MOLE CONCEPT

1. Mass of methane required to produce 22 g of CO_2 after complete combustion is _____ g.
(Given Molar mass in g mol^{-1} C = 12.0
H = 1.0
O = 16.0)

2. The quantity which changes with temperature is:
(1) Molarity (2) Mass percentage
(3) Molality (4) Mole fraction

3. Volume of 3 M NaOH (formula weight 40 g mol^{-1}) which can be prepared from 84 g of NaOH is _____ $\times 10^{-1}$ dm^3.

4. A solution of H_2SO_4 is 31.4% H_2SO_4 by mass and has a density of 1.25g/mL.The molarity of the H_2SO_4 solution is_____M (nearest integer)
[Given molar mass of H_2SO_4 = 98g mol^{-1}]

5. Molality of 0.8 M H_2SO_4 solution (density 1.06 g cm^{-3}) is _____ $\times 10^{-3}$ m.

6. If 50 mL of 0.5 M oxalic acid is required to neutralise 25 mL of NaOH solution, the amount of NaOH in 50 mL of given NaOH solution is _____ g.

7. 0.05 cm thick coating of silver is deposited on a plate of 0.05 m^2 area. The number of silver atoms deposited on plate are_____ $\times 10^{23}$.
(At mass Ag = 108, d = 7.9 g cm^{-3})

8. The mass of sodium acetate (CH_3COONa) required to prepare 250 mL of 0.35 M aqueous solution is _____ g.
(Molar mass of CH_3COONa is 82.02 g mol^{-1})

9. If a substance 'A' dissolves in solution of a mixture of 'B' and 'C' with their respective number of moles as n_A, n_B and n_C, mole fraction of C in the solution is:

(1) $\frac{n_C}{n_A \cdot n_B \cdot n_C}$ (2) $\frac{n_C}{n_A + n_B + n_C}$

(3) $\frac{n_C}{n_A - n_B - n_C}$ (4) $\frac{n_B}{n_A + n_B}$

10. Number of moles of methane required to produce 22g $CO_{2(g)}$ after combustion is x × 10^{-2} moles. The value of x is

11. A sample of $CaCO_3$ and $MgCO_3$ weighed 2.21 g is ignited to constant weight of 1.152 g. The composition of mixture is :
(Given molar mass in g mol^{-1}
$CaCO_3$:100, MgCO :84)
$_3$

(1) 1.187 g $CaCO_3$ +1.023 g $MgCO_3$

(2) 1.023 g $CaCO_3$ +1.023 g $MgCO_3$

(3) 1.187 g $CaCO_3$ +1.187 g $MgCO_3$

(4) 1.023 g $CaCO_3$ +1.187 g $MgCO_3$

12. The molarity of 1L orthophosphoric acid (H_3PO_4) having 70% purity by weight (specific gravity 1.54 g cm^{-3}) is _____M.
(Molar mass of $H_3PO_4 = 98$ g mol^{-1})

13. Consider the following reaction:
$3PbCl_2 + 2(NH_4)_3PO_4 \rightarrow Pb_3(PO_4)_2 + 6NH_4Cl$
If 72 mmol of $PbCl_2$ is mixed with 50 mmol of $(NH_4)_3PO_4$, then amount of $Pb_3(PO_4)_2$ formed is …… mmol. (nearest integer)

14. 10 mL of gaseous hydrocarbon on combustion gives 40 mL of CO_2(g) and 50 mL of water vapour. Total number of carbon and hydrogen atoms in the hydrocarbon is _____.

15. Combustion of glucose ($C_6H_{12}O_6$) produces CO_2 and water. The amount of oxygen (in g) required for the complete combustion of 900 g of glucose is:
[Molar mass of glucose in g mol^{-1} = 180]
(1) 480 (2) 960
(3) 800 (4) 32

SOLUTIONS

1. Ans. (8)

Sol. $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

Moles of $CO_2 = \frac{22}{44} = 0.5$

So, required moles of $CH_4 = 0.5$

Mass = 0.5 × 16 = 8gm

2. Ans. (1)

Sol. $\text{Molarity} = \frac{\text{Moles of solute}}{\text{Volume of solution}}$

Since volume depends on temperature, molarity will change upon change in temperature.

