

MANGANESE & ITS COMPOUNDS

Section - 3

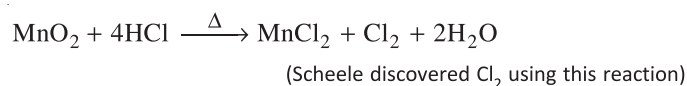
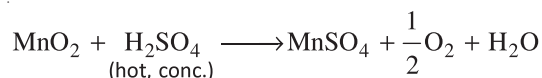
Manganese is mined as the ore pyrolusite (MnO_2) and is obtained by electrolysis of aqueous solution of MnSO_4 . 95% of it is used in the steel industry to produce alloys.

 Mn^{+II} State (Manganous)

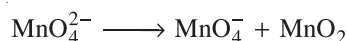
The (+II) state is the most stable and common state. Manganous salts like MnCl_2 , MnSO_4 are soluble in water and form pink coloured solutions of $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$ while MnCO_3 is sparingly soluble.

 Mn^{+IV} State

Very few Mn(+IV) compounds are known. MnO_2 is the most important oxide in the group and is commercially important. It occurs naturally as black coloured pyrolusite ore.

 **Mn^{+VI} State**

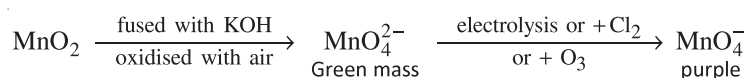
The only example in this category is dark green coloured manganate ion MnO_4^{2-} . It is a strong oxidising agent and only stable in very strong alkali solutions. In dilute alkali, water (neutral) or acidic solution it disproportionates.

 **Mn^{+VII} State**

Mn^{+7} state is obtained when all the electrons of d^5s^2 in Mn are used for bonding. It is not common but very well known as the purple coloured permanganate ion (MnO_4^-). The colour arises despite the d^0 configuration due to charge transfer.

Potassium Permanganate [KMnO_4]

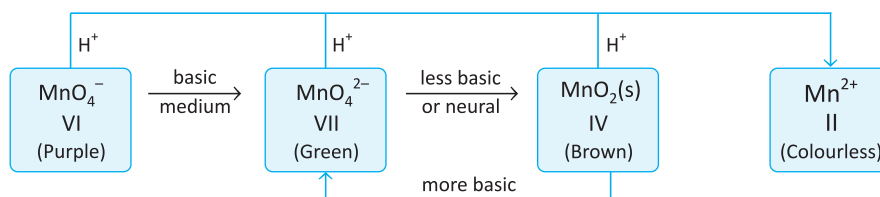
KMnO_4 exists as deep purple black prism with greenish lustre and is moderately soluble in water at room temperature. It is manufactured on a large scale as follows :



1. KMnO_4 is stored in dark bottles as its decomposition to MnO_2 is catalysed by sunlight.
2. KMnO_4 is widely used as an oxidising agent in both preparative and qualitative chemistry. In acidic solution it is reduced to Mn^{2+} , to MnO_4^{2-} in alkaline solutions and to MnO_2 in neutral or slightly basic solutions thus oxidising Fe^{2+} to Fe^{3+} , I^- to I_2 and H_2S to S.

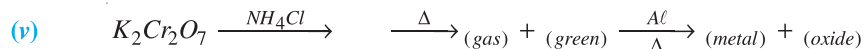
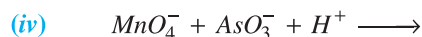
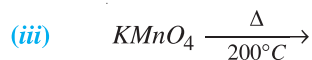
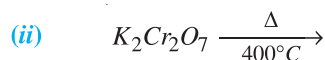
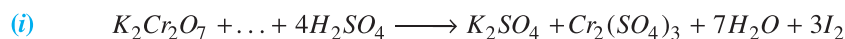
3. With larger amounts of KMnO_4 , an explosive oil Mn_2O_7 is formed. (Do not try this)

The following diagram will help you to memorize the interconnection between various manganese compounds :



IN-CHAPTER EXERCISE - B

1. Complete and balance the following equations.



2. Account for the following observations and write balanced chemical equations for them.

(i) The yellow colour of Na_2CrO_4 solutions change to orange on acidification.

(ii) Acidified solution of $\text{Cr}_2\text{O}_7^{2-}$ ions form a deep blue colour with H_2O_2 .

3. When a white crystalline compound X is heated with $\text{K}_2\text{Cr}_2\text{O}_7$ and concentrated H_2SO_4 , a reddish brown gas A is evolved. On passing A into caustic soda solution, a yellow coloured solution of B is obtained. Neutralising the solution of B with acetic acid and on subsequent addition of lead acetate, a yellow precipitate C is obtained. When X is heated with NaOH solution, a colourless gas is evolved and on passing this gas into K_2HgI_4 solution, a reddish brown precipitate D is formed. Identify A, B, C, D and X. Write the equations of reaction involved.
4. Pyrolusite on heating with KOH in the presence of the air gives a dark brown compound A. When ozonized oxygen is passed through a solution of A, a purple coloured compound B is formed. Write balanced chemical equations for the formation of B.
5. Acidified $\text{K}_2\text{Cr}_2\text{O}_7$ solution turns green when sodium sulphite is added to it. Explain.