



education

DEPARTMENT: EDUCATION
MPUMALANGA PROVINCE

GERT SIBANDE DISTRICT

GRADE 11

PHYSICAL SCIENCES TOPIC TEST

TOPIC: IDEAL GASES AND THERMAL PROPERTIES

SEPTEMBER 2023

MARKS: 50
TIME: 1 hour

This question paper consists of 8 pages and 1 graph paper

INSTRUCTIONS AND INFORMATION

1. Write your name in the appropriate space on the ANSWER BOOK.
2. This question paper consists of FOUR questions. Answer ALL the questions in the ANSWER BOOK.
3. Start EACH question on a NEW page in the ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave ONE line between two sub questions, for example between QUESTION 2.1 and QUESTION 2.2.
6. Give brief motivations, discussions, etc, where required.
7. Write neatly and legibly.



QUESTION 1

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write only the letter (A–D) next to the question number (1.1–1.5) in the ANSWER BOOK.

1.1 Which one of the following statements regarding the Kinetic Molecular Theory of ideal gases is INCORRECT?

- A Gas molecules collide elastically.
- B All molecules have the same kinetic energy.
- C Gas molecules are in random motion.
- D Attractive and repulsive forces can be neglected. (2)

1.2 The temperature of a gas is referred to as ...

- A the heat of the gas.
- B the product of the pressure and volume of the gas.
- C the measure of the average volume of the gas molecules.
- D the measure of the average kinetic energy of the gas molecules. (2)

1.3 Two gas syringes, **Q** and **R**, each contains the same gas at STP. The volume of syringe **Q** is 20 cm^3 and that of syringe **R** is 40 cm^3 as shown below. Assume ideal gas behaviour.



The CORRECT description of the gases in syringes **Q** and **R** is that:

- A The average kinetic energy of the molecules in **Q** is less than that of the molecules in **R**.
- B The total kinetic energy of the molecules in **Q** is less than that of the molecules in **R**.
- C The number of gas molecules in **Q** is equal to the number of gas molecules in **R**.
- D The product pV in **Q** is equal to the product pV in **R**. (2)

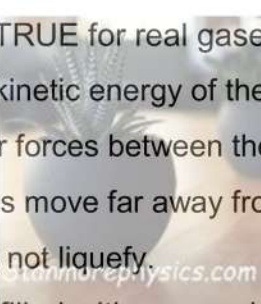
1.4 Which of the following statements best describe the kinetic theory of gases?

- 
- i The molecules of a gas occupy a specific volume.
 - ii There are very weak intermolecular forces between the particles of a gas.
 - iii The collisions between the gas particles are perfectly elastic.
 - iv Gas molecules exert no pressure when colliding with each other or with the volume of the container.

- A i. and ii.
- B iii. and iv.
- C ii. and iii.
- D i. and iv.

(2)

1.5 Which statement is TRUE for real gases at LOWER temperature?

- 
- A The average kinetic energy of the gas molecules is lower.
 - B Intermolecular forces between the gas molecules decreases.
 - C Gas molecules move far away from each other.
 - D The gas does not liquefy.

(2)

1.6 A cubic container is filled with a gas which exerts a pressure p . What will the Pressure exerted by the same amount of this gas be if the gas is placed in a cubic container whose side is half of that of the original container?

- 
- A $\frac{1}{8} p$
 - B $\frac{1}{4} p$
 - C $4p$
 - D $8p$

(2)

[12]

QUESTION 2

A certain amount of gas is sealed in a container of which the volume can change. The relationship between the pressure and volume of the gas at 20 °c is investigated. The results of the experiment are given in the table below.

