

Exercise 17.3

Entropy & ΔS

Name: _____

Date: _____ Per: _____

DIRECTIONS: Answer the following in the space provided.

Review

1. What is the specific heat capacity, in joules, of lead if 150. g of lead from a boiling water bath causes 500. g of water to go from 22.0 °C to 28.8 °C? (1.33J/g•°C)

2. Calculate the value of ΔH° for the reaction $2C(s) + H_2(g) \rightarrow C_2H_2(g)$. (226.6kJ)

$C(s) + O_2(g) \rightarrow CO_2(g)$	$\Delta H^\circ = -393.5 \text{ kJ}$
$H_2(g) + \frac{1}{2} O_2(g) \rightarrow H_2O(l)$	$\Delta H^\circ = -285.8 \text{ kJ}$
$2C_2H_2(g) + 5O_2(g) \rightarrow 4CO_2(g) + 2H_2O(l)$	$\Delta H^\circ = -2598.8 \text{ kJ}$

3. Ethanol (C_2H_5OH) has been proposed as an alternative fuel. Calculate the standard enthalpy of combustion per gram of liquid ethanol. ($\Delta H_f^\circ H_2O(l) = -285.8 \text{ kJ/mol}$, $\Delta H_f^\circ CO_2(g) = -393.5 \text{ kJ/mol}$, $\Delta H_f^\circ C_2H_5OH(l) = -278 \text{ kJ/mol}$)

Reaction: _____

4. Describe a spontaneous process: _____

5. How does spontaneity relate to reaction rate? _____

6. Define entropy: _____

7. Is entropy a form of energy? _____

8. Describe how the following changes affect the positional entropy of a substance.

a. Increase in volume of a gas at constant T . _____

b. Increase in temperature of a gas at constant V . _____

c. Increase in pressure of a gas at constant T . _____

9. Check all the following processes that require energy as they occur.

a. Salt dissolves in H_2O .

e. A house is built.

b. A clear solution becomes a uniform color.

f. A satellite is launched into orbit.

c. A cell produces proteins from amino acids.

g. A satellite falls back to earth.

d. Iron rusts.

h. Natural gas is burned in the air.

10. Define isothermal: _____

11. For an isothermal process, the formula for $\Delta S =$ _____.

12. When are state changes considered isothermal? _____

Exercise 17.3

Entropy & ΔS

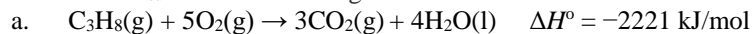
Name: _____

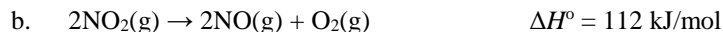
Date: _____ Per: _____

13. Which of the following involve an increase in the entropy of the system?

- a. melting of a solid c. freezing e. separation
 b. sublimation d. mixing f. boiling

14. Calculate ΔS_{surr} for the following reactions at 25 °C and 1 atm.





15. For each of the following pairs of substances, which substance has the greater value of S° ?

- a. $\text{C}_{\text{graphite}}(\text{s})$ or $\text{C}_{\text{diamond}}(\text{s})$: _____ c. $\text{CO}_2(\text{s})$ or $\text{CO}_2(\text{g})$: _____
 b. $\text{C}_2\text{H}_5\text{OH}(\text{l})$ or $\text{C}_2\text{H}_5\text{OH}(\text{g})$: _____

16. Predict the sign of ΔS° . Then, using Appendix A4 on page A21 in your textbook, calculate ΔS° for each of the following reactions:

Reaction	Prediction	Calculation
a. $2\text{H}_2\text{S}(\text{g}) + \text{SO}_2(\text{g}) \rightarrow 3\text{S}_{\text{rhombic}}(\text{s}) + 2\text{H}_2\text{O}(\text{g})$		
b. $2\text{SO}_3(\text{g}) \rightarrow 2\text{SO}_2(\text{g}) + \text{O}_2(\text{g})$		
c. $\text{Fe}_2\text{O}_3(\text{s}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{Fe}(\text{s}) + 3\text{H}_2\text{O}(\text{g})$		

17. The normal boiling point of ethanol ($\text{C}_2\text{H}_5\text{OH}$) is 78.3°C and its molar enthalpy of vaporization is 38.56 kJ/mol. What is the change in entropy in the system in J/K when 97.2 grams of ethanol at 1 atm condenses to a liquid at the normal boiling point? (-231 J/K)

18. The normal boiling point of water is 100.0°C and its molar enthalpy of vaporization is 40.67 kJ/mol. What is the change in entropy in the system in J/K when 39.3 grams of steam at 1 atm condenses to a liquid at the normal boiling point? (-238 J/K)