

# INTERNATIONAL GCSE CHEMISTRY

9202/1 PAPER 1

Specimen material

1 hour 30 minutes

### Materials

For this paper you must have:

- a ruler with millimetre measurements
- a calculator
- the periodic table (enclosed).

### Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the bottom of this page.
- Answer **all** questions.

### Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 90.

Please write clearly, in block capitals, to allow character computer recognition.

Centre number

Candidate number

Surname

Forename(s)

Candidate signature \_\_\_\_\_

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

1

This question is about the different properties of metals found in the periodic table.

0 1 . 1

Name the block of elements in the middle of the Periodic Table which includes vanadium?

[1 mark]

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0 1 . 2

Some of the properties of vanadium are shown in this list.

Tick the **two** boxes which are **not** typical of a Group 1 metal.

[2 marks]

It is a solid at room temperature.	<input type="checkbox"/>
It is a conductor of electricity.	<input type="checkbox"/>
It is a good conductor of heat.	<input type="checkbox"/>
It forms coloured compounds.	<input type="checkbox"/>
It forms ionic compounds.	<input type="checkbox"/>
It forms compounds that are catalysts.	<input type="checkbox"/>

A student was investigating the reaction of the Group 1 metal lithium and water.

She added a few drops of universal indicator to water in a trough and added a piece of lithium.



The word equation for the reaction is:



0 1 . 3

The lithium floated on the water.

State **two** other observations that the student would see during the reaction.

[2 marks]

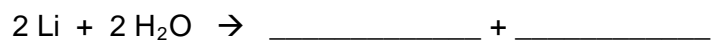
1 \_\_\_\_\_

2 \_\_\_\_\_

0 1 . 4

Complete the symbol equation for the reaction of lithium and water.

[2 marks]



0 1 . 5

State why all Group 1 metals have similar reactions with water.

Give your answer in terms of electronic structure.

[1 mark]

\_\_\_\_\_

\_\_\_\_\_

0 1 . 6

Explain why potassium is more reactive than lithium.

Give your answer in terms of electronic structure.

[3 marks]

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2

Copper is a widely used metal.

The main ore of copper contains copper sulfide.

Copper can be extracted from copper sulfide in a two stage process.

0 2 . 1

In the first stage of extraction the copper sulfide is heated in air.

Suggest the name of a gas released when copper sulfide is heated in air.

**[1 mark]**

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0 2 . 2

In the second stage copper oxide (CuO) is reduced using carbon.

Explain what happens during this reaction.

**[2 marks]**

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Copper-rich ores are running out.

New ways of extracting copper from low grade ores are being researched.

One way to extract the copper from land that contains low percentages of copper produces a solution of copper sulfate.

It is possible to get copper from a solution of copper sulfate using scrap iron.

0 2 . 3

It is economical to use scrap iron to get copper.

Give **one** reason why.

[1 mark]

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0 2 . 4

Name the type of reaction that takes place when iron reacts with copper sulfate solution.

[1 mark]

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0 2 . 5

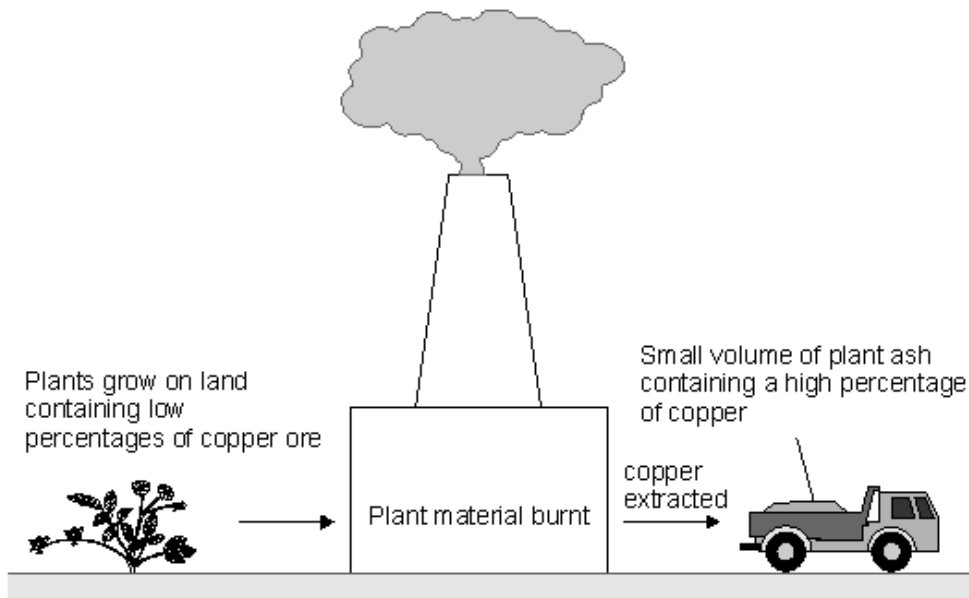
Write an ionic equation for the reaction between iron and copper sulfate solution.

