

Gas Stoichiometry Practice

For all of these problems, assume that the reactions are being performed at a pressure of 1.0 atm and a temperature of 298 K.

- 1) Calcium carbonate decomposes at high temperatures to form carbon dioxide and calcium oxide:



How many grams of calcium carbonate will I need to form 3.45 liters of carbon dioxide?

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$\frac{(1 \text{ atm})(V_1)}{273 \text{ K}} = \frac{(1 \text{ atm})(3.45 \text{ L})}{298 \text{ K}}$$

$$V_1 = 3.16 \text{ L}$$

at STP 1 mol = 22.4 L
x = 3.16 L
0.14 mol

$$\frac{0.14 \text{ mol CO}_2}{1} = \frac{x \text{ mol CaCO}_3}{1}$$

$$0.14 \text{ mol}$$

1 mol CaCO₃ = 100.1 g
.14 = x
14 g

- 2) Ethylene burns in oxygen to form carbon dioxide and water vapor:



How many liters of water can be formed if 1.25 liters of ethylene are consumed in this reaction?

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$\frac{(1 \text{ atm})V_1}{273 \text{ K}} = \frac{(1 \text{ atm})(1.25 \text{ L})}{298 \text{ K}}$$

$$V_1 = 1.15 \text{ L}$$

at STP 1 mol = 22.4 L
x = 1.15 L
0.05 mol

$$\frac{0.05 \text{ mol C}_2\text{H}_4}{1} = \frac{x \text{ mol H}_2\text{O}}{2}$$

$$0.1 \text{ mol}$$

at STP 1 mol = 22.4 L
0.1 x
2.24 L

$$\frac{(1 \text{ atm})(2.24 \text{ L})}{273 \text{ K}} = \frac{(1 \text{ atm})V_2}{298 \text{ K}}$$

$$V = 2.45 \text{ L}$$

- 3) When chlorine is added to acetylene, 1,1,2,2-tetrachloroethane is formed:



How many liters of chlorine will be needed to make 75.0 grams of C₂H₂Cl₄?

1 mol C₂H₂Cl₄ = 168.02 g
x 75 g
0.446 mol

$$\frac{x \text{ mol Cl}_2}{2} = \frac{0.446 \text{ mol C}_2\text{H}_2\text{Cl}_4}{1}$$

$$0.892 \text{ mol}$$

at STP 1 mol = 22.4 L
0.892 = x
19.98 L

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$\frac{(1 \text{ atm})(19.98 \text{ L})}{273 \text{ K}} = \frac{(1 \text{ atm})V}{298 \text{ K}}$$

$$V = 21.8 \text{ L}$$