Name: _____ Class: _____ Date: _____

Sec 3 Physics (SSMT / IP)

Worksheet 11: Waves

1 Water waves were produced in a ripple tank using a vibrator of frequency of 3 Hz. Which of the following values of speed and wavelength could the waves have had?

	speed	*wavelength*
A	1 cm/s	3 cm
B	2 cm/s	1 cm
C	5 cm/s	15 cm
D	12 cm/s	4 cm

[ ]

2 A wave source of 1000 Hz emits waves of wavelength 0.1m. How long does it take for the waves to travel 2500 m?

A	4 s	**C**	40 s
B	25 s	**D**	100 s

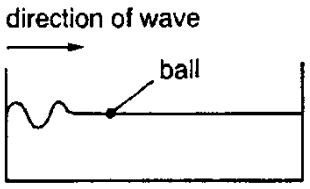
[ ]

3 The table shows examples of transverse and longitudinal waves. Which line in the table is correct?

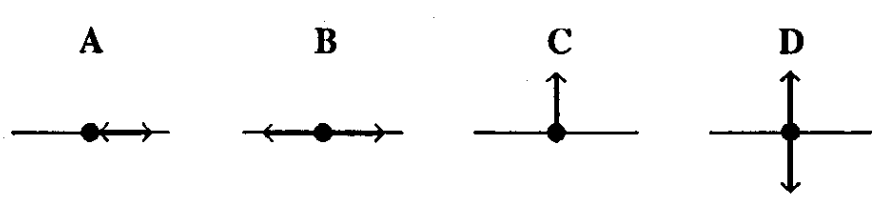
	transverse	***longitudinal***
A	gamma rays	sound
B	infra-red	radio
C	infra-red	water waves
D	radio	light

[ ]

4 The diagram shows a ball floating in a tank of water.



Which diagram shows the movement of the ball when the wave passes?



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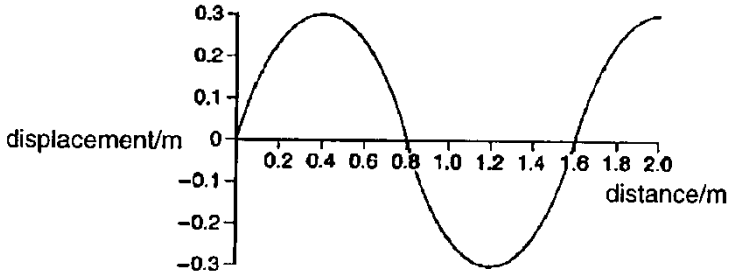
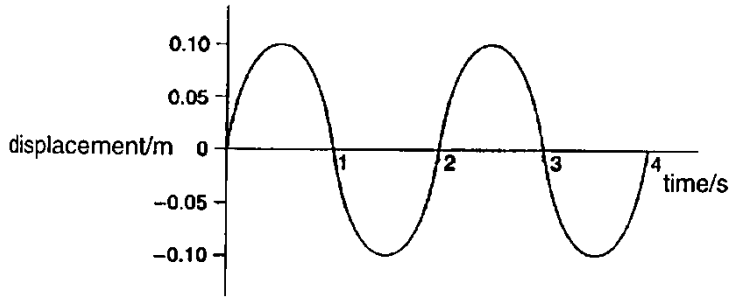
5 A long rope is stretched out on the floor. One end of the rope is then shaken. The graph shows the rope at a particular moment in time.



Which is the wavelength of the wave motion?

A 0.36 m **C** 0.8 m
B 0.6 m **D** 1.6 m [ ]

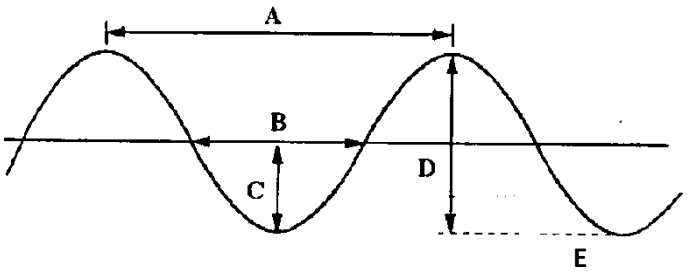
6 The diagram shows how displacement varies with time as a wave passes a fixed point.



What is the frequency of this wave?

