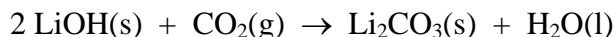


## An Example of Heterogeneous Stoichiometric Calculations Involving the Gas Laws

6-48

A method of removing CO<sub>2</sub>(g) from a spacecraft is to allow the CO<sub>2</sub> to react with LiOH. How many liters of CO<sub>2</sub>(g) at 25.9°C and 751 torr can be removed per kilogram of LiOH consumed?



This is a stoichiometry problem involving a solid and a gas.

First, get constants and "knowns" properly defined...

$$T = 25.9^\circ\text{C} + 273.2 \text{ K} = 299.1 \text{ K}$$

$$P = \frac{751 \text{ torr}}{760 \frac{\text{torr}}{\text{atm}}} = 0.9882 \text{ atm}$$

Now, calculate the molar quantity of CO<sub>2</sub> consumed per kg of LiOH:

$$n_{\text{CO}_2} = 1000 \text{ g LiOH} \times \frac{1 \text{ mol LiOH}}{24.02 \text{ g LiOH}} \times \frac{1 \text{ mol CO}_2}{2 \text{ mol LiOH}} = 20.815 \text{ mol CO}_2$$

Finally, calculate the volume of CO<sub>2</sub> consumed per kg LiOH:

$$\frac{PV}{nT} = R \quad \text{so.....} \quad V = \frac{nTR}{P} = \frac{(20.815 \text{ mol})(299.1 \text{ K})(0.08206 \frac{\text{L}\cdot\text{atm}}{\text{mol}\cdot\text{K}})}{0.9882 \text{ atm}} = 517 \text{ L}$$

6-32

A sample of N<sub>2</sub>(g) occupies a volume of 42.0 mL under the existing barometric pressure. Increasing the pressure by 85 mm Hg reduces the volume to 37.7 mL. What is the prevailing barometric pressure, in millimeters of mercury?

$$V_1 = 42.0 \text{ mL}$$

$$P_1 = \text{unknown}$$

$$V_2 = 37.7 \text{ mL}$$

$$P_2 = P_1 + 85 \text{ mmHg}$$

$$P_1(42.0 \text{ mL}) = (P_1 + 85 \text{ mmHg})(37.7 \text{ mL})$$

$$1.114P_1 = P_1 + 85 \text{ mmHg}$$

$$0.114P_1 = 85 \text{ mmHg}$$

$$P_1 = P_{\text{barometric}} = 745 \text{ mmHg}$$