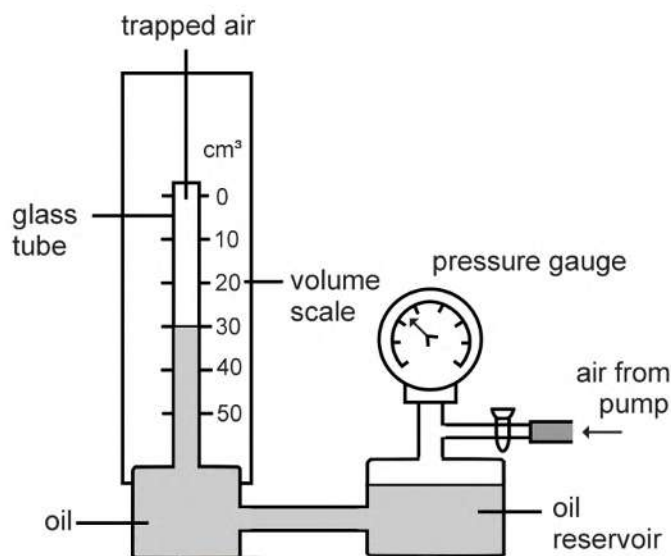
PRESSURE (kPa)	VOLUME (cm ³)
50	33
70	25
100	20
150	15
220	10
380	5

- 2.1 Use the ATTACHED GRAPH PAPER to draw a graph of volume versus pressure. (4)
- 2.2 Using the results in the table above or the graph drawn in question 2.1, Write down the:
 - 2.2.1 Dependent variable. (1)
 - 2.2.2 A mathematical expression, in symbols, for the relationship between the variables shown on the graph. (1)
 - 2.2.3 Pressure of the gas in kpa , when the volume is 19 cm³. (1)
- 2.3 Explain the relationship in QUESTION 2.2.2 in terms of the kinetic theory of gases. (2)
- 2.4 Write down the TWO variables that must be kept constant during this investigation. (2)
- 2.5 Briefly state how each variable in QUESTION 2.4 is kept constant. (2)

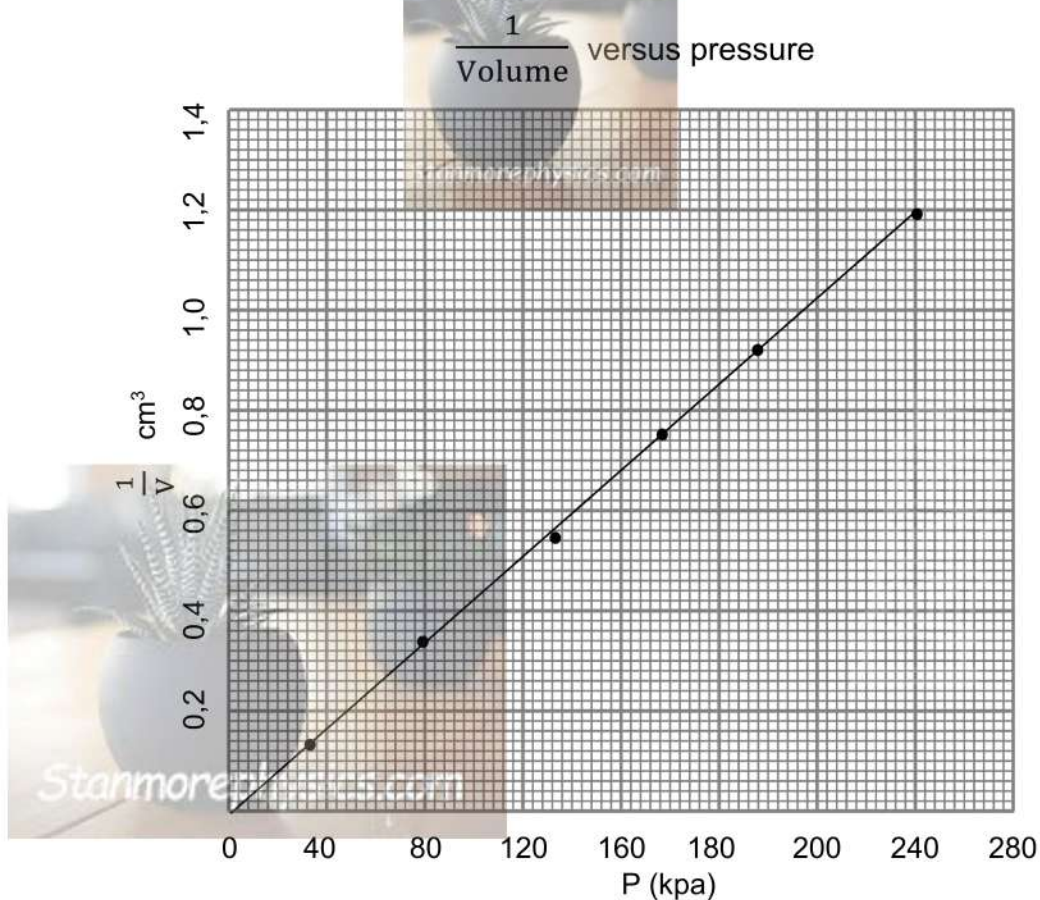
[13]

