REPRESENTATION OF ELEMENTS

Isobars : species having same Atomic mass but different atomic number

Ex. $_{7}N^{14}$, $_{6}C^{14}$

. $_{Z_1}X^{A}$ & $_{Z_2}Y^{A}$

Both will be isobars

Ex. $_{19}K^{40}$, $_{20}Ca^{40}$, $_{18}Ar^{40}$

REPRESENTATION OF ELEMENTS

Isotones / Isoneutronic :- the species having same no of neutrons.

$$ {}^{A_1}_{Z_1}X \qquad {}^{A_2}_{Z_2}Y $$

$$ n = A_1 - Z_1 = A_2 - Z_2 $$

Ex :- (i) ${}^{13}_{6}C$, ${}^{14}_{7}N$, ${}^{15}_{8}O$

$n = 7$ $\quad 7$ $\quad 7$

(ii) ${}^{2}_{1}H$, ${}^{3}_{2}He$

$n = 1$ $\quad 1$

(iii) ${}^{30}_{14}Si$, ${}^{31}_{15}P$, ${}^{32}_{16}S$

n $\quad 16$ $\quad 16$ $\quad 16$

REPRESENTATION OF ELEMENTS

Isoelectronic : the species which have same No of electrons.

Ex. Na^+ Ne F^-

e = 11-1 = 10 | 10-0 = 10 | 9+1 = 10

Ex. Select the isoelectronic pairs from following indicating their No of electrons.

Na^+, Mg^{+2}, P^{-3}, Al^{+3}, Cl^-, Ne, Ca^{+2}, N^{-3}, S^{-2}, K^+, CO_3^{-2}, CO_2

NO_3^-, N_2O, BO_3^{-3}, SO_4^{-2}, H_2O, NH_2^-, ClO_4^-, H_3O^+, PO_4^{-3}, NH_3

SOME IMPORTANT DEFINITIONS

1) Mg^{+2}, Al^{+3}, Na^{+}, Ne, H_2O, NH_2^{-}, H_3O^{+}, NH_3, N^{-3}. [10]

(2) P^{-3}, U^{-}, Ca^{+2}, S^{-2}, K^{+} [18]

(3) CO_2, N_2O [22]

(4) CO_3^{-2}, BO_3^{-3}, NO_3^{-} [32]

5) SO_4^{-2}, ClO_4^{-}, PO_4^{-3} [50]

SOME IMPORTANT DEFINITIONS

Isodiaphers : the species having same difference of neutron and protons.

$$ {}^{A_1}_{Z_1}X \qquad {}^{A_2}_{Z_2}Y $$

$n =$	$A_1 - Z_1$	$A_2 - Z_2$
$P =$	Z_1	Z_2
$n - p =$	$A_1 - 2Z_1$	$= A_2 - 2Z_2$

Ex. ${}^{15}_{7}N$ ${}^{13}_{6}C$

$n - p$

$= 15 - 14$ $\quad$ $13 - 12$

$= 1$ $\quad$ 1

SOME IMPORTANT DEFINITIONS

Isoesters : the species which has same No of electrons and atomicity.

Ex. N_2O

$e = 7\times2+8 = 22$

atom 3

CO_2

$6+8\times2 = 22$

3

CO

$e = 6+8 = 14$

atomicity = 2

N_2

$7\times2 = 14$

2

SOME IMPORTANT DEFINITIONS

Laws of chemical combination

"Experimental laws"

1) Law of mass conservation :- "Given by Lavoisier"

According to this law in a chemical change the mass of system remains constant.

Reactant ⟶ product.

Acc. this law

Mass of Reactant (Reacted + unreacted) = Mass of product

SOME IMPORTANT DEFINITIONS

Ex $BaCl_2 + H_2SO_4 \longrightarrow BaSO_4 + 2HCl$

If 20.8 g $BaCl_2$ reacts with 9.8 g H_2SO_4 and formed 7.3 g HCl and some amount of $BaSO_4$ find how much $BaSO_4$ is formed If none reactent is unreacted

Acc. to mass Conservation

$$20.8 + 9.8 = x + 7.3$$

$$x = 23.3\ g$$

Limitations

- Nuclear reaxn
  - fusion
  - fission
  - Radioactive decay.

not applicable.

SOME IMPORTANT DEFINITIONS

2) Law of Constant proportion :- "J Proust"

chemical composition of compound remains constant irrespective to source from where it is obtained. Ex. H_2O

2 : 16 (mass)

1 : 8

Ex. 0.7g Fe reacts with 0.4 g S and form ferrous sulphide. in another experiment 2.8g Fe dissolved in HCl and then Na_2S is added which produces 4.4 g ferrous sulphide, prove law of constant proportion is followed.

