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— **TUITION** —

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CHEMISTRY

INORGANIC CHEMISTRY

Level & Board	AQA (A-LEVEL)
TOPIC:	GROUP 2 METALS
PAPER TYPE:	QUESTION PAPER - 2
TOTAL QUESTIONS	10
TOTAL MARKS	37

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Group 2 Metals - 2

1. Which statement is not correct?

- A. Strontium has a lower first ionisation energy than calcium.
- B. Strontium has a larger ionic radius than calcium.
- C. Strontium reacts less vigorously with water than calcium.
- D. Strontium hydroxide is more soluble in water than calcium hydroxide.

(1)

2. This question is about Group 2 elements and their compounds.

(a) Explain why the melting point of magnesium is higher than the melting point of sodium.

(2)

(b) Give an equation to show how magnesium is used as the reducing agent in the extraction of titanium.

Explain, in terms of oxidation states, why magnesium is the reducing agent.

(2)

(c) State what is observed when dilute aqueous sodium hydroxide is added to separate solutions of magnesium chloride and barium chloride.

(2)

3. What is a use for barium sulfate?

- A.** In agriculture to act as a fertiliser
- B.** In agriculture to neutralise acidic soil
- C.** In medicine to produce an X-ray image
- D.** In medicine as an antacid to treat indigestion

(1)

4. This question is about magnesium and its compounds.

(a) State one observation when magnesium reacts with steam.
Give an equation, including state symbols, for this reaction.

(2)

(b) Describe the bonding in magnesium.

(2)

(c) Explain, in terms of structure and bonding, why magnesium chloride has a high melting point.

(3)

(d) Give one medical use for magnesium hydroxide.

(1)

5. What is the correct observation when barium metal is added to an excess of water?

- A.** Forms a colourless solution only
- B.** Forms a colourless solution and effervesces
- C.** Forms a white precipitate only
- D.** Forms a white precipitate and effervesces

(1)

6. This question is about s-block metals.

(a) Give the full electron configuration for the calcium ion, Ca^{2+}

(1)

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(b) Explain why the second ionisation energy of calcium is lower than the second ionisation energy of potassium.

(2)

(c) Identify the s-block metal that has the highest first ionisation energy.

(1)

(d) Give the formula of the hydroxide of the element in Group 2, from Mg to Ba, that is least soluble in water.

(1)

(e) A student added 6 cm³ of 0.25 mol dm⁻³ barium chloride solution to 8 cm³ of 0.15 mol dm⁻³ sodium sulfate solution.

The student filtered off the precipitate and collected the filtrate.

Give an ionic equation for the formation of the precipitate.

Show by calculation which reagent is in excess.

Calculate the total volume of the other reagent which should be used by the student so that the filtrate contains only one solute.

(3)

7. Which substance is used to reduce titanium(IV) chloride in the extraction of titanium metal?

- A. Magnesium
- B. Manganese
- C. Vanadium
- D. Zinc

(1)

8. A sample of strontium has a relative atomic mass of 87.7 and consists of three isotopes, ^{86}Sr , ^{87}Sr and ^{88}Sr

In this sample, the ratio of abundances of the isotopes $^{86}\text{Sr}:$ ^{87}Sr is 1:1

State why the isotopes of strontium have identical chemical properties.

Calculate the percentage abundance of the ^{88}Sr isotope in this sample.

Why isotopes of strontium have identical chemical properties

(4)

9. Which statement about barium sulfate is correct?

- A. It is soluble in water at a temperature of 100 °C.
- B. It is used in medicine because it does not dissolve in body fluids.
- C. It is a pale yellow solid.
- D. It reacts with acidified barium chloride solution.

(1)

10. A time of flight (TOF) mass spectrum was obtained for a sample of barium that contains the isotopes ^{136}Ba , ^{137}Ba and ^{138}Ba

(a) The sample of barium was ionised by electron impact. Identify the ion with the longest time of flight.

(1)

(b) A $^{137}\text{Ba}^+$ ion travels through the flight tube of a TOF mass spectrometer with a kinetic energy of $3.65 \times 10^{-16} \text{ J}$

This ion takes $2.71 \times 10^{-5} \text{ s}$ to reach the detector.

$$\text{KE} = \frac{1}{2} mv^2$$

where m = mass (kg) and v = speed (m s^{-1})

The Avogadro constant, $L = 6.022 \times 10^{23} \text{ mol}^{-1}$

Calculate the length of the flight tube in metres.

Give your answer to the appropriate number of significant figures.

(5)

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- Founder & CEO of Chemistry Online Tuition Ltd.
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