Chemical stoichiometry

20. (c) $MW = 2 \times V.D. = 2 \times 22 = 44$.

21. (d) $\underbrace{2K\overset{+7}{Mn}O_4 + 3H_2SO_4 \rightarrow K_2SO_4 + 2\overset{+2}{Mn}SO_4}_{\text{Change by 5}} + 3H_2O + 5[O]$

$\text{Eq. wt.} = \frac{\text{Mol. wt.}}{5}$

22. (c) Dibasic acid *NaOH;* $N_1V_1 = N_2V_2$

$\frac{W}{E} \times 1000 = \frac{1}{10} \times 25; \frac{0.16}{E} \times 1000 = \frac{25}{10}$

$M = 2 \times E = 2 \times 64 = 128.$

23. (d) *NaOH* *HCl*

$N_1V_1 = N_2V_2; 20 \times \frac{1}{10} = \frac{1}{20} \times V; V = 40ml.$

24. (a) $NV = N_1V_1 + N_2V_2$

$0.2 \times 2 = 0.5x + 0.1(2 - x)$

$0.4 = 0.5x + 0.2 - 0.1x$

$0.2 = 0.4x$

$x = \frac{1}{2}L = 0.5L$

25. (d) $NV = N_1V_1 + N_2V_2 + N_3V_3$

$N \times 1000 = 1 \times 5 + \frac{1}{2} \times 20 + \frac{1}{3} \times 30 = 5 + 10 + 10 = 25$

$N = 0.025 = \frac{N}{40}.$

26. (b) $NH_{3(g)} + HCl_{(g)} \rightarrow NH_4Cl_{(s)}$
$t=0$ $20ml$ $40ml$ 0
$t=t$ 0 $20ml$ solid

Final volume = 20*ml*.

27. (b) $KMnO_4$ Oxalic acid

$\frac{M_1V_1}{n_1} = \frac{M_2V_2}{n_2}; \frac{20\times0.1}{2} = \frac{M_2V_2}{5}; M_2V_2 = 5.$

28. (b) Acidic medium $E = \frac{M}{5} = \frac{158}{5} = 31.6gm.$

29. (c) 0.1 *M* $AgNO_3$ will react with 0.1 *M NaCl* to form 0.1 *M* $NaNO_3$. But as the volume is doubled, conc. of $NO_3^- = \frac{0.1}{2} = 0.05M$

30. (a) Acid base

$\boldsymbol{N_1V_1} = N_2V_2$; $N_1 \times 30 = 0.2 \times 15$; $N_1 = 0.1N$

31. (b) (I) Phenopthalein indicate partial neutralisation of $Na_2CO_3 \rightarrow NaHCO_3$

Meq. of Na_2CO_3+ Meq. of *NaOH* = Meq. of *HCl*

$\frac{W}{E} \times 1000 + \frac{W}{E} \times 1000 = NV$

(Suppose $Na_2CO_3 = agm$, *NaOH* = *b gm*)

$\frac{a}{106} \times 1000 + \frac{b}{40} \times 1000 = 300 \times 0.1$.....(1)

(II) Methyl orange indicate complete neutralisation

HCl *HCl*

$N_1V_1 = N_2V_2$, $25 \times 0.2 = 0.1 \times V_2soV_2 = 50ml$excess

$\therefore \frac{a}{53} \times 1000 + \frac{b}{40} \times 1000 = 350 \times 0.1$.....(2)

From (1) and (2) *b* =1*gm.*

32. (c) From solution of (31)

From equation (1)

$a = Na_2CO_3 = 0.53gm.$

33. (b) $(H_2SO_4)\frac{M_1V_1}{n_1} = \frac{M_2V_2}{n_2}(NaOH)$

$\frac{1\times V_1}{1} = \frac{1\times 10}{2}; V_1 = 5ml.$

34. (c) Atom in highest oxidation state can oxidize iodide to liberate I_2 which is volumetrically measured by iodometric titration using hypo.

$2I^- \rightarrow I_2$

Pb^{+2} →Lowest oxidation state can not oxidise iodide to I_2.

