Iso Poly Anion & Hetero Poly Anion

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What is an Acid?

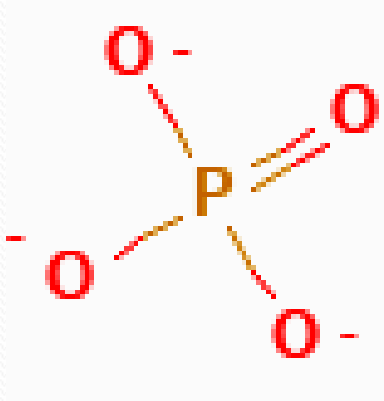
- An acid is a substance that produces hydrogen ions, H^+ in water.
- An acid therefore can conduct electricity.
- pH < 7
- It has a sour taste.
- It has a stinging feeling.
- It is corrosive.

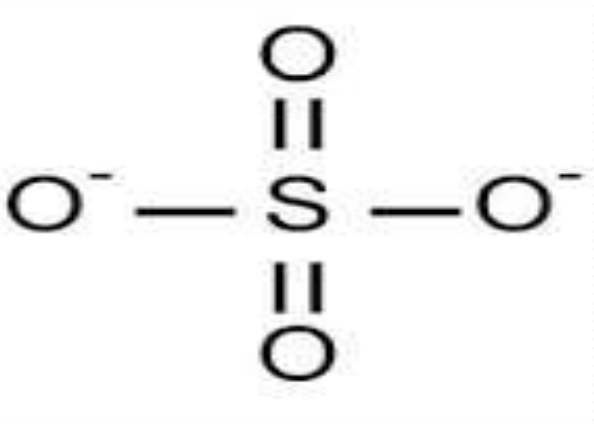
What is Poly Acid & Anion

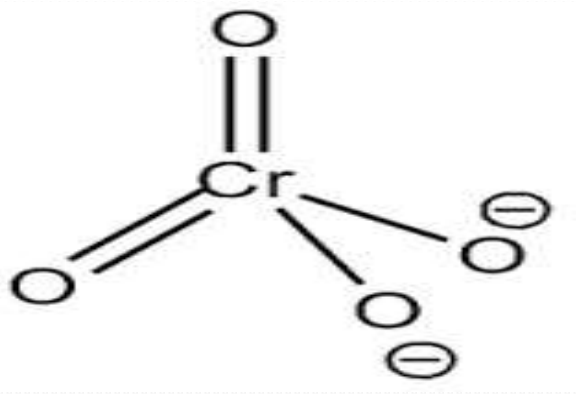
Acid which able o react with more than one molecule of mono base to form salt is called poly acid & on ionization forms anion is called poly acid anion which able to form salt with base known as poly acidic

H_2SO_4, H_3PO_4, H_2CrO_4 etc

Str of Phosphate, Sulphate, Colorate







Str. Of these Td where O atom or ion are at each corner of Tetrahedrally stable at low pH (less than 7) it is stable str. Similarly transition metals of gr. V^{th} B, VI^{th} B, VII^{th} B like V, W, Mo etc also forms ploy acid anion at high oxidation state & exist in aqueous soln at above pH 8.

VO_4^{3-}, CrO_4^{2-}, Mo_4^{2-}, Wo_4^{2-}

When two or more poly acid anion polymerised at low pH then ploymer of poly acid is formed

When pH decreases (acidification)

The term polynietalate acid or simply poly acid may he defined as the condensed or polynlerized form of the weak acids of amphoteric metals like vanadium, niobium, tantalum (VB group metals) or chromium, molybdenum, and tungsten VIB group metals) in the *5 and + 6 oxidation .states. The anions of these poly acid.f contain several molecules of the acid anhydride and the corre.spending .sa/f.s are called as poly halts.

$Cr_2O_7^{2-}$, $Cr_3O_{10}^{2-}$, CrO_{13}^{2-}

Types of Poly acid & anion

There are two types of Poly acids or anion

1. Isopoly acids & salts
2. Hetroploy acids & salts

Isopoly acid contain only one metal along with H & O while hetroploy acid contain two elements other than H & O. The corresponding salts of isopoly & hetropoly acids are called isopoly & hetropoly salts.

It has been prepared by elimination of water from two or more molecules of isopoly acid

Consider the polymerization of chromate ion to form different isopoly chromates anions. CrO_3 dissolves in an alkali to give yellow coloured CrO ions solution. At very high pH, above 8, the chromate ions, CrO , exist as the discrete entities but as the pH is lowered down, the protonation and dimerization takes place. For instance:

