Chemistry

The Periodic Table

IUPAC - International Union of Pure and Applied Chemistry.

Father of Periodic Table - Mendeleev.

Elements : are the basic unit of matter. They are pure substance made up of one kinds of atom and cannot be broken down into simpler substance.

There are today about 118 elements discovered so far.

Classification of Elements

I. Dobereiner's Triads

→ arranged elements in increasing order of at. weight.
→ arrangement of elements in groups of three called 'triads'.

Dobereiner's Law of Triads

→ The average [arithematic mean] of first and third element will be the sum of second element.

Lithium	Sodium	Potassium
7.0	23.0	39.0

$$\frac{7.0 + 39.0}{2} = \frac{46.0}{2} = 23.0$$

Drawbacks of Dobereiner's Triads

→ Dobereiner's law of triads was not holding true for all elements.

→ Properties of elements grouped into triads were found not to be similar.

II. Newland's Law of Octaves

→ arranged elements in increasing order of at. weight
→ elements are arranged in series of eight.

→ The property of 1st element resembles with the property of 8th element.

Drawbacks of Newland

→ He left the space for undiscovered elements.

→ The method was not applicable for heavy metals beyond potassium.

Mendeleev's Periodic Table

→ arranged the elements in increasing order of at. wt. in the form of table called modern periodic table.

→ the elements with the similar properties appeared at a regular interval.

Moseley's Classification

→ Elements are arranged in increasing order of at. no.

→ Elements are classified in Groups and Periods.

→ Elements were arranged in groups and periods according to their physical and chemical property.

Groups

→ are the vertical column of modern Periodic Table.

→ Total no. of groups are = 18

→ Group 1 is called alkali metals.

→ Group 2 is called alkaline earth metal.

→ Group 3 to 12 is called transition element.

→ Group 17 is called Halogen group.

→ Group 18 is called zero group.

Q. Why group 1 is called alkali metal group.
Because it reacts with water to give alkali.

Q. Why group 2 is called alkaline earth metal group.
Because it is obtained from earth.

Q. Why group 17 is called Halogen group.
It is also called salt producer because all elements of this group often reaction gives out salt.
e.g.

$$2Na + Cl_2 \longrightarrow 2NaCl$$

16.10.20

Q. Why group 18 is called zero group.
Because they do not take part in any reaction.

Valenced Shell

The outermost shell eg. sodium is called the valanced shell and the electrons in the valenced shell are called valence electrons.

Shell - K, L, M, N, O, P, Q → 7 shells

➤ Bhor's - Burry → $2n^2$ rule

e.g.,

K shell = $2n^2$ = $2 \times (1)^2$ = 2
L shell = = $2 \times (2)^2$ = 8
M shell = = $2 \times (3)^2$ = 18
N shell = = $2 \times (4)^2$ = 32
O shell = = $2 \times (5)^2$ = 50
P shell = = $2 \times (6)^2$ = 8? 72
Q shell = = $2 \times (7)^2$ = 98

Electronic Configuration

Distribution of elements in different shell of an atom.

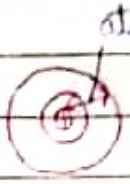
e.g., Sodium (Na_{11}) = K, L, M
2, 8, 1

Q. How many things we can find from electronic configuration?

i. atomic weight ii. Metal or Non-metal or metalloid or inert gas
iii. Groups iv. Periods

Atomic Radius / Size

→ The distance / size between nucleus and shell.



Ionisation Potential

→ The amount of energy required to remove an electron from the outer most shell of an isolated atom.

Electron affinity

→ The amount of energy released when an atom in gaseous state accepts an electron to form an anion.

Defects in Mendeleev's Periodic Table

→ Certain pair of elements having higher at. wt. have been given position before the elements having lower at. wt.

→ He was unable to define the position of rare earths and actinides.

→ He was unable to define isotops.

