CHAPTER 9 GROUP 2

1 State and explain the trend in melting point of the Group II elements Ca–Ba.

Trend .....

Explanation .....

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(3 marks)

2 State the trends in solubility of the hydroxides and of the sulphates of the Group II elements Mg–Ba.
Describe a chemical test you could perform to distinguish between separate aqueous solutions of sodium sulphate and sodium nitrate. State the observation you would make with each solution. Write an equation for any reaction which occurs.

(6 marks)

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3 (a) For the elements Mg–Ba, state how the solubilities of the hydroxides and the solubilities of the sulphates change down Group II.

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(b) Describe a test to show the presence of sulphate ions in an aqueous solution. Give the results of this test when performed on separate aqueous solutions of magnesium chloride and magnesium sulphate. Write equations for any reactions occurring.

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(c) State the trend in the reactivity of the Group II elements Mg–Ba with water. Write an equation for the reaction of barium with water.

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4 Group 2 metals and their compounds are used commercially in a variety of processes and applications.

(a) State a use of magnesium hydroxide in medicine.

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(1 mark)

(b) Calcium carbonate is an insoluble solid that can be used in a reaction to lower the acidity of the water in a lake.

Explain why the rate of this reaction decreases when the temperature of the water in the lake falls.

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(3 marks)

(c) Strontium metal is used in the manufacture of alloys.

(i) Explain why strontium has a higher melting point than barium.

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(2 marks)

(ii) Write an equation for the reaction of strontium with water.

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(1 mark)

(d) Magnesium can be used in the extraction of titanium.

(i) Write an equation for the reaction of magnesium with titanium(IV) chloride.

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(1 mark)

(ii) The excess of magnesium used in this extraction can be removed by reacting it with dilute sulfuric acid to form magnesium sulfate.

Use your knowledge of Group 2 sulfates to explain why the magnesium sulfate formed is easy to separate from the titanium.

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(1 mark)

5 Group 2 elements and their compounds have a wide range of uses.

(a) For parts **(a)(i)** to **(a)(iii)**, draw a ring around the correct answer to complete each sentence.

(i) From $Mg(OH)_2$ to $Ba(OH)_2$, the solubility in water

decreases. / increases. / stays the same.

(1 mark)

(ii) From Mg to Ba, the first ionisation energy

decreases. / increases. / stays the same.

(1 mark)

(iii) From Mg to Ba, the atomic radius

decreases. / increases. / stays the same.

(1 mark)

(b) Explain why calcium has a higher melting point than strontium.

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(2 marks)

(c) Acidified barium chloride solution is used as a reagent to test for sulfate ions.

(i) State why sulfuric acid should **not** be used to acidify the barium chloride.

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(1 mark)

(ii) Write the **simplest ionic** equation for the reaction that occurs when acidified barium chloride solution is added to a solution containing sulfate ions.

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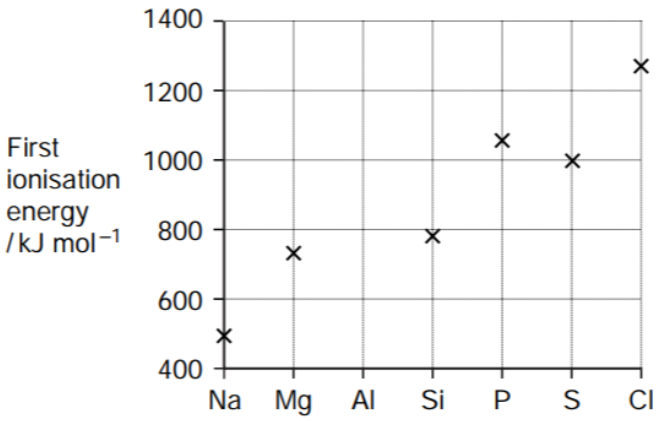
(1 mark)

6 The following diagram shows the first ionisation energies of some Period 3 elements.



(a) Draw a cross on the diagram to show the first ionisation energy of aluminium.

(1 mark)

(b) Write an equation to show the process that occurs when the first ionisation energy of aluminium is measured.

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(2 marks)

(c) State which of the first, second or third ionisations of aluminium would produce an ion with the electron configuration $1s^2\ 2s^2\ 2p^6\ 3s^1$

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(1 mark)

(d) Explain why the value of the first ionisation energy of sulfur is less than the value of the first ionisation energy of phosphorus.

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(2 marks)

(e) Identify the element in Period 2 that has the highest first ionisation energy and give its electron configuration.

Element .....

Electron configuration .....

(2 marks)

(f) State the trend in first ionisation energies in Group 2 from beryllium to barium. Explain your answer in terms of a suitable model of atomic structure.

Trend.....

Explanation .....

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(3 marks)

7 There are many uses for compounds of barium.

(a) (i) Write an equation for the reaction of barium with water.

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(1 mark)

(ii) State the trend in reactivity with water of the Group 2 metals from Mg to Ba

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(1 mark)

(b) Give the formula of the **least** soluble hydroxide of the Group 2 metals from Mg to Ba

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(1 mark)

(c) State how barium sulfate is used in medicine.
Explain why this use is possible, given that solutions containing barium ions are poisonous.

Use .....

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Explanation .....

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(2 marks)