

Name of the Student: _____

Max. Marks : 19 Marks

Time : 19 Minutes

Q1.

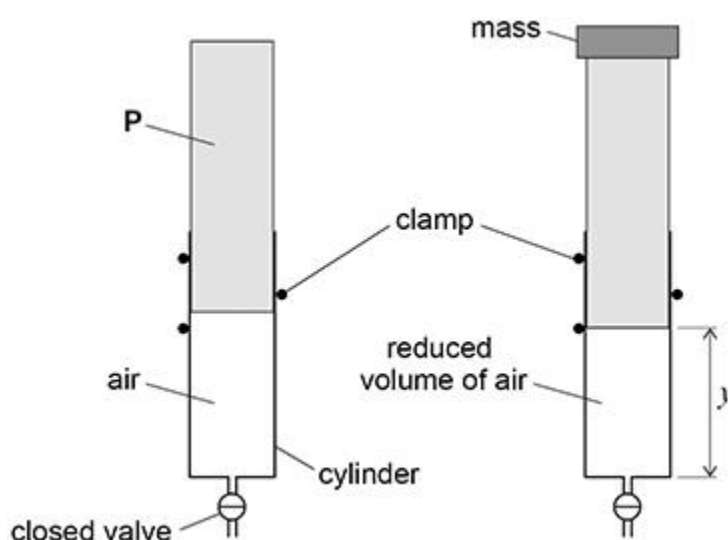
Figure 1 shows air trapped in a vertical cylinder by a valve and a piston **P**.
The valve remains closed throughout the experiment.

