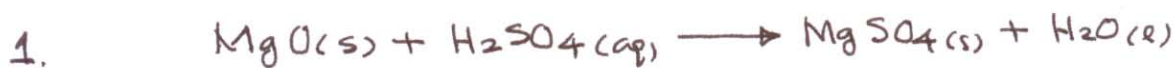


SOLUTIONS TO MOLE CONCEPT, BACK-TITRATIONS, & STOICHIOMETRY.



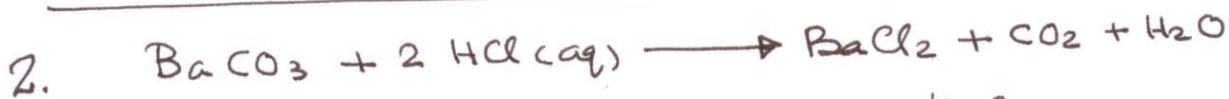
$$\text{mol H}_2\text{SO}_4 \text{ added} = 0.0400 \times 0.600 = 0.0240 \quad \text{--- (1)}$$

$$\begin{aligned} \text{mol H}_2\text{SO}_4 \text{ in excess} &= (0.0250 \times 0.320) \text{ mol NaOH} \times \frac{1 \text{ mol H}_2\text{SO}_4}{2 \text{ mol NaOH}} \\ &= 0.00400 \quad \text{--- (2)} \end{aligned}$$

$$\text{mol H}_2\text{SO}_4 \text{ that reacted with MgO} = \text{(1)} - \text{(2)} = 0.020$$

$$\therefore 0.020 \text{ mol H}_2\text{SO}_4 \times \frac{1 \text{ mol MgO}}{1 \text{ mol H}_2\text{SO}_4} \times \frac{40.3 \text{ g MgO}}{1 \text{ mol MgO}} = 0.806 \text{ g MgO}$$

$$\% \text{ MgO} = \frac{0.806}{0.984} \times 100 = 81.9$$

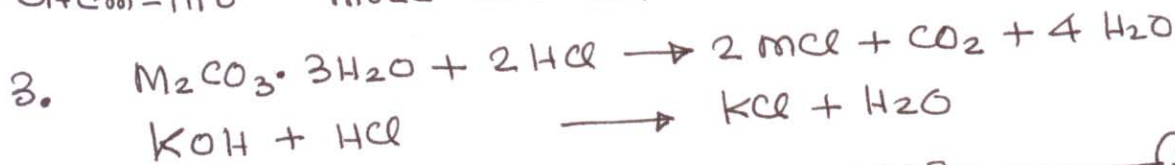


$$\text{mol of HCl} = 0.02500 \times 0.2120 = 5.30 \times 10^{-3} \quad \text{--- (1)}$$

$$\text{mol of HCl in excess} = (0.02248 \times 0.1082) = 2.43 \times 10^{-3} \quad \text{--- (2)}$$

$$\text{mol of HCl that reacted} = \text{(1)} - \text{(2)} = 2.87 \times 10^{-3}$$

$$2.87 \times 10^{-3} \text{ mol HCl} \times \frac{1 \text{ mol BaCO}_3}{2 \text{ mol HCl}} \times \frac{197.3 \text{ g BaCO}_3}{1 \text{ mol BaCO}_3} = 0.283 \text{ g BaCO}_3$$



$$\text{mol of HCl} = 0.04000 \times 0.8450 = 0.03380 \quad \text{--- (1)}$$

$$\text{mol HCl excess} = (0.05114 \times 0.1460) \text{ mol KOH} \times \frac{1 \text{ mol HCl}}{1 \text{ mol KOH}} = 7.46644 \times 10^{-3} \quad \text{--- (2)}$$

$$\text{mol reacted with } M_2CO_3 \cdot 3H_2O = \text{(1)} - \text{(2)} = 0.02633$$

$$0.02633 \text{ mol HCl} \times \frac{1 \text{ mol } M_2CO_3 \cdot 3H_2O}{2 \text{ mol HCl}} = 0.0131667$$

$$\therefore \text{MOLAR MASS} = \frac{5.00}{0.0131667} = 379.74$$

$$2 \times M + 12 + 48 + (3 \times 18.0) = \underline{379.74}$$

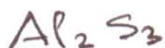
$$M = 132.87 \quad \text{--- } Ca_2CO_3 \cdot 3H_2O$$

