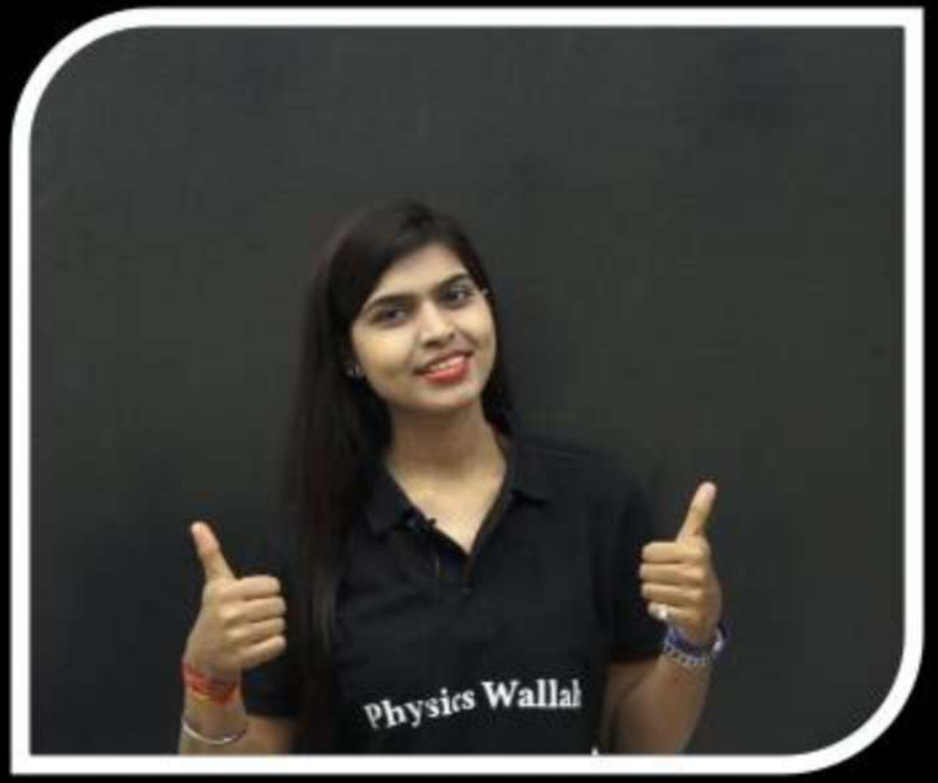
ARJUNA NEET BATCH

SOME BASIC CONCEPTS OF CHEMISTRY

LECTURE - 08



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Objective of today's class

Stoichiometry and stoichiometry calculation ,Limiting Reagents - 2

Limiting Reagents

$n_1 A + n_2 B \rightarrow n_3 C$

$\Downarrow \quad \Downarrow \quad \Downarrow$

$? \quad ?$

Eg $2H_2 + O_2 \rightarrow 2H_2O$

2g 64g ?

$\frac{1}{2} \times \frac{2}{2}$ $\frac{1}{1} \frac{64}{32} 2$

0.5 (2)

Limiting Reagent — Excess Reagent

$0.5 = \frac{1}{2} n_{H_2O}$

$n_{H_2O} = 1$

S-1 Write the Balanced Chemical Rx^n

S-2 Calculate S.M.

S-3 → S.M ↓ → L.R.

Product = S.M. ∴

Q. Liquid benzene (C_6H_6) burns in oxygen according to

$$2C_6H_6(l) + 15O_2(g) \rightarrow 12CO_2(g) + 6H_2O(g).$$

How many liters of O_2 at STP are needed to complete the combustion of 39 g of liquid benzene?

