

Honors Gas Stoich Problems

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



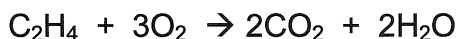
How many grams of calcium carbonate are needed to form 3.45 L of carbon dioxide at STP?

$$\begin{array}{r} \text{(3)} \\ 3.45 \text{ L} \end{array} \begin{array}{r} \text{(5)} \\ 100.09 \text{ g} \end{array} \begin{array}{r} 40.08 \\ 12.01 \\ 48.00 \\ 100.09 \text{ g} \end{array}$$

$$\frac{3.45 \text{ L}}{22.4 \text{ L}} \times \frac{1 \text{ mol CO}_2}{1 \text{ mol CO}_2} \times \frac{1 \text{ mol CaCO}_3}{1 \text{ mol CaCO}_3} \times \frac{100.09 \text{ g}}{1 \text{ mol}} = 15.4156 \dots \text{ g CaCO}_3$$

15.4 g CaCO₃

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

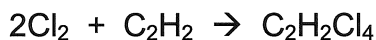


How many liters of carbon dioxide can be formed if 1.25 L of ethylene at STP are consumed in this reaction?

$$\frac{1.25 \text{ L C}_2\text{H}_4}{22.4 \text{ L}} \times \frac{1 \text{ mol C}_2\text{H}_4}{1 \text{ mol C}_2\text{H}_4} \times \frac{2 \text{ mol CO}_2}{1 \text{ mol C}_2\text{H}_4} \times \frac{22.4 \text{ L}}{1 \text{ mol}} = 2.50 \text{ L CO}_2$$

2.50 L CO₂

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



How many liters of chlorine at STP will be needed to make 75.0 g of C₂H₂Cl₄?

$$\frac{75.0 \text{ g C}_2\text{H}_2\text{Cl}_4}{171.8 \text{ g}} \times \frac{1 \text{ mol C}_2\text{H}_2\text{Cl}_4}{1 \text{ mol C}_2\text{H}_2\text{Cl}_4} \times \frac{2 \text{ mol Cl}_2}{1 \text{ mol C}_2\text{H}_2\text{Cl}_4} \times \frac{22.4 \text{ L}}{1 \text{ mol}} = 19.557 \dots \text{ L}$$

20.0 L

[Answers (in no order): 14.7 L; 3.86 L; 15.4 g; 20.0 L; 2.09 L; 2.50 L]

39.10

35.45

48.00

- 4.) Calculate the volume of oxygen gas produced at 1.50 atm and 25°C by the complete decomposition of 10.5 g of potassium chlorate. The balanced equation for this reaction is ...



$$V = \frac{nRT}{P}$$

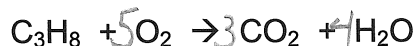
(3)

$$\frac{10.5 \text{ g KClO}_3 / \text{mol} / 3 \text{ mol O}_2 / 0.0821 \text{ L} \cdot \text{atm} / 298 \text{ K}}{122.55 \text{ g} / 2 \text{ mol KClO}_3 / \text{K} \cdot \text{mol} / 1.50 \text{ atm}}$$

$n_{\text{O}_2} = 2.09621... \text{ L}$

$\boxed{2.10 \text{ L}}$

- 5.) Consider the following unbalanced chemical equation for the combustion of propane.



What volume of oxygen gas at 25°C and 1.04 atm is needed for the complete combustion of 5.53 g of propane.

$$V = \frac{nRT}{P}$$

$$\frac{5.53 \text{ C}_3\text{H}_8 / \text{mol} / 5 \text{ mol O}_2 / 0.0821 \text{ L} \cdot \text{atm} / 298 \text{ K}}{44.11 \text{ g} / 1 \text{ mol C}_3\text{H}_8 / \text{K} \cdot \text{mol} / 1.04 \text{ atm}}$$

$n_{\text{O}_2} = 14.7463... \text{ L} \Rightarrow \boxed{14.7 \text{ L}}$

- 6.) 2.15 L of nitrogen gas at 27.0 °C and 750 torr completely reacts with excess hydrogen gas. What volume of ammonia at STP is formed?



conversion!

$$\frac{750 \text{ torr} / 2.15 \text{ L} / \text{mol K} / 1 \text{ atm} / 2 \text{ mol NH}_3 / 22.4 \text{ L}}{300. \text{ K} / 0.0821 \text{ L} \cdot \text{atm} / 760 \text{ torr} / 1 \text{ mol N}_2 / 1 \text{ mol}}$$

$n_{\text{N}_2} = 3.85922... \text{ L} \Rightarrow \boxed{3.9 \text{ L}}$

STP

HOMEWORK READ 469 - 473

[Answers (in no order): 14.7 L; 3.86 L; 15.4 g; 20.0 L; 2.09 L; 2.50 L]