



12085CH08

Objectives

After studying this Unit, you will be able to

- learn the positions of the d - and f -block elements in the periodic table;
- know the electronic configurations of the transition (d -block) and the inner transition (f -block) elements;
- appreciate the relative stability of various oxidation states in terms of electrode potential values;
- describe the preparation, properties, structures and uses of some important compounds such as $K_2Cr_2O_7$ and $KMnO_4$;
- understand the general characteristics of the d - and f -block elements and the general horizontal and group trends in them;
- describe the properties of the f -block elements and give a comparative account of the lanthanoids and actinoids with respect to their electronic configurations, oxidation states and chemical behaviour.

Unit

4

The d - and f -Block Elements

Iron, copper, silver and gold are among the transition elements that have played important roles in the development of human civilisation. The inner transition elements such as Th, Pa and U are proving excellent sources of nuclear energy in modern times.

The d -block of the periodic table contains the elements of the groups 3-12 in which the d orbitals are progressively filled in each of the four long periods. The f -block consists of elements in which $4f$ and $5f$ orbitals are progressively filled. They are placed in a separate panel at the bottom of the periodic table. The names *transition metals* and *inner transition metals* are often used to refer to the elements of d - and f -blocks respectively.

There are mainly four series of the transition metals, $3d$ series (Sc to Zn), $4d$ series (Y to Cd), $5d$ series (La and Hf to Hg) and $6d$ series which has Ac and elements from Rf to Cn. The two series of the inner transition metals; $4f$ (Ce to Lu) and $5f$ (Th to Lr) are known as *lanthanoids* and *actinoids* respectively.

Originally the name transition metals was derived from the fact that their chemical properties were transitional between those of s and p -block elements. Now according to IUPAC, transition metals are defined as metals which have incomplete d subshell either in neutral atom or in their ions. Zinc, cadmium and mercury of group 12 have full d^{10} configuration in their ground state as well as in their common oxidation states and hence, are not regarded as transition metals. However, being the end members of the $3d$, $4d$ and $5d$ transition series, respectively, their chemistry is studied along with the chemistry of the transition metals.

The presence of partly filled d or f orbitals in their atoms makes transition elements different from that of