Lec - 2

Date:________ M T W T F S

Amu on different scale

* $1g = 10^{-3} Kg$

* $1g = 10^{+3} mg$ * $1g = 10^{6} \mu g$

* $1g = 10^{9} ng$

* in gram:

$$1amu = \frac{1g}{N_A}$$

$$1amu = \frac{1g}{6.023 \times 10^{23}}$$

$$\boxed{1amu = 1.66 \times 10^{-24} g}$$ ✓

* in Kg:

$$1amu = \frac{10^{-3} Kg}{N_A}$$

$$\boxed{1amu = \frac{1Kg}{10^{3} N_A}}$$

1Kg

$$\boxed{1amu = \frac{1Kg}{6.02 \times 10^{26}}}$$ ✓

Note:

$$1amu = 1.66 \times 10^{-24} \times 1g$$

$$1amu = 1.66 \times 10^{-24} \times 10^{-3} Kg$$

$$1amu = 1.66 \times 10^{-27} Kg$$

Date: ______ (M)(T)(W)(T)(F)(S)

* mg:

$1 amu = \frac{10^3 mg}{N_A}$

$1 amu = \frac{10^3 mg}{6.022 \times 10^{23}}$

$1 amu = \frac{mg}{6.022 \times 10^{20}}$

$1 amu = 1.66 \times 10^{-24} \times 10^3 mg$

$\boxed{1 amu = 1.66 \times 10^{-21} mg}$

* μg:

$\boxed{1 amu = \frac{10^6 \mu g}{N_A}}$

$1 amu = \frac{1 \mu g}{6.022 \times 10^{23}} = \frac{1 \times 10^{-6} g}{6.022 \times 10^{23}}$ = 17

$1 amu = 1.66 \times 10^{-24} \times 10^6 \mu g$

$\boxed{1 amu = 1.66 \times 10^{-18} \mu g}$

* ng:

$1 amu = \frac{10^9 ng}{N_A}$

$1 amu = \frac{1 ng}{6.022 \times 10^{14}}$

$1 amu = 1.66 \times 10^{-24} \times 10^9 ng$

$\boxed{1 amu = 1.66 \times 10^{-15} ng}$

Date:

M T W T F S

MCQs:

The mass of $\boxed{\text{one atom}}$ of hydrogen is:

atomic mass

(a) $\frac{1\,kg}{10^3 \times NA}$ (b) $1g$ (c) $\frac{1\,kg}{NA}$ (d) $\frac{10^3\,kg}{NA}$ (e) None

"Amu on different Scales"

$1amu = \frac{1}{\cancel{12}}th$ of C^{12} ($\cancel{12}$ amu)

He:

$1amu = \frac{1}{\cancel{4}}th$ of He ($\cancel{4}$ amu)

H_2O:

$1amu = \frac{1}{\cancel{18}}th$ of H_2O ($\cancel{18}$ amu)

CO_2:

$1amu = \frac{1}{\cancel{44}}th$ of CO_2 ($\cancel{44}$ amu)

H_2SO_4:

$1amu = \frac{1}{\cancel{98}}th$ of H_2SO_4 ($\cancel{98}$ amu)

CH_3^+: $1amu = \frac{1}{15}th$ of CH_3^+ (

Sol:

H = 1amu

$1amu = \frac{10^{-3}\,kg}{NA} = \boxed{\frac{1\,kg}{10^3 NA}}$

Date:

M T W T F S

"Numerical value of Amu"

H_2O ← $H_2O = 18\,amu$

mass of H_2O is 18 times that of 1amu.

$= 18 \times 1amu$

$= 18 \times \frac{1}{12}$th of C-12

$= 18 \times m_P$

$= 18 \times m_N$

$= 18 \times 1g/N_A$

$= 18 \times \frac{1Kg}{10^3 N_A}$

Type 2

MCQs:

The mass of Ca is how much that of $\frac{1}{12}$th of C-12

(a) 40 times.

$Ca = 40\ amu$

$= 40 \times 1amu$

$= 40 \times \frac{1}{12}$th of C-12.

Type 3

Q#:

The mass of O_2 is ~~how~~ 32 times heavier than that of:

(a) $\frac{1g}{N_A}$

Solu:

$O_2 = 32 \times 1amu$

$= 32 \times \frac{1g}{N_A}$

Date:________ M T W T F S

"Amu & mass Comparison"

$$\boxed{H_2O}$$

mass of one particle ← 18 amu → Atomic mass

$18g$ → mass of N_A particle ⇒ Molar mass

$1\,amu = 1.66 \times 10^{-24}\,g$

$1g = \dfrac{1\,amu}{1.66 \times 10^{-24}}$

$$\boxed{1g = 6.023 \times 10^{23}\,amu}$$

$$\boxed{1g = N_A \times amu}$$

=> 1g is "N_A" times ↑ than that of Amu.

=> 1amu is $\frac{1}{N_A}$ that of 1g.

Q# The atomic mass of Mg is:

(✱) 24 amu.

↳ Not 24g.

Q#

The mass of a single SO_2 molecule is:

(✱) 64 amu

$\left(64 \times \frac{1}{18} \text{th of } H_2O\right)$

Lec-3

M T W T F S

Date:

Q# m. mass of N_2 is: 28g.

"Ratio of Amu & mass"

$$1 \text{ amu} = \frac{1g}{N_A}$$

$$\boxed{\frac{1 \text{ amu}}{1g} = \frac{1}{N_A}}$$

$$\boxed{\frac{1g}{1 \text{ amu}} = \frac{N_A}{1} \text{ or } N_A : 1}$$

$$1 \text{ amu} = \frac{1 \text{ Kg}}{10^3 N_A}$$

$$\boxed{\frac{1 \text{ amu}}{1 \text{ Kg}} = \frac{1}{10^3 N_A}}$$

$$\boxed{\frac{1 \text{ Kg}}{1 \text{ amu}} = \frac{10^3 N_A}{1}}$$

$$1 \text{ amu} = \frac{10^3 mg}{N_A}$$

$$\boxed{\frac{1 \text{ amu}}{1 mg} = \frac{10^3}{N_A}} = \frac{1000}{N_A}$$

$$\boxed{\frac{1 mg}{1 \text{ amu}} = \frac{N_A}{10^3}}$$

Date: M T W T F S

$$1\,amu = \frac{10^6\,\mu g}{N_A}$$

$$\boxed{\frac{1\,amu}{1\,\mu g} = \frac{10^6}{N_A}} \qquad \boxed{\frac{1\,\mu g}{1\,amu} = \frac{N_A}{10^6}}$$

$\longleftrightarrow$

"Masses Comparison"

imp

Type (1)

$$\boxed{\frac{\text{atom } A}{\text{atom } B} = \frac{mA}{mB}}$$

$mA \rightarrow$ larger mass

$mB \rightarrow$ smaller mass

imp

Type (2)

$$\boxed{\frac{\text{Atom } A}{\text{atom } B} = \frac{mA}{m_B} \times 100}$$

$mA \rightarrow$ smaller

$m_B \rightarrow$ Larger

Q# The mass of H_2O is how much that of C-12

(a) 4 (b) 6 (c) 1.5 (d) 2.5

$$\frac{H_2O}{C\text{-}12} = \frac{\cancel{18}\,3}{\cancel{12}\,2} = \boxed{1.5}$$

$\boxed{H_2O \text{ is } 1.5 \text{ high than } C\text{-}12}$

Q# The mass of Mg is how much that of He:

$$\frac{Mg}{He} = \frac{24}{4} = 6$$

Date:

M T W T F S

Q# The mass of H_2O is how much that of H_2O?

$$\frac{H_2}{H_2O} = \frac{2}{18} \times 100 = \boxed{11.1\%}$$

(H_2O is 88.89% ⇑ than H_2)

Note:

$H_2O = 100\%$ (consider)

$H_2 = 11.11\%$

$\boxed{88.89\%}$

Q#

Mass of H_2O is how much greater than mass of C-12?

$$\frac{C\text{-}12}{H_2O} = \frac{12}{\cancel{18}\,9} \times \cancel{100}\,50 = \boxed{66.6\%}$$

$H_2O = 100\%$

C-12 = 66.6%

$\boxed{34.4\%}$ → H_2O is 34.4% ⇑ than C-12

$\frac{C\text{-}12}{H_2O} =$

Date:

M T W T F S

Mass of "n" atoms:

$$\boxed{\text{Mass} = N \times \text{atomic mass} \times 1\ \text{amu}}$$

mass of 2 Ca atoms $= 2 \times 40 \times 1$ amu

$$\boxed{= 80\ \text{amu}}$$

$$\boxed{\text{mass} = N \times \text{atomic mass} \times 1.66 \times 10^{-24}\ g}$$

$$\boxed{\text{mass} = N \times \text{atomic mass} \times 1.66 \times 10^{-27}\ Kg}$$

$$\boxed{\text{mass} = N \times \text{atomic mass} \times \frac{1}{12^{th}} \text{ of } C\text{-}12}$$

$$\boxed{\text{mass} = N \times \text{atomic mass} \times \frac{1g}{N_A}}$$

Q#: The atomic mass of 1000 H atom is:

$$\text{mass} = 1000 \times \text{atomic mass} \times 1.66 \times 10^{-24}$$

$$\boxed{\text{mass} = 1.66 \times 10^{-21}\ g}$$

Q#

The mass of 10 Na atom is:

$$\text{mass} = 10 \times 23 \times \frac{1}{12} th \text{ of } C\text{-}12$$

$$= \boxed{\frac{230}{12} th \text{ of } C\text{-}12}$$

$$= \boxed{230\ g/N_A} \quad \boxed{= 230 \times 1.66 \times 10^{-27}\ Kg}$$

Date: ______ M T W T F S

Q#: Mass of 6.023×10^{23} molecules of O_2 is:

$$mass = \cancel{6.022 \times 10^{23}} \times 32 \times \frac{1g}{\cancel{N_A}}$$

$$= 32g$$

* $$mass = 6.022 \times 10^{23} \times 32 \times 1.66 \times 10^{-24} g$$

$$= 1 \times 32 \times g$$

$$= \boxed{32g}$$

* $$\underline{N_A \times \bar{32}} \times \frac{1g}{N_A} = \boxed{\frac{32 \cancel{N_A} g}{\cancel{N_A}}} = 32g$$

* $$N_A \times 32 \times \frac{1}{12^{th}} \text{ of } C\text{-}12 = \boxed{\frac{32 N_A}{12^{th}} C\text{-}12}$$

MCQs:

The mass of 1 million of hydrogen atoms are:

$$mass = 10^6 \times 1 \times 1.66 \times 10^{-27} Kg$$

$$\boxed{mass = 1.66 \times 10^{-21} Kg}$$

Lec-04

Date:____ M T W T F S

"amu to g"

Form = 1

* $1\,amu = \frac{1g}{Na}$

$\boxed{n\,(amu) = n\left(\frac{g}{N_A}\right)}$ ✓

* ✓

$\boxed{ng = n\,(amu \times N_A)}$

$\boxed{1amu = \frac{g}{N_A} \times N}$

Form = 2

$1\,amu = 1.66 \times 10^{-24}\,g$

$\boxed{n\,(amu) = n\,(1.66 \times 10^{-24}\,g)}$

$1g = 6.022 \times 10^{23}\,amu$

$\boxed{n\,(g) = n\,(6.022 \times 10^{23}\,amu)}$

MCQs:

The molar mass of H_2O is:

ⓐ 18 amu ⓑ $18\,g/N_A$ ✓ⓒ $18\,amu \times N_A$ ⓓ $18\,g \times amu$

MCQs

The ~~molar~~ atomic mass of ~~CO_2~~ Na is:

ⓐ $23\,g/N_A$ ⓑ $23 \times 1.66 \times 10^{-24}\,g$ ⓒ $23 \times 1.66 \times 10^{-24}\,amu$ ⓓ a & b ✓

$23\,amu$ or $23 \times 1.66 \times 10^{-24}\,g$.

