BAL BHARATI PUBLIC SCHOOL, PITAMPURA, DELHI – 110034

Class- 10

Chemistry

Ch-5: Periodic Classification of Elements

Week- 2nd Nov to 6th Nov'20 **No. of blocks- 1 or 2**

Guidelines

Dear Students,

- Refer to Science NCERT book before you begin to answer the questions.
- The assignment is to be done in the Chemistry notebook.
- Link for the chapter is :
  https://ncert.nic.in/ncerts/l/jesc105.pdf

Sub-Topics

1. Recapitulation
2. Trends in the Periodic Table

Instructional Aids /Resources:

- Class 10 Science NCERT textbook.
- You-tube links
  https://www.youtube.com/watch?v=bKKJkxqIg94

Learning Outcomes

Each student will be able to:

- state the Modern Periodic Table
- describe the periodicity in properties of elements
- define the term valency
- differentiate between metallic and non-metallic character
- find the position of an element in the Modern Periodic Table

Lesson Development

1. Recapitulation

The Modern Periodic Table

In 1913, Henry Moseley showed that the atomic number of an element is a more fundamental property than its atomic mass.

Modern Period Law: The physical and chemical properties of elements are the periodic function of their atomic number.

- Modern periodic table is based on atomic number of elements.

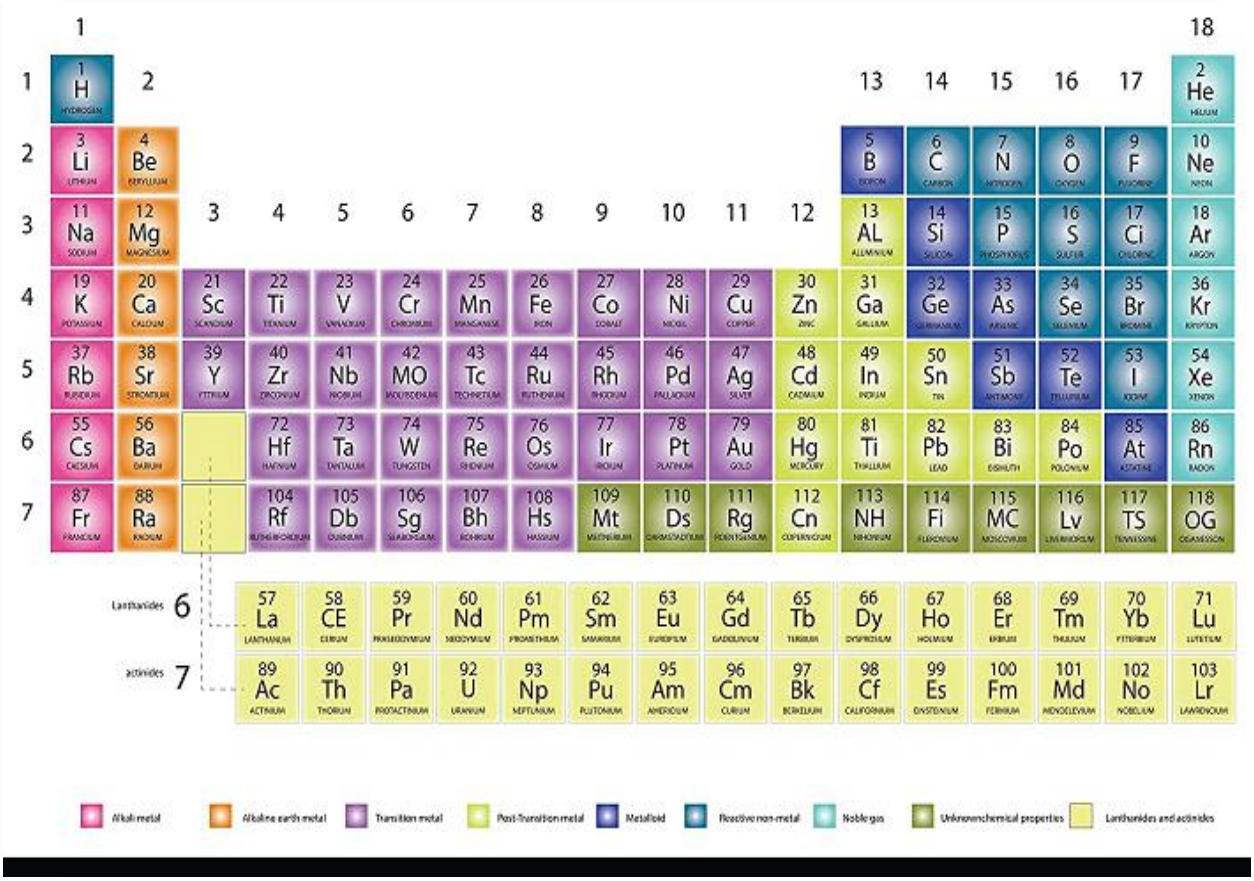
- Atomic number (Z) is equal to the number of protons present in the nucleus of an atom of an element.
- Modern periodic table contains 18 vertical column known as groups and seven horizontal rows known as periods.
- All the elements in a same group have the same number of valence electrons.
- All the elements in a same period have the same number of shells.
- No. of shells increase as we go down the group.

