

OXFORD

INTERNATIONAL
AQA EXAMINATIONS

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

INTERNATIONAL GCSE COMBINED SCIENCE

C

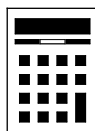
Paper 2 Chemistry Core

Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:

- a pencil and a ruler
- a scientific calculator
- the periodic table (enclosed).



Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- All working must be shown.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 100.
- You are expected to use a scientific calculator where appropriate.
- The periodic table is provided as a loose insert.

For Examiner's Use

Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
TOTAL	



J U N 2 2 9 2 0 4 C C 0 1

IB/M/Jun22/E10

9204/CC

Answer **all** questions in the spaces provided.

0 1

This question is about hydrocarbons.

The hydrocarbons in crude oil are separated and used as fuels.

0 1 . 1

Complete the sentence.

[1 mark]

Choose the answer from the box.

compound

mixture

molecule

polymer

Crude oil is a _____.

0 1 . 2

Which method is used to separate the hydrocarbons in crude oil?

[1 mark]

Tick (✓) **one** box.

Chromatography

Crystallisation

Filtration

Fractional distillation



0 1 . 3 Propane is a hydrocarbon obtained from crude oil.

What is the formula of propane?

[1 mark]

Tick (✓) **one** box.

CH₄

C₂H₆

C₃H₈

C₄H₁₀

0 1 . 4 When hydrocarbons burn, they produce substances that harm the environment.

Draw **one** line from each type of environmental harm to the substance that causes the harm.

[2 marks]

Environmental harm

Substance that causes the harm

Climate change

Carbon

Global dimming

Carbon dioxide

Carbon monoxide

Hydrogen

Sulfur dioxide

Question 1 continues on the next page

Turn over ►



0 1 . 5 Table 1 gives information about hydrocarbons **A, B, C, D** and **E**.

Table 1

Hydrocarbon	Relative formula mass (M_r)	Viscosity in arbitrary units
A	72	2.2
B	78	6.0
C	86	3.0
D	100	4.0
E	114	6.1

Describe how the viscosity of the hydrocarbons depends on their relative formula mass (M_r).

[2 marks]

0 1 . 6 Complete the sentence.

[1 mark]

Choose the answer from the box.

decreases

increases

stays the same

As the size of hydrocarbon molecules increases, the flammability of the hydrocarbons

_____.



Turn over for the next question

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ANSWER IN THE SPACES PROVIDED**

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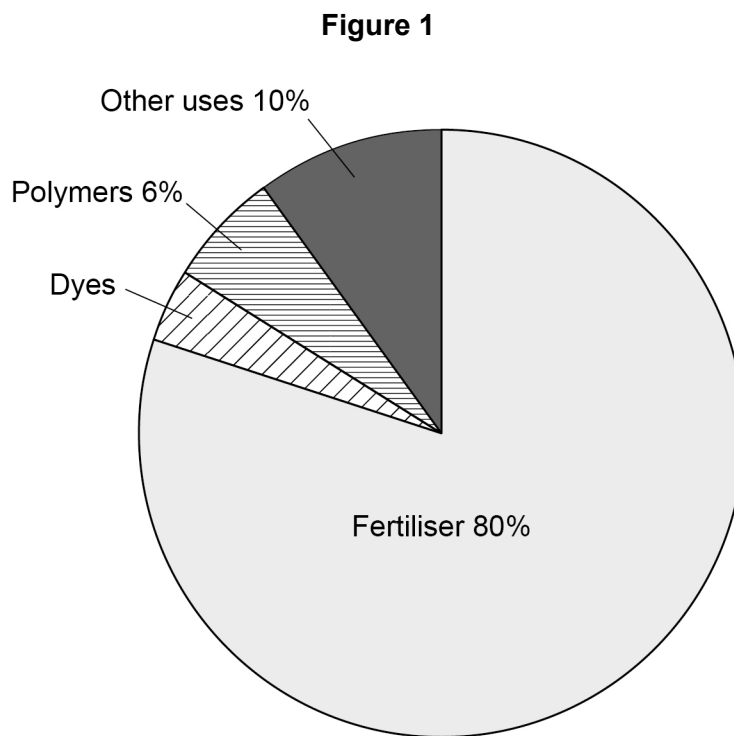


0 5

0 2

This question is about nitric acid.

Figure 1 shows the uses of nitric acid produced by a company.



0 2 . 1

Calculate the percentage of nitric acid used to make dyes.

