



Please write clearly

Centre Number

Candidate Number

Surname

Forname (s)

Signature

GCSE CHEMISTRY

Predicted Paper 2024

(based on AQA)

Higher Tier Paper 1

Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:

- a ruler
- a scientific calculator
- the periodic table.

Instructions

- Use black ink or black ball-point pen.
- Pencils should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer all questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough workings in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information

- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

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

0 1

In 1911 Ernest Rutherford conducted an experiment in which alpha particles were fired at a thin sheet of gold foil. The experiment led to the plum pudding model of the atom being replaced by the nuclear model.

0 1**. 1**

Describe the differences between the plum pudding model and the nuclear model of the atom.

[3 marks]

0 1**. 2**

Explain how the alpha particle scattering experiment led to the acceptance of the nuclear model of the atom.

[2 marks]

Gold is a transition metal. Other examples of transition metals are iron, nickel and cobalt.

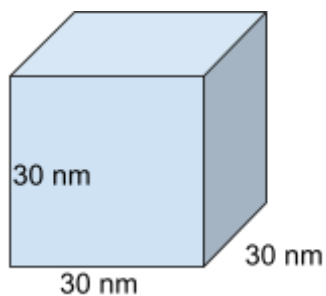
0 1 . 3 Give **two** properties of transition metals.

[2 marks]

Gold is sometimes used in the form of nanoparticles.

0 1 . 4 **Figure 1** shows us a nanoparticle. Each side of the cube has a length of 30 nm.

Figure 1



Calculate the volume of the cube in **Figure 1**.

[1 mark]

Volume of the cube = _____ nm

0 1 . 5 Give an advantage of using nanoparticles compared with larger particle sizes.

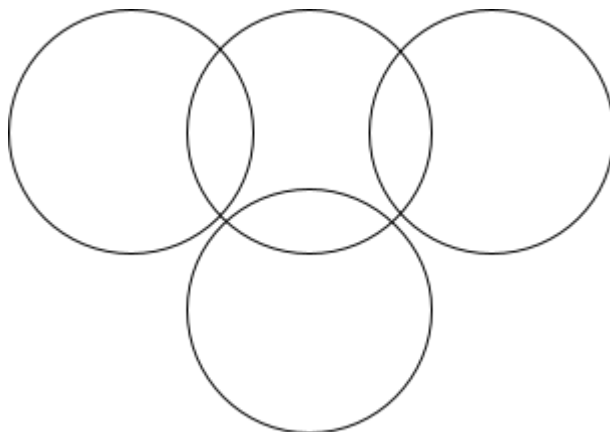
[1 mark]

Turn over to the next question

0 2 Phosphine is a highly toxic gas, which is found in the atmosphere of Jupiter. It has the molecular formula PH_3 .

0 2 . 1 Complete **Figure 2** to show the outer electrons in a phosphine molecule. **[2 marks]**

Figure 2



0 2 . 2 What is the type of bond in phosphine?

Tick (✓) **one** box.

Covalent

Ionic

Metallic

[1 mark]

0 2 . 3 Draw a ring around the correct answer to complete the sentences.

Phosphine is a [**simple covalent** | **giant covalent** | **solid**] molecule.

Phosphine has a low boiling point because it has weak [**electrostatic forces** | **intermolecular forces** | **covalent bonds**].

It takes [**a lot** | **a small amount** | **no**] energy to turn phosphine from a liquid into a gas.

[3 marks]

There is some evidence suggesting that the planets Neptune and Uranus contain large amounts of diamond.

Figure 3.1 represents the structure of diamond. **Figure 3.2** represents the structure of graphite.

Figure 3.1

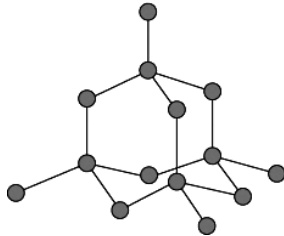
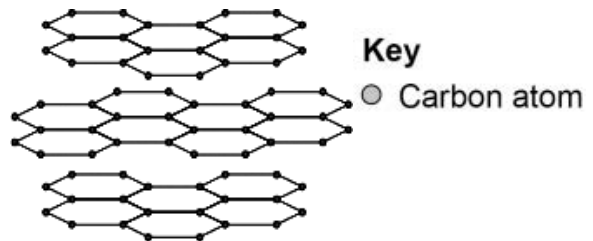


Figure 3.2



0 2 . 4

Explain why diamond is very hard, while graphite is very soft. Your answer should include a comparison of the structure and bonding in diamond with that of graphite.