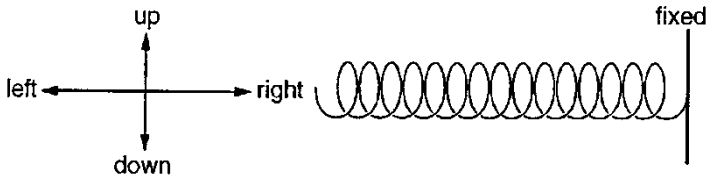
A 0.25 Hz **C** 1.0 Hz
B 0.50 Hz **D** 2.0 Hz [ ]

7 The diagram shows a cross-section of a water wave. Which distance is the amplitude of the wave?



[ ]

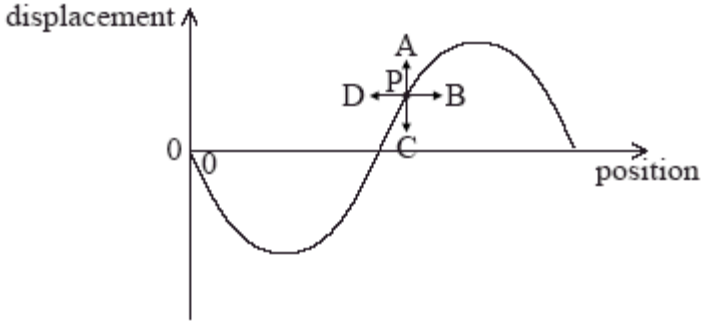
8 A lightly coiled spring is fixed at one end and held by hand at the other.



Which hand movements cause first a compression and then a rarefaction to travel along the spring?

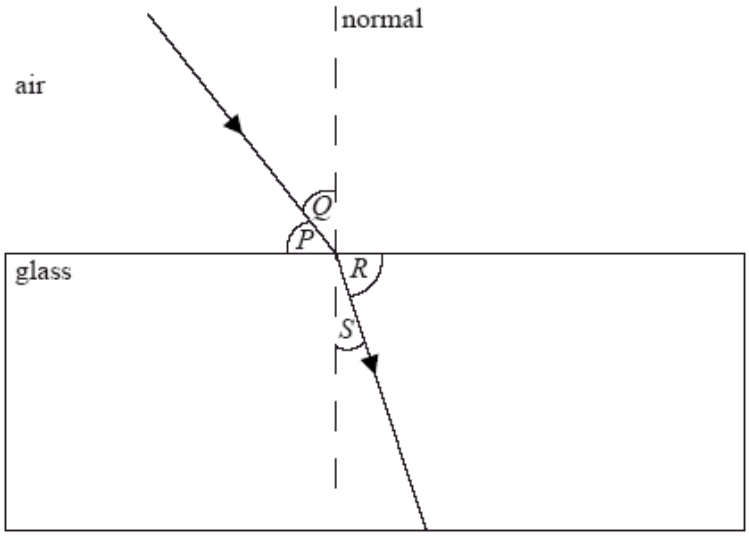
A down then up
B up then down
C left then right
D right then left [ ]

9 A transverse wave travels from *left to right*. The diagram shows at a particular instant of time, the displacement of particles in the medium varies with position. Which arrow represents the direction of the velocity of the particle marked P?



[ ]

10 Light travels from air into glass, as shown below.



What is the refractive index of glass?

A $\frac{\sin P}{\sin S}$

B $\frac{\sin Q}{\sin R}$

C $\frac{\sin P}{\sin R}$

D $\frac{\sin Q}{\sin S}$ [ ]

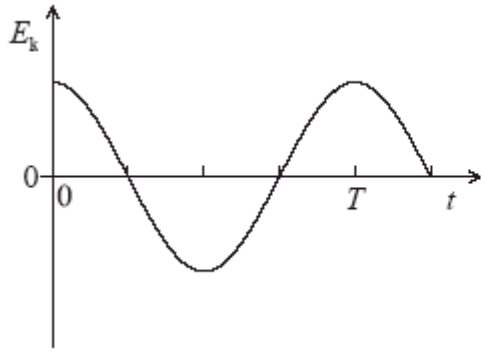
11 Which of the following electromagnetic waves has a frequency **greater** than visible light?