SOME IMPORTANT DEFINITIONS

Source 1

Fe	S
0.7 g	0.4 g

7 : 4

Source 2

Fe	FeS	S
2.8	4.4	1.6

Fe	:	S
2.8		1.6
7	:	4

Limitation :

Isotopic variation distroys laws.

SOME IMPORTANT DEFINITIONS

Law of multiple proportion : "J. Dalton"

If two element combines to form more than one compound. If fixed mass of 1 element combined with different mass of other element then that different mass should be in simple whole number ratio.

Ex.	fixed H	O	
H_2O	2	16	16 : 32
			1 : 2
H_2O_2	2	32	

Mole Concept

SOME IMPORTANT DEFINITIONS

fixed

	C	O
CO	12	16
CO_2	12	32

16 : 32

1 : 2

fixed

Ex:

	N	O
N_2O	28	16
NO	14	16] x2 = 32
N_2O_3	28	48
NO_2	14	32] x2 = 64
N_2O_5	28	80

16 : 32 : 48 : 64 : 80

1 : 2 : 3 : 4 : 5

SOME IMPORTANT DEFINITIONS

(4) Law of Reciprocal proportion "Ritcher"

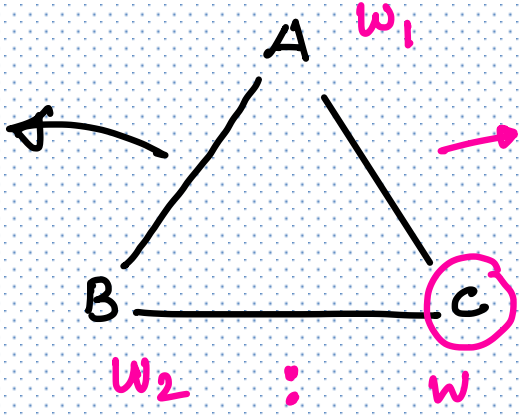
The Ratio of weight of two element A and B which combine with fixed mass of another element C. is either same or whole number ratio of mass in which A and B combine to each other.