QUESTION 3

The setup of apparatus below was used in an investigation to verify an ideal gas law. A fixed mass of nitrogen was used in each investigation.



The results obtained are shown in the graph below.



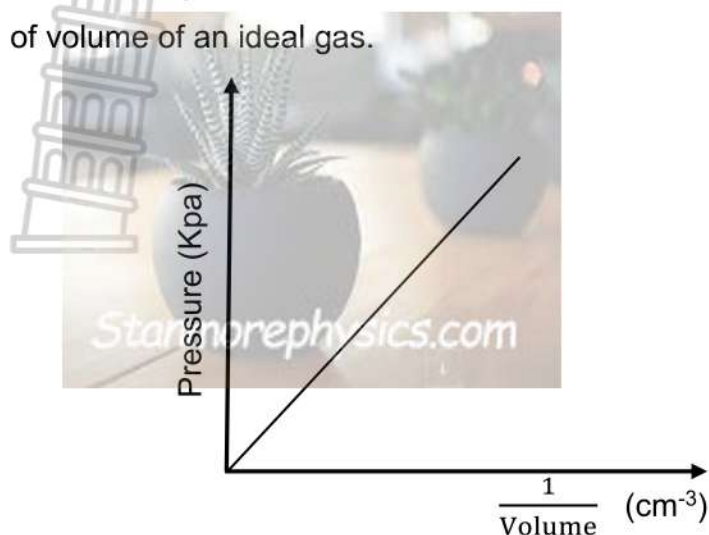
- 3.1 For this investigation, write down:
- 3.1.1 The investigative question. (2)
 - 3.1.2 The independent variable. (1)
 - 3.1.3 TWO precautions that were taken. (2)
- 3.2 Using the graph, write down:
- 3.2.1 The name of the ideal gas law which was being investigated, and state the law in words. (3)
 - 3.2.2 The volume of the gas in cm^3 when the pressure is 112Kpa. (2)
 - 3.2.3 The physical quantity that can be determined from the gradient of the graph. (1)
- 3.3 Under which temperature condition do real gases deviate from ideal gas behavior? Write only HIGH or LOW. Use kinetic theory of gases to explanation the answer. (3)

[14]



QUESTION 4

The sketch graph below shows the relationship between pressure and inverse of volume of an ideal gas.



- 4.1 Re, draw the above graph in the answer book. On the same set of axes, use a **BROKEN LINE** to sketch the graph that will be obtained for a real gas. (2)
- 4.2 Use the graph in QUESTION 4.1 and kinetic theory of gases to explain how real gases deviate from ideal gas behaviour. (3)
- 4.3 Write down **TWO** conditions under which real gases approaches ideal gas behaviour. (2)
- 4.4 Vehicle manufactures specify that the tyres of each specific vehicle must be filled with air not exceeding the recommended amount. Explain in terms of kinetic molecular theory, why it is dangerous to inflate a vehicle's tyres with air exceeding the recommended amount, especially when driving a long journey. (4)

[11]

TOTAL: 50

QUESTION 2.1

LEARNER'S NAMES:.....