[6 marks]

Turn over to the next question

Magnesium chloride is a salt.

- 0 3 . 2** Give the name of another substance which would form magnesium chloride when reacted with hydrochloric acid.

[1 mark]

Magnesium chloride is an ionic substance.

- 0 3 . 3** Describe what happens when a magnesium atom reacts with 2 chlorine atoms. Answer in terms of electrons.

[4 marks]

- 0 3 . 4** State symbols are used in chemical equations to show the state of each substance in a reaction. Complete the table.

[1 mark]

12

Table 1

state		liquid		aqueous
symbol	s		g	

Turn over to the next question

0 4**Table 2** shows the properties of the subatomic particles.**0 4 . 1**

Complete the table.

[3 marks]**Table 2**

	mass	charge	location
proton			
neutron			
	Very small		

Before the discovery of the subatomic particles, the elements were arranged in the periodic table by their atomic weights.

0 4 . 2

Complete the sentences below.

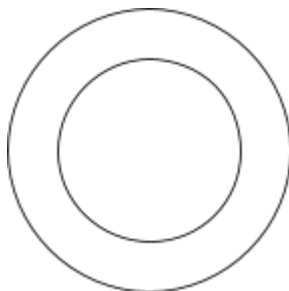
When Mendeleev designed his periodic table he placed elements with similar properties in _____. He also left gaps for _____ elements.

[2 marks]

0 4 . 3 Complete **Figure 4** to show the electronic structure of a fluoride ion (F^-).

[2 marks]

Figure 4



0 4 . 4 Copper has two stable isotopes.

^{63}Cu has a relative abundance of 69.15 %

^{65}Cu has a relative abundance of 30.85 %

Calculate the relative atomic mass of copper.

Give your answer to 1 decimal place.

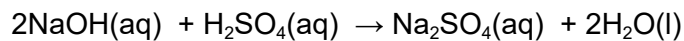
[2 marks]

Turn over to the next question

0 5

A student is investigating the reaction between sulfuric acid and sodium hydroxide.

The equation for this reaction is shown below.



15.0 cm³ of sulfuric acid reacts with 20.0 cm³ of 0.250 mol/dm³ sodium hydroxide.

0 5**1**

Find the concentration of the acid in mol/dm³.

Give your answer to 3 significant figures.

[6 marks]

Concentration of acid = _____ mol/dm³

0 5**2**

What is an acid?

Tick (✓) the correct box.

[1 mark]

A substance which releases H⁺ ions.

A substance which removes H⁺ ions.

A substance with no H⁺ ions.

0 5 . 3 Sulfuric acid is a strong acid, ethanoic acid is a weak acid.

Explain how a strong acid is different from a weak acid.

[2 marks]

Sodium sulfate is used in the paper making industry.

One method of making sodium sulfate is shown below.



0 5 . 4 Calculate the percentage atom economy for the method of producing sodium sulfate.

Give your answer to 3 significant figures.

Relative atomic masses (Ar): H = 1 O = 16 Na = 23 Mg = 24 S = 32

[4 marks]

Percentage atom economy (3 significant figures) = _____ %

Question 5 continues on the next page

A chemist wants to make 30 g sodium sulfate.

0 5 . 5 Calculate how much magnesium carbonate will be produced. Give

your answer to 1 decimal place.

[3 marks]

_____ g

16

0 6 Hydrogen fuel cells are sometimes used to generate electricity for cars.

0 6 . 1 Give the half equations for the electrode reactions in a hydrogen fuel cell.

[4 marks]

0 6 . 2 Give an advantage and a disadvantage of using hydrogen fuel cells to power an electric car.

