H2 Physics Revision Topic : Wave Motion

Structured Questions Name: ______________________________

1 **(a)** State what is meant by the term *polarisation* when applied to a wave.

....

.... [1]

(b) Explain why only transverse waves can be polarised.

....

....

....

.... [2]

(c) Some films released have enabled viewing in three dimensions (3D). This can be done using two superimposed polarised images on the screen. One of the images is the scene as viewed by a left eye and the other the scene as viewed by a right eye.

Explain how the images on the screen need to be polarised and how the spectacles of the cinema-goer also need to be polarised.

....

....

....

.... [3]

(d) Suggest why superposition has no meaning for the two superimposed images in part **(c)**.

....

....

.... [1]

[Total: 7]

2 **(a)** Sketch, on Fig. 4.1, a standing wave with 4 antinodes only.

Fig. 4.1

[2]

(b) Draw, on Fig. 4.2, a wave that is 90° out of phase with the wave shown.

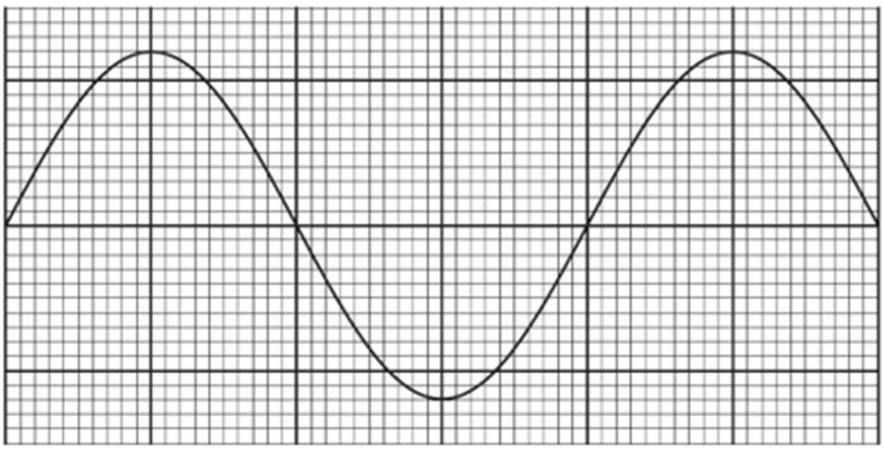

Fig. 4.2

[2]

(c) Sketch, on Fig. 4.3, the diffraction of a plane wave passing through a gap that is smaller than the wavelength of the wave.

2

Fig. 4.3

[3]

3 Fig 1.1 shows a displacement-distance graph for two sound waves A and B, of the same frequency and amplitude. Wave A is travelling to the right and wave B is travelling to the left.

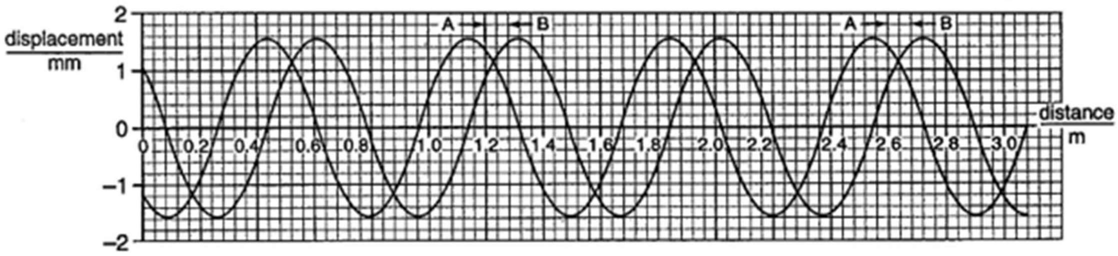

Fig 1.1

(a) **(i)** From the graph, deduce the phase difference between the two waves at the instant shown.

phase difference = ... rad [1]

(ii) The period of each wave is T.

Determine the maximum displacement of the resultant of the two waves

1. at the instant shown,

maximum displacement = ... mm [1]

2. at the instant shown + $\frac{T}{8}$,

maximum displacement = ... mm [1]

3. at the instant shown + $\frac{3T}{8}$.

maximum displacement = ... mm [1]

3 **(b)** Two microwaves sources S_1 and S_2 are located as shown in Fig 1.2. The sources are producing waves that are in phase and of wavelength λ. The distance between S_1 and S_2 is 3.5λ. Points lying on the line joining P and Q are equidistant from S_1 and S_2.