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SEPTEMBER 2023
Marking guidelines

MARKS: 50

These marking guidelines consist of 4 pages

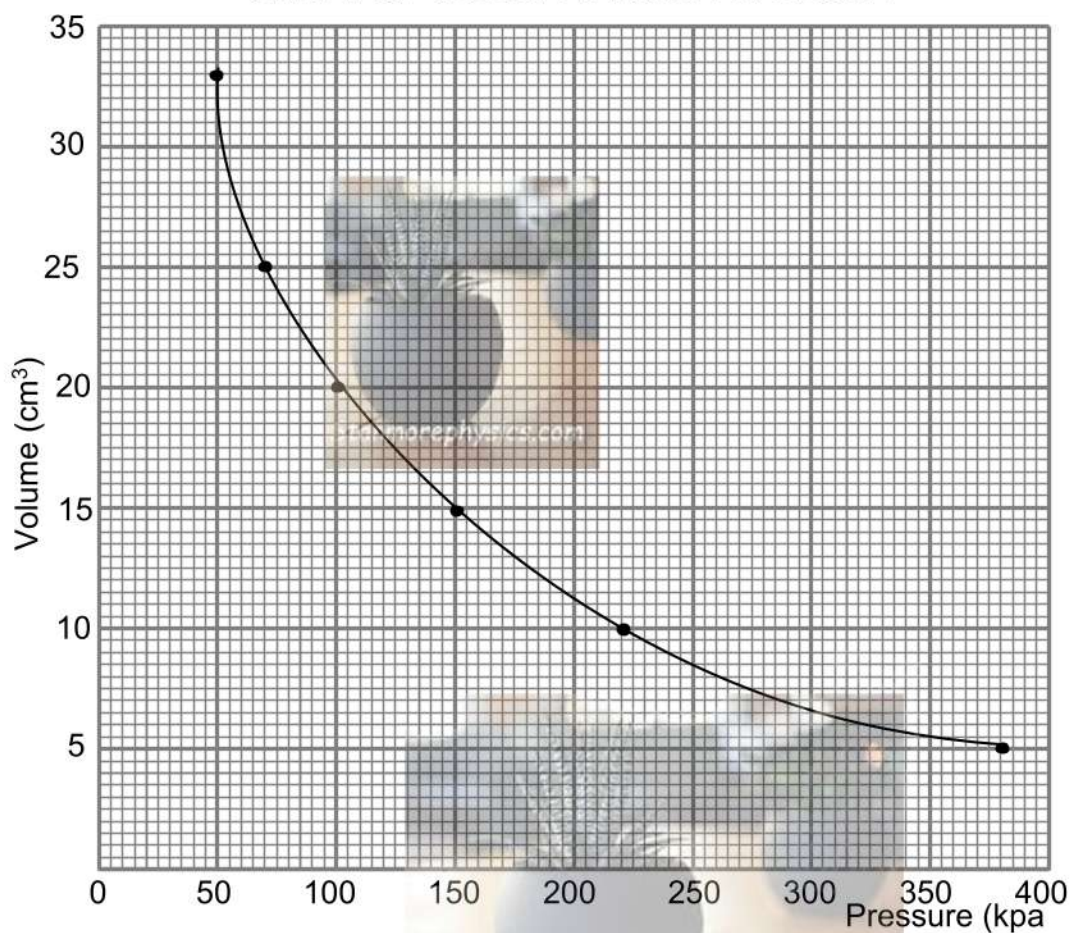
QUESTION 1

- | | | |
|-----|------|-------------|
| 1.1 | B ✓✓ | (2) |
| 1.2 | D ✓✓ | (2) |
| 1.3 | B ✓✓ | (2) |
| 1.4 | C ✓✓ | (2) |
| 1.5 | A ✓✓ | (2) |
| 1.6 | D ✓✓ | (2) |
| | | [12] |

QUESTION 2

2. 1

GRAPH OF VOLUME VERSUS PRESSURE



Criteria for marking the graph.

Both axes correctly labelled.

✓

At least 4 points correctly plotted.

✓✓

Correct shape.

✓

(4)

2.2.1 Volume ✓ (1)

2.2.2 $p \propto \frac{1}{V}$ OR $V \propto \frac{1}{p}$ ✓ (1)

2.2.3 110 kpa ✓ (1)

2.3 As the volume of the container decreases, the number of collisions per unit area ✓ on the walls of the container increases ✓ (2)

2.4 Mass ✓
Temperature ✓ (2)

2.5 **ANY TWO**
 • Volume readings are taken some time after increasing the pressure. ✓
 • Pressure is increased in small amounts to minimise the temperature changes. ✓
 • Same mass of gas is trapped (in tube)./ensure that there is no leakage of gas. ✓ (2)

[13]

QUESTION 3

3.1.1 What is the relationship between the volume of nitrogen/a gas and pressure? ✓✓ [OR: any other relevant statement] (2)

3.1.2 Pressure ✓ (1)

3.1.3 Temperature is kept constant ✓
Same mass/ amount of the gas is used ✓ (2)

3.2.1 Boyle's Law ✓
The pressure of an enclosed gas is inversely proportional to the volume it occupies at constant temperature. ✓✓ [2 or 0 mk] (3)

3.2.2 $\frac{1}{V} = 0,48 \text{ cm}^3$ ✓
 $V = 1,45 \text{ cm}^3$ ✓✓ (2)

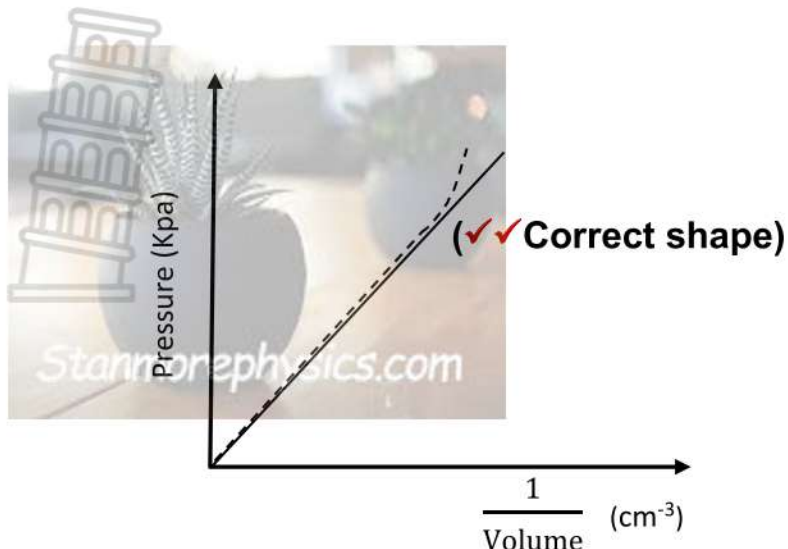
3.2.3 Temperature ✓ (1)

3.3 LOW ✓
At low temperature, the gas molecules move slower/with less kinetic energy and closer together ✓ Until the gas starts to condense ✓
OR: At low temperature, the intermolecular forces of attraction become significant ✓ then the gas condenses. ✓ (3)

[14]

QUESTION 4

4.1



(2)

- 4.2 At high pressure the gas particles are closer together. ✓
The forces of attraction between the particles become significant and increase. ✓
Resulting in an increase in volume, and the gas begins to liquefy. ✓

(3)

- 4.3 At low pressure ✓
At high temperature ✓

(2)

- 4.4
- Using excess tyre pressure/air increases the number of gas particles in the tyre. ✓
 - As the car moves the temperature in the tyre increases leading to an increase in the kinetic energy of the particles. ✓
 - This leads to an increase in the number and the rate of collisions between the gas particles and the inside of the tyre, increasing the pressure further. ✓
 - Since no further expansion is possible (tyre is rigid), the continue increase in pressure will cause the tyre to burst. ✓

(4)

[11]

TOTAL:50