Gas Stoichiometry: At STP and non-STP

3. 0.500 L of $H_2(g)$ reacts with excess $O_2(g)$ at STP according to the equation: $2\ H_2(g) + O_2(g) \rightarrow 2\ H_2O(g)$

   What volume of water is produced?

$$0.500\ L\ H_2 \times \frac{1\ mol\ H_2}{22.4\ L\ H_2} \times \frac{2\ mol\ H_2O}{2\ mol\ H_2} \times \frac{22.4\ L\ H_2O}{1\ mol\ H_2O} = \boxed{0.500\ L\ H_2O}$$

also works if both reactants & products are at constant T, P. (* shortcut for L→L @ STP :)

$$0.500\ L\ H_2 \times \frac{2\ L\ H_2O}{2\ L\ H_2} = \boxed{0.500\ L\ H_2O}$$

4. How many grams of carbon react if 543 L of gaseous carbon monoxide can be produced at 27°C and 0.247 atm according to the following equation? $2\ C(s) + O_2(g) \rightarrow 2\ CO(g)$

not @ STP, use $PV=nRT$

$$PV = nRT$$

$$(0.247\ atm)(543\ L) = n\left(0.08206 \frac{L\ atm}{mol\ K}\right)(300.\ K)$$

$$n = 5.45\ mol\ CO \times \frac{2\ mol\ C}{2\ mol\ CO} \times \frac{12.01\ g\ C}{1\ mol\ C} = \boxed{65.5\ g\ C}$$

5. Air bags in cars are inflated by the sudden decomposition of sodium azide, NaN_3, by the following reaction: $2\ NaN_3(s) \rightarrow 3\ N_2(g) + 2\ Na(s)$. What volume of nitrogen gas, measured at 1.30 atm and 87°C, would be produced by the reaction of 70.0 g of NaN_3?

$$70.0\ g\ NaN_3 \times \frac{1\ mol\ NaN_3}{65.02\ g\ NaN_3} \times \frac{3\ mol\ N_2}{2\ mol\ NaN_3} = 1.61\ mol\ N_2$$

$$PV = nRT$$

$$(1.30\ atm)V = (1.61\ mol\ N_2)\left(0.08206 \frac{L\ atm}{mol\ K}\right)(360.\ K)$$

$$\boxed{V = 36.7\ L\ N_2}$$

Molarity Stoichiometry: Solutions to All Your Problems

***Note:** millimoles (or mmol) can be your BEST friend during solution stoich!

$$\frac{mmol}{mL} = M$$

1. 250 mL of 0.70 M Li_3PO_4 and 250 mL of excess $Ca(OH)_2$ are mixed, producing an aqueous LiOH solution (and a calcium phosphate precipitate). What is the molar concentration of LiOH in this solution?