JEE Mains 2019 Chapter wise Question Bank

Mole Concept - Questions

Q1

A solution of sodium sulfate contains 92 g of Na^+ ions per kilogram of water. The molality of Na^+ ions in that solution in mol kg^{-1} is:

(1) 12 (2) 4
(3) 8 (4) 16

9 Jan Morning

Q2

For the following reaction the mass of water produced from 445 g of $C_{57}H_{110}O_6$ is:

$2C_{57}H_{110}O_6(s) + 163\ O_2(g) \rightarrow 114CO_2(g) + 110\ H_2O(1)$

(1) 490 g (2) 445 g
(3) 495 g (4) 890 g

9 Jan Evening

Q3

A mixture of 100 m mol of $Ca(OH)_2$ and 2 g of sodium sulphate was dissolved in water and the volume was made up to 100 mL. The mass of calcium sulphate formed and the concentration of OH^- in resulting solution, respectively, are : (Molar mass of $Ca(OH)_2$, Na_2SO_4 and $CaSO_4$ are 74, 143 and 136 g mol^{-1}, respectively; K_{sp} of $Ca(OH)_2$ is 5.5×10^{-6})

(1) 1.9 g, 0.28 mol L^{-1}
(2) 13.6 g, 0.28 mol L^{-1}
(3) 1.9 g, 0.14 mol L^{-1}
(4) 13.6 g, 0.14 mol L^{-1}

10 Jan Morning

Q4

A 10 mg effervescent tablet containing sodium bicarbonate and oxalic acid releases 0.25 mL of CO_2 at T = 298.15K and P = 1 bar. If molar volume of CO_2 is 25.0 L under such condition, what is the percentage of sodium bicarbonate in each tablet ?

[Molar mass of $NaHCO_3$ = 84 g mol^{-1}]

(1) 0.84 (2) 33.6
(3) 16.8 (4) 8.4

11 Jan Morning

Q5

25 mL of the given HCl solution requires 30 mL of 0.1 M sodium carbonate solution. What is the volume of this HCl solution required to titrate 30 mL of 0.2 M aqueous NaOH solution?

(1) 25 mL (2) 75 mL
(3) 50 mL (4) 12.5 mL

11 Jan Evening

Q6

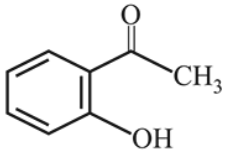
50 mL of 0.5 M oxalic acid is needed to neutralize 25 mL of sodium hydroxide solution. The amount of NaOH in 50 mL of the given sodium hydroxide solution is:

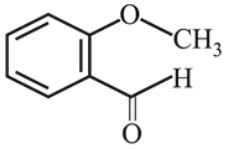
(1) 40 g (2) 10 g
(3) 20 g (4) 80 g

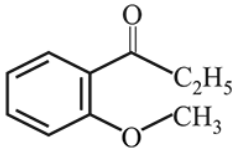
12 Jan Morning

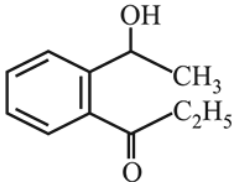
Q7

An organic compound neither reacts with neutral ferric chloride solution nor with Fehling solution. It however, reacts with Grignard reagent and gives positive iodoform test. The compound is :

(1) 

(2) 

(3) 

(4) 

8 April Evening

Q8

For a reaction,
$N_2(g) + 3H_2(g) \rightarrow 2\ NH_3(g)$; identify dihydrogen ($H_2$) as a limiting reagent in the following reaction mixtures.

(1) 56 g of N_2 + 10 g of H_2
(2) 35 g of N_2 + 8 g of H_2
(3) 28 g of N_2 + 6 g of H_2
(4) 14 g of N_2 + 4 g of H_2

9 April Morning

Q9

At 300 K and 1 atmospheric pressure, 10 mL of a hydrocarbon required 55 mL of O_2 for complete combustion, and 40 mL of CO_2 is formed. The formula of the hydrocarbon is :

(1) C_4H_{10} (2) C_4H_6 (3) C_4H_7Cl (4) C_4H_8

10 April Morning

Q10

The minimum amount of $O_2(g)$ consumed per gram of reactant is for the reaction : (Given atomic mass : Fe = 56, O = 16, Mg = 24, P = 31, C = 12, H = 1)

(1) $4\ Fe(s) + 3O_2(g) \rightarrow 2\ Fe_2O_3(s)$
(2) $P_4(s) + 5O_2(g) \rightarrow P_4O_{10}(s)$
(3) $C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O\ (l)$
(4) $2Mg(s) + O_2(g) \rightarrow 2MgO(s)$

10 April Evening

Q11

5 moles of AB_2 weigh 125×10^{-3} kg and 10 moles of A_2B_2 weigh 300×10^{-3} kg. The molar mass of A (M_A) and molar mass of B (M_B) in kg mol^{-1} are:

(1) $M_A = 10\times10^{-3}$ and $M_B = 5\times10^{-3}$
(2) $M_A = 50\times10^{-3}$ and $M_B = 25\times10^{-3}$
(3) $M_A = 25\times10^{-3}$ and $M_B = 50\times10^{-3}$
(4) $M_A = 5\times10^{-3}$ and $M_B = 10\times10^{-3}$

