

Chlorine and its compounds

- It catches fire on presence white fumes
 - PCl_3 // Phosphorous Trichloride
 - PCl_5 // Phosphorous Pentachloride
- 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
 - To increase the surface area for the dissolution of the gas
 - Prevent suck back (Award full 1mk for any one given)
- Refrigeration ✓1
 - Maintains pressure in aerosol cans and enables sprays to be sprayed in liquid form
 - They deplete the ozone layer. ✓1
 - They cause green house effect/Global warming.
- 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.
- Yellow solid deposit of sulphur on the wall of boiling tube
 - $\text{H}_2\text{S}(\text{g}) + \text{Cl}_2(\text{g}) \longrightarrow 2\text{HCl}(\text{g}) + \text{S}(\text{s})$
 - Done in fume chamber/ open air
 - Poisonous gases
- $2\text{Fe}(\text{s}) + 3\text{Cl}_2(\text{g}) \longrightarrow 2\text{FeCl}_3(\text{g})$
 $\text{Fe}(\text{s}) + 2\text{HCl}(\text{g}) \longrightarrow \text{FeCl}_2(\text{g}) + \text{H}_2(\text{g})$
 N.B Must be balanced
 State symbol must be correct
 Chemical symbols must be correct
 - In the absence of moisture, chlorine cannot form the acidic solution, hence no effect on the blue litmus paper
- Heat is necessary * REJECT high temperature ACCEPT, BOIL or if implied
 - MnO_2 is a weak oxidizing agent.
 - $\text{Cl}_2\text{O}(\text{g}) + \text{H}_2\text{O}(\text{l}) \longrightarrow 2\text{HOCl}(\text{aq})$ C.A.O
- Chlorine gas
 - $\text{HCl}(\text{aq}) + \text{MnO}_2 \longrightarrow \text{MnCl}_2(\text{aq}) + \text{Cl}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$
 - The petals turn to white due to the bleaching effect of NaOCl (sodium hypochlorite)
- $\text{MnO}_2(\text{s}) + 4\text{HCl}(\text{l}) \longrightarrow \text{MnCl}_2(\text{aq}) + 2\text{H}_2\text{O} + \text{Cl}_2(\text{g})$
Penalize ½mk if state symbols are not correct
 - ✓ 1 KMnO_4 or PbO_2
 - 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
 - Aluminium (III) Chloride
 - $2\text{Al}(\text{s}) + 3\text{Cl}_2(\text{g}) \longrightarrow 2\text{AlCl}_3(\text{s})$
Penalize ½mk for wrong state symbols
 - 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
 $HCl_{(aq)} + AgNO_3_{(aq)} \rightarrow HNO_3_{(aq)} + AgCl_{(s)}$
 $Cl_{(aq)} + Ag^+_{(aq)} \rightarrow AgCl_{(s)}$ ✓