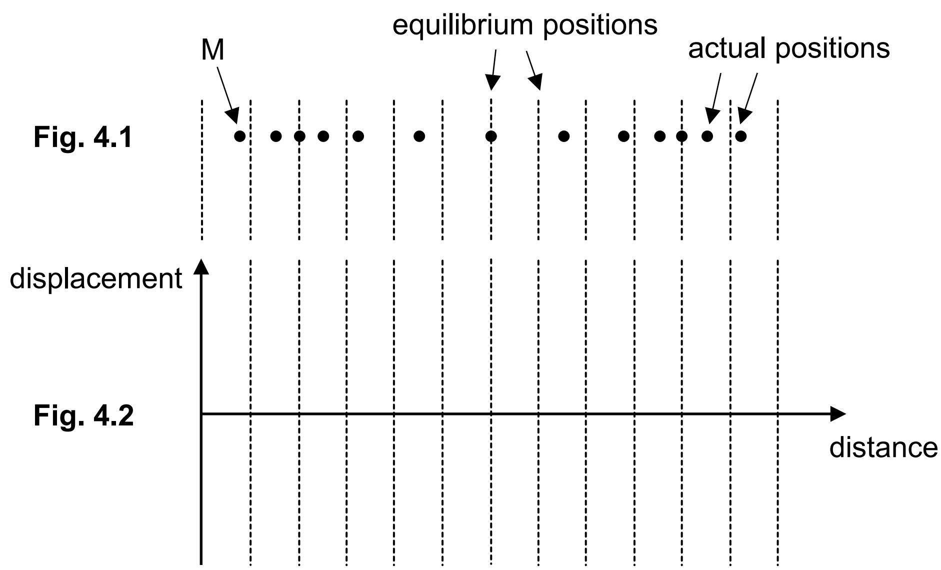
4 **(a)** Fig. 4.1 shows the equilibrium and actual positions at an instant in time of a series of particles forming part of a stationary sound wave. Particle M is at its maximum displacement.



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.

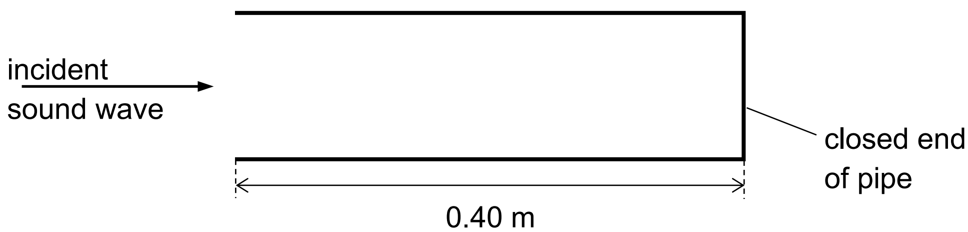


Fig. 4.3

(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]