

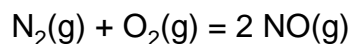
1. Ammonia is produced commercially by the Haber reaction:



The formation of ammonia is favored by

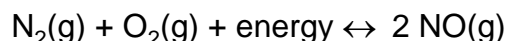
- (A) an increase in pressure
(B) a decrease in pressure
(C) removal of $\text{N}_2(\text{g})$
(D) removal of $\text{H}_2(\text{g})$
2. Given the reaction at equilibrium:
- $$2 \text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \leftrightarrow 2 \text{SO}_3(\text{g}) + \text{heat}$$
- Which change will shift the equilibrium to the right?
- (A) increasing the temperature
(B) increasing the pressure
(C) decreasing the amount of $\text{SO}_2(\text{g})$
(D) decreasing the amount of $\text{O}_2(\text{g})$
3. Which system at equilibrium will be *least* affected by a change in pressure?
- (A) $3 \text{H}_2(\text{g}) + \text{N}_2(\text{g}) \leftrightarrow 2 \text{NH}_3(\text{g})$
(B) $2 \text{S}(\text{s}) + 3 \text{O}_2(\text{g}) \leftrightarrow 2 \text{SO}_3(\text{g})$
(C) $\text{AgCl}(\text{s}) \leftrightarrow \text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq})$
(D) $2 \text{HgO}(\text{s}) \leftrightarrow 2 \text{Hg}(\ell) + \text{O}_2(\text{g})$
4. Given the closed system at equilibrium:
- $$\text{CO}_2(\text{g}) \leftrightarrow \text{CO}_2(\text{aq})$$
- As the pressure on the system increases, the solubility of the $\text{CO}_2(\text{g})$
- (A) decreases (C) remains the same
(B) increases
5. Given the equilibrium reaction:
- $$2 \text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \leftrightarrow 2 \text{SO}_3(\text{g}) + \text{Heat}$$
- When the pressure on the system is increased, the concentration of the SO_3 will
- (A) decrease (C) remain the same
(B) increase

6. Given the reaction at equilibrium:



If the temperature remains constant and the pressure increases, the number of moles of $\text{NO}(\text{g})$ will

- (A) decrease (C) remain the same
(B) increase
7. Given the reaction at equilibrium:
- $$2 \text{A}(\text{g}) + 3 \text{B}(\text{g}) \leftrightarrow \text{A}_2\text{B}_3(\text{g}) + \text{heat}$$
- Which change will not affect the equilibrium concentrations of $\text{A}(\text{g})$, $\text{B}(\text{g})$, and $\text{A}_2\text{B}_3(\text{g})$?
- (A) adding more $\text{A}(\text{g})$
(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:

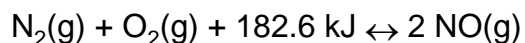


Which change will result in a *decrease* in the amount of $\text{NO}(\text{g})$ formed?

- (A) decreasing the pressure
(B) decreasing the concentration of $\text{N}_2(\text{g})$
(C) increasing the concentration of $\text{O}_2(\text{g})$
(D) increasing the temperature

Worksheet: LeChatelier's Principle

10. Given the reaction:



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 N₂(g)
- (C) decreasing the reaction temperature
- (D) decreasing the reaction pressure

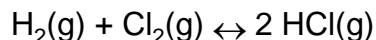
11. Given the Haber reaction at equilibrium:



Which stress on the system will decrease the production of NH₃(g)?

- (A) increasing the concentration of N₂(g)
- (B) increasing the pressure on the system
- (C) decreasing the concentration of H₂(g)
- (D) decreasing the temperature on the system

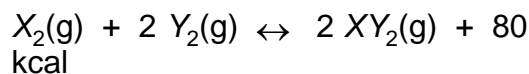
12. Given the reaction at STP and at equilibrium:



Which change will result in an increase in the concentration of Cl₂(g)?

- (A) decreasing the pressure of the system
- (B) decreasing the concentration of HCl(g)
- (C) increasing the concentration of H₂(g)
- (D) increasing the concentration of HCl(g)

13. Given the reaction at equilibrium:



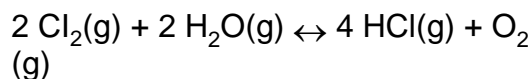
The equilibrium point will shift to the right if the pressure is

- (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:

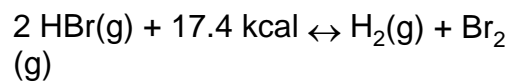


$$\Delta H = +27 \text{ kcal.}$$

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:



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

**Worksheet: LeChatelier's Principle
Answer Key**

1. A

2. B

3. C

4. B

5. B

6. C

7. B

8. C

9. B

10. B

11. C

12. D

13. B

14. C

15. B

16. A