

UNIT 4 - CHAPTER 4 END OF CHAPTER PRACTICE PROBLEMS - KEY

A) $49.73g H_2SO_4 \left| \frac{1 \text{ mol } H_2SO_4}{98g H_2SO_4} \right. = \frac{0.5 \text{ mol } H_2SO_4}{0.500 \text{ L SOL'N}} = \boxed{1.01 \text{ M } H_2SO_4}$

$$\begin{array}{r} 2H \times 1 = 2 \\ 1S \times 32 = 32 \\ 4O \times 16 = 64 \\ \hline 98 \end{array}$$

B) $5.035g FeCl_3 \left| \frac{1 \text{ mol } FeCl_3}{162.5g FeCl_3} \right. = \frac{0.031 \text{ mol } FeCl_3}{0.250 \text{ L}} = \boxed{0.12 \text{ M}}$

$$\begin{array}{r} 1Fe \times 56 = 56 \\ 3Cl \times 35.5 = 106.5 \\ \hline 162.5 \end{array}$$

2. A) $21.18g Fe(NO_3)_3 \left| \frac{1 \text{ mol } Fe(NO_3)_3}{242g Fe(NO_3)_3} \right. = \frac{0.088 \text{ mol } Fe(NO_3)_3}{1 \text{ L SOL'N}} = \boxed{0.088 \text{ M } Fe(NO_3)_3}$

$$\begin{array}{r} 1Fe \times 56 = 56 \\ 3N \times 14 = 42 \\ 9O \times 16 = 144 \\ \hline 242 \end{array}$$

B) $72.06g BaCl_2 \left| \frac{1 \text{ mol } BaCl_2}{208g BaCl_2} \right. = \frac{0.346 \text{ mol } BaCl_2}{0.5 \text{ L SOL'N}} = \boxed{0.69 \text{ M } BaCl_2}$

$$\begin{array}{r} 1Ba \times 137 = 137 \\ 2Cl \times 35.5 = 71 \\ \hline 208 \end{array}$$

3. A) $0.25 \text{ M } Na_3PO_4 = \frac{0.25 \text{ mol } Na_3PO_4}{1 \text{ L SOL'N}} \left| \frac{3 \text{ mol } Na^+}{1 \text{ mol } Na_3PO_4} \right. = \boxed{0.75 \text{ mol } Na^+}$

$$\frac{0.25 \text{ mol } Na_3PO_4}{1 \text{ L SOL'N}} \left| \frac{1 \text{ mol } PO_4^{3-}}{1 \text{ mol } Na_3PO_4} \right. = \boxed{0.25 \text{ mol } PO_4^{3-}}$$

B) $0.87 \text{ M } Na_2CO_3 = \frac{0.87 \text{ mol } Na_2CO_3}{1 \text{ L SOL'N}} \left| \frac{2 \text{ mol } Na^+}{1 \text{ mol } Na_2CO_3} \right. = \boxed{1.74 \text{ mol } Na^+}$

$$\frac{0.87 \text{ mol } Na_2CO_3}{1 \text{ L SOL'N}} \left| \frac{1 \text{ mol } CO_3^{2-}}{1 \text{ mol } Na_2CO_3} \right. = \boxed{0.87 \text{ mol } CO_3^{2-}}$$

4. A) $1.5 \text{ M } KMnO_4 = \frac{1.5 \text{ mol } KMnO_4}{1 \text{ L SOL'N}} \left| \frac{158g KMnO_4}{1 \text{ mol } KMnO_4} \right. = \frac{237g KMnO_4}{1 \text{ L MARK}} \left| \begin{array}{l} + \text{ADD } H_2O \text{ TO} \\ 1 \text{ L MARK} \end{array} \right.$

$$\begin{array}{r} 1K \times 39 = 39 \\ 1Mn \times 55 = 55 \\ 4O \times 16 = 64 \\ \hline 158 \end{array}$$

B) $0.2 \text{ M } AgNO_3 = \frac{0.2 \text{ mol } AgNO_3}{1 \text{ L SOL'N}} \left| \frac{170g AgNO_3}{1 \text{ mol } AgNO_3} \right. = \frac{8.5g AgNO_3}{250 \text{ mL MARK}} \left| \begin{array}{l} + \text{ADD } H_2O \text{ TO} \\ 250 \text{ mL MARK} \end{array} \right.$

$$\begin{array}{r} 1Ag \times 108 = 108 \\ 1N \times 14 = 14 \\ 3O \times 16 = 48 \\ \hline 170 \end{array}$$

