InkChemistry

QUESTION WORKBOOK

The Period 3 oxides: structure, bonding and acid–base character

Periodicity and Period 3 · Unit C12

AQA 3.2.4

18 questions · 66 marks

PRINT EDITION

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SECTION B · Standard, 3 to 5 marks

B1 POS-Q1

Give an equation, with state symbols, for the reaction of each of sodium oxide, phosphorus(V) oxide and sulfur dioxide with water, the approximate pH of each solution, and the classification of each oxide as basic or acidic. [4]

B2 POS-Q4

Explain why silicon dioxide has a high melting point but phosphorus(V) oxide has a low one. [4]

B3 POS-Q6

Explain, in terms of bonding, why sodium oxide forms an alkaline solution in water and sulfur trioxide forms an acidic one. [4]

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B4 POS-Q7 Explain why adding aluminium oxide or silicon dioxide to water does not change its pH, and describe one reaction of each oxide that shows its acid–base character. [4]

B5 POS-Q11 Calculate the volume of 0.200 mol dm^{-3} sodium hydroxide needed to neutralise completely, to Na_3PO_4, the acid formed when 1.42 g of P_4O_{10} is added to water. [4]

B6 POS-Q14 Suggest whether beryllium oxide, BeO, is basic, amphoteric or acidic, given that the electronegativity of beryllium is 1.5 and of oxygen 3.5, and give equations, with state symbols, for its reactions with hydrochloric acid and with sodium hydroxide solution. [4]

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B7 POS-Q15 Evaluate the statement that across Period 3 the metal oxides are basic and the non-metal oxides are acidic. [4]

B8 POS-Q19 Explain why sodium chloride gives a solution of pH 7 in water but silicon tetrachloride gives a solution of pH 1 to 2. Include an equation, with state symbols, for the reaction of silicon tetrachloride. [4]

B9 POS-Q20 Calculate the concentration of hydrogen chloride, and the pH, of the solution made when 1.043 g of phosphorus(V) chloride, PCl_5, is added to water and made up to 500 cm^3. Treat the hydrogen chloride as the only acid. The equation is $PCl_5(s) + 4H_2O(l) \rightarrow H_3PO_4(aq) + 5HCl(aq)$. [4]

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B10 POS-Q8 Give the meaning of the term amphoteric, and give equations, with state symbols, for the reactions of aluminium oxide with hydrochloric acid and with sodium hydroxide solution. [3]

B11 POS-Q10 Describe the structure of a molecule of phosphoric(V) acid, H_3PO_4, and of the phosphate(V) ion formed from it. [3]

B12 POS-Q12 Calculate the mass of magnesium oxide that exactly neutralises 25.0 cm^3 of 2.00 mol dm^{-3} hydrochloric acid. [3]

B13 POS-Q13 Suggest why a slurry of calcium oxide removes sulfur dioxide from power-station waste gases, and give an equation, with state symbols, for the reaction. [3]

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B14 POS-Q16 Compare the behaviour of aluminium oxide and silicon dioxide with water, with acids and with bases. [3]

B15 POS-Q18 Give equations, with state symbols, for the reactions of phosphorus(V) oxide, sulfur dioxide and sulfur trioxide with excess sodium hydroxide solution. [3]

B16 POS-Q21 Suggest explanations for two observations. A few drops of water added to solid aluminium chloride give steamy fumes. Aluminium chloride dissolved in a large volume of water gives no fumes, but the solution has a pH of about 3. [3]

B17 POS-Q22 Show that 1.20 dm^3 of sulfur dioxide, measured at room temperature and pressure, needs 100 cm^3 of 1.00 mol dm^{-3} sodium hydroxide solution to convert it completely to sodium sulfite, Na_2SO_3. Molar gas volume = 24.0 dm^3 mol^{-1}. [3]

SECTION C · Long, 6 marks or more

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C1 POS-Q17 Discuss how the bonding in the oxides of Period 3 changes from Na_2O to SO_3, and how the change accounts for their reactions with water. [6]

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