A Ultraviolet
B Radio
C Microwaves
D Infrared [ ]

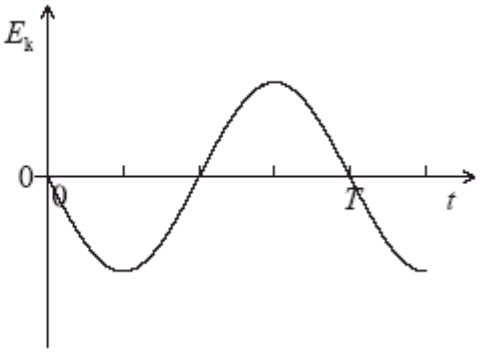
12 A particle oscillates with simple harmonic motion with period *T*.

At time $t = 0$, the particle has its maximum displacement. Which graph shows the variation with time *t* of the kinetic energy E_K of the particle?

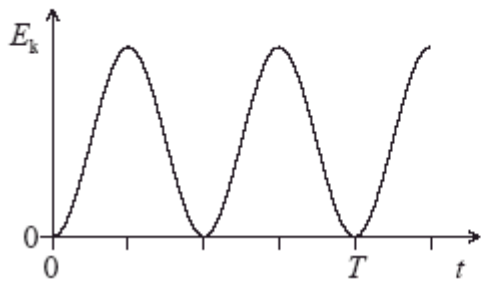
A.



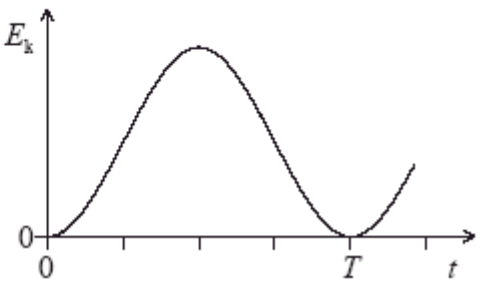
B.



C.

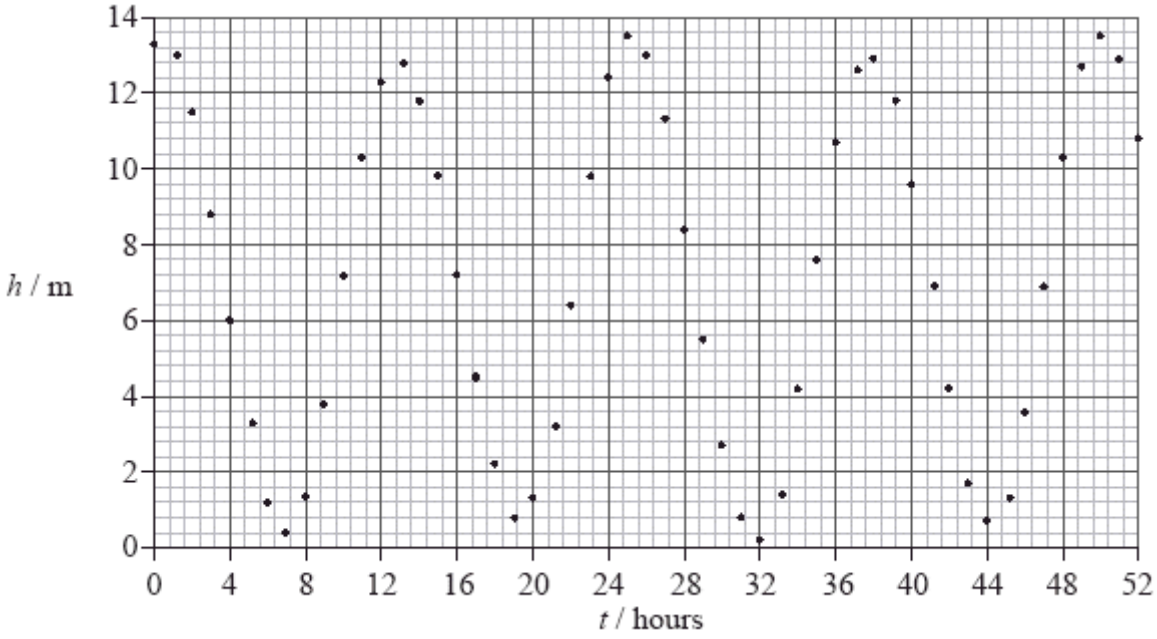


D.