Date: ______ M T W T F S

MCQs

100g of Mg is equal to how many amu?

$$100g = n \times 6.022 \times 10^{23} \text{ amu}$$

$$= 10^2 \times 6.022 \times 10^{23}$$

$$\boxed{(Mg)\ 100g = 6.022 \times 10^{25} \text{ amu}}$$

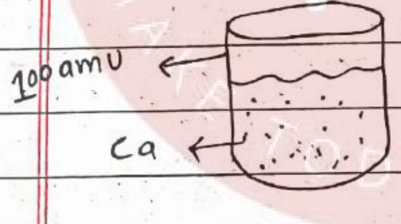
MCQs

1000 amu of H_2O is equal to how many gram:

$$1 \text{amu} = 1.66 \times 10^{-24}$$

$$\boxed{1000 \text{ amu} = 1.66 \times 10^{-21} g}$$

(*) Sample of atoms / molecules



$$\text{No. atoms} = \frac{\text{mass (amu)}}{\text{atomic mass (amu)}}$$

$$\text{No. molecules} = \frac{\text{mass (amu)}}{\text{atomic mass (amu)}}$$

Date:________ M T W T F S

ETEA

A sample of C-12 having mass 60 amu contains how many C-12?

Sol:

$$\text{No. atoms} = \frac{60}{12} = \boxed{05}$$

MCQs

How many H_2O is present in a beaker having mass 54 amu:

Sol:

$$\text{No. } H_2O = \frac{54}{18} = \boxed{03}$$

"No. atoms in a molecule"

(Mass in amu)

$$\boxed{\text{No. atoms} = \frac{\text{mass (amu)}}{\text{Atomic mass}} \times \text{atomicity}}$$

"No. specific atoms in a molecule"

$$\boxed{\text{No. specific atoms} = \frac{\text{mass (amu)}}{\text{Atomic mass}} \times \text{required atom per formula}}$$

MCQs

How many atoms are present in 34 amu of NH_3:

Sol:

$$\text{No. atoms} = \frac{\cancel{34}^{\,2}}{\cancel{17}} \times 4 = 8$$

M T W T F S

Date:

MCQs

How many atoms are present in 72 amu of H_2O:

sol: $\frac{72}{18} \times 3 = 12$

MCQs

What mass of H_2O has same No # atoms as in 51 amu of NH_3?

$\frac{51}{17} \times 4 = 12$

$12 = \frac{mass}{2} \times 2 = \frac{12 \times \cancel{x}}{\cancel{x}} = 12$ atoms

Note

1 amu = 4

1 amu = 3

12

$\boxed{\begin{array}{l} 51 \text{ amu } NH_3 \\ 12 \text{ amu } H_2O \end{array} \rightarrow \text{same No. atoms} = 12}$

MCQs

How many oxygen atoms are present in 196 amu of H_2SO_4:

sol: $\frac{196}{98} \times 4 = 8$

MCQs

which one contain more No # hydrogen atoms:

✓ (a) 32 amu of CH_4 = $2 \times 4 = 8$

(b) 52 amu of C_2H_2 = $2 \times 2 = 4$

(c) 2 amu of H_2 = $1 \times 2 = 2$

(d) 36 amu of H_2O = $2 \times 2 = 4$

Lec - 05

Date: ________ M T W T F S

No. electrons: when $\boxed{mass > amu}$

$$\boxed{No.\ e^- = \frac{mass\ in\ (amu)}{M.\ mass\ (amu)} \times e^-\ per\ formula}$$

$$\boxed{No.\ v.e^- = \frac{mass\ in\ (amu)}{M.\ mass\ (amu)} \times valence\ e^-\ per\ formula}$$

$$\boxed{No.\ unpaired\ e^- = \frac{mass\ in\ (amu)}{M.\ mass\ (amu)} \times No.\ unpaired\ e^-\ per\ formula}$$

$$\boxed{No.\ l.pair = \frac{mass\ in\ (amu)}{M.\ mass\ (amu)} \times L.P\ per\ formula}$$

Q# How many v.e⁻ are present in 34 amu of NH_3:

sol: $\frac{\cancel{34}}{\cancel{17}} \times 8 = \boxed{16 e^-}$

$NH_3 \rightarrow N \rightarrow 5e^-$

$NH_3 \rightarrow H \rightarrow 3e^-$

$\rightarrow 8e^-$

Q# How many unpaired e⁻ are present in 48 amu of O^{-1}.

sol $= \frac{48}{16} \times 1 = \boxed{3 e^-}$

$_9O = 1s^2, 2s^2, 2p^5$

⇅ ⇅ ⇅ ⇅ ↑

$_9\bar{O} = 1s^2, 2s^2, 2p^5$

⇅ ⇅ ↑

unpaired e⁻ in 32 amu of O_2^{-2}

$O_2 \rightarrow O\ \ 1s^2, 2s^2, 2p^4$

$O_2 \rightarrow O$

Date:______ (M)(T)(W)(T)(F)(S)

Q# What mass of H_2O has same lone ~~cases~~ pair as in 68 amu of NH_3?

$$\frac{68}{17} \times 1 = 4$$

$$\boxed{36\ amu} = \frac{72}{2} = 4 = \frac{}{18} \times 2$$

Q#

How many electrons are present in 36 amu of H_2O^+?

Sol: $\frac{36}{18} \times 9$

$= 18$

$2H = 2e^-$ $O = 8e^-$

$10e^- - 9e^-$

Neutron & Proton

$$\boxed{Neutron = \frac{mass}{M \cdot mass} \times Neutrons\ per\ formula}$$

$$\boxed{proton = \frac{mass\ (amu)}{M \cdot mass} \times protons\ per\ formula}$$

Q# How many neutrons are present in 54 amu of H_2O?

$= \frac{54}{18} \times 8$

$= 3 \times 8$

$\boxed{= 24}$

H: H^1, $N = 1 - 1 = 0$

$_8O^{16}$: $N = 16 - 8$, $\boxed{N = 8}$

Date:________ M T W T F S

Orbitals

$$\boxed{\text{No. orbitals} = \frac{\text{mass (amu)}}{\text{M. mass}} \times \text{orbitals per formula.}}$$

$$\boxed{\text{No. } s/p/d/f = \frac{\text{mass (amu)}}{\text{M. mass}} \times s/p/d/f \text{ per formula}}$$

Molecular orbital:
→ present in a molecule

$$\boxed{\text{No. m. orbital} = \text{No \# atomic orbital}}$$

→ $$\boxed{\text{m. orbital} = \frac{\text{mass (amu)}}{\text{m. mass}} \times \text{M.O per formula}}$$

Q# How many m. orbitals are present in 32 amu of O_2^{+2}?

$\frac{32}{32} \times 10$

~~$O_2 = 1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 3d^{10}$~~

$\boxed{\text{No. M. orbitals} = 10}$ ✓

sol → $O = 1s^2, 2s^2, 2p^4$

[↑↓] [↑↓] [↑↓ | ↑ | ↑]

$O = 1s^2, 2s^2, 2p^4$ → O_2

[↑↓] [↑↓] [↑↓ | ↑ | ↑]

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Q# The no. m. orbitals in 56 amu of N_2^{-3}

Sol: $\frac{56}{28} \times 10$

$\boxed{= 80}$

$_7N = 1s^2, 2s^2, 2p^3 = 5$
$_7N = 1s^2, 2s^2, 2p^3 = 5$ → 10

Q# How many s orbitals are present in 28 amu of N^{-3}?

Sol: $\frac{28}{14} \times 2 = 4$ $N = 1s^2, 2s^2, 2p^3$

[↑↓] [↑↓] [↑↓|↑↓|↑↓]

Q# When 48 amu of O^{+2} is reduced by 1 e^-s, the No # filled orbitals become?

Ans => $\boxed{\cancel{05}}$ 6

$_8O = 1s^2, 2s^2, 2p^4$

$\cancel{\frac{48}{16}}.3 \times 4$ =

$\frac{48}{16} \times 2$ =

[↑↓] [↑↓] [~~↑↓~~|~~↑↓~~|↑↓]

[↑|↑|↑]

Bonds

① Covalent bond:

$$\boxed{No.\ CB = \frac{mass(amu)}{M.mass} \times C.B \text{ per formula}}$$

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$$\boxed{\text{No. } \sigma \text{ bond} = \frac{\text{mass (amu)}}{\text{M. mass}} \times \sigma\text{-bond per formula}}$$

$\boxed{\text{Lec} - 06}$

$$\boxed{\text{No. } \pi \text{ bond} = \frac{\text{mass (amu)}}{\text{M. mass}} \times \pi\text{-bonds per formula}}$$

Single / double / Triple

$$\text{No. bond} = \frac{\text{mass (amu)}}{\text{M. mass}} \times \text{single/double/Triple}$$

Q#

in 88 amu of CO_2

$\Rightarrow$ Covalent Bond $= \frac{88}{44} \times 4 = \boxed{8 \text{ bonds}}$

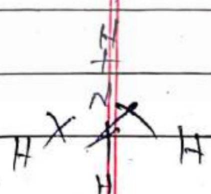
$\Rightarrow$ σ- bond $= \frac{88}{44} \times 2 = \boxed{4 \text{ bonds}}$

$\Rightarrow$ π- bonds $= \frac{88}{44} \times 2 = \boxed{4 \text{ bonds}}$

$O = C = O$

$C.B = \frac{88}{44} \times 4$

NH3



σ ~~C.B~~ $= \frac{88}{44} \times 2$

CO_2

$O = C = O$

$\pi = \frac{88}{44} \times 2$

$\times 2$

"Mole"

* Atom → atomic mass → amu → g → mole / gram atom
* Molecule → M. mass → amu → g → mole / gram molecule
* Ion → Ionic. mass → amu → g → mole / gram ~~formula~~ ion
* ionic compound → Formula mass → amu → g → mole / gram formula

single particle

amu used

molar mass

Conversion:

$H_2O = 18\,amu$

$= 18\,amu \times N_A$

$= 18 \times 1\,amu \times N_A$

$= 18 \times 1.66 \times 10^{-24} \times 6.023 \times 10^{23}$

$= 18 \times 1 \times g$

$= \boxed{18g}$

unit:

(*) itself a unit of Amount of substance.