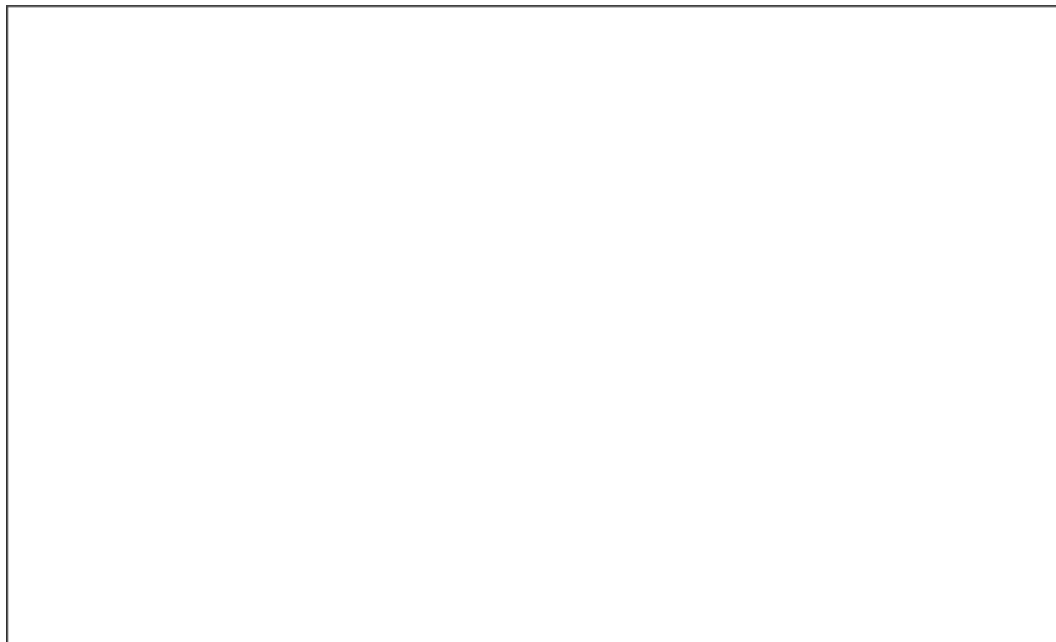
[2 marks]

Question 6 continues on the next page

0 6 . 3 Draw a diagram of the cell.

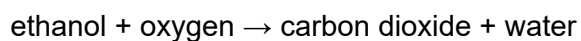
Label the electrolyte and the 2 metal electrodes.

[2 marks]



Ethanol is a fuel sometimes used in vehicles.

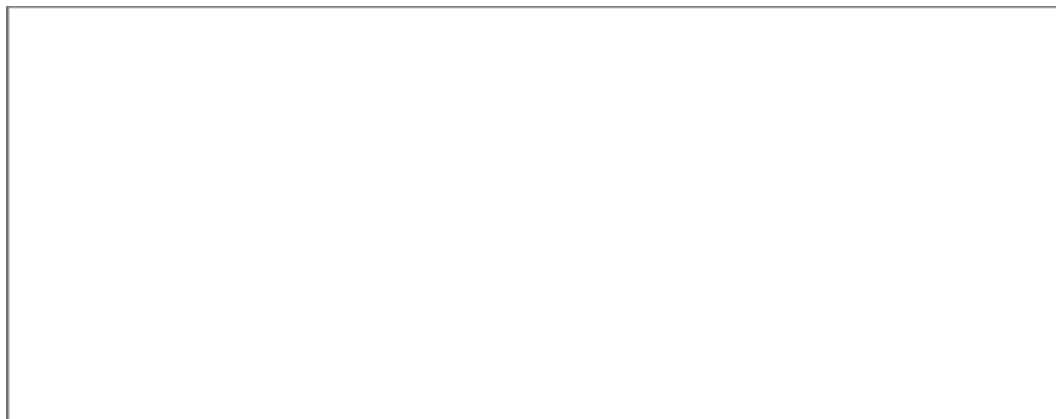
The reaction for the combustion of ethanol is shown below, this is an exothermic reaction.



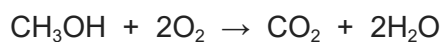
0 6 . 4 Draw the energy change diagram for the reaction between methanol and oxygen.

Label the activation energy.

[2 marks]



- 0 6 . 5** The balanced symbol equation for the reaction between methanol and oxygen is shown below:



Use the data in **Table 3** to calculate the overall energy change of the reaction.