[ ]

13 The graph shows the height h of sea level at different times t in the Bay of Fundy.



Which of the following gives the approximate amplitude and period of the tides?

	Amplitude	Period
A	6.5 m	6 hours
B	13 m	12 hours
C	6.5 m	12 hours
D	13 m	6 hours

[ ]

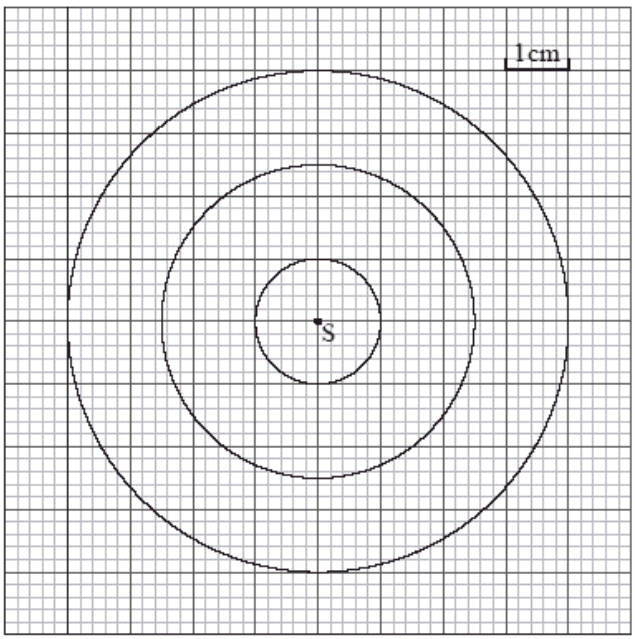
14 Which of the following is a wavelength value found in the visible region of the electromagnetic spectrum?

A 4×10^{-5} m
B 4×10^{-7} m
C 4×10^{-9} m
D 4×10^{-11} m [ ]

15 Two waves meet at a point in space. Which of the following properties always add together?

A Displacement
B Amplitude
C Speed
D Frequency [ ]

16 The diagram below is a snapshot of wavefronts of circular waves emitted by a point source S at the surface of the water. The source vibrates at a frequency f = 10.0 Hz.



The speed of the wavefront is

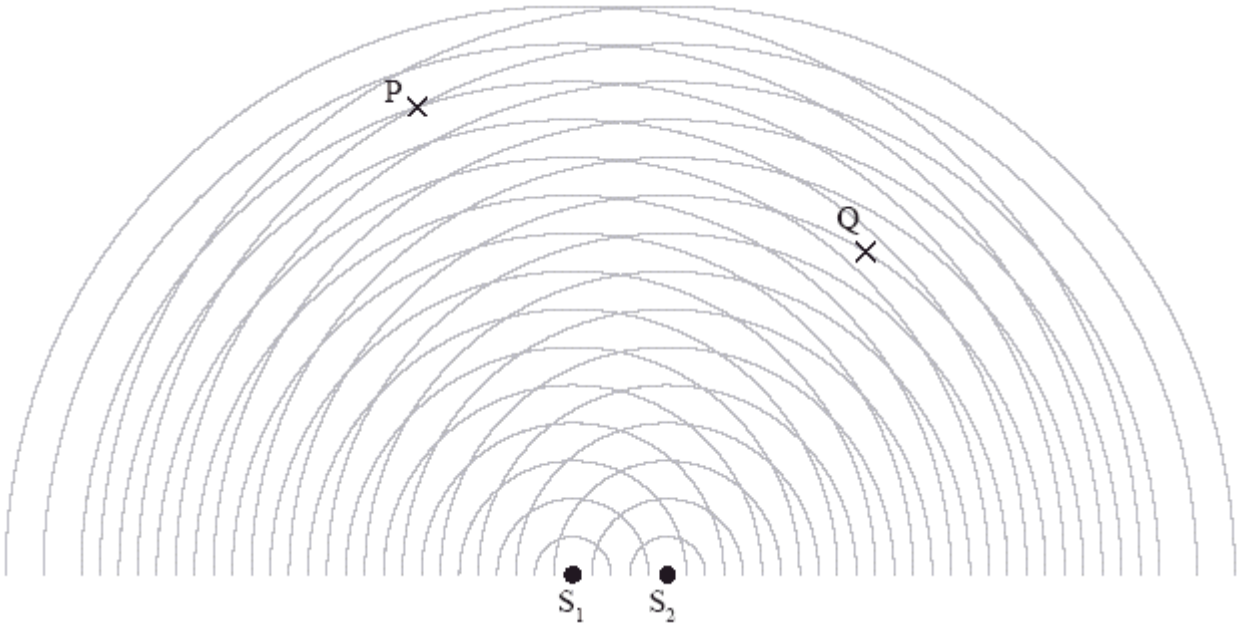
A 0.15 cm s^{-1}.

