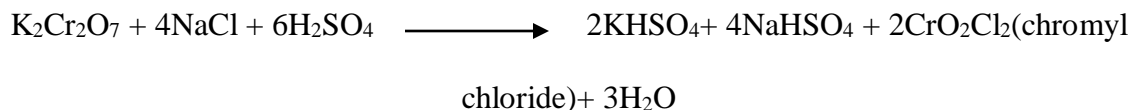


Chemistry

Chapter 06 (Transition Elements)

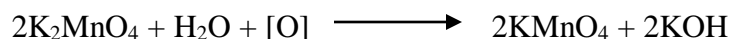
1. Explain chromyl chloride test. Give chemical equation.

When solid potassium dichromate is heated with solid metal chloride in the presence of concentrated sulphuric acid chromyl chloride is produced.



2. How KMnO_4 can be prepared by electrolytic method?

In electrolytic method manganate is converted to permanganate by electrolytic oxidation. During electrolysis of an aqueous solution of K_2MnO_4 , water is decomposed to evolve hydrogen gas at the cathode and oxygen gas at the anode. Oxygen liberated at the anode oxidizes manganate ion $(\text{MnO}_4)^{2-}$ into permanganate ion $(\text{MnO}_4)^{1-}$ while hydrogen is liberated at the cathode.



3. Write formulas of chromate and dichromate ions. In which colour they usually exist?

The formula of chromate ion is CrO_4^{2-} and that of dichromate ion is $\text{Cr}_2\text{O}_7^{2-}$. All the chromates are yellow in colour.

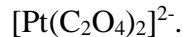
4. Give coordination number and oxidation number of iron (Fe) in $\text{K}_4[\text{Fe}(\text{CN})_6]$.

The coordination number of iron (Fe) in $\text{K}_4[\text{Fe}(\text{CN})_6]$ is 6 and the oxidation number is 2.

5. What are chelates? Give an example.

When all the donor atoms of a polydentate ligand get coordinated with the same metal ion, a complex compound is formed which contains one or more rings in its structure and hence is called a chelate.

Example



6. Why does damaged tin plated iron get rusted quickly?

If the protective coating is damaged, then iron comes into contact with moisture. A galvanic cell is established in which tin acts as a cathode and iron as an anode. The electrons flow from iron to tin, where they discharge H^+ ions, leaving behind OH^- in the solution. These hydroxide ions react with iron forming $\text{Fe}(\text{OH})_3$, which dissolves rapidly in water. From this, it can be concluded that plated iron gets rusted more rapidly when the protective coating is damaged than the non-plated iron.

7. What are typical and non-typical transition elements?

The elements of group IIB and group IIIB are referred to as non-typical transition elements and the elements in the remaining transition series are called typical transition elements.

8. Give reason for the development of colours in the transition metal complexes.

In transition elements, the d orbitals are responsible for the colour development in their compounds. When these orbitals are involved in bonding, they split up into two energy levels, one set has a higher energy than the other. The electrons residing in low energy d-orbitals absorb a part of the visible light and jump to high energy d orbitals. The process is called d-d transition. The energy difference of d-orbitals varies from ion to ion. Thus, every ion absorbs a different wavelength and transmits the remaining set of wavelengths that gives different colours to the ions.

9. Give formulas of Magnetite and Haematite.

The formula of magnetite is Fe_3O_4 and of haematite is Fe_2O_3 .

10. Write carbon content in pig iron and cast iron.

The carbon content in pig iron or cast iron is 2.5 to 4.5%.

11. What is the %age of carbon in different types of steel?

Steel is an alloy of iron containing 0.25 to 2.5% of carbon and traces of S,P,Si and Mn. Mild steel has 0.1 to 0.2% C. The medium carbon steel has 0.2 to 0.7% carbon and the high carbon steel has 0.7 to 1.5% carbon.

12. Why transition elements have variable oxidation states?

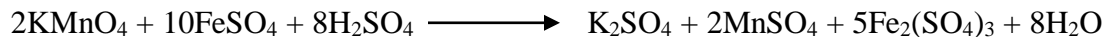
Transition elements have variable oxidation states because of the involvement of the unpaired d electrons in addition to s electrons in bond formation.

