AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.3.5

Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Past-paper questions

Tier	**Higher**
Question groups	**12**
Available paper years	**2018–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

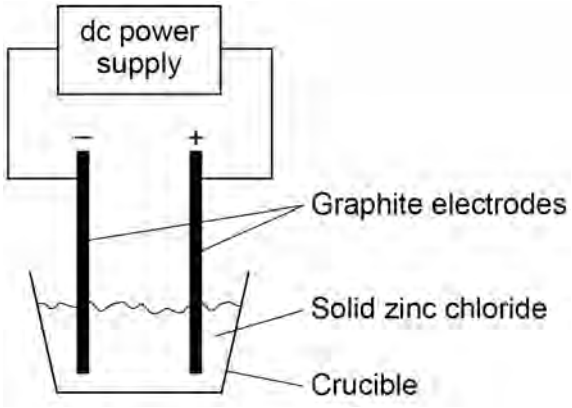
Question 01

June 2018 | 8462/1H | Original Q6

0 6 A student investigated the electrolysis of different substances.

Figure 6 shows the apparatus.

Figure 6



0 6 . 1 Explain why electrolysis would **not** take place in the apparatus shown in **Figure 6**.

[2 marks]

0 6 . 2 Explain why graphite conducts electricity.

Answer in terms of the structure and bonding in graphite.

[3 marks]

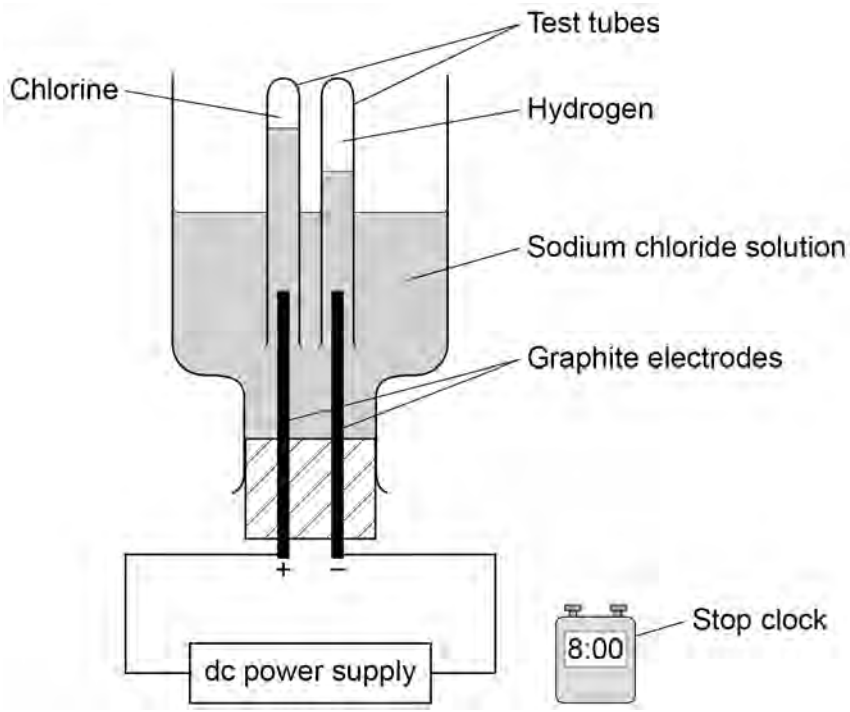
4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 01 · continued

The student investigated how the volume of gases produced changes with time in the electrolysis of sodium chloride solution.

Figure 7 shows the apparatus.

Figure 7



0 6 . 3 The student made an error in selecting the apparatus for this investigation.

How should the apparatus be changed?

Give **one** reason for your answer.

[2 marks]