35. (d) $\boldsymbol{KMnO_4}$ =Mohr salt

$\frac{M_1V_1}{n_1} = \frac{M_2V_2}{n_2}; \frac{0.1\times 10}{1} = \frac{M_2V_2}{5}; M_2V_2 = 5.$

36. (d) The equivalent weight of $\boldsymbol{H_3PO_4} = \frac{\text{molecular weight}}{2}$

∵mole wt of H_3PO_4= 3 + 31 + 64 = 98

$\therefore \frac{98}{2} = 49$

37. (b) $Ba(OH)_2 + CO_2 \rightarrow BaCO_3 + H_2O$

Atomic wt. of $BaCO_3$ =137 + 12 + 16 × 3= 197

No. of mole $= \frac{\text{wt. of substance}}{\text{mol wt.}}$

∵1 mole of $Ba(OH)_2$ gives 1 mole of $BaCO_3$

∴.205 mole of $Ba(OH)_2$will give .205 mole of $BaCO_3$

∴wt. of 0.205 mole of $BaCO_3$ will be

$.205 \times 197 = 40.385gm \approx 40.5gm$

38. (d) $N_1 = 0.5N \rightarrow 10mg$ per mL

$N_2 = \frac{10\times10^{-3}gm}{40\times1} \times 1000$=0.25$N$

$V_1 = 500ml,\qquad V_2 =?$

$N_1V_1 = N_2V_2;\ 0.5 \times 500 = 0.25 \times V_2$

$V_2 = 1000mL$ final volume water added = 1000 – 500

= 500mL.

39. (a) eq. of $KMnO_4$ = eq. of $Fe(C_2O_4)$

$x \times 5 = 1 \times 3$

$x = 0.6$

40. (b)

Element	At.wt.	Mole	Ratio	Empirical formula
C =86%	12	7.1	1	CH_2
H =14%	1	14	2	Beleongs to alkeneC_nH_{2n}

41. (b) $AgNO_3 \equiv 2Ag^+ + \underset{(H_2S)}{S^{2-}} \rightarrow Ag_2S$

∵2 mole →1 mole [100×1 =100 millimole]

∴100 miliimole →50 millimole H_2S required

$CuSO_4 \equiv Cu^{+2} + \underset{(H_2S)}{S^{2-}} \rightarrow CuS$

∵1 mole →1 mole [100×1=100 millimole]

∴100 millimole →100 millimole H_2S required

Ratio $\frac{50}{100} = \frac{1}{2}$.

42. (c) At room temperature $2H_{2(g)} \quad + \quad O_{2(g)} \quad \rightarrow \quad 2H_2O_{(l)}$

t =0 50*ml* 50*ml* 0

t =*t* 50 – 2*x* 50 – *x* 2*x*

=0 25*gases* (50)liquid

In this case $H_2$is limiting reagent

x = 25*ml*

At 110°*C* $2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(g)}$ $V_{\text{gas}} = 75ml$

t =*t* 0 25*ml* 50*ml*

43. (c) $\overset{+2}{Cu}SO_4 + 2KI \rightarrow K_2SO_4 + \overset{+2}{Cu}I_2$; $2\overset{+2}{Cu}I_2 \rightarrow \overset{+1}{Cu}I_2 + I_2$

$\boldsymbol{I_2 + 2Na_2S_2O_3 \rightarrow 2NaI + Na_2S_4O_6}$

Eq. wt. Of $\boldsymbol{CuSO_4.5H_2O}$ = **Mol. wt.** = **250**

100 *ml* of 0.1 *N* hypo ≡ 100 *ml* of 0.1 *N* $CuSO_4.5H_2O$

$= \frac{250\times0.1\times100}{100} = 2.5gm$

44. (d) $\boldsymbol{HNO_3 + KOH \rightarrow KNO_3 + H_2O}$

$\frac{\mathbf{12.6}}{\mathbf{63}}$ =0.2 mole; $HNO_3 \equiv KOH$

0.2 mole ≡0.2 mole

$0.2 \times 56 = 11.2gm.$

45. (a) Isobutane and *n*-butane $[C_4H_{10}]$ have same molecular formula;