[3 marks]

Table 3

Bond	Bond energy in KJ
C-H	435
C-O	336
O-H	464
O=O	498
C=O	830

Turn over to the next question

0 7

A student is given three different metals, Cu, Zn and Fe.

She is also given sulfate solutions of those metals; CuSO_4 , ZnSO_4 and FeSO_4 .

0 7 . 1

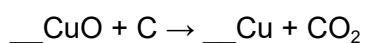
Describe a method the student could use to determine the order of reactivity of these metals.

[4 marks]

Carbon can be used to extract copper from copper oxide.

0 7 . 2

Balance the equation below:

[1 mark]

0 7 . 3

Explain why copper is reduced. Answer in terms of electrons.

[1 mark]

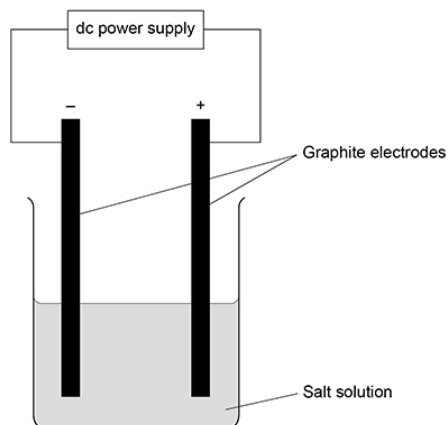
0 8

This question is about electrolysis of aqueous solutions.

A student investigates the electrolysis of different solutions using graphite electrodes.

Figure 5 shows a simplified version of the electrolysis cell used.

Figure 5

**0 8 . 1**

Explain why the salt solution is able to conduct electricity.

[2 marks]

0 8 . 2

An aqueous solution of copper sulfate is electrolysed. Give the products at the electrodes.

[2 marks]

Positive electrode _____

Negative electrode _____

Question 8 continues on the next page

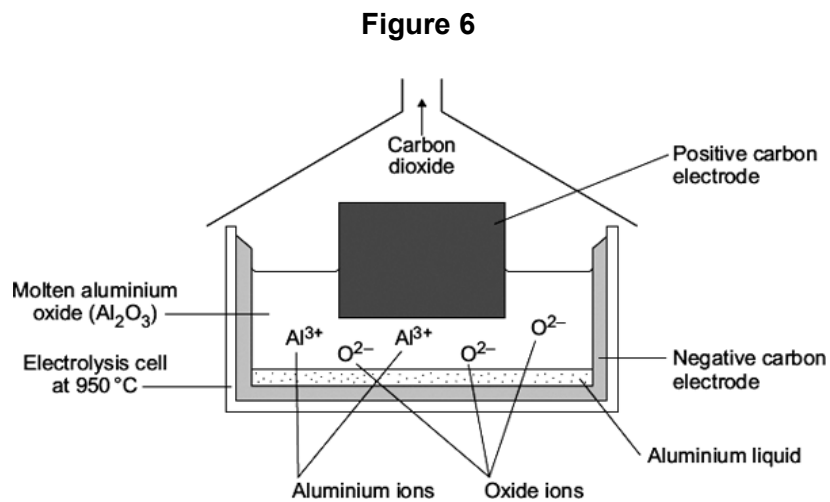
0 8 . 3 An aqueous solution of potassium chloride is electrolysed. Give the products at the electrodes.

[2 marks]

Positive electrode _____

Negative electrode _____

Figure 6 shows aluminium being extracted from aluminium oxide, Al_2O_3 using electrolysis.



0 8 . 4 Explain why the carbon electrodes need to be continually replaced?

Include a balanced symbol equation in your answer.

[3 marks]

0 8 . 5 Give the half equation for the reduction of aluminium ions.

[2 marks]

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Turn over to the next question

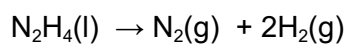
The chemist isolates 26 g of hydrazine.

0 9 . 2 Calculate the percentage yield for this reaction.

[3 marks]

Percentage yield = _____ %

Hydrazine is passed over a catalyst to release hydrogen gas in the following equation:



The chemist puts 20 g of hydrazine onto the catalyst, it completely reacts.

0 9 . 3 Calculate the total volume of gas produced at room temperature and pressure.

[5 marks]

Volume of gas = _____

END OF QUESTIONS