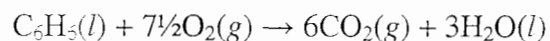


CHM152 Quiz 8 25 Pts Fall 2007 Name: \_\_\_\_\_

Due Wednesday Nov. 21. Show all work to receive credit.

1. The complete combustion of liquid benzene is represented by the equation:



Using the data below, calculate, for this reaction

- $\Delta H^\circ$
- $\Delta S^\circ$
- $\Delta G^\circ$  at  $25^\circ\text{C}$ .

Substance:	$\text{C}_6\text{H}_6(l)$	$\text{O}_2(g)$	$\text{CO}_2(g)$	$\text{H}_2\text{O}(l)$
$\Delta H^\circ_f$ (kJ/mol):	49	0	-394	-286
$S^\circ$ (J/mol·K):	173	205	214	70

2. For the reaction of xenon and fluorine gases to form solid  $\text{XeF}_4$ ,  $\Delta H^\circ = -251$  kJ and  $\Delta G^\circ = -121$  kJ at  $25^\circ\text{C}$ . Calculate  $\Delta S^\circ$  for the reaction.

3. A chemical reaction has  $\Delta G^\circ = 10.0$  kJ and  $\Delta S^\circ = 50.0$  J/K

a. Calculate  $\Delta H^\circ$  for this reaction at  $25^\circ\text{C}$ .

b. Could this reaction ever be spontaneous? Explain your answer.

7. Iron(III) oxide can be reduced by carbon monoxide.



Use the following thermodynamic data at 298 K to determine the equilibrium constant at this temperature.

Substance:	$\text{Fe}_2\text{O}_3(s)$	$\text{CO}(g)$	$\text{Fe}(s)$	$\text{CO}_2(g)$
$\Delta H^\circ_f$ (kJ/mol):	-824.2	-110.5	0	-393.5
$\Delta G^\circ_f$ (kJ/mol):	-742.2	-137.2	0	-394.4
$S^\circ$ (J/K·mol):	87.4	197.7	27.78	213.7

8. Calculate the equilibrium constant at 25°C for the reaction of methane with water to form carbon dioxide and hydrogen. The data refer to 25°C.



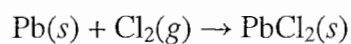
Substance:	$\text{CH}_4(g)$	$\text{H}_2\text{O}(g)$	$\text{CO}_2(g)$	$\text{H}_2(g)$
$\Delta H^\circ_f$ (kJ/mol):	-74.87	-241.8	-393.5	0
$\Delta G^\circ_f$ (kJ/mol):	-50.81	-228.6	-394.4	0
$S^\circ$ (J/K·mol):	186.1	188.8	213.7	130.7

9. Use the thermodynamic data at 298 K below to determine the  $K_{sp}$  for barium carbonate,  $\text{BaCO}_3$  at this temperature.

Substance:	$\text{Ba}^{2+}(aq)$	$\text{CO}_3^{2-}(aq)$	$\text{BaCO}_3(s)$
$\Delta H^\circ_f$ (kJ/mol):	-538.36	-676.26	-1219
$\Delta G^\circ_f$ (kJ/mol):	-560.7	-528.1	-1139
$S^\circ$ (J/K·mol):	13	-53.1	112

4. A chemical reaction has  $\Delta H^\circ = 42.8 \text{ kJ}$  and  $\Delta S^\circ = 92.5 \text{ J/K}$ , at  $25^\circ\text{C}$ . Calculate the temperature at which  $\Delta G^\circ = 0$ . State any approximation involved in your calculation.

5. Which relationship or statement best describes  $\Delta S^\circ$  for the following reaction? Give an explanation for your answer.



- A.  $\Delta S^\circ \approx 0$   
B.  $\Delta S^\circ < 0$   
C.  $\Delta S^\circ > 0$   
D.  $\Delta S^\circ = \Delta H^\circ/T$   
E. More information is needed to make a reasonable prediction.
6. The temperature at which the following process reaches equilibrium at 1.0 atm is the normal boiling point of hydrogen peroxide.



Use the following thermodynamic information at 298 K to determine this temperature.

Substance:	$\text{H}_2\text{O}_2(l)$	$\text{H}_2\text{O}_2(g)$
$\Delta H^\circ_f$ (kJ/mol):	-187.7	-136.3
$\Delta G^\circ_f$ (kJ/mol):	-120.4	-105.6
$S^\circ$ (J/K·mol):	109.6	232.7