**Homework 1**

**Answer the fallowing questions in details (systematically with laws and units):**

1. A mixture of gases contains 0.75 mol N2, 0.30 mol O2, and 0.15 mol CO2. If the total pressure of the mixture is 2.15 atm, what is the partial pressure of each component?
2. a) What is the pressure (in kPa) of 4.0 g sample of O­2 in a 2.5 liters container at 27 °C? , b) What would be its pressure when heated to 127 °C, in the same volume?
3. Given that  = 500 m.s-1 for a 4.0 g sample of methane  
   a) What is the average kinetic energy () of one molecule of this sample, in **kJ**?

b) What is the total kinetic energy of this sample, in **kJ**?

1. What is the kinetic energy of 2.0 moles of an ideal gas at 50 oC and 2.0 atm, in J?
2. a) What is the **rms** speed of CH4 at STP, in km.s-1?

b) What is the **average** speed () of CH4 at STP, in km.s-1?

1. What is the real pressure, according to the van der Waals’ equation, for one mole of benzene vapor (a=9.44 atm L2 mol-2, b= 0.0855 L mol-1) at 77 oC in a 10.0 L?
2. At STP (1 atm, 0oC), how many molecules of N2 are there in a sample of this gas that occupies 300 cm3?
3. At 7 oC and 870 torr, the density of an unknown mononuclear diatomic gas is 1.60 g L-1. What is this gas?
4. At an altitude of 15 km the temperature is 217 K and the pressure 12.1 kPa. What is the mean free path (in µm) of N2 molecules if πd2 = 0.43 nm2?
5. How many collisions per second does an N2 molecules make at an altitude of 15 km?
6. At what pressure does the mean free path of argon (Ar) at 25 oC become comparable to the diameters of the atoms themselves (i.e λ = d) if πd2 = 0.36 nm2?