OXFORD

INTERNATIONAL
AQA EXAMINATIONS

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

INTERNATIONAL GCSE

CHEMISTRY

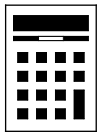
Paper 1

Thursday 4 November 2021 07:00 GMT Time allowed: 1 hour 30 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.
- Pencil should only be used for drawing.
- 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).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- Show all your working.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 90.
- You are expected to use a scientific calculator where appropriate.
- A periodic table is provided as a loose insert.

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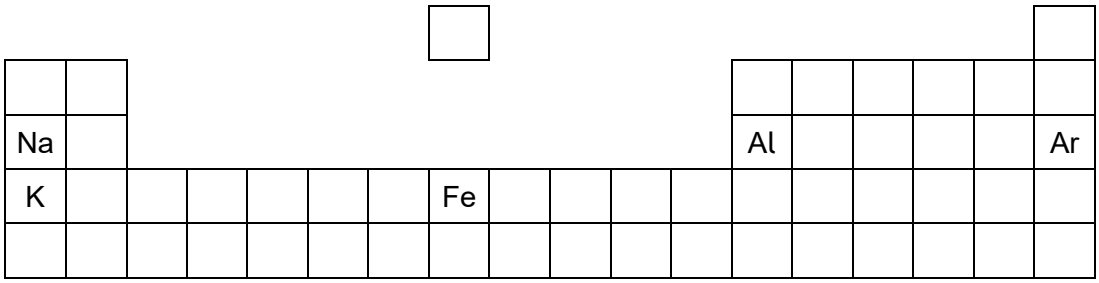
Answer **all** questions in the spaces provided.

0 1 This question is about elements.

Figure 1 shows the symbols and the positions of five elements in the periodic table.

Figure 1



Use **Figure 1** and the full version of the periodic table to answer Question **01**.

0 1 . 1 What is the name of the element with the symbol Na?

[1 mark]

Tick (✓) **one** box.

Nickel ☐

Nitrogen ☐

Sodium ☐

Sulfur ☐

Do not write outside the box

Elements in the periodic table are arranged in columns known as groups.

0 1 . 2 Which element in **Figure 1** is in Group 3?

[1 mark]

Tick (✓) **one** box.

Al ☐ Ar ☐ Fe ☐ K ☐ Na ☐

0 1 . 3 Which element in **Figure 1** is a noble gas?

[1 mark]

Tick (✓) **one** box.

Al ☐ Ar ☐ Fe ☐ K ☐ Na ☐

0 1 . 4 Which element in **Figure 1** is a metal that can be used as a catalyst?

[1 mark]

Tick (✓) **one** box.

Al ☐ Ar ☐ Fe ☐ K ☐ Na ☐

0 1 . 5 Give **one** reason why the elements Na and K have similar chemical properties.

[1 mark]

Question 1 continues on the next page

Do not write outside the box

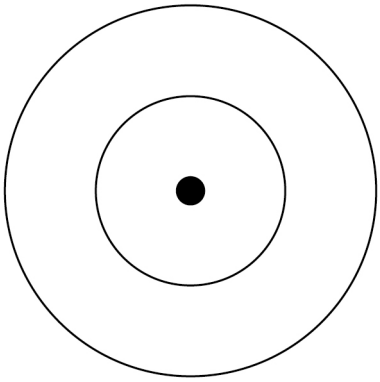
0 1 . 6 An atom of the element fluorine has 9 electrons.

Complete **Figure 2** to show the electronic structure of a fluorine atom.

Use **×** to represent an electron.

[1 mark]

Figure 2



0 1 . 7 An element has a density of 1.82 g/cm^3.

Calculate the volume of a piece of this element with a mass of 9.10 g.

Use the equation:

$$\text{Volume} = \frac{\text{mass}}{\text{density}}$$

[2 marks]

Volume = _____ cm^3

8

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0 2 This question is about hydrocarbons.

0 2 . 1 Name the **two** elements in a hydrocarbon.

[2 marks]

1 _____

2 _____

0 2 . 2 Which process is used to separate the hydrocarbons in crude oil?

[1 mark]

Tick (✓) **one** box.

Chromatography ☐

Electrolysis ☐

Filtration ☐

Fractional distillation ☐

Question 2 continues on the next page

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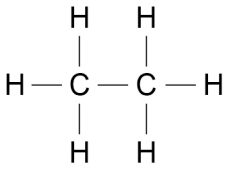
0 2 . 3 **Figure 3** shows the displayed structure of a hydrocarbon molecule.

Figure 3



What is the name of this hydrocarbon molecule?

[1 mark]

Tick (✓) **one** box.

Ethane ☐

Methane ☐

Propane ☐

Do not write outside the box

Cracking breaks down large hydrocarbon molecules into smaller hydrocarbon molecules.

The products of cracking include alkanes and alkenes.

0 2 . 4 Give **two** conditions needed for cracking.

[2 marks]

1 _____

_____

2 _____

_____

0 2 . 5 Give **one** use of the alkanes produced by cracking.

[1 mark]

_____

_____

0 2 . 6 Give **one** use of the alkenes produced by cracking.

[1 mark]

_____

_____

0 2 . 7 Complete the sentence.

[1 mark]

When alkenes react with bromine water, the bromine water turns from orange to _____ .

9

Turn over ►

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0 3 This question is about carbon.

0 3 . 1 Carbon atoms form covalent bonds.

Complete the sentence.

Choose the answer from the box.

[1 mark]

gained	**lost**	**shared**

When carbon atoms form covalent bonds, electrons

are _____ .

0 3 . 2 Which is a form of carbon?

[1 mark]

Tick (✓) **one** box.

Ammonia ☐

Fullerene ☐

Silica ☐

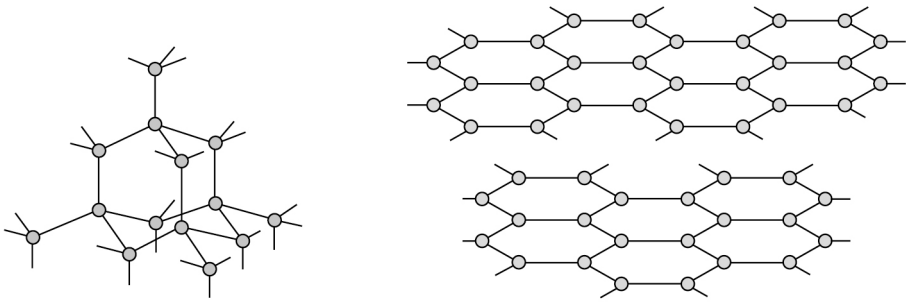
Question 3 continues on the next page

Diamond and graphite are other forms of carbon.

Diamond and graphite have different properties.

Figure 4 represents the arrangement of carbon atoms in diamond and in graphite.

Figure 4



Diamond **Graphite**

0 3 . 3 **Table 1** shows the relative hardness of diamond and of graphite.

Table 1

	Relative hardness
Diamond	10
Graphite	1.6

Calculate how many times harder diamond is than graphite.

[2 marks]

Number of times harder = _____

Do not write outside the box

0 3 . 4 Explain why diamond is hard.

[3 marks]

0 3 . 5 Explain why graphite conducts electricity.

[3 marks]

10

Turn over for the next question

Do not write outside the box

0 4 This question is about metals and metal oxides.

0 4 . 1 Large quantities of iron and aluminium are recycled every year.

Suggest **one** reason why iron and aluminium are recycled.

[1 mark]

0 4 . 2 Explain why carbon is used to extract iron from iron oxide.

[2 marks]

Iron can also be extracted from iron oxide using aluminium in a redox reaction.

The word equation for the reaction is:

iron oxide + aluminium → iron + aluminium oxide

0 4 . 3 What does 'redox reaction' mean?

[1 mark]

Do not write outside the box

0 4 . 4 The formula of an oxide of iron is Fe_2O_3

Calculate the relative formula mass (M_r) of this oxide of iron.

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

[2 marks]

Relative formula mass = _____

0 4 . 5 Aluminium oxide contains 52.9% by mass of aluminium.

A sample of aluminium oxide contains 12.1 g of aluminium.

Calculate the mass of the sample of aluminium oxide.

Give your answer to 3 significant figures.

[3 marks]

Mass of aluminium oxide (3 significant figures) = _____ g

9

Turn over for the next question

Do not write outside the box

0 5 This question is about acids, bases and salts.

0 5 . 1 Metal oxides and hydroxides are bases.

What are soluble hydroxides called?

[1 mark]

Tick (✓) **one** box.

Alcohols ☐

Alkalis ☐

Alkenes ☐

Esters ☐

0 5 . 2 Acids react with bases to produce salts.

Name the acid used to produce copper nitrate.

[1 mark]

_____

Zinc chloride solution can be produced by reacting zinc oxide with hydrochloric acid.

0 5 . 3 The equation for the reaction to produce zinc chloride solution is:

$$ZnO(s) + 2\,HCl(aq) \rightarrow ZnCl_2(\_\_\_\_) + H_2O(\_\_\_\_)$$

Complete the equation by adding state symbols.

[1 mark]

Do not write outside the box

0 5 . 4 A student produced zinc chloride solution by reacting zinc oxide with hydrochloric acid.

This is the method used.

1 Add 50 cm^3 of hydrochloric acid to a beaker.

2 Warm the hydrochloric acid.

3 Add excess zinc oxide to the hydrochloric acid and stir the mixture.

Explain how zinc chloride **solution** can be obtained from the mixture.

[2 marks]

0 5 . 5 Zinc chloride can also be produced by reacting zinc carbonate with hydrochloric acid.

The equation for the reaction is:

$$ZnCO_3 + 2\,HCl \longrightarrow ZnCl_2 + H_2O + CO_2$$

Calculate the maximum mass of zinc chloride that can be produced from 25.0 g of zinc carbonate.

Relative formula masses (M_r): $ZnCO_3 = 125$ $ZnCl_2 = 136$

[3 marks]

Maximum mass of zinc chloride produced = _____ g

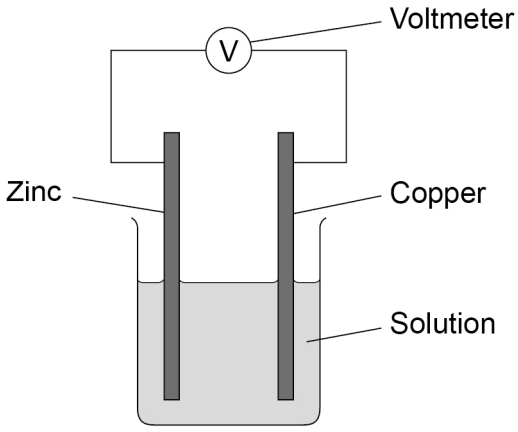
8

Turn over ►

0 6 A student investigated the potential difference produced by a chemical cell at different temperatures.

Figure 5 shows the apparatus.

Figure 5



The student:

- heated the solution to different temperatures
- used a voltmeter to measure the potential difference in volts.

Table 2 shows the results.

Table 2

Temperature of solution in °C	Potential difference in volts
20	1.00
25	1.04
30	1.08
35	1.12
40	1.14
45	1.14
50	1.14

Do not write outside the box

0 6 . 1 Describe how the potential difference changes as the temperature of the solution changes.

Use data from **Table 2**.

[3 marks]

0 6 . 2 The student did the investigation again using different equipment.

The student obtained the same results.

Which word describes the measurements in this investigation?

[1 mark]

Tick (✓) **one** box.

Anomalous ☐

Repeatable ☐

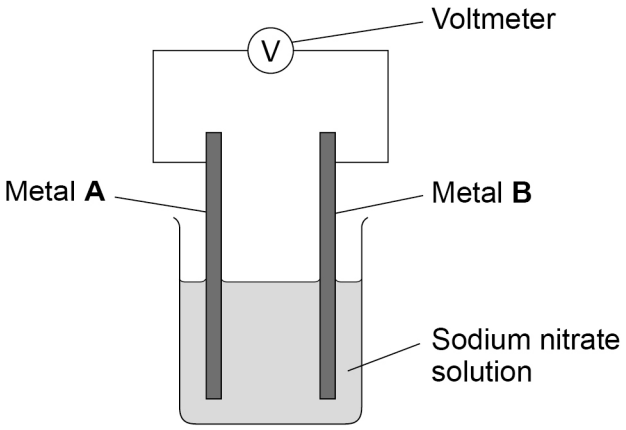
Reproducible ☐

Question 6 continues on the next page

Another student investigated the potential difference produced by a chemical cell when different metals are used as electrodes.

Figure 6 shows the chemical cell.

Figure 6



The greater the difference in reactivity of the metals, the greater the potential difference produced by the cell.

If metal **A** is more reactive than metal **B** then the potential difference measured is positive.

Table 3 shows the results.

Table 3

Metal A	Metal B	Potential difference in volts
Copper	Copper	0.00
Copper	Cobalt	−0.62
Copper	Zinc	−1.44
Magnesium	Copper	+2.70
Silver	Copper	−0.40

Do not write outside the box

0 6 . 3 Write down the metals from **Table 3** in order of reactivity.

[2 marks]

Most reactive _____

_____

_____

_____

Least reactive _____

0 6 . 4 Determine the potential difference produced by a cell that has zinc as metal **A** and silver as metal **B**.

Use **Table 3**.

[2 marks]

_____

_____

_____

Potential difference = _____ volts

0 6 . 5 The chemical cell contained 0.075 dm^3 of sodium nitrate solution of concentration 0.60 mol/dm^3.

Calculate the number of moles of sodium nitrate used.

[2 marks]

_____

_____

_____

Number of moles = _____

Question 6 continues on the next page

Do not write outside the box

0 6 . 6 The reactivity of metals can also be compared by reacting the metals with sulfuric acid.

Metals react with sulfuric acid to produce hydrogen gas.

A student investigated the order of reactivity of four different metals by reacting the metals with sulfuric acid.

Describe a method for the investigation.

Your method should give valid results.

[6 marks]

16

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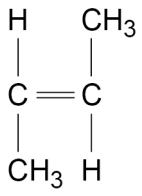
0 7 This question is about polymers.

0 7 . 1 Describe what happens in a polymerisation reaction.

[2 marks]

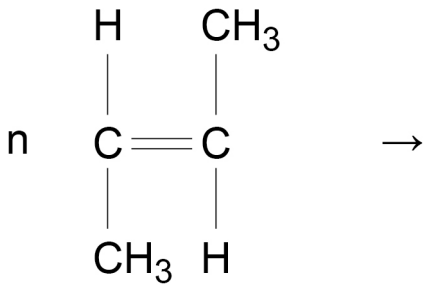
0 7 . 2 **Figure 7** represents a molecule of butene.

Figure 7



Complete the equation to represent the formation of poly(butene) from butene.

[3 marks]



Question 7 continues on the next page

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0 7 . 3 Low-density (LD) poly(ethene) and high-density (HD) poly(ethene) are polymers made from ethene molecules.

How can two different polymers be made using ethene molecules?

[1 mark]

0 7 . 4 Low-density (LD) poly(ethene) is a thermosoftening plastic.

Explain why low-density (LD) poly(ethene) has a low melting point.

[2 marks]

Do not write outside the box

0 7 . 5 Polymers are used to make drinks bottles.

Table 4 shows some properties of two different polymers used to make drinks bottles.

Both of the polymers can be recycled.

The drinks bottles hold the same volume.

Table 4

	Polymer A	**Polymer B**
Source of raw material	Cornstarch	Crude Oil
Energy used to produce one drinks bottle in kilojoules	1400	4000
Mass of one drinks bottle in grams	22.0	19.1

Evaluate the use of polymer **A** and of polymer **B** to make drinks bottles.

[4 marks]

12

Turn over for the next question

Do not write outside the box

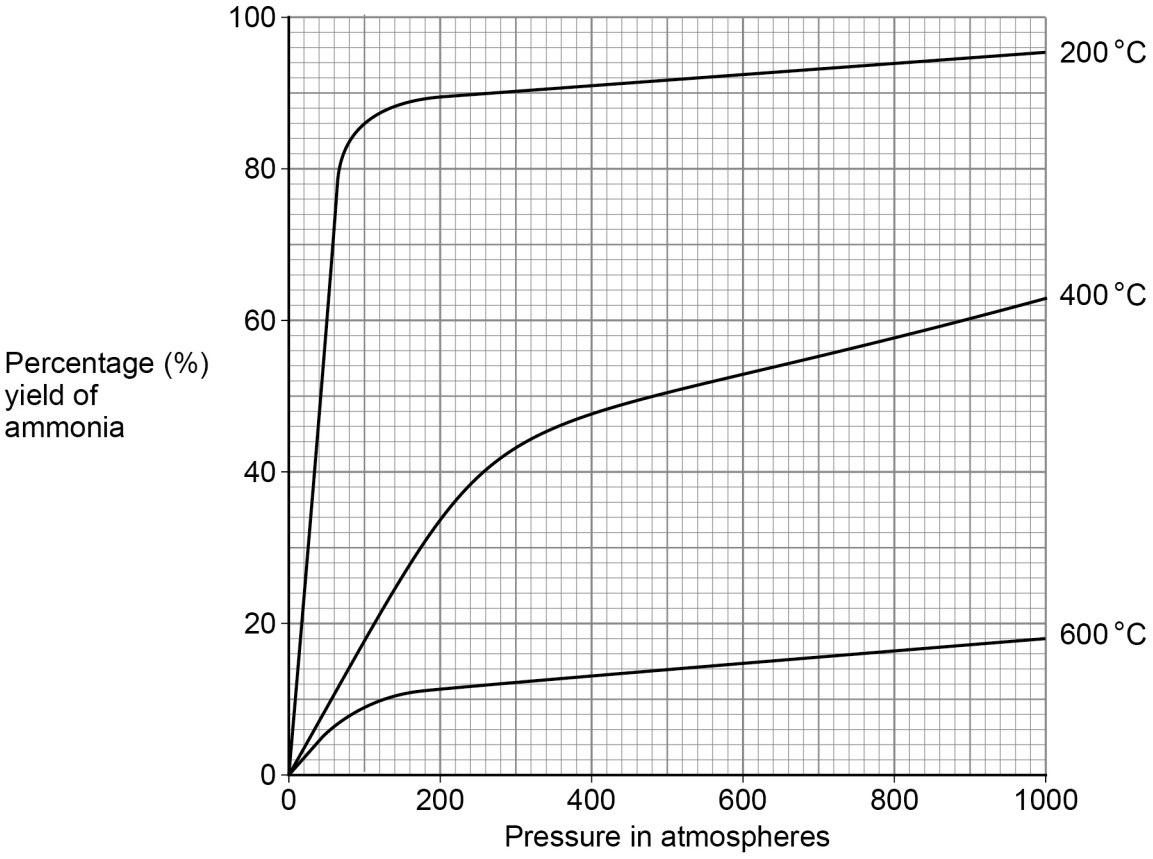
0 8 The Haber process produces ammonia from nitrogen and hydrogen.

The equation for the reaction is:

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

Figure 8 shows how the percentage yield of ammonia changes when the pressure increases at different temperatures.

Figure 8



0 8 . 1 Give **one** reason why the Haber process does **not** produce a 100% yield of ammonia.
[1 mark]

Do not write outside the box

0 8 . 2 The reaction to produce ammonia is exothermic.

How does **Figure 8** show this reaction is exothermic?

[1 mark]

0 8 . 3 Explain the change in the percentage yield of ammonia when the pressure is increased.

Use **Figure 8** and the equation for the reaction.

[3 marks]

0 8 . 4 At 400 °C and 800 atmospheres the theoretical maximum mass of ammonia produced is 450 kg.

Determine the actual mass of ammonia produced at 400 °C and 800 atmospheres.

Use **Figure 8** and the equation:

$$\text{Percentage yield} = \frac{\text{actual mass produced}}{\text{theoretical maximum mass produced}} \times 100$$

[4 marks]

Actual mass of ammonia produced = _____ kg

9

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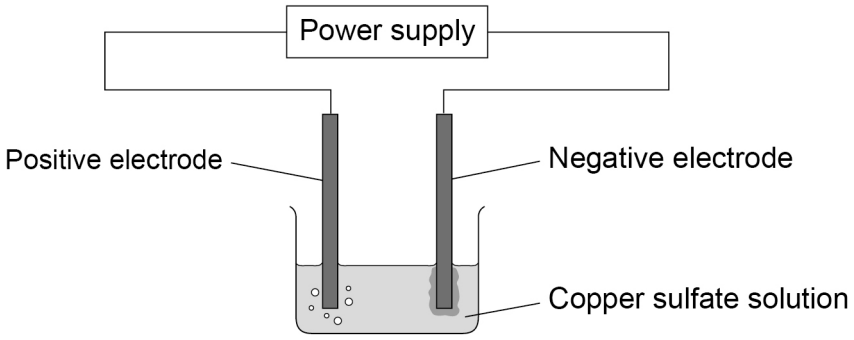
0 9 This question is about the electrolysis of copper sulfate solution.

Figure 9 shows the apparatus.

Figure 9



Oxygen gas is produced at the positive electrode.

Copper is produced at the negative electrode.

0 9 . 1 Why does copper sulfate solution conduct electricity?

[1 mark]

Do not write outside the box

0 9 . 2 Describe a test for oxygen gas.

Give the result if oxygen gas is present.

[2 marks]

Test _____

Result _____

_____

0 9 . 3 Complete the half equation for the reaction at the positive electrode.

You should balance the half equation.

[2 marks]

$$\_\_\_\ OH^- \rightarrow \_\_\_\ H_2O + O_2 + \_\_\_\_\_$$

0 9 . 4 Explain how copper atoms are produced at the negative electrode.

Use **Figure 9**.

[3 marks]

_____

_____

_____

_____

_____

_____

0 9 . 5 Electrolysis is used to electroplate metal objects.

Give **one** reason why some metal objects are electroplated with copper.

[1 mark]

_____

_____

9

END OF QUESTIONS

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