



CHARLES LAW APPARATUS LA30-210

The apparatus consists of a uniform capillary tube, 30cm long, sealed at one end and marked with a linear metric scale. The scale can be used to measure the height of an air column contained below a mercury bead.

Enclosing the air column

Observe normal precautions when handling and using mercury.

A short length of nylon line, about 0.5mm diameter is required. Dip the end of the nylon in some light oil and pass it down the length of the bore. This allows smooth movement of the mercury during the experiment.

Place the sealed end of the tube in a very hot water bath for several minutes and then remove it and invert the open end into a dish containing a small amount of clean mercury. When about 5mm of mercury has been drawn into the tube (as it cools) remove the dish and allow the bead to move down the bore.

Turn the tube over so that the sealed end is at the bottom and pass the nylon line down the tube and through the mercury bead. Gently move the nylon up and down, through the mercury, until the bead has moved to the correct position which is at about the 15 to 17cm mark on the tube.

The Experiment

Since the tube is of uniform bore the length of the air column below the mercury is proportional to its volume. Since the tube is open to the atmosphere the pressure of the air column will remain constant. Provide the students with a tall beaker or pyrex measuring cylinder full of just boiled water to act as a water bath. The tube is immersed to just above the mercury level and when the bead stops rising the air column length is recorded along with the water temperature. The water bath is allowed to cool (by adding cold water in small amounts) and the air column length is recorded for different temperatures. The final temperature should be as close to zero Celsius as possible - by using ice cubes if available.

If the values of column length are plotted against temperature a straight line is obtained with an intercept at -273°C on the temperature axis. This gives the value of Absolute Zero or 0 Kelvin. The modern statement of Charles' Law is shown to be true i.e. at constant pressure the volume of an (ideal) gas is proportional to its absolute temperature.

Alternatives to mercury

Sulphuric Acid
Oil

Lascells Ltd.

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