Use **Figure 1**.

[1 mark]

Percentage = _____ %



0 2 . 2

The company produces 300 kg of nitric acid each day.

Calculate the mass of this nitric acid used to produce polymers.

Use **Figure 1**.

[2 marks]

Mass of nitric acid = _____ kg

0 2 . 3

The formula of nitric acid is HNO_3

Nitric acid dissolves in water to form nitrate ions.

Which other ion is formed when nitric acid dissolves in water?

[1 mark]

Tick (✓) **one** box.

Hydrogen ion

Hydroxide ion

Oxide ion

Question 2 continues on the next page

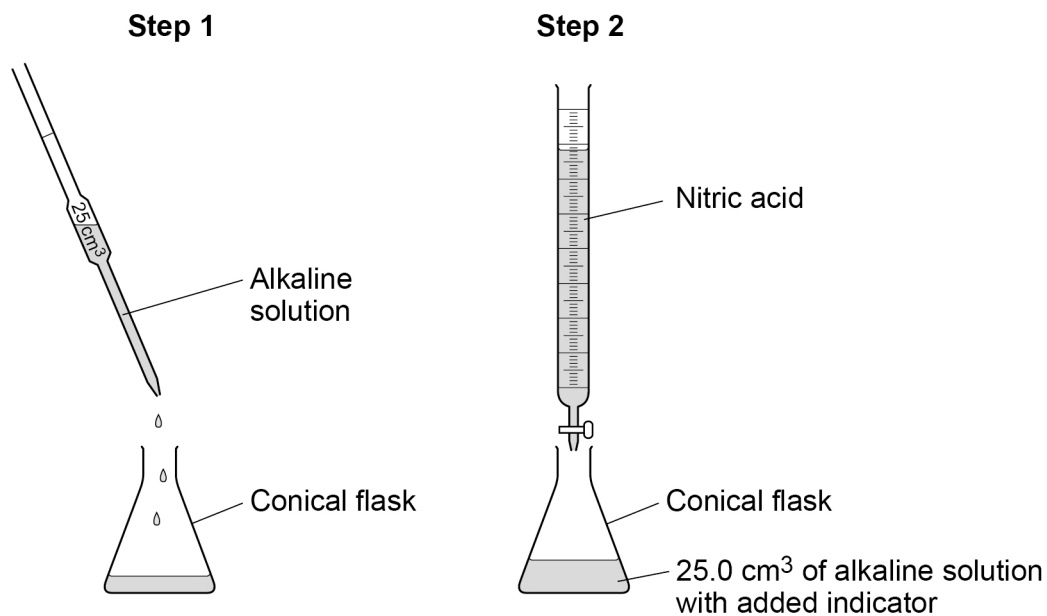
Turn over ►



A student titrated nitric acid against 25.0 cm^3 of an alkaline solution.

Figure 2 shows the equipment used in step 1 and step 2 of the titration.

Figure 2



0 2 . 4 Accurate measurement is important in a titration.

Draw **one** line from each solution to the equipment used to measure the volume of the solution.

[2 marks]

Solution	Equipment used to measure volume of solution
Nitric acid	Beaker
	Burette
	Funnel
	Pipette
	Ruler
Alkaline solution	



0 2 . 5 In step 2 of the titration the student added nitric acid to the conical flask.

Complete the sentence.

[1 mark]

Choose the answer from the box.

crystallised	dissolved	neutralised	precipitated
--------------	-----------	-------------	--------------

The student added nitric acid to the conical flask until all the alkali was

_____.

0 2 . 6 Table 2 shows the student's results.

Table 2

Titration	1	2	3	4
Volume of nitric acid in cm ³	24.35	24.25	24.35	24.30

Calculate the mean volume of nitric acid used.

[2 marks]

Mean volume = _____ cm³

0 2 . 7 Nitric acid reacts with an alkaline solution to produce ammonium nitrate (NH₄NO₃).

Give the name of the alkaline solution.

[1 mark]

0 2 . 8 Calculate the total number of atoms in the formula of ammonium nitrate (NH₄NO₃).

[1 mark]

Number of atoms = _____

11

Turn over ►



0 3

A student made an insoluble salt using a precipitation reaction.

This is the method used.

- 1 Mix potassium iodide solution with silver nitrate solution.
- 2 Separate the insoluble salt produced.

0 3 . 1

The student needed 0.015 moles of silver nitrate to fully react with the potassium iodide.

