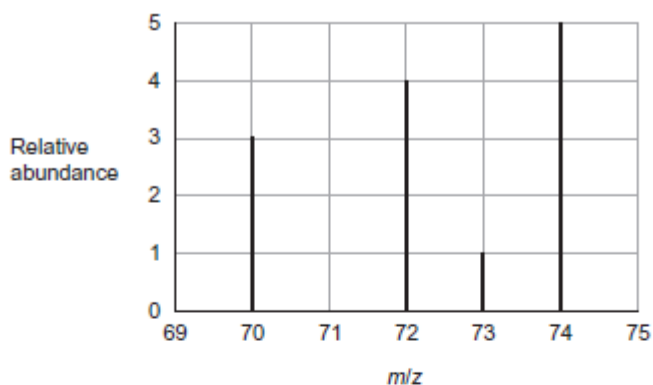


1 The mass spectrum of the isotopes of element X is shown in the diagram.



1 (a) Define the term *relative atomic mass*.

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(2 marks)

1 (b) Use data from the diagram to calculate the relative atomic mass of X.

Give your answer to one decimal place.

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(3 marks)

1 (c) Identify the ion responsible for the peak at 72

.....
(1 mark)

1 (d) Identify which **one** of the isotopes of X is deflected the most in the magnetic field of a mass spectrometer. Give a reason for your answer.

Isotope

Reason

(2 marks)

1 (e) In a mass spectrometer, the relative abundance of each isotope is proportional to the current generated by that isotope at the detector.

Explain how this current is generated.

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(2 marks)

1 (f) X and Zn are different elements.

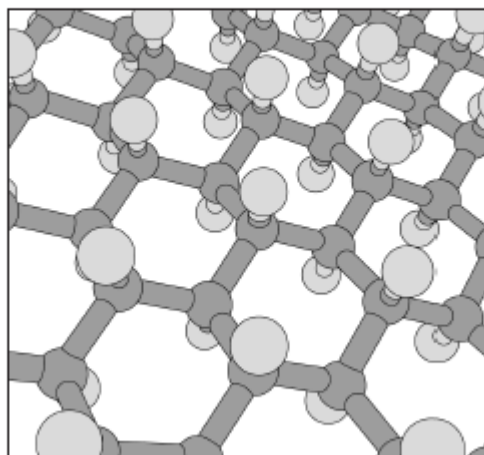
Explain why the chemical properties of ^{70}X and ^{70}Zn are different.

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(1 mark)

2)

In 2009 a new material called graphane was discovered. The diagram shows part of a model of the structure of graphane. Each carbon atom is bonded to three other carbon atoms and to one hydrogen atom.



(a) Deduce the type of crystal structure shown by graphane.

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(1 mark)

(b) State how two carbon atoms form a carbon-carbon bond in graphane.

.....
.....
(1 mark)

(c) Suggest why graphane does **not** conduct electricity.

.....
.....
(1 mark)

(d) Deduce the empirical formula of graphane.

.....
(1 mark)

CHERRY HILL TUITION AQA CHEMISTRY AS PAPER 6

3)

Fritz Haber, a German chemist, first manufactured ammonia in 1909.
Ammonia is very soluble in water.

- (a) State the strongest type of intermolecular force between one molecule of ammonia and one molecule of water.

.....
(1 mark)

- (b) Draw a diagram to show how one molecule of ammonia is attracted to one molecule of water. Include all partial charges and all lone pairs of electrons in your diagram.

(3 marks)

- (c) Phosphine (PH_3) has a structure similar to ammonia.

In terms of intermolecular forces, suggest the main reason why phosphine is almost insoluble in water.

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(1 mark)

4)

Aluminium and thallium are elements in Group 3 of the Periodic Table.
Both elements form compounds and ions containing chlorine and bromine.

- (a) Write an equation for the formation of aluminium chloride from its elements.

.....
(1 mark)

- (b) An aluminium chloride molecule reacts with a chloride ion to form the AlCl_4^- ion.