5. A) $(500 \text{ mL})(1.0 \text{ M}) = (X \text{ mL})(17.8 \text{ M})$
Stock SOL'N

$X = 28 \text{ mL Stock SOL'N} + \text{ADD IT TO } 472 \text{ mL } H_2O$

$$\begin{array}{r} 500 \\ - 28 \\ \hline 472 \text{ mL } H_2O \end{array}$$

B) $(1.5 \text{ L})(0.25 \text{ M}) = (X \text{ L})(1.0 \text{ M})$
Stock SOL'N

$X = 0.375 \text{ L Stock SOL'N} + \text{ADD IT TO } 1.125 \text{ L } H_2O$

$$\begin{array}{r} 1.5 \text{ L} \\ - 0.375 \text{ L} \\ \hline 1.125 \text{ L } H_2O \end{array}$$

C) $M = \frac{\text{mol SOLUTE}}{\text{L SOL'N}}$

$0.15 \text{ M} = \frac{X \text{ mol } KBrO_3}{1.0 \text{ L SOL'N}}$

$X = 0.15 \text{ mol } KBrO_3 \left| \frac{167g KBrO_3}{1 \text{ mol } KBrO_3} \right. = \frac{25g KBrO_3}{1.0 \text{ L MARK}} \left| \begin{array}{l} + \text{ADD } H_2O \\ \text{TO } 1.0 \text{ L} \\ \text{MARK} \end{array} \right.$

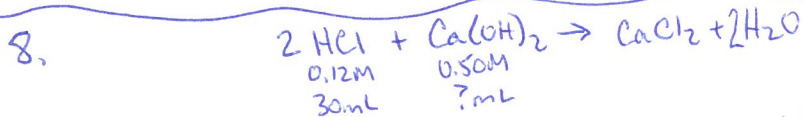
$$\begin{array}{r} 1K \times 39 = 39 \\ 1Br \times 80 = 80 \\ 3O \times 16 = 48 \\ \hline 167 \end{array}$$

$$6. \quad \frac{3.6973 \text{ KHP} | 1 \text{ mol KHP}}{2043 \text{ KHP}} = \frac{0.018 \text{ mol KHP}}{0.1000 \text{ L Sol'n}} = \boxed{0.18 \text{ M KHP}}$$

$$\begin{aligned} 8 \times 12 &= 96 \\ 5 \times 1 &= 5 \\ 4 \times 16 &= 64 \\ 1 \times 39 &= 39 \\ \hline &204 \end{aligned}$$

$$7. \quad \frac{120.09 \text{ NaOH} | 1 \text{ mol NaOH}}{403 \text{ NaOH}} = \frac{3 \text{ mol NaOH}}{0.500 \text{ L Sol'n}} = \boxed{6.00 \text{ M}}$$

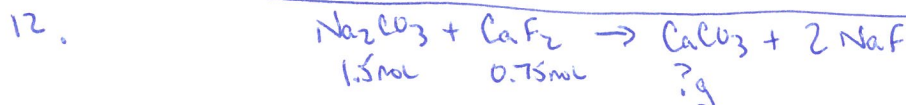
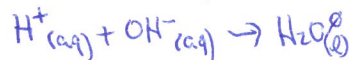
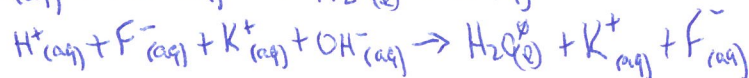
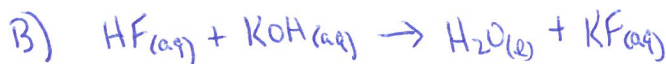
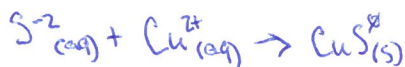
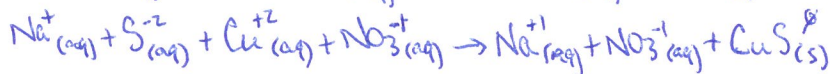
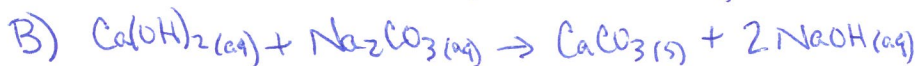
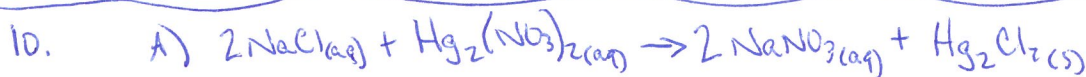
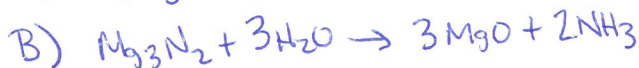
$$\begin{aligned} 1 \text{ Na} \times 23 &= 23 \\ 1 \text{ O} \times 16 &= 16 \\ 1 \text{ H} \times 1 &= 1 \\ \hline &40 \end{aligned}$$