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

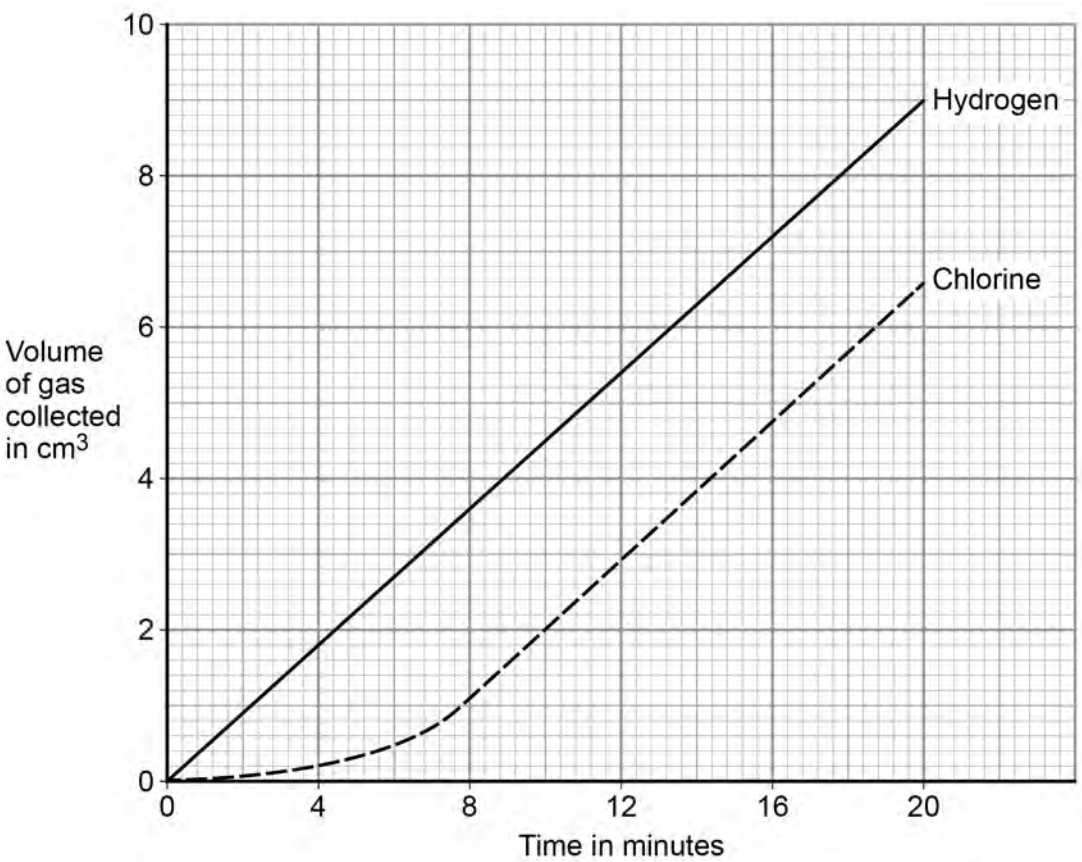
Question 01 · continued

Another student used the correct apparatus.

This student measured the volumes of gases collected every minute for 20 minutes.

Figure 8 shows the student's results.

Figure 8



0 6 . 4 Describe the trends shown in the results.

Use values from **Figure 8**.

[3 marks]

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 01 · continued

0 6 . 5 The number of moles of each gas produced at the electrodes is the same.

No gas escapes from the apparatus.

Suggest **one** reason for the difference in volume of each gas collected.

[1 mark]

0 6 . 6 Calculate the amount in moles of chlorine collected after 20 minutes.

Use **Figure 8**.

The volume of one mole of any gas at room temperature and pressure is 24.0 dm^3

Give your answer in standard form.

[3 marks]

Moles of chlorine = _____ mol

14

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 02

June 2019 | 8462/2H | Original Q5

0 5 This question is about combustion of fuels.

0 5 . 1 Some central heating boilers use wood as a fuel.

Suggest **two** reasons why wood is more sustainable than natural gas as a fuel for central heating boilers.

[2 marks]

1 _____

_____

2 _____

_____

Natural gas is mainly methane.

When methane burns it can produce both carbon monoxide and carbon dioxide.

0 5 . 2 Explain the process by which carbon monoxide can be produced when methane is burned.

[2 marks]

_____

_____

_____

_____

0 5 . 3 Balance the equation for the combustion of methane to produce carbon monoxide.

[1 mark]

$$___\ CH_4(g) + ___\ O_2(g) \rightarrow ___\ CO(g) + ___\ H_2O(l)$$

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 02 · continued June 2019 | 8462/2H | Original Q5

0 5 . 4 Propane burns to form carbon dioxide and water.

The equation for the reaction is:

$$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(l)$$

3.60 dm^3 carbon dioxide is produced when a sample of propane is burned in 7.25 dm^3 oxygen.

Calculate the volume of unreacted oxygen.

Give your answer in cm^3

[4 marks]

Volume of unreacted oxygen = _____ cm^3

9

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

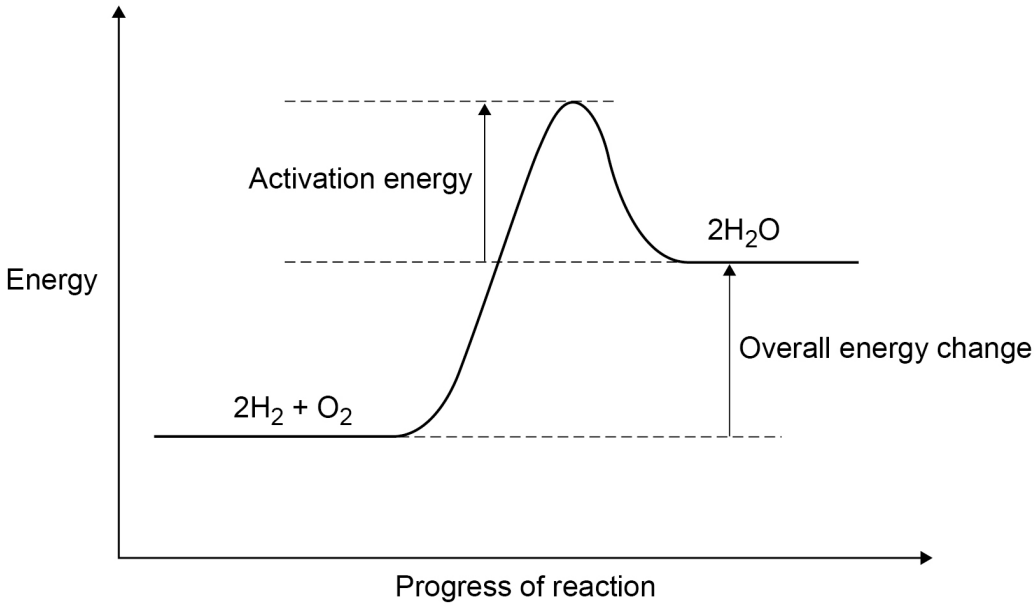
Question 03

0 7 The reaction between hydrogen and oxygen releases energy.

0 7 . 1 A student drew a reaction profile for the reaction between hydrogen and oxygen.

