

HW 20

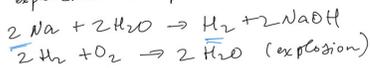
Answers to HW19

HW 19

$C_3H_6 + O_2 \rightarrow CO_2 + H_2O$
 what volume of carbon dioxide is produced when 0.26 L of propene react with 0.36 L of O_2 at STP.

- coefficients
 $2 C_3H_6 + 9 O_2 \rightarrow 6 CO_2 + 6 H_2O$
- We need 4.5 times more O_2 than C_3H_6 . But we don't have it, so our limiting reactant is O_2 . we will base calculation on 0.36 L of O_2 .
- ratio of O_2 to CO_2 3:2
 The volume of CO_2 $\frac{0.36 \times 2}{3} = 0.24 L$

An explosion took place



How much (by volume) hydrogen exploded if 2.3 g of Na reacted?

- Let's find moles of Na
 $\frac{2.3 \text{ g}}{23 \text{ g/mol}} = 0.1 \text{ mol}$
- Based on the coefficients we will get two times less $H_2 \rightarrow 0.05 \text{ mol}$
- If 22.4 L has 1 mole of H_2
 $\frac{1.12 L}{22.4} \text{ will contain } 0.05 \text{ mol of } H_2$

We have a flask with a volume of 5.6 L, at $0^\circ C$. We mix 36.5 g of HCl, 7.1 g of Cl_2 , 3.4 g of NH_3 .

We have the following reaction:



The NH_4Cl - crystals form.

Figure out the atmospheric pressure inside the flask.

- Convert everything to moles
 $\frac{36.5 \text{ g HCl}}{M \text{ of HCl } 35.5 + 1} = 1 \text{ mol}$
 $\frac{7.1 \text{ g of } Cl_2}{71} = 0.1 \text{ mol}$
 $\frac{3.4 \text{ g of } NH_3}{17} = 0.2 \text{ mol}$
- Cl_2 does not participate in the reaction. We can keep in mind 0.1 mol
 $HCl + NH_3 \rightarrow NH_4Cl \downarrow$
 $1 \text{ mol} \quad 0.2 \text{ mol}$
 NH_3 is limiting reactant only 0.2 mol of HCl will be used. We are left with 1 - 0.2 = 0.8 mol of HCl
 0.8 mol of HCl and 0.1 mol of Cl_2 left as gases in the flask,
 total 0.9 moles
 $P = \frac{nRT}{V} = \frac{0.9 \times 22.4}{5.6 L} = 3.6 \text{ atm}$

Oxygen

- To calculate masses of products and reactants using *balanced* chemical equations we use a unit called **mole**. One mole of a substance is the amount whose mass equals the molecular or atomic weight (in atomic mass units, amu) of the substance **expressed in grams**. This means that molecular weight of any substance in amu (from periodic table) is equal to molar weight in grams.
- *A mole of anything has 6.022×10^{23} particles*. This is called Avogadro's number, after Amedeo Avogadro, who first suggested that equal volumes of gas have equal numbers of molecules.
- 1 mole of any gas takes a volume of 22.4 liters at "normal conditions". This is a molar gas volume under the normal conditions. Normal conditions are temperature of 0°C (273 K) and pressure of 1 atm (101 325 Pa)
- For conditions that differ from normal we use the ideal gas equation: $pV = nRT$

n – gas mole number

p – gas pressure (atm)

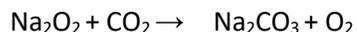
V – gas volume (liters)

T – temperature (K)

R – gas constant (0.0821 l x atm/mole x K)

Questions

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



2. 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:

