CHE 112 - Homework - Ch 12a
An Introduction to Entropy

OER 12.1-12.2 Score: _____/55

Name: _____ Date: _____

[2 pt] 1. What is the difference in what is studied between Kinetics and Thermodynamics?

[2 pt] 2. What is the First Law of Thermodynamics? (Hint: We first learned it in Ch. 9!)

[4 pt] 3. Define the terms Spontaneous Process and Nonspontaneous Process. What is the major difference between the two terms?

[6 pt] 4. Define the terms Entropy, give the symbol, and standard units. Also include the sign conventions for Entropy. What 3 types of process result in an increase in Entropy?

[3 pt] 5. The decomposition of hydrogen peroxide: $H_2O_2(l) \longrightarrow H_2O(l) + O_2(g)$ is spontaneous, yet H_2O_2 is stable for long periods of time. Explain.

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[5 pt] 6. Tell whether the entropy changes (ΔS) for the following processes are likely to be positive (+) or negative (-). Explain

(a) The conversion of liquid water to vapor at 100℃. 6(a) _____

(b) The freezing of liquid water at 0℃. 6(b) _____

(c) The eroding of a mountain by a glacier? 6(c) _____

(d) Uniform mixing of bromine and nitrogen gas in a flask. 6(d) _____

(e) Boiling of water at STP. 6(e) _____

[5 pt] 7. Predict the sign of the entropy change in the system for the following processes. Explain.

(a) A solid sublimes 7(a) _____

(b) A liquid freezes. 7(b) _____

(c) $PCl_5(s) \longrightarrow PCl_3(l) + Cl_2(g)$ 7(c) _____

(d) $CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(l)$ 7(d) _____

(e) $CH_4(g) + Cl_2(g) \rightleftharpoons CH_3Cl(g) + HCl(g)$ 7(e) _____

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[4 pt] 8. Circle the state that has the higher entropy per mole of substance (or write it in the answer blank) Explain.

(a) Ice at -40 ℃ or Ice at 0 ℃? 8(a) _____

(b) N_2 at 25 ℃and 1 Atm or N_2 at 25 ℃ and 10 Atm? 8(b) _____

(c) N_2 at 0 ℃ and volume = 10 L or N_2 at 0 ℃ and volume = 50 L? 8(c) _____

(d) Water vapor at 150 ℃ and 1 atm or Water vapor at 100 ℃ and 2 atm 8(d) _____

[4 pt] 9. Circle the state that has the higher entropy per mole of substance. Explain.

(a) (A) NO or (B) NO_2 9(a) _____

(b) CH_3COOH or HCOOH 9(b) _____

(c) Br_2(l) orBr_2(s) 9(c) _____

(d) (S(s) or SO_3(g) 9(d) _____

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[4 pt] 10. Define Entropy according to Boltzmann. Include a mathematical equation, define each symbol and give the typical units.

[16 pt] 11. Consider the distribution of ideal gas molecules among 3 bulbs (A, B, and C) of equal volume. For each of the following conditions determine the number of ways that the state can be achieved, and calculate the entropy of the state. Explain.

(a) 2 molecules in bulb A. 11(a) _____

(b) 2 molecules randomly distributed in any of the bulbs 11(b) _____

(c) 3 molecules in bulb C. 11(c) _____

(d) 3 molecules randomly distributed in any of the bulbs 11(d) _____

(e) 1 mol of molecules in bulb A. 11(e) _____

(f) 1 mol of molecules randomly distributed among bulbs A, B, and C. 11(f) _____

(g) What is the value of ΔS going from the state in part (e) to the state in part (f)? 11(g) _____

(h) What is the value if you use the equation $\Delta S = nR\ln(V_f/V_i)$? 11(h) _____