3. Ans. (7)

Sol. $M = \frac{n_{NaOH}}{V_{sol}(\text{in L})} \Rightarrow 3 = \frac{(84/40)}{V}$

$\Rightarrow V = 0.7\text{L} = 7 \cdot 10^{-1}\text{L}$

4. Ans. (4)

Sol. $M = \frac{n_{solute}}{V} \cdot 1000$

$= \frac{\left(\frac{31.4}{98}\right)}{\left(\frac{100}{1.25}\right)} \cdot 1000 = 4.005 \approx 4$

5. Ans. (815)

Sol. $m = \frac{M \cdot 1000}{d_{sol} \cdot 1000 - M \cdot \text{Molar mass}_{solute}}$

815×10^{-3} m

6. Ans. (4)

Sol. Equivalent of Oxalic acid = Equivalents of NaOH

$50 \times 0.5 \times 2 = 25 \times M \times 1$

$M_{NaOH} = 2M$

W_{NaOH} in 50ml = $2 \times 50 \times 40 \times 10^{-3}$ g = 4g

7. Ans. (11)

Sol. Volume of silver coating

= 0.05 × 0.05 × 10000 = 25 cm^3

Mass of silver deposited = 25 × 7.9 g

Moles of silver atoms = $\frac{25 \cdot 7.9}{108}$

Number of silver atoms = $\frac{25 \cdot 7.9}{108} \cdot 6.023 \cdot 10^{23}$

= 11.01×10^{23}

Ans. 11

8. Ans. (7)

Sol. Moles = Molarity × Volume in litres

= 0.35 × 0.25

Mass = moles × molar mass

= 0.35 × 0.25 × 82.02 = 7.18 g

9. Ans. (2)

Sol. Mole fraction of C = $\frac{n_C}{n_A + n_B + n_C}$

10. Ans. (50)

Sol. $CH_{4(g)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(\ell)}$

$n_{CO_2} = \frac{22}{44} = 0.5$ moles

So moles of CH_4 required = 0.5 moles

i.e. 50×10^{-2} mole

x = 50

11. Ans. (1)

Sol:- $CaCO_3(s) \xrightarrow{\Delta} CaO(s) + CO_2(g)$

$MgCO_3(s) \xrightarrow{\Delta} MgO(s) + CO_2(g)$

Let the weight of $CaCO_3$ be x gm

$\therefore$ weight of $MgCO_3 = (2.21 - x)$gm

Moles of $CaCO_3$ decomposed = moles of CaO formed

$\frac{x}{100}$ = moles of CaO formed

$\therefore$ weight of CaO formed $= \frac{x}{100} \cdot 56$

Moles of $MgCO_3$ decomposed = moles of MgO formed

$\frac{(2.21 - x)}{84} =$ moles of MgO formed

$\therefore$ weight of MgO formed $= \frac{2.21 - x}{84} \cdot 40$

$\Rightarrow \frac{2.21 - x}{84} \cdot 40 + \frac{x}{100} \cdot 56 = 1.152$

$\therefore x = 1.1886$ g = weight of $CaCO_3$

& weight of $MgCO_3 = 1.0214$ g

12. Ans. (11)

Sol. Specific gravity (density) = 1.54 g/cc.

Volume $= 1\text{L} = 1000$ ml

Mass of solution $= 1.54 \cdot 1000 = 1540$ g

% purity of H_2SO_4 is 70%

So weight of $H_3PO_4 = 0.7 \cdot 1540 = 1078$ g

Mole of $H_3PO_4 = \frac{1078}{98} = 11$

Molarity $= \frac{11}{1\text{L}} = 11$

13. Ans. (24)

Sol. Limiting Reagent is $PbCl_2$

mmol of $Pb_3(PO_4)_2$ formed

$= \frac{\text{mmol of } PbCl_2 \text{ reacted}}{3}$

= 24 mmol

14. Ans. (14)

Sol. $\boxed{\begin{matrix}CxHy \\ 10\text{ml}\end{matrix}} + O_2 \rightarrow CO_2 + H_2O$

$$CxHy + \left(x + \frac{y}{4}\right)O_2 \rightarrow \underset{10x}{xCO_2} + \underset{5y}{\frac{y}{2}H_2O}$$

10x = 40

x = 4

5y = 50

y = 10

C_4H_{10}

15. Ans. (2)

Sol. $C_6H_{12}O_{6(s)} + 6O_{2(g)} \rightarrow 6CO_{2(g)} + 6H_2O_{(\ell)}$

$\frac{900}{180}$

= 5 mol 30 mol

Mass of O_2 required = 30 × 32 = 960 gm