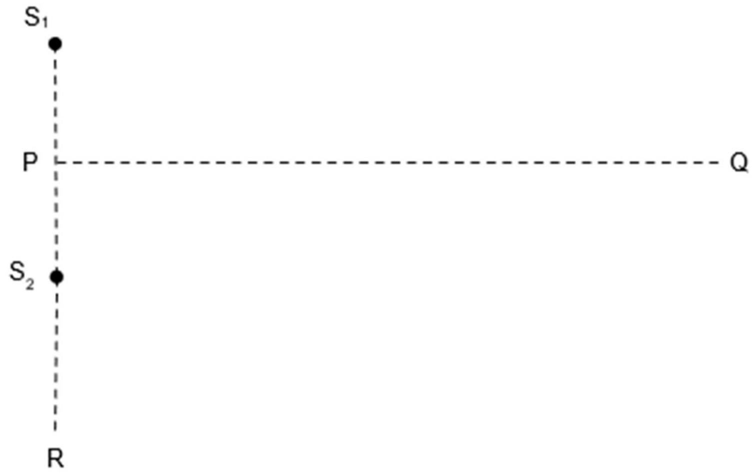

Fig 1.2

Assume that any drop in intensity of the wave, from each source, with distance is negligible.

State and explain whether a maximum or minimum is detected by a microwave sensor as it is moved along the line joining

(i) S_1 and S_2,

....

....

....

.... [2]

(ii) P and Q,

....

....

.... [2]

(iii) S_2 and R.

....

....

.... [2]

4 **(a)** Fig. 4.1 shows the equilibrium and actual positions at an instant in time of a series of particles forming part of a stationary sound wave. Particle M is at its maximum displacement.

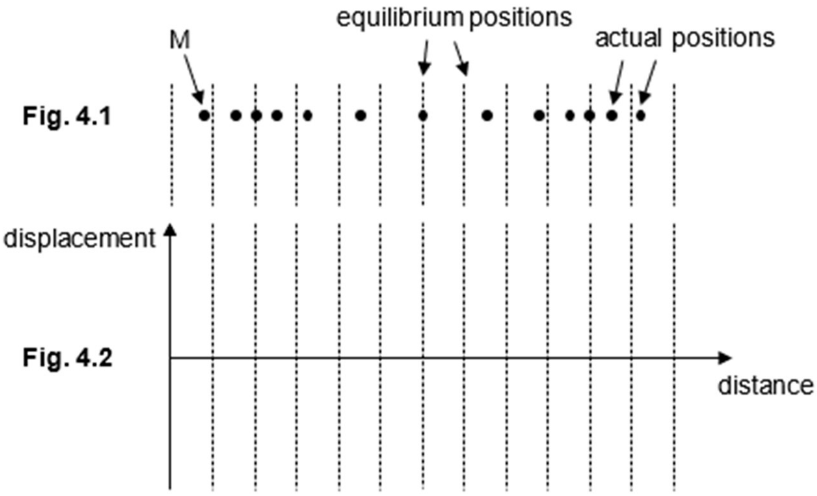

Fig. 4.1

Fig. 4.2

On Fig. 4.2,

(i) sketch the variation with distance of the displacement of the particles at the instant shown, taking motion to the right as positive. Label your sketch **P**.

[2]

(ii) sketch the variation with distance of the displacement of the particles at one-quarter of a period later. Label your sketch **Q**.

[1]

(iii) indicate the position of one displacement antinode with **A** and the position of one displacement node with **N**.

[1]

(b) The stationary wave in **(a)** is formed in a pipe of length 0.40 m that is closed at one end and open at the other. An incident sound wave of frequency 1060 Hz travels parallel to the axis of the pipe, and enters the pipe, as shown in Fig. 4.3.

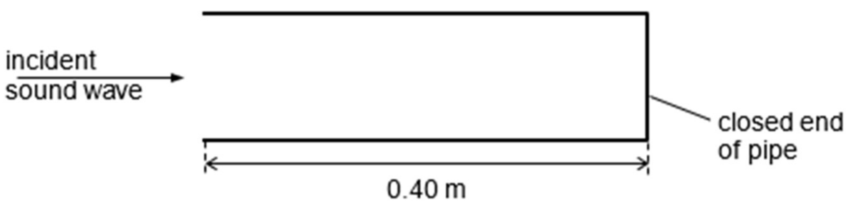

Fig. 4.3

4 **(i)** Explain the formation of the stationary (standing) wave in the pipe.

....

....

....

.... [2]

(ii) When a microphone is moved along the length of the pipe from the opening to the end, three maxima are detected.

