Waves - 2

1.

(a) Define the following terms associated with waves.

(i) wavelength (λ)

.....

.....

.....

(ii) frequency (f)

.....

.....

.....

(iii) speed (v)

.....

.....

.....

[4]

(b) Use these definitions to deduce the equation relating λ, f and v.

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.....

.....[3]

(c) A source of sound vibrates with a period of 0.020 s and an amplitude of 1.2 cm.

(i) Use the grid in Fig. 2.1 to sketch a graph showing the variation with time t of the displacement x of the source. Label each axis with an appropriate numerical scale and draw two full cycles of the wave. [4]

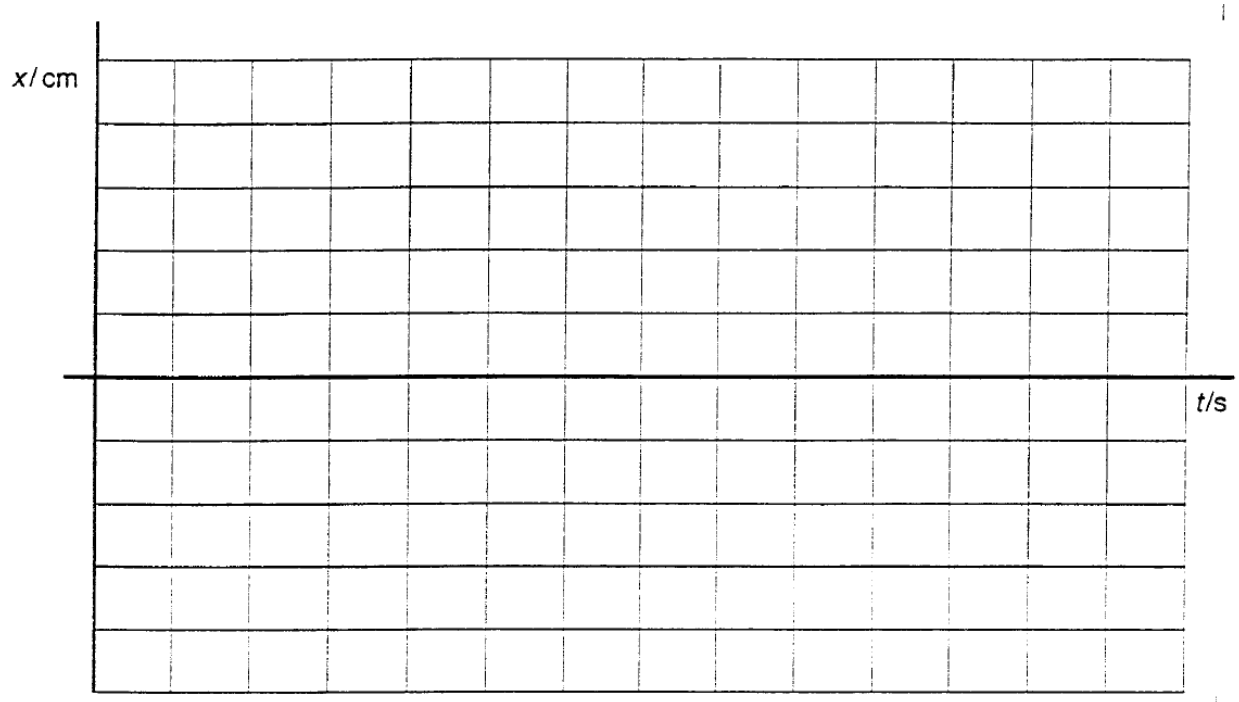

Fig. 2.1

(ii) Describe how the wave source moves to produce the sound waves.

.....

.....[1]

(iii) The speed of the sound waves is 340 m s^{-1}. Determine the wavelength.

wavelength = ... m [3]

2.

(a) Explain the meaning of the term *diffraction.*

.....

.....

.....[2]

(b) **(i)** Describe how transverse water waves with a plane wavefront may be produced in a ripple tank.

.....

.....

.....[2]

(ii) State how the wavelength of the waves could be shortened.

.....

.....[1]

(c) Fig. 5.1 shows plane water waves in a ripple tank approaching a narrow gap, the size of which is approximately the same as the wavelength of the waves.