(a) 74 L (b) 11.2 L

(c) 22.4 L (d) 84 L

$2C_6H_6 + 15O_2 \rightarrow 12CO_2 + 6H_2O$

39 g $V_L = ?$

$\Rightarrow \frac{1}{2} \times \eta_{C_6H_6} = \frac{1}{15} \times \eta_{O_2}$

$\Rightarrow \frac{1}{2} \times \frac{39}{78} = \frac{1}{15} \times \frac{V_L}{22.4}$

$\Rightarrow \frac{1}{2} \times \frac{1}{2} = \frac{1}{15} \times \frac{V_L}{22.4}$

$\Rightarrow \frac{1}{4} = \frac{1}{15} \times \frac{V_L}{22.4}$

$\Rightarrow \frac{1}{4} = \frac{1}{15} \times \frac{V_L}{5.6}$

$V_L = 5.6 \times 15$

$\Rightarrow 84L$

Q. 1 mol of $KClO_3$ is thermally decomposed and excess of aluminum is burnt in the gaseous product. How many moles of Al_2O_3 are formed?

(a) 1
(b) 2
(c) 1.5
(d) 3

$2KClO_3 \xrightarrow{\Delta} 2KCl + 3O_2$

1 mole ? ?

$4Al + 3O_2 \rightarrow 2Al_2O_3$

$\frac{3}{2}$? ?

L.R. L.R.

$\Rightarrow \frac{1}{2} \times n_{KClO_3} = \frac{1}{3} n_{O_2}$

$\Rightarrow \frac{1}{2} \times 1 = \frac{1}{3} n_{O_2}$

$n_{O_2} = \frac{3}{2}$

$\Rightarrow \frac{1}{3} \times \frac{3}{2} = \frac{1}{2} \times n_{Al_2O_3}$

$n_{Al_2O_3} = 1$

Q. The amount of zinc required to produce 1.12 ml of H_2 at STP treatment with dilute HCl will be

(a) 65 g
(b) 0.065 g
(c) 32.5×10^{-4} g
(d) 6.5 g

$$Zn + 2HCl \rightarrow ZnCl_2 + H_2$$

? 1.12 ml

$$\frac{1}{1} \times n_{Zn} = \frac{1}{1} n_{H_2}$$

$$\frac{w}{A.M.} = \frac{V_L}{22.4}$$

$$w = \frac{1.12\,ml \times 65}{22.4 \times 1000} \rightarrow 32.5 \times 10^{-3}\ g$$

Q. Volume of CO_2 obtained at STP by the complete decomposition of 9.85 g Na_2CO_3 is

(a) 2.24 litre
(b) Zero
(c) 0.85 litre
(d) 0.56 litre

$Na_2CO_3 \xrightarrow{\Delta} NaO + CO_2$

9.85

Law of V

STP

Standard temp. & press

$T = 0^\circ C$ $P = 1$ atm

A=

COKE

Q. One litre of CO_2 is passed through red hot cake. The volume becomes 1.4 litres at same temperature and pressure. The composition of products is

(a) 0.8 litre of CO_2 and 0.6 litre of CO

(b) 0.8 litre of CO_2 and 0.6 litre of CO

(c) 0.6 litre of CO_2 and 0.8 litre of CO

(d) 0.4 litre of CO_2 and 1.0 litre of CO

$$(g)CO_2 + C_{(s)} \rightarrow 2CO(g)$$

1 L

$\Rightarrow 1-x \qquad 2x \Rightarrow$

$\Rightarrow 1-x+2x=1.4$

$\Rightarrow x = 1.4-1$

$= 0.4\,L$

$CO \Rightarrow 2x = 2\times 0.4 = 0.8\,L$

$CO_2 = 1-x = 1-0.4$

$= 0.6\,L$

Q. How many litre of oxygen at STP is required to burn 60g C_2H_6?

(a) 22.4 L
(b) 11.2 L
(c) 22.4 × 7 L
(d) 8.5 L

$$C_2H_6 + \frac{7}{2}O_2 \rightarrow 2CO_2 + 3H_2O$$

60 g ?

