Chemistry

Standard level

Paper 1B

Practice paper

Topic: Periodicity (Topic 3)

1. A student investigated the properties of Period 3 oxides by adding samples to water and testing the pH.

Oxide	Observation	pH of Resulting Solution
Na_2O	Vigorous reaction, dissolves	13-14
MgO	Slightly dissolves	8-9
P_4O_{10}	Reacts, dissolves	1-2

(a) Write a balanced chemical equation for the reaction of P_4O_{10} with water. **[1]**

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(b) Explain why Na_2O forms a strongly basic solution while P_4O_{10} forms a strongly acidic solution. **[2]**

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2. Physical and chemical properties of selected Group 17 elements (halogens).

Element	Atomic Number	Boiling Point / K
Chlorine	17	239
Bromine	35	332
Iodine	53	457

(a) Identify the trend in boiling points down Group 17 and explain it in terms of intermolecular forces. **[2]**

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(b) A student reacted Bromine water ($Br_2(aq)$) with Potassium Iodide solution (KI(aq)). State the color change observed and write the ionic equation for the reaction. **[2]**

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3. Observations of the reaction of Group 1 metals with water were recorded in a laboratory.

Metal	Observation 1	Observation 2
Lithium	Float and fizzes slowly	Remains as a solid piece
Sodium	Floats and melts into a ball	Rapid fizzing
Potassium	Ignites with a lilac flame	Extremely vigorous reaction

(a) Deduce the trend in reactivity down Group 1 based on these observations. **[1]**

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(b) Explain this trend in terms of atomic radius and ionization energy. **[3]**

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4. Effective nuclear charge (Z_{eff}) and shielding (S) are used to explain periodic trends. For Fluorine, Z = 9, S = 2. For Chlorine, Z = 17, S = 10.

(a) Calculate Z_{eff} for both Fluorine and Chlorine. **[1]**

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(b) Discuss how the increase in the number of principal energy levels affects the atomic radius of Chlorine compared to Fluorine. **[2]**

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