[1 mark]

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Another new way to extract the copper from land that contains low percentages of copper is phytomining.

Phytomining uses plants. Plants are grown on this land and absorb copper compounds through their roots.



0 2 . 6

Suggest **two** advantages of phytomining compared to the other methods.

[2 marks]

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0 2 . 7

Suggest **one** disadvantage of phytomining compared to the other methods.

[1 mark]

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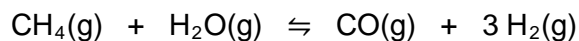


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3

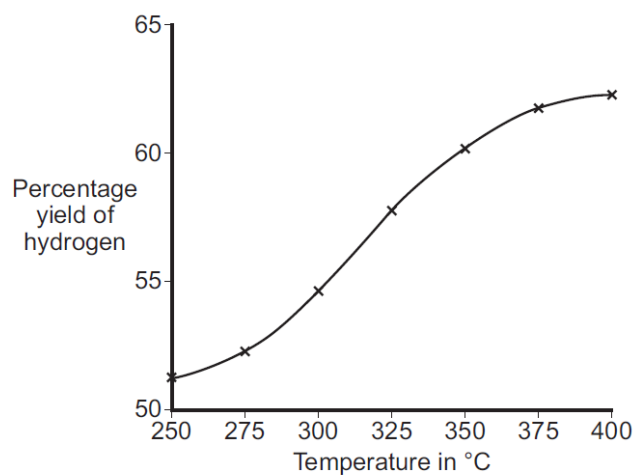
Hydrogen gas is produced by the reaction of methane and steam.

The equation for the reaction of methane and steam is:



This reaction is endothermic in the forward direction.

The graph shows the yield of hydrogen at different temperatures.



0 3 . 1

How does the graph show that the forward reaction is endothermic?

[1 mark]

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0 3 . 2

Why is a higher yield produced if the reaction is repeated at a lower pressure?

[1 mark]

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0	4	.	1
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Magnesium reacts with chlorine to form the compound magnesium chloride.

Describe the type of bonding in a molecule of chlorine.

Give your answer in terms of electron arrangement.

**[3 marks]**

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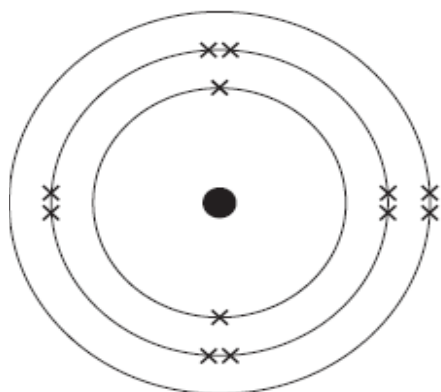
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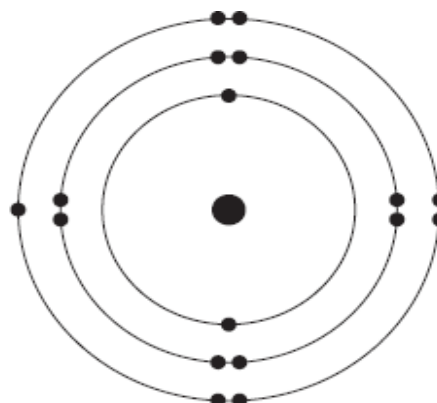
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0 4 . 2

The diagram shows an atom of magnesium and an atom of chlorine.