Determine the wavelength of the sound.

wavelength = ... m [3]

(iii) Calculate the speed of the sound wave.

speed = ... m s^{-1} [1]

5

(a) A progressive wave transfers energy. A stationary wave does not transfer energy. State **two other** differences between progressive waves and stationary waves.

1. ....

....

....

2. ....

....

....

[2]

(b) Fig. 7.1 shows a progressive wave travelling from left to right along a stretched string at a speed of 0.40 m s^{-1}. The diagram shows the string at time t = 0 s.

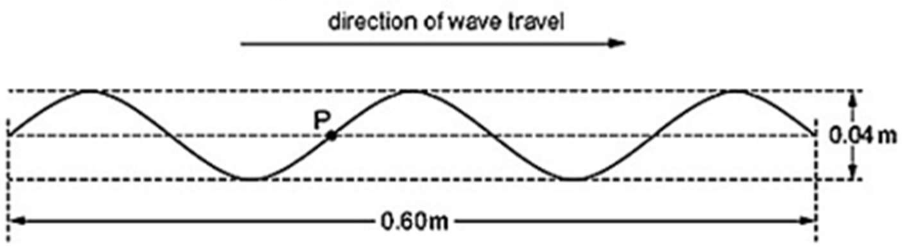

Fig. 7.1

Sketch, on the grid in Fig 7.2, the variation with time of the displacement of point **P** on the string between t = 0 s and t = 0.9 s. Show your workings in the space below the grid.

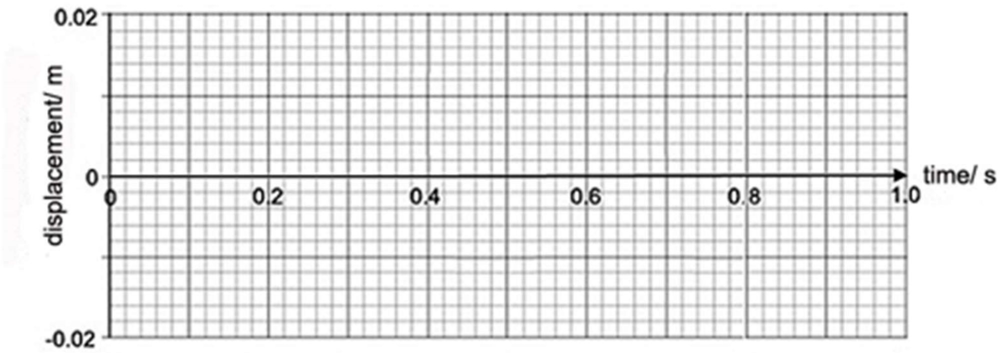

Fig. 7.2

[3]

5 **(c)** A stationary wave is formed on a stretched string between two fixed points A and B.

The variation with distance x along the string of the displacement y of particles of the string for the wave at time t = 0 s is shown on Fig. 7.3.

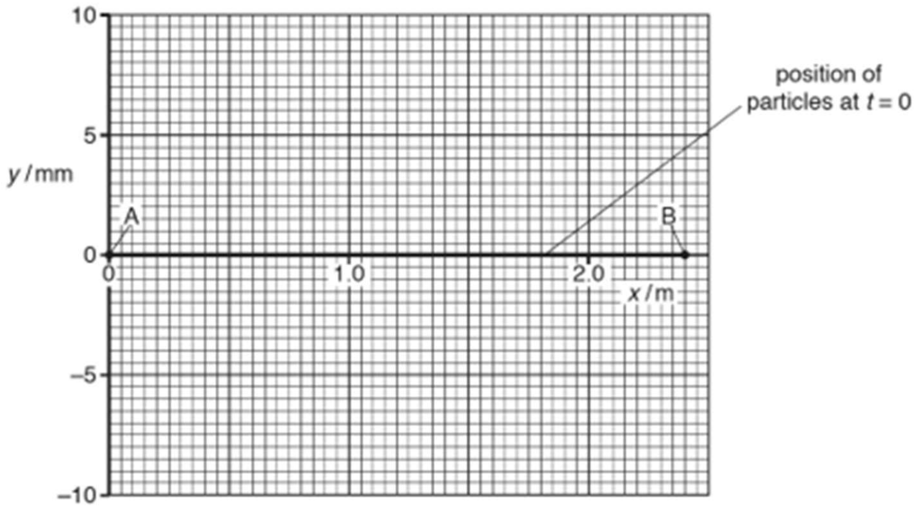

Fig. 7.3

The wave has a period of 20 ms and a wavelength of 1.2 m. The maximum amplitude of the particles of the string is 5.0 mm.

(i) On Fig. 7.3, draw a line to represent the position of the string at t = 5.0 ms. [2]

(ii) State the phase difference between the particles of the string at x = 0.40 m and at x = 0.80 m.

phase difference = ... rad [1]

(iii) State and explain the change in the kinetic energy of a particle at an antinode between t = 0 and t = 5.0 ms. A numerical value is not required.

....

....

....

....

.... [2]

5 **(d)** Fig. 7.4 shows two emitters A and B, placed 2.00 m apart, emitting radio waves of same frequency and same phase which interfere with one another to produce lines of constructive and destructive interference.

The Automated Guided Vehicle (AGV) is a device that detects radio waves and searches for lines of constructive interference. When placed equidistant from both emitters, the AGV will automatically adjust its position so that it is always aligned along the centre-line.

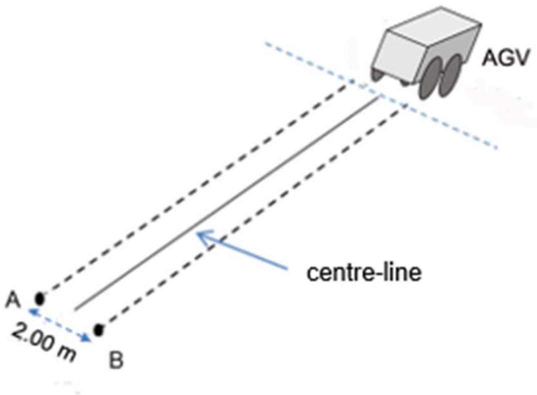

Fig 7.4 (not to scale)

(i) Explain why the centre-line is a line of constructive interference.

....

....

.... [1]

(ii) During one such operation, the AGV strays off from the centre-line as shown in Fig. 7.5.

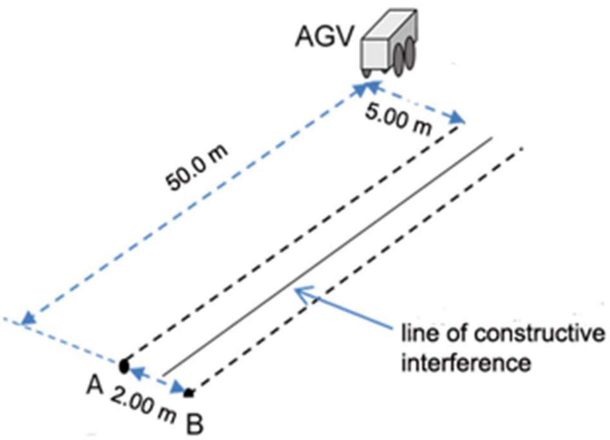

Fig 7.5 (not to scale)

5 Fig. 7.6 shows the separate radio signals X and Y detected by the receiver on the AGV.

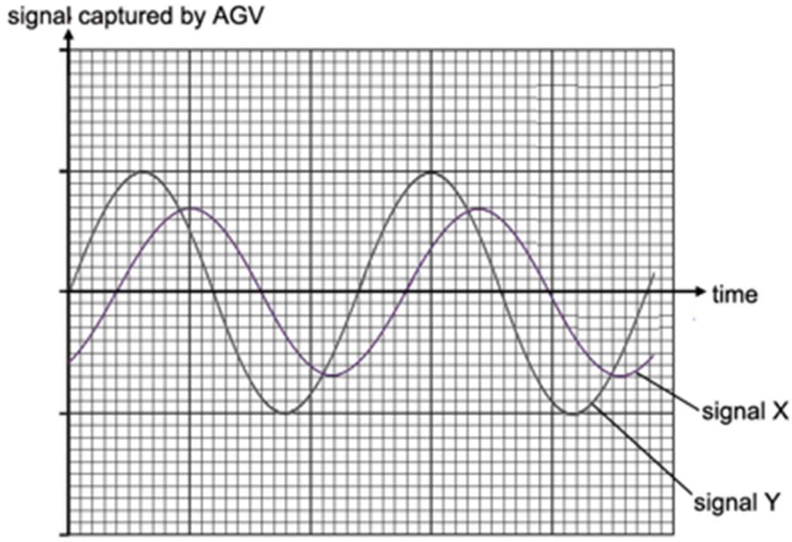

Fig 7.6

1. State and explain whether the source of signal X is from emitter A or B.

....

....

.... [2]

2. Calculate the phase difference between signals X and Y.

phase difference = ... rad [1]

3. Assuming the path difference is less than one wavelength, determine the frequency of the radio waves.

frequency = ... Hz [4]

4. Sketch on Fig. 7.6 the resultant signal detected by the AGV as a result of interference. [2]