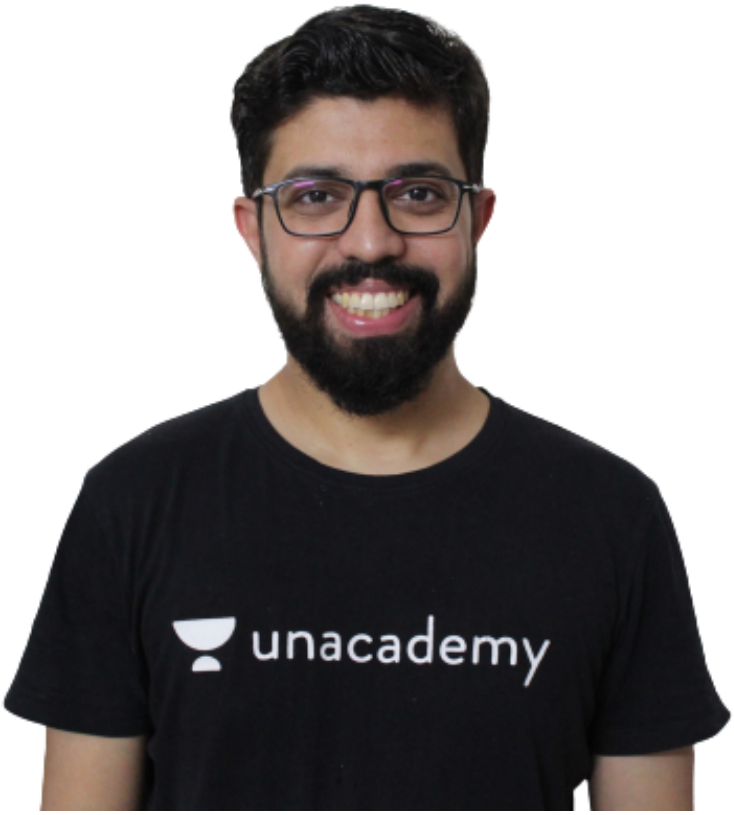
Mole Concept

DPP-4 Solutions



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1. **57.28mL**

Sol. Moles of oxalic acid = $\frac{3.225}{90} = 0.0358$

5 moles of oxalic acid reacts with 2 moles of $KMnO_4$

0.0358 moles of oxalic acid reacts with = 0.01432 moles of $KMnO_4$

$V = \frac{0.01432}{0.250} = 0.05728L$

= 57.28 mL

2. **1.3925 M**

Sol. $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

moles of NaOH = 0.3

Let conc. of H_2SO_4 = M

$\Rightarrow$ Moles of H_2SO_4 = 0.1 M

1 mole of H_2SO_4 reacts with 2 moles of NaOH

(0.1M) moles H_2SO_4 reacts with (0.2 M) moles of NaOH

NaOH left = (0.3 – 0.2 M) moles

$NaOH + HCl \rightarrow NaCl + H_2O$

1 mole of NaOH reacts with 1 mole of HCl

$\Rightarrow$ moles of HCl = 0.5 × 0.043 = 0.0215 moles

$\therefore$ 0.3 – 0.2 M = 0.0215

M = 1.3925M

3. **66.67 mL**

Sol. $HCl + NaHCO_3 \rightarrow NaCl + CO_2 + H_2O$

moles of $NaHCO_3$ = $\frac{16.8}{84} = 0.2$

1 moles of $NaHCO_3$ reacts with 1 mole of HCl

$\therefore$ moles of HCl = 0.2 moles

$\therefore$ 3 × V = 0.2

V = 66.67 mL.

4. **450 mL**

Sol. $M_1V_1 = M_2V_2$

200 × 0.65 = 0.2 × V

v = 650mL

$\Rightarrow$ H_2O added = 650 – 200 = 450mL

5. **1.25 M**

Sol. $M_1V_1 + M_2V_2 = MV$

(2×4) + (3×1.5) = 10 × M

M = 1.25 M

6. **426 ml**

Sol. $M_1V_1 = M_2V_2$

70 × 0.0913 = 0.0150 × V_2

V_2 = 426 mL

7. **2.14L of 0.4M solution**

Sol. Let Volume of 2.5 M NaOH = VL

$\Rightarrow$ Volume of 0.4 M NaOH = (3 – V) L

$M_1V_1 + M_2V_2 = MV$

$\therefore$ 2.5V + 0.4 (3 – V) = 3 × 1

$\Rightarrow$ V = 0.857L

$\Rightarrow$ Volume of 2.5M NaOH = 0.857L

Volume of 0.4M NaOH = 2.14L

8. **(a) 0.8M Na^+, 0.8M Cl^-**

(b) 0.8M Ba^{2+}, 1.6M Cl^-

(c) 3.6M Na^+, 3.6M Cl^-

(d) 1.6M Ba^{2+}, 3.2M Cl^-,

(e) 1.8M Na^+, 1.6M Ba^{2+}, 5M Cl^-.