MCQs

The single molecular mass of CO_2 is:

(a) 44 (b) 44 amu ✓ (c) 44g (d) All

MCQs: molar mass of CO_2 → $\boxed{44g}$

Date:_______ M T W T F S

Avogadro's Number

* proportionality constant

* Relate No. particles & Mole.

(N ∝ n)

$N \propto n$

$N = N_A n$

$$\boxed{N_A = \frac{\text{No. particles}}{\text{Mole}}}$$

=> It is Ration b/w No. particles & mole.

unit: unit of Avogadro constant is:

$$\boxed{N_A = \frac{1}{mol}}$$

$N_A = 6.022 \times 10^{23}$ particles.

Dependance:

* 1 mole $H_2(g)$ = 6.023×10^{23}
* 1 mole $H_2O(l)$ = 6.023×10^{23}

=> independant of Nature of substance

=> " " State

$\boxed{\text{depend on No. moles}}$

Date:______ M T W T F S

1 mole:

$x \Rightarrow$ atomic mass, M. mass, ionic mass, formula mass

$\Rightarrow \boxed{1 \text{ mole} = x \times g}$

As $1g = 10^{-3} Kg$

$\Rightarrow \boxed{1 \text{ mole} = x \times 10^{-3} Kg}$

$\Rightarrow \boxed{1 \text{ mole} = x \times \frac{Kg}{10^3}}$ $\Rightarrow \boxed{1 \text{ mole} = x \times 10^3 mg}$

$\Rightarrow \boxed{1 \text{ mole} = x \times 10^6 \mu g}$ $\Rightarrow \boxed{1 \text{ mole} = x \times 10^9 ng}$

$\Rightarrow \boxed{1 \text{ mole} = x \times amu \times N_A}$ $\Rightarrow \boxed{1 \text{ mole} = N_A}$

$\Rightarrow \boxed{1 \text{ mole} = 6.022 \times 10^{23}}$

$\Rightarrow$ 1 mole at STP of any gas $= 22.4 dm^3$ $\Rightarrow$ 1 mole NTP $= 24.04 dm^3$

$\Rightarrow$ 1 mole at STP $= 273 R$ $\Rightarrow$ 1 mole at NTP $= 293R$

$\Rightarrow$ 1 mol at RTP $= 24.46 dm^3$ $\Rightarrow$ 1 mole at RTP $= 298R$

Scanned with CamScanner

Date: M T W T F S

MCQs

Which one represent one mole of N_2?

ⓐ 28 g/N_A ⓑ 28×10^{-3} Kg ⓒ 28×10^{4} mg ⓓ 28 $\frac{amu}{N_A}$

MCQs Which One is equal to 1 mole of H_2?

ⓐ 2 (amu × N_A) = g ⓑ 273 R

ⓒ 12g of $^{12}_{6}C$ ⓓ 24 dm^3 CO_2 at NTP

ⓔ All

$\boxed{2g = 1mole}$ 1 mole of H_2 = 2g

$\frac{24}{24} = 1$

Concepts:

① Molar volume: (V_m)

Volume occupied by one mole of a gas.

M. Form: $\boxed{V_m = \frac{Volume}{mole}}$

or

$\boxed{V_m = \frac{V}{n}}$ $PV = nRT$ $V_m \leftarrow \frac{V}{n} = \frac{RT}{P}$

or

$\boxed{V_m = \frac{RT}{P}}$ → applied for gases only.

For liquid, solid

$d = \frac{m}{V} \Rightarrow V = \frac{m}{d}$

$\boxed{V_m = \frac{molar\ mass}{density}}$

Date:

M T W T F S

Lec-07

Molar Volume:

Volume occupied by one mole of gas.

$$\boxed{V_m = \frac{V}{n}} \qquad \boxed{V_m = \frac{RT}{P}} \rightarrow \text{gases only.}$$

$$\boxed{V_m = \frac{\text{molar mass}}{\text{density}}} \rightarrow \text{gas, solid, liquid}$$

unit: $\boxed{V_m = dm^3/mol}$ or cm^3/mol / m^3/mol

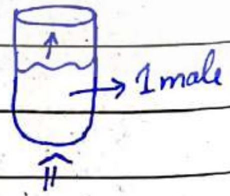
Facts:

=> intensive property
⇓
=> Not depend on "Amount of substance"

=> Not depend on "nature of gas."

depend
⇓
depend on condition.

✓ * $V_m \propto T$



✓ * $V_m \propto \frac{1}{P}$

✓ * $V_m \propto \frac{1}{d}$ $\quad (d = mV)$

Date:________ M T W T F S

V_m at different condition:

(*) **STP:**

$T = 0^\circ C$ or $273K$ $P = 1\ atm$

$$V_m = \frac{0.0821 \times 273}{1} \Rightarrow \boxed{V_m = 22.4\ dm^3}$$

(*) **NTP:**

$T = 20^\circ C$ or $293K$ $P = 1\ atm$

$$V_m = \frac{0.0821 \times 293}{1} \Rightarrow \boxed{V_m = 24.04\ dm^3}$$

(*) **RTP:**

$T = 25^\circ C$ or $298K$ $P = 1\ atm$

$$V_m = \frac{0.0821 \times 298}{1} \Rightarrow \boxed{V_m = 24.46\ dm^3}$$

Max Molar volume

Note:

RTP	> NTP	> STP
$25^\circ C$	$20^\circ C$	$0^\circ C$
1 atm	1 atm	1 atm

Q# Which one has max molar volume at $0^\circ C$ & 1 atm?

T - P - ?

(a) 2 mole H_2
(b) 3 mole H_2
(c) 1.5 mole N_2
(d) Same ✓ (V_m independent of
=> Amount ✓
=> Nature ✓

Date:______ M T W T F S

MCQs # Which one has max molar volume at $100°C$ & 0.5 atm?

(a) $2g\ H_2$ (b) $4g\ H_2$ (c) $8g\ H_2$ (d) Same ✓

independant of A & N

imp MCQs #

Which one has max molar volume at same condition?

(a) 0.5 mole H_2
(b) 0.7 mole CH_4 } → value less than 1 mol so less than $V_m = 22.4$

✓(c) 1.5 mole N_2

(d) Same

MCQs

CO_2 has max molar volume at:

(a) $10°C$ & 1 atm ✓(b) $20°C$ & 0.5 atm

(c) $20°C$ & 1 atm (d) Same

Note:

$\boxed{V_m \propto \frac{T}{P}}$

MCQs

~~Which one has max~~

The molar volume of ice will be max at:

(a) $1 g/cm^3$ (b) $0.9 g/dm^3$ ✓(c) $0.7 g/dm^3$

$\boxed{V_m \propto \frac{1}{d}}$

$\boxed{V_m = \frac{\text{molar mass}}{d}}$

Date:

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Q# The molar volume of H_2 gas at $27°C$ & 2 atm is:

(a) R (b) 50R (c) 150 (d) 200R (e) None

$$V_m = \frac{RT}{P} = \frac{R \times 300}{2} = 150R$$

Q#

The molar V of CH_4 at $100°C$ & 0.5 atm will be?

$$V_m = \frac{RT}{P} = \frac{0.0821 \times 373}{0.5} = \boxed{61.2}$$

Molar ~~Volume~~ Mass

Mass of one mole of a substance.

$$\Rightarrow \boxed{M.\ mass = \frac{mass}{mole}}$$

$$\Rightarrow \boxed{Kg/mol} \ / \ \boxed{g/mol}$$

Facts:

* intensive property
  ↳ independant of Amount but $\boxed{\text{Amount should 1}}$
* depend on $\boxed{\text{Nature of substance}}$

✓ * 1 mole $H_2 \longrightarrow 2\ g/mol$

✓ * 1 mole $H_2O \longrightarrow 18\ g/mol$

⇒ independant of $\boxed{\text{condition}}$.

Date:________ M T W T F S

indepe of Amount

Q#

Which one has max molar mass?

(a) 2 mole H_2 (b) 3 mole H_2 (c) 4 mole H_2

(d) Same ✓

(a) 8 mole H_2 (b) 3 mole O_2 (c) 2 mole CH_4

✓ (d) 1 mole CO_2 (e) Same

Amount → Not depend

(a) 8g CH_4 (b) 16g O_2 (c) 4g H_2 (d) 40g CO_2

(e) Same

$8/16 = 0.5$ $16/32 = 0.5$ $4/2 = 2$ $40/44 = 0.99$

Mass of one mole of a substance

Date:________ M T W T F S

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Numericals:

(1) $\boxed{\text{Mole} = \dfrac{\text{Mass in g}}{\text{M}\cdot\text{mass}}}$ ✓

$\boxed{\dfrac{m_1}{m_2} = \dfrac{n_1 \times M\cdot M_1}{n_2 \times M\cdot M_2}}$ ✓ → mass ratio

$N \alpha n$

$\boxed{\dfrac{m_1 : m_2 : m_3}{n_1 M\cdot M_1 : n_2 M\cdot M_2 : n_3 M\cdot M_3}}$ ✓

(2) $\boxed{\text{Mole} = \dfrac{\text{No. particles}}{N_A}}$ ✓

$(N \alpha n)$ $\boxed{\dfrac{N_1}{N_2} = \dfrac{n_1}{n_2}}$ ✓ $\boxed{\dfrac{N_1}{N_2} = \dfrac{m/M\cdot M_1}{m/M\cdot M_2}}$

$\boxed{\dfrac{N_1}{N_2} = \dfrac{V/V_m}{V/V_m}}$

(3) $\boxed{\text{Mole} = \dfrac{\text{Volume}}{V_m}}$

$(V \alpha \text{ mole})$ $\boxed{\dfrac{V_1}{V_2} = \dfrac{n_1}{n_2}}$ ✓ $\boxed{\dfrac{V_1}{V_2} = \dfrac{m_1/M\cdot M_1}{m_2/M\cdot M_2}}$ ✓

Date:

M T W T F S

Q# Which one has max mass?

(a) $8g\ H_2$ (b) $67.2\ dm^3\ CH_4$ STP (c) $12.044 \times 10^{23}\ O_2$

(d) 2 gram atom Na (e) same

a): $m =$ moles $\times$ M.Mass

$= 4 \times 2 = 8g$

d) $2 \times 23 = 46$

b): $\frac{67.2}{22.4} \times 16 = 48g$

c) $\frac{12.044}{6.023} \times 32 = 64g$

Q# The ratio of masses of 4g of H_2 to 0.5 mole of SO_2:

Sol: $\frac{H_2}{SO_2} = \frac{2 \times 2}{0.5 \times 64} = \frac{4}{32} = \boxed{1:8}$

Q# The ratio of mass of equal moles H_2, He & CH_4 is:

Sol: $m_{H_2} : m_{He} : m_{CH_4}$

$n \times M.M : n \times M.M : n \times M.M$

$1 \times 2 : 1 \times 4 : 1 \times 16$

$2 : 4 : 16$

$\boxed{1 : 2 : 8}$

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Q# The ratio of masses of CH_4 & H_2 if equal moles & masses of both are taken.

