

Bridge Course Learning Material

By

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Bridge course, Chemistry

What is chemistry:

Chemistry is defined as that branch of Science which deals with the study of composition Structure and properties of matter and the changes which the matter undergoes under diff't conditions and the law which govern these change.

What does the mean matter?

Matter is defined as any thing that occupies space, possesses mass and the presence of which can be felt by any one or more of our five senses.

~~Matter is 3 types.~~

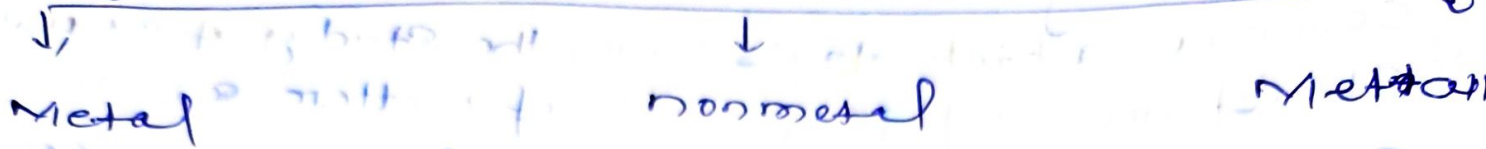
Atom Element:

An element is usually defined as the simplest form of a pure substance with definite physical and chemical properties and which can neither be broken into nor built from simpler substances by any chemical or physical method.

an element is defined as a pure substance that contains only one kind of particles. These particles may be atom or molecules.

Ex - carbon, Sulphur, iron, gold etc

Types of Elements



* Metals

Metals are those elements which reflect light and hence possess lustre.

- * They are good conductor of electricity, malleable (hammered to form sheet) and ductile (wire) exist as solids at room temp (except Hg) and possess high density.

Ex - Copper, Silver

Non Metals

* Non metals are those elements which do not reflect light and hence don't possess lustre.

Further they are brittle, poor conductors of heat and electricity (except graphite)

and exist in all 3 states.

Ex - Sulphur, phosphorus, iodine are solids, bromine is a liquid while oxygen, nitrogen, Chlorine, etc are gases.

Metalloids

Metalloids are those elements which possess the characteristics of both i.e. metals as well as non-metals.

Ex - Arsenic, antimony, bismuth etc.

Compounds

Compounds are pure substances containing more than one kind of elements or atoms.

A compound is a pure substance containing two or more than two elements combined together in a fixed proportion by mass and which can be decomposed into its constituent elements by suitable chemical method.

Ex - H_2O , CO_2 , SO_2 etc.

Types of compounds:

↓
Organic compounds

↓
Containing carbon and few other elements like hydrogen, oxygen, nitrogen, sulphur, halogen etc.

↓
Inorganic compound

↓
Containing any two or more elements out of 114 elements.

Rutherford's Atomic Model

In 1911, performed cone scattering expt in which he bombarded thin foils (nearly 100 nm thickness) of metals like gold, silver, platinum or copper with a beam of fast moving α -particles.

The source of α -particles was placed in a block lead.

Slits ~~was~~ were used to get a fine beam. The presence of α -particles at any point around the thin foil of gold after striking it was detected with the help of a zinc sulphide screen. The point at which an α -particle strikes this screen, a flash of light is given out.

