

PART A: ASSESSMENT OF LEARNERS' CONDUCT OF THE EXPERIMENT

NAME: _____

Skills	Mark allocation versus level of attainment per skill		
	No mark	1 mark	2 marks
Naming of parts of Boyle's law apparatus	Learner is unable to name all parts	Learner is able to name all parts	
Function of parts of Boyle's law apparatus	Learner is unable to state function of any all parts	Learner is unable to state function of some parts	Learner is able to state function of all parts
Precision	Measurements are inaccurately recorded and without units	Some values are recorded correctly but some aspects are missing or poorly done.	Measurements of both pressure and volume including units are neatly tabulated

Rubric mark = 5

PART B PRACTICAL TASK: THE VERIFICATION OF BOYLE'S LAW

KNOWLEDGE AREA: MATTER AND MATERIALS

AIM: In this experiment we investigate the relationship between the pressure and volume of a fixed mass of gas.

INTRODUCTION

The relationship between the pressure and volume of a fixed mass of gas is explained by Boyle's law.

Volume can be expressed in SI units i.e. cubic meters (m³), cubic centimetres (cm³), or in other units when doing calculations.

$$1000 \text{ cm}^3 = 1000 \text{ ml} = 1 \text{ dm}^3$$

$$1 \text{ m}^3 = 1 \times 10^6 \text{ cm}^3$$

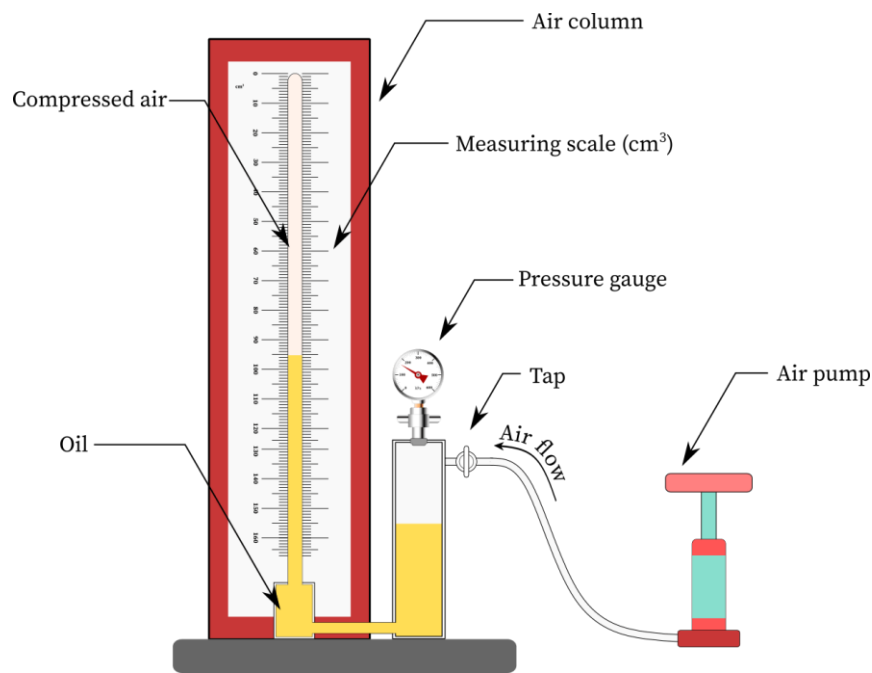
Pressure can be expressed in SI units i.e. pascals (Pa) , kilopascals (kPa), megapascals (MPa), atmospheres (atm) or other units when doing calculations.

$$1 \text{ kPa} = 1000 \text{ Pa}$$

$$101,325 \text{ kPa} = 1 \text{ atmosphere (1 atm)} = \text{standard pressure}$$