		MOL RATIO
4.	mol of M = 0.6400 × 0.500 = 0.02	2
	mol of S = 0.120 × 0.250 = 0.03	3

$$\therefore M_2S_3$$

$$2 \times M + 3 \times S = 150$$

$$\therefore M = 27.0$$

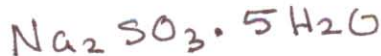


$$5. \quad (0.04000 \times 0.100) \text{ mol NaOH} \times \frac{1 \text{ mol H}^+}{1 \text{ mol NaOH}} \times \frac{1 \text{ mol SO}_3^{2-}}{2 \text{ mol H}^+} = 0.00200$$

$$\text{MOLAR MASS} = \frac{0.4322 \text{ g}}{0.00200 \text{ mol}} = 216.1 \text{ g/mol}$$

$$(2 \times Na) + (1 \times S) + (3 \times O) + (x \times 18.0) = 216.1$$

$$x = 5$$



$$6. \quad 5.623 \text{ g NaOH} \times \frac{1 \text{ mol NaOH}}{40.00 \text{ g NaOH}} \times \frac{1}{0.2500 \text{ L}} = 0.5623 \text{ M}$$

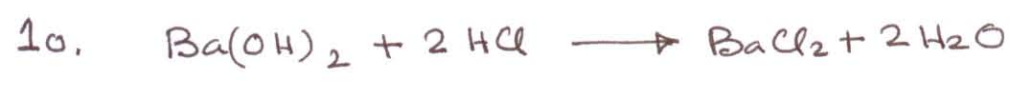
CHEM-1110 MOLE CONCEPT

7. $M_1 V_1 = M_2 V_2$ $M_1 = 0.5623$ $M_2 = ?$
 $V_1 = 10.00 \text{ mL}$ $V_2 = 60.00 \text{ mL}$

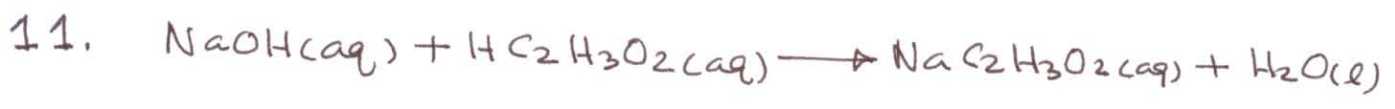
$$M_2 = \frac{0.5623 \times 10.00}{60.00} = 0.09372 \text{ M}$$

8. $(0.750 \times 0.225) \text{ mol} \times \frac{77.0 \text{ g}}{1 \text{ mol}} = 13.0 \text{ g NH}_4\text{C}_2\text{H}_3\text{O}_2$

9. $\frac{[(0.0250 \times 0.375) + (0.042 \times 0.632)] \text{ mol NaCl}}{(25.0 + 42.0) / 1000 \text{ L}} = 0.5360 \text{ M}$

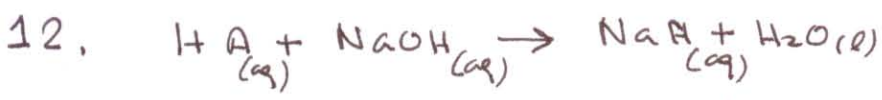


$$(0.03567 \times 0.0748) \text{ mol HCl} \times \frac{1 \text{ mol Ba(OH)}_2}{2 \text{ mol HCl}} \times \frac{10^3 \text{ mL}}{0.0487 \text{ mol Ba(OH)}_2} = 27.40 \text{ mL Ba(OH)}_2$$



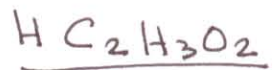
$$(0.01655 \times 0.5062) \text{ mol NaOH} \times \frac{1 \text{ mol HC}_2\text{H}_3\text{O}_2}{1 \text{ mol NaOH}} \times \frac{60.10 \text{ g}}{1 \text{ mol HC}_2\text{H}_3\text{O}_2} = 0.5027 \text{ g}$$