Sol: $\frac{CH_4}{H_2} = \frac{n \times M.mass}{n \times M.M} = \frac{1 \times \cancel{16}}{1 \times \cancel{2}} = \boxed{8:1}$

Q# Which one has max volume?

✓ (a) 8g H_2 → 4 mole

(b) 44.8 dm^3 O_2 at STP → 2 moles

(c) 32g CH_4 → 2 moles

(d) 3 gram molecules N_2 → 3 moles

Q# The ratio of volumes of equal masses of CH_4 & He is:

Sol: $\frac{V_1}{V_2} = \frac{n_1}{n_2} \Rightarrow \frac{V_1}{V_2} = \frac{m_1/M.M_1}{m_2/M.M_2} = \frac{CH_4}{He} = \frac{1/16}{1/4}$

$\Rightarrow \frac{1}{\cancel{16}} \times \frac{\cancel{4}}{1} = \boxed{1:4}$

Q# The ratio of volumes of 44.8 dm^3 of O_2 at RTP & 67.2 of N_2 at STP:

Sol: $\frac{V_1}{V_2} = \frac{n_1}{n_2} = \frac{V}{M.V} \times \frac{M.V}{V} \Rightarrow \frac{48}{\cancel{24}} \times \frac{67.2}{22.4}$

$= \boxed{2:3}$

Date:

Q# The ratio of volume of 4 dm^3 O_2 at 27°C & 2 atm to 8 dm^3 CH_4 at 127°C & 4 atm?

$$\frac{O_2}{CH_4} = \frac{n_1}{n_2} = \frac{V_1/V_m}{V_2/V_m}$$

$O_2 = V_m = \cancel{0.0821 \times 300} = 150R$

$$\frac{O_2}{CH_4} = \frac{4/150R}{8/100}$$

$CH_4 = \frac{400R}{4} = 100R$

$$= \frac{4}{150} \times \frac{100}{8} = \boxed{\frac{2}{6}}$$

$\frac{1}{3}$

Q# The ratio of Number of molecules of 8 dm^3 O_2 to 30 dm^3 CH_4 at same conditions?

$$\frac{N_1}{N_2} = \frac{n_1}{n_2} = \frac{V/V_m}{V/V_m} = \frac{8}{V_m} \times \frac{V_m}{30}$$

$= \boxed{4:15}$

Q# if the mass ratio of H_2 & CH_4 is $\frac{1}{4}$ then No # molecules ratio of H_2 & CH_4:

$$\frac{H_2}{CH_4} = \frac{1/4/2}{1/4/16} = \frac{1}{8} \times \frac{16}{4}$$

$= \boxed{2:1}$

$\frac{1}{8}$ $\frac{1}{64}$ $\frac{64}{8}$ $\frac{1}{8}$

Date:

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No. atoms in a Molecule:

$\boxed{\text{No. atoms} = \text{Mole} \times \text{Atomicity} \times N_A}$

According to Avogadro's Law

$V \propto n$ → when volume given but No condition

$\boxed{\text{No. atoms} = \text{Volume} \times \text{Atomicity} \times N_A}$

Comparison:

Furan 7, 4C

=> Same mass & same atomicity

$\boxed{\text{No. atoms} \propto \frac{1}{\text{M. mass}}}$ ✓

~~Palmitic~~

=> Same moles & same volumes & No. molecules.

18%

$\boxed{\text{No. atoms} \propto \text{Atomicity}}$

Q#:

A sample contains 10g H_2, 10g N_2 & 10g O_2. Which one has least No. atoms:

m = same => O_2

$\boxed{\text{No. atoms} \propto \frac{1}{\text{M. mass}}}$

Date:________ M T W T F S

Q# Which one has more no. atoms?

(a) 2mg H_2O ✓ (b) 2mg N_2O (c) 2mg CO_2.

$$\boxed{\text{No. atoms} \propto \frac{1}{M.M}}$$

Q# Equal masses of which one contain max atoms.

(a) NH_3 (b) H_2O_2 (c) CH_3^+ ✓ (d) Same

15g

Q# which one has max NO# atoms?

(a) $2dm^3$ O_2 (b) $3dm^3$ CH_4 ✓ (c) $1.5dm^3$ NO_2

(d) $4dm^3$ H_2 (e) Same

$4N_A$ $8N_A$ $15N_A$ $4.5N_A$

$$\boxed{\text{No. atoms} = \text{Volume} \times \text{atomicity} \times N_A}$$

$V_m = \frac{RT}{P}$

$R \times \frac{353}{0.5}$

$V_m =$

Q# if equal volume of the following gases are present at 80°C & 0.5 atm then which one has max No. atoms.

No. atoms = Mole × Ato × N_A

$\boxed{\frac{1}{176.5} \times 5 \times N_A}$

(a) CH_4 ✓ (b) NO_2 (c) H_2 (d) Same

Q# A sample contains equal mass of the following gases. which one has max NO # atoms.

(a) H_2O (b) CH_4 (c) H_2 (d) Same

$N = \frac{m}{18} \times 3 \times N_A$ $N = \frac{m}{16} \times 5 \times N_A$ $N = \frac{m}{\cancel{2}} \times \cancel{2} \times N_A$

$\frac{N_A}{6}$ $5N_A$

$$\boxed{H_2 > CH_4 > H_2O}$$

Date:

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Q# How many atoms are present in $67.2\ dm^3$ of CH_3^+ at STP?

(a) $\frac{N_A}{2}$ (b) $4N_A$ (c) $9N_A$ (d) $12N_A$

$$N = \frac{67.2}{22.4} \times 4 \times N_A = \boxed{12\ N_A}$$

Q# How many atoms are present in 6mg of H_2^+?

$$\text{Mole} = 6 \times 10^{-3} \times 2 = 12 \times 10^{-3}$$

$$N = \frac{6 \times 10^{-3}}{\cancel{2}} \times \cancel{2} \times N_A = \boxed{6 \times 10^{-3}\ N_A}$$

Q# Which one Max atoms?

(a) $0.5\ dm^3$ of H_2O
$1.5\ N_A$

(b) $2\ cm^3$ of CO_2
→ 0.002   0.006

(c) $0.05\ dm^3$ of CH_4
$0.025\ N_A$

✓ (d) $100\ cm^3$ of PCl_5
→ $0.1 = 6\ N_A$

(+) No # Specific atoms in a Molecule

$$\boxed{\text{Required atoms} = \text{moles} \times \text{specific atom per formula} \times N_A}$$

$44\ dm^3$ of CO_2

No. # C   moles of C

$$\boxed{\text{Moles Required atoms} = \text{Moles} \times \text{Required atoms per formula}}$$

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Volume given (No condition)

$$\boxed{\text{Required atom} = \frac{\text{Volume} \times \text{Required atoms}}{} \times N_A}$$

Comparison:

⇒ Same volume, Same molecule, Same mole.

$$\boxed{\text{No. specific atoms} \propto \text{atomicity of specific atoms}}$$

Q# ~~Which~~ Equal mass of which one contain more Hydrogen atoms?

(a) CH_4 H_2O C_2H_2 NH_3

$H = \frac{1}{\cancel{16}} \times \cancel{4} \times N_A$ $\frac{1}{18} \times 2 \times N_A$ $\frac{1}{26} \times 2 \times N_A$ $\frac{1}{17} \times 3 \times N_A$

$\frac{N_A}{4}$ $\frac{N_A}{9}$ $\frac{N_A}{13}$

$$\boxed{CH_4 > NH_3 > H_2O > C_2H_2}$$

Date: Lec - 10 (M)(T)(W)(T)(F)(S)

Q# How many moles of Nitrogen atoms are present in 18.066×10^{24} molecules of N_2H_4.

(a) 3 moles (b) 30 moles (c) 300 moles (d) 200 moles

Sol:

$$\frac{18.066 \times 10^{24}}{6.02 \times 10^{23}} \times 2 = \boxed{60 \text{ moles}}$$

Q#

Equal masses of which one contain more hydrogen atoms?

Note:

Equal mass & required atoms same then

$$\boxed{\text{Required atoms} \propto \frac{1}{M.\text{mass}}}$$

Q#

Equal volume of which one contain more carbon atoms?

(a) C_2H_2 (b) CH_4 (c) C_3H_8 ✓ (d) same

$$\boxed{\text{Required atoms} \propto \text{Atomicity}}$$

No # ions

$$\boxed{\text{Total ions} = \text{Mole} \times \text{ions per formula} \times N_A}$$

$$\boxed{\text{cations} = \text{Moles} \times \text{cations per formula} \times N_A}$$

$$\boxed{\text{Anions} = \text{Moles} \times \text{Anions per formula} \times N_A}$$

Date:

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NH_4^{+1}, CO_3^{-2}, SO_4^{-2}, NO_3^{-1}, PO_4^{-3}

one count.

Q# How many ions are present in 0.5 mole of $Al(SO_4)_3$?

ⓐ N_A ⓑ $1.5N_A$ ⓒ $2.5N_A$ ⓓ $3N_A$ ⓔ $12N_A$

$$Al_2(SO_4)_3 \longrightarrow 2Al^{+3} + 3SO_4^{-2}$$

$$\text{ions} = 0.5 \times 5 \times N_A = 2.5N_A$$

Q# How many protons are produced by partial dissociations of 49g of H_2SO_4.

$$H_2SO_4 \longrightarrow H^+ + HSO_4^{-1}$$

$$HSO_4^{-1} \longrightarrow H^+ + SO_4^{-2}$$

$$H^+ = \frac{49}{98} \times 1 \times N_A = \boxed{0.5N_A}$$

Q# How many OH^- are produced in 5 moles of $Ca(OH)_2$

ⓐ 6.022×10^{24} ✓

$$Ca(OH)_2 \longrightarrow Ca^{+2} + 2OH^-$$

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Charge

$$\boxed{\text{charge} = \text{Moles of ion} \times \text{total charge}} \times \frac{96500C \times}{1F}$$

(1 mole e^- = 96500 C)

(1 mole e^- = 1 Faraday)

Q# How much charge is present in 8 g of O^{-2}.