(i) On Fig. 5.1, draw the pattern of the wavefronts emerging from the gap. [2]

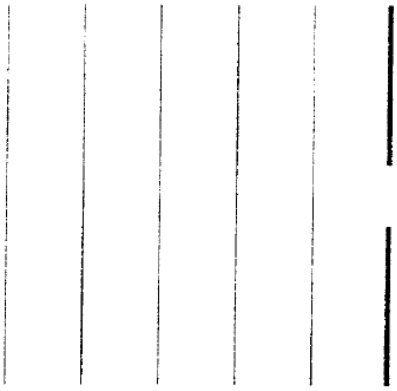

Fig. 5.1

(ii) Describe how the pattern of wavefronts emerging from the gap would change if the size of the gap were significantly increased.

[2]

(iii) State why, under normal circumstances, light seems to travel in a straight line and does not appear to be diffracted.

.....

.....[1]

3.

(a) (i) Describe the essential difference between longitudinal and transverse waves.

.....

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.....

.....

..... [2]

(ii) State **three** wave phenomena that apply to both transverse and longitudinal waves.

.....

.....

..... [3]

(iii) State and describe with the aid of a diagram **one** wave phenomenon that applies to transverse waves only.

[3]

(b) Fig. 2.1 shows the trace produced on the screen of a cathode ray oscilloscope (c.r.o.) when a microphone is connected across its input (y-plates) terminals. The time-base setting of the c.r.o. is 10 ms cm^{-1}.

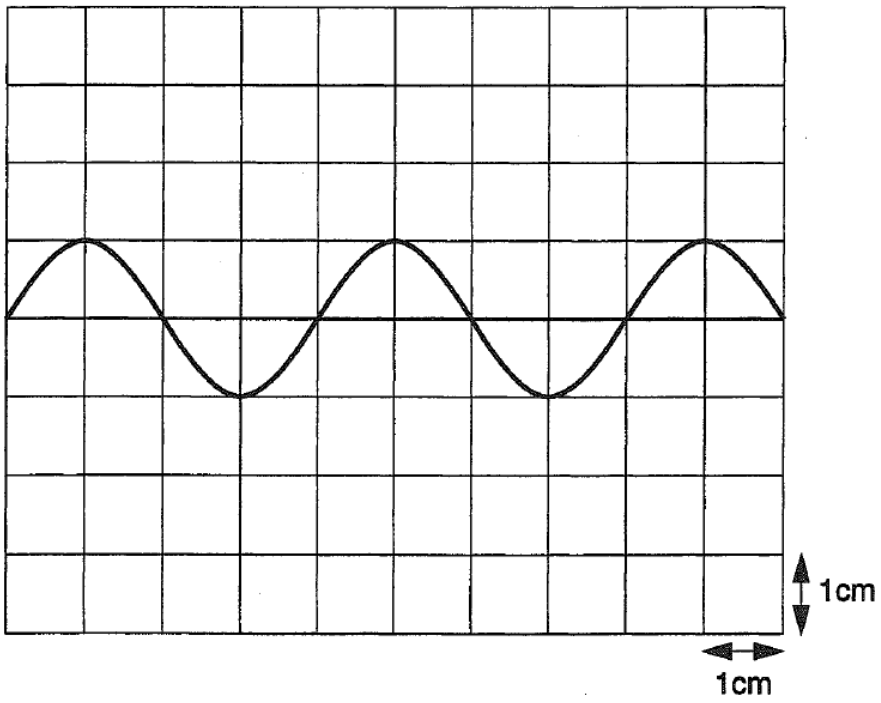

Fig. 2.1

(i) Calculate the frequency of the sound being received by the microphone.

frequency = ... Hz [3]

(ii) State and explain how the c.r.o. trace would change if the time-base setting were adjusted from 10 ms cm^{-1} to 1 ms cm^{-1}.

.....

.....

.....

..... [3]

(iii) The speed of sound in air is $330\,m\,s^{-1}$. Calculate the wavelength of the sound received by the microphone.

wavelength = ... m [3]

4.

(a) (i) State the meaning of *plane polarisation* of light waves.

.....

..... [1]

(ii) Explain why sound waves cannot be *plane-polarised.*

.....

.....

..... [2]

(b) Fig. 4.1 shows an experiment in which a student observes a parallel beam of plane-polarised light passing through a Polaroid filter.