Mass Ration

$w_1 : w_2$

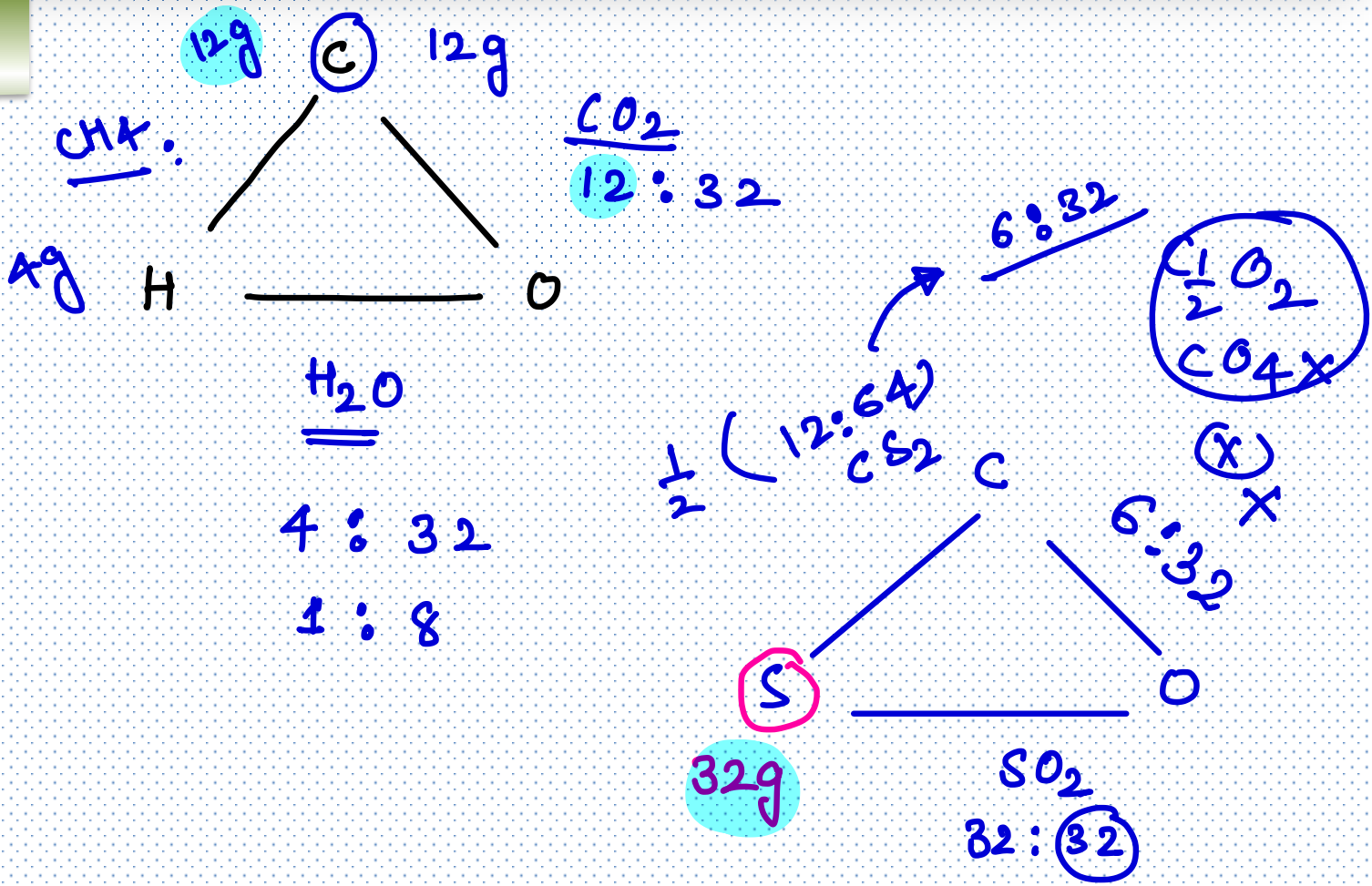
OR

$n\,[w_1 : w_2]$

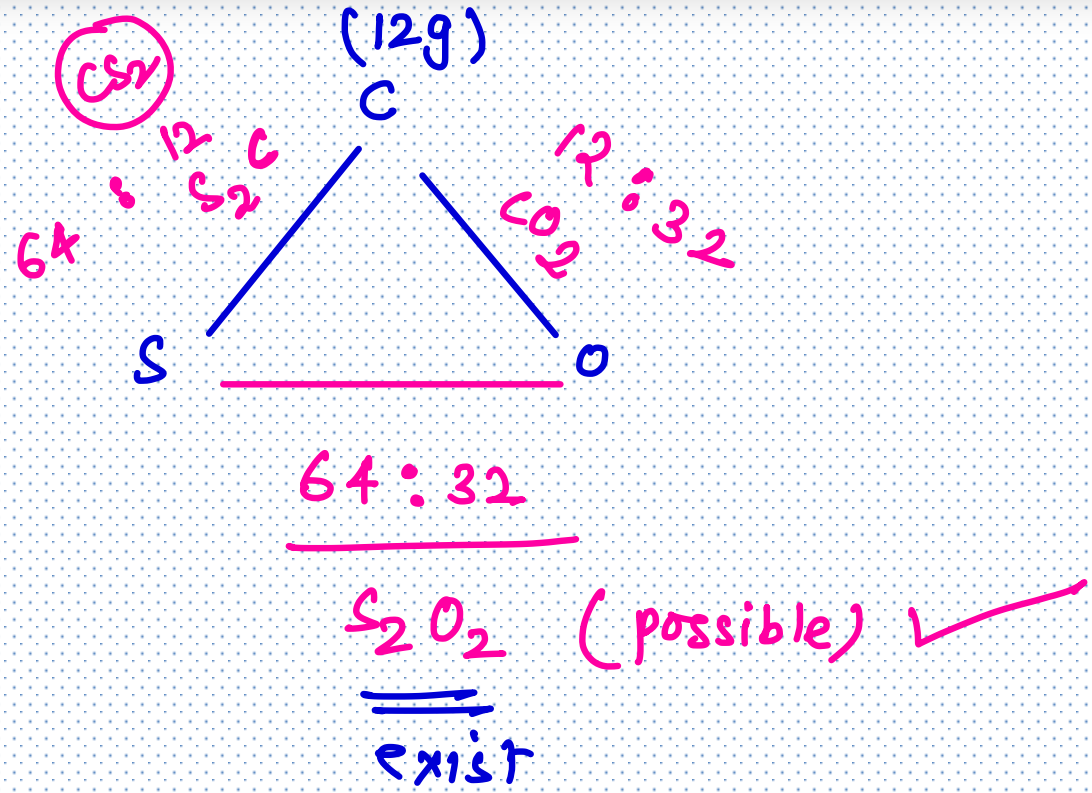


Mole Concept

SOME IMPORTANT DEFINITIONS



SOME IMPORTANT DEFINITIONS



SOME IMPORTANT DEFINITIONS

5) Law of gaseous volume OR Gaylusac's Law → According to this law if gases reacts to each other they reacts in Ratio of their volume if product is also gaseous then product will also formed in ratio of its volume.

