

Exercise 17.7

Gibb's Free Energy

Name: _____

Date: _____ Per: _____

DIRECTIONS: Answer the following in the space provided.

Review

1. The enthalpy of vaporization of ethanol is 38.6 kJ/mol at its boiling point (78°C). Determine ΔS_{sys} , ΔS_{surr} , and ΔS_{univ} when 1.00 mole of ethanol is vaporized at 78°C and 1.00atm.

2. Given the values of ΔH and ΔS , calculate ΔG for each set of conditions and determine which changes will be spontaneous at constant T and P?

	$\Delta G = \Delta H - T\Delta S$	Spontaneous?
a. $\Delta H = +25 \text{ kJ}$ $\Delta S = +5 \text{ J/K}$ $T = 300 \text{ K}$		
b. $\Delta H = +25 \text{ kJ}$ $\Delta S = +100 \text{ J/K}$ $T = 300 \text{ K}$		
c. $\Delta H = -10. \text{ kJ}$ $\Delta S = +5 \text{ J/K}$ $T = 300 \text{ K}$		
d. $\Delta H = -10 \text{ kJ}$ $\Delta S = -40 \text{ J/K}$ $T = 300 \text{ K}$		

3. Ethanethiol ($\text{C}_2\text{H}_5\text{SH}$; also called ethyl mercaptan) is commonly added to natural gas to provide the "rotten egg" smell of a gas leak. The boiling point of ethanethiol is 35°C and its heat of vaporization is 27.5 kJ/mol. What is the entropy of vaporization for this substance?

4. For ammonia (NH_3), the enthalpy of fusion is 5.65 kJ/mol and the entropy of fusion is 28.9 J/K•mol.

a. Will $\text{NH}_3(\text{s})$ spontaneously melt at 200. K?

b. What is the approximate melting point of ammonia?

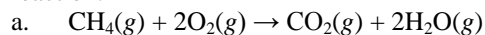
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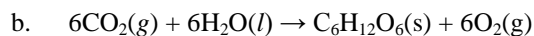
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5. From data in Appendix 4 in your book or your thermodynamic table to calculate ΔH° , ΔS° , and ΔG° for the following reaction:



$\Delta H =$
$\Delta S =$
$\Delta G =$



$\Delta H =$
$\Delta S =$
$\Delta G =$

6. For the reaction at 298 K: $2\text{NO}_2(g) \rightleftharpoons \text{N}_2\text{O}_4(g)$

- a. The values of ΔH° and ΔS° are -58.03 kJ/mol and $-176.6 \text{ J/K}\cdot\text{mol}$, respectively. What is the value of ΔG° at 298 K?

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- b. Assuming that ΔH° and ΔS° do not depend on temperature, at what temperature is $\Delta G^\circ = 0$? Is ΔG° negative above or below this temperature?

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