	INDIAN SCHOOL AL WADI AL KABIR	
Class: X	**Department: SCIENCE 2021 – 22** **SUBJECT : CHEMISTRY**	**Date of completion: -** **13.02.22**
HANDOUTS	**CHAPTER: PERIODIC CLASSIFICATION OF ELEMENTS**	**Note:** **A4 FILE FORMAT**
Name of the student:	**Class & Sec:**	**Roll No:**

PERIODIC CLASSIFICATION OF ELEMENTS

There are 118 elements known at present and it is very difficult to study the behavior and properties of each and every element. Classification or grouping based on similarities makes the study about elements effective and easy. In this way, the study of a large number of elements is reduced to the study of a few groups of elements. This is the **reason for the periodic classification of elements.**

The earliest attempt to classify the elements resulted in grouping the then known elements as metals and non metals.

Dobereiner's triads

Dobereiner arranged the elements in the increasing order of atomic mass, he could identify some groups of three elements each. He called these groups triads. He was the first scientist to show the relationship between properties of elements and their atomic masses.

According to Dobereiner's law of triads, when elements are arranged in the order of increasing atomic masses, groups of three elements having similar chemical properties are obtained. The atomic mass of the middle element of the triad being equal to the mean of atomic masses of the other two elements.

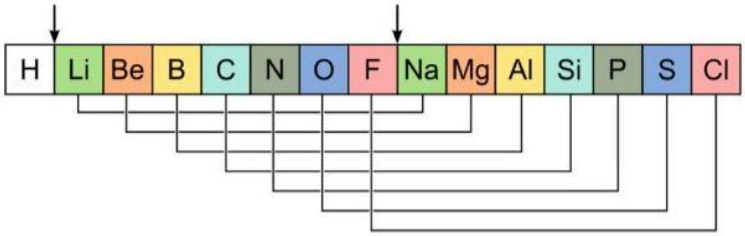
S. No.	Element	Atomic Mass	Mean of I and III
1.	I. Lithium II. Sodium III. Potassium	7 23 39	$\frac{7+39}{2}=23$
2.	I. Calcium II. Strontium III. Barium	40 88 137	$\frac{40+137}{2}=88.5$
3.	I. Chlorine II. Bromine III. Iodine	35.5 80 127	$\frac{35.5+127}{2}=81.25$

Limitation of Dobereiner's classification

He could identify only three triads from the then known elements. He failed to arrange all the then known elements in the form of triads.

Newland's law of octaves

When elements are arranged in the order of increasing atomic masses, the properties of the eighth element are a repetition of the properties of the first element.



Eg:-The properties of Lithium and Sodium were found to be the same. Beryllium and Magnesium resemble each other.

Limitations of Newlands law of octaves

1. It was applicable only up to Calcium as after calcium every eighth element did not possess properties similar to that of the first.
2. Newlands assumed that only 56 elements existed in nature and no more elements would be discovered. But later on several elements were discovered, whose properties did not fit into the law of octaves.
3. In order to fit elements in to his table, he adjusted two elements in the same slot, but also put some unlike elements under the same note.

   Eg: - Cobalt and Nickel are in the same slot and these are placed in the same column as F, Cl and Br which have very different properties than these elements. Iron which resembles cobalt and nickel has been placed far away from these elements.

MENDELEEV'S PERIODIC TABLE

Mendeleev's periodic law: -The properties of elements are the periodic function of their atomic masses.

Mendeleev arranged all the then known 63 elements in the order of increasing atomic masses in horizontal rows but in such a way that elements having similar properties came directly under one another in the same vertical column or group.

The formulae of hydrides and oxides formed by an element were treated as one of the basic properties of an element for its classification.

There were 7 periods (horizontal rows) and 8 groups (vertical columns) in the original periodic table of Mendeleev. The eighth group is of transition elements.

In order to make sure that the elements having similar properties fall in the same group, (i) He left some gaps in his periodic table. (ii) He placed a few elements in the wrong order of their atomic masses by keeping the element with higher atomic mass first and the element with lower atomic mass later. [For example, cobalt appeared before nickel]

Merits of Mendeleev's classification

1. He predicted the existence of some elements that had not been discovered at that time. (left gaps for undiscovered elements)
2. He could predict the properties of several elements on the basis of their positions in the periodic table. (He named them by prefixing Eka to the name of preceding element in the same group. Scandium, Gallium and Germanium, discovered later have properties similar to Eka-boron,Eka – aluminium and Eka –silicon respectively.)
3. His periodic table could accommodate noble gases when they were discovered.