$$0.12 \text{ M HCl} = \frac{0.12 \text{ mol HCl} | 0.030 \text{ L}}{1 \text{ L Sol'n}} = 0.036 \text{ mol HCl} \quad \frac{1 \text{ mol Ca(OH)}_2}{2 \text{ mol HCl}} = 0.0018 \text{ mol Ca(OH)}_2$$

$$\frac{0.5 \text{ M Ca(OH)}_2}{\text{Ca(OH)}_2} = \frac{0.0018 \text{ mol Ca(OH)}_2}{x \text{ L}}$$

$$x = 0.0036 \text{ L} = \boxed{3.6 \text{ mL Ca(OH)}_2}$$



$$\frac{1.5 \text{ mol Na}_2\text{CO}_3 | 1 \text{ mol CaCO}_3 | 100 \text{ g CaCO}_3}{1 \text{ mol Na}_2\text{CO}_3 | 1 \text{ mol CaCO}_3} = 1500 \text{ g CaCO}_3$$

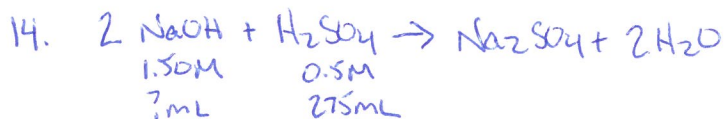
$$\frac{0.75 \text{ mol CaF}_2 | 1 \text{ mol CaCO}_3 | 100 \text{ g CaCO}_3}{1 \text{ mol CaF}_2 | 1 \text{ mol CaCO}_3} = \boxed{75 \text{ g CaCO}_3}$$

$$\begin{aligned} 1 \text{ Ca} \times 40 &= 40 \\ 1 \text{ C} \times 12 &= 12 \\ 3 \text{ O} \times 16 &= 48 \\ \hline &100 \end{aligned}$$



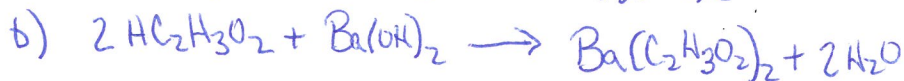
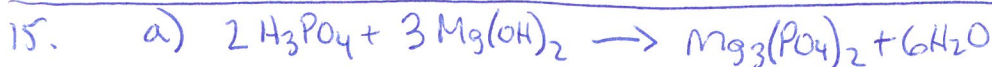
$$0.2789 \text{ M NaOH} = \frac{0.2789 \text{ mol} | 0.010 \text{ L}}{1 \text{ L Sol'n}} = 0.002789 \text{ mol NaOH} \quad \frac{1 \text{ mol HCl}}{1 \text{ mol NaOH}} = 0.002789 \text{ mol HCl}$$

$$0.1379 \text{ M HCl} = \frac{0.002789 \text{ mol HCl}}{x \text{ L}} \quad x = 0.0202 \text{ L} = \boxed{20.2 \text{ mL HCl}}$$



$$0.5 \text{ M H}_2\text{SO}_4 = \frac{0.5 \text{ mol H}_2\text{SO}_4}{1 \text{ L sol'n}} \times 0.275 \text{ L} = 0.1375 \text{ mol H}_2\text{SO}_4 \times \frac{2 \text{ mol NaOH}}{1 \text{ mol H}_2\text{SO}_4} = 0.275 \text{ mol NaOH}$$

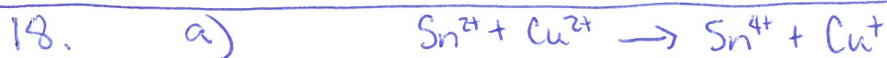
$$1.50 \text{ M NaOH} = \frac{0.275 \text{ mol NaOH}}{X \text{ L}} \quad X = 0.183 \text{ L} = \boxed{183 \text{ mL NaOH}}$$



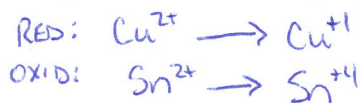
$$16. \quad (X \text{ mL})(1\text{OH}^-)(0.2\text{M}) = (50 \text{ mL})(2\text{H}^+)(0.1\text{M}) \quad \boxed{X = 50 \text{ mL}}$$

$$17. \quad * \text{MONOPROTIC BASE} = 1 \text{ OH}^- *$$

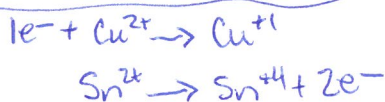
$$(30.0 \text{ mL})(1\text{OH}^-)(X \text{ M}) = (12.0 \text{ mL})(1\text{H}^+)(0.15\text{M}) \quad \boxed{X = 0.06 \text{ M}}$$



