

# CHEMISTRY STUDY MATERIALS FOR CLASS 12

## ( NOTES BASED ON NCERT )

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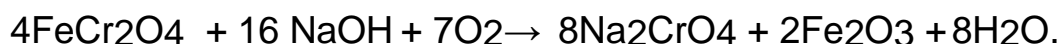
**DATE:- 15/07/2020**

### The d & f - Block Elements

**Potassium dichromate,  $K_2Cr_2O_7$ :**

**Preparation:** It is prepared from chromite ore or ferro chromes ( $FeCr_2O_4$  or  $FeOCr_2O_3$ ) by following steps.

- (a) Fusion of the ore with molten alkali in presence of air



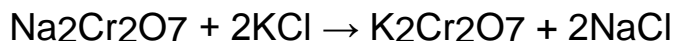
The fused mass is extracted with water and filtered.

- (b) Conversion of sodium chromate into sodium dichromate by treating the filtrate with dil  $H_2SO_4$



$Na_2SO_4$  being less soluble is separated as  $Na_2SO_4 \cdot 10H_2O$  by fractional crystallization.

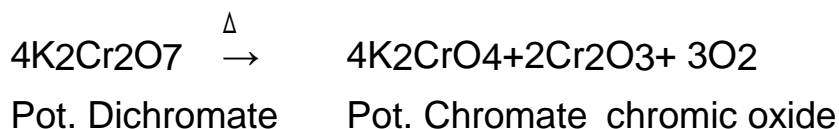
- (c) Conversion of sodium dichromate into potassium dichromate by heating with KCl.



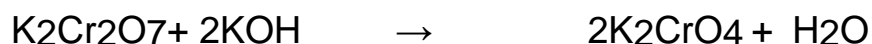
Potassium dichromate being less soluble is obtained by fractional crystallization.

### **Properties:**

- (i) **Physical state :** Potassium dichromate forms orange red crystals which melts at 669K. It is moderately soluble in cold water but freely soluble in hot water.
- (ii) **Action of heat :** When heated strongly to white heat, it decomposes with the evolution of oxygen.



- (iii) **Action of alkalis:** When an alkali is added to an orange red solution containing dichromate ions, a yellow solution is obtained due to the formation of chromate ions. For example,



Pot. Dichromate

Pot. Chromate

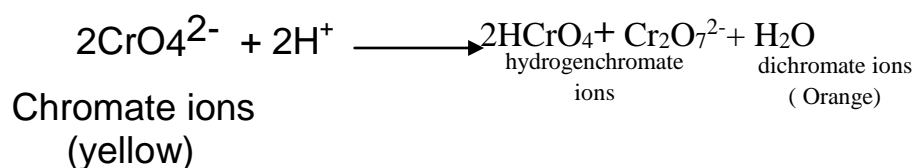
On acidifying the above yellow solution containing chromate ions, it again change to orange red due to the formation of dichromate ions.



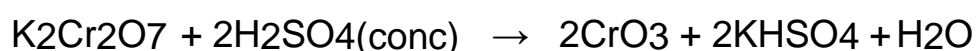
Pot. Chromate

Pot. Dichromate

In fact, in any given solution, dichromate ions and chromate ions exist in equilibrium and are interconvertible by altering the  $pH$  of the solution.



- (iv) **Action of concentrated sulphuric acid** : In cold, red crystals of chromic anhydride ( $\text{CrO}_3$ ) are formed

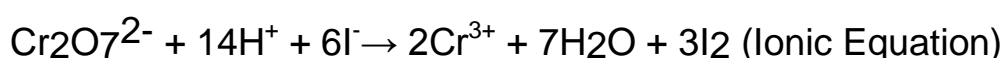


- (v) **Oxidising properties** : Potassium dichromate is a powerful oxidizing agent. In acidic solution, its oxidizing action can be represented as follows.

Ionic equation :  $\text{CrO}_7^{2-} \rightarrow 2\text{Cr}^{3+} + 7\text{H}_2\text{O} + 14\text{H}^+ + 6\text{e}^-$  [  $E^0 = +1.31\text{V}$  ]

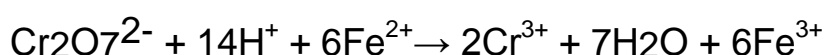
Molecular equ<sup>n</sup> :  $\text{K}_2\text{Cr}_2\text{O}_7 + 4\text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + \text{Cr}_2(\text{SO}_4)_3 + 4\text{H}_2\text{O} + 3[\text{O}]$

- (a) It oxidises iodides to iodine



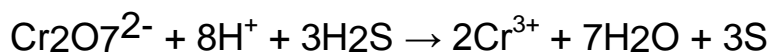
This reaction is used in the estimation of iodide ions in the volumetric analysis.

- (b) It oxidises ferrous salts of ferric salts:

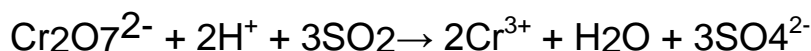


This reaction is used in the estimation of ferrous ions in the volumetric analysis.

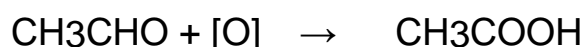
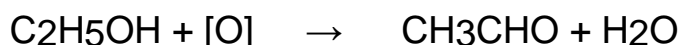
(c) It oxidises  $\text{H}_2\text{S}$  to  $\text{S}$  :



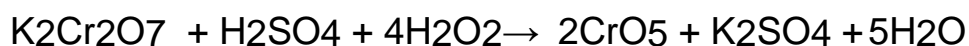
(d) It oxidises sulphur dioxide to sulphuric acid :



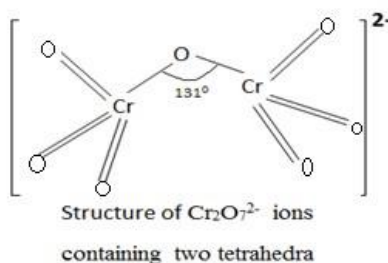
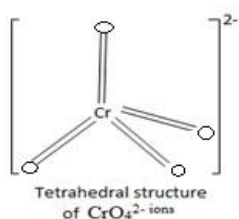
(e) It oxidises ethyl alcohol to acetaldehyde and acetic acid :



(vi) **With hydrogen peroxide** : Acidified potassium dichromate forms a deep blue colour with hydrogen peroxide due to the formation of  $\text{CrO}_5$ .



The blue colour fades away gradually due to decomposition of  $\text{CrO}_5$  into  $\text{Cr}^{3+}$  ions and oxygen.



(vii) **Structure of chromate and dichromate ions** :

## Uses.

- (i) In volumetric estimation of reducing agents e.g., ferrous salts, iodides and sulphites. This is due to the fact that  $\text{K}_2\text{Cr}_2\text{O}_7$  is obtained in a much higher degree of purity than  $\text{Na}_2\text{Cr}_2\text{O}_7$
- (ii) In the preparation of chromium compounds e.g., chrome alum.
- (iii) In photography for hardening of gelatin.
- (iv) In dyeing for producing  $\text{Cr}(\text{OH})_3$  as mordant.
- (v) Chromic acid mixture ( $\text{K}_2\text{Cr}_2\text{O}_7 + \text{conc. H}_2\text{SO}_4$ ) is used for cleaning glass wares in the laboratory.
- (vi) As an oxidizing agent.

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