Volume Stoich. Hmwk:

8) $2KI + F_2(g) \rightarrow 2KF + I_2(g)$

a) given: $0.72 mol\ F_2$ need: ? $L\ I_2$ Type: mol → vol

$$0.72 mol\ F_2 \times \frac{1\ mol\ I_2}{1\ mol\ F_2} \times \frac{22.4 L\ I_2}{1\ mol\ I_2} = \boxed{16 L\ I_2}$$

b) given: $56.2 L\ I_2$ need: ? mol KI Type: vol → mol

$$56.2 L\ I_2 \times \frac{1 mol\ I_2}{22.4 L\ I_2} \times \frac{2\ mol\ KI}{1\ mol\ I_2} = \boxed{5.02 mol\ KI}$$

9) $2Na + 2H_2O \longrightarrow 2NaOH + H_2(g)$

a) given: $15.0 L\ H_2$ need: ? mol Na Type: vol → mol

$$15.0 L\ H_2 \times \frac{1 mol\ H_2}{22.4 L\ H_2} \times \frac{2\ mol\ Na}{1\ mol\ H_2} = \boxed{1.34\ mol\ Na}$$

Volume Stoich. Hmwk:

(10) $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$

a) given: 31.8L NH_3 need: ? L N_2 Type: Vol → vol

$$31.8\,L\,NH_3 \times \frac{1\,mol\,NH_3}{22.4\,L\,NH_3} \times \frac{1\,mol\,N_2}{2\,mol\,NH_3} \times \frac{22.4\,L\,N_2}{1\,mol\,N_2} = \boxed{15.9\,L\,N_2}$$

b) given: 5627 L N_2 need: ? L H_2 Type: vol → vol

$$5627\,L\,N_2 \times \frac{1\,mol\,N_2}{22.4\,L\,N_2} \times \frac{3\,mol\,H_2}{1\,mol\,N_2} \times \frac{22.4\,L\,H_2}{1\,mol\,H_2} = \boxed{1688\,L\,H_2}$$

(11) ___ $CH_4(g)$ + <u>2</u> $O_2(g) \rightarrow$ <u>2</u> $H_2O(g)$ + ___ $CO_2(g)$ (3)

a) given: 10.0L O_2 need: ? L CH_4 Type: Vol → vol

$$10.0\,L\,O_2 \times \frac{1\,mol\,O_2}{22.4\,L\,O_2}_{(2)} \times \frac{1\,mol\,CH_4}{2\,mol\,O_2}_{(3)} \times \frac{22.4\,L\,CH_4}{1\,mol\,CH_4}_{(2)} = \boxed{5.00\,L\,CH_4}$$

b) given: 70.5L CH_4 need: ? L CO_2 Type: vol → vol

$$70.5\,L\,CH_4 \times \frac{1\,mol\,CH_4}{22.4\,L\,CH_4} \times \frac{1\,mol\,CO_2}{1\,mol\,CH_4} \times \frac{22.4\,L\,CO_2}{1\,mol\,CO_2} = \boxed{70.5\,L\,CO_2}$$

Volume Stoich. Hmwk:

(12) $2K + 2H_2O \rightarrow 2KOH + H_2(g)$

a) given: 20.0g K need: ? L H_2 Type: mass → vol

$$20.0\text{g K} \times \frac{1\text{ mol K}}{39.10\text{g K}} \times \frac{1\text{ mol } H_2}{2\text{ mol K}} \times \frac{22.4\text{L } H_2}{1\text{ mol } H_2} = \boxed{5.73\text{ L } H_2}$$

b) given: 23.0L H_2 need: ? g H_2O Type: vol → mass

$$23.0\text{L } H_2 \times \frac{1\text{ mol } H_2}{22.4\text{L } H_2} \times \frac{2\text{ mol } H_2O}{1\text{ mol } H_2} \times \frac{18.02\text{g } H_2O}{1\text{ mol}} = \boxed{37.0\text{g } H_2O}$$

(13) $Zn + 2HCl(aq) \rightarrow ZnCl_2 + H_2(g)$

a) given: 60.70L H_2 need: ? g Zn Type: vol → mass

$$60.70\text{L } H_2 \times \frac{1\text{ mol } H_2}{22.4\text{L } H_2} \times \frac{1\text{ mol Zn}}{1\text{ mol } H_2} \times \frac{65.39\text{g Zn}}{1\text{ mol Zn}} = \boxed{177.2\text{g Zn}}$$

b) given: 47.8g HCl need: ? L H_2 Type: mass → vol

$$47.8\text{g HCl} \times \frac{1\text{ mol HCl}}{36.46\text{g HCl}} \times \frac{1\text{ mol } H_2}{2\text{ mol HCl}} \times \frac{22.4\text{L } H_2}{1\text{ mol } H_2} = \boxed{14.7\text{ L } H_2}$$

