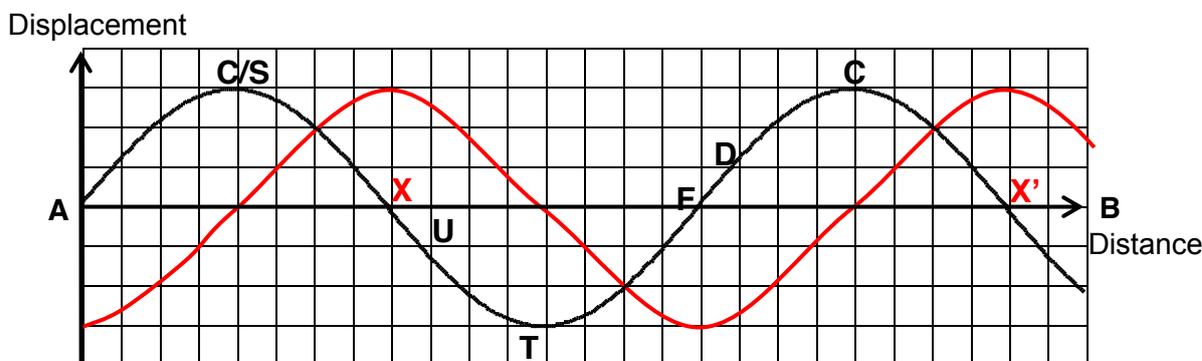


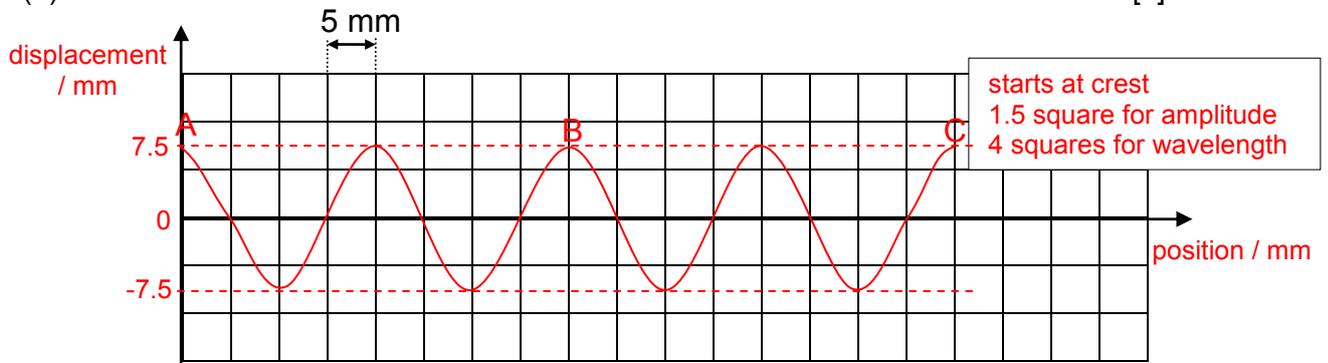
Fig. 1

- (i) the crest **C** and the trough **T**. [1]
- (ii) 1.5 cm [1]
- (iii) 8.0 cm [1]
- (iv) points **X** and **X'** along **AB** that are in phase with each other. [1]  
(**XX'** are one wavelength apart)
- (v) **D** a particle which is on its way down. [1]
- (vi) **U** a particle which is on its way up. [1]
- (vii) **S** a particle which is momentarily at rest. [1]
- (viii) **F** a particle which is travelling fastest. [1]
- (b)
- (i) 1.60 s [1]
- (ii) 0.625 Hz [1]
- (c) Fill in the blanks with reference to parts (a) and (b). max. [3]  
In 1 s, 0.625 waves are formed.  
The length of one wave is 8.0 cm. (wavelength  $\lambda = 8.0 \text{ cm}$ )  
Therefore, the length travelled in 1 s is 5.0 cm.  
The speed of the wave is 5.0 cm/s.
- (d) see Fig. 1 above [2]  
Distance travelled by wave to the right =  $v \times t = 5.0 \times 0.40 = 2.0 \text{ cm}$

2

- (a)  
 (i) the wavelength = 2.00 cm [1]  
 (ii) the wave speed  $v = 4.0 \times 2.00 = \underline{8.0 \text{ cm/s}}$  [1]

(b) [2]