B 1.5 cm s^{-1}.

C 15 cm s^{-1}.

D 30 cm s^{-1}. [ ]

17 Two coherent point sources, S_1 and S_2, emit spherical waves.



Which of the following best describes the intensity of the waves at P and Q?

	P	Q
A	maximum	minimum
B	minimum	maximum
C	maximum	maximum
D	minimum	minimum

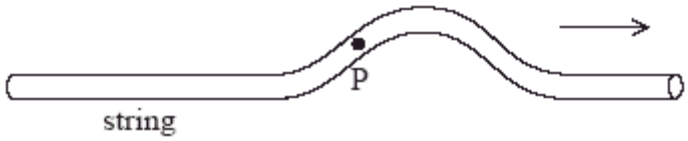
[ ]

18 Monochromatic light travels from air into water. Which of the following describes the changes in wavelength and speed?

	Wavelength	Speed
A	increases	decreases
B	increases	increases
C	decreases	increases
D	decreases	decreases

[ ]

19 A wave pulse is travelling to the right along a string.

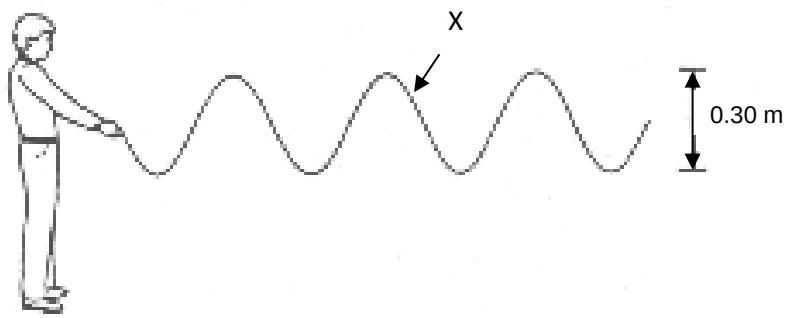


Which of the following best represents the direction of the velocity of the point P?

A ↑
B ↓
C →
D ←

STRUCTURED QUESTIONS

1 The figure below shows a student setting up waves on a long elastic cord. The student's hand makes one complete up-and-down movement in 0.40s, and in each up-and-down movement, the hand moves through a height of 0.30 m. The wavelength of the waves on the string is 0.80 m.



For this wave, determine

a Amplitude = ...

b Period = ...

c Frequency = ...

d Speed = ... [6]

e Using a line with arrows on both ends, label the wavelength of the waves in the diagram above. [1]

f Label 2 points **Y** and **Z** on the line in phase with point X. [2]

g Sketch the shape of the waves in real life. [2]

2 Transverse waves are produced in a long rope by securing one end of the rope to a wall and then moving the other end from side to side by hand. The frequency of the waves is 2 Hz.

a How are "transverse waves" different from "longitudinal waves"?

.....

.....

.....

..... [2]

b Explain the meaning of the expression “the frequency is 2 Hz”.

.....

..... [1]

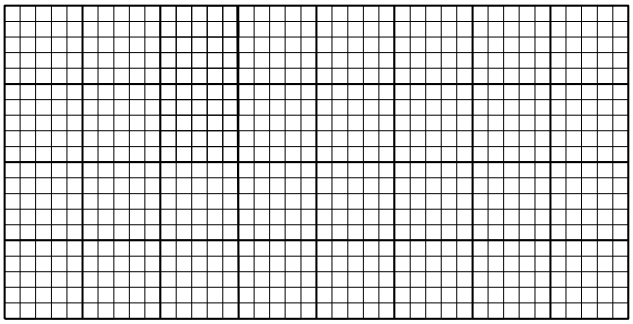
c What determines the amplitude of the waves produced?

.....