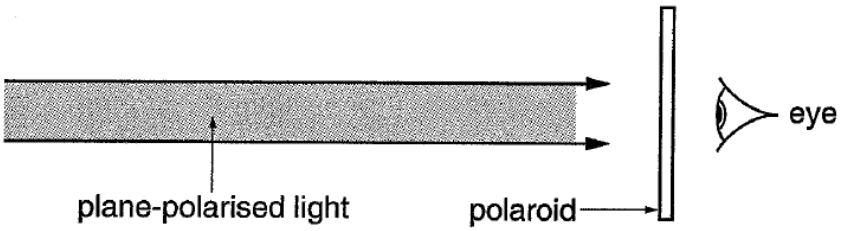

Fig. 4.1

Fig. 4.2 shows how the intensity of the light reaching the student will vary as the Polaroid filter is rotated through 360° in its own plane. Suggest why there is a series of maxima and minima.

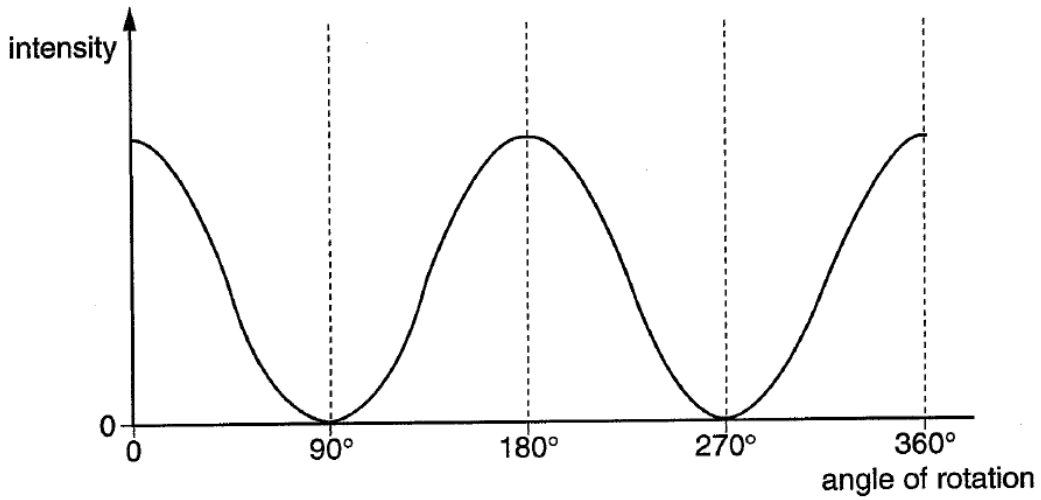

Fig. 4.2

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.....

.....

..... [2]

(c) State an example of plane-polarisation that does **not** involve visible light and state how the polarised wave may be detected.

.....

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.....

.....

.....

..... [2]

5.

(a) State what is meant by the diffraction of waves.

.....

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.....

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..... [2]

(b) Fig. 6.1 shows water ripples approaching a gap in a barrier. In **(i)** the gap is narrow and in **(ii)** the gap is wide.

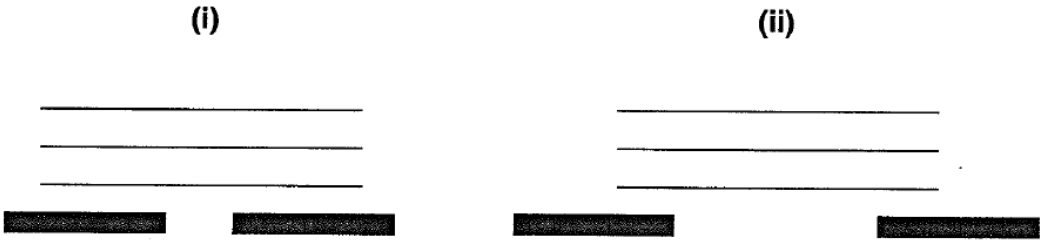

Fig. 6.1

On Fig. 6.1 draw the appearance of the ripples after they have passed through the gap. [3]

6.

Fig. 3.1 shows, at a given instant, the shape of a stretched rope along which a transverse wave is travelling from left to right. The letters V, W, X, Y and Z identify five particles on the rope.

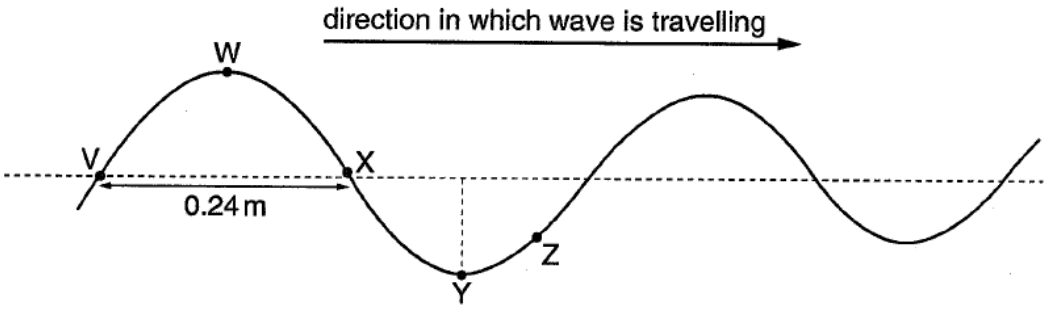

Fig. 3.1

(i) On Fig. 3.1 sketch the shape of the rope a short time later. [1]

(ii) On Fig. 3.1 draw arrows to show the directions in which the particles X and Z are moving during this short time. [2]

(iii) The distance between V and X is 0.24 m (as shown). The frequency of the wave is 3.6 Hz. Calculate the speed of the wave.

wave speed = ... $m\,s^{-1}$ [3]

(iv) The frequency is doubled to 7.2 Hz. Determine the changes, if any, in

1. the wave speed

.....

.....

2. the wavelength.

.....

..... [3]

7.

(a) All waves are either longitudinal or transverse. State **one** example of each.

longitudinal .....

transverse .....[2]

(b) Define

(i) the frequency of a wave

.....[1]

(ii) the period of a wave.

.....[1]

(c) Fig. 2.1 shows the variation of displacement with position at a particular instant for a progressive sound wave travelling in air.

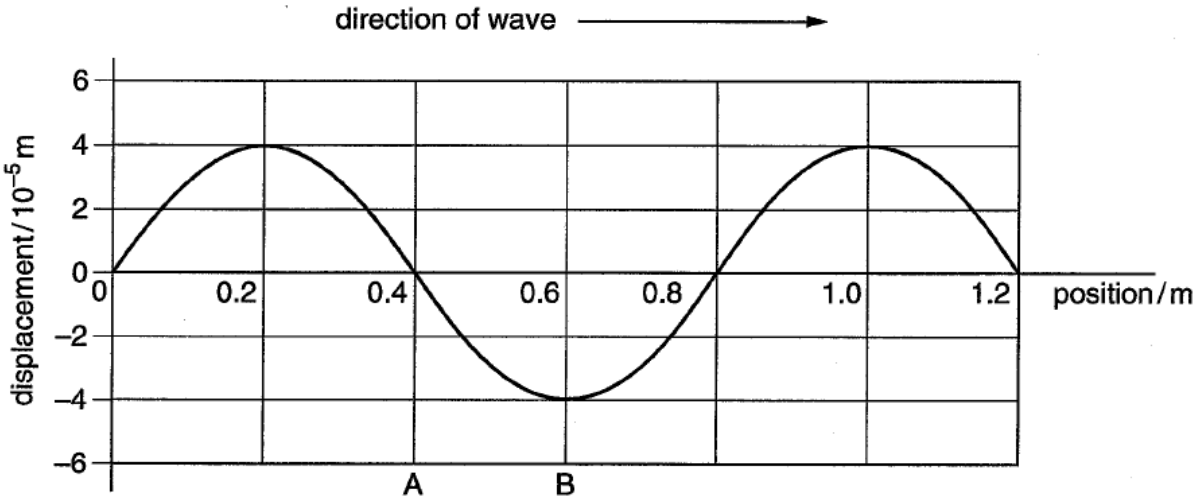

Fig. 2.1

(i) State the amplitude of the sound wave shown in Fig. 2.1

amplitude = ... m [1]

(ii) Describe the motion of an air particle at position A as one full cycle of the wave passes.

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.....[3]