

## HW 19

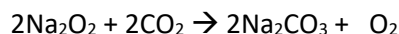
### Oxygen

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  $\text{Na}_2\text{O}_2$  will be needed for a 24-h trip in a single-person submarine using the following equation:



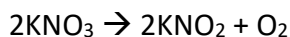
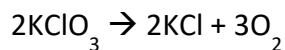
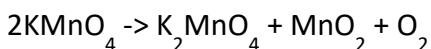
- a. We balance the equation:



This tells us that from 2 moles of  $\text{Na}_2\text{O}_2$  we get 1 mole of oxygen  $\text{O}_2$ .

- 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  $24 \times 2 = 48$  moles of  $\text{Na}_2\text{O}_2$ .
- 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):  
 $M(\text{Na}_2\text{O}_2) = 2 \times 23 + 2 \times 16 = 78 \text{ g/mole}$   
We will need:  $78 \text{ g/mole} \times 48 \text{ moles} = 3744 \text{ g}$  or 3 kg 744 g of  $\text{Na}_2\text{O}_2$ .

1. There are 10 g of each:  $\text{KMnO}_4$ ,  $\text{KClO}_3$ ,  $\text{KNO}_3$  in the lab. How many liters of oxygen can be obtained from each of these reagents? Use the following equations and the example below:



- a) Let's find the volume of oxygen that can be obtained from potassium permanganate ( $\text{KMnO}_4$ ). According to the equation from 2 moles of potassium permanganate we can obtain 1 mole of oxygen. The molar mass of  $\text{KMnO}_4$  is:  
 $39 (\text{K}) + 55 (\text{Mn}) + 4 \times 16 (4 \text{ oxygen atoms}) = 158 \text{ g/mole}$   
This means that from  $2 \times 158 \text{ g} = 316 \text{ g}$  of  $\text{KMnO}_4$  we obtain 1 mole of oxygen.
- b) We calculate how many moles of oxygen we will obtain from 10 g of  $\text{KMnO}_4$ :  
 $10 \text{ g} / 316 (\text{g/mole}) = 0.0316 \text{ mole oxygen}$

- 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  $\text{KMnO}_4$  we will obtain 1.3 liters of oxygen.

2. Find oxides among the following compounds:  $\text{NO}_2$ ,  $\text{HNO}_2$ ,  $\text{Fe}(\text{OH})_3$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{K}_2\text{Cr}_2\text{O}_7$ ,  $\text{Mn}_2\text{O}_7$ ,  $\text{SiO}_2$ ,  $\text{CO}$ ,  $\text{CO}_2$ ,  $\text{PbO}$ ,  $\text{PbS}$ ,  $\text{H}_2\text{O}$ ,  $\text{H}_2\text{SO}_4$ ,  $\text{O}_2$ .
3. What is the density of  $\text{O}_2$  (in g/L) under normal conditions?
4. Write down reaction of decomposition of azurite  $\text{Cu}_3\text{C}_2\text{H}_2\text{O}_8$  if you know that all the products are compounds known to you.