..... [1]

3 Transverse waves of wavelength 40 mm and amplitude 15 mm travel across a liquid surface.

a On the grid (2mm) below, draw a **full-scale** diagram showing a side view of the liquid surface at a particular instant. [2]



b If the frequency of vibrations of the waves is 12 Hz, calculate the speed at which they travel across the liquid surface.

Speed = …….. mm s^{-1} [2]

4 a Figure 4.1 shows the graph of the displacement of a wave with distance along the wave at a particular time.

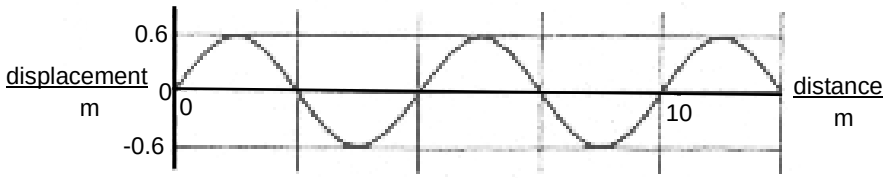


Figure 4.1

State the values for

(i) the amplitude of the wave: ..... m [1]

(ii) the wavelength of the wave: ..... m [1]

b Figure 4.2 shows the graph of the displacement of the same wave with time at a particular point along the wave.

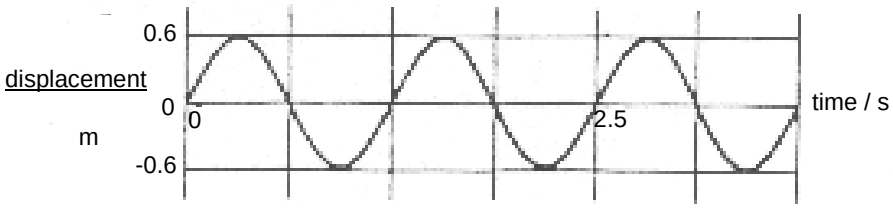


Figure 4.2

State values for

(i) Time for one cycle = ... s [1]

(ii) Frequency of the wave = ... Hz [1]

c Calculate the speed of the wave drawn in Figures 4.1 and 4.2.

Speed of wave = …… ms^{-1} [2]

5 A progressive wave moves past two points, P and Q, separated by a distance of 0.90 m. Figure 5.1 shows the displacement y at point P varies with time *t*. Figure 5.2 shows the graph of the displacement of the wave at time *t* = 0 over some distance from point P.

Figure 5.1

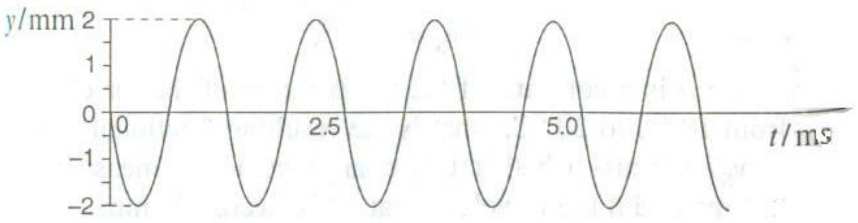
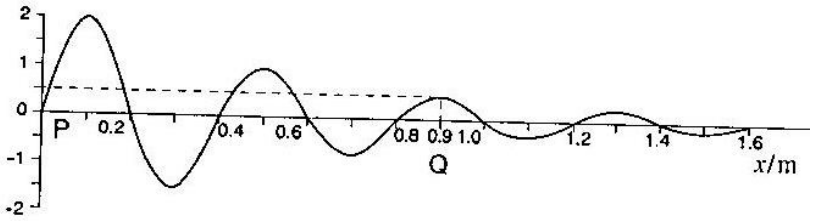


