Properties and uses of d-block elements

The elements with a halfway filled d-subshell are d-block elements. They also go by the name 'transition elements' because they form a transition between metals and non-metals. The d and f block contains both metals and non-metals. The transition elements can be either regular transition elements or the non-typical transition elements. The d – block has three arrangements, each of ten elements.

These arrangements are described by the totally filled 3d, 4d, and 5d subshells and are named as 3d – (first series) which include Sc – Zn, 4d arrangement (second series) which includes Y-Cd and the 5d arrangement (third series) which includes La-Hg separately.There is a deficient fourth series comprising of just three elements in particular Ac, Ku, and Ha. In these elements, the 6d subshell begins to fill at Ac. Out of these, elements like iron, cobalt and nickel are used in making magnets.

Uses of d Block Elements

The uses of the d block elements are:

- Iron and its amalgam, steel, are utilized broadly in the development industry.
- Titanium is as a part of the manufacture of airship and spaceship.
- Tungsten comes in use in making electrical fibres.
- Manganese dioxide comes in use as a part of dry battery cells.
- Zinc comes in use as the negative anode in fixed dry batteries.
- Niobium composites are perfect as a part of fly motors.
- Tantalum comes into use to make expository weights.
- Silver bromide comes into use as a part of photography.

- Many d- block or transition metals and their compounds find their use as impetuses in the chemical reactions.
- Palladium chloride comes into use in the Wacker process of oxidation of ethane to ethanol.
- Iron comes in use in the production of ammonia in Haber's process.
- Ziegler-Natta, a complex of trimethyl aluminium and titanium tetrachloride come into use in the polymerisation of ethene to polythene.

Uses of f Block Elements

Some applications of the f block elements are:

- Lanthanide alloys (mischmetal) utilized for the creation of instrumental steels and heat resistance.
- Carbides, Borides, and nitrides of lanthanides come in use as refractories.
- Lanthanide oxides come in use in cleaning glass as abrasives.
- Thorium is a part of cancer treatment and glowing gas mantles.
- We utilize Uranium as an atomic fuel.
- Plutonium is a part of nuclear reactors and nuclear bombs.

Compounds of Transition Elements

- Ferrous Sulphate (Green Vitriol), $FeSO_4.7H_2O$
- Hydrated and anhydrous FeSO4 is green and white in colour respectively. It is isomorphous with Epsom salt, $MgSO_4.7H_2O$ and $ZnSO_4.7H_2$ It effervesces on exposure to air. Like other ferrous salts, it takes up

HNO_3 forming brown coloured double compound, $Fe(NO)SO_4$, nitroso ferrous sulphate.

- It forms double salts with sulphates of alkali metals with general formula $R_2SO_4.FeSO_4.6H_2O$. With ammonium sulphate, it forms a double salt known as ferrous ammonium sulphate or Mohr's salt, $FeSO_4$.(NH4)2SO4.6H2O. It does not effervesce. It ionises in solution to gives Fe^{2+}, NH^{4+} and SO_4^{2-} ions.

- Ferric Oxide, Fe_2O_3
- Anhydrous salt is yellow, deliquescent compound and highly soluble in H_2O. On heating, it gives $FeCl_2$ and Cl_2. Its aqueous solution is acidic due to hydrolysis.

- Silver Nitrate, $AgNO_3$
- Silver nitrate forms precipitate with some salt solutions which help in the detection of acid radicals. It decomposes on heating.

- Mercury (I) Chloride / Mercurous Chloride / Calomel, (Hg_2Cl_2)
- It is a white power insoluble in water but soluble in chlorine water. On treatment with ammonia, if turns black due to the formation of finely divided mercury.

- Mercury (II) Chloride $HgCl_2$
- It is a white crystalline solid sparingly soluble in cold water but soluble in hot water. Its solubility can be increased by adding Cl. When treated with $SnCl_2$ it is reduced to mercury.

- Mercury-II Iodide
- Mercuric iodide exists in two forms, i.e. red and yellow. The yellow form is stable above 400 K white the red form is stable below this temperature. An alkaline solution of K_2HgI_4 is called Nessler's reagent and is used to detect the presence of NH^{4+} with which it gives a brown precipitate due to the formation of iodide of Million's base.

- **Solved Examples for You**

- Question: Depict through chemical equations how the halides of transition elements react?

- Answer: Anhydrous halides of each of the transition elements can be prepared by the direct reaction of the metal with halogens.

  - $2Fe(s)+3Cl_2(g)\longrightarrow 2FeCl_3(s)$

- Heating a metal halide with additional metal can be used to form a halide of the metal with a lower oxidation state:

  - $Fe(s)+2FeCl_3(s)\longrightarrow 3FeCl_2(s)$

- The preparation of stable water solutions of the halides of the metals of the first transition series is by the addition of a hydrohalic acid to carbonates, hydroxides, oxides, or other compounds that contain basic anions. $NiCO_3(s)+2HF(aq)\longrightarrow NiF_2(aq)+H_2O(l)+CO_2(g)$