Sol:

$$\text{charge} = \frac{8}{16} \times 2 \times 1F = \boxed{1F}$$

Q# How much charge is present in 3.011×10^{25} Mg^{+2}

Sol:

$$\text{charge} = \frac{3.011 \times 10^{25}}{6.023 \times 10^{23}} \times 2 \times 1F = 0.5 \times 2 \times 10^2$$

$$= \boxed{100F}$$

Q# How many charge is present in Ca^{+2} in 200g of $CaCO_3$?

$$\text{charge} = \frac{200}{100} \times 2 \times 1F = \boxed{4F}$$

100g $CaCO_3 \longrightarrow 1 Ca^{+2}$

200g $CaCO_3 \longrightarrow \boxed{2 Ca^{+2}}$

Date:

Q# The charge on sulphate in 0.5 mole of $Al_2(SO_4)$?

charge = $0.5 \times 6 \times 1F = \boxed{3F}$

ions $\longrightarrow$ $\boxed{1.5F}$

$\longleftrightarrow$

Mass of Ion from charge

Q#

How much mass of O^{-2} having charge 0.5F

Mole = charge

1 mole O^{-2} = 2F

mole = 0.5F

$2x = 0.5$ $\quad x = \frac{0.5}{2}$

$\boxed{x = 0.25 \text{ mole}}$

$x = 0.25 \times 16 = \boxed{4g}$

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Mass, Nomber & volume of ions from charge

Q# How much mass of Al^{+3} having charge charge 3F.

sol: Al^{+3} = charge

1mol = 3F

x = 3F

3x = 3 $\boxed{x = 1 \text{ mole}}$ x = 1×27

$\boxed{x = 27g}$

Q#
How much ions of sulphate SO_4^{-2} having charge 0.5F.

sol:

SO_4^{-2} : charge

1mole : 2F

x = 0.5F

2x = 0.5

$x = \frac{0.5}{2}$

$\boxed{x = 0.25}$ mole

$\boxed{0.25 \times NA}$

Q#: How many Al^{+3} ions having charge 1.5F

Al^{+3} : charge

1 : 3

x : 1.5

3x = 1.5

$x = \frac{1.5}{3}$

x = 0.75

~~0.75~~ 0.5 mol

$\boxed{0.5 \times NA} = \boxed{\text{[illegible]}}$

M T W T F S

Date:

Q# How much volume of gaseous NH_4^+ having charge 1.5F at STP.

NH_4^+ : charge

1 : 1F

x : 1.5

$x = 1.5 \times 22.4$

$\boxed{x = 33.6}$

=> Amount of atoms from amount of another atom in a molecule:

Molecule

Given atom	Required atom
Mass given	mass
No	Number
Mole	Mole

Q# How many moles of hydrogen atoms are present in H_2O if there is 0.5 mole of oxygen atom?

$\boxed{H_2O}$

⇓

H : O

2 mole : 1 mole

x : 0.5

x = 1 mole of H_2.

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Q# A sample of $AlCl_3$ contain 6.022×10^{31} Al^{+3} ions then moles of Cl^- are:

$AlCl_3$

Al : Cl

$\frac{6.023 \times 10^{31-23}}{6.023}$ 1 mole : 3 mole

6.022×10^{31} : x

$= 10^8$

10^8 mole

$\boxed{x = 3 \times 10^8 \text{ mole}}$

Q# What is the mass of Hydrogen atom in $C_6H_{12}O_6$ if there are 12.044×10^{23} atoms of C:

C : H

6 12

2 : x

x = 4 mole

$4 \times 1 = \boxed{4g}$

Q#

How many No# of Oxygen atoms are present in H_2SO_4 if there are 8g of sulphur atoms.

S : O

1 mol : 4 mole

x : 0.25

4x = 0.25

$x = \frac{0.25}{4} \times N_A$

$\boxed{x = N_A}$

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Date: ______ M T W T F S

Q# How many moles of SO_4^{-2} ions are present in $Al_2(SO_4)_3$ if there is 9g Al^{+3}.

Sol:

$Al : SO_4$

2 mole : 3 mole

$\frac{1}{3} : x$

$2x = \cancel{3} \times \frac{1}{\cancel{3}}$

$\boxed{x = \frac{1}{2}}$ mole.

Q# ~~...~~ if each compound contains 2 mole of hydrogen atoms then which one has more C atoms.

C_3H_4	C_3H_6	C_3H_8
3 : 4	3 : 6	3 : 8
x : 2	x : 2	x : 2
$\boxed{x = \frac{6}{4}}$	$x = \frac{6}{6}$	$x = \frac{6}{8}$

$\boxed{\text{No. atoms} \propto \text{No. required atoms}}$

Required atoms same

$\boxed{\text{No. atoms} \propto \frac{1}{\text{atomicity of attached atoms}}}$

Q# if each compound contain 0.5 mole of H then which one has more Carbon atoms.

(a) CH_4 (b) C_2H_4 (c) C_3H_8

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Q# if each compound contain 2 mol of hydrogen atoms then w^o has more oxygen atoms?

$\boxed{H_2O_2 > H_2O > H_3O^+}$

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Amount of molecules from amount of atoms:

Molecule (Required) ⇓ Mass, Volume, No, moles

Atoms (Given) Mass, volume, No, moles

Molecules should be one mole.

Q# How many moles of NH_3 is present if it contains 1.5 moles of H?

$NH_3 : H$

1 mole : 3 mol

x : 1.5 mol

$3x = 1.5$ $x = \frac{1.5}{3}$

$\boxed{x = 0.5 \text{ mole}}$

Q#

How many moles of H_2SO_4 are present if it contains 8g of Oxygen atom

$H_2SO_4 : O$

1 : 4

x : 0.5

$4x = 0.5$ $x = \frac{0.5}{4} = \boxed{0.125}$

Date: ________ M T W T F S

Q# What is the mass of $CaCO_3$ if it contains 4g of Carbon atom?

$CaCO_3 : C$

$1 : 1$

$x : \frac{1}{3}$

$x = 1 \times \frac{1}{3} \times 100 = \boxed{33.3g}$

Q# How many molecules of $C_6H_{12}O_6$ are present if it contains 9 moles of H atom.

$C_6H_{12}O_6 : H$

$1 : 12$

$x : 9$

$12x = 9 \quad x = \frac{9}{12} = \frac{3}{4} = 0.75$ mole

$\boxed{0.75 \times N_A}$

Q# How many moles of H_2SO_4 are present if it contains 32g of Oxygen & 1g of hydrogen atom?

$H_2SO_4 : H \, \& \, O$

1 mol : 6 (total)

$x = 3$

$\cancel{6}x = \cancel{3}$ $\boxed{x = 0.5 \text{ mole}}$

Q# What is the mass of H_2SO_4 if it contains 0.5 moles of sulphur & 48g oxygen.

Date:______ M T W T F S

H_2SO_4 : S & O

1 : 5

x : 3.5

$5x = 3.5$ $x = \frac{3.5}{5} \times 98 = \boxed{68.6g}$

Q# How many volume is occupied by CO_2 at STP if it contains 3.011×10^{23} Carbons & 16g of oxygen.

CO_2 : C & O

1 : 3

x : 2.5

$x = \frac{\cancel{1.5}}{\cancel{3}} \times 22.4 = \boxed{11.2 dm^3}$

Q# if $C_6H_{12}O_6$ contains 4g of H-atoms then NO. oxygen atom

NO. $C_6H_{12}O_6$ molecules.

No. oxygen

$C_6H_{12}O_6$

H : O

12 : 6

4 : x

$12x = 24$

$x = \frac{24}{12} = 2 mole$

$\boxed{2N_A}$

$C_6H_{12}O_6$: H

1 : 12

x : 4

$12x = 4$

$x = \frac{4}{12} = \boxed{0.33 \times N_A}$

Date:________ M T W T F S

(#) (a) No. atoms in a molecule:

(b) Moles of atoms " " ":

(c) Volume of atoms " " ":

(d) mass of atoms " " ":

Q# What is the mass of hydrogen in 0.5 moles of NH_3?

$NH_3 : H$

$1 : 3$

$0.5 : x$

$x = 0.5 \times 3 = 1.5 \times 1$

$\boxed{1.5g}$

Q# What is the mass of OH^- in 3.011×10^{24} formula units of $Ca(OH)_2$.

$Ca(OH)_2 \longrightarrow : OH^-$

1 mole : 2 mole

5 : x

$x = 10 \times 17$ $\boxed{x = 170g}$

Q# if there are 34g of NH_3 then volume occupied by ~~each~~ hydrogen at STP?

$NH_3 : H$

$1 : 3$

$2 : x$

$x = 6 \times 22.4$

$x = \boxed{134.4}$

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Moles from density:

$$\boxed{n = \frac{M}{M\cdot mass}}$$

$d = \frac{m}{V}$

$m = d \times V$

$$\boxed{n = \frac{d \times V}{m\cdot mass}} \rightarrow \text{for Solid \& liquid}$$

$(\text{Mole} \propto V) \rightarrow$ for gas.

$$\boxed{\text{No \# atoms} = \frac{d \times V}{m\cdot mass} \times \text{atomicity} \times N_A}$$

$$\boxed{\text{Required atom} = \frac{dV}{M\cdot M} \times \text{Required atom per formula} \times N_A}$$

e, n, p

No. particles = moles × particles per formula × N_A

$$\boxed{\text{No \# atoms} = \frac{dV}{M\cdot mass} \times \text{particles per formula} \times N_A}$$

Q# How many moles of H_2O (gas) (vapours) are in $1\ dm^3$ of H_2O. $d = 1g/dm^3$

1 mole

Q# How many moles of H_2O liquid are present present in $1\ dm^3$?

Date: ______ M T W T F S

$$moles = \frac{1 \times 1}{18} = \frac{\frac{1g}{10^{-3}\,dm^3} \times 1\,dm^3}{18} = \frac{1000}{18} = \boxed{55.5\ mole}$$

Q# How many atoms are present in $9\,cm^3$ of H_2O ($d = 1\,g/cm^3$).

$$\frac{9 \times 1}{18} \times 3 \times N_A \quad \frac{\cancel{9}^{3} N_A}{\cancel{18}_{2}} \quad \boxed{1.5\,N_A}$$

Q# How many H atoms are present in $0.5\,dm^3$ of H_2O ($d = 0.7\,g/cm^3$)

$$H = \frac{0.5 \times 0.7\,g/10^{-3}}{\cancel{18}\,9} \times \cancel{2} \times N_A$$

$$H = \frac{0.7 \times 10^3 \times 0.5}{9} \times N_A$$

$$\boxed{H = 38.8\,N_A}$$

Q# How many electrons are present in $0.5\,cm^3$ of $H_2O_{(l)}$? $d = 1g/cm^3$

$$No.\ e^- = \frac{1 \times 0.5}{\cancel{18}\,9} \times \cancel{10}^{5} \times N_A = \frac{5}{18} N_A$$

Q# Equal volumes of $H_2O_{(l)}$ has max moles when its density is:

* $1\,g/cm^3$ $\quad Moles = \frac{d \times V}{M.M}$
* $0.7\,g/cm^3$
* $0.6\,g/cm^3$ $\quad \boxed{moles \propto d}$

Date:______ M T W T F S

Mass from density:

Q# What is the mass of 120 cm^3 of $H_2O_{(l)}$ ($d = 1\,g/cm^3$)

