Answer in question #64035, Chemistry / General Chemistry

Question:

calculate the mass of ammonia formed by the decomposition of 10.0 grams of ammonium carbonate

Solution:

The equation for decomposition of ammonium carbonate:

$$(NH_4)_2CO_3 \rightarrow 2NH_3 + H_2O + CO_2$$

One can see that the number of the moles of ammonium carbonate and ammonia go in following relation:

$$\frac{n(NH_3)}{2} = n((NH_4)_2CO_3)$$

Also, we know that the mass of ammonia is the product of its number of the moles and molar mass:

$$m(NH_3) = n(NH_3) \cdot M(NH_3)$$

To find a number of the moles of ammonium carbonate, we just divide the mass by molar mass:

$$n((NH_4)_2CO_3) = \frac{m((NH_4)_2CO_3)}{M((NH_4)_2CO_3)} = \frac{10.0 \ (g)}{96.09 \ (g \ mol^{-1})} = 0.1041 \ (mol)$$

Finally, the mass of ammonia formed is:

$$m(NH_3) = 2n\big((NH_4)_2CO_3)\big) \cdot M(NH_3)$$
$$m(NH_3) = 2 \cdot 0.1041 \ (mol) \cdot 17.031 (g \ mol^{-1}) = 3.6 \ (g)$$

Answer: 3.6 g