

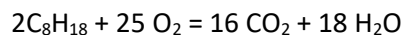
## HW 17

### *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  $6.022 \times 10^{23}$  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)

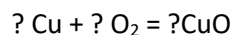
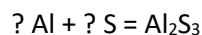
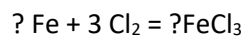
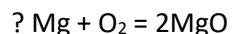
1. How much oxygen (in kg) does a car consumes between two fillings of its gas tank?

The equation for combustion is:

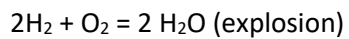
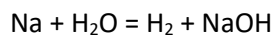


This means that the combustion of 2 molecules of gas requires 25 molecules of oxygen. An average tank of a car takes 40 L of gas. The density of gas is 0.7 kg/L.

2. Insert the missing equation coefficients:



3. What number of moles of Cr (52 amu) is in 20.8 g of this metal?
4. An explosion took place because of the following two reactions:



Find equation coefficients for the first equation and calculate how much (by volume) hydrogen exploded if 2.3 g of Na reacted.