$$\Rightarrow \frac{1}{1} \times n_{C_2H_6} = \frac{2}{7} \times n_{O_2}$$

$$\Rightarrow \frac{60}{30} = \frac{2}{7} \times \frac{V_L}{22.4}$$

$$V_L = 22.4 \times 7$$

Q. The crystalline salt $Na_2SO_4.xH_2O$ on heating loses 55.9% of its mass and becomes anhydrous. The formula of crystalline salt is

(a) $Na_2SO_4.5H_2O$ (b) $Na_2SO_4.7H_2O$

(c) $Na_2SO_4.2H_2O$ (d) $Na_2SO_4.10H_2O$

$$Na_2SO_4.\underline{x}H_2O \xrightarrow{\Delta} Na_2SO_4 + xH_2O$$

100% → 44.1 + 55.9

$$\frac{1}{1}\eta_{Na_2SO_4} = \frac{1}{x}\eta_{H_2O}$$

$$\Rightarrow \frac{44.1}{142} = \frac{1}{x} \times \frac{55.9}{18}$$

$$\Rightarrow x \approx 10$$

Q 10 g MnO_2 on x^n with HCl forms 2.24 L of Cl_2 g at NTP, the percentage impurity of MnO_2 is ?

$$MnO_2 + 4HCl \longrightarrow MnCl_2 + Cl_2 + 2H_2O$$

10 g — 2.24 L

$$\frac{1}{1} \times \eta_{MnO_2} \times \frac{x}{100} = \frac{1}{1} \eta_{Cl_2}$$

$$\Rightarrow \frac{10}{87} \times \frac{x}{100} = \frac{2.24 \times 10}{22.4 \times 100}$$

x = % Purity = 87%

% Impurity = 100 − 87

= 13%

Q. A mixture of 2.3 g formic acid and 4.5 g oxalic acid is treated with conc. H_2SO_4. The evolved gaseous mixture is passed through KOH pellets. Weight (in g) of the remaining product at STP will be

[NEET-2018]

(a) 1.4 (b) 3.0

(c) 4.4 (d) 2.8

$HCOOH \xrightarrow[-H_2O]{\text{Conc } H_2SO_4} CO$

2.3 g ?

$\Rightarrow \frac{1}{1} n_{HCOOH} = \frac{1}{1} n_{CO} \Rightarrow \frac{2.3}{10 \times 46} = \frac{w}{28}$

$w_1 = 1.4\ g$

$COOH$
$|$
$COOH \xrightarrow{\text{Conc. } H_2SO_4} CO + CO_2 \xrightarrow[CO_2 \text{ absorb}]{KOH} CO$

4.5 g ?

$$\frac{1}{1} n_{\text{oxalic acid}} = \frac{1}{1} n_{CO_2}$$

$$\Rightarrow \frac{4.5}{10 \times 90} = \frac{\omega_2}{28}$$

$$\omega_2 = 1.4\,g$$

$$\therefore \omega_1 + \omega_2$$

$$1.4 + 1.4$$

$$2.8\,g$$

$$\begin{array}{l} \text{COOH} \\ | \\ \text{COOH} \end{array}$$

$$\Rightarrow \frac{24}{64} \quad \frac{2}{90}$$

Q. Suppose the elements X and Y combine to form two compounds XY_2 and X_3Y_2. When 0.1 mole of XY_2 weighs 10g and 0.05 mole of X_3Y_2 weighs 9g, the atomic weights of X and Y are

[NEET-Phase-2-2016]

(a) 40,30
(b) 60,40
(c) 20,30
(d) 30,20

$0.1\,(XY_2) = 10g$

$\Rightarrow \frac{0.1}{10}(x+2y) = 10$

$\Rightarrow x + 2y = 100 \quad -(1)$

$\times 5$

$(X_3Y_2)\,0.05 = 9g$

$(3X+2Y)\,\frac{0.05}{100} = 9$

$15X + 10Y = 900 \quad -(2)$

$5x + 10y = 500$

$15x + 10y = 900$

$-10x = -400$

$x = 40$

Put in (1)

$$X + 2Y = 100$$

$$2Y = 100 - 40$$

$$2Y = 60$$

$$Y = \frac{60}{2}$$

$$Y = 30$$

Q. What is the mass of the precipitates formed when 50 mL of 16.9% (w/v) solution of $AgNO_3$ is mixed with 50mL of 5.8% (w/v) NaCl solution? [Re-AIPMT -2015]