Q. What are isotope ?

Isotopes are the elements whose at. no. is different from at. wt. of same element.

e.g. Sodium (Na_{11}) = K, L, M
2, 8, 1

i. Property - Metal

Q. How to find property?
If in the outer shell of an element e.g. Sodium its outer shell is M i.e 1, or, if in the outer shell if the electrons will be 1, 2, 3 then the element will be metal and 4, 5, 6, 7 then the element will be non-metal and 8 then the element will be **noble gas** or inert gas.

ii. Group - 1

Q. How to find group?
If in the outer shell the electrons will be 1 and 2 then the group will be 1 and 2 itself but when it arise to 3, 4, 5, 6, 7 and 8 the will add 10 in each, then will get the group

e.g., Boron (B5) = K, L
2, 3

group = 3 + 10 = 13

∴ Valency - 1

Q. How to find valency?
If in the outer shell the electrons will more than 4 then subtract them with 8 and less than 4 or 4 then it will be itself its valency.

iii. Periods - 3

Q. How to find period?
No. of shells will be the period.

e.g., Calcium ($CaCO_3$) = K, L, M, N
2, 8, 8, 2

Period = 4 (K, L, M, N)

iv. Atomic weight - 22 approx (exceptional)

Q. How to find atomic weight (at. wt.) ?
Atomic no. will be just double, will get at. wt.
eg. Sodium (Na) = 11 x 2 = 22 approx.

Periods
→ are the horizontal column of modern periodic table.
→ total no. of periods - 7

Atomic Number
atomic no. = no. of protons = no. of electrons

Protons are positively charge i.e. 1 i.e. cation
→ elementary charge and a mass slightly less than that of a neutron.
→ Protons along with neutrons make up the nucleus.

Electrons are negatively charged. 1. i.e. anion

→ Electron is discovered by J. J. Thomson (1897)

→ Proton is discovered by Ernest Rutherford in 1920.

Neutrons
→ is a subatomic particle.
→ has a neutral charge.
→ mass is slightly greater than a proton.

Atoms

→ are the basic unit of matter.

→ consists of a nucleus made of protons and neutrons orbited by electrons.

→ It is the smallest thing in the universe and could not be divided.

Sub - Shell

1 S = 2 electrons
2 P = 6 electrons
3 d = 10 electrons
4 f = 14 electrons

s	p	d	f
2	6	10	14

1S 2S
2P 3S 3P 4S
3d 4P 5S 4d 5P 6S
4f 5d 6P 7S 5f 6d 7P 8S

e.g. $Zn = 30 = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^{10}$
Electric configuration of Zinc

$Ca = 20 = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2$
Electronic configuration of calcium

	$1s^2$	$2s^2\ 2p^6$	$3s^2\ 3p^6$	$4s^2$
shells →	K	L	M	N
Values →	2	8	8	18

Metallic and Non-metallic property

→ Moving from left to right in periods metallic property decreases and non-metallic property increases.

→ While moving from top to bottom in groups metallic property increases and non-metallic property decreases.

Q1. An element x atomic no. 17 reacts with element Y atomic no. 20 to form a divalent halide. where does the elements x and Y are placed in the Periodic Table.

K, L, M — K, L, M, N

^{17}x = 2, 8, 7 — ^{20}Y = 2, 8, 8, 2

Group = 17 — Group = 2

Period = 3 — Period = 4

Q2. Classify x and Y as non-metal, metal or metalloid.

x = non-metal

Y = metal

Q3. What will be the nature of oxide of element Y? Identify the nature of bonding in compound formed.

Basic oxide. It is an Ionic bond.

Q4. Chlorine, bromine and iodine forms Groups Dobereiner's Triads. The at. mass/weight of chlorine and Iodine are 35.5 and 126.9. Predict the at. mass/weight of bromine.

$$\frac{35.5 + 126.9}{2} = \frac{162.4}{2} = 81.2$$

Q5. Atomic no. 10, 20, 7, 14

i. Identify the elements in the periodic table

10 = Neon , 20 = Calcium

7 = Nitrogen , 14 = Silicon

ii. Identify the periods of these elements in the periodic table.

	K, L, M, N	
$Neon_{10}$ =	2, 8	Period = 2
$Calcium_{20}$ =	2, 8, 8, 2	Period = 4
$Nitrogen_{7}$ =	2, 5	Period = 2
$Silicon_{14}$ =	2, 8, 4	Period = 3

iii. Identify the group no.

	Groups
$Neon_{10}$ =	18
$Calcium_{20}$ =	2
$Nitrogen_{7}$ =	17
$Silicon_{14}$ =	14

iv. Determine the valency of these elements.

$Neon_{10}$ = 8 - 8 = 0 , $Calcium_{20}$ = 2

$Nitrogen_{7}$ = 8 - 5 = 3

$Silicon_{14}$ = 4