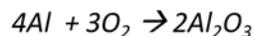
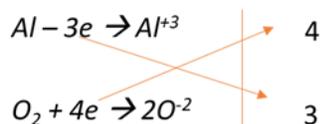
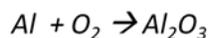


HW February 12, 2023

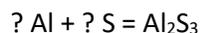
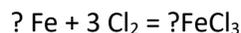
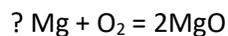
The mole, molar gas volume, Clapeyron-Mendeleev equation

- 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 Clapeyron-Mendeleev 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)

Redox chemical reactions can be balanced by looking at the transfer of electrons:



1. Insert the missing equation coefficients:



$\text{NH}_3 + \text{O}_2 = \text{NO} + \text{H}_2\text{O}$ (use electron balance and show your work)

2. What number of moles of Cr (52 amu) is in 20.8 g of this metal?
3. What is the mass of 6.02×10^{23} molecules of methane CH_4 ?
4. 4 g of hydrogen (H_2) were mixed with 64 g of oxygen (O_2). The mixture exploded forming water (H_2O). Write down the equation of the chemical reaction. Balance it! How many grams of water did form? How many grams of oxygen remained unreacted?
5. Write down a reaction between magnesium and oxygen with the formation of magnesium oxide. How many grams of magnesium and how many liters of oxygen will be necessary to obtain 50 g of magnesium oxide?
6. There are 180 g of water in a glass. How many molecules are there? How many moles?
7. A steel container with the volume of 40 L is filled with hydrogen under a pressure of 60 atm and at a temperature of 25°C . How many moles of hydrogen are in the container? How many grams? What volume this hydrogen will take under normal conditions?