The concentration of the silver nitrate solution was 0.15 mol/dm³

Calculate the volume of silver nitrate solution needed for the reaction.

Give your answer in cm³

Use the equation:

$$\text{volume (dm}^3\text{)} = \frac{\text{number of moles}}{\text{concentration (mol/dm}^3\text{)}}$$

[3 marks]

Volume = _____ cm³

0 3 . 2

The word equation for the precipitation reaction is:

potassium iodide + silver nitrate → potassium nitrate + **insoluble salt X**

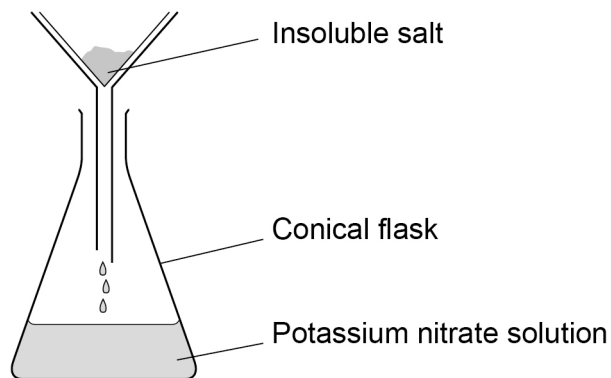
Give the name of the **insoluble salt X**.

[1 mark]



Figure 3 shows the method of separation used in the precipitation experiment.

Figure 3



0 3 . 3 Name the method of separation shown in **Figure 3**.

[1 mark]

0 3 . 4 The student dips a wire loop into the potassium nitrate solution in **Figure 3**.

The solution gives a distinctive colour when the loop is held in a Bunsen burner flame.

What is the colour of the flame?

[1 mark]

Tick (✓) **one** box.

Green

Lilac

Red

Yellow

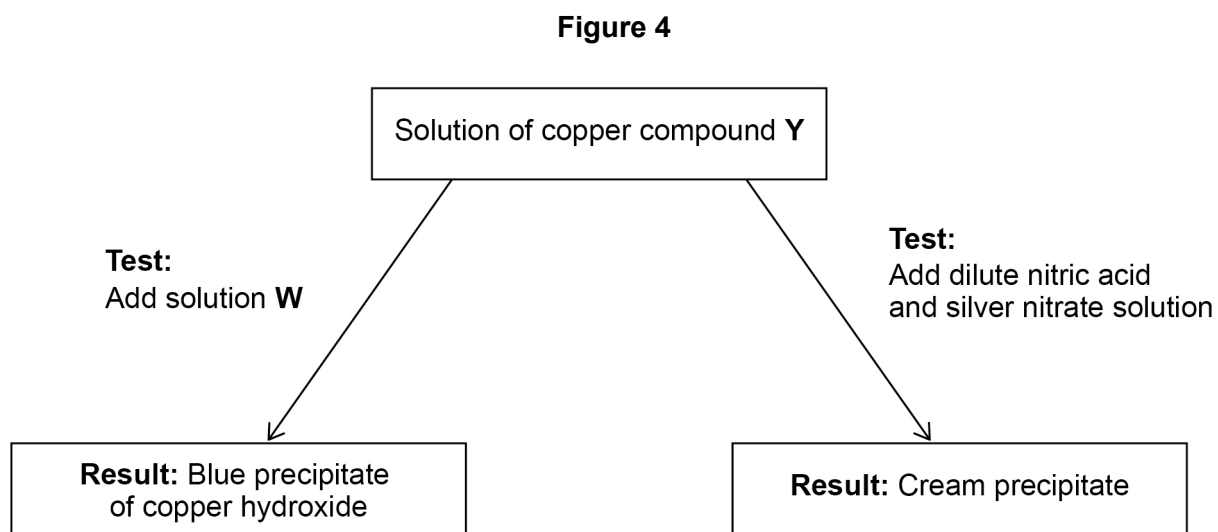
Question 3 continues on the next page

Turn over ►



A student tested a solution of a copper compound, **Y**.

Figure 4 shows the tests and the results of the tests.



0 3 . 5 **Y** is not very soluble in water.

Describe **one** method to help **Y** dissolve in water.

[1 mark]



0 3 . 6 Solution **W** is used to test for copper ions.

What is the name of solution **W**?

Use **Figure 4**.

[1 mark]

Tick (✓) **one** box.

Sodium chloride solution

Sodium hydroxide solution

Sodium nitrate solution

Sodium sulfate solution

0 3 . 7 Which negative ion does **Y** contain?

