

### **Modern periodic law:**

- In 1913, Henry moseley showed that the atomic number is a more fundamental property of an element than its atomic weight.
- This observation led to the development of modern periodic law. The modern periodic law states that ‘‘the physical and chemical properties of the elements are periodic function of their atomic numbers.’’
- This means that when the elements are arranged in order of increasing atomic numbers.
- The elements with similar properties recur after regular intravals .the periodic repetition is called periodicity.

### **Long form of the periodic table (or) modern periodic table:**

- The long form of the periodic table consists of horizontal rows called periods and vertical columns called groups.

### **Periods:**

- In terms of electronic structure of the atom .a periods constitutes a series of elements whose atoms have the same number of electron shell. i.e., principle quantum number(n).
- There are seven periods and each periods starts with a different principle number.
- The first period corresponds to the filling of electrons in the first energy shell(n=1).
- Now this energy level has only one orbitals (1s) and it can accommodate two electrons.
- This means that there can be only two elements (hydrogen,  $1s^1$  and helium,  $1s^2$ ) in the first periods.
- similarly

periods	Principal valence shell(n)	Orbitals being filled up	Electrons to the accomodated	No.of . electrons
first	n=1	1s	2	2
second	n=2	2s,2p	2+6	8
third	n=3	3s,3p	2+6	8
fourth	n=4	4s,3d,4p	2+10+6	18
fifth	n=5	5s,4d,4p	2+10+6	18
sixth	n=6	6s,4f,5d,6p	2+14+10+6	32
seventh	n=7	7s,5f,6d,7p	2+14+10+6	32

- The first three periods containing 2,8 and 8 elements respectively are called short periods.
- The next three periods containing 18,18 and 32 elements respectively are called long periods.

### Groups:

- A vertical column in the periodic table is known as group.
- A group consists of a series of elements having similar configuration of the outer energyshell.
- There are 18 vertical columns in long form of the periodic table. The groups are numbered from 1 to 18 previously,
- These were numbered from I to VII as A and B, VIII and zero groups elements.
- The elements belonging to the same group are said to constitute a family.
- For examble , elements 17 VII A constitute halogen family.

### Periodicity in properties:

- When elements are arranged in the increasing order of their atomic number.
- There is a periodic change in their physical properties like atomic radius, ionisation potential, electron affinity etc and their chemical activity.
- i.e., their physical and chemical properties repeated at regular intervals. This is referred to as periodicity in properties.

### Atomic and Ionic radii:

- The term atomic (or) ionic radii is defined as the distance between the centres of the nucleus and the outermost shell of electron in an atom (or) ion.
- For example the atomic radius of H atom is equal to  $74/2=37$  pm. (bond distance in  $H_2$  molecule is 74 pm).
- Both atomic radius and ionic radius decrease from left to right across a period in the periodic table.
- Example:
- In the elements of 2<sup>nd</sup> period, the covalent radii decrease as we go from Li to F as shown below.
- Elements of 2<sup>nd</sup> period
- Li, Be, B, C, N, O, F

Atomic radii values decreasing →

- Thus in any period the alkali metals (that are present at the extreme left of the periodic table) have the largest size while the halogens (that are present at the extreme right excluding the zero group elements) have the smallest size.

### Explanation:

- As we proceed from left to right in a period the electrons added to the orbitals of the same main energy level.
- Addition of each electron to the same energy levels, the nuclear charge increases (atomic number) by one.

- The increased nuclear charge attracts the electrons more strongly close to the nucleus and these decreases the size of the atom.