Chem E-1a
Friday Review Problems
Chapter 5: Gases

1. Gaseous acetylene, C_2H_2, will react with hydrogen gas under appropriate conditions to form ethane gas, C_2H_6. A 2.00 L reaction vessel is filled with 3.00 atm of hydrogen and 1.00 atm of acetylene at 25°C and the reaction is allowed to proceed to completion. After the reaction is complete the temperature in the vessel is returned to 25°C.

   a) Write a complete balanced equation for this reaction. (Note: acetylene and ethane are both gases under these conditions.)

   b) Calculate the mass of ethane that is formed.

1. (cont.)
   c) Calculate the total pressure inside the vessel after the reaction is complete.

   d) Calculate the mole fraction of ethane in the resulting mixture.

   e) Inert argon gas is pumped into the vessel until the total pressure is 5.00 atm. Calculate the number of moles of argon gas that were added.

   f) Calculate the rms speed of the ethane molecules at 25°C.

   g) Calculate the average kinetic energy per mole and per molecule of the ethane molecules at 25°C.

2. Solid calcium chlorate, $Ca(ClO_3)_2$, will decompose upon heating, releasing oxygen gas and leaving behind solid $CaCl_2$. 2.00 grams of calcium chlorate are completely decomposed, and the oxygen gas is collected over water at a temperature of 25°C and a pressure of 756 torr. (Note: The vapor pressure of water at 25°C is 23.8 torr.)

   a) Write a complete balanced equation for the decomposition of $Ca(ClO_3)_2$.

   b) Calculate the volume of oxygen that was collected.

   c) What mass of water vapor is mixed with the oxygen gas?

3. Sulfur dioxide gas can react with oxygen gas under appropriate conditions to form sulfur trioxide gas. A 1.00 L reaction vessel is charged with 2.00 atm of sulfur dioxide and 2.00 atm of oxygen at a temperature of 1000 K. Sulfur trioxide is formed, but the reaction **does not** go to completion. The final total pressure in the vessel is 3.32 atm.

   a) Write a complete balanced equation for this gas-phase reaction.

   b) Calculate the partial pressure of each gas in the resulting mixture.