Figure 3 shows the student's reaction profile.

Figure 3



The student made **two** errors when drawing the reaction profile.

Describe the **two** errors.

[2 marks]

1 _____

_____

2 _____

_____

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 03 · continued

0 7 . 2 The reaction between hydrogen and oxygen in a hydrogen fuel cell is used to produce electricity.

Hydrogen fuel cells and rechargeable cells are used to power some cars.

Give **two** advantages of using hydrogen fuel cells instead of using rechargeable cells to power cars.

[2 marks]

1 _____

_____

2 _____

_____

0 7 . 3 Reactions occur at the positive electrode and at the negative electrode in a hydrogen fuel cell.

Write a half equation for **one** of these reactions.

[1 mark]

_____

Question 7 continues on the next page

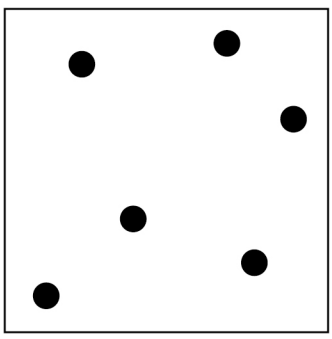
4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 03 · continued

0 7 . 4 The three states of matter can be represented by a simple particle model.

Figure 4 shows a simple particle model for hydrogen gas.

Figure 4



Give **two** limitations of this simple particle model for hydrogen gas.

[2 marks]

1 _____

_____

2 _____

_____

0 7 . 5 The hydrogen gas needed to power a car for 400 km would occupy a large volume.

Suggest **one** way that this volume can be reduced.

[1 mark]

_____

_____

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 03 · continued

0 7 . 6 The energy needed for a car powered by a hydrogen fuel cell to travel 100 km is 58 megajoules (MJ).

The energy released when 1 mole of hydrogen gas reacts with oxygen is 290 kJ

The volume of 1 mole of a gas at room temperature and pressure is 24 dm^3

Calculate the volume of hydrogen gas at room temperature and pressure needed for the car to travel 100 km

[4 marks]

Volume of hydrogen gas = _____ dm^3

12

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 04

November 2020 | 8462/2H | Original Q8

0 8 This question is about the rate of the reaction between hydrochloric acid and calcium carbonate.

A student investigated the effect of changing the size of calcium carbonate lumps on the rate of this reaction.

This is the method used.

1. Pour 40 cm^3 of hydrochloric acid into a conical flask.

2. Add 10.0 g of small calcium carbonate lumps to the conical flask.

3. Attach a gas syringe to the conical flask.

4. Measure the volume of gas produced every 30 seconds for 180 seconds.

5. Repeat steps 1 to 4 using 10.0 g of large calcium carbonate lumps.

The student calculated the number of moles of gas from each volume of gas measured.

Table 4 shows the student's results for large calcium carbonate lumps.

Table 4

Time in seconds	Number of moles of gas
0	0.0000
30	0.0011
60	0.0020
90	0.0028
120	0.0034
150	0.0038
180	0.0040

The student plotted the results for small calcium carbonate lumps on **Figure 4**.

0 8 . 1 Complete **Figure 4**.

You should:

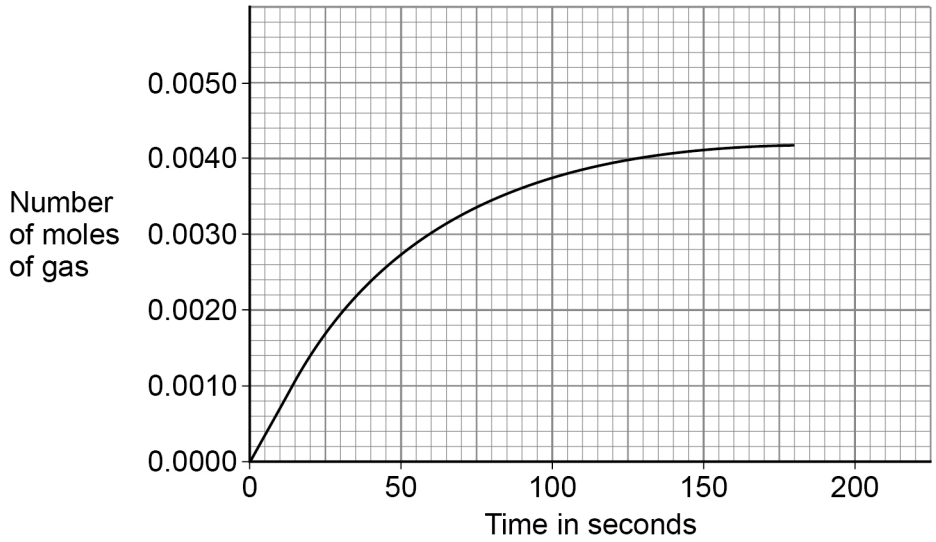
- plot the data for large calcium carbonate lumps from **Table 4**
- draw a line of best fit.

[3 marks]

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 04 · continued

Figure 4



0 8 . 2 Determine the mean rate of reaction for **small** calcium carbonate lumps between 20 seconds and 105 seconds.

Give the unit.

Use **Figure 4**.

[4 marks]

Mean rate of reaction = _____ Unit _____

0 8 . 3 The student concluded that the large calcium carbonate lumps reacted more slowly than the small calcium carbonate lumps.

How do the student's results show that this conclusion is correct?