12 April Morning

JEE Mains 2019 Chapter wise Question Bank

Mole Concept - Answers

Q1

(2) Number of moles in 92 g of $Na^+ = \frac{92}{23} = 4$ moles

$$\text{Molality } (m) = \frac{\text{Number of moles}}{\text{Mass of solvent (in kg)}}$$

$$\therefore \quad m = \frac{4}{1} = 4 \text{ mol kg}^{-1}$$

9 Jan Morning

Q2

(3) For the given reaction:

$$2C_{57}H_{110}O_6(s) + 163\ O_2(g) \rightarrow 114\ CO_2(g) + 110\ H_2O(l)$$

$$n = \frac{445}{890} = 0.5$$

Now, moles of water $= \frac{110}{2} \times 0.5 = 27.5$

$\therefore$ Mass of water $= 27.5 \times 18 = 495$ g

9 Jan Evening

Q3

(1) $Na_2SO_4 + Ca(OH)_2 \rightarrow CaSO_4 + 2NaOH$

m mol of $Na_2SO_4 = \frac{2 \times 1000}{143} = 13.98$ m mol

m mol of $CaSO_4$ formed = 13.98 m mol

Mass of $CaSO_4$ formed

$= 13.98 \times 10^{-3} \times 136 = 1.90$ g

m mol of NaOH = 28 m mol

$$Ca(OH)_2 \rightleftharpoons \underset{S}{Ca^{2+}} + \underset{2S+0.28}{2OH^-}$$

Value of 'S' will be negligible so

$$[OH^-] = \frac{0.028}{0.1} = 0.28 \text{ mol L}^{-1}$$

10 Jan Morning

Q4

(4) $2NaHCO_3 + H_2C_2O_4 \longrightarrow Na_2C_2O_4 + 2CO_2 + 2H_2O$

$$\text{Moles of } CO_2 \text{ evolved} = \frac{0.25}{25 \times 10^3} = 10^{-5}$$

$\therefore$ Moles of $NaHCO_3 = 10^{-5}$

$\therefore$ Mass of $NaHCO_3 = 84 \times 10^{-5}$ g

$= 0.84 \times 10^{-3}$ g

$= 0.84$ mg

$\therefore$ % by weight $= \frac{0.84}{10} \times 100 = 8.4\%$

11 Jan Morning

Q5

(1) 25 mL of HCl solution requires 30 mL of 0.1 M Na_2CO_3 solution.

$\because$ $N_1V_1 = N_2V_2$

$\therefore$ $25 \times N_1 = 30 \times 0.2$ (0.1 M Na_2CO_3 = 0.2N Na_2CO_3)

$N_1 = \frac{6}{25} = 0.24$N

Now, HCl solution is titrated with NaOH solution.

$M_1V_1 = M_2V_2$; 0.24 N HCl = 0.24 M HCl

$\therefore$ $V \times 0.24 \times 1 = 30 \times 0.2 \times 1 \Rightarrow V = 25$ mL

11 Jan Evening

Q6

(Bonus)

Oxalic acid		Sodium hydroxide
N_1V_1	=	N_2V_2
$(2 \times M_1)V_1$	=	M_2V_2
$2 \times 0.5 \times 50$	=	$M_2 \times 25$
M_2	=	2

$$\text{Molarity} = \frac{\text{No. of moles}}{\text{Vol.(L)}}$$

$$2 = \frac{\text{No. of moles}}{50/1000}$$

$$\text{No. of moles} = \frac{1}{10} = 0.1$$

$$\text{No. of moles} = \frac{W}{\text{Molar mass}}$$

$$W = 0.1 \times 40 = 4 \text{ g}$$

No option is correct.

12 Jan Morning

Q7

(4) CH_4 has one atom of carbon among 5 atoms (1C + 4H)

$\therefore$ Mole % of C $= \frac{1}{5} \times 100 = 20\ \%$

8 April Evening

Q8

(1) According to the stoichiometry of balanced equation

28 g N_2 react with 6 g H_2

$$\underset{\substack{1 \text{ mole} \\ 28 \text{ g}}}{N_2} + \underset{\substack{3 \text{ mole} \\ 6 \text{ g}}}{3H_2} \longrightarrow 2NH_3$$

$\therefore$ For 56 g of N_2, 12 g of H_2 is required.

9 April Morning

Q9

(2) Let the hydrocarbon be C_xH_y

$$CxH_y + \left(x + \frac{y}{4}\right)O_2 \longrightarrow xCO_2 + \frac{y}{2}H_2O$$

Before combustion:	10 mL	55 mL	0
After combustion:	0	$55 - 10\left(x + \frac{y}{4}\right)$	10 x

Volume of CO_2, $10x = 40$; $x = 4$

$$55 - 10\left(x + \frac{y}{4}\right) = 0; \quad y = 6$$

$\therefore$ Hydrocarbon is C_4H_6

10 April Morning

Q10

(1) (1) $4Fe + 3O_2 \longrightarrow 2Fe_2O_3$

1 g Fe requries $= \frac{3 \times 32}{4 \times 56} = 0.43$ g of oxygen

(2) $P_4 + 5O_2 \longrightarrow P_4O_{10}$

1 g of P requries $= \frac{5 \times 32}{31 \times 4} = 1.3$ g of oxygen

(3) $C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O$

1 g of C_3H_8 requires $= \frac{5 \times 32}{44} = 3.6$ g of O_2

(4) $2Mg + O_2 \longrightarrow 2MgO$

1 g requires $= \frac{32}{2 \times 24}$ g $= 0.66$ g of O_2

10 April Evening

Q11

(4) 5 mol AB_2 weighs 125 g

$\therefore$ $AB_2 = 25$ g/mol

10 mol A_2B_2 weighs 300 g

$\therefore$ $A_2B_2 = 30$ g/mol

$\therefore$ Molar mass of A(M_A) = 5 g or 5×10^{-3} kg

Molar mass of B (M_B) = 10 g or 10×10^{-3} kg

12 April Morning