1.

Which statement about the halogens is correct?

**A** Iodine cannot behave as an oxidising agent.

**B** The volatility of the elements increases from chlorine to iodine because of the increase in molecular size down the group.

**C** When an equimolar mixture of chlorine and hydrogen is exploded, only one product is formed.

**D** When concentrated sulfuric acid is added to solid sodium bromide, hydrogen sulfide is one of the products.

Ans: C

2.

When concentrated sulfuric acid is added to solid sodium bromide, bromine gas is produced, along with a number of other products. However, when concentrated sulfuric acid is added to solid sodium chloride, only hydrogen chloride and sodium hydrogensulfate are produced.

What is the reason for this difference?

**A** Bromine is less volatile than chlorine.

**B** Hydrochloric acid is a weak acid.

**C** Sulfuric acid is **not** an oxidising agent.

**D** The bromide ion is a stronger reducing agent than the chloride ion.

Ans: D

3.

The solids sodium chloride and sodium iodide both react with concentrated sulfuric acid at room temperature.

With NaC$l$, the products are $NaHSO_4$ and HC$l$.

With NaI, the products are $NaHSO_4$, HI, $I_2$, $SO_2$, $H_2O$, S and $H_2S$.

What is the explanation for this difference in products?

**A** Chloride ions will displace iodine from the solution.

**B** Hydrogen chloride is more volatile than hydrogen iodide.

**C** Iodide ions are better reducing agents than chloride ions.

**D** Sulfuric acid is able to act as a dehydrating agent with NaI.

Ans: C

4.

When concentrated sulfuric acid is added to solid sodium chloride, $HCl$ is formed but **not** $Cl_2$.

When concentrated sulfuric acid is added to solid sodium iodide, $I_2$ is formed.

Which statement explains these observations?

**A** Sulfuric acid is an oxidising agent and chloride ions are more easily oxidised than iodide ions.

**B** Sulfuric acid is an oxidising agent and iodide ions are more easily oxidised than chloride ions.

**C** Sulfuric acid is a reducing agent and chloride ions are more easily reduced than iodide ions.

**D** Sulfuric acid is a reducing agent and iodide ions are more easily reduced than chloride ions.

Ans: B

5.

An excess of chlorine was bubbled into 100 $cm^3$ of hot 6.0 mol $dm^{-3}$ sodium hydroxide.

How many moles of sodium chloride would be produced in the reaction?

**A** 0.30 **B** 0.50 **C** 0.60 **D** 0.72

Ans: B

6.

Powder P is a mixture containing two of $AgCl$, AgBr or AgI.

P is shaken with dilute aqueous ammonia. A yellow solid, Q, remains.

The mixture is filtered and Q is washed and dried. The filtrate is collected and treated with aqueous nitric acid to produce a white precipitate, R, which is filtered off, washed and dried.

Q and R are warmed separately with concentrated sulfuric acid, $H_2SO_4$.

Which observations are made?

| | Q + concentrated $H_2SO_4$ | R + concentrated $H_2SO_4$ |
|---|---|---|
| **A** | violet fumes | orange fumes |
| **B** | violet fumes | steamy fumes |
| **C** | steamy fumes | violet fumes |
| **D** | orange fumes | steamy fumes |

Ans: B

- Q = AgI
    - AgI + H2SO4 = HI + AgHSO24

    - HI + $H_2SO_4$ = $I_2$ + $SO_2$ + $H_2O$, thus violet fumes of $I_2$
- Filtrate = AgCl in aqueous ammonia
    - When treated with aq. Nitric acid, AgCl is again formed
    - AgCl + $H_2SO_4$ = HCl + $AgHSO_4$, thus steamy fumes of HCl

7.

In reaction 1, concentrated sulfuric acid is added to potassium chloride and the fumes produced are bubbled into aqueous potassium iodide solution.

In reaction 2, potassium chloride is dissolved in aqueous ammonia and this is then added to aqueous silver nitrate.

What are the observations for reactions 1 and 2?

| | observation for reaction 1 | observation for reaction 2 |
|---|---|---|
| **A** | brown solution | colourless solution |
| **B** | brown solution | white precipitate |
| **C** | colourless solution | colourless solution |
| **D** | colourless solution | white precipitate |

Ans: C

- $H_2SO_4$ + KCl = HCl + $KHSO_4$
  HCl + KI = HI + KCl = colourless solution
- KCl + $NH_3$ + $AgNO_3$ (order does not matter) = colourless solution, because no ppt forms due to $NH_3$