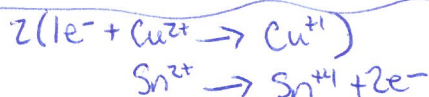
STEP 1
1/2 REACTIONS



STEP 2
BALANCE CHARGES



STEP 3
BALANCE e-
BETWEEN EQUATIONS



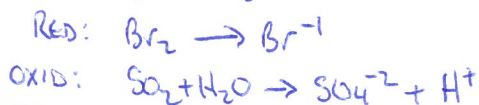
STEP 4
ADD EQUATIONS



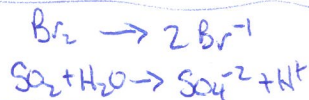
STEP 5
CANCEL e-



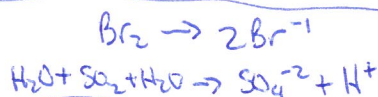
STEP 1



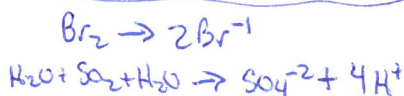
STEP 2



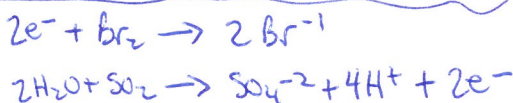
STEP 3



STEP 4



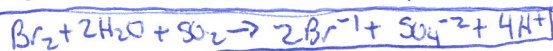
STEP 5



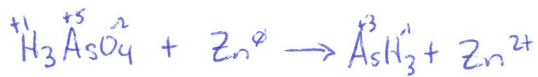
STEP 6



STEP 7

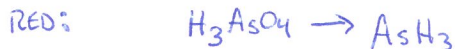


19. A)



STEP 1 -

1/2 RXNS



STEP 2 -

BALANCE ALL BUT H+O (DONE)



STEP 3 -

BALANCE O w/ H₂O

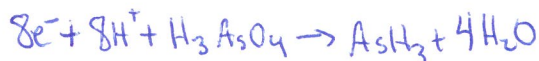
STEP 4 -

BALANCE H w/ H⁺



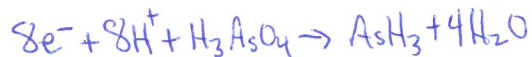
STEP 5 -

BALANCE CHARGE w/ e⁻



STEP 6 -

BALANCE e⁻ w/ MULTIPLIER



STEP 7 -

ADD EQUATIONS



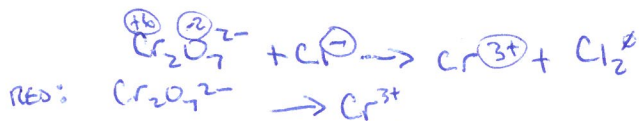
STEP 8 -

CANCEL e⁻



B)

STEP 1



STEP 2



STEP 3



STEP 4



+12 → +6

-2 → 0

STEP 5



STEP 6



STEP 7



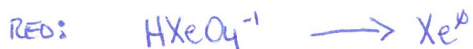
STEP 8



20 A)



STEP 1 -
KROKNS



STEP 2 - (DONE)
BALANCE ELEMENTS



STEP 3 -
BALANCE O w/ H₂O



STEP 4 -
BALANCE H w/ H⁺



+6 → ∅

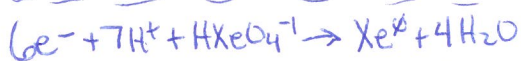


∅ → +2

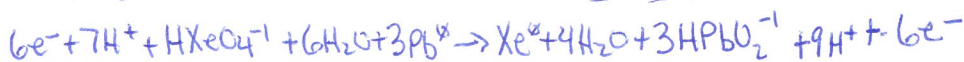
STEP 5 -
BALANCE CHARGE w/ e⁻



STEP 6 -
BALANCE e⁻ BETWEEN
EQUATIONS



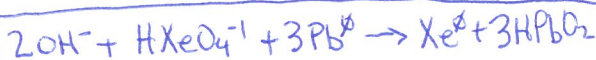
STEP 7 -
ADD EQUATIONS



STEP 8 -
CANCEL e⁻ + H₂O + H⁺



STEP 9 -
ADD OH⁻ TO BOTH SIDES
TO ELIMINATE H⁺, CANCEL H₂O

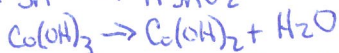


B)



STEP 1

STEP 2 (DONE) +
STEP 3



STEP 4

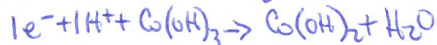


∅ → +2

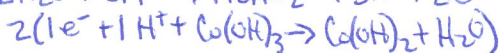
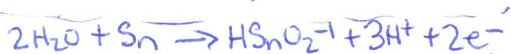


+1 → ∅

STEP 5



STEP 6



STEP 7



STEP 8



STEP 9

