CLASS 10- SCIENCE

CHAPTER 5- PERIODIC CLASSIFICATION OF ELEMENTS

PART 3- MODERN PERIODIC TABLE AND TRENDS

INTRODUCTION

- In 1913, Henry Moseley showed that the atomic number (Z) of an element is a more fundamental property than its atomic mass.
- Accordingly, the Modern Periodic Law can be stated as, “The physical and chemical properties of the elements are the periodic function of their atomic numbers.”
- In this table, the elements are arranged in the increasing order of their atomic number.
- The elements are arranged in 18 vertical columns called Groups and 7 horizontal rows called Periods.

INTRODUCTION (cont.)

- First period with 2 elements is called a very short period.
- Second and third periods with 8 elements each are called short periods.
- Fourth and fifth periods with 18 elements each are called long periods.
- Sixth period with 32 elements is called a very long period.
- Seventh period with 28 elements is known as incomplete period.
- 14 elements of sixth and seventh periods each are placed separately at the bottom of the table. They are known as lanthanoides and actinoides respectively.

INTRODUCTION (cont.)

- Group 1 elements are known as alkali metals.
- Group 2 elements are known as alkaline earth metals.
- Group 17 elements are known as halogens.
- Group 18 elements are known as noble gases.
- The metals are on the left-hand side of the modern periodic table while the non-metals are on its right-hand side.
- A zigzag line of elements like boron, silicon, germanium, arsenic, antimony, etc. separates metals from non-metals. These elements are classified as metalloids or semi-metals because they exhibits some properties of both metals and non-metals.

LITTLE MORE

Q1) Among all the periods, which period is known to be incomplete and why?

Ans)

Earlier, the 7th period of Modern Periodic Table was considered to be incomplete because there were 28 elements instead of 32 elements in this period. But, later on all the 32 elements were recognised and named properly by IUPAC. Still this period is sometimes considered to be incomplete because the properties of some elements have not been studied properly as they are only identified in labs. Also, they are highly unstable and so not much information is available for these elements.

Q2) How the anomalies of Mendeleev's Periodic Table were removed in the Modern Periodic Table?

Ans)

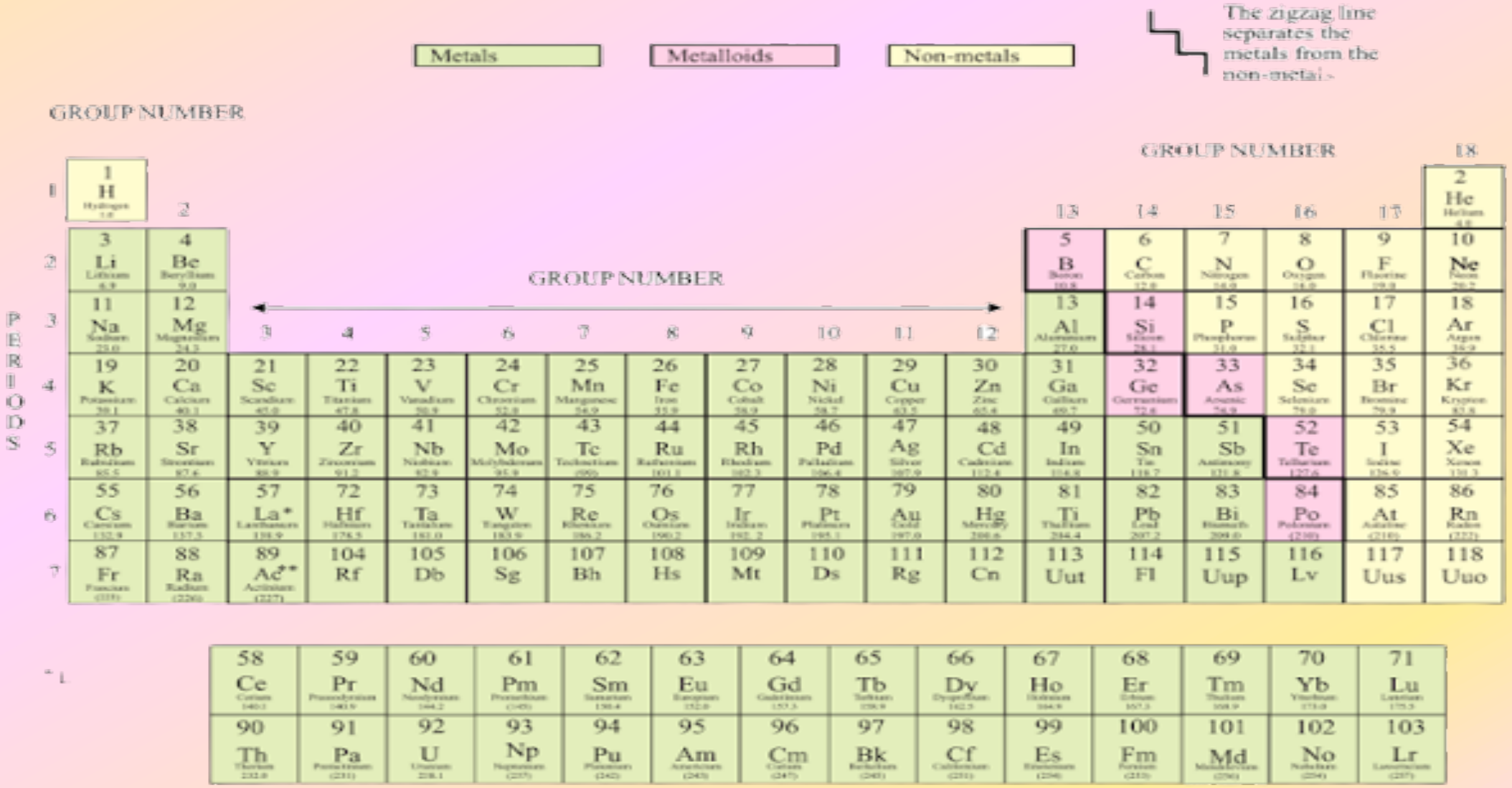
(i) Hydrogen is kept in group 1 with elements having same number of valence electrons.

