

Transition Elements Overview



Here is a summary of the chemistry of potassium permanganate (KMnO_4) based on the provided textbook:

Preparation:

- Industrial Method:** Potassium permanganate is commercially prepared through the alkaline oxidative fusion of manganese dioxide (MnO_2) with potassium hydroxide (KOH) and an oxidizing agent such as potassium nitrate (KNO_3). The reaction yields potassium manganate (K_2MnO_4), which is then electrolytically oxidized to potassium permanganate.

- Reaction:

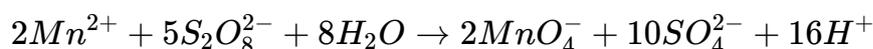


The manganate (K_2MnO_4) disproportionates in neutral or acidic conditions to form permanganate (KMnO_4).

- Disproportionation reaction:

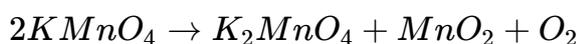


- Laboratory Preparation:** It is produced by oxidizing manganese (II) salts with peroxodisulphate in an acidic medium:



Properties:

- Physical Properties:** Potassium permanganate forms dark purple, nearly black crystals, which are isostructural with potassium perchlorate (KClO_4). It is moderately soluble in water.
 - Solubility: 6.4 g/100 g of water at 293 K.
 - When heated, KMnO_4 decomposes:



- Magnetic Properties:** KMnO_4 exhibits diamagnetism but also shows weak paramagnetism that is temperature-dependent.

Chemical Behavior:

- Oxidizing Agent:** Potassium permanganate is a strong oxidizing agent, especially in acidic solutions. It can oxidize substances such as iodide to iodine, iron (II) to iron (III), and oxalates to carbon dioxide.
 - Example reactions in acidic solution:
 - $5\text{Fe}^{2+} + \text{MnO}_4^- + 8\text{H}^+ \rightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O} + 5\text{Fe}^{3+}$
 - $10\text{I}^- + 2\text{MnO}_4^- + 16\text{H}^+ \rightarrow 2\text{Mn}^{2+} + 8\text{H}_2\text{O} + 5\text{I}_2$

2. **Redox Potential:** Potassium permanganate's reduction to various manganese species depends on the medium's pH. In acidic media, it can reduce to Mn^{2+} , while in neutral or alkaline media, it reduces to MnO_2 or manganate (MnO_4^{2-}).

Uses:

- **In Chemistry:** Widely used as an oxidizing agent in organic synthesis, volumetric analysis, and titrations.
- **In Industry:** Employed in bleaching textiles and decolorizing oils due to its strong oxidative properties.

This summary provides a concise understanding of potassium permanganate's preparation, properties, and chemical behavior, as extracted from the textbook.