No. of elements placed in a particular period depends upon the fact how elements are filled in various shells.

- Maximum no. of electrons that can be accommodated in a shell depends on the formula $2n^2$ where n is the no. of the given shell.

  E.g. K shell – $2 \times (1)^2 = 2$ elements in the first period

  L shell – $2 \times (2)^2 = 8$ elements in the second period.



2. Trends in Modern Periodic Table:

(i) Valency

The combining capacity of an element is known as its valency. Valency of an element is determined by the number of valence electrons present in the outermost shell of its atom.

Variation in a Period

On moving from left to right in a period, the valency first increases from 1 to 4 and then decreases to zero (0).

Example ; Valency of 2nd period elements are :

	Li	Be	B	C	N	O	F	Ne
Valency	1	2	3	4	3	2	1	0

Variation in a Group

On moving from top to bottom in a group, the valency remains the same because the number of valence electrons remains the same.

Example:

- Valency of first group elements = 1
- Valency of second group elements = 2.

NOTE: Valency of all the elements of group 18 is zero. This is because all these elements have complete outer most shell.

(ii) Atomic Size

- Atomic size refers to the radius of an atom. It is a distance between the center of the nucleus and the outermost shell of an isolated atom.

Variation in a Period

On moving from left to right in a period, atomic size decreases because nuclear force of attraction increases.

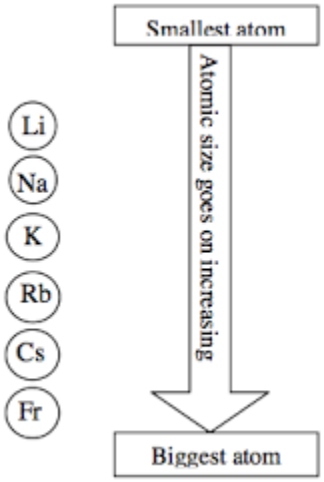
As we move from left to right in the Modern Periodic Table, the atomic number of each succeeding element increases by 1. The addition of an extra electron takes place in the

same shell. As a result, the effective nuclear force of attraction on the valence electrons increases. This leads to decrease in the atomic size.
Example: Size of second period elements: Li > Be > B > C > N > O > F

Point to know: The atomic size of noble gases in corresponding period is the largest due to the presence of fully filled electronic configuration (i.e. complete octet).

Variation in a Group

On moving from top to bottom in a group, the atomic size of elements increases.
As we move down the group, new shell of electrons is added at each succeeding element. As a result, the distance between the nucleus and the last shell increases and thus the atomic size increases.
Example: Atomic size of first group element: Li < Na < K < Rb < Cs < Fr



Atomic size of 17th group elements: F < Cl < Br < I

(iii) Metallic character and Non- metallic character

Metallic character

It is the tendency of an atom to lose electrons. Metals possess 1, 2 or 3 valence electrons and thus have strong tendency to lose these electrons to form positive ions. Therefore, metals are said to be electropositive elements.

Non- Metallic character

It is the tendency of an atom to gain electrons. Non- Metals possess 4 to 7 valence electrons and thus have strong tendency to gain electrons to form negative ions. Therefore, non-metals are said to be electronegative elements.

