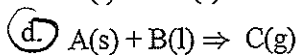
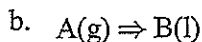
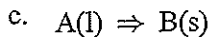
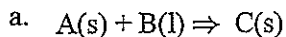


## Thermodynamics Preliminary 14c :(standards 9-5,6,7)

### Multiple Choice

Identify the letter of the choice that best completes the statement or answers the question.

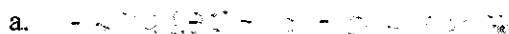
d 1. (#9-5) Which of the following reactions is spontaneous due to entropy?



increasing movement

c 2. (#9-6) Which of the following results is an endothermic and endergonic reaction?

$\Delta H \quad \Delta S \quad \Delta G$



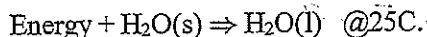
+ΔH

+ΔG

ΔS

Not a factor in this pen

d 3. (#9-6) Answer the following question relative to the reaction provided.



I. This reaction is spontaneous at 25°C.

yes, Ice melts above 0°C ↑ (-ΔG)

II. This reaction is endothermic.

yes on reactant side → this is only ΔH or q

III. As the temperature drops this ΔG can become positive

yes → ΔG = ΔH - TΔS  
+  $\frac{-}{+}$  (- gets smaller)

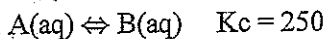
a. I only

c. I and II only

b. II only

d. I, II, and III only

c 4.



(#9-7) Substance "A" is placed in an empty container and allowed to proceed. Which of the following is true of the equilibrium mixture.

I.  $[A] = [B]$  No, product favored  $B > A$

II.  $\Delta G^\circ > 0$  No  $\Delta G^\circ = "-"$

III. At the conclusion of the process  $\Delta G = 0$  yes

a. I only

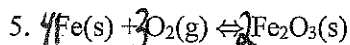
c. III only

b. II and III only

d. I, II, and III

(#9-5) \_\_\_ /2 (#9-6) \_\_\_ /2 (#9-7) \_\_\_ /1

	Fe(s)	O <sub>2</sub> (g)	Fe <sub>2</sub> O <sub>3</sub> (s)
$\Delta H_f$			-824.
$\Delta S$ (J/molK)	27.78	205	87.4
$\Delta G_f$			-742.2



a) Determine the Gibbs free energy of the following reaction. (#9-6)

$(2)742 - 0 = -1484\text{KJ}$

b) What is the  $\Delta H_f$  for Fe? The value is not listed?

0, Relative scale

c) Is this reaction spontaneous at STP?

yes,  $-\Delta G^\circ$

d) Calculate the value of the entropy change with the values included. (#9-5)

$\Delta G = \Delta H - T\Delta S$  or  $\Delta S = \sum S_p - \sum S_r$

$(2)87.4 - (205(3) + 4(27.78))$

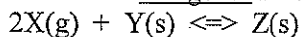
e) In what range would you expect K? (#9-7)

$+174.4 - 723 - 551$

greater than 1

f) As this reaction proceeds to its end point the  $\Delta G_{\text{rxn}}$  will eventually become? zero

6. Below is a exergonic reaction at 298K.  $-\Delta G$



a) Predict the sign of  $\Delta S$ . (#9-5)  $-\Delta S$

b) What is the sign of  $\Delta H$ . (#9-6)  $-$

$\Delta G = \Delta H - T\Delta S$   
 $- \quad \quad \quad -$   
 $\quad \quad \quad \uparrow$   
 must Be  
 "-"