$\boxed{mass = d \times V}$

$= 1\,g/\cancel{cm^3} \times 120\,\cancel{cm^3} = \boxed{120\,g}$

$\boxed{d = 1\,g/cm^3}$ $\boxed{1\,cm^3 = 1\,g}$ (if $d = 1\,g/cm^3$)

$\boxed{120\,cm^3 = 120\,g}$

Q# One cm^3 of C_2H_6 contains how much mass if $d = 0.79\,g/cm^3$

$d = \frac{m}{V}$

$m = d \times V$

$= 0.79 \times 1 = \boxed{0.79\,g}$

Q# What is mass of H atom in $\underline{96\,cm^3}$ of H_2O ($d = 1$)

density case
mass of atom from molecule

$\boxed{m = d \times volume}$

mass of molecules

$m = d \times V$

$= 1 \times 96 = \boxed{96\,g}$

mass of atom:

$H_2O : H$

$1 : 2$

$18\,g : 2\,g$

$96 : x$

$\frac{192}{18} = \boxed{10.62}$

Date:________ (M)(T)(W)(T)(F)(S)

Q# What is the mass of carbon atom in $1\,dm^3$ of C_2H_2 ($d = 0.5\,g/cm^3$)

Solution:

$m = 0.5g$

$C_2H_2 : C$

$1 : 2$

$26 : 24$

$0.5 : x$

$26x = 12$

$x = \frac{12}{26} = \boxed{0.46\,g}$

Lec - 14

Moles from Molarity:

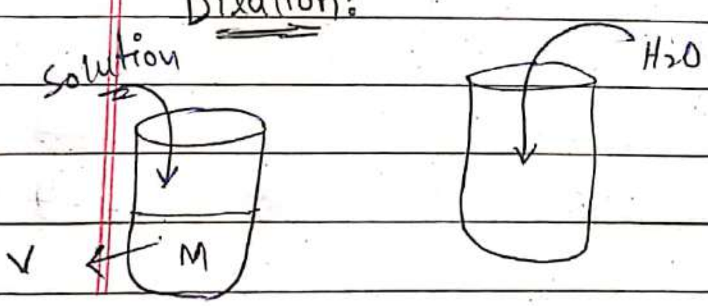
$$\boxed{M = \frac{n}{V}}$$

$mole = M \times V (dm^3)$

(No# atoms = $M \times V \times$ atomicity $\times N_A$)

(No# required atoms = $M \times V \times$ Require atom per formula $\times N_A$)

Dilution:



Date:

M T W T F S

$M_1V_1 = M_2V_2$ (V= same unit)

Q# How many moles of NaOH present in $1 cm^3$ of 0.001 molar solution?

$n = M \times V$

$0.001 \times 10^{-3} \times 10^{-3} = 10^{-6}$

Q# How many atoms are present in $0.5 cm^3$ of 0.01M solution of Na_2CO_3?

$n = 0.5 \times 10^{-3} \times 0.01 \times 6 \times N_A$

$= \boxed{3 \times 10^{-5} N_A}$

Q# How many electrons are present in 0.1M of $0.5 dm^3$ of NH_4^+?

$e^- = 0.1 \times 0.5 \times 10 \times N_A$

$= \boxed{0.5 N_A}$

Q# How many electrons are present in $0.5 dm^3$ of 0.1 M solution of $^{12}CO_3^{-2}$?

$0.5 \times 0.1 \times 32 \times N_A$

$1.6 N_A$

Date:

M T W T F S

Q# When $0.5cm^3$ of $0.1M$ solution of NaCl is mixed with $1dm^3$ of KOH. The molarity of KOH is:

NaCl : KOH

$M_1V_1 = M_2V_2$

$\frac{0.1 \times 0.5}{1 \times 10^3} = 1 \times M_2$

$\boxed{M_2 = \frac{0.05}{1} \; 5 \times 10^{-3}}$

Q# When 0.1 M of $0.1cm^3$ of KBr is mixed with 0.5M of NaOH. then volume of NaOH is.

$\frac{0.1 \times 0.1}{0} = 0.5 \times V_2$

$\frac{0.01}{0.5} = V_2 \; 1 \times 10^{-2}$

$\frac{1 \times 10^{-2}}{5 \times 10^{-1}}$ $\frac{1 \times 10^{-1}}{5}$

$5\overline{)10}$ .2

0.2×10

2×10^{-1}

2×10^{-2}

$\boxed{2 \times 10^{-2}}$

Date:

M T W T F S

No # (sub) particle

$$\boxed{\text{No \# } e^- = \text{Moles} \times e^- \text{ per formula} \times N_A}$$

$$\boxed{V \cdot e^- = \text{moles} \times \text{valence } e^- \text{ per for} \times N_A}$$

if V = given → but No condition.

$$\boxed{\text{No\# } e^- = \text{Volume} \times e^- \text{ per formula} \times N_A}$$

Q# How many e^- are present in $0.5\,dm^3$ of gaseous H_2O?

$$\text{No \# } e^- = 0.5 \times 10 \times N_A$$
$$= \boxed{5 N_A}$$

Q# The no. e^- in 44 Kg of CO_2^{+2}?

$$\frac{44 \times 1000}{44} \times 20 \times N_A$$

$$20\,\text{Kg}\,N_A = \boxed{20 \times 10^2\, N_A}$$

Q# How many unpaired e^- are present in 0.5 mole of N^{+2}?

$${}_7N = 1s^2, 2s^2, 2p^3 \quad \boxed{\uparrow \mid \cancel{\uparrow} \mid \cancel{\uparrow}}$$

$$0.5 \times 1 \times N_A = \boxed{0.5 N_A}$$

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Date:

M T W T F S

Q# What volume of NH_3 has no # lone pairs as in 9g of H_2O at STP.

$NA = NA \times 2 \times \frac{9}{18}$ ~~0.5 mole 11.2 dm~~

$NA = NA \times 1 \times \frac{22.4}{22.4}$

Lec-15

Sub- Particle:

$$\boxed{\text{No\# protons / Neutron} = \text{Moles} \times \text{proton/N per formula} \times NA}$$

Bonds:

$$\boxed{\text{No\# C.B, } \sigma, \pi, \text{-ve} = \text{Moles} \times \text{Bonds per formula} \times NA}$$

Orbitals:

$$\boxed{\text{Orbitals} = \text{Moles} \times \text{orbitals per formula} \times NA}$$

volume given & other conditions:

$$\boxed{\text{No. particle} = \frac{V}{V_m} \times \text{particles per formula} \times NA}$$

$V_m = \frac{RT}{P}$

Date:

M T W T F S

Q# $10\,dm^3$ of H_2O at 0.0821 atm & $27°C$ contain how many σ bond?

No # σ-bond $= \frac{\frac{\cancel{10}}{0.0821 \times \cancel{300}}}{0.0821} \times \cancel{2} \times N_A$ $\boxed{\frac{2N_A}{3}}$

Q# How many sigma bonds are present in $5\,dm^3$ of NH_3?

No. σ-bond $= 5 \times 3 \times N_A = \boxed{15 N_A}$

Q# How many covalent bonds are present in $67.2\,dm^3$ of CO_2 at STP

$O \overset{①}{\underset{②}{=}} C \overset{③}{\underset{④}{=}} O$ C.B $= \frac{67.2}{22.4} \times 4 \times N_A = 12 N_A$

Q# Which one contains maximum bonds?

ⓐ $5\,dm^3$ of $H_2O_{(g)}$ ✓
ⓑ $11.2\,dm^3$ CO_2 at STP
ⓒ $1\,dm^3$ of $PCl_{5(g)}$
ⓓ $10\,cm^3$ $H_2O_{(l)}$

a): $5 \times 2 \times N_A$
$= 10 N_A$ ✓

b): $\frac{11.2}{22.4} \times 4 \times N_A$
$\boxed{2 N_A}$

$= \frac{dV}{M.mass}$

c): $1 \times 5 \times N_A$
$= 5 N_A$

d): $\frac{10\,cm^3 \times 1\,g/cm^3}{18} \times 2 = \boxed{\frac{20}{18} N_A}$

Q# How many molecular orbitals are present in 3.011×10^{24} N_2 molecules?

$5 \times 10 \times N_A = 50 N_A$

$N_2 \to N = 1s^2, 2s^2, 2p^3$
$\quad\;\, \to N = 1s^2, 2s^2, 2p^3$

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M T W T F S

Date:

Water of Crystallization:

OR

Water of hydration:

$CaSO_4 \cdot 5H_2O$

When H_2O is not given

$$CaSO_4 \cdot 5H_2O \xrightarrow{\Delta} CaSO_4 + 5H_2O$$

hydrated compound — Anhydrous compounds.

$$\boxed{\text{Moles of } H_2O = \text{Moles of H·compound} - \text{Moles of Anhy compound}}$$

$$\boxed{\text{Mass of } H_2O = \text{Mass of H·compound} - \text{mass of An·compound}}$$

When H_2O is given:

$$\boxed{\text{Moles of } H_2O = \frac{\text{Moles of } H_2O \text{ lost}}{\text{Moles of hydrated compound}}}$$

Q# When two moles of $CaSO_4 \cdot xH_2O$ (H_2O moles?) is heated the 1.5 moles of $CaSO_4$ formed. then formula of compound is:

Moles of H_2O = 1.5 − 2

= 0.5 or $\frac{1}{2}$

$CaSO_4 \cdot \frac{1}{2}H_2O$

Date:

M T W T F S

Q# When 360 g of $MgSO_4 \cdot xH_2O$ is heated in 270 g of $MgSO_4$ powdered. then formula of hydrated compound is:

Mass of H_2O = 360 − 270

$$= 90g = \frac{90}{18} = 5 \text{ mole}$$

Formula = $MgSO_4 \cdot 5H_2O$

Q# when 0.090 mole of $CuSO_4 \cdot xH_2O$ is heated then 0.45 moles of H_2O is produced. then formula of hydrated compounds?

$$\text{Moles of } H_2O = \frac{0.45 \text{ mole}}{0.090 \text{ mole}} = 5 \text{ mole}$$

$CuSO_4 \cdot 5H_2O$

Q# when 3.36 g of $CaSO_4 \cdot xH_2O$ is heated then 1.8 g of H_2O is produced then x in formula is:

$$\text{Moles} = \frac{\frac{1.8}{18}}{\left(\frac{3.36}{136}\right)} = \frac{0.1}{0.02} = 5 \quad x = 5$$

2 − 1.5

$\frac{1}{2}$

Date: Lec- 16 M T W T F S

Concept of Mole in chemical Rxn:

steps:

1. Write balanced equation
2. Compare G. Data & Required data.
3. Ignore other reactants.
4. Convert G. data into moles.
5. Convert R. data into desired unit.