Use **Figure 4**.

[1 mark]

Tick (✓) **one** box.

Bromide

Chloride

Iodide

9

Turn over for the next question

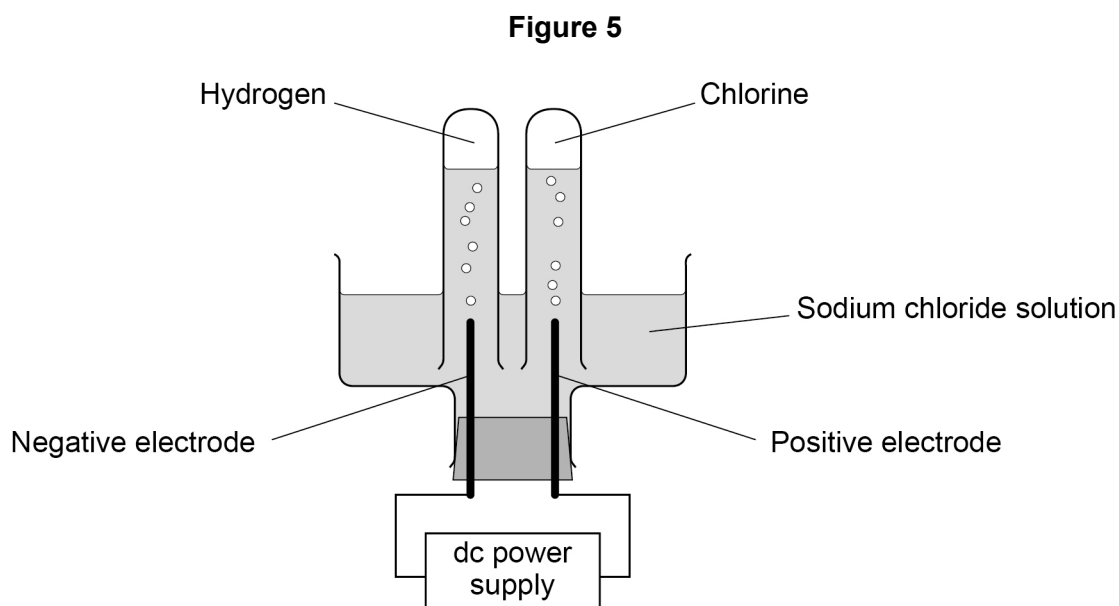
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0 4

This question is about the electrolysis of sodium chloride solution.

Figure 5 shows the apparatus used to electrolyse sodium chloride solution.



The electrolysis of sodium chloride solution produces:

- hydrogen gas
- chlorine gas
- sodium hydroxide solution.

0 4 . 1

The half equation for the reaction at the negative electrode is:



Complete the sentence.

[1 mark]

Choose the answer from the box.

atoms	electrons	molecules	protons
-------	-----------	-----------	---------

Hydrogen ions move to the negative electrode where they gain

_____.



0 4 . 2 Why is hydrogen and **not** sodium produced at the negative electrode?

[1 mark]

Tick (✓) **one** box.

Hydrogen is a gas.

Hydrogen is less reactive than sodium.

Sodium ions move to the positive electrode.

Sodium is a metal.

0 4 . 3 The half equation for the reaction at the positive electrode is:



Explain why chloride ions move to the positive electrode.

[2 marks]

Question 4 continues on the next page

Turn over ►



0 4 . 4

Chlorine and sodium hydroxide are substances formed during the electrolysis of sodium chloride solution.

Draw **one** line from each substance to a product made from the substance.

[2 marks]

Substance	Product made from the substance
Chlorine	Alloy
	Fuel
Sodium hydroxide	Lubricant
	Plastic
	Soap

0 4 . 5

An indicator is added to the sodium chloride solution at the start of the experiment.

The sodium hydroxide produced is an alkali.

Name the indicator that would show the change in pH during the experiment.

Give the colour change.

[3 marks]

Indicator _____

Colour change from _____ to _____

9



0 5

This question is about elements in Group 7 of the periodic table.

Table 3 shows information about Group 7 elements.

Table 3

Element	Formula	Melting point in °C	Boiling point in °C	Colour
Fluorine	F ₂	-220	-188	pale yellow
Chlorine	Cl ₂	-101	-35	yellow-green
Bromine	Br ₂	-7	59	orange
Iodine	I ₂	114	184	purple-black

0 5**1**

What is the state of bromine at a temperature of 25 °C?

