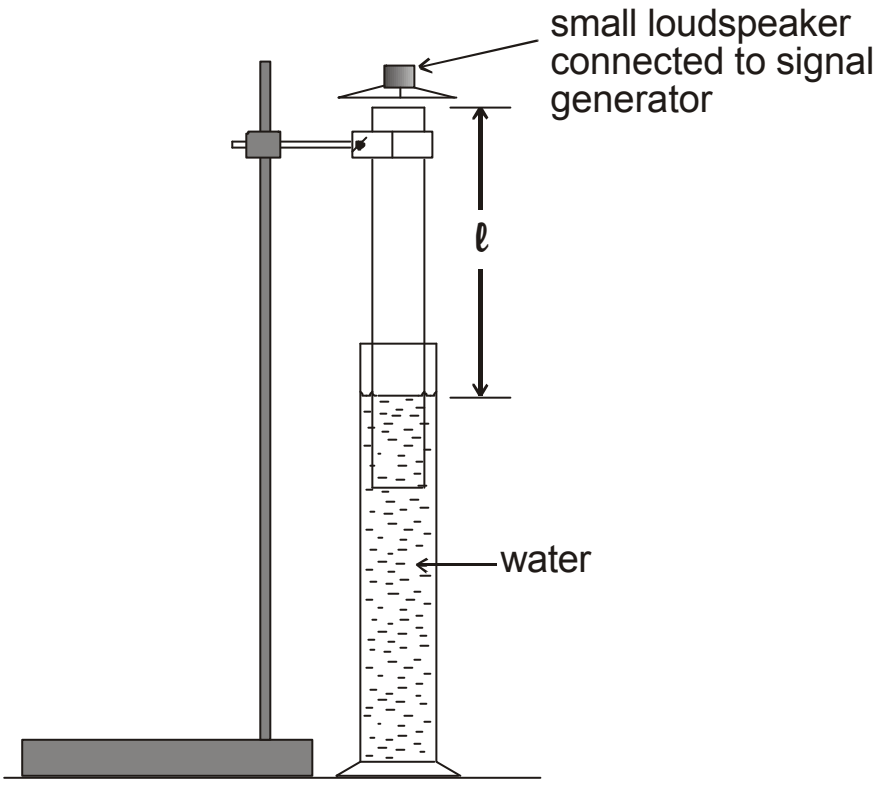
3W

Experiment to measure the speed of sound in a resonance tube

1. **Preparation:** a) Read about resonance in tubes closed at one end. In particular, you should be aware of the fact that the speed of sound in a tube is NOT the same as the speed of sound in open air.

   b) You should know the meaning of the term “end-correction”.

2. Set up apparatus as shown below.



Use the *low impedance* output of the signal generator.

The calibration of most signal generators is approximate. Use a frequency meter to measure the frequencies supplied by the generator. A frequency meter is connected in the same way as a voltmeter.

Cause the air column in the tube to resonate at its fundamental frequency. (If you hear a resonance, how can you be sure that it is the fundamental frequency?) Measure the length of the tube ℓ for a range of frequencies f.

It is much easier to *first* set the frequency and *then* find the length at which resonance occurs for that frequency than to set the length and find the corresponding frequency.

Before starting, make a quick estimate of the frequency of resonance to be expected using the fact that for the fundamental frequency, the length of the tube is approximately equal to one quarter of the wavelength of the sound; this can save a lot of time.

If the speed of sound in the tube is v and the end-correction of the tube is e, then

$$\ell + e = v/4f$$

Plot a graph from which you can find v and e.

The end-correction is usually found to be about 0·6 r where r is the radius of the tube. See if your result agrees with this.