

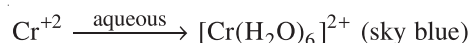
CHROMIUM & ITS COMPOUNDS

Section - 2

Chromium metal is produced on a large scale from the ore chromite ($\text{FeO} \cdot \text{Cr}_2\text{O}_3$ or FeCr_2O_4). It is unreactive or passive at low temperature due to the formation of a protective coating of oxide, Cr_2O_3 . Thus it is used in electroplating to prevent corrosion of iron articles. For Cr the +II, +III, +VI states are well known. Cr(+II) is reducing, Cr(+III) is the most stable and important, and Cr(+VI) is strongly oxidising.

Cr^{+II} state (Chromous Compounds)

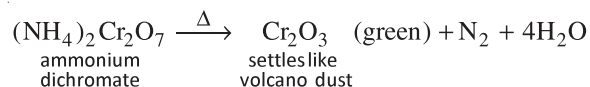
Cr^{+2} is one of the strongest reducing agent known in aqueous solution. The Cr^{+2} ion is blue coloured in aqueous solution.



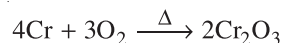
Important compounds are CrCl_2 and $\text{Cr}_2(\text{CH}_3\text{COO})_4$.

Cr^{+III} state (Chromic Compounds)

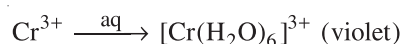
It is the most stable and important state of chromium. *Chromic Oxide* (Cr_2O_3) is used as a green pigment in paint, rubber, cement and prepared in the well known volcano experiment :



The heat produced continues the above reaction on its own. Also,

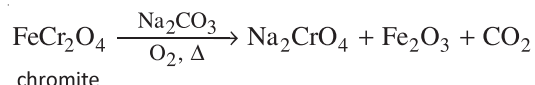


Chromic chloride (CrCl_3) is a solid which forms red-violet flakes and dissolves in water to form violet coloured solutions.

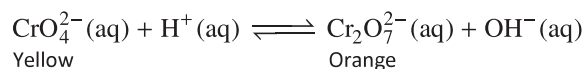
**Cr^{+VI} State**

Few Cr^{+6} compounds are known. These are very strong oxidising agents and include chromates $[\text{CrO}_4]^{2-}$, dichromates $[\text{Cr}_2\text{O}_7]^{2-}$ and chromium trioxide CrO_3 .

Sodium chromate (Na_2CrO_4) is a yellow solid prepared by fusing chromite with Na_2CO_3 .

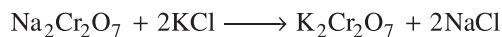


On acidifying sodium chromate, an orange coloured solid sodium dichromate ($\text{Na}_2\text{Cr}_2\text{O}_7$) is obtained while this sodium dichromate turns yellow in basic solutions due to reformation of CrO_4^{2-} . The reversible reaction is thus represented by :

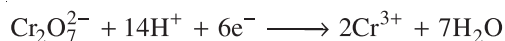


Potassium dichromate [$K_2Cr_2O_7$]

To prepare potassium dichromate, $Na_2Cr_2O_7$ is first prepared from chromite as discussed above and then it is converted to $K_2Cr_2O_7$ by a KCl solution.

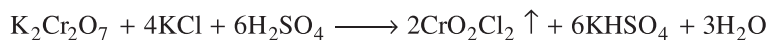


1. Action of heat : $K_2Cr_2O_7 \xrightarrow{\Delta} K_2CrO_4 + Cr_2O_3 + O_2 \uparrow$
Green solid
2. Potassium dichromate is widely used as an oxidizing agent and a primary standard. The orange coloured $K_2Cr_2O_7$ solution gets decolourized and Cr^{3+} is formed.

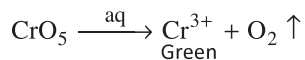
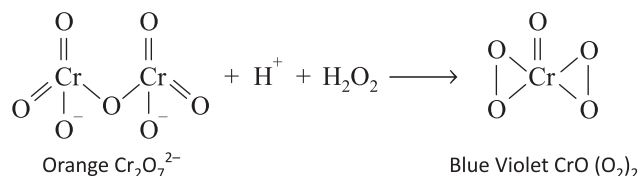


Thus it oxidises HCl to Cl_2 , KI to I_2 , and $FeSO_4$ to $Fe_2(SO_4)_3$. Note that $K_2Cr_2O_7$ is preferred to $Na_2Cr_2O_7$ for use in volumetric analysis because the Na compound is hygroscopic whilst the K compound is not.

3. The **Chromyl Chloride Test** is used to detect $Cr_2O_7^{2-}$ when treated with conc. HCl or any chloride in conc. H_2SO_4 , reddish brown vapours of chromyl chloride are obtained.



4. When hydrogen peroxide is added to $K_2Cr_2O_7/H^+$, a deep blue - violet peroxo compound CrO_5 is formed. This decomposes rapidly into Cr^{3+} and O_2 in aqueous solution.



Note : *Chromic acid (CrO_3)* is a bright orange solid used to clean laboratory glassware. It is obtained by adding conc. H_2SO_4 to a saturated solution of sodium dichromate.

