4 **(a)** With reference to the direction of transfer of energy, compare the oscillations of transverse and longitudinal progressive waves.

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.....

..... [2]

(b) A pipe is open at one end and closed at the other with a piston. The piston can slide freely and is at a distance of 4.5×10^{-2} m from the open end of the pipe.

A loudspeaker is positioned near the open end of the pipe and emits a sound wave of a single constant frequency. A stationary wave is formed in the pipe, as illustrated in Fig. 4.1.

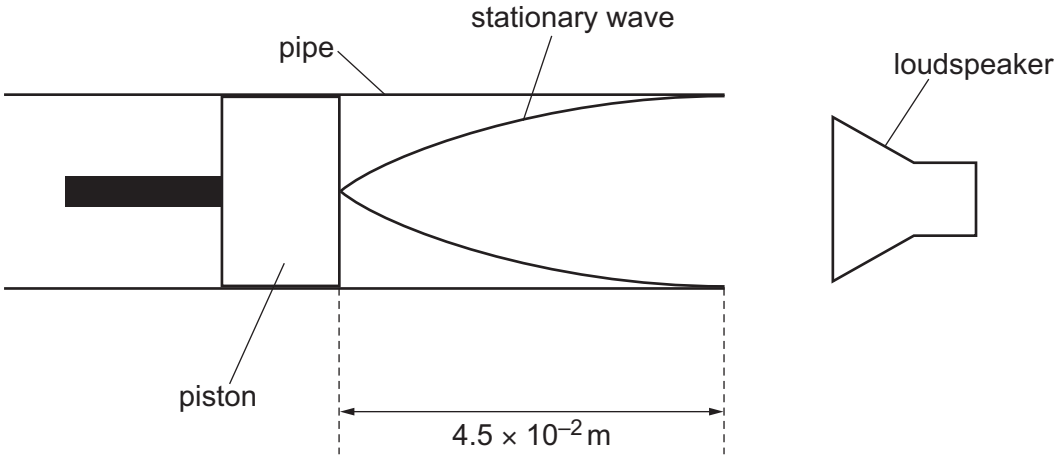

Fig. 4.1

(i) On Fig. 4.1, draw a letter A at the position of an antinode. [1]

(ii) The speed of sound in air is $340\,m\,s^{-1}$.

Determine the frequency of the sound wave.

frequency = ... Hz [3]

(iii) The piston is moved to the left. The frequency of the sound wave emitted by the loudspeaker is then changed so that a stationary wave is formed with same number of antinodes as in Fig. 4.1.

State and explain the change that is made to the frequency of the sound wave.

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..... [2]

[Total: 8]