Q# $3H_2 + N_2 \longrightarrow 2NH_3$

if 9 moles of H_2 react with excess of N_2 then moles of NH_3 formed:

Sol: $H_2 : NH_3$

$B/G = B/x$

$\cancel{3}/9 : 2/x$

$\frac{1}{3} = \frac{2}{x}$ $\boxed{x = 6}$

Date: ______ M T W T F S

Q# $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

if 8g of CH_4 react with O_2 at STP then volume of CO_2:

Sol:

$CH_4 : CO_2$

$1 : 1$

$0.5 : x$

$x = 0.5 \text{ mole} = \boxed{11.2 \, dm^3}$

Q# $2SO_2 + O_2 \longrightarrow 2SO_3$

How much O_2 is required to react with $15 \, dm^3$ of SO_2 to form SO_3:

sol:

$O_2 : SO_2$ $\quad \frac{15}{2}$

$1 : 2$ $\quad \boxed{x = 7.5}$

$x : 15$

Q# How much O_2 is required for Complete combustion of $5 \, cm^3$ CH_4 & $5 \, cm^3$ C_2H_4 ?

sol:

$\cancel{4CH_4 + O_2 \longrightarrow 2C_2H_4}$

$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

$CH_4 : O_2$

$1 : 2$ $\quad \boxed{x = 10} \, cm^3$

$5 : x$

$C_2H_4 + 3O_2 \longrightarrow 2CO_2 + 2H_2O$

$C_2H_4 : O_2$

$1 : 3$

$5 : x$ $\quad \boxed{x = 15 \, cm^3}$

Date: ______

M T W T F S

Q# $2H_2 + O_2 \longrightarrow 2H_2O$.

What is mass of O_2 required to react with H_2 to produce 1 Kg of H_2O.

Sol:

$H_2O : O_2$

2 mole : 1

$1000g \leftarrow 1 Kg : x$ $\quad 2x = \frac{1000}{18}$

$x = \frac{55.5}{2} = \boxed{x = 27.7 \text{ mole}}$

$x = 27.7 \times 32$

$\boxed{x = 941g}$

other type

Amount of Product or Reactant.

Q# $3H_2 + N_2 \longrightarrow 2NH_3$

How many moles of reactants are required to produce 4 mole of NH_3 = ?

Sol:

$N_2 + H_2 : NH_3$

4 : 2

x : 4

$2x = 16$

$\boxed{x = 8 \text{ moles}}$

Date: M T W T F S

Q# $C_2H_4 + 3O_2 \longrightarrow 2CO_2 + 2H_2O$

How many moles of products are produced when 16 g of O_2 rxn with C_2H_4?

Sol:

O_2 : Product

3 : 4

0.5 : x $3x = 2$ $x = \frac{2}{3}$

$\boxed{x = 0.66}$ mole

other type

2 Given data

$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

if 32g of CH_4 react with 4 moles of O_2 then volume of product at STP formed?

$CH_4 + O_2$: $CO_2 + H_2O$

3 : 3

6 : x

$3x = 18$ ~~$3x = 24$~~ $x = \frac{24}{3} \times 22.4$

$x = 6 \times 22.4$

$\boxed{x = 134\ dm^3}$

Q# $3H_2 + N_2 \longrightarrow 2NH_3$

if $9\ cm^3$ of H_2 react with $3\ cm^3$ of N_2 then NH_3 :

Sol:

4 : 2

12 : x

$4x = 24$

$\boxed{x = 6\ cm^3}$

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Date: ________ (M)(T)(W)(T)(F)(S)

(#) Mass of Reactant or Products

Find each reactant or product separately and sum it.

Q# $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

if 8g of CH_4 is combusted then mass of product produced?

Sol:

depend on nature of substance → mass

$CH_4 : CO_2$

$1 : 1$

$0.5 : x$

$x = 0.5$ mole

$x = 0.5 \times 44$

$\boxed{x = 22g}$

$CH_4 : H_2O$

$1 : 2$

$0.5 : x$

$x = 1 \times 18$

$\boxed{x = 18g}$

$x = 22 + 18$

$\boxed{x = 40g}$

Q# $C_2H_4 + 3O_2 \longrightarrow 2CO_2 + 2H_2O$

if 3 moles of C_2H_4 are react with 6 moles of O_2 then mass of the product is:

Rxn : CO_2

$4 : 2$

$9 : x$

$4x = 18$

$x = \frac{18}{4}$

$x = 4.5 \times 18$

$\boxed{x = 198g}$

$C_2H_4 : CO_2$

$1 : 2$

$3 : x$

$x = 6 \times 44$

$\boxed{264}$

$C_2H_4 : H_2O$

$1 : 2$

$3 : x$

$x = 6 \times 18$

$\boxed{108}$

264

108

$\boxed{372g}$

Date: M T W T F S

Rxn : H_2O

$\boxed{mass = 279g}$

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Limiting & Excess Reagent

* Rxn completely used
* control product
* mass either ⇑ or ⇓ than Excess

* Not used completely
* Not control products
* mass either ⇑ or ⇓ than excess.

Identification of L.R & E.R :

=> Reactant : Reactant

$\frac{Mole}{S.C} : \frac{Mole}{S.C}$

Mole → given

S.C → Balance equation

value = less = $\boxed{limiting}$

→ greater = $\boxed{E.R}$

→ same = $\boxed{NO\ L.R\ \&\ E.R}$

Volume: → No condition.

$\frac{V}{S.C} : \frac{V}{S.C}$

Note:

In reversible rxn → $\boxed{\text{NO limiting \& Excess reagent}}$

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Date:

Q# $3H_2 + N_2 \longrightarrow 2NH_3$

6 moles H_2 & 4 moles N_2 then L·R is:

Sol: $\frac{3}{6} : \frac{1}{4}$

$\boxed{2 : 4}$

$\boxed{H = L \cdot R}$

Q# $2H_2 + O_2 \longrightarrow 2H_2O$

if 8g H_2 react with 32g of O_2 then L·R?

4 1

Sol: $\frac{4}{2} : \frac{1}{1}$

$\boxed{2 : 1} \rightarrow$ L·R

Q# $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

if $20cm^3$ CH_4 react with $40cm^3$ of O_2 then L·R is:

Sol: $\frac{20}{1} : \frac{40}{2}$

$\boxed{20 : 20} \rightarrow$ NO L·R

Q# $2H_2 + O_2 \longrightarrow 2H_2O$

if equal mass of H & O is taken then L·R = ?

Sol: $\frac{16}{2} : \frac{1}{1}$

$\boxed{8 : 1} \rightarrow$ L·R = O

Date:

Q# if equal volume of SO_2 & O_2 are taken the E.R is:

Sol:

$$2SO_2 : O_2 \longrightarrow 2SO_3$$

$SO_2 : O_2$

$\frac{4}{2} : \frac{4}{1}$

$\boxed{2 : 4}$ → Excess

Q# ~~$2H_2 + O_2 \longrightarrow 2H_2O$~~

$$CO + \frac{1}{2}O_2 \longrightarrow CO_2$$

if ratio of moles of CO to O_2 is $3/4$ then L.R?

Sol:

$CO : O_2$

$\frac{3}{1} : \frac{4}{0.5}$

L.R ← $\boxed{3 : 8}$

Type #2 Find Amount of product

① Find L.R & E.R

② compare L.R & product.

Date:______ (M)(T)(W)(T)(F)(S)

Q# $3H_2 + N_2 \longrightarrow 2NH_3$

if 12g H_2 react with 4moles of N_2 then moles of NH_3?

$H_2 : N_2$

$\frac{6}{3} : \frac{4}{1}$

$H_2 \leftarrow \boxed{2 : 4}$

balance H_2 : product

$3 : 2$

given $6 : x$

$3x = 12$

$\boxed{x = 4 \text{ moles}}$

Q# $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

if 32g of CH_4 react with $44.8\ dm^3$ of O_2 then volume of CO_2 at STP is:

$CH_4 : O_2$

$\frac{2}{1} : \frac{2}{2}$

$2 : 1$

$O_2 : CO_2$

$2 : 1$

$2 : x$

$2x = 2$

$x = 1 \times 22.4$

$\boxed{x = 22.4\ dm^3}$

Date: M T W T F S

Lec-18

Q# $CH_4 = 10\,cm^3$ $O_2 = 10\,cm^3$ how much CO_2?

$CH_4 : O_2$

$\frac{10}{1} = \frac{10}{2} = 5 : 1$

$O_2 : CO_2$

$2 : 1$

$10 : x$

$2x = 10$

$\boxed{x = 5\,cm^3}$

good Question

Q# $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

if 32 g CH_4 of react with 18.066×10^{23} O_2 then rxn mixture contain?

(a) CH_4, O_2, CO_2 ✓(b) CH_4, CO_2, H_2O

(c) O_2, CO_2, H_2O (d) O_2, CO_2, H_2O, CO_2.

Sol:

$CH_4 : O_2$

$\frac{2}{1} : \frac{3}{2}$ finish in rxn so CH_4, $CO_2 + H_2O$.

$2 : 1.5 \rightarrow$ L.R

Q# $3H_2 + N_2 \longrightarrow 2NH_3$

12 g H_2 react with 2 moles of N_2 then rxn mixture contain?

Sol:

$H_2 : N_2$

$\frac{6}{3} : \frac{2}{1}$

$\boxed{2 : 2} \rightarrow$ means only products are present. (NH_3) present.

All amount react.

Date:______ (M)(T)(W)(T)(F)(S)

Reacted amount of L·R:

$\boxed{\text{Given amount}}$ will be reacted amount.

Reacted amount of E·R:

1. Find L·R & E·R
2. Compare L·R & E·R
3. cross multiplication.
4. Find E·R

Unreacted amount of E·R:

$$\boxed{U\cdot R \text{ amount} = \text{Initial amount} - \text{Reacted amount}}$$

Q# $3H_2 + N_2 \longrightarrow 2NH_3$

if 12g of H_2 react with 28 g of N_2 then reacted amount of L·R

Sol:

$$\boxed{L\cdot R = N_2 = 28g}$$

Date: M T W T F S

Q# $3H_2 + N_2 \longrightarrow 2NH_3$

if 12 moles of H_2 react with 2 moles of N_2 then how much reactant left unreacted after rxn?

$H_2 : N_2$

$\frac{12}{3} : \frac{2}{1}$

$\boxed{4 : 2}$

$N_2 : H_2$

$1 : 3$

$2 : x$

$\boxed{x = 6 \text{ mole}}$

$UR = 12 - 6$

$= \boxed{6 \text{ moles}} \rightarrow$ left unreacted.

Q# $2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O_{(g)}$

if $10 cm^3$ H_2 react with $20 cm^3$ of O_2 then volume of reactant left after the rxn.

sol:

$H_2 : O_2$

$\frac{10}{2} : \frac{20}{1}$

$\boxed{5 : 20}$

$H_2 : O_2$

$2 : 1$

$10 : x$

$2x = 10$

$\boxed{x = 5}$

$U.R = 20 - 5$

$\boxed{= 15 \, cm^3}$

Date: ______ M T W T F S

Volume of Rxn mixture

$$\boxed{V_{R \cdot M} = V_{products} + V_{unreacted\ amount\ of\ E \cdot reagent}}$$

① L·R & E·R
② Product
③ Reacted amount of E·R
④ unreacted amount.

