

Experiment VW8 Stationary waves in an air column

Aim

To investigate how the air vibrates in a tube and measure the speed of sound in an air column.

Apparatus

- glass tube (1.0 m–1.5 m long)
- rubber bung
- loudspeaker, diameter 60 mm
- signal generator
- lycopodium powder or cork dust
- metre rule

1 Thoroughly clean and dry the glass tube and introduce a thin layer of lycopodium powder along its length. A convenient way of doing this is to sprinkle the powder on a metre rule, insert the rule in the tube and then invert it. Tape the loudspeaker to the open end of the tube. Use a paper cone to compensate for the different diameters.

2 Set up the apparatus as shown in figure 1. Switch on the signal generator. The speaker will force the air in the tube to vibrate at the same frequency as that produced by the signal generator.

3 Vary the frequency and observe what happens to the powder. Explain why at a particular frequency the powder eventually settles into heaps (piles) at certain positions throughout the length of the tube.

4 Record this frequency and find the average distance between adjacent nodes.

5 Alter the frequency and find another value at which resonance occurs. Repeat step 4.

6 What is the relationship between the distance l between adjacent nodes and the natural frequency f of vibration of the air column?

7 Find an average value for the speed of sound c in the air column at this particular temperature.

Note: You may need to remove the lycopodium powder and re-introduce a thin uniform layer along the length of the tube.