[1 mark]

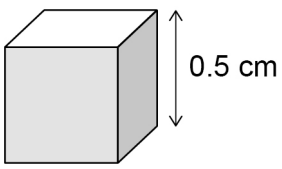
4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 04 · continued

The difference in the rates of reaction of large lumps and of small lumps of calcium carbonate depends on the surface area to volume ratios of the lumps.

Figure 5 shows a cube of calcium carbonate.

Figure 5



0 8 . 4 Calculate the surface area to volume ratio of the cube in **Figure 5**.

Give your answer as the simplest whole number ratio.

[3 marks]

Surface area : volume = _____ : _____

0 8 . 5 A larger cube of calcium carbonate has sides of 5 cm

Describe how the surface area to volume ratio of this larger cube differs from that of the cube shown in **Figure 5**.

[1 mark]

12

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 05

November 2021 | 8462/1H | Original Q5

0 5 This question is about salts.

0 5 . 1 Name the salt produced by the neutralisation of hydrochloric acid with potassium hydroxide.

[1 mark]

_____

0 5 . 2 Write an ionic equation for the neutralisation of hydrochloric acid with potassium hydroxide.

[1 mark]

_____ + _____ → _____

0 5 . 3 Soluble salts can be produced by reacting dilute hydrochloric acid with an insoluble solid.

Copper, copper carbonate and copper oxide are insoluble solids.

Which of these insoluble solids can be used to make a copper salt by reacting the solid with dilute hydrochloric acid?

[1 mark]

Tick (✓) **one** box.

- Copper and copper carbonate only ☐
- Copper and copper oxide only ☐
- Copper carbonate and copper oxide only ☐
- Copper, copper carbonate and copper oxide ☐

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 05 · continued

A student makes crystals of magnesium sulfate.

This is the method used.

1. Add sulfuric acid to a beaker.
2. Warm the sulfuric acid.
3. Add a spatula of magnesium oxide to the beaker.
4. Stir the mixture.
5. Repeat steps 3 and 4 until there is magnesium oxide remaining in the beaker.
6. Filter the mixture.
7. Evaporate the filtrate gently until crystals start to form.
8. Leave the solution to finish crystallising.

0 5 . 4 Give **one** reason for:

- step 2
- step 5
- step 6.

[3 marks]

Step 2 _____

_____

Step 5 _____

_____

Step 6 _____

_____

0 5 . 5 How should the filtrate be evaporated gently in **step 7**?

[1 mark]

_____

_____

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 05 · continued

0 5 . 6 Iron chloride is produced by heating iron in chlorine gas.

The equation for the reaction is:

$$2\,Fe + 3\,Cl_2 \rightarrow 2\,FeCl_3$$

Calculate the volume of chlorine needed to react with 14 g of iron.

You should calculate:

- the number of moles of iron used
- the number of moles of chlorine that react with 14 g of iron
- the volume of chlorine needed.

Relative atomic mass (A_r): Fe = 56

The volume of 1 mole of gas = 24 dm^3

[3 marks]

Volume of chlorine = _____ dm^3

10

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 06

June 2022 | 8462/1H | Original Q7

0 7 This question is about silicon and compounds of silicon.

0 7 . 1 The reactivity series sometimes includes non-metals such as carbon, hydrogen and silicon.

Silicon can be extracted by reducing silicon dioxide with different substances.

The equation for one possible reaction is:

$$2\,C(s) + SiO_2(s) \rightarrow Si(s) + 2\,CO(g)$$

Explain what this reaction shows about the position of silicon in the reactivity series.

[2 marks]

0 7 . 2 Aluminium also reduces silicon dioxide.

Carbon is used rather than aluminium to reduce silicon dioxide because carbon is cheaper than aluminium.

Carbon can be obtained by heating coal.

Aluminium is obtained from aluminium oxide.

Explain why aluminium is more expensive than carbon.

[2 marks]

Magnesium also reduces silicon dioxide.

The equation for the reaction is:

$$2\,Mg(s) + SiO_2(s) \rightarrow Si(s) + 2\,MgO(s)$$

0 7 . 3 Give **one** reason why the products are difficult to separate if magnesium is used to reduce silicon dioxide.

[1 mark]

0 7 . 4 Calculate the minimum mass in grams of magnesium needed to completely reduce 1.2 kg of silicon dioxide.

Relative atomic masses (A_r): O = 16 Mg = 24 Si = 28

[5 marks]

Minimum mass of magnesium = _____ g

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

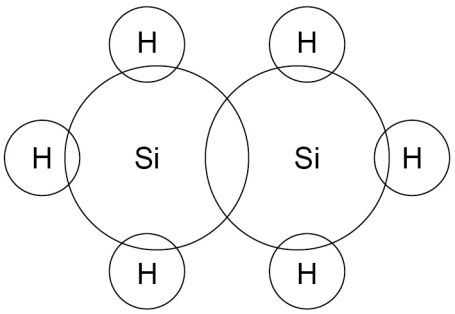
Question 06 · continued

Si_2H_6 is a covalent compound of silicon and hydrogen.

0 7 . 5 Complete **Figure 9** to show the outer shell electrons in a molecule of Si_2H_6

[1 mark]

Figure 9



0 7 . 6 Si_2H_6 reacts with oxygen.

The equation for the reaction is:

$$2\,Si_2H_6(g) + 7\,O_2(g) \rightarrow 4\,SiO_2(s) + 6\,H_2O(g)$$

30 cm^3 of Si_2H_6 is reacted with 150 cm^3 (an excess) of oxygen.