$$2H_2CrO_4 \longrightarrow H_2Cr_2O_7$$

$$3H_2CrO_4 \xrightarrow{-H_2O} 2H_2Cr_3O_{10}$$

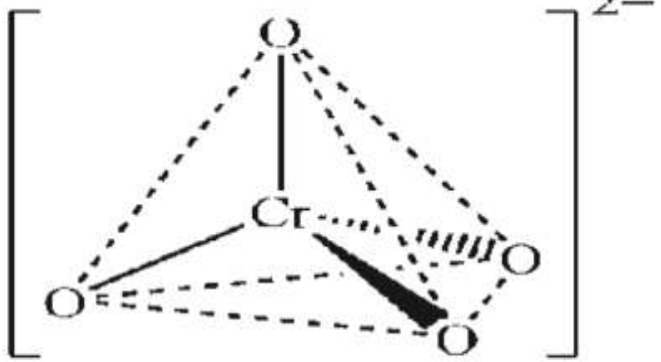
and

$$4H_2CrO_4 \xrightarrow{-2H_2O} H_2Cr_4O_{13}$$

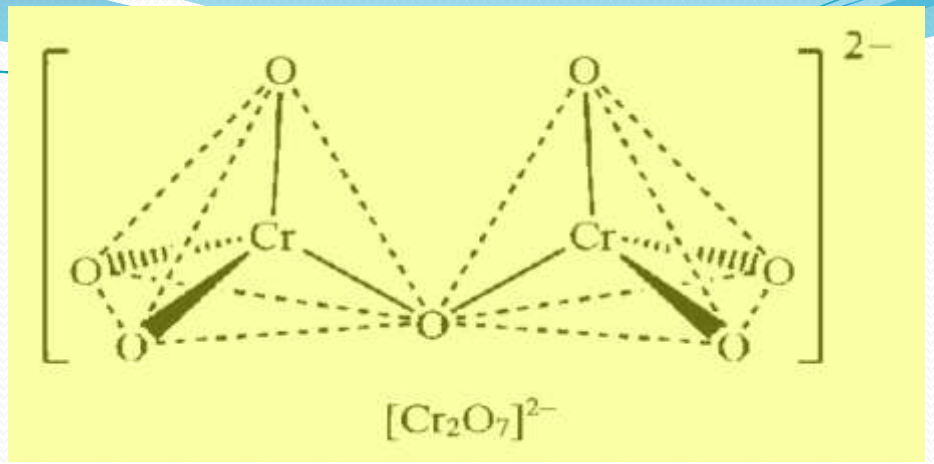
and

$$\xrightarrow{-3H_2O}$$

The polymeric anions $Cr_2O_7^{-2}$, $Cr_3O_{10}^{-2}$ and $Cr_4O_{13}^{-2}$ produced by the polyacids H_2CrO_4, H_2CrO_{10} and $H_2Cr_4O_{13}$, can successfully be isolated from their aqueous as sodium or potassium polysalts like $K_2Cr_2O_4$, $K_2Cr_3O_{10}$ and $K_2Cr_4O_{13}$, respectively. Among the isopoly-anions of V, Nb, Ta, Cr, Mo and W, only Cr is found to have tetrahedral CrO_4^{-2}' units joined through the corners. The other metal ions form isopolyanions by the sharing of edges of octahedral MO, V units. This may be attribute to the small size of Cr which can afford only four oxide ions around itself.

