In alkaline medium it oxides potassium iodide to potassium iodate and nitro toluene to nitro benzoic acid.

$$I^- + 6OH^- \rightarrow IO_3^- + 3H_2O + 6e^-$$

$$C_6H_4 \begin{matrix} NO_2 \\ CH_3 \end{matrix} + 7OH^- \rightarrow C_6H_4 \begin{matrix} NO_2 \\ COO^- \end{matrix} + 5H_2O + 6e^-$$

- **Action of hydrogen** - It burns on heating in a current of.

$$2KMnO_4 + 5H_2 \rightarrow 2KOH + 2MnO + 4H_2O$$

- **Equivalent weight of $KMnO_4$ in different medium**
  - Equivalent weight in acid medium $= \frac{\text{Molecular weight}}{5}$
  - Equivalent weight in alkaline medium $= \frac{\text{Molecular weight}}{1}$
  - Equivalent weight in neutral medium $= \frac{\text{Molecular weight}}{3}$

  (See ionic equations above)

ISES

ıs oxidising agent, disinfectant, 1% alkaline solution of $KMnO_4$ is used to test unsaturation in organic ompounds under the name of Baeyer's reagent. It is used for the volumetric estimation of Fe^{++} salts,oxalic cid etc.

COMPOUNDS OF CHROMIUM

POTASSIUM DICHROMATE $K_2Cr_2O_7$

PREPARATION

It is manufactured from chromite ore $(FeCr_2O_4)$. The steps involved are -

- **Preparation of sodium dichromate** - Finely powdered chromite is mixed with soda ash and quick lime and roasted in reverberatory furnace or rotary furnace in excess of air.

  $$4Fe(CrO_2)_2 + 8Na_2CO_3 + 7O_2 \rightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$$

  Chromite can be fused with molten alkali in presence of air.

  $$4Fe(CrO_2)_2 + 16NaOH + 7O_2 \rightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8H_2O$$

  The solution is filtered and acidified with dil. H_2SO_4 when sodium dichromate is obtained.

  $$2Na_2CrO_4 + H_2SO_4 \rightarrow Na_2Cr_2O_7 + Na_2SO_4 + H_2O$$

- Conversion of sodium dichromate to potassium dichromate.

  $$Na_2CrO_7 + 2KCl \rightarrow 2NaCl + K_2Cr_2O_7$$

  Hot concentrated solution of Potassium dichromate $(Na_2Cr_2O_7)$ is less soluble and separates out on crystallisation.

PROPERTIES

It is garnet red prismatic (orange) crystalline compound having melting point 398°C. Soluble in water.

CHEMICAL PROPERTIES

- **Action of heat**

  $$4K_2Cr_2O_7 \rightarrow 4K_2CrO_4 + \underset{\text{Chromic oxide}}{2Cr_2O_3} + 3O_2$$

- **Action of cold** H_2SO_4

  $$K_2CrO_7 + 2H_2SO_4 \rightarrow 2KHSO_4 + 2CrO_3 + H_2O \ (\text{Red crystals of chromic anhydride})$$

- **Action of alkali**

  $$K_2Cr_2O_7 + 2KOH \rightarrow 2K_2CrO_4 + H_2O$$

- **Oxidising nature** - It is powerful oxidising in nature.

  $$K_2Cr_2O_7 + 4H_2SO_4 \longrightarrow K_2SO_4 + Cr_2(SO_4)_3 + 4H_2O + 3O$$

  $$Cr_2O_7^{2-} + 14H^+ + 6e^- \longrightarrow 2Cr^{3+} + 7H_2O$$

  $$SO_2 + 2H_2O \longrightarrow SO_4^{2-} + 2H^+ + 2e^-$$

  $$Fe^{2+} \longrightarrow Fe^{3+} + e^-$$

  $$C_2O_4^{2-} \longrightarrow 2CO_2 + 2e^-$$

  $$H_2O_2 \longrightarrow O_2 + 2H^+ + 2e^-$$

- **Formation of chromyl chloride** - When a chloride is heated with potassium dichromate and conc. orange red vapour of chromyl chloride are formed.

  $$K_2Cr_2O_7 + 4NaCl + 6H_2SO_4 \rightarrow 2CrO_2Cl_2 + 2KHSO_4 + 4NaHSO_4 + 3H_2O$$

- With lead salts it gives insoluble chromate salt.

  $$2Pb(NO_3)_2 + K_2Cr_2O_7 + H_2O \rightarrow 2PbCrO_4 + 2KNO_3 + 2HNO_3$$

- In photography
- Chromic acid $\left(\text{mixture of } K_2Cr_2O_7 + H_2SO_4\right)$ used as cleaning agent,
- In preparation of compounds such as $K_2SO_4.Cr_2(SO_4)_2.24H_2O, CrO_2Cl_2$ etc.

STRUCTURE

It consists of two tetrahedra with common oxygen atom

Dichromate ion

Structure of chromate ion : It has tetrahedral structure

Chromate ion CrO_4^{2-}

At pH about 4 dichromate ion ($Cr_2O_7^{2-}$) and chromate ion (CrO_4^{2-}) exist in equilibrium. These are interconvertible.

$$\underset{\text{(yellow)}}{2CrO_4^{2-}} + 2H \underset{\text{Alkali}}{\overset{\text{Acid}}{\rightleftharpoons}} 2HCrO_4^- \underset{\text{Alkali}}{\overset{\text{Acid}}{\rightleftharpoons}} \underset{\text{(orange)}}{Cr_2O_7^{2-}} + H_2O$$