Calculate the total volume of gases present after the reaction.

All volumes of gases are measured at the same temperature and pressure.

[4 marks]

Volume of gases = _____ cm^3

15

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 07

June 2023 | 8462/1H | Original Q7

0 7 This question is about electrolysis.

Aluminium is manufactured by electrolysing a molten mixture of aluminium oxide (Al_2O_3) and cryolite (Na_3AlF_6).

0 7 . 1 Complete the half equation for the reaction occurring at the negative electrode.

[1 mark]

$$Al^{3+} + ____ e^- \rightarrow Al$$

0 7 . 2 Cryolite contains Na^+ ions as well as Al^{3+} ions.

Suggest **one** reason why sodium is **not** a product of the electrolysis.

[1 mark]

Question 7 continues on the next page

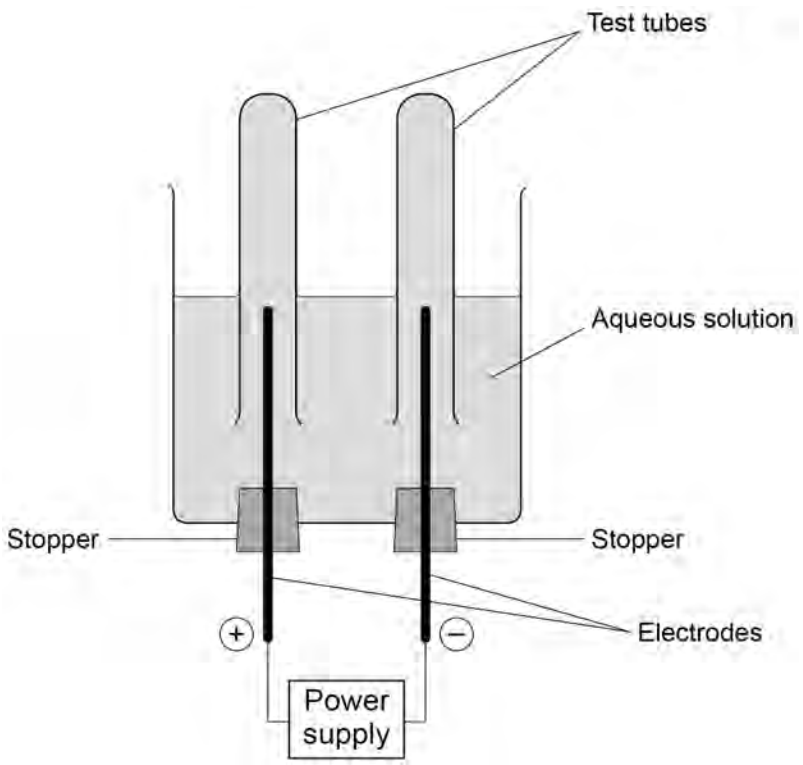
4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 07 · continued

A student investigated the electrolysis of an aqueous solution of a different compound.

Figure 7 shows the apparatus.

Figure 7



4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 07 · continued

Hydrogen was produced at the negative electrode and oxygen was produced at the positive electrode.

0 7 . 3 Explain how oxygen was produced from water during the electrolysis of this aqueous solution.

[4 marks]

0 7 . 4 The student compared the volumes of the two gases collected.

How can the student change the apparatus in **Figure 7** to compare the volumes of the two gases produced more accurately?

Give **one** reason for your answer.

[2 marks]

Change _____

Reason _____

0 7 . 5 The overall equation for the reaction is:

$$2\,H_2O(l) \rightarrow 2\,H_2(g) + O_2(g)$$

What is the volume of oxygen produced when 20 cm^3 of hydrogen has been produced?

[1 mark]

Tick (✓) **one** box.

10 cm^3 ☐ 20 cm^3 ☐ 30 cm^3 ☐ 40 cm^3 ☐

9

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 08

1 0 This question is about titanium dioxide (TiO_2).

1 0 . 1 Self-cleaning windows are coated with a layer of nanoparticles of titanium dioxide.

Titanium dioxide:

- helps sunlight break down dirt particles
- attracts water, so dirt is washed away by rain.

Nanoparticles of titanium dioxide are used instead of fine particles of titanium dioxide for coating self-cleaning windows.

Suggest **two** reasons why.

[2 marks]

1 _____

_____

2 _____

_____

Question 10 continues on the next page

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 08 · continued

10.2 Titanium is extracted from titanium dioxide in a two-stage process.

The equation for the first stage in the process is:

$$TiO_2 + 2\,Cl_2 + 2\,C \rightarrow TiCl_4 + 2\,CO$$

Calculate the volume of chlorine gas needed to react completely with 100 kg of titanium dioxide.

Relative atomic masses (A_r): O = 16 Ti = 48

The volume of one mole of gas = 24 dm^3

[6 marks]

Volume = _____ dm^3

8

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 09

June 2024 | 8462/1H | Original Q7

0 7 This question is about iron.

0 7 . 1 Iron is a metal.

Describe how iron conducts thermal energy.

[2 marks]

0 7 . 2 Pure iron is too soft for many uses.

Explain why mixing iron with other metals makes alloys which are harder than pure iron.

[3 marks]

Question 7 continues on the next page

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 09 · continued

0 7 . 3 When iron reacts with chlorine, 0.12 mol of iron reacts with 0.18 mol of chlorine (Cl_2).

Which is the correct equation for the reaction?

