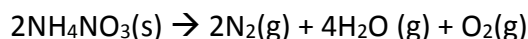


### Question #63302, Chemistry / General chemistry

When heated to 350 °C at 0.950 atm, ammonium nitrate decomposes to produce nitrogen, water and oxygen gases:



How many grams of  $\text{NH}_4\text{NO}_3$  are needed to produce 18.3 L of oxygen?

#### Solution:

The mass of ammonium nitrate equal to mole number multiply by molar mass of ammonium nitrate:

$$m(\text{NH}_4\text{NO}_3) = n(\text{NH}_4\text{NO}_3) \cdot M(\text{NH}_4\text{NO}_3)$$

To find the mass using this equation we need to find the mole number of the ammonium nitrate. As the reaction occurs at constant conditions that is why we can use the law of equivalence.

$$2n(\text{NH}_4\text{NO}_3) = n(\text{O}_2)$$

$$n(\text{NH}_4\text{NO}_3) = \frac{1}{2}n(\text{O}_2)$$

The mole number of the oxygen equal to ratio between the volume of the oxygen and molar volume (constant value 22.4 L/mol):

$$n(\text{O}_2) = \frac{V(\text{O}_2)}{V_m} = \frac{18.3 \text{ L}}{22.4 \frac{\text{L}}{\text{mol}}} = 0.82 \text{ mol}$$

The mole number of ammonia nitrate:

$$n(\text{NH}_4\text{NO}_3) = \frac{1}{2}n(\text{O}_2) = \frac{1}{2}0.82 \text{ mol} = 0.41 \text{ mol}$$

The mass of  $\text{NH}_4\text{NO}_3$  are needed to produce 18.3 L of oxygen:

$$m(\text{NH}_4\text{NO}_3) = n(\text{NH}_4\text{NO}_3) \cdot M(\text{NH}_4\text{NO}_3) = 0.41 \text{ mol} \cdot 80 \frac{\text{g}}{\text{mol}} = 32.8 \text{ g}$$

**Answer:**  $m(\text{NH}_4\text{NO}_3) = 32.8 \text{ g}$