**Magnesium**



**Chlorine**

Describe how magnesium atoms and chlorine atoms change into ions to produce magnesium chloride ( $\text{MgCl}_2$ ).

Give your answer in terms of electrons.

**[4 marks]**

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0 4 . 3

Explain why magnesium chloride has a high melting point.

**[3 marks]**

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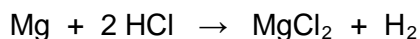
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5

A student investigated the rate of reaction of magnesium and hydrochloric acid



0 5 . 1

Which row in the table gives the correct state symbol for each of the chemicals?

Tick **one** box.

[1 mark]

Mg	HCl	MgCl <sub>2</sub>	H <sub>2</sub>	Tick
(aq)	(aq)	(s)	(aq)	
(aq)	(g)	(s)	(g)	
(s)	(g)	(aq)	(aq)	
(s)	(aq)	(aq)	(g)	

Concentration of hydrochloric acid in moles per dm<sup>3</sup>

0.5      1.0      1.5      2.0

Hydrochloric acid

Magnesium ribbon

0 5 . 2

The student changed the concentration of the hydrochloric acid.

Give **two** variables that the student should control.

[2 marks]

1. \_\_\_\_\_

2. \_\_\_\_\_

0	5	.	3
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Explain why increasing the temperature would increase the rate of reaction.

**[3 marks]**

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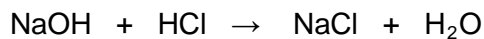
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The student wanted to check the concentration of the hydrochloric acid.

She used a pipette to measure out 25.0 cm<sup>3</sup> of the 0.50 mol/dm<sup>3</sup> hydrochloric acid solution and placed this in a conical flask. She then titrated this with 0.30 mol/dm<sup>3</sup> sodium hydroxide.



0 5 . 4

Calculate the number of moles of hydrochloric acid used.

[2 marks]

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0 5 . 5

Calculate the number of moles of NaOH needed to neutralise this number of moles of HCl.

[1 mark]

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0 5 . 6

Calculate the volume of sodium hydroxide solution that the student would use for this titration.

[2 marks]

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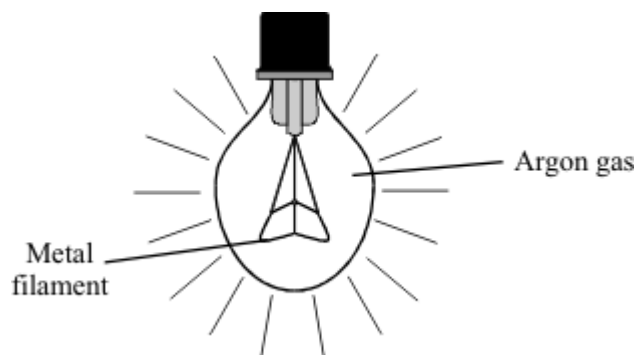
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6

The design of light bulbs has changed in recent years to make them more energy efficient.

Filament light bulbs are being phased out in some countries because they are inefficient. The diagram below shows a filament light bulb.



0 6 . 1

Argon is used in the lightbulbs because it is unreactive.

Why is argon unreactive?

[1 mark]

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0 6 . 2

Why is oxygen **not** a suitable gas to use in a light bulb?

[1 mark]

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The metal filament was usually made from tungsten.

The table below shows some properties of tungsten and other metals

Metal	Melting point in °C	Density in g cm <sup>-3</sup>	Ability to conduct electricity (bigger number is more conductive)
Tungsten	3414	19.3	8.9
Copper	1085	8.96	58.5
Nickel	1455	8.90	14.3

0 6 . 3

Suggest why tungsten was used to make the filaments in the light bulbs.