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

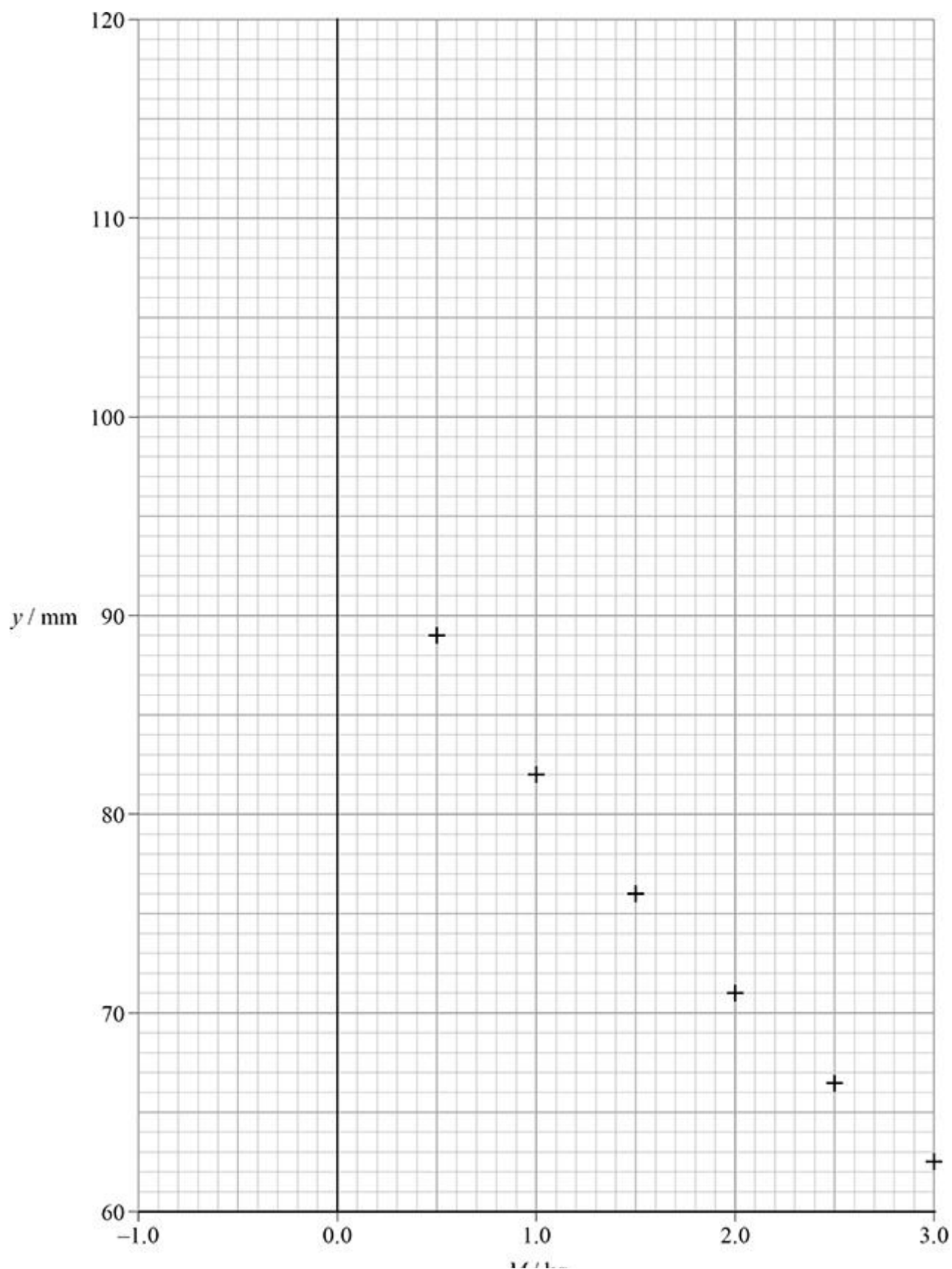


The vertical distance y between the end of **P** and the closed end of the cylinder is measured.

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.

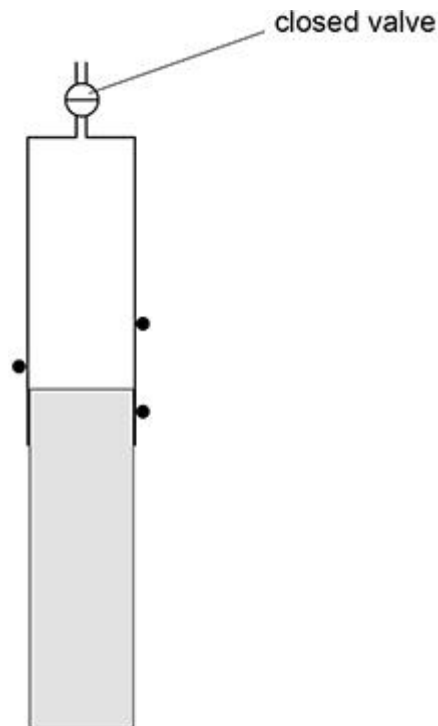
Figure 2



- (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.

(3)

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

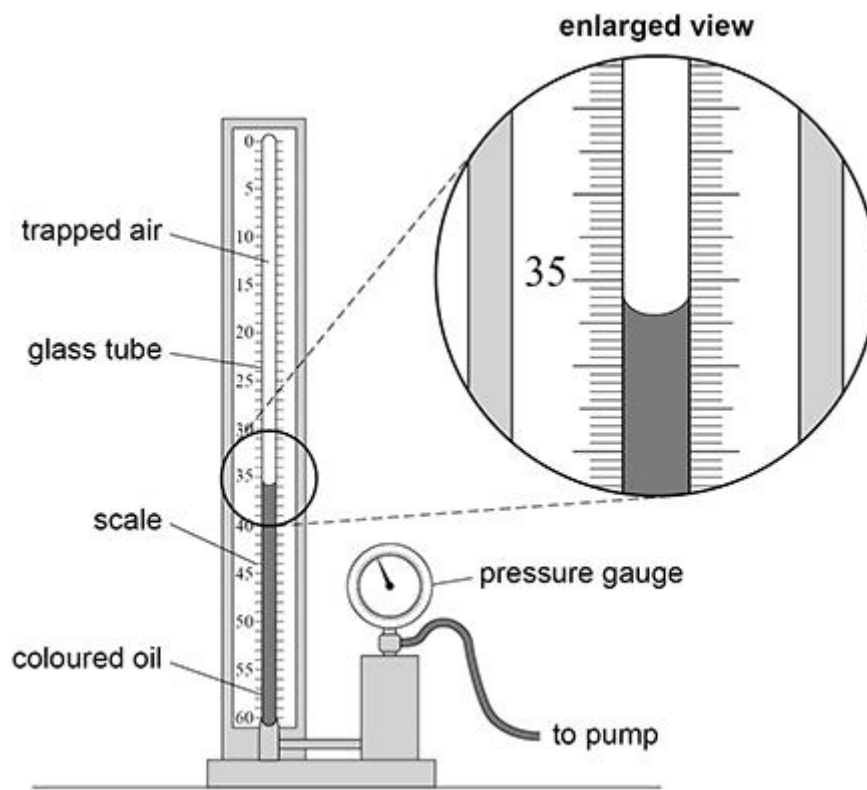
Deduce y when the cylinder is in the inverted position shown in **Figure 3**.