APPARATUS

- Boyle’s law apparatus



PROCEDURE

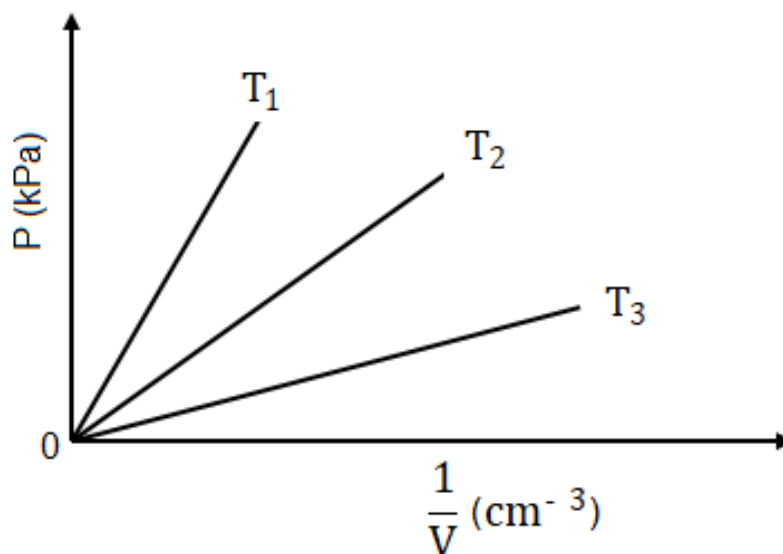
- Use the pump to increase the pressure on the enclosed mass of air.
- Record both the pressure and the volume of air once the oil has stabilised.
- Repeat the experiment for a set of at least four more values.
- Complete the following table using the values obtained (4)

Pressure (kPa)	Volume (cm³)	$\frac{1}{V}$ (cm ⁻³)	pV

- What is observable about the values of pV in the table above? (1)
- Plot a graph with volume on the horizontal axis versus pressure on the vertical axis. (3)
- Why is pressure plotted along the vertical axis? (1)
- Plot a graph of the inverse of the volume versus pressure. (3)
- What conclusion can you draw from the graph obtained in 8 above? (2)
- Express the conclusion in 9 above in the form of an equation. (2)
- Show that the slope of the graph obtained in 8 above has units of energy. (2)
- Why should we wait for a few minutes when taking readings? (2)

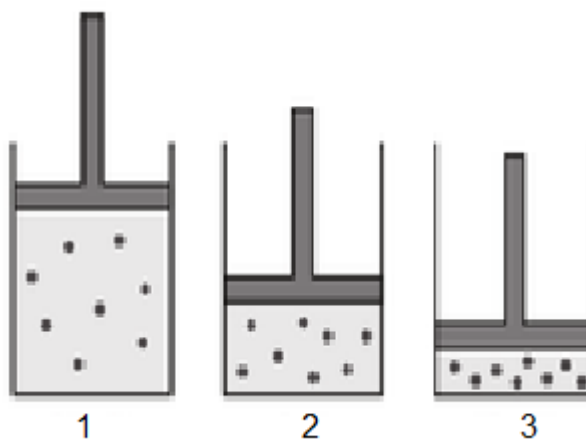
PART C

1. When a balloon is inflated at constant temperature, both the volume and the pressure will increase. Explain why Boyle's law is not applicable in this example. (1)
2. Draw a graph to indicate how the graph obtained in PART B No. 8 will behave at very high pressure. (2)
3. Consider the following graphs of pressure versus the reciprocal of volume for a given mass of a particular gas.



Discuss what happened during this investigation. (3)

4. The following diagrams represents a sealed piston which encloses a gas.



From observation of these diagrams,...

- 4.1. Which variable decreased when the change from diagram 1 to diagram 3 took place? (1)
- 4.2. Which variable stayed constant when the change from diagram 1 to diagram 3 took place? (1)
5. A helium balloon has a volume of 735 ml at ground level. The balloon is transported to an altitude where the pressure is 0.8 atm. At this altitude, the gas occupies a volume of 1286 ml. Assuming that the temperature is constant, what is the pressure at ground level in kilopascals? (4)

6. An enclosed gas is at a pressure of 143,95 kPa. If the volume is increased by 40% at constant temperature. What is the new pressure in kilopascals? (4)
7. A 50,0 cm³ soap bubble is formed at standard pressure. When a thunder storm passes later in the day, the pressure changes to 93,326 kPa. Will the soap bubble size become BIGGER, SMALLER or REMAIN UNCHANGED? Assume that the temperature stays constant. If the bubble changes its size, what will the change be, in cubic centimetres? (5)
8. The total volume of carbon dioxide (CO₂(g)) and marble chips (CaCO₃(s)) in a container is 100 cm³. The pressure in the container is 101,33 kPa. If the pressure is increased to 133,33 kPa at constant temperature, the volume decreases to 80 cm³. What is the volume of the marble chips in cubic centimetres? (4)

[25]