11. Group 17

11.3 Some reactions of the halide ions

Paper 2

Question Paper

1 **(d)** Concentrated sulfuric acid is added to separate samples containing equal amounts of NaCl, NaBr and NaI. All three samples initially react to produce the hydrogen halide.

(i) Write an equation to describe the acid–base reaction that occurs when concentrated sulfuric acid reacts with NaBr.

..... [1]

(ii) Deduce which sodium halide, NaCl, NaBr or NaI, produces the largest percentage yield of hydrogen halide when concentrated sulfuric acid is added. Explain your answer by considering the relative reactivity of the halide ions as reducing agents.

identity of sodium halide .....

explanation .....

.....

.....

[3]

2 **(c)** A student does three tests on separate samples of NaCl(aq).

Complete Table 1.2 with the observations the student makes in each test.

Table 1.2

test	test	observations
1	addition of a few drops of $Br_2(aq)$	
2	addition of a few drops of concentrated H_2SO_4	
3	addition of a few drops of dilute $AgNO_3(aq)$	

[3]

3 Radium, Ra, is an element found in Group 2 of the Periodic Table. It is a crystalline solid at room temperature and conducts electricity.

Radium chloride, $RaCl_2$, has a melting point of 900 °C and is soluble in water.

(d) A sample of aqueous calcium halide, $CaX_2(aq)$, contains either chloride, bromide or iodide ions.

Complete Table 2.1 to describe a two-step process that could be used to identify the halide ion present.

Table 2.1

step	method	observation with $CaCl_2$	observation with $CaBr_2$	observation with CaI_2
step **1**				
step **2**				

[3]

4 **(d)** $HCl(g)$ is prepared by adding $NaCl(s)$ to concentrated H_2SO_4.

HI(g) is **not** prepared by adding NaI(s) to concentrated H_2SO_4 because the HI(g) produced also reacts with concentrated H_2SO_4.

(i) Identify the type of reaction that occurs when NaI(s) reacts with concentrated H_2SO_4 to form HI(g).

..... [1]

(ii) Write an equation for the reaction of HI(g) and concentrated H_2SO_4.

..... [1]

(iii) Explain why HI(g) reacts with concentrated H_2SO_4 whereas HCl does not.

..... [1]

5 Magnesium shows reactions typical of a Group 2 metal.

(c) 1 cm^3 of $MgCl_2(aq)$ is placed in a test-tube. A few drops of $AgNO_3(aq)$ are added, followed by 1 cm^3 of dilute $NH_3(aq)$.

State in full what is observed in this experiment.

.....

..... [2]

6 Sodium halide salts react with concentrated sulfuric acid at room temperature.

(a) (i) Write an equation to represent the reaction of $NaCl(s)$ with concentrated sulfuric acid.

..... [1]

(ii) Name this type of reaction.

..... [1]

(b) NaI(s) reacts with concentrated sulfuric acid, at room temperature, to form steamy fumes.

(i) Identify the chemical responsible for the steamy fumes.

..... [1]

(ii) The reaction of NaI(s) with concentrated sulfuric acid continues, forming several other products, including a dark grey solid.

Identify the chemical responsible for the dark grey solid and **one** other product of this further reaction.

dark grey solid .....

other product .....
[2]

(c) Explain the differences in observations, at room temperature, when NaI(s) reacts with concentrated sulfuric acid compared to those for $NaCl(s)$.

.....

.....

..... [2]

(d) Complete the equation for the reaction of Br^- with excess concentrated H_2SO_4 at room temperature.

.....Br^- + ...H^+ + ...H_2SO_4 → .....

[1]

7 A Group 2 metal combines with bromine to form a crystalline solid, **M**Br_2.

Excess aqueous $AgNO_3$ is added to a solution of **M**Br_2 and a precipitate forms. The mixture is filtered. The precipitate is dried and the mass of the precipitate is recorded.

(a) State the formula and colour of the precipitate.

..... [2]

(e) Compound **Y** is a pure **insoluble** solid which contains halide ions.

A single reagent is added directly to compound **Y** to determine the halide ion present.

Identify the reagent added. State the observation which would confirm that **Y** contains bromide ions.

reagent .....

observation .....

[2]

8 **(a)** An unlabelled bottle contains a straight-chain halogenoalkane, **Q**. The molecular formula of **Q** is C_5H_{11}**X**, where **X** is a halogen; bromine, chlorine or iodine.

A test is carried out to identify the halogen present in **Q**.
A sample of **Q** is added to NaOH(aq) and warmed. Dilute nitric acid is then added followed by a few drops of aqueous silver nitrate. A cream precipitate is observed.

(i) Suggest the identity of **X**.

..... [1]

(ii) Write an ionic equation to describe the formation of the cream precipitate. Include state symbols.

..... [1]

(iii) Describe a further test which would confirm the identity of **X**.

test .....

expected result .....

[2]