Observations

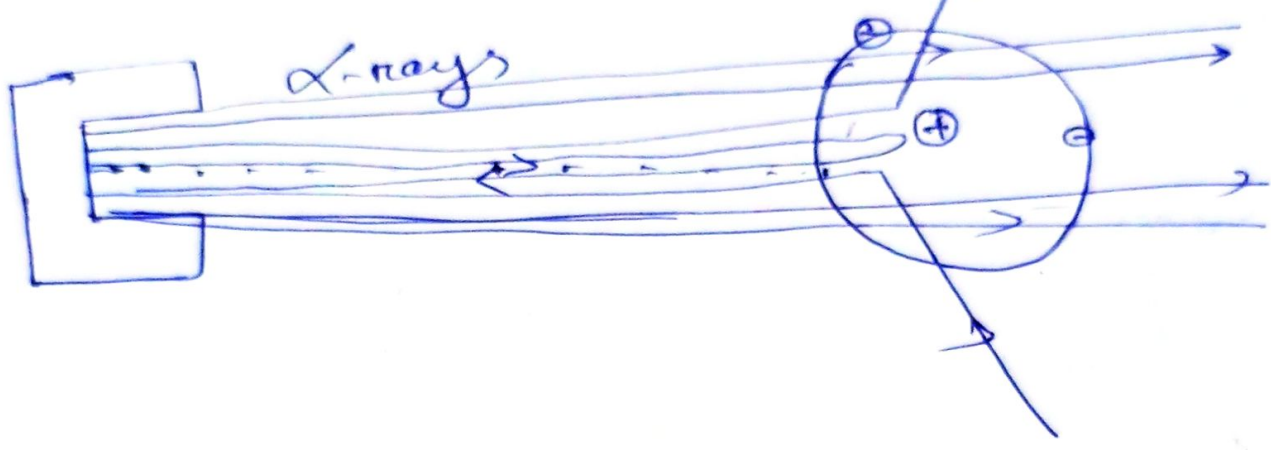
- (i) Most of the α -particles (99.9%) passed through the foil without undergoing any deflection.
- (ii) few α -particles underwent deflection through small angles.
- (iii) very few were deflected back i.e. through an angle greater than 90° .

Conclusion ~~Draw back~~ of Rutherford's model

- (i) Since most of the α -particles passed through the foil without undergoing any deflection, there must be sufficient empty space within the atom.
- (ii) Since few α -particles were deflected through small angle and α -particles were positively charged particles, these could be deflected only by some positive body present within the atom. The α -particles deflected were those which passed very close to this positive body.
- (iii) Since some α -particles were deflected back and α -particles are heavy particles, these could be deflected back only when they strike some heavier body inside the atom.
- (iv) Since the no. of the particles deflected back is very very small, this shows that the heavy body present in the atom must be occupying a very small volume.
The small heavy positively charged body present within the atom was called 'nucleus'

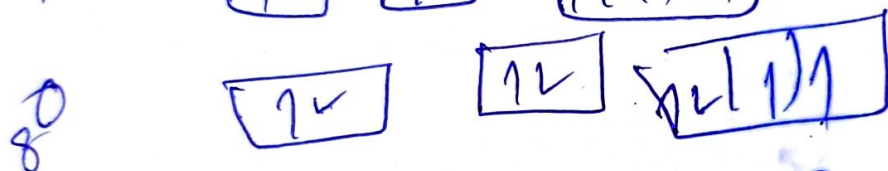
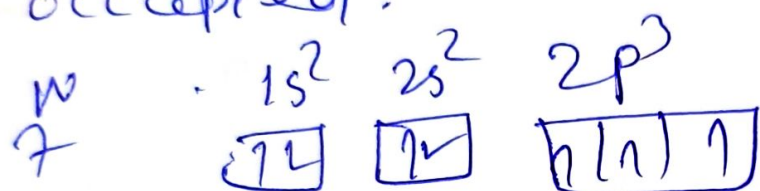
Thus acc. to R.M of atom, the atom
is two parts.

- i) nucleus - very small, carries +ve charge.
- ii) Extrahuclear - space around the nucleus in which the e^- were distributed.



Hund's rule (Maximum multiplicity)

- This rule deals with the filling of e^- into degenerate (equal energy) orbitals.
- Acc. to this rule e^- pairing in p, d, and f orbitals can't occur until each orbital of a given subshell contains one e^- or it's singly occupied.



- Further all the singly occupied orbitals will have parallel spins, i.e. in the same direction viz. either clockwise or anti-clockwise

Bohr-Bury Scheme

① The max. no. of e that can be accommodated in shell is equal $2n^2$. $n = \text{no. of principal q. no.}$

Shell	n	Max. electron
K	1	$2 \times 1^2 = 2$
L	2	$2 \times 2^2 = 8$
M	3	$2 \times 3^2 = 18$
N	4	$2 \times 4^2 = 32$

② may go in to a new outer shell where 8 electrons are completed in outer shell.