(Ag = 107.8 , N = 14, O = 16 , Na = 23, Cl = 35.5)

(a) 7g

(b) 14g

(c) 28g

(d) 3.5g

w/v %

$AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$

50ml of 16.9% (w/v) $\Rightarrow \frac{50ml \times 16.9g}{100ml} = 8.45g$

50ml of 5.8% (w/v) $\frac{50ml \times 5.8g}{100ml} = 2.9g$

w = ?

$$AgNO_3 + NaCl \longrightarrow AgCl + NaNO_3$$

8.45 2.9 ?

$\frac{1}{1} n_{AgNO_3}$ $\frac{1}{1} n_{NaCl}$

$\Rightarrow \frac{8.45}{170}$ $\frac{1}{1} \frac{2.9}{58.5}$

$\Rightarrow 0.05$ 0.05

$\Rightarrow 0.05 = \frac{1}{1} n_{AgCl}$

$0.05 = \frac{\omega}{143.5}$

$\omega \Rightarrow 143.5 \times 0.05$

$\Rightarrow 7.00$ 7g

Q. 20.0 g of a magnesium carbonate sample decomposes on heating to give carbon dioxide and 8.0g magnesium oxide. What will be the percentage purity of magnesium carbonate in the sample? (At. Wt : Mg = 24) [Re-AIPMT -2015]

(a) 60 (b) 84

(c) 75 (d) 96

$$MgCO_3 \longrightarrow MgO + CO_2$$

20g 8.0g

$$\frac{x}{100} \times 20 \times \frac{1}{1} \times n_{MgCO_3} = \frac{1}{1} n_{MgO}$$

$$x \Rightarrow \frac{20}{100} \times \frac{x}{84} = \frac{8}{40}$$

$$x = 84\%$$

Q. 1.0 g of magnesium is burnt with 0.56 g O_2 in a closed vessel. Which reactant is left in excess and how much? (At. Wt. Mg = 24 : O = 16)

[AIPMT -2014]

(a) Mg, 0.16 g

(b) O_2, 0.16 g

(c) Mg, 0.44 g

(d) O_2, 0.28 g

Q. When 22.4 litre of H_2 (g) is mixed with 11.2 litres of Cl_2(g), each at S.T.P, the moles of HCl(g) formed is equal to

[AIPMT - 2014]

(a) 1 mol of HCl (g)

(b) 2 mol of HCL (g)

(c) 0.5 mol of HCl (g)

(d) 1.5 mol of HCl (g)

Q. 10 g of hydrogen and 64 g of Oxygen were filled in a steel vessel and exploded. Amount of water produced in this reaction will be

[AIPMT - 2014]

(a) 3 mol
(b) 4 mol
(c) 1 mol
(d) 2 mol

Q. How many moles are three in 1 metre^3 of any gas at NTP ? ($1m^3 = 10^3$ litre)

Q. How many molecules of CO_2 are contained in 1 litre of air if the volume content of CO_2 is 0.03 % at NTP?

Q. The measured density at NTP of a gaseous sample of a compound was found to be 1.78 g/L. What is the weight of 1 mole of the gaseous sample?

Q. 600 ml of a mixture of O_3 and O_2 weighs 1 gm at NTP? Calculate the volume of ozone in the mixture.

Q. How many litre of liquid CCl_4 (d = 1.5 g/cc) must be measured out to contain 1×10^{25} CCl_4 molecules.

Q. What mass of NaCl would contain the same total no. of ions as 245 gm of $MgCl_2$.

thanks
for watching