

Name of the Student: _____

Max. Marks : 19 Marks

Time : 19 Minutes

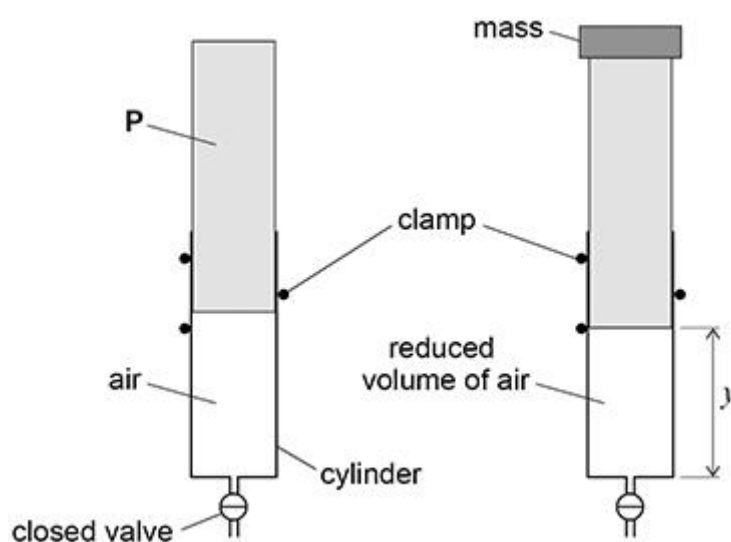
Q1.

Figure 1 shows air trapped in a vertical cylinder by a valve and a piston **P**. The valve remains closed throughout the experiment.

A mass is placed on top of **P**.

P moves downwards and the volume of the trapped air decreases.

There are no air leaks and there is no friction between the cylinder and **P**.

