Chem1A, General Chemistry I

1.) Consider the following formation of carbon tetrachloride (CCl_4) gas, from methane (CH_4) and chlorine gas (Cl_2). (35 pts)

$$CH_4 (g) + 4\ Cl_2 (g) \rightarrow CCl_4 (g) + 4\ HCl (g) \qquad \Delta H_{rxn} = \text{-397.3 kJ/mol}$$

Substance	ΔH_f (kJ/mol)
CH_4 (g)	-74.81
Cl_2 (g)	0
HCl (g)	-92.31

a.) Calculate the standard enthalpy of formation (ΔH_f) for CCl_4 (g) in kJ/mol using the above standard heats of formation.

b.) Calculate the bond energy (ΔH) for a single C-Cl bond in gas phase.

Bond Type	H–C	Cl–Cl	H–Cl
Bond Energy (kJ/mol)	414	243	431

2.) Write any possible quantum number set for the following electrons described.

    a.) An electron in a first energy level s-orbital, spin up.   _____

    b.) An electron in a third energy level d-orbital, spin down.   _____

    c.) Any electron in a fifth energy level f-orbital of any spin.   _____

3.) The threshold frequency for indium (In) is 9.96×10^{14} s^{-1}.

    a.) Calculate the energy of this frequency, in J.

    b.) What is the minimum wavelength of light required to eject an electron from In, in nm?

    c.) How many electrons would be ejected by 2.50 mJ of light with a wavelength of 2.15×10^{-12} m?

4.) An electron in a hydrogen atom travels from n = 5 to n = 2. ($R_H = 1.097 \times 10^7$ m^{-1})

    a.) Calculate the wavelength associated with this transition, in nm.

    b.) Is this energy being **emitted** or **absorbed**?   _____

4.) Write the electron configuration for the following elements. (14 pts)

    a.) Br   _____

    b.) Pb   _____

    c.) In   _____

    d.) Ba   _____

    e.) Which will have the **highest** electron affinity?   _____

    f.) Which one will have the **largest** atomic radius?   _____

    g.) Which will have the **least** metallic character?   _____

5.) Draw the **MOST PLAUSIBLE** Lewis structure for the following molecules, including all possible **resonance structures** as well as **formal charges**. (16 pts)

    a.) SO_3^{-2}

    b.) O_3