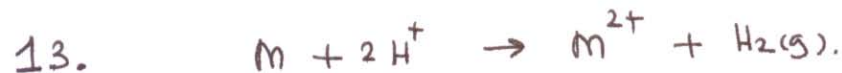
$$\% \text{ ACETIC ACID} = \frac{0.5027 \text{ g acid}}{(10.00 \text{ mL} \times \frac{1.006 \text{ g}}{1 \text{ mL}}) \text{ solution}} = 5.00 \%$$



$$(0.02468 \times 0.1017) \text{ mol NaOH} \times \frac{1 \text{ mol ACID}}{1 \text{ mol NaOH}} = 2.510 \times 10^{-3} \text{ mol ACID}$$

$$\text{MOLAR MASS} = \frac{0.1506 \text{ g}}{2.510 \times 10^{-3} \text{ mol}} = 60.0 \text{ g/mol}$$





$$\text{mol Acid added} = (0.05000 \times 0.500) = 0.02500 \quad \text{--- (1)}$$

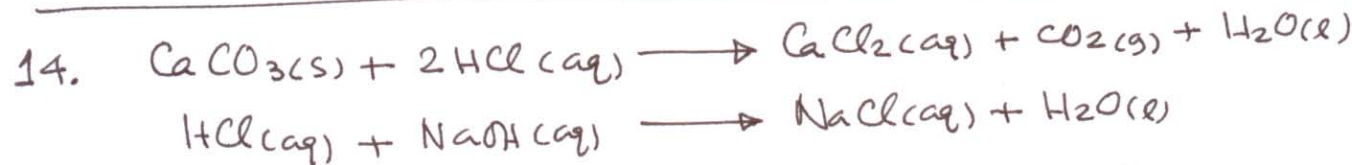


$$\begin{aligned} \text{mol HCl unused} &= (0.02436 \times 0.1054) \cancel{\text{mol NaOH}} \times \frac{1 \text{ mol HCl}}{1 \cancel{\text{mol NaOH}}} \\ &= 0.002568 \quad \text{--- (2)} \end{aligned}$$

$$\text{mol HCl used} = \text{(1)} - \text{(2)} = 0.02243$$

$$\text{mol of } M = \frac{0.02243}{2} = 0.01122$$

$$\text{MOLAR MASS OF } M = \frac{0.2726 \text{ g}}{0.01122 \text{ mol}} = 24.3 \text{ g/mol}$$



$$\text{mol of HCl added} = (2.00 \times 2.52) = 5.04 \quad \text{--- (1)}$$

$$\begin{aligned} \text{mol of excess HCl} &= (0.02487 \times 0.9987) \cancel{\text{mol NaOH}} \times \frac{1 \text{ mol HCl}}{1 \cancel{\text{mol NaOH}}} \times \frac{2000}{10} \\ &= 4.9675 \quad \text{--- (2)} \end{aligned}$$

$$\text{mol HCl reacted} = \text{(1)} - \text{(2)} = 0.0725$$

$$\text{mol } CaCO_3 = \frac{0.0725}{2}$$

$$\text{mass of } CaCO_3 = \frac{0.0725}{2} \times 100.1 = 3.63$$

15. $(0.02943 \times 0.04212) \cancel{\text{mol } Cr_2O_7^{2-}} \times \frac{6 \text{ mol Fe}}{1 \cancel{\text{mol } Cr_2O_7^{2-}}} \times \frac{55.85 \text{ g}}{1 \text{ mol Fe}} \times \frac{100}{0.8765}$
 $\text{--- } 47.39 \%$

16 Let mass of Ag = x g, ∴ mass of Cu = (0.500 - x) g

$$x \text{ g Ag} \times \frac{1 \text{ mole Ag}}{107.9 \text{ g Ag}} \times \frac{1 \text{ mole Ag}_2\text{S}}{2 \text{ mole Ag}} \times \frac{247.9 \text{ g Ag}_2\text{S}}{1 \text{ mole Ag}_2\text{S}} = \left(\frac{247.9}{2 \times 107.9} \right) x \quad \text{--- (A)}$$

$$(0.500 - x) \text{ g Cu} \times \frac{1 \text{ mole Cu}}{63.5 \text{ g Cu}} \times \frac{1 \text{ mole CuS}}{1 \text{ mole Cu}} \times \frac{95.6 \text{ g CuS}}{1 \text{ mole CuS}} = (0.500 - x) \left(\frac{95.6}{63.5} \right) \quad \text{--- (B)}$$

