CH 302 Spring 2007 Worksheet 1
A potpourri of thermo questions to get your mind reengaged.

(Questions 1-6) Match the correct term for each question given below. You will only use an answer once, but not all the answers will be used.

Word Bank:

Standard enthalpy change	enthalpy of formation	bond enthalpy
bond order	bond energy	heat capacity
thermochemical	standard state	thermodynamics
state functions	equilibrium	empirical state

1. Parameters that define the current state of a chemical system.

2. ΔH when reactants in standard states are converted to products in standard states.

3. The study of energy change in chemical systems.

4. The energy necessary to break one mole of bonds in a gaseous substance.

5. The most stable state of a substance under standard pressure and temperature.

6. The amount of heat required to raise the temperature of an object one degree C.

7. Which of the following is a correct statement correct concerning the Second Law of Thermodynamics?

   A. Energy cannot be created nor destroyed.
   B. The entropy in the universe is conserved.
   C. The entropy in a system increases in the phase change from liquid to gas.
   D. The free energy of a system is temperature dependent.

8. Explain why the freezing of liquid water (in which the water becomes more ordered) does ***not*** violate the Second Law.

9. If you heat 1 kg of water over a Bunsen burner for a few seconds for a few seconds, it might get a little warm. So the same for 1 kg of copper, and it's likely to burn your hand. What physical quantity explains this difference?

10. Provide a simple derivation of the fact that ΔG is negative for a spontaneous process starting with the Second Law, $\Delta S_{universe} > 0$.

11. The following reaction is exothermic. For what temperatures is the reaction spontaneous?

$$2\ A(g) + B(g) \rightarrow A_2B(g)$$

12. Write a single equation expressing the First Law of Thermodynamics for an isolated system.

13. In terms of RT, what is the amount of motional (translational and rotational) internal energy in H_2O? In CO_2?

14. For the freezing of benzene, $\Delta H = 2.375$ kJ/mol and $\Delta S = 8.523$ J/mol. What is the freezing point of benzene?

15. Which of the following molecules will have the largest positional entropy at 0 K?
    A. SF_6
    B. CH_4
    C. CO_2
    D. XeF_5I
    E. $CHCl_3$

16. What is the entropy of 10 molecules of the correct answer to number 15 at 0 K?

17. Given the following table, which species is the most stable?

	ΔG_f° (kJ/mol)
CO_2 (g)	-394.4
NO_2 (g)	+51
SO_2 (g)	-300.2
H_2O (g)	-228.60

18. Without using a table, give the free energy of formation for each of the following species: He(g), N_2(g), C(graphite), Hg(l), Fe(s)

19. Find ΔGr° (at 298 K) for the following reaction, given the thermodynamic data below.

$$2\ C_6H_6(g) + 15\ O_2(g) \rightarrow 12\ CO_2(g) + 6\ H_2O(\ell)$$

	ΔH_f° (kJ/mol)	S° (J/mol)
C_6H_6 (g)	+82.931	269.2
O_2 (g)	0	205.14
CO_2 (g)	-393.51	213.74
H_2O (ℓ)	-285.83	69.91

20. At a certain temperature, the work done on the following reaction is 6.00 kJ. What is this temperature?

$$2\ A(g) + B(g) \rightarrow A_2B(g)$$