HW 1
CHEM 362

Available: Tuesday, September 3, 2019 **Due: Monday, September 9, 2019**
Place homework in box outside Professor Dunbar's office, RM 1224 Chemistry Building
Key will be posted late in the day on the due date at dunbar.tamu.edu website

1. Write an equation that can be used to define the mean S-F bond energy in SF_6.
How is this value likely to be related in magnitude to the energy of the process?

$$SF_6\ (g) \rightarrow SF_5\ (g) + F\ (g)$$

2. What is a qualitative definition of entropy and how does it relate to the tendency for reactions to occur?
What will be the signs of ΔS for the following reactions?
   a. $H_2O\ (l) \rightarrow H_2O\ (g)$
   b. $P_4\ (g) + 10\ F_2\ (g) \rightarrow 4\ PF_5\ (g)$
   c. $I_2\ (g) + Cl_2\ (g) \rightarrow 2\ ICl\ (g)$
   d. $BF_3\ (g) + NH_3\ (g) \rightarrow H_3NBF_3\ (g)$
   e. $CO_2\ (g) \rightarrow CO_2\ (s)$

3. Prepare graphs of the concentration of reactant A as a function of time if A disappears in a first-order fashion. Assume that $[A]_{initial} = 1$ M and $k = 1x10^{-3}\ M^{-1}s^{-1}$. How should the data for a first-order reaction be plotted in order to obtain a straight line?

4. What do you suppose is the main thermodynamic reason why the following reaction has an equilibrium constant >1?

$$BCl_3\ (g) + BBr_3\ (g) \rightarrow BCl_2Br\ (g) + BClBr_2\ (g)$$

5. What is the value of an equilibrium constant that has a ΔG^o value of zero?
Draw a Reaction Profile for such a system.

6. The conversion of diamond into graphite is a spontaneous reaction (thermodynamically favored). Why doesn't diamond eventually change into graphite?

7. What were the two bold postulates made by Bohr that allowed him to derive an equation for the energies of an electron in the H atom?
What does the term Bohr radius mean?

8. State the quantum numbers for the following orbitals:
   1*s*, 2*s*, 2*p*, 2*d*, 4*d*, 4*f*

9. State the Pauli Exclusion Principle in the form relevant to atomic structure.
Show how it leads to the conclusion that, in a given principal shell, there can be only two *s*, six *p*, ten *d*, and fourteen *f*, electrons.

10. Why is the first ionization enthalpy of the O atom lower than that of the N atom?

11. Prepare dot density diagrams similar to that found of page 41 of Chapter 2 (Fig. 2-3) for:
   a. $2p_x$ orbital
   b. 3*s* orbital

c. $3d_{xy}$ orbital

Remember that one must take both the shape and function $r^2[R(r)]^2$ into consideration.

12. Arrange the following in order of increasing *second* ionization energy (i.e. put the lowest ionization energy first).

$_{19}K$ $_{56}Ba$ $_{49}In$ $_{52}Te$

13. In what way(s) do 3*d* and 4*d* orbitals differ?

14. Which member of the following pairs has the lower electron affinity?

$_{8}O$ or $_{7}N$ $_{37}Rb$ or $_{55}Cs$ $_{33}As$ or $_{32}Ge$ $_{19}K^+$ or $_{11}Na$

15. Based on their ground state electronic configurations, list what you would expect as common oxidation states for:

$_{81}Tl$ $_{82}Pb$ $_{34}Se$ $_{58}Ce$ $_{92}U$

16. What are the different types of radii that must be considered when discussing the elements?
Tell how they are defined and how the values are determined.