Use **Table 3**.

[1 mark]

Tick (✓) **one** box.

Gas

Liquid

Solid

0 5**2**

Bromine water is used to test for alkenes.

Give the colour change if an alkene is present.

[2 marks]

Colour change from _____ to _____

Question 5 continues on the next page

Turn over ►

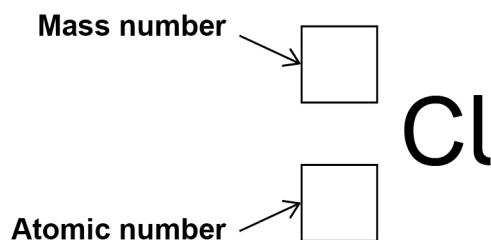


0 5 . 3 An atom of chlorine has 17 protons and 18 neutrons.

Complete **Figure 6** for this atom of chlorine.

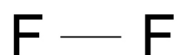
[2 marks]

Figure 6



0 5 . 4 **Figure 7** shows the displayed structure of a fluorine molecule.

Figure 7



What type of bonding is in a fluorine molecule?

[1 mark]

Tick (✓) **one** box.

Covalent

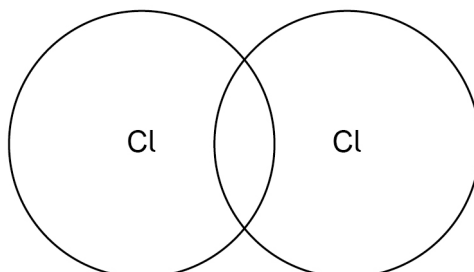
Ionic

Metallic



0 5 . 5

Complete **Figure 8** to show the arrangement of outer shell electrons in a chlorine molecule.

[2 marks]**Figure 8**

0 5 . 6

A purple-black solid is produced when bromine reacts with potassium iodide solution.

Complete the word equation for the reaction.

Use **Table 3**.

[2 marks]

bromine + potassium iodide → _____ + _____

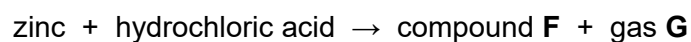
10

Turn over for the next question**Turn over ►**

0 6

Zinc reacts with dilute hydrochloric acid.

The word equation for the reaction is:

**0 6 . 1**What is the name of compound **F**?**[1 mark]**Tick (✓) **one** box.

Zinc chloride

Zinc hydroxide

Zinc nitrate

Zinc sulfate

0 6 . 2What is the name of gas **G**?**[1 mark]**Tick (✓) **one** box.

Carbon dioxide

Hydrogen

Nitrogen

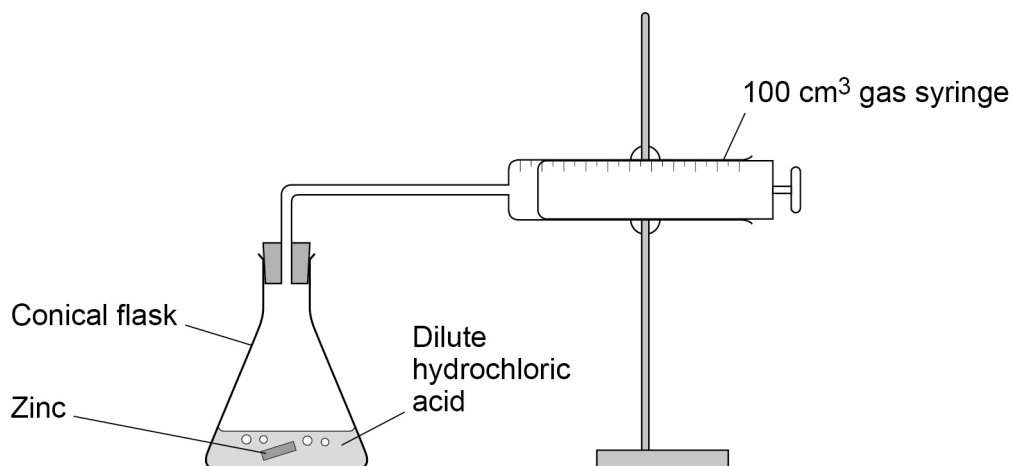
Oxygen



A student investigated the rate of the reaction between zinc and dilute hydrochloric acid.

Figure 9 shows the apparatus.

Figure 9



0 6 . 3 The student used 0.0040 moles of zinc.