$$\underset{\text{1 V}}{H_2(g)} + \underset{\text{1 V}}{Cl_2(g)} \longrightarrow \underset{\text{2 V}}{2HCl(g)}$$

1 : 1 : 2

1 L : 1 L : 2 L

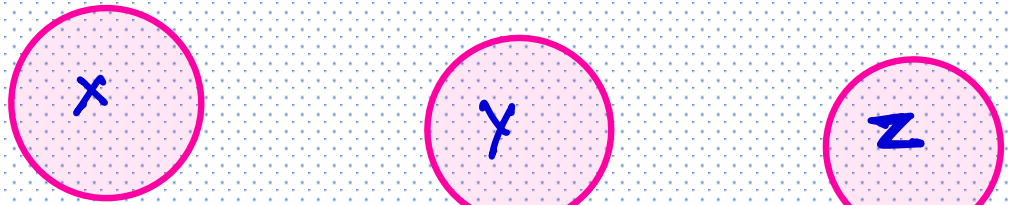
2 L : 2 L : 4 L

100 ml : 100 ml : 200 ml

SOME IMPORTANT DEFINITIONS

Hypothesis

1) **Avogadro Hypothesis** :- at same temperature and pressure condⁿ equal volumes of gases have have equal No of moles and molecules.

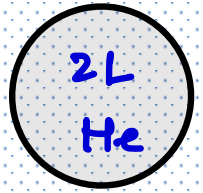


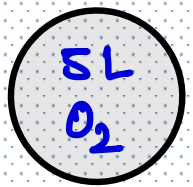
No of mole $n_x = n_y = n_z$

No of molecule $N_x = N_y = N_z$

SOME IMPORTANT DEFINITIONS

(Ex)





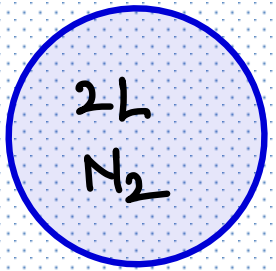
[25°C, 1 atm]

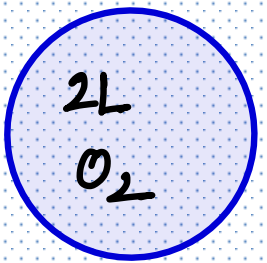
Ratio of moles 2 : 5 : 7

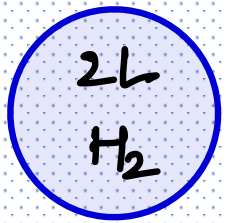
Ratio of molecules = 2 : 5 : 7

SOME IMPORTANT DEFINITIONS

- **Berzelius hypothesis** :- At constant temperature and pressure equal volume of gases contains equal No of atoms. [when atomicity of gases are same]







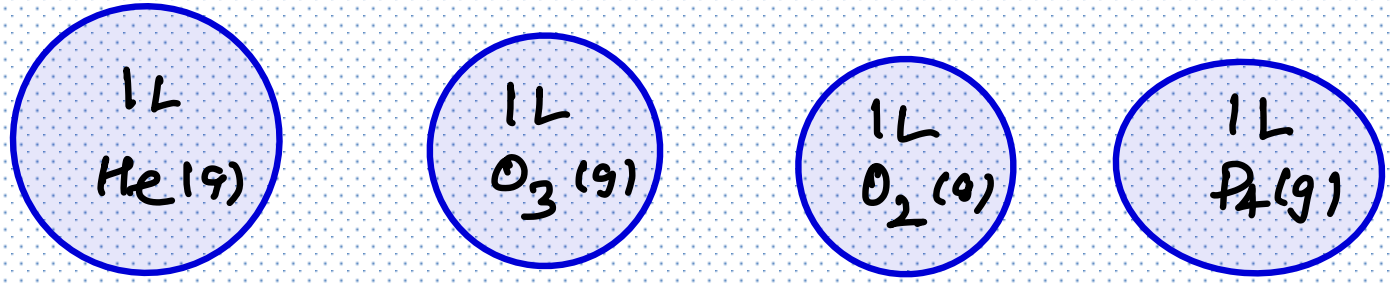
[at 25°C 1 atm]

No of atoms : = =

1

SOME IMPORTANT DEFINITIONS

at 25°C
1 atm



Ratio of atom = Ratio of atomicity

1 : 3 : 2 : 4

SOME IMPORTANT DEFINITIONS

Short cut :-

(i) If in question taking about one compound again and again then Law of constant proportion"

(ii) If in a question only two elements form more than one compound Law of multiple proportion

(iii) If Question is asking about three element and their compounds in pairs Law of Reciprocal proportion.

HW → BBT / Race – I