Worksheet 12: Thermodynamics problems you see on a quiz.

(These 8 questions are very similar in content and format to the kind of questions you will see on quizzes 5 and 6 and on exam 3. Don't simply memorize them, but learning how to work this kind of problem and similar problems that you make up yourself will be a great aid as you work the first quiz.)

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

1. The free energy of a system is temperature dependent.
2. Entropy of a system increases in the phase change from a liquid to a gas.
3. Energy cannot be created nor destroyed.
4. The entropy in the universe is conserved.

2. 75 g of a potato chips are burned in a calorimeter that contains 2 liters of water initially at 297K. After the combustion, the temperature rises 12°C. How much heat is evolved per gram of potato chip burned? The heat capacity of the calorimeter is 200 J/°C? The density of water is 1.0 g/ml. The specific heat of water is 4.18 J/g°C.

1. 7.1 kJ/g
2. 100.3 kJ/g
3. 102.7 kJ/g
4. 1.37 kJ/g

3. What is the change of enthalpy associated with the combustion of one mole of ethylene?

$$C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$$

1. 0 kJ
2. -1323 kJ
3. +1323 kJ
4. -3230 kJ
5. +3230 kJ

4. For the combustion reaction of acetaldehyde (C_2H_4O)

$$2C_2H_4O + 5O_2 \rightarrow 4CO_2 + 4H_2O$$

assume all reactants and products are gases and calculate the ΔH^0_{rxn} using the following bond energy values:

C-C BE = 611 kJ/mol
C-H BE = 413 kJ/mol
O=O BE = 498 kJ/mol
C=O BE = 799 kJ/mol
H-O BE = 463 kJ/mol

1. -1080 kJ/mol
2. +1080 kJ/mol
3. 0 kJ/mol
4. -2303 kJ/mol
5. +2303 kJ/mol

5. For the reaction

$$3H_2(g) + N_2(g) \rightarrow 2NH_3(g)$$

find the approximate value for the work done at 300 K.

1. -5.0 kJ
2. -2:5 kJ
3. 2.5 kJ
4. 5.0 kJ

6. Heat flow is considered negative when heat flows (into, out of) a system; work is considered positive when work is done (by, on) a system.

1. out of; by
2. into; by
3. out of; on
4. into; on

7. Which of the following processes results in an increase in the system entropy?

1. cleaning up from the party while your parents are out of town
2. getting dressed in the morning
3. making ice cubes
4. pouring salt on an icy bridge
5. memorizing the eight question types on the first quiz

8. For the exothermic combustion of a hydrogen balloon:

$$2H_2 + O_2 \text{ --> } 2\ H_2O_{(g)}$$

what can you say about the spontaneity?

1. Always spontaneous because ΔS in formation $H_2O_{(g)}$ is negative.
2. Always spontaneous because ΔS in formation $H_2O_{(g)}$ is positive.
3. Spontaneous at higher temperature because ΔS in formation $H_2O_{(g)}$ is negative
4. Spontaneous at lower temperature because ΔS in formation $H_2O_{(g)}$ is negative.
5. Spontaneous at higher temperature because ΔS in formation $H_2O_{(g)}$ is positive.
6. Spontaneous at lower temperature because ΔS in formation $H_2O_{(g)}$ is positive.