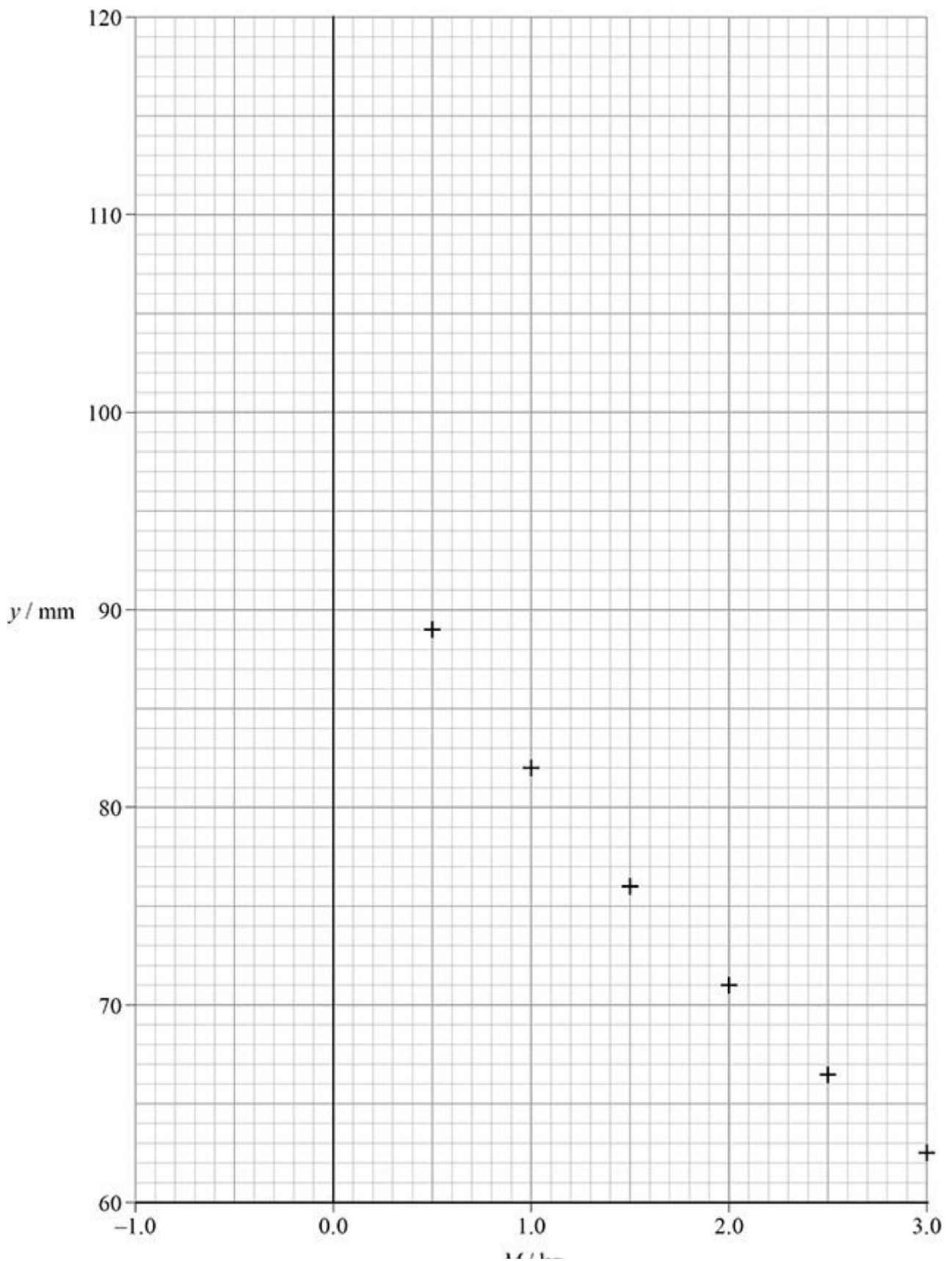
Figure 1

The vertical distance y between the end of **P** and the closed end of the cylinder is measured.

Additional masses are used to find out how y depends on the total mass M placed on top of **P**.

Figure 2 shows a graph of these data.

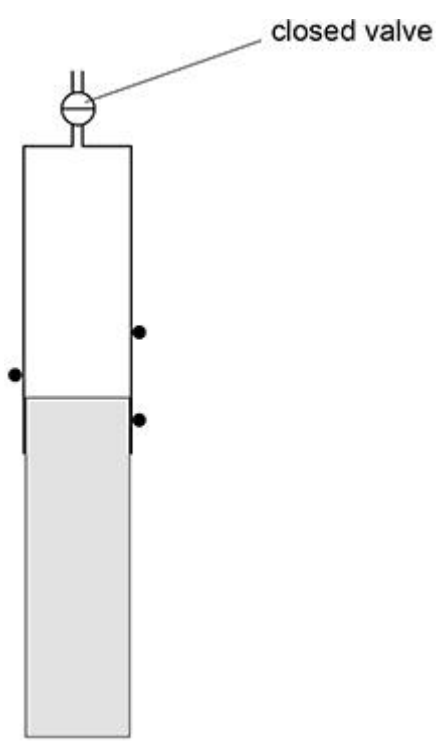
Figure 2



- (a) Show that y is **not** inversely proportional to M .
Use data points from **Figure 2**.

- (b) The masses are removed and the cylinder is inverted. **P** moves downwards without friction before coming to rest, as shown in **Figure 3**.

Figure 3



Explain why **P** does not fall out of the cylinder unless the valve is opened.

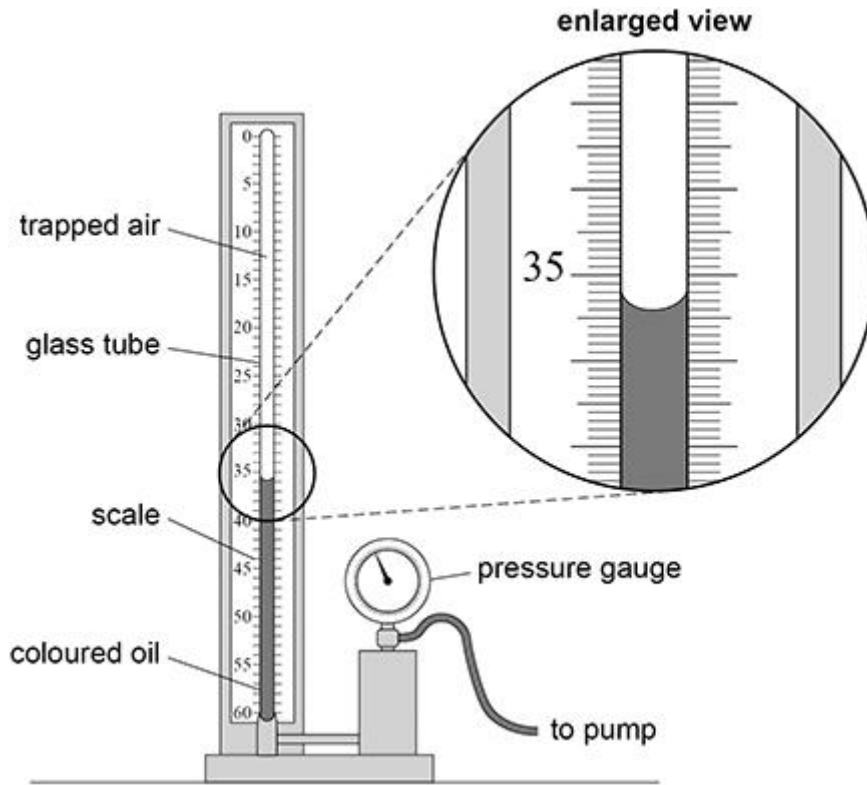
- (c) The mass of **P** is 0.350 kg.

