PROBLEMS AND SOLUTIONS (LAB MANUAL, PAGE 26 & 27)

15. Calculate the amount of oxalic acid ($C_2H_2O_4.2H_2O$, MW 126) for the preparation of 250 ml 0.1 N oxalic acid solutions.

Solution: We know, $$C = \frac{W \times 1000}{M \times V}$$

Given that, C = 0.1N, V = 250ml, M = 63 (gram-equiv-wt of oxalic acid), W = ?

Therefore, rearranging the above formulae,

W = (C×M×V)/1000 = (0.1×63×250)/1000 = 1.575 gm (Ans)

16. Calculate the normality of HCl solution if 5gm of HCl (MW 36.5) is taken in 250 ml solution.

Solution: We know, $$C = \frac{W \times 1000}{M \times V}$$

Given that, W = 5 gm, V = 250ml, M = 36.5 (gram-equiv-wt of oxalic acid), C = ?

Therefore, putting the values in the above formulae,

C = (5×1000)/(36.5×250) = 0.548 N (Ans)

17. If 15ml 0.25 N HCl solutions react with 20ml NaOH solution, then calculate the normality of NaOH solution.

Solution: We know, $S_{base} \times V_{base} = S_{acid} \times V_{acid}$

Given that, V_{acid} = 15 ml, S_{acid} = 0.25 N, V_{base} = 20 ml, S_{base} = ?

Therefore, rearranging the above formulae,

$S_{base} = (S_{acid} \times V_{acid})/ V_{base}$ = (0.25 × 15)/20 = 0.1875 N (Ans)

18. Suppose, 9.5 ml of oxalic acid solution and 11.5 ml of dil. HCl solution are required to titrate 10 ml NaOH solution separately. Calculate the normality of NaOH and dil. HCl solutions. [Given that oxalic acid solution is 0.13(N)].

Solution: We know, $S_{base} \times V_{base} = S_{acid} \times V_{acid}$

(A) Given that, $V_{oxalic\ acid}$ = 9.5 ml, $S_{oxalic\ acid}$ = 0.13 N, V_{NaOH} = 10 ml, S_{NaOH} = ?

Therefore, rearranging the above formulae,

S_{NaOH} = ($S_{oxalic\ acid}$ × $V_{oxalic\ acid}$)/ V_{NaOH} = (0.13 × 9.5)/10 = 0.1235 N (Ans)

(B) Given that, $V_{dil.HCl}$ = 11.5 ml, S_{NaOH} = 0.1235 N, V_{NaOH} = 10 ml, $S_{dil.HCl}$ = ?

Therefore, rearranging the above formulae,

$S_{dil.HCl}$ = (S_{NaOH} × V_{NaOH})/ $V_{dil.HCl}$ = (0.1235 × 10)/11.5 = 0.107 N (Ans)

19. Calculate the amount of Na_2CO_3 (MW 106) to prepare 0.3 N 200ml Na_2CO_3 solution.

Solution: We know, $$C = \frac{W \times 1000}{M \times V}$$

Given that, C = 0.3 N, V = 200 ml, M = 53 (gram-equiv-wt of Na_2CO_3), W = ?

Therefore, rearranging the above formulae,

W = (C×M×V)/1000 = (0.3×53×200)/1000 = 3.18 gm (Ans)

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22. Calculate the amount of Cu^{+2} in a 150 ml blue vitriol solution if 10 ml of it is titrated with 5 ml 0.039N sodium thiosulphate solution. (1 ml 1N $Na_2S_2O_3 \equiv$ 0.06354 gm of Cu^{+2}).