Limitations of Mendeleev's classification

1. The position of isotopes could not be explained judiciously.
2. The atomic masses do not increase in a regular manner in going from one element to the next. So it was not possible to predict how many elements could be discovered between two elements.
3. A correct position could not be assigned to hydrogen in the periodic table as hydrogen resembles alkali metals and halogens.

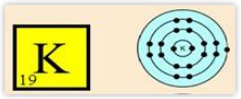
MODERN PERIODIC TABLE (18 groups and 7 periods)

Modern periodic law: -The properties of elements are periodic function of their atomic numbers.

- Vertical columns in a periodic table are known as **groups.**
- Horizontal rows in a periodic table are known as **periods.**

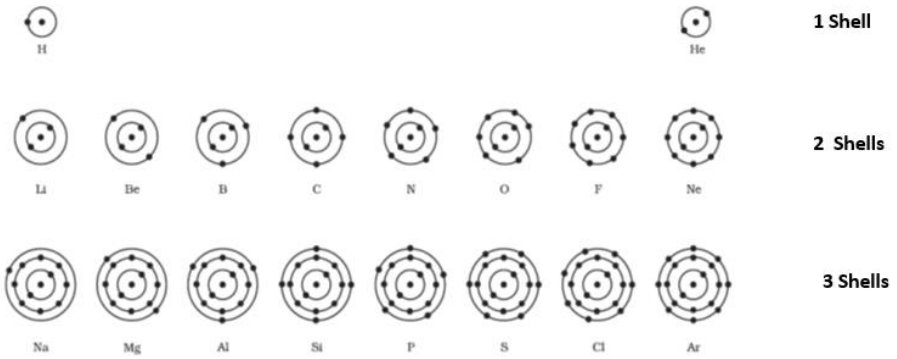
- All the elements in a group have same number of valence electrons.
- Number of valence electrons gives the group number.
- For groups 1 and 2, number of valance electrons = group number.

- For groups 13 to 18, number of valance electrons = group number-10
- Number of shells increases as we go down the group

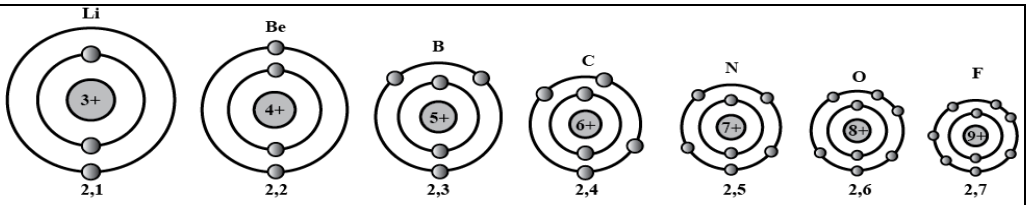
Group 1	Electronic configuration	Number of valence electrons	Group number = number of valence electrons	No. of shells
	2, 1	1	1	2
	2, 8, 1	1	1	3
	2, 8, 8, 1	1	1	4

Group 17	Electronic configurations	No. of valence electrons	Group number = number of valence electrons + 10	No. of shells
F	2, 7	7	17	2
Cl	2, 8, 7	7	17	3
Br	2, 8, 18, 7	7	17	4
I	2, 8, 18, 18, 7	7	17	5

- All the elements in a period have the same number of shells.



- Number of shells gives the period number.
- From left to right in a period, number of valence shell electrons increases by one and the atomic number also increases by one.

Elements							
	Li	Be	B	C	N	O	F
Electronic configuration	2,1	2,2	2,3	2,4	2,5		
No. of shells	2	2	2	2	2		
Period no.	2	2	2	2	2		

elements	Na	Mg	Al	Si	P
Electronic configuration	2,8,1	2,8,2	2,8,3	2,8,4	2,8,5
No. of shells	3	3	3	3	3
Period no.	3	3	3	3	3

The maximum number of electrons that can be accommodated in a shell depends on the formula $2n^2$

K shell --- 2 x1 = 2, First period has 2 elements

L Shell ---- 2 x 4 = 8, Second period has 8 elements.