The outermost shell can't have more 8 e and the penultimate shell can't have more than 18 e

The outermost shell can't have more than 2 e and penultimate shell can't have more than 9 e unless the next innermost shell has received the max^m no. of e is

required by rule ①

H ₁ - 1	O ₈ - 2, 16
He ₂ - 2	Ne ₉ - 2, 7
Li ₃ - 2, 1	Ni ₁₀ - 2, 8
Be ₄ - 2, 2	Ni ₁₁ - 2, 8, 1
B ₅ - 2, 3	Mg ₁₂ - 2, 8, 2
C ₆ - 2, 4	Al ₁₃ - 2, 8, 3
N ₇ - 2, 5	Sc ₁₄ - 2, 8, 4
Si ₁₄ - 2, 8, 4	P ₁₅ - 2, 8, 5

S ₁₆ - 2, 8, 6	Mn ₂₅ - 2, 8, 13, 2
Cl ₁₇ - 2, 8, 7	Fe ₂₆ - 2, 8, 14, 2
Ar ₁₈ - 2, 8, 8	Co ₂₇ - 2, 8, 15, 2
K ₁₉ - 2, 8, 8, 1	Ni ₂₈ - 2, 8, 16, 2
Ca ₂₀ - 2, 8, 8, 2	Cu ₂₉ - 2, 8, 17, 2
Sc ₂₁ - 2, 8, 9, 2	Zn ₃₀ - 2, 8, 18, 2
Ti ₂₂ - 2, 8, 10, 2	V ₂₃ - 2, 8, 11, 2
V ₂₃ - 2, 8, 11, 2	Cr ₂₄ - 2, 8, 12, 2

Weak backs of Rutherford's model:

Rutherford's model of atom does not explain the Stability of the atom. Acc. to the Electro Magnetic theory, during the acceleration, the charged particles lose energy. This loss of energy slows down the speed of the e^- and eventually, the e^- falls into the nucleus and the atom collapse.

- Rutherford's model of atom does not describe anything about the distribution of the e^- and the energies of these e^-
- Rutherford's model of atom was unable to explain the line spectra given by every element

Bohr's atomic model

Niels Bohr gave a model for an atom in order to explain the line spectrum and the stability of the atom.

- 1- The e^- revolve around the nucleus only in certain circular orbits called the energy shells or the energy level. An e^- revolving in a particular energy shell is associated with a fixed amount of energy. These shells are numbered as 1, 2, 3, ... etc. (from the nucleus) or designated as K, L, M, N, ... etc. shells.

2- The e^- revolve around the nucleus in certain discrete orbits (energy level) without losing any energy.

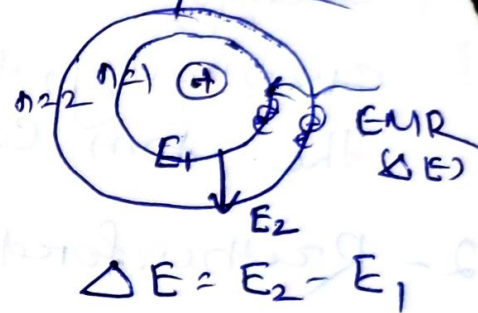
3- The e^- present in a particular energy shell possess a definite amount of energy. So these energy shells are also called the Stationary energy states.

$$\Delta E = E_2 - E_1$$

$$E_1 = h\nu_1$$

$$E_2 = h\nu_2$$

$$\Delta E = h\nu_2 - h\nu_1$$



The frequency of the radiation absorbed or emitted during the transition differ on energy as follows,

$$\Delta E = E_2 - E_1$$

$$h\nu = E_2 - E_1$$

$$\nu = \frac{E_2 - E_1}{h}$$

← Bohr's frequency rule
 E_2 = energy of the higher energy

E_1 = Energy of the lower energy

h = Planck's const.
 $6.626 \times 10^{-34} \text{ J s}$

Aufbau's principle

Aufbau means 'building up'

↓
means the filling up of orbitals with e^-

→ The principle states: In the ground state of the atoms, the orbitals are filled in order of their increasing energies.

→ In other words, e^- first occupy the lower energy orbital available to them and enter into higher energy orbitals only after the lower energy orbitals are filled.

Arrangement of orbitals with increasing energy on the basis of $(n+l)$ rule

orbital	value of n	value of l	value of $(n+l)$	Energy
1s	1	0	$1+0=1$	$1s^2$
2s	2	0	$2+0=2$	$2s^2$
2p	2	1	$2+1=3$	2p ($n=2$)
3s	3	0	$3+0=3$	3s ($n=3$)
3p	3	1	$3+1=4$	3p ($n=3$)
4s	4	0	$4+0=4$	
3d	3	2	$3+2=5$	
4p	4	1	$4+1=5$	

↑
greater the value of n Greater the energy