Name the type of bond formed in this reaction. Explain how this type of bond is formed in the AlCl_4^- ion.

Type of bond

Explanation

.....
(2 marks)

- (c) Aluminium chloride has a relative molecular mass of 267 in the gas phase.

Deduce the formula of the aluminium compound that has a relative molecular mass of 267

.....
(1 mark)

- (d) Deduce the name or formula of a compound that has the same number of atoms, the same number of electrons and the same shape as the AlCl_4^- ion.

.....
(1 mark)

- (e) Draw and name the shape of the TlBr_5^{2-} ion.

Shape of the TlBr_5^{2-} ion.

Name of shape

(2 marks)

(f) (i) Draw the shape of the $TlCl_2^+$ ion.

(1 mark)

(f) (ii) Explain why the $TlCl_2^+$ ion has the shape that you have drawn in part (f) (i).

.....
.....
.....

(1 mark)

(g) Which **one** of the first, second or third ionisations of thallium produces an ion with the electron configuration $[Xe] 5d^{10}6s^1$?

Tick (✓) **one** box.

First

Second

Third

(1 mark)

5 Zinc forms many different salts including zinc sulfate, zinc chloride and zinc fluoride.

(a) People who have a zinc deficiency can take hydrated zinc sulfate ($\text{ZnSO}_4 \cdot x\text{H}_2\text{O}$) as a dietary supplement.

A student heated 4.38 g of hydrated zinc sulfate and obtained 2.46 g of anhydrous zinc sulfate.

Use these data to calculate the value of the integer x in $\text{ZnSO}_4 \cdot x\text{H}_2\text{O}$
Show your working.

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(3 marks)

(b) Zinc chloride can be prepared in the laboratory by the reaction between zinc oxide and hydrochloric acid.
The equation for the reaction is



A 0.0830 mol sample of pure zinc oxide was added to 100 cm³ of 1.20 mol dm⁻³ hydrochloric acid.

Calculate the maximum mass of anhydrous zinc chloride that could be obtained from the products of this reaction.

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(4 marks)

- (c) Zinc chloride can also be prepared in the laboratory by the reaction between zinc and hydrogen chloride gas.



An impure sample of zinc powder with a mass of 5.68 g was reacted with hydrogen chloride gas until the reaction was complete. The zinc chloride produced had a mass of 10.7 g.

Calculate the percentage purity of the zinc metal.
Give your answer to 3 significant figures.

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(4 marks)

- (d) Predict the type of crystal structure in solid zinc fluoride and explain why its melting point is high.

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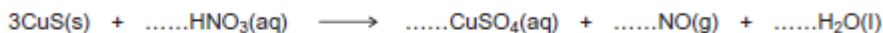
(3 marks)

CHERRY HILL TUITION AQA CHEMISTRY AS PAPER 6

The price of copper is increasing as supplies of high-grade ores start to run out. The mineral covellite (CuS), found in low-grade ores, is a possible future source of copper.

- 6 (a) When copper is extracted from covellite, a reaction occurs between copper(II) sulfide and nitric acid to form a dilute solution of copper(II) sulfate.

- (a) (i) Balance the equation for this reaction.



(1 mark)

- (a) (ii) Give the oxidation state of nitrogen in each of the following.

HNO₃.....

NO

(2 marks)

- (a) (iii) Deduce the redox half-equation for the reduction of the nitrate ion in acidified solution to form nitrogen monoxide and water.

.....
(1 mark)

- (a) (iv) Deduce the redox half-equation for the oxidation of the sulfide ion in aqueous solution to form the sulfate ion and H⁺(aq) ions.

.....
(1 mark)

- (b) Use your knowledge of metal reactivity to state and explain a low-cost method for the extraction of copper from a dilute aqueous solution of copper(II) sulfate. Write the **simplest ionic** equation for the reaction that occurs during this extraction process.

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Simplest ionic equation

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(4 marks)