Figure 5.2



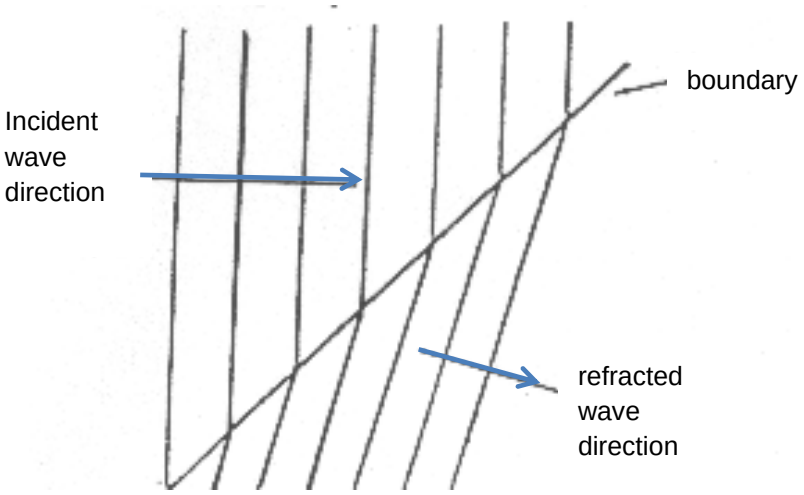
Using the data from the graphs, deduce for this wave the

a wavelength = …….. m [1]

b frequency = …….. Hz [1]

c speed of wave = …….. ms^{-1} [1]

6 In the full-scale diagram, the unlabelled line represents successive wave crests. Refraction of plane waves occurs as they cross a boundary. The frequency of the incident waves is 6.0 Hz.



By making a suitable measurement, calculate

a the wavelength of the incident waves,

wavelength = …….. cm [2]

b the speed of the incident waves,

speed = …….. cm s^{-1} [2]

c the frequency of the refracted waves,

frequency = …….. Hz [1]

d the wavelength of the refracted waves,

wavelength = ……. cm [1]

e the speed of the refracted waves,

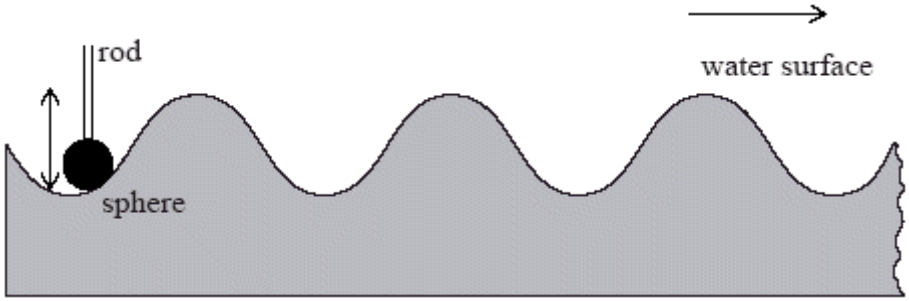
speed = ……. cm s^{-1} [2]

f refractive index of the boundary.

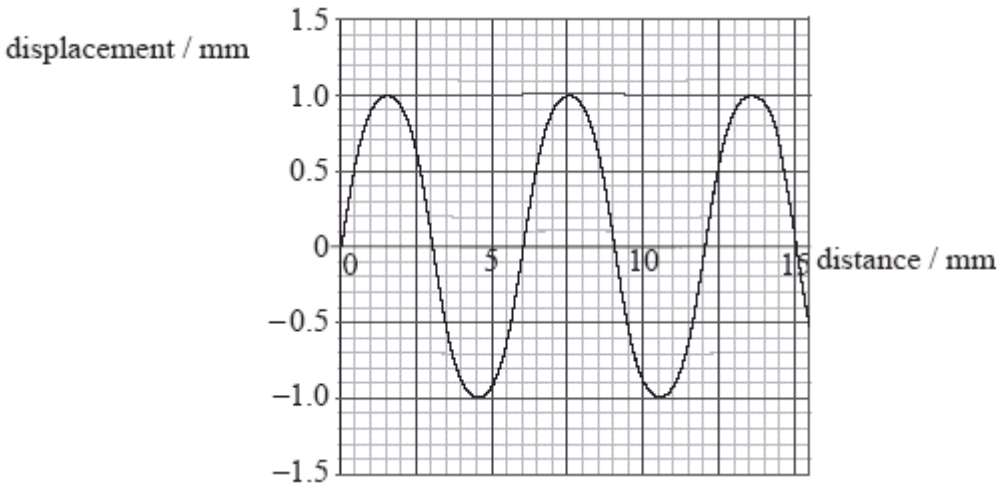
Refractive index = …… [2]

7 This question is about water wave motion.

A small sphere, mounted at the end of a vertical rod, dips below the surface of shallow water in a tray. A motor attached to the rod drives the sphere vertically up and down. The oscillations of the sphere produce travelling waves on the surface of the water.



a The diagram shows how the displacement of the water surface at a particular instant in time varies with distance from the sphere. The period of oscillation of the sphere is 0.027 s.



