

Chlorine and its compounds

1. (i) It catches fire or presence white fumes
 (ii) PCl_3 // Phosphorous Trichloride
 (iii) PCl_5 // Phosphorous Pentachloride

2. (a) - In water hydrogen chloride dissociates to form hydrogen (H^+) and chloride (Cl^-) ions.
 - The presence of H^+ ions in aqueous solution of hydrogen chloride is responsible for acidic properties which turns blue litmus paper red
 (b) - To increase the surface area for the dissolution of the gas
 - Prevent suck back (Award full 1mk for any one given)

3. a) - Refrigeration ✓1
 - Maintains pressure in aerosol cans and enables sprays to be sprayed in liquid form
 b) - They deplete the ozone layer. ✓1
 - They cause green house effect/Global warming.

4. a) Acidify water with nitric acid ✓½. Add aqueous lead nitrate/ AgNO_3 ✓½
 Formation of a white ppt. Show presence of Cl^- white ppt of PbCl_2 or AgCl formed.

5. a) Yellow solid deposit of sulphur on the wall of boiling tube
 b) $\text{H}_2\text{S (g)} + \text{Cl}_2\text{(g)} \longrightarrow 2\text{HCl(g)} + \text{S(s)}$
 c) - Done in fume chamber/ open air
 -Poisonous gases

6. i) $2\text{Fe(s)} + 3\text{Cl}_2\text{(g)} \longrightarrow 2\text{FeCl}_3\text{(g)}$
 $\text{Fe(s)} + 2\text{HCl(g)} \longrightarrow \text{FeCl}_2\text{(g)} + \text{H}_2\text{(g)}$
 N.B Must be balanced
 State symbol must be correct
 Chemical symbols must be correct
 ii) In the absence of moisture, chlorine cannot form the acidic solution, hence no effect on the blue litmus paper

7. a) Heat is necessary * REJECT high temperature ACCEPT, BOIL or if implied
 o MnO_2 is a weak oxidizing agent.
 b) $\text{Cl}_2\text{O(g)} + \text{H}_2\text{O(l)} \longrightarrow 2\text{HOCl(aq)}$ C.A.O

8. (a) Chlorine gas
 (b) $\text{HCl(aq)} + \text{MnO}_2 \longrightarrow \text{MnCl}_2\text{(aq)} + \text{Cl}_2\text{(g)} + 2\text{H}_2\text{(g)}$
 (c) The petals turn to white due to the bleaching effect of NaOCl (sodium hypochlorite)

10. (a) (i) $\text{MnO}_2\text{(s)} + 4\text{HCl(l)} \longrightarrow \text{MnCl}_2\text{(aq)} + 2\text{H}_2\text{O} + \text{Cl}_2\text{(g)}$
 Penalize ½mk if state symbols are not correct
 ✓ 1 (ii) KMnO_4 or PbO_2
 (iii) The Chloride gas can be dried by passing it through a wash-bottle of ✓ 1 concentrated sulphuric acid and is then collected by downward delivery. ✓ 1
 ✓ 1

- (b)(i) A- Aluminium (III) Chloride
 (ii) $2\text{Al(s)} + 3\text{Cl}_2\text{(g)} \longrightarrow 2\text{AlCl}_3\text{(s)}$
 Penalize ½mk for wrong state symbols
 (iii) Moles Al used from the equation in b(ii)
 ✓ ½

$$= \frac{0.84}{27} = 0.031 \text{ Moles}$$

$$\text{Moles of } Cl_2 \text{ used} = \frac{0.031 \times 3}{2} = 0.047$$

Mark consequently from the equation

11. (a) $Cl_{2(g)} + H_2S_{(g)} \rightarrow HCl_{(g)} + S_{(s)}$
 (b) Yellow solid particles deposited in the flask
 (c) Excess chlorine and hydrogen sulphide gas should not be emitted into the atmosphere because they are pollutants /harmful ✓ ^{1/2}
12. (a) Chlorine gas
 (b) (i) Remove traces of hydrogen chloride gas
 (ii) Drying agent
13. (a) Fe^{3+}
 (b) It is an oxidizing agent ✓
 (c) $2Fe(OH)_3_{(s)} \rightarrow Fe_2O_3_{(s)} + 3H_2O_{(l)}$ ✓
14. (i) Anhydrous Calcium Chloride (1/2 mks)
 (ii) A white ppt is formed
 HCl gas forms Cl^- ions solution which react with silver ions to form silver Chloride which is insoluble OR
 $HCl_{(aq)} + AgNO_3_{(aq)} \rightarrow HNO_3_{(aq)} + AgCl_{(s)}$
 $Cl_{(aq)} + Ag^+_{(aq)} \rightarrow AgCl_{(s)}$ ✓