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

$y = \underline{\hspace{2cm}}$ mm (4)

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 .

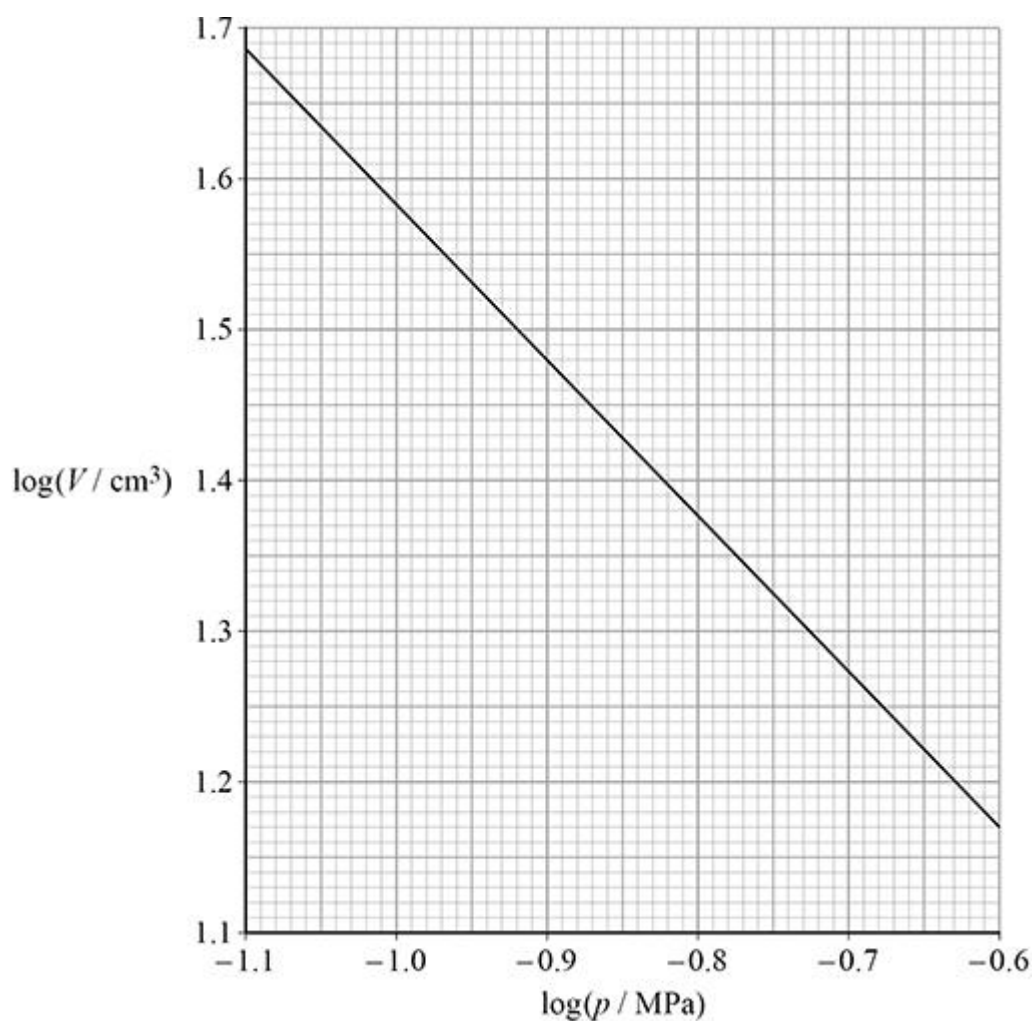
State:

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

volume = $\underline{\hspace{2cm}}$ cm^3 (2)

- (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.

$V = \underline{\hspace{2cm}} \text{ cm}^3$ (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)