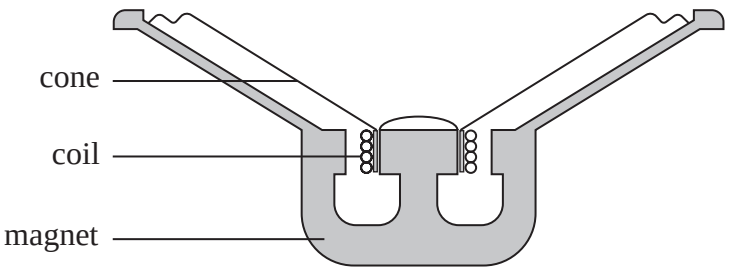
9 A simple loudspeaker consists of a cone, a coil of wire and a magnet. The cone and coil are attached to each other and are free to move. An alternating current in the coil causes the cone to oscillate. The loudspeaker is mounted in a wooden box. A cross-section through the loudspeaker is shown.



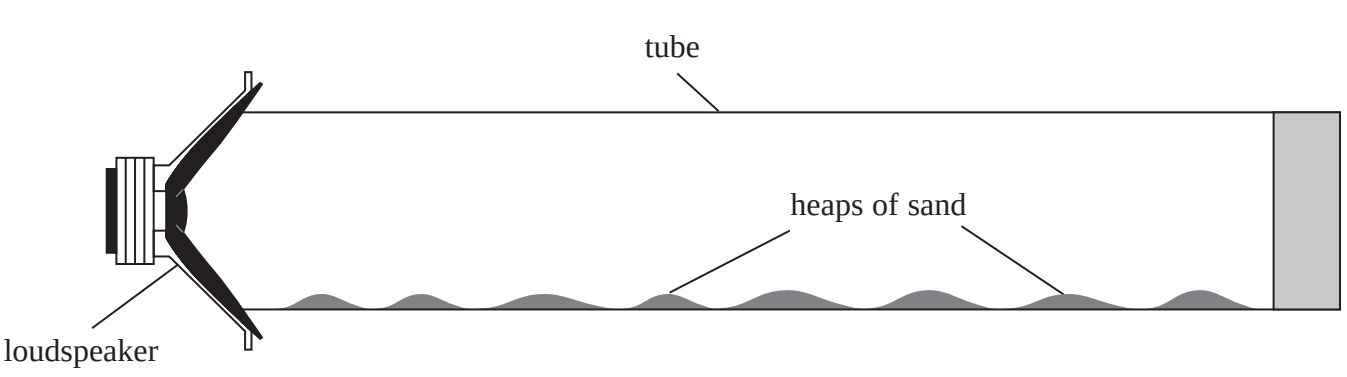
A student made the following observations:

- when an alternating potential difference (p.d.) is applied to the coil, the cone oscillates
- the frequency of oscillation is the same as the frequency of the p.d.
- at particular frequencies, the box vibrates with a large amplitude.

*(a) Explain these observations.

(6)

(b) The student connected a signal generator to the loudspeaker, and placed the loudspeaker near to one end of a long tube containing sand. The student adjusted the signal generator until the sand collected in small heaps as shown.



(i) Explain why the sand collects in heaps.

(4)

(ii) The student determined the distance *d* between the centres of adjacent heaps.

Describe the procedure she should follow to determine an accurate value for *d*.

(3)

(iii) Assess whether the experimental data is consistent with a value for the speed of sound of $340\,m\,s^{-1}$.

signal generator frequency = 3.25 kHz.

d = 5.1 cm

(3)

(Total for Question 9 = 16 marks)