Sol. (a) $M_1V_1 = M_2V_2$

200 × 2 = 500 × M $\quad M_{NaCl}$ = 0.8M

$\Rightarrow$ $[Na^+]$ = 0.8M

$[Cl^-]$ = 0.8 M

(b) $M_1V_1 = M_2V_2$

200 × 2 = 500 × M $\quad M_{BaCl_2}$ = 0.8M

$\Rightarrow$ $[Ba^{+2}]$ = 0.8M

$[Cl^-]$ = 1.6M

(c) $M_1V_1 + M_2V_2 = MV$

200 × 3 + 300 × 4 = 500 × M

$\Rightarrow$ M_{NaCl} = 3.6M

$[Na^+]$ = 3.6M

$[Cl^-]$ = 3.6M

(d) $M_1V_1 + M_2V_2 = MV$

200 × 2 + 400 × 3 = M × 1000

$\Rightarrow$ M_{BaCl_2} = 1.6M

$[Ba^{+2}]$ = 1.6M

$[Cl^-]$ = 1.6 × 2 = 3.2M

(e) moles of NaCl = 3 × 0.3 = 0.9 mol.

moles of $BaCl_2$ = 4 × 0.2 = 0.8 mol.

$\Rightarrow$ moles of Na^+ = 0.9 mol

moles of Ba^{+2} = 0.8 mol

moles of Cl^- = 0.9 + 2 × 0.8 = 2.5 mol

$[Na^+] = \frac{0.9}{0.5} = 1.8$ M

$[Ba^{+2}] = \frac{0.8}{0.5} = 1.6M$

$[Cl^-] = \frac{2.5}{0.5} = 5M$

9. **56.03mL**

Sol. we are diluting 95% alcohol to 30% alcohol by wt.

$\Rightarrow$ Mass of solute will remain same

Lets assume we have 'V' mL of 95% alcohol by wt.

Mass of solution = (0.809V) g

100g solution contains = 95g alcohol

(0.809V)g solution contains = (0.768V)g alcohol

Now same mass of alcohol will be present in 30% alcohol by wt.

mass of soln. = 150 × 0.957g

= 143.5g

100g solution contains = 30g alcohol

143.5g solution contains = 43.05g

$\therefore$ 0.768V = 43.05

V = 56.05 mL

10. **0.08865g**

Sol. $2C_4H_{10}S + NaOCl \rightarrow C_8H_8S_2 + NaCl + H_2O$

milli-moles of NaOCl = 5×0.0985

= 0.4925 milli moles

1 mole of NaOCl reacts with 180g of $C_4H_{10}S$

$\Rightarrow 0.4925\times10^{-3}$ moles NaOCl reacts with

$= 180 \times 0.4925 \times 10^{-3}$ g

= 0.08865g of $C_4H_{10}S$

11. **0.9375 g**

Sol. $CaCO_3$ (s) + 2HCl (aq) $\rightarrow$ $CaCl_2$ (aq) + CO_2 (g) + H_2O (ℓ)

1 mol of $CaCO_3$ react with = 2 moles of HCl.

moles of HCl = $0.75 \times 25 \times 10^{-3} = 0.01875$

2 moles of HCl react with = 1 mol $CaCO_3$

0.01875 moles of HCl react with

$= 9.375 \times 10^{-3}$ moles of $CaCO_3$

mass of $CaCO_3 = 9.375 \times 10^{-3} \times 100$

= 0.9375 g

12. **(b)**

Sol. $C_6H_5COOH + CH_3OH \rightarrow C_6H_5COOCH_3 + H_2O$

mass of $CH_3OH = 70 \times 0.79$

= 55.3g

122 g $C_6H_5COOH \equiv$ 32 g CH_3OH

24.4 g $C_6H_5COOH \equiv$ 6.4 g CH_3OH

C_6H_5COOH is the LR.

122 g C_6H_5COOH gives $\equiv$ 136 g ester

24.4 g C_6H_5COOH gives = 27.2 g ester

$$\% \text{ yield} = \frac{21.6}{27.2}\times100 = 79.4\%$$

13. **(c)**

Sol. 90g H_2SO_4 is present in 100g solution

$\Rightarrow$ mass of solute = 90g

moles of solute = 90/98 mol

ρ_{soln} = 1.8g/mL

$$\rho_{soln.} \frac{\text{mass of solution}}{\text{volume of solution}}$$

$$1.8 = \frac{100}{V_{soln.}}$$

$V_{soln.}$ = 55.55mL

$$\text{Molarity} = \frac{90/98}{55.55\times10^{-3}} = 16.5M$$

$M_1V_1 = M_2V_2$

$16.5 \times V = 0.2 \times 1$

V = 0.012L = 12 mL

14. **(a)**

Sol. conc. of Na^+ would be due to NaCl only

$M_1V_1 = M_2V_2$

$200 \times 5 = M\ (100 + 200)$

M = 10/3

$$\text{ppm} = \frac{\text{mass of solute}}{\text{mass of solution}}\times10^6 = \frac{23}{300}\times10^6$$

= 76666.65 ppm