$$\therefore \text{(A)} + \text{(B)} = \text{TOTAL SULFIDE} = 0.730$$

$$\therefore x = 0.0644$$

$$\% \text{ Ag} = \frac{0.0644}{0.500} \times 100 = \underline{\underline{12.9}}$$

$$17. 1.69 \text{ L H}_2 \times \frac{1 \text{ mole H}_2}{22.4 \text{ L H}_2} = \frac{1.69}{22.4}$$

$$x \text{ g Al} \times \frac{1 \text{ mole Al}}{27.0 \text{ g Al}} \times \frac{3 \text{ mole H}_2}{2 \text{ mole Al}} = \frac{3x}{54} \quad \text{--- (A)}$$

$$(1.67 - x) \text{ g Zn} \times \frac{1 \text{ mole Zn}}{65.4 \text{ g Zn}} \times \frac{2 \text{ mole H}_2}{1 \text{ mole Zn}} = (1.67 - x) \frac{1}{65.4} \quad \text{--- (B)}$$

$$\text{(A)} + \text{(B)} = \text{TOTAL mole H}_2 = \frac{1.69}{22.4}$$

$$x = 1.24 \text{ (g of Al)}$$

$$18. x \text{ g RbCl} \times \frac{143.5 \text{ g AgCl}}{121 \text{ g RbCl}} = \left(\frac{143.5}{121} \right) x \text{ g AgCl} \quad \text{--- (A)}$$

$$(0.2380 - x) \text{ g NaCl} \times \frac{143.5 \text{ g AgCl}}{58.5 \text{ g NaCl}} = \left(\frac{143.5}{58.5} \right) (0.2380 - x) \text{ g AgCl} \quad \text{--- (B)}$$

$$\text{(A)} + \text{(B)} = \text{TOTAL AgCl} = 0.4302$$

$$x = 0.1212$$

$$\% \text{ RbCl} = \frac{0.1212}{0.2380} \times 100 = 50.92, \quad \therefore \text{NaCl} = 49.08$$

$$19. \quad x \text{ g NaI} \times \frac{234.8 \text{ g AgI}}{149.9 \text{ g NaI}} = \left(\frac{234.8}{149.9}\right) x \text{ g AgI} \quad \text{--- (A)}$$

$$(3.9762 - x) \text{ g KI} \times \frac{234.8 \text{ g AgI}}{166.0 \text{ g KI}} = (3.9762 - x) \left(\frac{234.8}{166.0}\right) \text{ g AgI} \quad \text{--- (B)}$$

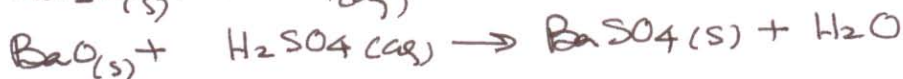
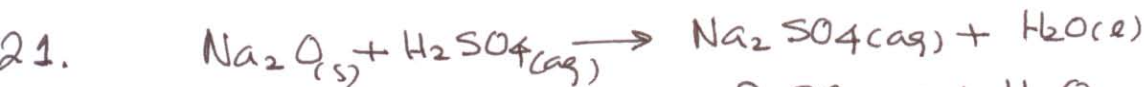
$$\text{(A)} + \text{(B)} = \text{TOTAL AgI} = 5.8622$$

$$x = 1.578 \quad \therefore \% \text{ NaI} = \frac{1.578}{3.9762} \times 100 = 39.69$$

$$\therefore \% \text{ KI} = \underline{\underline{60.31}}$$

$$20. \quad 0.990 \text{ g H}_2\text{O} \times \frac{1 \text{ mole H}_2\text{O}}{18.0 \text{ g H}_2\text{O}} \times \frac{2 \text{ mole NaHCO}_3}{1 \text{ mole H}_2\text{O}} \times \frac{84.0 \text{ g NaHCO}_3}{1 \text{ mole NaHCO}_3} = 9.24$$

$$\therefore \% \text{ NaHCO}_3 = \frac{9.24}{9.90} \times 100 = 93.3, \quad \% \text{ CaCO}_3 = \underline{\underline{6.67}}$$



$$6.00 \text{ g BaSO}_4 \times \frac{153.3 \text{ g BaO}}{233.4 \text{ g BaSO}_4} = 3.94 \text{ g BaO}$$

$$\% \text{ BaO} = \frac{3.94}{6.00} \times 100 = \underline{\underline{65.7}}$$