January 29

1. Replace the question marks below to obtain correct chemical equations:

$Ca + 2HCl = Ca"?" + H_2 \uparrow$

$2Mg + "?" = 2MgO$

$2H_2"?" + 3O_2 = 2H_2O + 2SO_2$

$Fe_2O_3 + 3H_2 = 2Fe + 3"?"O$

$CaCl_2 + 2NaOH = Ca(OH)_2 + 2Na"?"$

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 x 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)

2. What volume will 56 g of nitrogen gas (N_2) occupy under normal conditions?
3. What volume will 80 g of gas argon will occupy under normal conditions?
4. There are 6.72 L of oxygen in an oxygen bag under normal conditions. How many grams of oxygen is there? How many moles of oxygen?
5. What is the density of H_2S gas in g/L under normal conditions?
6. There is hydrogen gas in a 40-L gas tank under 60 atm at 25°C. How many moles of hydrogen are in the tank? How many grams? What volume will this hydrogen take under normal conditions?