[1 mark]

Tick (✓) **one** box.

$Fe + Cl_2 \rightarrow FeCl_2$ ☐

$Fe + 3Cl_2 \rightarrow FeCl_6$ ☐

$2Fe + Cl_2 \rightarrow 2FeCl$ ☐

$2Fe + 3Cl_2 \rightarrow 2FeCl_3$ ☐

The most common oxides of iron are Fe_2O_3 and Fe_3O_4

0 7 . 4 What is the ratio of the numbers of ions in Fe_3O_4?

[1 mark]

Tick (✓) **one** box.

$2\ Fe^{2+} : 1\ Fe^{3+} : 4\ O^{2-}$ ☐

$1\ Fe^{2+} : 2\ Fe^{3+} : 4\ O^{2-}$ ☐

$3\ Fe^{2+} : 4\ O^{2-}$ ☐

$3\ Fe^{3+} : 4\ O^{2-}$ ☐

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 09 · continued

0 7 . 5 Calculate the percentage (%) by mass of iron in Fe_3O_4

Relative atomic masses (A_r): O = 16 Fe = 56

[3 marks]

Percentage by mass of iron = _____ %

0 7 . 6 Fe_2O_3 reacts with carbon to produce carbon dioxide.

The equation for the reaction is:

$$2\,Fe_2O_3(s) + 3\,C(s) \rightarrow 4\,Fe(s) + 3\,CO_2(g)$$

Calculate the volume of carbon dioxide gas at room temperature and pressure that is produced from 40.0 kg of Fe_2O_3 using excess carbon.

Relative formula mass (M_r): Fe_2O_3 = 160

The volume of 1 mole of any gas at room temperature and pressure is 24 dm^3.

[5 marks]

Volume of carbon dioxide = _____ dm^3

15

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 10

June 2024 | 8462/2H | Original Q5

0 5 This question is about burning fuels in central heating boilers.

In the future, gas central heating boilers may burn hydrogen rather than natural gas.

Table 2 shows information about these fuels when 1 dm^3 of the fuel is burned in a central heating boiler.

Table 2

	Fuel	
	Hydrogen	**Natural gas**
Energy released in kJ	11.9	37.1
Mass of carbon dioxide produced in grams	0.00	1.83
Mass of water vapour produced in grams	0.75	1.50
Mass of oxides of nitrogen produced in grams	6.6×10^{-4}	4.9×10^{-4}

0 5 . 1 Explain how oxides of nitrogen are produced when burning fuels.

[2 marks]

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 10 · continued

0 5 . 2 Explain **one** positive impact on the environment of burning hydrogen rather than natural gas as a fuel.

Use **Table 2**.

[2 marks]

0 5 . 3 Explain **one** negative impact on the environment of burning hydrogen rather than natural gas as a fuel.

Use **Table 2**.

[2 marks]

Question 5 continues on the next page

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 10 · continued

0 5 . 4 Air is 20% oxygen.

Calculate the volume of air needed to provide enough oxygen to react with 3.50 dm^3 of hydrogen gas.

The equation for the reaction is

$$2\ H_2 + O_2 \rightarrow 2\ H_2O$$

[3 marks]

Volume of air = _____ dm^3

0 5 . 5 Central heating boilers can also burn kerosene.

Kerosene is produced from crude oil in a fractionating column using fractional distillation.

In the first step, crude oil is heated and hydrocarbon vapours are formed.

Explain how kerosene is produced from these hydrocarbon vapours.

[3 marks]

12

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 11

June 2024 | 8462/2H | Original Q9

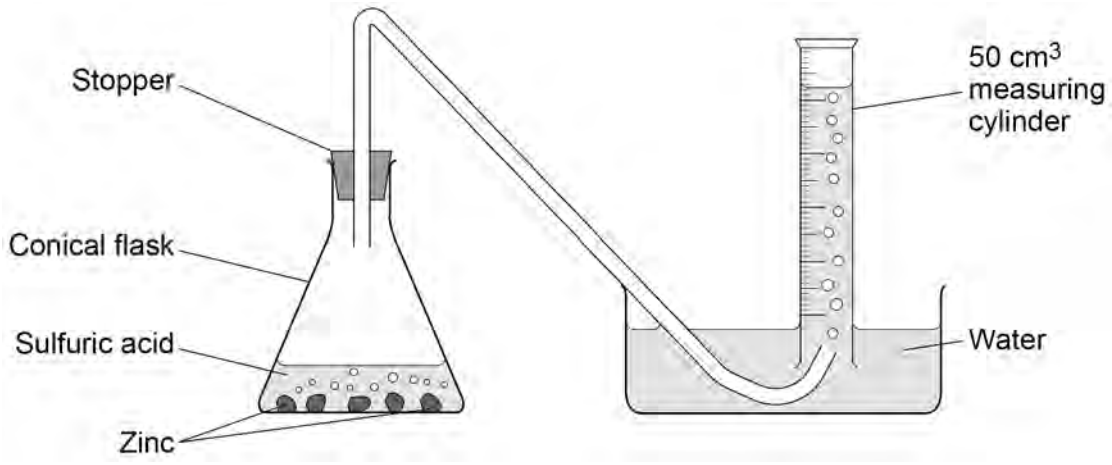
0 9 A student investigated the rate of the reaction between zinc and sulfuric acid.

The equation for the reaction is

$$Zn(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + H_2(g)$$

Figure 10 shows the apparatus.

Figure 10



This is the method used.