Variation in a Period

As we move from left to right in a period, the number of valence electrons increases from 1 to 7. As a result, the effective nuclear force of attraction acting on the valence electrons increases.

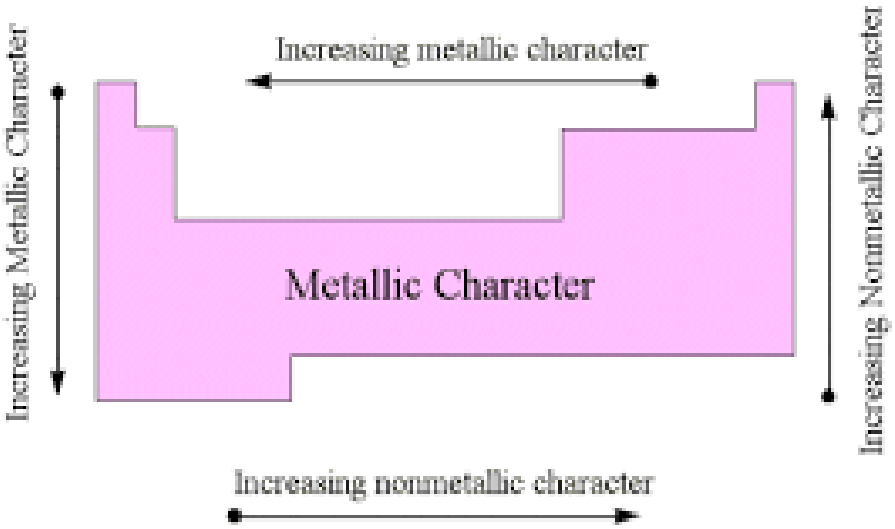
Thus the tendency of an element to lose electrons decreases, whereas, the tendency to gain electrons increases. **Thus on moving from left to right in a period, the metallic character decreases while the non- metallic character increases.**

Variation in a Group

On moving from top to bottom in a group, the atomic size gradually increases. As a result, the force of attraction between the nucleus and the valence electrons decreases. Therefore, the tendency of an element to lose electrons increases and hence the metallic character or the electropositive character increases as we move down the group.

Example: First group elements: Li < Na < K < Rb < Cs

On the other hand, the tendency of an element to gain electrons decreases and hence the non-metallic character or the electronegative character decreases as we move down the group.



Let's Summarize

S. No.	Property	Variation across period	Reason	Variation along group	Reason
1.	Atomic size	Decreases	Due to increase in nuclear charge	Increase	Due to addition of new shells distance between outermost electron and nucleus increases due to addition of new shells.
2.	Metallic Character	Decreases	Due to increase In effective nuclear	Increases	Decrease in effective nuclear charge

			charge, tendency to lose valence electrons decreases.		experienced by valence electrons, tendency to lose electrons (metallic character) increases.
3.	Non-Metallic increases Character (electro-negativity)	Increase	Due to increase in effective nuclear charge tendency to gain electrons increases	Decreases	Due to decrease in effective nuclear charge experienced by valence electron (due to addition of new shell), tendency to gain electrons decreases.

Assignment Questions (To be done in the Chemistry notebook)

1. "Hydrogen occupies a unique position in the Modern Periodic Table". Justify the statement.

2. Three elements A, B and C have 3, 4 and 2 electrons respectively in their outermost shell. Give the group number to which they belong in the Modern Periodic Table. Also, give their valencies.

3. An element is placed in 2nd Group and 3rd Period of the Periodic Table. It burns in presence of oxygen to form a basic oxide.
(a) Identify the element.
(b) Write the electronic configuration.
(c) Write the balanced equation when it burns in the presence of air.
(d) Write a balanced equation when this oxide is dissolved in water.
(e) Draw the electron dot structure for the formation of this oxide.

4. An element X which is a yellow solid at room temperature shows catenation and allotropy. X forms two oxides which are also formed during the thermal decomposition of ferrous sulphate crystals and are the major air pollutants.
(a) Identify the element X.
(b) Write the electronic configuration of X.
(c) Write the balanced chemical equation for the thermal decomposition of ferrous sulphate crystals.
(d) What would be the nature (acidic/ basic) of oxides formed?
(e) Locate the position of the element in the Modern Periodic Table.

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