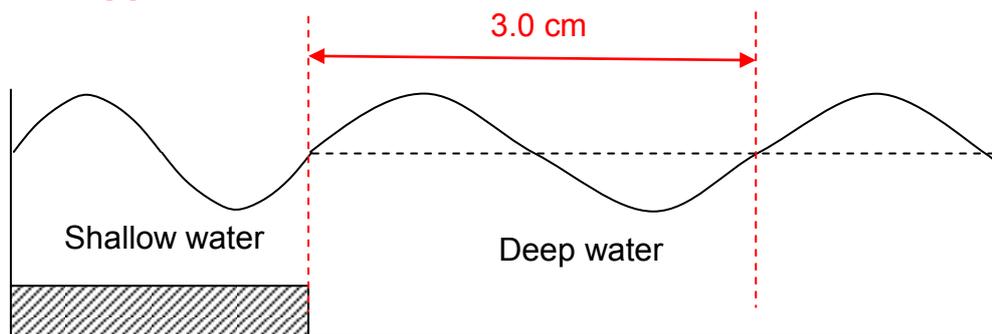
(c) Briefly describe the movement of the water particle at point C as the wave travels past. [1]

The water particle at C oscillates vertically as the wave travels past it.

[>= 2 marks]: The water particle at C (crest) will accelerate vertically downwards then decelerate to a momentary stop at the trough. It will then accelerate upwards then decelerate to a stop at the crest. This oscillation of the particle is then repeated as the wave travels past.)

(d) The following diagram shows another view of the water waves travelling from a shallow to a deeper region where its speed is increased by a ratio of 1.5. Complete the sketch of the incident wave as it travels into the deeper region. (Assume no change in amplitude of the waves)

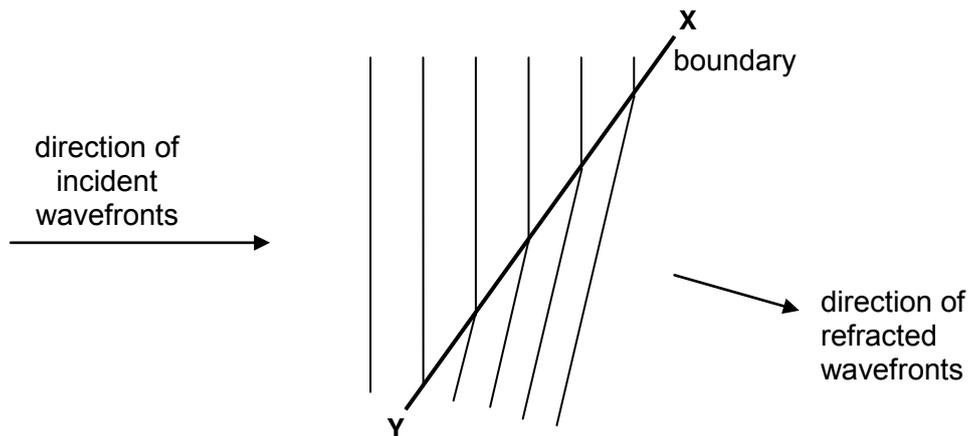
Shape of wave [1]



Calculation [1]

For the same frequency  $f$ ,  $\frac{v_2}{v_1} = \frac{\lambda_2}{\lambda_1} \rightarrow \frac{\lambda_2}{\lambda_1} = 1.5 \rightarrow \lambda = 1.5 \times 2.0 \text{ cm} = 3.0 \text{ cm}$

3



**Note:** Use a protractor to measure the direction of waves accurately.  
 Direction of waves are at  $90^\circ$  to the wavefronts.

(a) Describe how the initial incident wavefronts could be produced in a ripple tank. [1]

A plane dipper (or horizontal wooden bar) just touching the surface of the water is attached to a motor vibrating with a frequency of 5.0 Hz.

(b) Describe how you would arrange to bring about the refraction at XY. [1]

A transparent Perspex block (or glass block) is submerged in the water to the right of XY to form a shallow region above the block.

(c) Determine the following characteristics of the wave. Show all formulae and necessary working clearly. [6]

speed of incident waves	$v = f \times \lambda = 5.0 \times 0.7 = 3.5 \text{ cm s}^{-1}$
frequency of refracted waves	$f = v / \lambda = 3.5 / 0.7 = 5.0 \text{ Hz}$ (same as incident waves)
wavelength of refracted waves	0.4 cm (measured using a ruler)
speed of refracted waves	$v = f \times \lambda = 5.0 \times 0.4 = 2.0 \text{ cm s}^{-1}$
angle of incidence	$36^\circ \pm 1^\circ$ (angle measured to nearest degree, no d.p.)
angle of refraction	$23^\circ \pm 1^\circ$