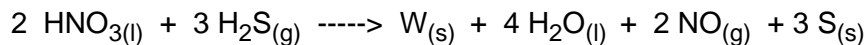


Thermochemistry and Thermodynamics Worksheet 4

1. For the reaction $A_{(g)} \rightleftharpoons B_{(g)} + C_{(g)}$, $K_p = 2 \times 10^{-4}$ at 25°C . A mixture of the three gases at 25°C is placed in a reaction flask and the initial pressures are: $P_A = 2 \text{ atm}$, $P_B = 0.5 \text{ atm}$, and $P_C = 1 \text{ atm}$. At the instant of mixing, which of the following is true for the reaction in the forward direction.
- (A) $\Delta G < 0$
 - (B) $\Delta G > 0$
 - (C) $\Delta S = 0$
 - (D) $\Delta G^\circ = 0$
 - (E) $\Delta G^\circ < 0$
2. Which choice would definitely be non-spontaneous for the following changes in enthalpy (ΔH) and entropy (ΔS)?
- (A) $+\Delta H$ and $+\Delta S$
 - (B) $+\Delta H$ and $-\Delta S$
 - (C) $-\Delta H$ and $+\Delta S$
 - (D) $-\Delta H$ and $-\Delta S$
 - (E) $\Delta H = 0$ and $+\Delta S$
3. A catalyst is added to a system in equilibrium, which of the following events occurs?
- (A) The equilibrium shifts to the right.
 - (B) The equilibrium shifts to the left.
 - (C) There is no effect on equilibrium.
 - (D) ΔH increases.
 - (E) ΔH decreases.
4. Given the reaction: $N_{2(g)} + 3 H_{2(g)} \rightleftharpoons 2 NH_{3(g)}$ $\Delta H = -24 \text{ kCal}$
Which change will increase the equilibrium concentration of NH_3 ?
- (A) A decrease in the total pressure.
 - (B) A decrease in $[N_2]$.
 - (C) A decrease in the temperature of the reaction chamber.
 - (D) An increase in the volume of the reaction chamber.
5. For a given chemical system, the value of the equilibrium constant K will depend on temperature unless:
- (A) $\Delta G^\circ > 0$
 - (B) $\Delta H^\circ = 0$
 - (C) $\Delta S^\circ = 0$
 - (D) $\Delta G^\circ < 0$
 - (E) $\Delta n = 0$ (no change in the number of moles)

Thermochemistry and Thermodynamics Worksheet 4

6. The following chemical reaction occurs at 25°C:



You are given the following thermodynamic data:

<u>Species</u>	<u>ΔH_f° (kJ/mol)</u>	<u>ΔG_f° (kJ/mol)</u>
HNO _{3(l)}	-174.1	-80.8
H ₂ S _(g)	-20.6	-33.6
H ₂ O _(l)	-285.8	-237.2
NO _(g)	90.2	86.6

(A) What is the value of the standard Gibbs Free Energy for the system represented above?

(B) What is the value of the equilibrium constant for the system represented above? ($R = 8.314 \text{ J/K}$)

(C) Calculate ΔS° at 25°C.

7. $K_{\text{eq}} = 36$ at 300°C for the reaction: $\text{A}_{2(g)} + \text{B}_{2(g)} \rightleftharpoons 2 \text{AB}_{(g)}$

(A) Calculate the ΔG° at 300°C for this reaction. ($R = 8.314 \text{ J/K}$)

(B) What is ΔH for the reaction if ΔS° at 300°C is $20.0 \text{ J/mol}\cdot\text{K}$?

(C) Calculate K_{eq} for the reaction: $\text{AB}_{(g)} \rightleftharpoons 1/2 \text{A}_{2(g)} + 1/2 \text{B}_{2(g)}$