Calculate the mass of zinc used.

Use the equation:

$$\text{mass (g)} = \text{number of moles} \times \text{relative atomic mass (}A_r\text{)}$$

Relative atomic mass (A_r): Zn = 65

[2 marks]

Mass of zinc = _____ g

Question 6 continues on the next page

Turn over ►



The student repeated the experiment using different metals.

Table 4 shows the results.

Table 4

Metal	Volume of gas produced in 120 seconds in cm ³
zinc	48
iron	35
magnesium	79

0 6 . 4 Calculate the rate of reaction between zinc and hydrochloric acid.

Use **Table 4** and the equation:

$$\text{rate of reaction (cm}^3/\text{s)} = \frac{\text{volume of gas (cm}^3\text{)}}{\text{time (s)}}$$

[2 marks]

Rate of reaction = _____ cm³/s

0 6 . 5 Write the metals iron, magnesium and zinc in order of reactivity.

Use **Table 4**.

[1 mark]

Most reactive _____

Least reactive _____



0 6 . 6

The student repeated the experiment using copper.

The reaction did not produce any gas.

Give **one** reason why the reaction using copper did not produce any gas.

[1 mark]

Question 6 continues on the next page

Turn over ►



Table 5 shows information about four different materials.

Table 5

Material	Composition	Strength in arbitrary units	Reaction with hydrochloric acid
Bronze	copper and tin	125	yes
Gunmetal	copper, tin and zinc	300	yes
Poly(ethene)	carbon and hydrogen	20	no
Zinc	zinc	130	yes

0 6 . 7 Why are bronze and gunmetal described as alloys?

Use **Table 5**.

[2 marks]

0 6 . 8 Gunmetal is made in a similar way to making bronze but with added zinc.

What is the effect of adding zinc?

Use **Table 5**.

[1 mark]



06.9

Which material in **Table 5** could be used to make containers for transporting hydrochloric acid?

Give **one** reason for your choice.

[2 marks]

Material _____

Reason _____

13

Turn over for the next question

Turn over ►



0 7

Alkanes have the general formula C_nH_{2n+2}

0 7 . 1

Complete the formula of an alkane with 5 carbon atoms.

[1 mark]

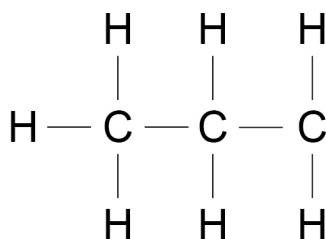


0 7 . 2

An alkane has the formula C_4H_{10}

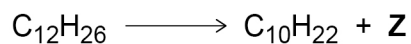
Complete the displayed structure of this alkane.

[1 mark]



The alkane $C_{12}H_{26}$ is cracked to produce smaller molecules.

The equation for the reaction is:



Z is an alkene.

0 7 . 3 What is the formula of **Z**?

[1 mark]

Tick (✓) **one** box.

CH_4

C_2H_4

C_2H_6

C_3H_6

0 7 . 4 Why is **Z** described as an unsaturated compound?

[1 mark]

Tick (✓) **one** box.

All the bonds in each molecule of **Z** are double bonds.

All the bonds in each molecule of **Z** are single bonds.

One bond in each molecule of **Z** is a double bond.

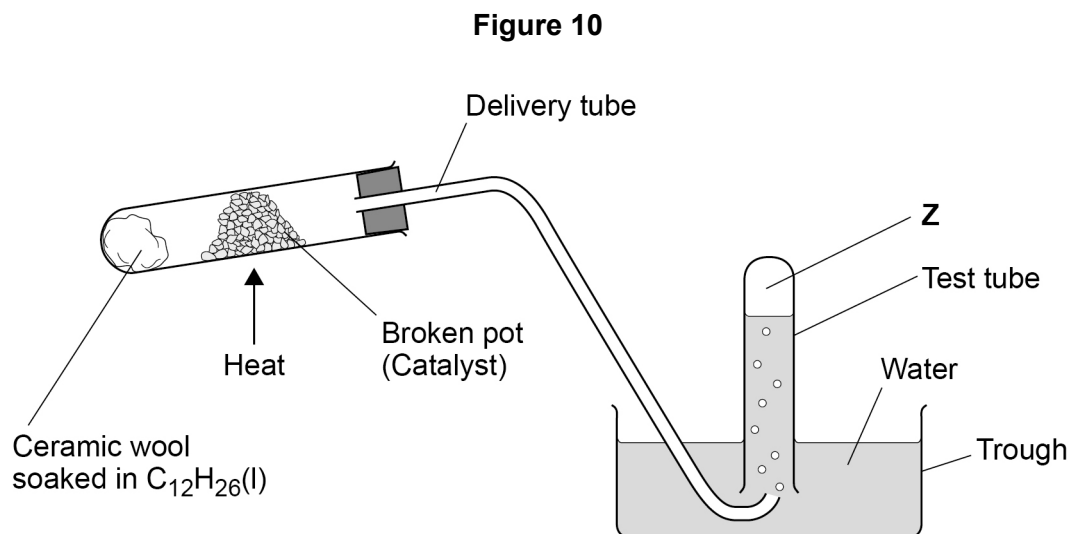
One bond in each molecule of **Z** is a single bond.

