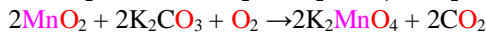
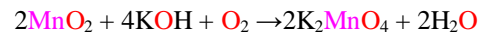
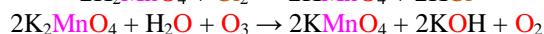
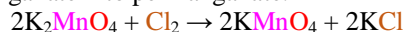


Manufacturing of Potassium Permanganate KMnO_4

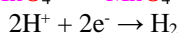
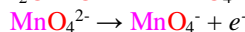
- ❖ This is the most important and well known salt of permanganic acid.
- ❖ It is prepared from the pyrolusite ore.
- ❖ It is prepared by fusing pyrolusite ore either with KOH or K_2CO_3 in presence of atmospheric oxygen or any other oxidising agent such as KNO_3 . The mass turns green with the formation of potassium manganate, K_2MnO_4 .



The fused mass is extracted with water. The solution is now treated with a current of chlorine or ozone or carbon dioxide to convert manganate into permanganate.



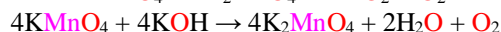
- ❖ Now-a-days, the conversion is done electrolytically.
- ❖ It is electrolysed between iron cathode and nickel anode. Dilute alkali solution is taken in the cathodic compartment and potassium manganate solution is taken in the anodic compartment. Both the compartments are separated by a diaphragm. On passing current, the oxygen evolved at anode oxidises manganate into permanganate.



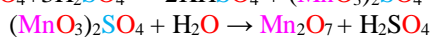
At cathode:

Properties:

- ❖ It is purple coloured crystalline compound. It is fairly soluble in water. When heated alone or with an alkali, it decomposes evolving oxygen.



- ❖ On treatment with conc. H_2SO_4 , it forms manganese heptoxide *via* permanganyl sulphate which decomposes explosively on heating.



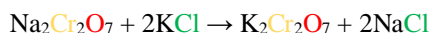
- ❖ Potassium permanganate is a powerful oxidising agent.
- ❖ A mixture of sulphur, charcoal and KMnO_4 forms an explosive powder.
- ❖ A mixture of oxalic acid and KMnO_4 catches fire spontaneously after a few seconds. The same thing happens when glycerine is poured over powdered KMnO_4 .
- ❖ Potassium permanganate acts as an oxidising agent in alkaline, neutral or acidic solutions.

Uses:

- ❖ KMnO_4 is used as an oxidising agent in laboratory and industry.
- ❖ In volumetric estimations, the solution is first standardised before use.
- ❖ In volumetric estimations, acidified standardised KMnO_4 solution is used. For maintaining acidic medium only dilute H_2SO_4 is used.
- ❖ HCl or HNO_3 are not used because HCl reacts with KMnO_4 and produce Cl_2 gas while HNO_3 , itself reacts as an oxidising agent.
- ❖ Alkaline potassium permanganate is called Baeyer's reagent. This reagent is used in organic chemistry for the test of unsaturation. KMnO_4 is used in the manufacture of saccharin, benzoic acid, acetaldehyde, etc.
- ❖ KMnO_4 is used in qualitative analysis for detecting halides, sulphites, oxalates, etc.
- ❖ It is widely used as a disinfectant and germicide. A very dilute solution of KMnO_4 is employed for washing wounds and gargling of mouth sores.
- ❖ It is also used for purifying well water.

Potassium Dichromate $\text{K}_2\text{Cr}_2\text{O}_7$

- ❖ It is the most important compound of Cr (VI). It is manufactured from chromite ore. Chromite ore is first converted into sodium dichromate.
- ❖ The hot saturated solution of sodium dichromate is mixed with KCl. Sodium chloride precipitates out from the hot solution which is filtered off. On cooling the mother liquor, crystals of potassium dichromate separate out.



Properties:

- ❖ It is orange-red coloured crystalline compound.
- ❖ It is moderately soluble in cold water but freely soluble in cold water.
- ❖ It melts at 398 °C. On strongly heating, it decomposes liberating oxygen.

Uses:

- ❖ As a volumetric reagent in the estimation of reducing agents such as oxalic acid, ferrous ions, iodide ions, etc.
- ❖ It is used as a primary standard.
- ❖ For the preparation of several chromium compounds such as chrome alum, chrome yellow, chrome red, zinc yellow, etc.
- ❖ In dyeing, chrome tanning, calico printing, photography, etc.
- ❖ Chromic acid as a cleansing agent for glassware.
- ❖ In organic chemistry as an oxidising agent.
- ❖ As laboratory reagent.
- ❖ Acidified solution of $K_2Cr_2O_7$ provides a test to find out whether a person is drunken or not. A person is asked to breathe into a solution of $K_2Cr_2O_7$ (acidified). If the colour of the solution turns green, it confirms that the person is in drunken state.

Manufacturing of Hydrochloric Acid

Preparation:

- ❖ By the direct combination of elements: $H_2 + Cl_2 \rightarrow 2HCl$
- ❖ By heating a halide with acid: $2NaCl + H_2SO_4 \rightarrow Na_2SO_4 + 2HCl$

Hydrochloric acid is used:

- ❖ In the preparation of chlorine, chlorides and aqua-regia.
- ❖ As a laboratory reagent.
- ❖ For cleaning iron sheets during tin plating and galvanisation.
- ❖ For extraction of glue from animal tissues and bones.
- ❖ In medicines

References:

- ❖ Industrial Inorganic Chemistry by Karl Heinz Buchel Hans-Heinrich Moretto Peter Woditsch, Second Edition WILEY-VCH.
- ❖ A Textbook of Inorganic Chemistry by O. P. Tandon
- ❖ Principles of Inorganic Chemistry by Puri, Sharma and Kalia

Industrial Gases & Chemicals

1. Discuss the manufacturing process of acetylene gas and specify its three uses.
2. Define acid mine drainage.
3. Define O_2 sag curve.
4. What is oleum? Explain the contact process for manufacturing sulphuric acid. What are the main applications of sulphuric acid?
5. Write short notes on manufacture and use of bleaching powder.
6. How is hypo is manufactured? What are the main applications of hypo and what precautions should be kept in mind while using it?
7. Define cryogenic air separation.
8. Manufacture and uses of nitrogen.
9. With the help of diagram describe the principle involved in the Linde process for the production of nitrogen and oxygen from air.
10. Give two applications of the followings: (i) Phosgene, (ii) H_2O_2 and (iii) alum.
11. Explain chlor-alkali process.