Atomic number

The atomic number is the number of protons in an atom of the element. Atomic number of the element = number of protons in an atom of the element

For example, there are 11 protons in the nucleus of a sodium atom. Thus, the atomic number of sodium is 11.The number of protons in every atom of the same element is equal. The number of protons in different elements is different. Therefore, the atomic numbers of two atoms of different elements will never be the same. **Hence, the atomic number of an element is a unique characteristic of that element.** For instance, if the atomic number of an element is 6, it means that the element is carbon. In no other element, the atomic number is equal to 6. The atomic number of an element is symbolised by Z. In a neutral atom, the number of protons is equal to the number of electrons in it. So, it implies that the atomic number of an element is equal to the number of electrons in an atom of that element.

However, when chemical reactions take place, electrons may be either lost from or gained by atoms. Such charged atoms are called ions. The number of electrons in an ion may be less or more than the number of protons. But, since the number of protons in an ion formed by a particular atom does not change, its atomic number remains unchanged.

⍓ Mass number

Of the fundermental subatomic particles called protons, neutrons and electrons contained in an atom, electrons are very light. The mass of protons and neutrons is nearly equal.Approximately, the mass of an electron is 1/1840 the mass of a proton. So in comparison to the mass of protons and neutrons in an atom, the mass

of electrons is negligibly small. Therefore, the mass of an atom depends only on the mass of protons and neutrons. **The sum of the number of protons and neutrons in the nucleus of an atom is called the mass number.**

\ mass number = number of protons + number of neutrons

Symbol A signifies the mass number of an element.

⍓ Atomic number of sodium is 11.

- Hence, a sodium atom contains 11 protons.
- If it contains 12 neutrons,the mass number of the sodium atom = 11+12=23.

There is a standard way of writing the atomic number and mass number of an element. On the left hand side of the symbol of the relevant element, the atomic number is written at the bottom and the mass number at the top.

Example (The mass number of sodium (Na) is 23. Its atomic number is 11.

X Na
A 23 Z 11

A - mass number atomic number - 11 Z - atomic number mass number - 23

The difference between the mass number and the atomic number gives the number of neutrons in the atom.

3.2 Electronic Configuration

The maximum number of electrons that can be accomodated in the respective energy levels according to the atomic model accepted at present was discussed earlier. **Representing how electrons are filled in the respective energy levels from the one nearest to the nucleus of an atom and outwards is called electronic configuration.** Let's look at an example. The atomic number of sodium is 11. Therefore, a sodium atom has 11 protons and 11 electrons. Those eleven electrons in the sodium atom are distributed as 2 electrons in the first energy level, 8 electrons in the second energy level and 1 electron in the third energy level. Hence the electronic configuration of sodium can be written as follows.

Table 3.2 - Electronic configurations of the elements with atomic numbers from 1 to 20

Element	Symbol	Atomic number	Electronic configuration			
			K	L	M	N
Hydrogen	H	1	1			
Helium	He	2	2			
Lithium	Li	3	2	1		
Beryllium	Be	4	2	2		
Boron	B	5	2	3		

Carbon	C	6	2	4		
Nitrogen	N	7	2	5		
Oxygen	O	8	2	6		
Fluorine	F	9	2	7		
Neon	Ne	10	2	8		
Sodium	Na	11	2	8	1	
Magnesium	Mg	12	2	8	2	
Aluminium	Al	13	2	8	3	
Silicon	Si	14	2	8	4	
Phosphorus	P	15	2	8	5	
Sulphur	S	16	2	8	6	
Chlorine	Cl	17	2	8	7	
Argon	Ar	18	2	8	8	
Potassium	K	19	2	8	8	1
Calcium	Ca	20	2	8	8	2

When an energy level of an atom of an element is the last energy level bearing electrons, the maximum number of electrons it can accommodate is 8. Thus, the number of electrons in the energy levels of potassium and

calcium are not 9 and 10.

3.3 Modern Periodic Table

As at present, more than 115 elements have been discovered. Studying their properties individually is a very tedious task. Scientists in various parts of the world collect information about elements and their compounds continuously. This host of information is so large and diverse that no one is able to memorise all the facts about them. Therefore different scientists have attempted to classify elements in various ways.The periodic classification is the greatest result of this attempt. A Periodic Table for classifying elements was first introduced by Dmitri Mendeleeff ,a Russian scientist.

The modern Periodic Table (Fig. 3.3) is based on the atomic number and the electronic configuration. The periodic law states that the properties of elements are periodic functions of their atomic number. This means that when the elements are arranged in the ascending order of their atomic

numbers, elements with similar properties recur at regular intervals of elements.

In the PeriodicTable, horizontal rows
are called **Periods** while vertical columns are known as **Groups**.

• Dividing Elements into Periods

The Period to which an element belongs is decided by the number of energy levels (shells) carrying electrons in an atom of that element.

Period 1 Period 2 Period 3 Period 4

- Only the first energy level carries electrons
- Only the first and second energy levels carry electrons
- Only the first, second, and third energy levels carry electrons
- Only the first, second, third and fourth energy levels carry electrons

⍓ Dividing Elements into Groups

The properties of an element depends on the number of electrons present in its outermost energy level. These are known as valence electrons. As per the above table, it is seen that the properties of lithium which has only one valence electron is similar to that of sodium.