[1 mark]

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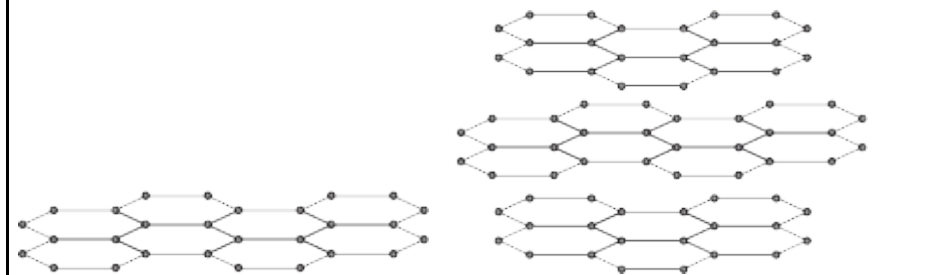
A new light bulb has recently been produced that is made from graphene. This is a very energy efficient light bulb.

The box below has some information about graphene.

Carbon can be made into thin, strong sheets called graphene.

A graphene sheet is a single layer of graphite.

Graphene conducts electricity extremely well.



Graphene

Graphite

Use the information above and your knowledge of bonding in graphite to:

0 6 . 4

Explain why graphene is strong;

[3 marks]

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**0 6 . 5**

Explain why graphene can conduct electricity.

**[2 marks]**

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**0 6 . 6**

Graphite is made up of layers of graphene.

Explain why graphite can be used as a lubricant.

**[2 marks]**

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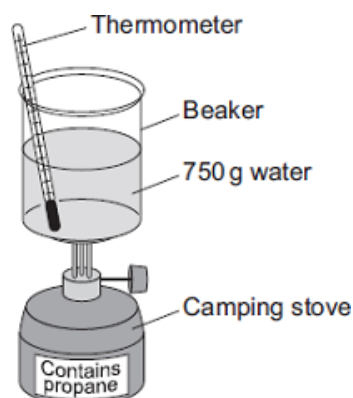
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7

A stove uses propane gas.



A student did an experiment to find the energy released when propane is burned.

The student:

- put 750 g water into a beaker
- measured the temperature of the water, which was 17 °C
- heated the water by burning propane
- measured the temperature of the water again, which was then 64 °C.

The student calculated the energy released using the equation

$$Q = m \times 4.2 \times \Delta T$$

Where:

Q = energy released (J)

m = mass of water (g)

$\Delta T$  = temperature change (°C)

07.1

Use the student's results to calculate the energy released in joules (J).

**[3 marks]**

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Energy released = \_\_\_\_\_ J

To find how much propane had been used the student weighed the stove before and after the experiment.

The mass of the stove decreased by 6.0 g.

07.2

Calculate the energy in kJ released when 1 mole of propane burns.

Use the information above and your answer to question 07.1.

Relative formula mass ( $M_r$ ) of propane = 44.

**[2 marks]**

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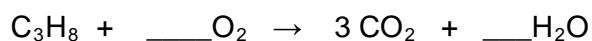
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Energy released = \_\_\_\_\_ kJ

07.3

Balance the symbol equation for the combustion of propane:

**[1 mark]**

07.4

Describe a test that could be used to identify the gas carbon dioxide.

**[2 marks]**

Test

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Observation

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07.5

Calculate the mass of carbon dioxide produced when 6g of propane is fully combusted.

**[3 marks]**

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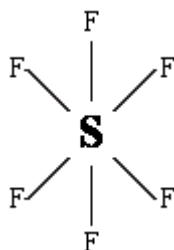
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Mass = \_\_\_\_\_ g

8 The diagram below represents a molecule of sulfur hexafluoride.



0 8 . 1

What type of chemical bond holds the sulfur and fluorine atoms together in sulfur hexafluoride molecules?

[1 mark]

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0 8 . 2

Explain why sulfur hexafluoride has a low boiling point.

Give your answer in terms of structure.

[2 marks]

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0 8 . 3

Fluorine reacts with the non-metal sulfur to make sulfur hexafluoride ( $\text{SF}_6$ ).

Write a balanced symbol equation for this reaction.

[2 marks]

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0 8 . 4

Sulfur hexafluoride is a colourless, odourless, non-flammable gas, which is insoluble in water and extremely unreactive.