Question 7 continues on the next page

Turn over ►



Figure 10 shows the apparatus used to crack the alkane $C_{12}H_{26}$



This is the method used.

- 1 Gently heat the ceramic wool soaked in $C_{12}H_{26}(l)$.
- 2 Strongly heat the broken pot (catalyst).
- 3 Collect Z in the test tube.

0 7 . 5 What happens to $C_{12}H_{26}(l)$ when it is heated **gently**?

[1 mark]

Tick (✓) **one** box.

Combusts

Decomposes

Oxidises

Vaporises



Table 6 gives information about the products of the cracking reaction.

Table 6

Product	Type of compound	Boiling point in °C
$C_{10}H_{22}$	alkane	174
Z	alkene	-104

0 7 . 6 Suggest why $C_{10}H_{22}$ does **not** collect with **Z** in the test tube in **Figure 10**.

Use **Table 6**.

[1 mark]

0 7 . 7 Give **one** use for each product of the cracking reaction.

Use **Table 6**.

[2 marks]

Use for $C_{10}H_{22}$ _____

Use for **Z** _____

8

Turn over for the next question

Turn over ►



0 8

This question is about Groups 1, 7 and 0 of the periodic table.

Use the periodic table to answer the questions.

0 8 . 1

Which Group 1 metal is denser than water?

[1 mark]

Tick (✓) **one** box.

Lithium

Potassium

Rubidium

Sodium

0 8 . 2

Which Group 7 element has an electron arrangement of 2,8,7?

[1 mark]

Tick (✓) **one** box.

Bromine

Chlorine

Fluorine

Iodine



0 8 . 3 Which Group 0 element has atoms with two electrons in the outer energy level?

[1 mark]

Tick (✓) **one** box.

Argon

Helium

Krypton

Neon

0 8 . 4 Which Group 1 metal forms a positive ion with the same number of electrons as an atom of the Group 0 element argon (Ar)?

[1 mark]

0 8 . 5 Give the total number of electrons in a bromide ion (Br^-).

[1 mark]

0 8 . 6 Give **one** reason why Group 0 elements are unreactive.

[1 mark]

Question 8 continues on the next page

Turn over ►



0 8 . 7 Group 1 metals combine with Group 7 elements to produce soluble ionic compounds.

43.2 moles of rubidium fluoride dissolve in 1.50 kg of water at 25 °C

Solubility is the number of moles of compound that dissolves in 100 g of water at 25 °C

Calculate the solubility of rubidium fluoride in mol/100 g

[3 marks]

Solubility = _____ mol/100 g

9



0 9

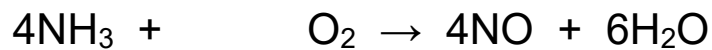
Ammonia is oxidised using a hot catalyst.

The word equation for the reaction is:

ammonia + oxygen → nitrogen monoxide + steam

0 9 . 1

Complete the balanced symbol equation for the reaction.

[1 mark]**0 9 . 2**

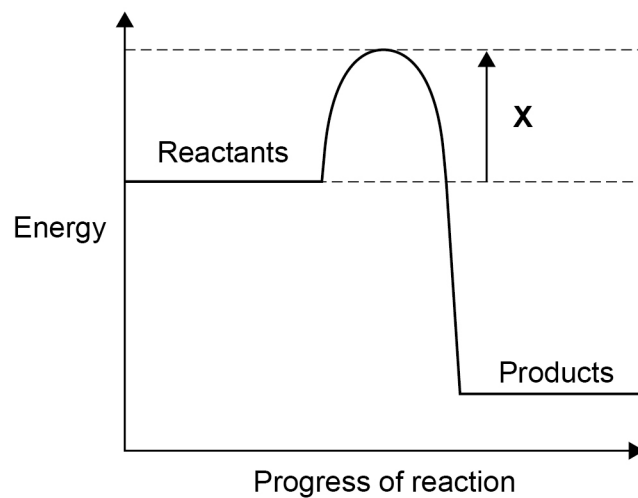
Why is this reaction described as oxidation?

