13.3 Gas Stoichiometry

* In reactions involving gases, the coefficients represent both moles, and volumes.

So, in the following eqn: $2NH_{3(g)} \rightarrow 3H_{2(g)} + N_{2(g)}$

The coeffients tell us the ratio of $N_2 : H_2 = \frac{1 \text{ mole } N_2}{3 \text{ mole } H_2}$,

this also means volumes follow same ratio $\frac{1 \text{ L } N_2}{3 \text{ L } H_2}$

* To solve a stoich problem for gases you have to know the balanced equation & volume of 1 gas

ex) $2HCl_{(aq)} \rightarrow 1H_{2(g)} + 1Cl_{2(g)}$ Balance

If you have 2.3 L of H_2, what is volume of Cl_2 produced?

$$2.3 \text{ L } \cancel{H_2} \left| \frac{1 \text{ L } Cl_2}{1 \text{ L } \cancel{H_2}} \right. = (2.3 \text{ L } Cl_2 \text{ produced})$$

ex) $2CO_{(g)} + O_{2(g)} \rightarrow 2CO_{2(g)}$ Balance

7.1 L CO used - how much CO_2 is produced?

$$7.1 \text{ L } \cancel{CO} \left| \frac{2 \text{ L } CO_2}{2 \text{ L } \cancel{CO}} \right. = (7.1 \text{ L } CO_2 \text{ produced})$$

ex) 7.1 L CO used, how much O_2 required?

$$7.1 \text{ L } \cancel{CO} \left| \frac{1 \text{ L } O_2}{2 \text{ L } \cancel{CO}} \right. = (3.55 \text{ L } O_2)$$

Volume to Mass Stoich

* You will start off with vol of 1 gas, and P & T.

1st - convert L of given to L of unknown

2nd - Plug volume into $PV = nRT$ to solve for moles of unknown

3rd - Convert moles to mass of unknown (using molar mass)

ex) $2H_2O \rightarrow 2H_2 + O_2$ Balance

If you end up with 2 L of H_2, how many grams of O_2 will you have?

$2H_2O \rightarrow 2H_2 + O_2$ @ STP (1 atm & 298 K) $R = 0.0821$

1st $\frac{2\ \text{L}\ H_2}{2\ \text{L}\ H_2} \left| \frac{1\ \text{L}\ O_2}{} \right. = 1\ \text{L}\ O_2$ produced

2nd $PV = nRT$ $\quad 1\text{atm} \times 1\text{L} = n \times 0.0821 \times 298\text{K}$

$O_2 = 2\times O = 16.0 \times 2$ $\quad n = .04\ \text{mol}\ O_2$

3rd $\frac{0.04\ \text{mol}\ O_2}{1\ \text{mol}\ O_2} \left| \frac{32.0\ \text{g}}{} \right. = \boxed{1.28\ \text{g}\ O_2}$