Volume Stoich. Hmwk:

(14) $2C + O_2(g) \rightarrow 2CO(g)$ (3)

a) given: 34.2L CO need: ? g C Type: vol → mass

$$34.2\text{L CO} \times \frac{1\text{ mol CO}}{22.4\text{L CO}}_{(2)} \times \frac{2\text{ mol C}}{2\text{ mol CO}}_{(3)} \times \frac{12.01\text{g C}}{1\text{ mol C}}_{(2)} = \boxed{18.3\text{g C}}$$

b) given: 21.9g C need: ? L $O_2(g)$ Type: mass → vol

$$21.9\text{g C} \times \frac{1\text{ mol C}}{12.01\text{g C}} \times \frac{1\text{ mol } O_2}{2\text{ mol C}} \times \frac{22.4\text{L } O_2}{1\text{ mol } O_2} = \boxed{20.4\text{L } O_2}$$

(15) $2NaF + Cl_2(g) \rightarrow 2NaCl + F_2(g)$

a) given: 88.0L Cl_2 need: ? g NaCl Type: vol → mass

$$88.0\text{L } Cl_2 \times \frac{1\text{ mol } Cl_2}{22.4\text{L } Cl_2} \times \frac{2\text{ mol NaCl}}{1\text{ mol } Cl_2} \times \frac{58.45\text{g NaCl}}{1\text{ mol NaCl}} = \boxed{459\text{g NaCl}}$$

b) given: 97.8g NaF need: ? L F_2 Type: mass → vol

$$97.8\text{g NaF} \times \frac{1\text{ mol NaF}}{42.00\text{g NaF}} \times \frac{1\text{ mol } F_2}{2\text{ mol NaF}} \times \frac{22.4\text{L } F_2}{1\text{ mol } F_2} = \boxed{26.1\text{L } F_2}$$

$$\% \text{ yield} = \frac{\text{lab or actual value}}{\text{theoretical value}} \times 100$$

Compares the value obtained in lab to the mathematical value (theo.).

Limiting Factor

Compares the quantity of product created when the starting values of both reactants are known. Can be used to find "left over" or unused reactants.

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$$

given #1: $30.0 L\ H_2$
given #2: $40.0 L\ O_2$
} needed: ? $L\ H_2O$

limiting factor

$$30.0 L\ H_2 \times \frac{1 mol\ H_2}{22.4\ L H_2} \times \frac{2 mol\ H_2O}{2 mol\ H_2} \times \frac{22.4 L\ H_2O}{1 mol\ H_2O} = \boxed{30.0 L\ H_2O}$$

Theo Yield (the smaller value)

$$40.0 L\ O_2 \times \frac{1 mol\ O_2}{22.4 L\ O_2} \times \frac{2 mol\ H_2O}{1 mol\ O_2} \times \frac{22.4 L\ H_2O}{1 mol\ H_2O} = \boxed{80.0 L\ H_2O}$$

$$\underset{\text{Theo yield}}{30.0 L\ H_2O} \times \frac{1 mol\ H_2O}{22.4 L\ H_2O} \times \frac{1 mol\ O_2}{2 mol\ H_2O} \times \frac{22.4 L\ O_2}{1 mol\ O_2} = 15.0 L\ O_2 \text{ used}$$

$$\underset{\text{(given)}}{40.0 L\ O_2} - \underset{\text{(used)}}{15.0 L\ O_2} = \boxed{25.0 L \text{ left over (remaining)}}$$

if 10.0 g of sodium reacts with 10.0g of chlorine gas how many grams of sodium chloride is produced? What is the limiting factor? How much reactant is leftover?

$\underline{2}\ Na + \underline{\ \ }\ Cl_2(g) \rightarrow \underline{2}\ NaCl$

$10.0g\ Na \times \frac{1\ mol\ Na}{23.00g\ Na} \times \frac{2\ mol\ NaCl}{2\ mol\ Na} \times \frac{58.45g\ NaCl}{1\ mol\ NaCl} = 25.4\ g\ NaCl$

L.F.

$10.0g\ Cl_2 \times \frac{1\ mol\ Cl_2}{70.90g\ Cl_2} \times \frac{2\ mol\ NaCl}{1\ mol\ Cl_2} \times \frac{58.44g\ NaCl}{1\ mol\ NaCl} = 16.5\ g\ NaCl$ (Theo yield)

$16.5g\ NaCl \times \frac{1\ mol\ NaCl}{58.45g\ NaCl} \times \frac{2\ mol\ Na}{2\ mol\ NaCl} \times \frac{23.00g\ Na}{1\ mol\ Na} = 6.49g\ Na$ used

$10g - 6.49g = 3.51g\ Na$ leftover

If the lab produced 12.8g NaCl, what is the % yield?