1. Consider the following reaction:

\[ 2 \text{H}_2\text{O}_\text{aq} \rightleftharpoons 2 \text{H}_2\text{O} + \text{O}_2 \]

\[ \Delta H = \frac{+241.8 \text{kJ/mol}}{2 \text{mol}} = +120.9 \text{kJ} \]

What will be the effect on the equilibrium of this reaction if

a) heat is added  
   \text{Shifts to right, Savors more products}

b) volume of reacting container is decreased  
   \text{Shifts to left, Savors more reactants}

c) \text{H}_2\text{O}_\text{aq} \text{ is added}  
   \text{Shifts to right, Savors more products}

d) \text{O}_2 \text{ is removed}  
   \text{Shifts to right, Savors more products}

2. Consider the following reaction.

\[ \text{Cl}_2\text{g} \rightleftharpoons 2 \text{Cl}_\text{g} \]

What will be the effect on the equilibrium of this reaction if

a) concentration of \text{Cl}_2\text{g} \text{ is decreased}  
   \text{Shifts to left, Savors more reactants}

b) volume of the container is increased  
   \text{Shifts to right, Savors more products}

c) pressure is increased on the reaction  
   \text{Shifts to left, Savors more reactants}

d) concentration of \text{Cl}_\text{g} \text{ is decreased}  
   \text{Shifts to right, Savors more products}

3. Consider the following reaction

\[ \text{H}_2\text{g} + \text{F}_2\text{g} \rightleftharpoons 2 \text{HF}_\text{g} \]

What will be the effect on the equilibrium of this reaction if

a) a catalyst is added  
   \text{No effect on equilibrium, Speeds up rxn}

b) concentration of \text{F}_2\text{g} \text{ is increased}  
   \text{Shifts to right, Savors products}

c) volume of the reacting vessel is increased  
   \text{No effect}
d) \( HF_\text{aq} \) is removed from the reacting vessel

\( \Delta H = n \Delta H_f \text{prod} - n \Delta H_f \text{rea} \)

\( = \left[ 1(-393.5) + 1(-74.6) \right] - \left[ 2(0) + 2(-241.8) \right] \)

\( = 15.5 \text{ kJ} \)

4. Consider the reaction \( N_2(\text{g}) + 3H_2(\text{g}) \rightleftharpoons 2NH_3(\text{g}) \)

\( \Delta H_f = \frac{\text{kJ/mol}}{2(145.9)} = -9.18 \text{ kJ/mol} \)

What is the effect on the equilibrium of this reaction if

a) heat is removed from the reaction moves to the right, favors more products

b) nitrogen is added to the system moves to the right, favors more products

c) \( \text{NH}_3(\text{aq}) \) is removed from the system moves to the right, favors more products

d) volume of the container is increased moves to the left, favors more reactants

e) pressure on the system is reduced moves to the left, favors more reactants

5. Consider the reaction: \( H_2(\text{g}) + 2H_2O(\text{g}) \rightleftharpoons \text{CH}_4(\text{g}) + \text{CO}_2(\text{g}) \)

What is the effect on the equilibrium of this reaction if

a) heat is added to the reaction moves to the right, favors more products

b) volume of the container is reduced moves to the right, favors more products

c) pressure is increased on the system moves to the right, favors more products

d) \( \text{H}_2(\text{g}) \) is added to the system moves to the right, favors more products

e) \( \text{CH}_4(\text{g}) \) is added to the system moves to the left, favors more reactants

f) a catalyst is added to the system No effect on equilibrium