

## Practical 6, Topic 4

### Measuring the speed of sound by the method of resonance

#### Criteria assessed

- DCP
- CE

#### Materials needed

- Set of tuning forks (at least six, ranging in frequency from about 250 Hz to 700 Hz)
- Graduated tube of length up to 40–50 cm and diameter no more than 10–15 cm
- Ruler
- Thermometer

#### What to do

In a tube partially filled with water, a tuning fork of frequency  $f$  will induce vibration of the air molecules if the length of the air column is such that the frequency of the sound produced equals that of the tuning fork. The wavelength of the standing wave in the tube is  $4(L + e)$  where  $L$  is the length of the air column and  $e$  is the end correction. Thus the speed of sound,  $c = 4f(L + e)$ .

- Start with very little water in the tube and sound a tuning fork above the tube.
- Listen for a strong reverberating sound from the tube.
- You must experiment with putting a bit more water in the tube and then taking some out until you convince yourself that the intensity of the sound heard is a maximum? (Do all members of your group agree that the intensity is the largest?)
- Measure the temperature of the room with the thermometer. (Why must you do this?)

Your objective is to measure the speed of sound.

- What will you measure and how will your variables be plotted so that a straight line is obtained?
- How is the speed of sound obtained from your graph?
- How do you determine the end correction  $e$ ?
- What is the ratio  $\frac{e}{D}$  where  $D$  is the diameter of the tube?

This lab will be assessed against criteria DCP and CE.

- What are the uncertainties in the measured quantities?
- What are the uncertainties in the calculated quantities?
- What is the value you obtain for the speed of sound?
- How close is this value to the accepted value (at the given temperature)?