13. What is ligand? Give types of ligands/ Define Ligand with an example.

The atoms or ions or neutral molecules, which surround the central metal ion and donate electron pairs to it are called ligands. They may be anions or neutral molecules e.g. $K_4[Fe(CN)_4]$, $[Ag(NH_3)_2]Cl$. In the above examples, CN^- and NH_3 are the anionic and neutral ligands, respectively. Ligands having two donor atoms are called bidentate ligands, e.g.

Oxalate ion $\begin{array}{c} COO^- \\ | \\ COO^- \end{array}$ is a bidentate ligand and its coordination with the metal ion occurs through its both negatively charged oxygen atoms.

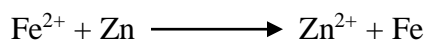
14. Complete and balance the following chemical equation? $KMnO_4 + FeSO_4 + H_2SO_4 \longrightarrow$



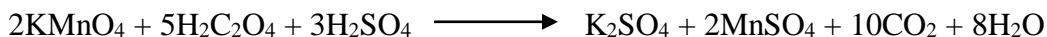
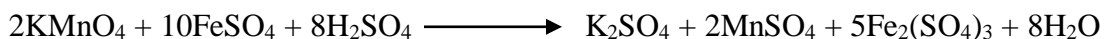
15. Define sacrificial corrosion.

Galvanizing is done by dipping a clean iron sheet in a zinc chloride bath and heating. The iron sheet is then removed, rolled into zinc bath and air cooled. In this case, if a protective layer of zinc is damaged a galvanic cell is established in the presence of moisture. Iron serves as a

cathode and zinc as an anode. Electrons flow from zinc to iron, as a result Zn decays while Fe remains intact. This is called sacrificial corrosion.

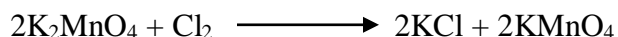


16. KMnO_4 acts as an oxidizing agent. Show with two examples.



17. What is Stadelers process?

In this method Cl_2 is passed through the green solution of K_2MnO_4 until it becomes purple due to the formation of KMnO_4 . Here, Cl_2 oxidizes K_2MnO_4 into KMnO_4 .

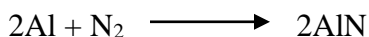


18. What are chromates and dichromates?

Chromates and dichromates are the salts of chromic acid, H_2CrO_4 and dichromic acid, $\text{H}_2\text{Cr}_2\text{O}_7$, respectively. Both acids exist only in aqueous solution and when attempts are made to isolate them from solution they decompose immediately into chromic anhydride (CrO_3) and water. Their salts are, however, quite stable.

19. How entrapped bubbles of air removed from molten steel?

In order to remove entrapped bubbles of gases (blow holes) such as O_2 , N_2 , CO_2 , a little aluminium or ferro-silicon is added. Aluminium removes nitrogen as nitride.



20. What is meant by interstitial compound and substitutional alloy?

When small non-metal atoms like H,B,C,N enter the interstices of transition metals and impart useful features to them, they are called interstitial compounds. These are non-stoichiometric compounds. Sometimes they are also termed as interstitial alloys.

21. Define Paramagnetism, diamagnetism and Ferromagnetism.

Paramagnetism

Substances which are weakly attracted by a strong magnetic field are called paramagnetic substances.

Example

Mn^{2+} .

Diamagnetism

Those substances which are weakly repelled by a strong magnetic field are called diamagnetic substances.

Example

Zn^{2+} .

Ferromagnetism

A ferromagnetic substance contains permanent atomic magnetic dipoles that are spontaneously oriented. Ferromagnetism is a kind of magnetism that is associated with iron, cobalt, nickel, and some alloys or compounds containing one or more of these elements.

22. What is meant by outer transition metals and inner transition metals?

f-block elements, i.e., Lanthanides and Actinides are also called inner transition metals, whereas, d-block elements are called outer transition metals.

23. Why d and f block elements are called transition elements?

The d-block and f-block elements are called transition elements because they are located between the s and p-block elements and their properties are in transition between the metallic elements of the s-block and non-metallic elements of the p-block.

24. What is galvanizing? How it is done?

Galvanizing is coating iron or steel with a protective layer of zinc. Galvanizing is done by dipping a clean iron sheet in a zinc chloride bath and heating. The iron sheet is then removed, rolled into zinc bath and air cooled.

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