Explain how **three** of the properties of sulfur hexafluoride make it suitable for use as an insulator inside electrical devices.

[3 marks]

Property 1: \_\_\_\_\_

Explanation: \_\_\_\_\_

\_\_\_\_\_

Property 2: \_\_\_\_\_

Explanation: \_\_\_\_\_

\_\_\_\_\_

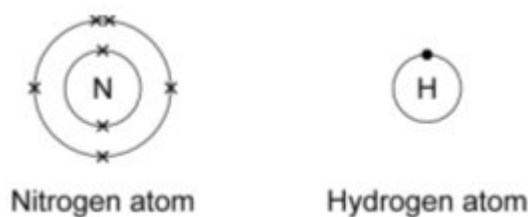
Property 3: \_\_\_\_\_

Explanation: \_\_\_\_\_

\_\_\_\_\_

Ammonia is another gas made by combining two non-metal elements. It has the formula  $\text{NH}_3$

The diagrams show how electrons are arranged in nitrogen and hydrogen atoms.



0 8 . 5

Draw a diagram to show how the electrons are arranged in an ammonia molecule.

You need only show the electrons in the highest energy level.

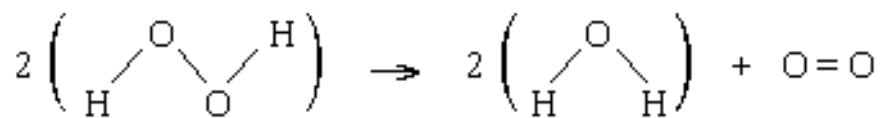
[2 marks]

9

At room temperature, hydrogen peroxide decomposes very slowly to form water and oxygen. The decomposition is speeded up when a catalyst is added.

The following equation represents the decomposition of hydrogen peroxide.

The displayed formulae of the chemicals involved are shown.



Use the following information about bond energies to answer this part of the question.

Bond	Bond energy (kJ)
O = O	498
O – O	146
H – O	464

09 . 1

Calculate the energy needed to break all the bonds in the reactants..

[2 marks]

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Energy needed = \_\_\_\_\_ kJ

09 . 2

Calculate the energy released when new bonds are formed in the products.

[2 marks]

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Energy released = \_\_\_\_\_ kJ

**0 9 . 3**

Calculate the energy change for this reaction.

**[1 mark]**

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Energy change = \_\_\_\_\_ kJ

**0 9 . 4**

Is the reaction exothermic or endothermic?

Give a reason for your answer.

**[1 mark]**

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**0 9 . 5**

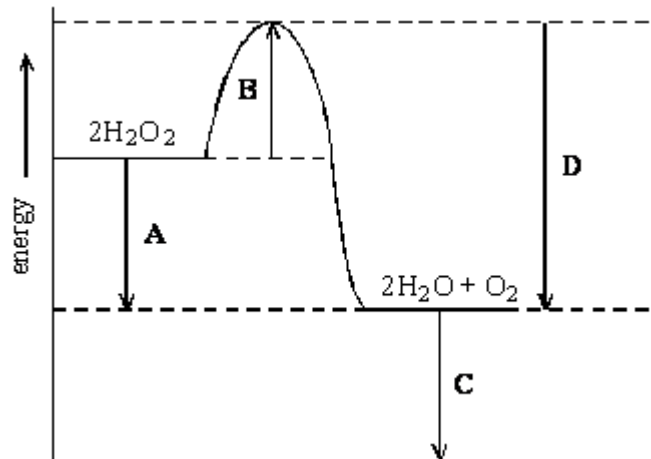
What is meant by 'activation energy'?

**[1 mark]**

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The energy level diagram for the decomposition of hydrogen peroxide into water and oxygen is shown below.



**0 9 . 6** Which energy change, **A**, **B**, **C** or **D**, is the activation energy?

[1 mark]

\_\_\_\_\_

**0 9 . 7** Explain how a catalyst makes hydrogen peroxide decompose more quickly.

Give your answer in terms of particles.

[2 marks]

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**END OF QUESTIONS**

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