Worksheet: LeChatelier's Principle **NAME:**_____

1. Ammonia is produced commercially by the Haber reaction:

$$N_2(g) + 3\ H_2(g) \leftrightarrow 2\ NH_3(g) + \text{heat}$$

The formation of ammonia is favored by
(A) an increase in pressure
(B) a decrease in pressure
(C) removal of $N_2(g)$
(D) removal of $H_2(g)$

2. Given the reaction at equilibrium:

$$2\ SO_2(g) + O_2(g) \leftrightarrow 2\ SO_3(g) + \text{heat}$$

Which change will shift the equilibrium to the right?
(A) increasing the temperature
(B) increasing the pressure
(C) decreasing the amount of $SO_2(g)$
(D) decreasing the amount of $O_2(g)$

3. Which system at equilibrium will be *least* affected by a change in pressure?
(A) $3\ H_2(g) + N_2(g) \leftrightarrow 2\ NH_3(g)$
(B) $2\ S(s) + 3\ O_2(g) \leftrightarrow 2\ SO_3(g)$
(C) $AgCl(s) \leftrightarrow Ag^+(aq) + Cl^-(aq)$
(D) $2\ HgO(s) \leftrightarrow 2\ Hg(\ell) + O_2(g)$

4. Given the closed system at equilibrium:

$$CO_2(g) \leftrightarrow CO_2(aq)$$

As the pressure on the system increases, the solubility of the $CO_2(g)$
(A) decreases (C) remains the same
(B) increases

5. Given the equilibrium reaction:

$$2\ SO_2(g) + O_2(g) \leftrightarrow 2\ SO_3(g) + \text{Heat}$$

When the pressure on the system in increased, the concentration of the SO_3 will
(A) decrease (C) remain the same
(B) increase

6. Given the reaction at equilibrium:

$$N_2(g) + O_2(g) = 2\ NO(g)$$

If the temperature remains constant and the pressure increases, the number of moles of NO(g) will
(A) decrease (C) remain the same
(B) increase

7. Given the reaction at equilibrium:

$$2\ A(g) + 3\ B(g) \leftrightarrow A_2B_3(g) + \text{heat}$$

Which change will not affect the equilibrium concentrations of $A(g)$, $B(g)$, and $A_2B_3(g)$?
(A) adding more $A(g)$
(B) adding a catalyst
(C) increasing the temperature
(D) increasing the pressure

8. The addition of a catalyst to a system at equilibrium will increase the rate of
(A) the forward reaction, only
(B) the reverse reaction, only
(C) both the forward and reverse reactions
(D) neither the forward nor reverse reaction

9. Given the reaction at equilibrium:

$$N_2(g) + O_2(g) + \text{energy} \leftrightarrow 2\ NO(g)$$

Which change will result in a *decrease* in the amount of NO(g) formed?
(A) decreasing the pressure
(B) decreasing the concentration of $N_2(g)$
(C) increasing the concentration of $O_2(g)$
(D) increasing the temperature

Version A

10. Given the reaction:

$$N_2(g) + O_2(g) + 182.6\ kJ \leftrightarrow 2\ NO(g)$$

Which change would cause an immediate increase in the rate of the forward reaction?
(A) increasing the concentration of NO(g)
(B) increasing the concentration of $N_2(g)$
(C) decreasing the reaction temperature
(D) decreasing the reaction pressure

11. Given the Haber reaction at equilibrium:

$$N_2(g) + 3\ H_2(g) \leftrightarrow 2\ NH_3(g) + heat$$

Which stress on the system will decrease the production of $NH_3(g)$?
(A) increasing the concentration of $N_2(g)$
(B) increasing the pressure on the system
(C) decreasing the concentration of $H_2(g)$
(D) decreasing the temperature on the system

12. Given the reaction at STP and at equilibrium:

$$H_2(g) + Cl_2(g) \leftrightarrow 2\ HCl(g)$$

Which change will result in an increase in the concentration of $Cl_2(g)$?
(A) decreasing the pressure of the system
(B) decreasing the concentration of HCl(g)
(C) increasing the concentration of $H_2(g)$
(D) increasing the concentration of HCl(g)

13. Given the reaction at equilibrium:

$$X_2(g) + 2\ Y_2(g) \leftrightarrow 2\ XY_2(g) + 80\ kcal$$

The equilibrium point will shift to the right if the pressure is
(A) increased and the temperature is increased
(B) increased and the temperature is decreased
(C) decreased and the temperature is increased
(D) decreased and the temperature is decreased

14. For a given system at equilibrium, lowering the temperature will always
(A) increase the rate of reaction
(B) increase the concentration of products
(C) favor the exothermic reaction
(D) favor the endothermic reaction

15. Base your answer to the following question on the following system at equilibrium:

$$2\ Cl_2(g) + 2\ H_2O(g) \leftrightarrow 4\ HCl(g) + O_2(g)$$

$$\Delta H = +27\ kcal.$$

If the temperature of the system is increased at a constant pressure, the rate of the forward reaction will
(A) decrease
(B) increase
(C) remain the same

16. Given the equilibrium reaction at constant pressure:

$$2\ HBr(g) + 17.4\ kcal \leftrightarrow H_2(g) + Br_2(g)$$

When the temperature is increased, the equilibrium will shift to the
(A) right, and the concentration of HBr(g) will decrease
(B) right, and the concentration of HBr(g) will increase
(C) left, and the concentration of HBr(g) will decrease
(D) left, and the concentration of HBr(g) will increase