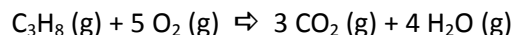


Pre-AP Chemistry/AP Chemistry

Unit #17—Gas Laws

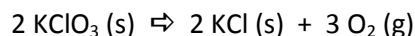
Gas Stoichiometry

What volume of oxygen gas is needed for the complete combustion of 4.0 L of propane gas at STP conditions?



$$\frac{4.0 \text{ L C}_3\text{H}_8}{22.4 \text{ L C}_3\text{H}_8} \left| \frac{1 \text{ mol C}_3\text{H}_8}{1 \text{ mol C}_3\text{H}_8} \right| \left| \frac{5 \text{ mol O}_2}{1 \text{ mol C}_3\text{H}_8} \right| \left| \frac{22.4 \text{ L O}_2}{1 \text{ mol O}_2} \right| = 200 \text{ L O}_2$$

Calculate the grams of oxygen gas and potassium chloride produced at 1.00 atm and 25 °C by the complete decomposition of 10.5 L of potassium chlorate.



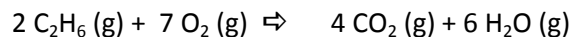
$$25 \text{ }^\circ\text{C} + 273.15 \text{ K} = 298.15 \text{ K}$$

$$\frac{(1 \text{ atm})(10.5 \text{ L})}{(0.08206 \text{ Latm/Kmol})(298.15 \text{ K})} = 0.429 \text{ mol KClO}_3$$

$$\frac{0.429 \text{ mol KClO}_3}{2 \text{ mol KClO}_3} \left| \frac{3 \text{ mol O}_2}{1 \text{ mol KClO}_3} \right| \left| \frac{31.998 \text{ g O}_2}{1 \text{ mol O}_2} \right| = 20.591 \text{ g O}_2$$

$$\frac{0.429 \text{ mol KClO}_3}{2 \text{ mol KClO}_3} \left| \frac{2 \text{ mol KCl}}{1 \text{ mol KClO}_3} \right| \left| \frac{74.551 \text{ g KCl}}{1 \text{ mol KCl}} \right| = 31.982 \text{ g KCl}$$

If 14.4 L of ethane is combusted at 102.7 °C and 99.3 kPa, how many grams of water will be produced? How many moles of carbon dioxide will be produced? How many liters of oxygen gas is needed for the combustion reaction?



$$102.7 \text{ }^\circ\text{C} + 273.15 \text{ K} = 375.85 \text{ K}$$

$$\frac{99.3 \text{ kPa}}{101.3 \text{ kPa}} \left| \frac{1 \text{ atm}}{101.3 \text{ kPa}} \right| = 0.980 \text{ atm}$$

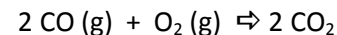
$$\frac{(0.980 \text{ atm})(14.4 \text{ L})}{(0.08206 \text{ Latm/Kmol})(375.85 \text{ K})} = 0.458 \text{ mol C}_2\text{H}_6$$

$$\frac{0.458 \text{ mol C}_2\text{H}_6}{2 \text{ mol C}_2\text{H}_6} \left| \frac{6 \text{ mol H}_2\text{O}}{1 \text{ mol C}_2\text{H}_6} \right| \left| \frac{18.015 \text{ g H}_2\text{O}}{1 \text{ mol H}_2\text{O}} \right| = 24.753 \text{ g H}_2\text{O}$$

$$\frac{0.458 \text{ mol C}_2\text{H}_6}{2 \text{ mol C}_2\text{H}_6} \left| \frac{4 \text{ mol CO}_2}{1 \text{ mol C}_2\text{H}_6} \right| = 0.916 \text{ mol CO}_2$$

$$\frac{0.458 \text{ mol C}_2\text{H}_6}{2 \text{ mol C}_2\text{H}_6} \left| \frac{7 \text{ mol O}_2}{1 \text{ mol C}_2\text{H}_6} \right| \left| \frac{22.4 \text{ L O}_2}{1 \text{ mol O}_2} \right| = 35.907 \text{ L O}_2$$

If 1.39 grams of carbon monoxide reacts with oxygen, what volume of carbon dioxide is produced at 12.3 °C at 107.4 kPa?



$$\frac{1.39 \text{ g CO}}{28.005 \text{ g CO}} \left| \frac{2 \text{ mol CO}_2}{2 \text{ mol CO}} \right| = 38.927 \text{ mol CO}_2$$

$$12.3 \text{ }^\circ\text{C} + 273.15 \text{ K} = 285.45 \text{ K}$$

$$\frac{107.4 \text{ kPa}}{101.3 \text{ kPa}} \left| \frac{1 \text{ atm}}{101.3 \text{ kPa}} \right| = 1.060 \text{ atm}$$

$$(38.927 \text{ mol})(0.08206 \text{ Latm/Kmol})(285.45 \text{ K}) (1.060 \text{ atm}) = 860.214 \text{ L CO}_2$$