$C_4H_{10} + \frac{13}{2}O_2 \rightarrow 4CO_2 + 5H_2O$

For 58*gm* of C_4H_{10} 208 *gm* O_2 is required then for 5 *kg* of C_4H_{10} $O_2 = \frac{5\times208}{58}$

$= 17.9kg$

46. (b) $n = \frac{16.8}{22.4} = 0.75$mole of $H_2$and O_2

$\mathbf{2H_2O \to \underset{2:1}{2H_2 + O_2}\ 0.75}$ $\mathbf{0.25 \quad O_2}$
$\mathbf{0.25 \quad H_2}$

2 mole H_2 – 2 moleH_2O

0.5 moleH_2 – 0.5 mole H_2O = 9*gm*.

47. (a) ∵ 3*ml* (*O*) →1*ml* O_3

30*ml* (*O*)→10*ml*O_3

$x = \frac{150\times10}{100} = 15ml$

V of O_2 +*V* of $O_3 = 135 + 10 = 145ml$

Turpentine oil absorb ozone.

48. (a) 50% *HCl* itself means 50*gm HCl* react with 100*gm* sample

% Purity = $\frac{50}{100} \times 100 = 50\%$.

49. (a) $AgNO_3 + HCl \to AgCl + HNO_3$

$\mathbf{\frac{30}{170}}$ $\mathbf{\frac{500\times0.2}{1000}}$

t =0 0.176 mole 0.1 mole limiting =14.345*gm*

t =*t* 0.076 mole 0 0.1mole

50. (d) $KMnO_4 \quad FeSO_4$

$\mathbf{\frac{M_1V_1}{n_1} = \frac{M_2V_2}{n_2}; M_1V_1 = \frac{n_1}{n_2}M_2V_2}$

$\mathbf{= \frac{2}{10} \times 10 \times \frac{1}{10} = \frac{1}{5} = 0.2}$

For (d), $\mathbf{M_1V_1 = 0.02 \times 10 = \frac{1}{5}}$

51. (c) $\underset{\text{1mol.}}{ROH} + CH_3MgI \rightarrow \underset{\text{1 mol=22400}cc}{CH_4} + Mg \begin{matrix} OR \\ I \end{matrix}$

1.12 *mL* is obtained from 4.12 *mg*

$\therefore$ 22400 *mL* will be obtained from

$\frac{4.12}{1.12} \times 22400mg = 84.2g$

52. (b)

Element	%(a)	At.wt.(b)	a/b	Ratio
X	50	10	5	2
Y	50	20	2.5	1

Simplest formula = X_2Y

53. (a) $A_3(BC_4)_2 = 3 \times 2 + [5 + (-2 \times 4)]_2 = 0.$

54. (b) $\underset{10gm}{CaCO_3} \rightarrow CaO + CO_2$

90% pure 9*gm* = $\frac{9}{100}$mole

$CaCO_3 \equiv CO_2 =$ 0.09mole

At NTP Vol.$CO_2 = 0.09 \times 22.4 = 2.016L.$

55. (b) $Cd^{+2} \quad + \quad S^{2-} \rightarrow CdS$

20×1= 20

$Cu^{+2} + S^{2-} \rightarrow CuS$

20×0.5 =10

Ratio =2: 1

56. (b) $Mg^{+2} \equiv H_2$

$\boldsymbol{n} = \frac{\mathbf{12gm}}{\mathbf{24gm}} = \frac{\mathbf{1}}{\mathbf{2}}$mole of H_2

57. (a) $\underset{1\text{mole}}{Mg} + \underset{0.5\text{mole}}{\frac{1}{2}O_2} \rightarrow MgO$

0.5 mole of oxygen react with 1 mole of *Mg*

1.5 mole of oxygen react with $\frac{1.5}{0.5} = 3$mole

$24 \times 3 = 72gm.$

58. (c) $\underset{100g}{CaCO_3} + \underset{2N}{2HCl} \rightarrow CaCl_2 + \underset{44\ g}{CO_2} + H_2O$

100 g $CaCO_3$ with 2 *N HCl* gives 44 g CO_2

100 g $CaCO_3$ with 1 *N HCl* gives 22 g CO_2

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