1. Pour 50 cm^3 of sulfuric acid into the conical flask.
2. Add excess zinc to the conical flask.
3. Insert the stopper and start a timer.
4. Measure the volume of hydrogen collected in the 50 cm^3 measuring cylinder every 20 seconds for 180 seconds.

0 9 . 1 Explain why the volume of hydrogen collected in the 50 cm^3 measuring cylinder is less than the volume of hydrogen produced.

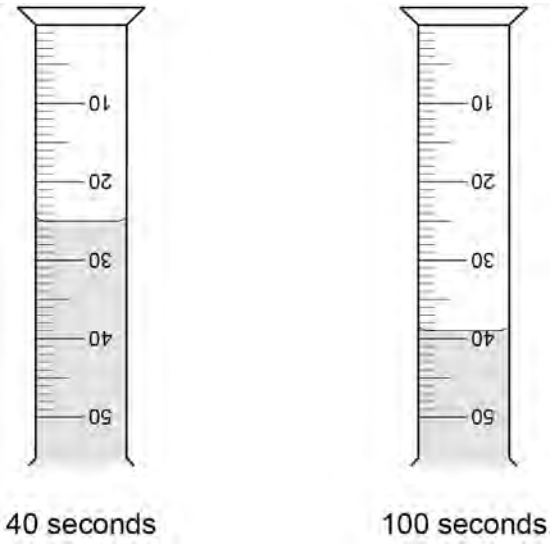
[2 marks]

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 11 · continued

Figure 11 shows the volumes of hydrogen collected in the 50 cm^3 measuring cylinder after 40 seconds and after 100 seconds.

Figure 11



0 9 . 2 Determine the number of moles of hydrogen collected between 40 seconds and 100 seconds.

The volume of one mole of any gas at room temperature and pressure is 24 dm^3.

[4 marks]

Moles of hydrogen = _____

Question 9 continues on the next page

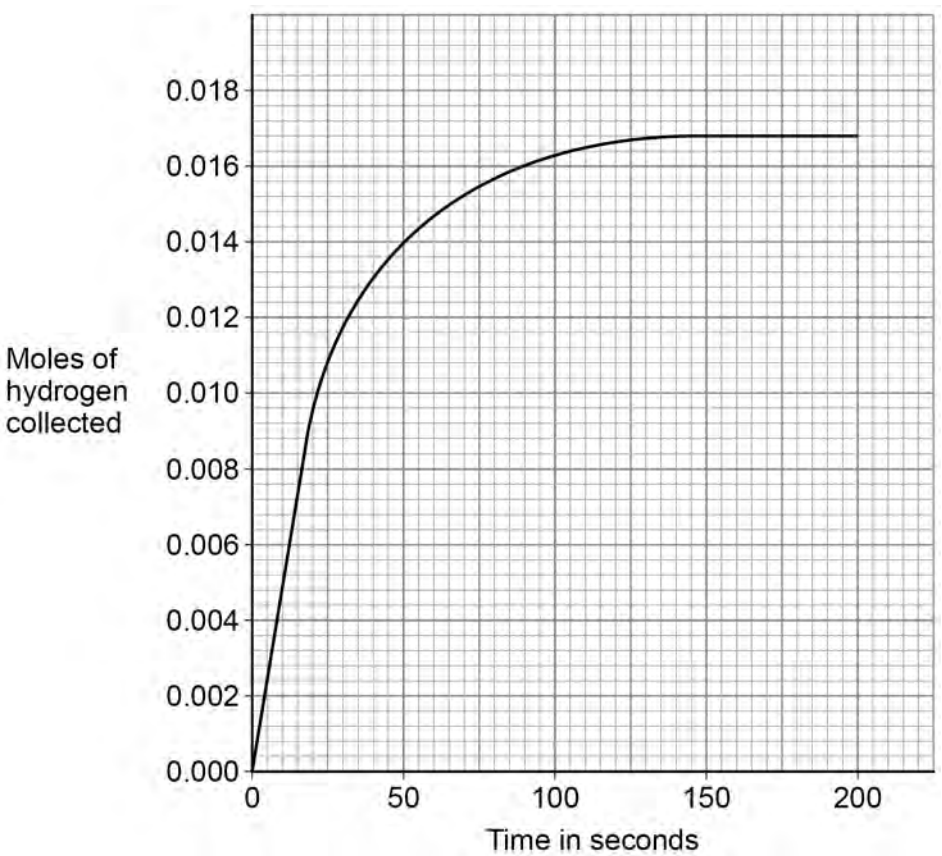
A different student investigated how the concentration of sulfuric acid affected the rate of the reaction.

0 9 . 3 The student did a different experiment using sulfuric acid of concentration 0.40 mol/dm^3.

The student calculated the number of moles of hydrogen collected after every 20 seconds.

Figure 12 shows the results.

Figure 12



4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 11 · continued

Determine the rate of reaction at 45 seconds.

You should draw a tangent on **Figure 12**.

Give your answer in standard form.