Q# $2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O_{(g)}$

if 50 cm^3 of H_2 react with $10\ cm^3$ O_2 then volume of rxn mixture is:

Sol: $H_2 : O_2$

$\frac{50}{2} : \frac{10}{1}$

$\boxed{25 : 10}$

(E·R = H_2) (L·R = O_2)

product:

$H_2O : O_2$
$2 : 1$
$x : 10$
$\boxed{x = 20\ cm^3}$
⇓
products

Reacted amount:

L·R : E·R
$H_2 : O_2$
$2 : 1$
$x : 10$
$\boxed{x = 20\ cm^3}$

unreacted:

$x = 50 - 20$
$= \boxed{30\ cm^3}$

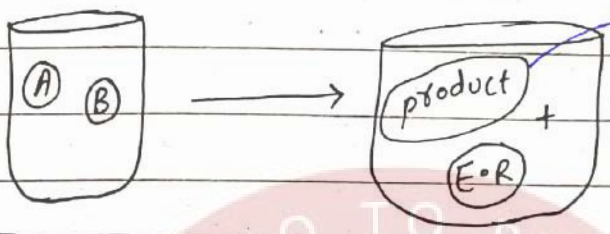
Date: ______ M T W T F S

$V_{R.M} = 20 + 30$

$\boxed{V_{R.M} = 50\,cm^3}$

Decrease in Volume

negligible as compared to gases (V)



solid or liquid

V_p not consider.

$$\boxed{\text{Decrease in } V = V_{initial} - \left(V_{product} + V_{\underset{(unreacted)}{E.R}}\right)}$$

$$\boxed{\text{"} = V_{initial} - V_{\underset{(unreacted)}{ER}}}$$

Q# $2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O_{(g)}$

if $50\,cm^3$ of H_2 react with $10\,cm^3$ of O_2 then theoritical decrease in volume is?

Sol:

V in decrease $= 60 - (20+30)$

$= 60 - 50 = \boxed{10\,cm^3}$ ← V in decrease

$2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O_{(l)}$ → if not mention then standard is taken.

if $50\,cm^3$ of H_2 react with $10\,cm^3$ of O_2 then decrease in volume is?

Date:

x (V_p)

M T W T F S

V decrease = 60 − 30

$\boxed{= 30\ cm^3}$

Q# $2SO_2 + O_2 \longrightarrow 2SO_3$

if $60\ cm^3$ of SO_2 react with $10\ cm^3$ of O_2 then volume of rxn is:

Sol:

L·R = O_2 E·R = SO_2

product:

$O_2 : SO_3$

$1 : 2$

$10 : x$

$\boxed{x = 20\ cm^3}$

Reacted amount of E·R

L·R : E·R

$O_2 : SO_2$

$1 : 2$

$10 : x$

$\boxed{x = 20\ cm^3}$

60 − 20

unreacted $= 40\ cm^3$

$V_{mixture} =$ 20 + 40

$\boxed{= 60\ cm^3}$

Decrease in Volume:

$= 70 - (20 + 40)$

$= 70 - 60$ → ⇓ in volume

$= \boxed{10\ cm^3}$

g → amu   1g = N_A x amu
16g   16 N_A amu

Date: Lec- 19

Percentage Composition

percentage of mass ABC

① %age A + B + C = 100%

② $\boxed{\%age = \frac{\text{atomic mass} \times \text{No. atoms}}{(\text{M. mass of compound})} \times 100}$ → when unknow

$\boxed{\text{M. mass} = \frac{\text{atomic mass} \times \text{No. atoms}}{\%age} \times 100}$ then put ①

mass of sample + element = given

$\boxed{\%age = \frac{\text{weight of element}}{\text{weight of sample}} \times \frac{\text{atomic mass} \times \text{No. atoms}}{\text{Molar mass of compound}} \times 100}$

Comparison:

Same type of element in sample

$\boxed{\%age \propto \text{No required atom}}$

$\boxed{\%age \propto \frac{1}{\text{No. attached atoms}}}$ → when R. atoms same

Date:________ M T W T F S

MCQs

(1) which one has max %age of N by mass?

(a) NO (b) NO_2 (c) N_2O ✓ (d) same

s.type s.type s.type

$\boxed{\%age \propto No. R}$

(2) W.O. has max %age of C by mass?

(a) C_2H_2 ✓ (b) C_2H_4 (c) C_2H_6

(3) max %age of C?

(a) CH_4 (b) C_2H_4 (c) C_3H_8 ✓

MCQs A 2g sample of MgO contain 0.5 g of Mg then %age composition of Mg is.

Sol:

$$\%age = \frac{0.5}{\cancel{2}} \times \frac{\cancel{24}^{6} \times 1}{\cancel{40}} \times \cancel{100}^{5}$$

$\boxed{15\%}$

MCQs An unknown compound contain 5% of Mg. the molar mass of compound is?

24
.20
00
480
480

Sol:

$$M.mass = \frac{24 \times 1}{\cancel{5}} \times \cancel{100}^{20} = \boxed{480g}$$

Date: (M)(T)(W)(T)(F)(S)

MCQs What is %age of Na in NaOH?

sol:

$$\%age = \frac{23 \times 1}{\cancel{40}} \times \cancel{100}^{2.5} = \boxed{57.5\%}$$

23
2.5

5 MCQs ~~A 10g alloy of Zn Sn Mg~~

What is the mass of Mg in a sample of 10% MgO?

sol:

$$mass = \frac{\%age \times Molar\ mass\ of\ compound}{No.\ atoms \times 100}$$

$$= \frac{1\cancel{0} \times 4\cancel{0}}{1 \times 1\cancel{00}} = \boxed{4g}$$

Yield

* Amount of product obtained in a reaction.

① **Theoritical Yield:**

=> ideal yield => calculated yield.
=> Non practical yield.

amount of product obtained from balance chemical equation.

$$2H_2 + O_2 \longrightarrow 2H_2O$$

$$4g + 32g \longrightarrow 36g$$

$$\boxed{36g \longrightarrow 36g}$$

Scanned with CamScanner

Date:

=> not depend on Condition

=> unit = gram/ dm^3/ mol

=> in case of No # particle => $\boxed{\text{No unit}}$

② Actual yield:

* practical yield * experimental yield.

=> Amount of product obtained experimentally.

=> depend on the Condition

=> unit = gram/ dm^3/ mol

=> in case of No. particles = No unit

③ %age yield:

=> efficiency of reaction.

$$\boxed{\%\text{age yield} = \frac{\overbrace{\text{Actual yield}}^{\text{gram}}}{\underbrace{\text{Theoritical yield}}_{\text{gram}}} \times 100}$$

Date: M T W T F S

Volume:

No condition volume

then $\boxed{\%age\ Y = \frac{A \cdot Y}{T \cdot Y} \times 100}$

=> %age yield depend on Condition.

$\boxed{\%age\ Y \propto A \cdot Y}$

$\boxed{\%age\ Y \propto \frac{1}{exp \cdot error}}$

=> $\boxed{\text{No unit}}$

Lec-20

Possibility

$$2H_2 + O_2 \longrightarrow 2H_2O$$

36g   36g

- $A \cdot Y = T \cdot Y \longrightarrow$ possible ideality
- $A \cdot Y > T \cdot Y \longrightarrow$ Not possible
- $A \cdot Y < T \cdot Y \longrightarrow$ possible

Reasons:

experimental error

Date:________ (M)(T)(W)(T)(F)

* Personal error
* Mechanical loss
* Side reaction.
* parallel rxn → step wise rxn. energy loss

Actual yield = ?

=> already given in question

T.Y = ?

=> Compare given Reactant and product.

=> Cross multiplication.

%age yield:

$$\boxed{\%\text{age yield} = \frac{A.Y}{T.Y} \times 100}$$

Q# $3H_2 + N_2 \longrightarrow 2NH_3$

if 12g of H_2 react with N_2 then 30 g of NH_3 formed. A.Y is:

(a) 30g (b) 12g (c) 20g (d) None

Date:

Q#

$$3H_2 + N_2 \longrightarrow 2NH_3$$

if 9 moles of H_2 react with excess of N_2 then T.Y is:

Sol:

$H_2 : NH_3$

$3 : 2$

$9 : x$

$3x = 18$

For %age → always be in "g"

$\boxed{x = 6 \text{ moles}} \times 17 =$

Q#

$$2H_{2(g)} + O_{2(g)} \longrightarrow 2H_2O$$

if $5cm^3$ of O_2 react with excess of H_2 then $2cm^3$ of H_2O formed then T.Y is:

↳ A.Y

Sol:

$O_2 : H_2O$

$1 : 2$

$5 : x$

$\boxed{x = 10cm^3}$

Q#

$$C + O_2 \longrightarrow CO_2$$

if 24 g of carbon react with O_2 then 22g of CO_2 produced. efficiency of rxn is:

$C : CO_2$

$1 : 1$

$2 : x$

$x = 2$ mole

$2 \times 44 = 88g$

88g

$\%age = \frac{\cancel{22}^{11}}{\cancel{88}_{12}} \times 100$

$\boxed{25\%}$

Date:_______ (M)(T)(W)(T)(F)(S)

Q# $2SO_2 + O_2 \longrightarrow 2SO_3$

if $5cm^3$ SO_2 react with O_2 then $2.5\ cm^3$ SO_3 then %age yield:

Sol:

$SO_2 : SO_3$

$2 : 2$

$5 : x$

$x = 5cm^3$

$\%age = \frac{2.5}{5} \times 100$

$= 50\%$

Two Reactant is given

* Find L.R & E.R
* Compare L.R & products.

Q# $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

if 8g CH_4 react with 0.5 mole O_2 then T.Y of CO_2?

L.R $\frac{0.5}{1}$ $\frac{0.5}{2}$

0.5 0 → L.R

$x = \frac{5}{20}$

$O : CO_2$

$2 : 1$

$0.5 : x$

$2x = 0.5$

$x = \frac{0.5}{2}$

$\boxed{0.25}$ mole

Date:

M T W T F S

Q# $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

if 44.4 dm^3 CH_4 at STP react with 32g of O_2 then 11.2 dm^3 of O_2 is produced. then %age yield of CO_2?

Sol:

$A \cdot Y \rightarrow 11.2\,dm^3$

$0.5m = \boxed{22g}$

$CH_4 : O_2$

$\frac{2}{1} \quad \frac{2}{2}$

$2 : 0.5$

$O_2 : CO_2$

$2 : 1$

$1 : x$

$2x = 2$

$x = 1\,mol$

$= \boxed{\quad} 22$

$\frac{22g}{22} \times 100$ $\boxed{100\%}$

(good question)

Q# if theoritical yield is 4 time that of A.Y then %age yield is:

Sol:

$T \cdot Y = 4 \quad A \cdot Y = 1$

%age $\frac{1}{4} \times 100 = \boxed{25\%}$