[2 marks]

Question 9 continues on the next page**Turn over ►**

Figure 11 shows the energy level diagram for the reaction.

Figure 11



0 9 . 3 What does the arrow labelled **X** on **Figure 11** represent?

[1 mark]

0 9 . 4 Explain why heating to a high temperature is needed to start the reaction.

You should refer to particles and collisions.

[2 marks]

0 9 . 5 How does **Figure 11** show that the reaction is exothermic?

[1 mark]



0 9 . 6

Explain the effect of a catalyst on the rate of a reaction.

[2 marks]

0 9 . 7

Nitrogen monoxide is produced when ammonia is oxidised.

Nitrogen monoxide has simple molecules.

What are **two** characteristics of substances that have simple molecules?

[2 marks]

Tick (✓) **two** boxes.

Giant lattice of atoms

High melting point

Ionically bonded

Low boiling point

Non-conductor of electricity

Question 9 continues on the next page

Turn over ►



09.8

Calculate the percentage by mass of nitrogen in nitrogen dioxide (NO_2).

Give your answer to 3 significant figures.

Relative atomic masses (A_r): N = 14 O = 16**[4 marks]**

Percentage by mass of nitrogen (3 significant figures) = _____ %

15

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3 7

1 0

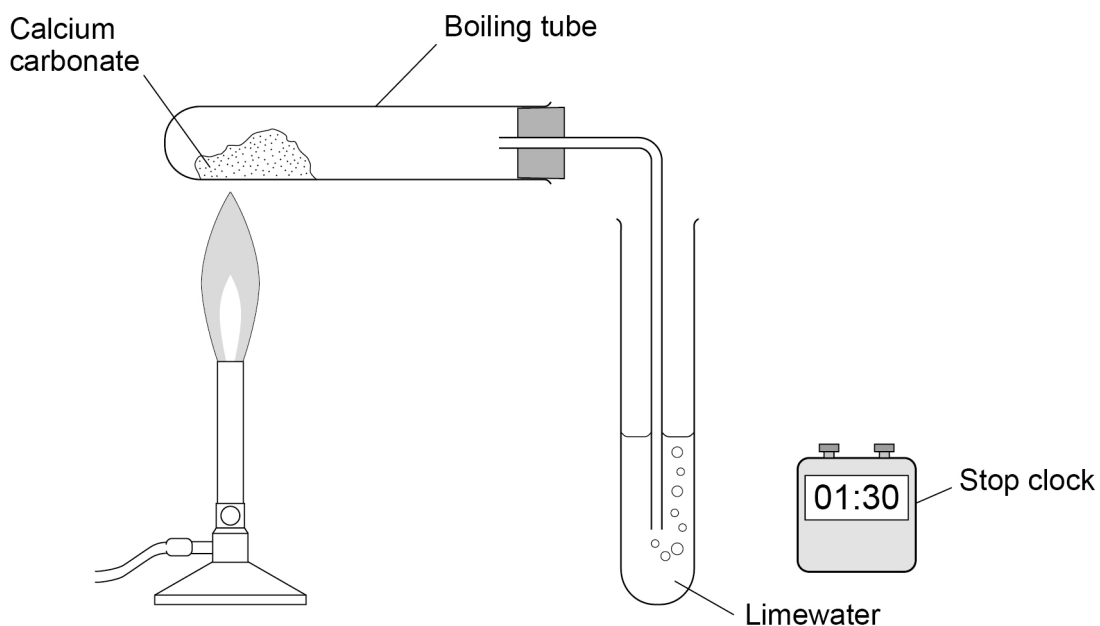
A student investigated the rate of thermal decomposition of calcium carbonate.

The word equation for the reaction is:



Figure 12 shows the apparatus used.

Figure 12



1 0 . 1

Limewater is calcium hydroxide solution.

Carbon dioxide reacts with limewater to produce a white precipitate and water.

Complete the equation for this reaction with:

- the formula of the white precipitate
- the state symbol of the white precipitate.

[2 marks]



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