Answer on Question #76661 - Chemistry - General Chemistry

Question:

1. Nitrous oxide is also called laughing gas. It can be prepared by thermal decomposition of ammonium nitrate. The product is H2O. How many grams of nitrous oxide are formed if 0.46 mole of ammonium nitrate is used in the reaction?

2. A common laboratory preparation of oxygen gas is the thermal decomposition of potassium chlorate. Assuming complete decomposition, calculate the number of grams of O2 gas that can be obtained from 46.0 grams of potassium chlorate.

Solution:

1. Reaction of ammonium nitrate decomposition:

$$NH_4NO_3 \rightarrow N_2O + 2H_2O$$

We know that amount of moles of ammonium nitrate is equal to 0.46 and by the equation we can say that the same amount of moles of nitrous oxide forms during reaction:

$$n(NH_4NO_3) = n(N_2O) = 0.46\ moles$$

The mole number is the ratio between the mass and molar mass of compound. After simple mathematical conversion of this common equation we can obtain amount of grams formed during this equation:

$$n(N_2O) = \frac{m(N_2O)}{M(N_2O)}$$

$$m(N_2O) = n(N_2O) \cdot M(N_2O)$$

$$m(N_2O) = 0.46\ moles \cdot 44.01 \frac{g}{mole} = 20.24\ g$$

2. Solution of this question will go by the same way. Decomposition of potassium chlorate looks like:

$$2KClO_3 \rightarrow 2KCl + 3O_2$$

Let's obtain the mole number of potassium chlorate which take part in the reaction:

$$n(KClO_3) = \frac{m(KClO_3)}{M(KClO_3)}$$

$$n(KClO_3) = \frac{46.0\ g}{122.5\ g/mol} = 0.38\ moles$$

By the balanced chemical reaction:

$$2n(KClO_3) = 3n(O_2)$$

$$n(O_2) = \frac{2}{3} n(KClO_3)$$

The mass of the oxygen gas can be calculated by the formula:

$$m(O_2) = n(O_2) \cdot M(O_2) = \frac{2}{3} n(KClO_3) \cdot M(O_2)$$

$$m(O_2) = \frac{2}{3} \cdot 0.38\ moles \cdot 15.99 \frac{g}{mole} = 4.05\ g$$

Answer:

1. The mass of nitrous oxide is equal to 20.24 g.

2. The mass of oxygen gas is equal to 4.05 g.