

Gases and Stoichiometry Part 2

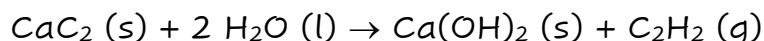
1. Consider the following reaction:



What volume of oxygen, in L, at 28.0°C and 1.00 atm is produced if 6.85 g of KClO_3 decomposes?

$$\begin{aligned} M_m \text{KClO}_3 &= 122.55 \text{ g/mol} & 28.0^\circ\text{C} + 273.15 &= 301.15 \text{ K} \\ 6.85 \text{ g KClO}_3 &\times \frac{1 \text{ mol KClO}_3}{122.66 \text{ g}} \times \frac{3 \text{ mol O}_2}{2 \text{ mol KClO}_3} &= 0.0838 \text{ mol O}_2 \\ PV = nRT \text{ and } V &= \frac{nRT}{P} = \frac{0.0838 \text{ mol} \times 0.0821 \frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}} \times 301.15 \text{ K}}{1.00 \text{ atm}} = \mathbf{2.07 \text{ L}} \end{aligned}$$

2. Consider the following chemical equation:



What volume of C_2H_2 is produced if 1.523 g of CaC_2 is reacted. The pressure is 731.9 torr at a temperature of 23.0 °C.

$$\begin{aligned} M_m \text{CaC}_2 &= 64.009 \text{ g/mol} & 23.0^\circ\text{C} + 273.15 &= 296.15 \text{ K} \\ 1.523 \text{ g CaC}_2 &\times \frac{1 \text{ mol CaC}_2}{64.009 \text{ g}} \times \frac{1 \text{ mol C}_2\text{H}_2}{1 \text{ mol CaC}_2} &= 0.0238 \text{ mol C}_2\text{H}_2 \\ PV = nRT \text{ and } V &= \frac{nRT}{P} = \frac{0.0238 \text{ mol} \times 0.0821 \frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}} \times 296.15 \text{ K}}{731.9 \text{ torr} \times \frac{1.00 \text{ atm}}{760 \text{ torr}}} = \mathbf{0.959 \text{ L}} \end{aligned}$$

3. An airbag has a volume of 60.0 L at a temperature of 22.0 °C. Nitrogen gas, N_2 , is formed from solid sodium azide, NaN_3 according to the following chemical equation.



How many grams of NaN_3 is required if the pressure inside the airbag, once it inflates, is 826 mmHg?

$$826 \text{ mmHg} = 1.09 \text{ atm}, 22^\circ\text{C} = 295 \text{ K}, M_m \text{NaN}_3 = 65.009 \text{ g/mol}$$

$$\begin{aligned} n &= \frac{PV}{RT} = \frac{1.09 \text{ atm} \times 60.0 \text{ L}}{0.0821 \frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}} \times 295 \text{ K}} = 2.70 \text{ mol N}_2 \\ 2.70 \text{ mol N}_2 &\times \frac{2 \text{ mol NaN}_3}{3 \text{ mol N}_2} \times \frac{65.009 \text{ g NaN}_3}{1 \text{ mol NaN}_3} = \mathbf{117 \text{ g NaN}_3} \end{aligned}$$