M shell ------ 2 x 9 = 18, Third period has 8 elements (outermost shell can have only 8 electrons)

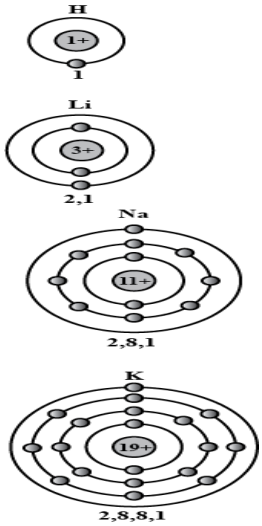
TRENDS IN THE MODERN PERIODIC TABLE

1. **VALENCY: -**Valency is determined by the number of electrons in the outermost shell.

- In a period from left to right number of valence electrons increases by one (1 to 8)
- In a group all the elements have same number of valence electrons.

2. **ATOMIC SIZE**:- (radius of the atom.) It is the distance between the centre of the nucleus and the outermost shell of an isolated atom.

- **Atomic size increases down the group**.
- New shells are being added as we go down the group. This increases the distance between outermost electrons and nucleus. The atomic size increases inspite of the increase in nuclear charge.

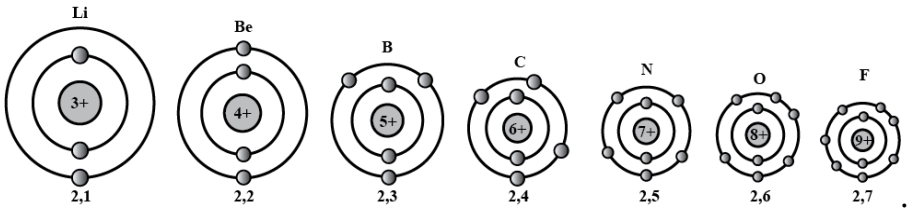


Eg: - Group 1 elements

Li	Smallest atom
Na	
K	
Rb	
Cs	
Fr	Biggest atom

- Atomic radius decreases in moving left to right along a period.

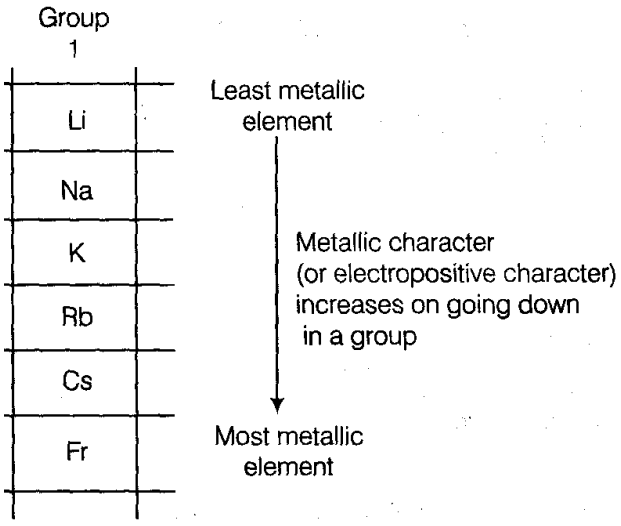
- The shell number being the same, nuclear charge increases from left to right, which tends to pull the electrons closer to the nucleus and reduces the size of the atom.



- In the modern periodic table, Group 1 and 2 and 13 to 17 contain normal elements or **representative elements**
- 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 Noble gases.
- Group 3 to 12 elements are known as Transition elements.

Metallic and non-metallic character

- On going down in a group, the metallic character increases.



- Electropositive character---→ Tendency to lose electrons (to form positive ions)
- Metals are electropositive.
- **On going down in a group, non-metallic character decreases.**

- Non-metals are electronegative (tendency to gain electrons—to form negative ions.)
- On moving from left to right in a period, the metallic character decreases. From left to right, size decreases and difficult to remove outer electrons as they are strongly attracted towards the nucleus.

Na	Mg	Al	Si	P	S	Cl

Non-metallic character increases from left to right in a period

- Non-metals are found on the right hand side of the periodic table towards the top.
- The trends in metallic and non-metallic properties help us to predict the nature of oxides formed by the elements. Oxides of metals are basic and that of non-metals are acidic in general.

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