Deduce y when the cylinder is in the inverted position shown in **Figure 3**.

Draw a line of best fit on **Figure 2** to arrive at your answer.

Figure 4 shows apparatus used in schools to investigate Boyle's law.

Figure 4



A fixed mass of air is trapped above some coloured oil inside a glass tube, closed at the top. A pump applies pressure to the oil and the air. The trapped air is compressed and its pressure p is read from the pressure gauge.

- (d) A scale, marked in 0.2 cm^3 intervals, is used to measure the volume V of the air. A student says that the reading for V shown in **Figure 4** is 35.4 cm^3 .

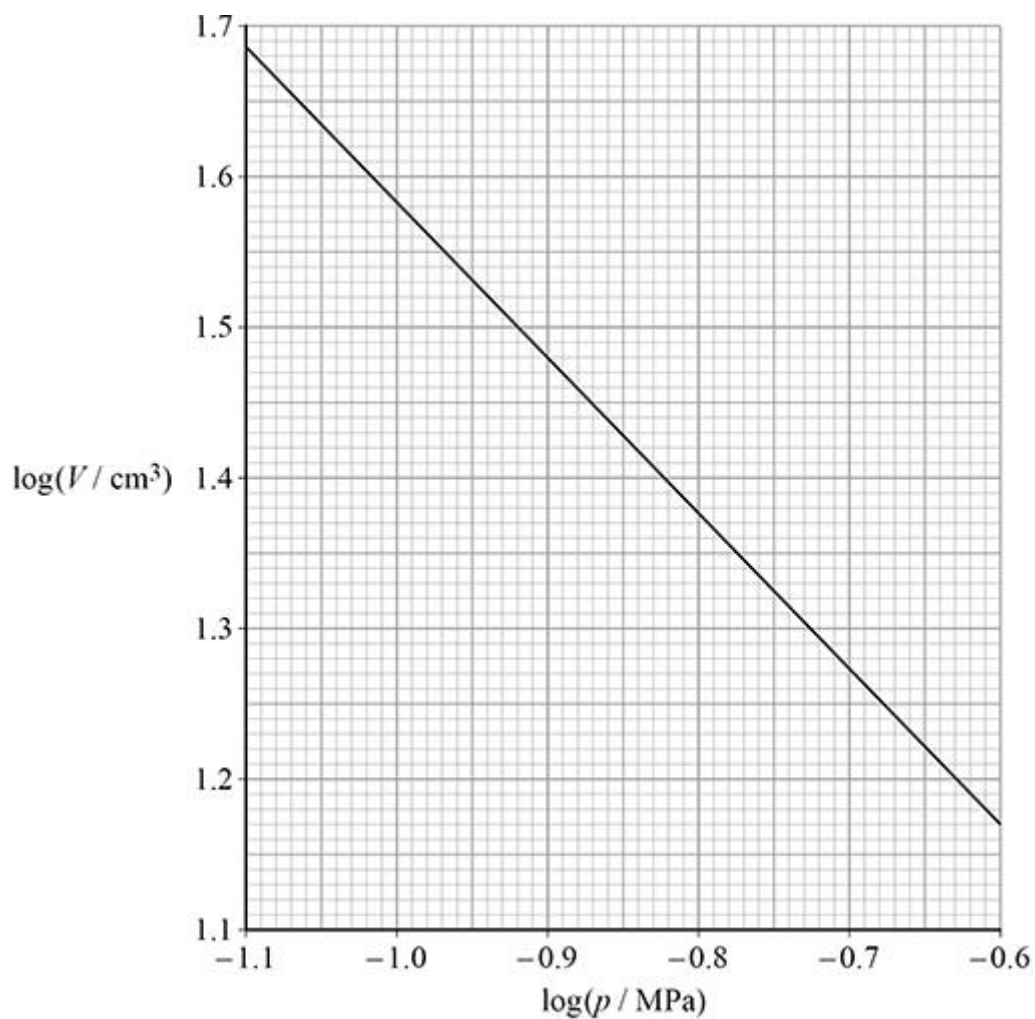
State:

- the error the student has made
- the correct reading, in cm^3 , of the volume.

volume = _____ cm^3

(e) **Figure 5** shows data obtained using the apparatus in **Figure 4**.

Figure 5



Explain why the gradient of the graph in **Figure 5** confirms that the air obeys Boyle's law.

(3)

(f) The largest pressure that can be read from the pressure gauge is $3.4 \times 10^5 \text{ Pa}$.

Determine, using **Figure 5**, the volume V corresponding to this pressure.

$$V = \text{_____ cm}^3$$

(3)

- (g) State **one** property of the air that must not change during the experiment.
Go on to suggest how this can be achieved.

(2)

(Total 19 marks)