(ii) In the Modern Periodic table elements are arranged in the increasing order of their atomic number, so there was no need to place more than one elements in one slot.

(iii) The atomic numbers of cobalt and nickel are 27 and 28 respectively. So, cobalt is placed before nickel in the modern periodic table.

(iv) All isotopes of an element have same atomic number but different atomic masses. So, they are given the same position in the modern periodic table.

MODERN PERIODIC TABLE



POSITION OF ELEMENTS IN THE MODERN PERIODIC TABLE-

- Elements in a group have the same number of valence electrons.
- Number of shell increases on going down the group.
- Elements in a period have the same number of shells.
- Number of valence shell electrons increases by one unit (as atomic number increases by one unit) on moving from left to right in a period.
- Each period shows that a new electronic shell is filled.
- Maximum no. of electrons that can be accommodated in a shell depend on the formula $2n^2$ where n is the no. of the given shell. Eg- K shell has 2 electrons, L shell has 8 electrons and so on.
- Position of an element in the table tells about its reactivity.

TRENDS IN THE MODERN PERIODIC TABLE

- Valency - The valency of an element is determined by the number of valence shell electrons in its atoms. So, we can say that the valency is the combining capacity of an element.

➢ The valency remains same on moving from top to bottom in a group. This is so because the number of valence electrons remains the same in a particular group.

➢ In a period, on moving from left to right, the valency first increases from 1 to 4 and then it decreases from 4 to 0.

TRENDS IN THE MODERN PERIODIC TABLE (cont.)

- Atomic size- The atomic size refers to the radius of an atom. It is determined by the distance between the centre of the nucleus and the outermost shell of an isolated atom.

➢The atomic size increases on moving from top to bottom in a group. This is so because new shells are being added as we go down the group which increases the distance between the nucleus and the outermost shell.

➢The atomic size decreases on moving from left to right in a period. This is so because the effective nuclear charge increases from left to right which pulls the valence electrons closer to the nucleus thus reducing the atomic radius.

TRENDS IN THE MODERN PERIODIC TABLE (cont.)

- Metallic character – This means the tendency of an atom to lose electrons. Metals are electropositive in nature as they lose their valence electrons while forming bonds.

➢Metallic character increases on going down the group. This is so because, as we go down the group, the effective nuclear charge experienced by the valence electrons decreases. This happens due to the increased distance between the nucleus and the outermost electrons and thus can be lost easily.

➢Metallic character decreases on moving from left to right across a period. This is so because, the effective nuclear charge experienced by the valence shell electrons increases as the number of electrons increases in the same shell. Thus, the atom will not lose the electrons easily.

TRENDS IN THE MODERN PERIODIC TABLE (cont.)

- Non-metallic character - – This means the tendency of an atom to gain electrons. Non-metals are electronegative in nature as they tend to gain electrons while forming bonds.

➢ Non-metallic character decreases on going down the group. This is so because as the atomic size increases the nuclear pull for the valence electrons decreases. Thus, the tendency to gain electrons decreases.

➢ Non-metallic character increases on moving from left to right across a period. This is so because, increase in nuclear charge increases the tendency to gain electrons.

TRENDS IN THE MODERN PERIODIC TABLE (cont.)

- Electronegativity – It is the tendency of an atom of a given element to attract the shared pair of electrons towards itself in a covalently bonded molecule.

➢ Electronegativity decreases on going down the group. This is so because as the atomic size increases down the group, the effective nuclear charge (to attract the shared pair of electrons) decreases.

➢ Electronegativity increases on moving from left to right across a period. This is so because of the increase in the effective nuclear charge which helps to attract the shared pair of electrons.

LITTLE MORE

- Nature of oxides – Metal oxides are basic in nature. Non-metal oxides are acidic in nature.

- Chemical reactivity – In metals, reactivity increases down the group as the tendency to lose electrons increases. In non-metals, reactivity decreases down the group as the tendency to gain electrons decreases.

THANK YOU