**CH302H – Principles of Chemistry II: Honors**
Fall 2014, Unique 51880

**Homework, Week 3**

1. The standard enthalpy of combustion of cyclopropane is -2091 kJ $mol^{-1}$ at 25°C. From this information and the enthalpy of formation for $CO_2(g)$ and $H_2O(g)$, calculate the enthalpy of formation of cyclopropane. The enthalpy of formation of propene is +20.4 kJ $mol^{-1}$. Calculate the enthalpy of isomerization of cyclopropane to propene.

2. In class we found that when a single cylinder of an automobile internal combustion engine expands 650 mL against an external pressure of 1.0 atm, the cylindar does 65.7 J of work.

a) Assuming the engine is running on pure octane ($C_8H_{18}$), how much gas does this cylinder expansion stroke use?

b) How far does this single cylinder expansion stoke move the car? Be careful to state your assumptions.

c) If the car ran on jelly-filled donuts instead of octane, how many jelly-filled donuts would be necessary to perform this work? Be careful to state your assumptions.

3. If you were on the surface of the moon you would need to wear a space suit with thermal insulation. In exploring the moon you might generate 4 kJ of heat per kg of mass per hour. If your body retains all of this heat because the insulation, how much would your temperature change per hour during this activity? How long would you recommend for such a moon walk? Assume your body mass is 65 kg and that your heat capacity is approximately that of water ($C_{p,m}(H_2O_{(l)}) = 75.29$ J $K^{-1}$ $mol^{-1}$).

4. Calculate the standard enthalpy of solution of AgCl(s) in water from the enthalpies of formation of the solid and aqueous ions.

5. A gas microbalance is a device for measuring the molecular weight of gasses. In a gas microbalance, a glass bulb containing a standard gas sits on one end of a beam, which itself sits on a fulcrum. The beam is enclosed in a vessel with rigid walls, and when the vessel is evacuated the end of the beam containing the glass bulb rests on the bottom of the vessel. As the gas being measured is slowly introduced into the vessel, the buoyancy of the glass bulb increases, and the beam pivots on the fulcrum until it reaches a level balance point.

a) Draw the initial and final states of the gas microbalance described above.

b) To calibrate the balance, $CHF_3$ gas was pumped into the vessel until the balance point was reached at 0.557 atm. An unknown fluorocarbon gas ($C_xH_yF_z$) gas was then pumped into the vessel, and the balance point of the beam was reached at a pressure of 0.430 atm. What is the molar mass of the unknown fluorocarbon gas and what is a possible molecular formula?