3 A horizontal string is stretched between two fixed points A and B. A vibrator is used to oscillate the string and produce an observable stationary wave.
At one instant, the moving string is straight, as shown in Fig. 3.1.

Fig. 3.1

The dots in the diagram represents the positions of the nodes on the string. Point P, which is in the middle of the 2 adjacent dots on the string is moving downwards.
The wave on the string has a speed of 35 m s^{-1} and period of 0.040 s.

(a) Explain how the stationary wave is produced.

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..... [2]

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(b) On Fig. 3.1, sketch a line to show a possible position of the string a quarter of a cycle later than the position shown on the diagram. [1]

(c) Determine the horizontal distance from A to B.

distance = ... m [2]

(d) A particle on the string has zero displacement at t = 0 s. From time t = 0 to time = 0.060 s, the particle moves through a total distance of 72 mm.

(i) Calculate the amplitude of oscillation of the particle.

amplitude = ... mm [2]

(ii) State a time at which this particle will have maximum speed.

time = ... s [1]

(iii) Calculate the maximum speed of this particle.

maximum speed = ... m s^{-1} [2]

(e)

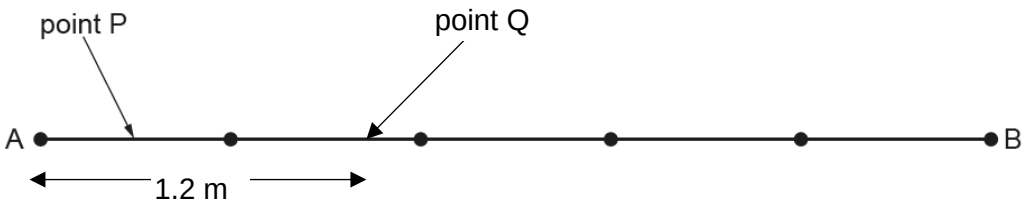

Fig. 3.2

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Fig. 3.2 again shows one instant in which the string is straight, and points P and Q are two points on the string as shown. Point P is midway between the two dots while point Q is at a distance of 1.2 m from point A.

Compare the vibrations of the point P with those of point Q, with reference to amplitude, phase and frequency.

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