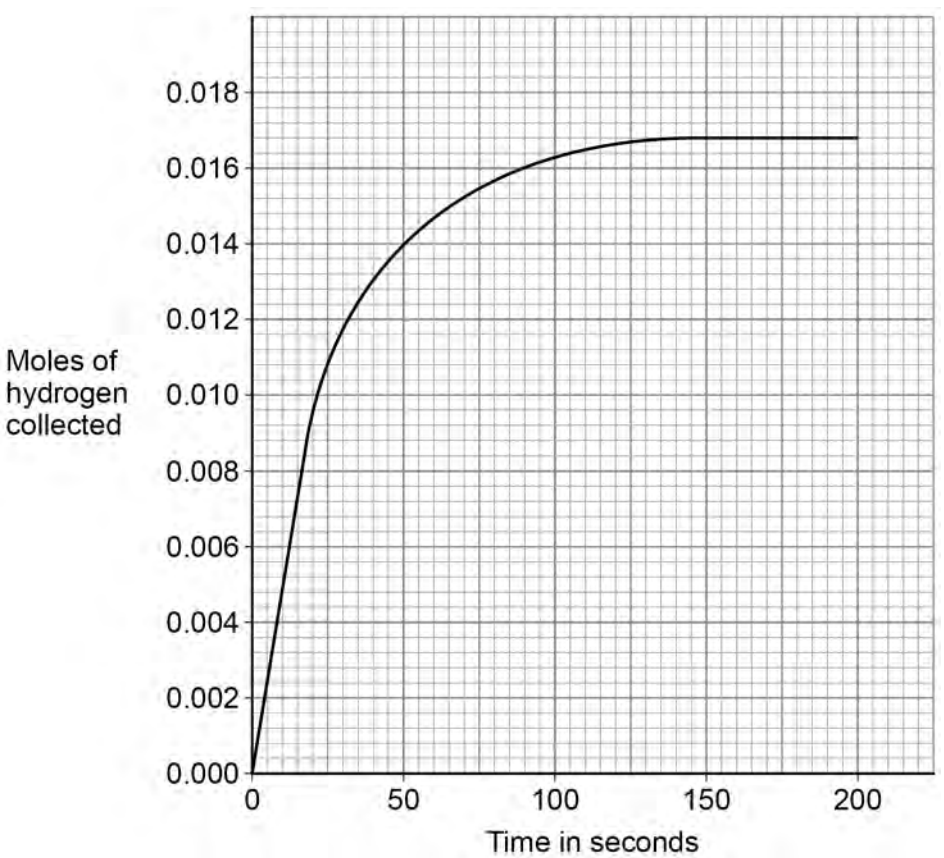
[5 marks]

Rate of reaction (in standard form) = _____ mol/s

Question 9 continues on the next page

0 9 . 4 **Figure 13** shows the results for 0.40 mol/dm^3 sulfuric acid.

Figure 13



The student repeated the experiment using 0.20 mol/dm^3 sulfuric acid instead of 0.40 mol/dm^3 sulfuric acid.

Excess zinc was used in each experiment.

Sketch a line on **Figure 13** to show the results you would expect.

[2 marks]

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 11 · continued

0 9 . 5 Explain how increasing the temperature would affect the rate of reaction between zinc and sulfuric acid.

[3 marks]

16

4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 12

0 5 This question is about unsaturated hydrocarbons.

0 5 . 1 **Table 6** shows the boiling points of some unsaturated hydrocarbons.

Table 6

Formula of unsaturated hydrocarbon	Boiling point in °C
C_2H_4	– 104
C_3H_6	– 47
C_4H_8	**X**
C_5H_{10}	30
C_6H_{12}	63

Estimate the boiling point **X** in **Table 6**.

[1 mark]

_____ °C

0 5 . 2 C_2H_4 reacts with water vapour (steam).

Name the compound produced when C_2H_4 reacts with water vapour.

[1 mark]

_____

Question 5 continues on the next page

Question 12 · continued

C_4H_8 reacts with chlorine (Cl_2).

0 5 . 3 Describe the test for chlorine.

Give the result of the test.

[2 marks]

Test _____

_____

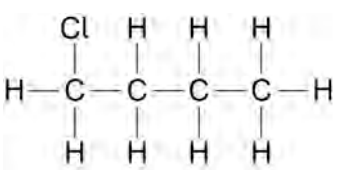
Result _____

_____

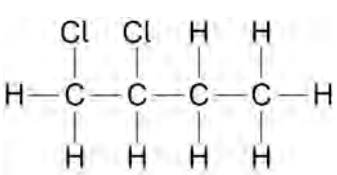
0 5 . 4 Which is the displayed formula of the organic compound produced when C_4H_8 reacts with chlorine?

[1 mark]

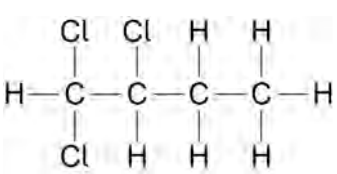
Tick (✓) **one** box.



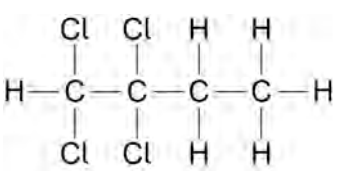
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4.3.5 Use of amount of substance in relation to volumes of gases (chemistry only) (HT only)

Question 12 · continued

0 5 . 5 Name the unsaturated hydrocarbon with the formula C_3H_6

[1 mark]

0 5 . 6 Why does C_3H_6 tend to burn in air with a smoky flame?

[1 mark]

0 5 . 7 C_3H_6 is a gas at room temperature and pressure.

Calculate the volume of 2.1 g of C_3H_6 at room temperature and pressure.

Give your answer in cm^3.

The volume of one mole of any gas at room temperature and pressure is 24 dm^3.

Relative atomic masses (A_r): H = 1 C = 12

[5 marks]

Volume = _____ cm^3

12