HW 19

Oxygen

Below is the solution to the problem #1 from the previous HW.

A person needs about 1 mole of oxygen per hour to breath. Calculate how much Na_2O_2 will be needed for a 24-h trip in a single-person submarine using the following equation:

$$Na_2O_2 + CO_2 \rightarrow Na_2CO_3 + O_2$$

a. We balance the equation:

$$2Na_2O_2 + 2CO_2 \rightarrow 2Na_2CO_3 + O_2$$

This tells us that from 2 moles of Na_2O_2 we get 1 mole of oxygen O_2.

b. For a 24-h trip we will need: 1 mole/hr x 24 hr = 24 moles of oxygen. If to get 1 mole of oxygen we need 2 moles of sodium peroxide, then to get 24 moles of oxygen we will need 24x2 = 48 moles of Na_2O_2.
c. To obtain the answer in grams, we calculate the molar mass of sodium peroxide and multiply it by the number of moles that we need (48):
M (Na_2O_2) = 2x23 + 2x16 = 78 g/mole
We will need: 78g/mole x 48 moles = 3744g or 3 kg 744 g of Na_2O_2.

1. There are 10 g of each: $KMnO_4$, $KClO_3$, KNO_3 in the lab. How many liters of oxygen can be obtained from each of these reagents? Use the following equations and the example below:

$$2KMnO_4 \rightarrow K_2MnO_4 + MnO_2 + O_2$$

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

$$2KNO_3 \rightarrow 2KNO_2 + O_2$$

a) Let's find the volume of oxygen that can be obtained from potassium permanganate ($KMnO_4$). According to the equation from 2 moles of potassium permanganate we can obtain 1 mole of oxygen. The molar mass of $KMnO_4$ is:

39 (K) + 55 (Mn) + 4x16 (4 oxygen atoms) = 158 g/mole

This means that from 2x158 g = 316 g of $KMnO_4$ we obtain 1 mole of oxygen.

b) We calculate how many moles of oxygen we will obtain from 10 g of $KMnO_4$:

10g/316 (g/mole) = 0.0316 mole oxygen

c) One mole of any gas occupies 24 l under normal conditions. To calculate what volume 0.0316 moles of oxygen will occupy we multiply the volume per 1 mole by the number of moles:

$$24 \text{ l/mole} \times 0.0316 \text{ moles} = 1.3 \text{ liter}$$

This is the answer to the question -from 10 g of $KMnO_4$ we will obtain 1.3 liters of oxygen.

2. Find oxides among the following compounds: NO_2, HNO_2, $Fe(OH)_3$, Fe_2O_3, $K_2Cr_2O_7$, Mn_2O_7, SiO_2, CO, CO_2, PbO, PbS, H_2O, H_2SO_4, O_2.

3. What is the density of O_2 (in g/L) under normal conditions?

4. Write down reaction of decomposition of azurite $Cu_3C_2H_2O_8$ if you know that all the products are compounds known to you.