Solution: We know, 1 ml 1N $Na_2S_2O_3 \equiv$ 0.06354 gm of Cu^{+2}

Given that, V_{thio} = 5 ml, S_{thio} = 0.039 N, volume of blue vitriol solution = 150 ml

Therefore, amount of Cu^{+2} in 10 ml of blue vitriol solution = 0.06354 × V_{Thio} × S_{Thio} gm

Amount of Cu^{+2} in 150 ml of blue vitriol solution = 0.06354 × V_{Thio} × S_{Thio} × 15 gm

= 0.06354 × 5 × 0.039 × 15 gm

= 0.18585 gm (Ans)

23. Calculate the known value of copper when 3g blue vitriol is dissolved in100 ml of solution. (Atomic weight of Cu = 63.54, Mol. weight of $CuSO_4.5H_2O$ = 249.68).

Solution: We know, $$\frac{At.wt.of\ Cu\ /\ Fe \times Amount\ of\ salt\ taken\ (in\ gm)}{Mol.wt.of\ blue-vitriol\ /\ Mohr's\ salt}$$

Given that, Atomic weight of Cu = 63.54, Mol. weight of $CuSO_4.5H_2O$ = 249.68; Amount of blue vitriol taken = 3 gm;

Therefore, Known value of copper in 100 ml of blue vitriol solution = (63.54 × 3)/249.68

= 0.76345 gm (Ans)

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25. Calculate the amount of Fe^{+2} in a 300 ml Mohr's salt solution if 10 ml of this solution is titrated with 4 ml 0.075N $K_2Cr_2O_7$ solution. (1 ml 1N $K_2Cr_2O_7 \equiv$ 0.05584 gm of Fe^{+2}). Ans: 0.50256 gm

Solution: We know, 1 ml 1N $K_2Cr_2O_7 \equiv$ 0.05584 gm of Fe^{+2}

Given that, $V_{K2Cr2O7}$ = 4 ml, $S_{K2Cr2O7}$ = 0.075 N, volume of Mohr's salt solution = 300 ml

Therefore, amount of Fe^{+2} in 10 ml of Mohr's salt solution = $0.05584 \times V_{K2Cr2O7} \times S_{K2Cr2O7}$ gm

Amount of Fe^{+2} in 300 ml of Mohr's salt solution = $0.05584 \times V_{K2Cr2O7} \times S_{K2Cr2O7} \times 30$ gm

$= 0.05584 \times 4 \times 0.075 \times 30$ gm

= 0.50256 gm (Ans)

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27. Calculate the amount of Fe^{+2} ions in 500 ml Mohr's salt solution if 10ml of this solution is titrated with 7.5ml 0.06N $KMnO_4$ solution. (1ml 1N $KMnO_4$= 0.05584 gm of F^{+2}). Ans: 1.256 gm

Solution: We know, 1 ml 1N $KMnO_4 \equiv$ 0.05584 gm of Fe^{+2}

Given that, V_{KMnO4} = 7.5 ml, S_{KMnO4} = 0.06 N, volume of Mohr's salt solution = 500 ml

Therefore, amount of Fe^{+2} in 10 ml of Mohr's salt solution = $0.05584 \times V_{KMnO4} \times S_{KMnO4}$ gm

Amount of Fe^{+2} in 500 ml of Mohr's salt solution = $0.05584 \times V_{K2Cr2O7} \times S_{K2Cr2O7} \times 50$ gm

$= 0.05584 \times 7.5 \times 0.06 \times 50$ gm

= 1.2564 gm (Ans)

28. Calculate the known value of iron when 2g Mohr's salt is dissolved in100 ml of solution. (Atomic weight of Fe = 55.84, Mol. weight of $FeSO_4.(NH_4)_2SO_4.6H_2O$ = 392.14). Ans: 0.2847 gm

Solution: We know, $$\frac{At.wt.of\ Cu/Fe \times Amount\ of\ salt\ taken\ (in\ gm)}{Mol.wt.of\ blue-vitriol/Mohr's\ salt}$$

Given that, Atomic weight of Fe = 55.84, Mol. weight of $FeSO_4.(NH_4)_2SO_4.6H_2O$ = 392.14, Amount of Mohr's salt taken = 2 gm;

Therefore, Known value of iron in 100 ml of blue vitriol solution = $(55.84 \times 2)/392.14$

= 0.28479 gm (Ans)