Use the diagram to calculate

(i) the amplitude.

Amplitude = …….. mm [1]

(ii) the wavelength.

wavelength = ……..…….. mm [1]

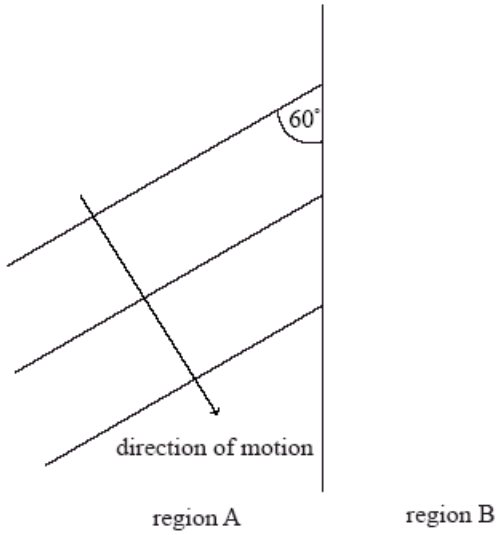
(iii) the frequency.

Frequency = …… Hz [1]

(iv) the speed.

Speed = …… mm s^{-1} [1]

b The wave moves from region A into region B of shallower water. The waves move more slowly in region B. The diagram (not to scale) shows some of the wavefronts in region A.



(i) With reference to a wave, distinguish between a ray and a wavefront.

.....

.....

.....

..... [2]

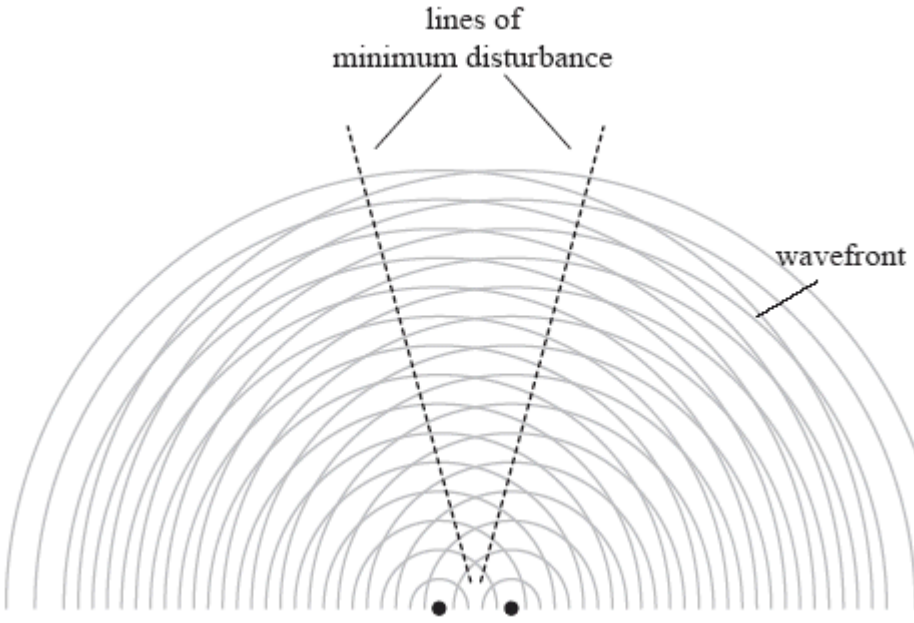
(ii) The angle between the wavefronts and the interface in region A is 60°. The refractive index ${}_{A}n_{B}$ is 1.4.

Determine the angle between the wavefronts and the interface in region B.

Angle = ……. [2]

(iii) On the diagram above, construct **three** lines to show the position of three wavefronts in region B. [2]

c Another sphere is dipped into the water. The spheres oscillate in phase. The diagram shows some lines in region A along which the disturbance of the water surface is a minimum.



(i) Outline how the regions of minimum disturbance occur on the surface.

.....

.....

.....

.....

.....

(ii) The frequency of oscillation of the spheres is increased.

State **and** explain how this will affect the positions of minimum disturbance.

.....

.....

.....

.....

..... [2]