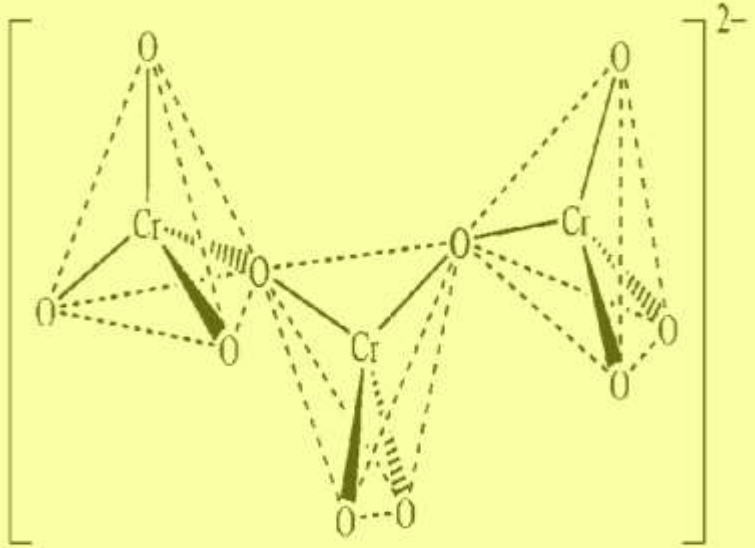


$[CrO_4]^{2-}$

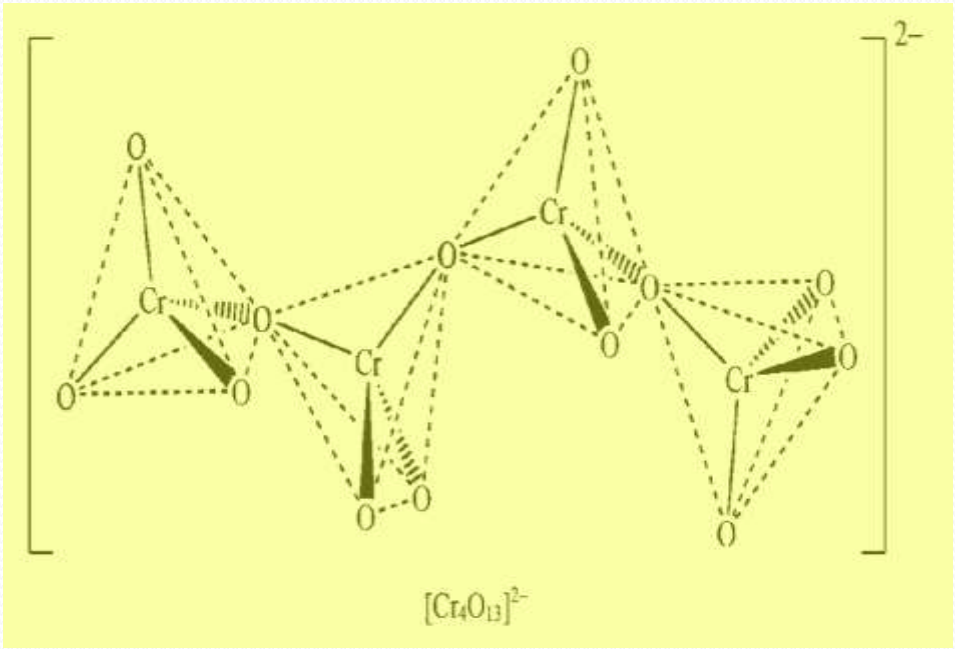


$[Cr_2O_7]^{2-}$

Td with 4 - O atom/ion at each corner



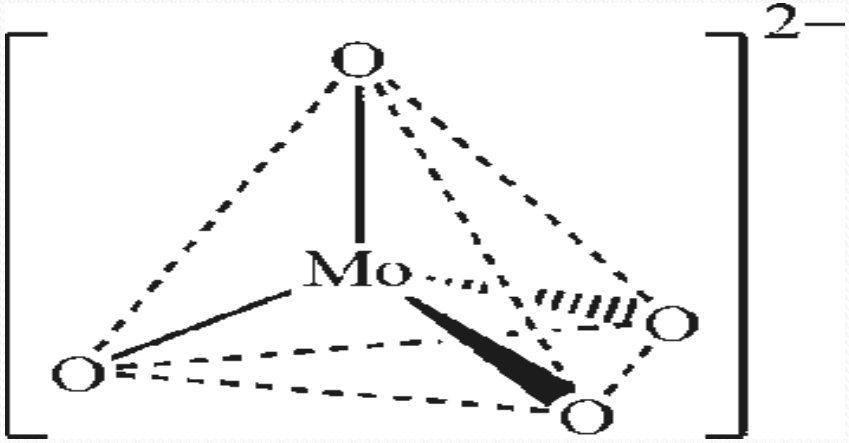
$[Cr_3O_{10}]^{2-}$



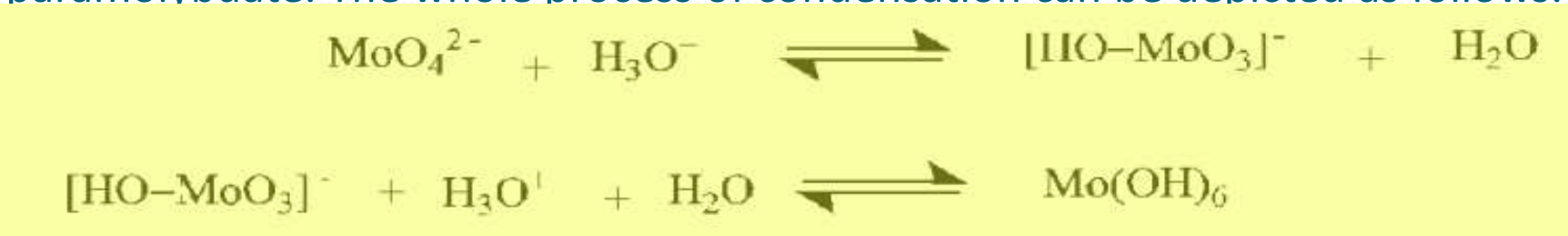
$[Cr_4O_{13}]^{2-}$

The tri-chromate and tetra-chromate anions can be crystallized as *their* alkali metal salts only from strongly acidic solution and no polymerization beyond *tetramenc* entity is observed. The Cr—O—Cr bond angle of all polychromates is approximately 120°.

- ***Isopoly Acids and Salts of Mo and W***
- When molybdenum trioxide is dissolved in highly basic aqueous solutions of sodium hydroxide or potassium hydroxide (alkali solutions), molybdate ions with tetrahedral geometry are formed as:
- $MoO_3 + 2NaOH \longrightarrow Na_2MoO_4 + H_2O$



When the pH of the solution is lowered down, the protonation of molybdate ions start followed by the condensation yielding the first major polyanion i.e. paramolybdate. The whole process of condensation can be depicted as follows:



Although the entropy (S) of the second reaction is negative yet it is as fast as the first reaction which may be attributed to the large negative enthalpy for second reaction, compensating the entropy loss. The Mo(OH) , thus formed during the course of the second reaction, reacts with [MoOs(OH)] ions present in the acidic media as: