

GCSE Chemistry (9 – 1)

Mole Gases

Name:

Group:

Instructions

- Read each question carefully before you begin to answer it.
- Use black ink or black ball-point pen for your answers.
- Fill in the boxes at the top of this page with your name and group.
- Attempt to answer every question in the booklet.
- Answer the questions in the spaces provided – there may be more space than you need in some answer spaces.
- Calculators may be used for this booklet.
- For any calculations, you **must** show all your working.
- Any and all drawings or graphs should be completed in pencil.



For markers use	
Question	Mark
1	/5
2	/8
3	/8
4	/6
5	/6
6	/6
7	/4
8	/4
Total	/47
%	
Grade	

Information

- The maximum mark for this paper is 47 marks.
- The marks for each question are shown in brackets.
- Please be aware that good English and clear presentation are required in your answers.



1. The “**mole**” allows us to easily convert between gas volumes and amounts, we can do this based on the key fact that one mole of any gas occupies exactly 24dm^3 at room temperature and pressure (r.t.p).

Circle the letter of the correct answer for each of the following questions.

- a. At room temperature and pressure (r.t.p.), what volume does 1 mole of any gas occupy?

A

12 dm^3

B

24 dm^3

C

240 dm^3

D

100 dm^3

(1 mark)

- b. Calculate the number of moles in 48 dm^3 of oxygen gas at r.t.p.

A

0.5 mol

B

2.0 mol

C

24 mol

D

1152 mol

(1 mark)

- c. Look at the balanced equation for the decomposition of calcium carbonate:



If you thermally decompose 0.5 moles of CaCO_3 , what volume of CO_2 gas is produced at r.t.p.?

A

0.5 dm^3

B

12 dm^3

C

24 dm^3

D

48 dm^3

(1 mark)

- d. A student reacts magnesium with water to produce hydrogen gas:



If 2 moles of water react completely, what volume of hydrogen gas is produced?

A

12 dm^3

B

24 dm^3

C

36 dm^3

D

48 dm^3

(1 mark)

- e. What is the volume of 4 g of helium (He) gas at r.t.p.?
(Relative atomic mass of He = 4)

A

4 dm^3

B

6 dm^3

C

24 dm^3

D

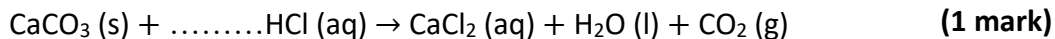
96 dm^3

(1 mark)

(Total for Question 1 is 5 marks)

2. A student investigates the reaction between calcium carbonate (marble chips) and dilute hydrochloric acid.
- Relative atomic masses (Ar): Ca = 40, C = 12, O = 16.
 - Molar volume of gas at room temperature and pressure (r.t.p.) = 24 dm³/mol.

a. Balance the chemical equation for this reaction.



The reaction produces carbon dioxide gas.

b. Describe the chemical test for carbon dioxide and the result you would see.

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(2 marks)

The student uses 5.0 g of calcium carbonate (CaCO₃) and excess acid.

c. Calculate the theoretical maximum volume of carbon dioxide gas produced. Give your answer in dm³.

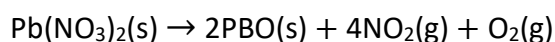
Volume = ...dm³
(3 marks)

d. The student collected the gas in a measuring cylinder. The actual volume collected was 0.96 dm³. Calculate the percentage yield of the reaction.

Percentage Yield = ... %
(2 marks)

(Total for Question 2 is 8 marks)

3. Lead is an element in Group 4 of the Periodic Table.
- a. Lead(II) oxide is formed when lead(II) nitrate, $\text{Pb}(\text{NO}_3)_2(\text{s})$, is heated strongly.



- i. Lead(II) oxide is a metal oxide. State whether this oxide is acidic or basic.

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(1 mark)

- ii. State the meaning of the Roman numeral (II) in the name lead(II) nitrate.

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(1 mark)

0.0100 moles of $\text{Pb}(\text{NO}_3)_2(\text{s})$ is heated in a crucible.

- b. Calculate the mass of 0.0100 moles of $\text{Pb}(\text{NO}_3)_2(\text{s})$.
(Relative atomic masses: Pb = 207, N = 14, O = 16)

Mass = ... g
(2 marks)

- c. Calculate the total volume of gas, in dm^3 at r.t.p., produced when 0.0100 moles of $\text{Pb}(\text{NO}_3)_2$ is heated.
(Molar volume of gas at r.t.p. = 24 dm^3)

Volume = ... dm^3
(2 marks)

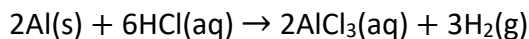
Carbon can be used to remove the oxygen from lead(II) oxide.

- d. Write the symbol equation for the reaction between lead(II) oxide and carbon to form lead and carbon dioxide.

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(2 marks)

(Total for Question 3 is 8 marks)

4. A student investigates the reaction between a piece of aluminium foil and excess dilute hydrochloric acid. The balanced equation for the reaction is:



The student uses **1.35 g** of aluminium.

- a. Calculate the volume of hydrogen gas produced at room temperature and pressure.
Give your answer in **dm³** and show your working.

- Relative atomic masses (Ar): Al = 27
- Molar volume of gas at room temperature and pressure (r.t.p.) = 24 dm³/mol.

Volume = ... dm³
(4 marks)

- b. The student collected the hydrogen gas in a measuring cylinder inverted in a trough of water.
The actual volume collected was less than the calculated value.

Suggest **two** reasons why the volume collected was less than expected.

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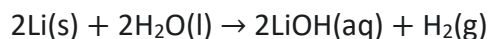
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(2 marks)

(Total for Question 4 is 6 marks)

5. A teacher demonstrates the reaction between lithium metal and water.
The balanced equation for the reaction is:



The teacher uses 0.7 g of lithium.

- a. Calculate the volume of hydrogen gas produced at room temperature and pressure.
Give your answer in dm^3 .
- Relative atomic masses (Ar): Li = 7
 - Molar volume of gas at room temperature and pressure (r.t.p.) = $24 \text{ dm}^3/\text{mol}$.

Volume = ... dm^3
(4 marks)

After the reaction is complete, the teacher adds a few drops of universal indicator to the solution formed.

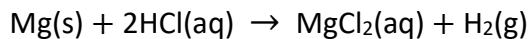
- b. State the colour the Universal Indicator would turn and explain why.

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(2 marks)

(Total for Question 5 is 6 marks)

6. A student investigates the reaction between magnesium powder and hydrochloric acid.
The equation for the reaction is:



The student mixes 1.20 g of magnesium with 2.19 g of hydrogen chloride (dissolved in water).
Calculate the volume of hydrogen gas produced at room temperature and pressure.

You **must** show your working to determine which reactant is limiting.

Relative atomic masses (Ar): Mg = 24, H = 1, Cl = 35.5

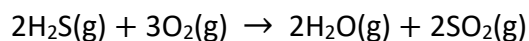
Molar volume of gas at room temperature and pressure (r.t.p.): 24 dm³/mol.

Volume = ... dm³

(6 marks)

(Total for Question 6 is 6 marks)

7. Hydrogen sulfide burns in oxygen to produce steam and sulfur dioxide.



50 dm³ of hydrogen sulfide is mixed with 60 dm³ of oxygen and ignited.

Calculate the final total volume of the gas mixture at the end of the reaction.

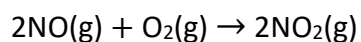
Assume all gases are measured at the same temperature and pressure.

Volume = ... dm³

(4 marks)

(Total for Question 7 is 4 marks)

8. Nitrogen monoxide reacts with oxygen to form nitrogen dioxide.



10 cm³ of nitrogen monoxide is mixed with 10 cm³ of oxygen.

Calculate the total volume of gas remaining at the end of the reaction.

Assume all gases are measured at the same temperature and pressure.

Volume = ... dm³

(4 marks)

(Total for Question 8 is 4 marks)