11-3 Gas Stoichiometry

Volume - Volume

- Treat coefficients as a molar ratio

  Moles and Volumes are directly related (Avogadro's Law)

Volume – Mass

- Use Ideal Gas Law to convert between volume and moles
- Use mole ratio (stoichiometry) to relate moles of the gas and the other reactant/product you are looking for
- Use molar mass to convert between mass and moles

Volume – Mass

- Opposite order from Volume – Mass problems

11-3 Gas Stoichiometry

Volume - Volume

$$C_3H_8(g) + 5O_2(g) \rightarrow 3CO_2(g) + 4H_2O(g)$$

What will be the volume of CO_2 produced from the complete combustion of 0.350 L of propane? (Assume the same temperature and pressure)

$$0.350\ \text{L}\ C_3H_8 \left(\frac{3CO_2}{1C_3H_8}\right) = 1.05\ \text{L}\ CO_2$$

11-3 Gas Stoichiometry

Volume - Mass

$$CaCO_3(s) \xrightarrow{\Delta} CaO(s) + CO_2(g)$$

How many grams of calcium carbonate must be decomposed to produce 5.00 L of CO_2 gas with 1 atm of pressure at 273 K?

$$PV = nRT \quad \rightarrow \quad n = \frac{PV}{RT}$$

$$n = \frac{(1\ \text{atm})(5.0\ \text{L})}{(0.0821\ \frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}})(273\ \text{K})} = 0.223\ \text{mol}\ CO_2$$

$$0.223\ \text{mol}\ CO_2 \left(\frac{1\ CaCO_3}{1\ CO_2}\right)\left(\frac{100.1\ \text{g}}{\text{mol}}\right) = 22.3\ \text{g}\ CaCO_3$$

11-3 Gas Stoichiometry

Mass - Volume

$$2C(s) + O_2(g) \rightarrow 2CO(g)$$

How many liters of carbon monoxide at 300 K and 0.247 atm can be produced from the burning of 65.5 g of carbon?

$$65.5\ \text{g C} \left(\frac{\text{mol}}{12.0\ \text{g}}\right)\left(\frac{2\ CO}{2\ C}\right) = 5.46\ \text{mol CO}$$

$$PV = nRT \quad \rightarrow \quad V = \frac{nRT}{P}$$

$$V = \frac{(5.46\ \text{mol})(0.0821\ \frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}})(300\ \text{K})}{(0.247\ \text{atm})} = 544\ \text{L CO}$$