InkChemistry

QUESTION WORKBOOK

# Group 2: trends down the group and reactions with water

Group 2 and Group 7 · Unit C13

AQA 3.2.2 · OCR A 3.1.2 (a), 3.1.2 (b), 3.1.2 (d)

20 questions · 65 marks

NAVY SCREEN EDITION

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## SECTION A · Short, 1 to 2 marks

**A1** GTD-Q13

Suggest why beryllium shows no visible reaction with water, even as steam, although it is in Group 2. [2]

**A2** GTD-Q23

Suggest the approximate pH of the solution formed when strontium oxide is shaken with water, and explain your answer. [2]

## SECTION B · Standard, 3 to 5 marks

**B1** GTD-Q4

Explain why the melting point decreases from calcium to barium, and identify the element from magnesium to barium whose melting point does not fit the trend. [4]

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**B2** GTD-Q11 Explain the roles of magnesium and of argon in the reduction $TiCl_4(g) + 2Mg(l) \rightarrow Ti(s) + 2MgCl_2(l)$ at about 1000 °C, identifying the species oxidised and the species reduced. [4]

**B3** GTD-Q14 Compare the reactions of magnesium and barium with cold water. [4]

**B4** GTD-Q15 Evaluate the claim that titanium is expensive because its ore is rare. [4]

**B5** GTD-Q3 Explain why the first ionisation energy decreases from magnesium to barium. [3]

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**B6** GTD-Q6 Describe what is seen when magnesium is heated in steam, and write an equation with state symbols for the reaction. [3]

**B7** GTD-Q7 Complete the equation for the reaction of barium with cold water, including state symbols, $Ba(s) + 2H_2O(l) \rightarrow$, and state what happens to the oxidation state of barium. [3]

**B8** GTD-Q8 Explain why the reactivity of the Group 2 metals with water increases down the group. [3]

**B9** GTD-Q9 Calculate the mass of magnesium, in kg, needed to react with 500 kg of titanium(IV) chloride. Ar values: Ti 47.9, Cl 35.5, Mg 24.3. [3]

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**B10** GTD-Q10 Calculate the volume of hydrogen, in $cm^3$ at room temperature and pressure, given off when 0.400 g of calcium reacts completely with water. Ar of Ca = 40.1; molar gas volume = 24.0 $dm^3\ mol^{-1}$. [3]

**B11** GTD-Q12 Suggest why sodium can be used in place of magnesium to reduce titanium(IV) chloride, write the equation with state symbols for a reaction at 850 °C, and compare the number of moles of each metal needed per mole of titanium. [3]

**B12** GTD-Q16 Explain why calcium reacting with water gives a cloudy mixture, while barium reacting with water gives a clear solution. [3]

**B13** GTD-Q19 Explain why calcium reacts with dilute sulfuric acid for only a short time, while magnesium goes on reacting until the metal or the acid is used up. [3]

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**B14** GTD-Q20 Calculate the volume of hydrogen, in $cm^3$ at room temperature and pressure, given off when 0.250 g of strontium reacts with excess dilute hydrochloric acid. Ar of Sr = 87.6; molar gas volume = 24.0 $dm^3\ mol^{-1}$. [3]

**B15** GTD-Q21 Suggest why an open bag of quicklime, calcium oxide, gets warm and its lumps crumble to powder after rain gets into it. Give an equation with state symbols, and suggest the pH of the mixture when the powder is shaken with more water. [3]

**B16** GTD-Q22 Describe what is seen when hot magnesium ribbon is lowered into a gas jar of chlorine, and give the equation, with state symbols, and the change in oxidation state of each element. [3]

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**B17** GTD-Q24 Calculate the volume of carbon dioxide, in $cm^3$ at room temperature and pressure, given off when 0.750 g of calcium carbonate reacts with excess dilute hydrochloric acid. Mr of $CaCO_3$ = 100.1; molar gas volume = 24.0 $dm^3\ mol^{-1}$. [3]

## SECTION C · Long, 6 marks or more

**C1** GTD-Q18 Explain the trends in atomic radius, first ionisation energy and reactivity with water from magnesium to barium. Include an equation in your answer. [6]

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