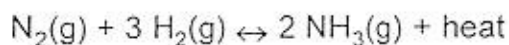


1. Ammonia is produced commercially by the Haber reaction:



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:



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)  $2 \text{HgO}(\text{s}) \leftrightarrow 2 \text{Hg}(\ell) + \text{O}_2(\text{g})$

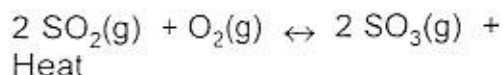
4. Given the closed system at equilibrium:



As the pressure on the system increases, the solubility of the  $\text{CO}_2(\text{g})$

- (A) decreases (C) remains the same  
 (B) increases

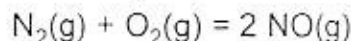
5. Given the equilibrium reaction:



When the pressure on the system is increased, the concentration of the  $\text{SO}_3$  will

- (A) decrease (C) remain the same  
 (B) increase

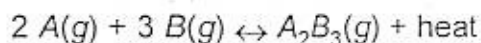
6. Given the reaction at equilibrium:



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:



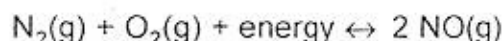
Which change will not affect the equilibrium concentrations of  $\text{A}(\text{g})$ ,  $\text{B}(\text{g})$ , and  $\text{A}_2\text{B}_3(\text{g})$ ?

- (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

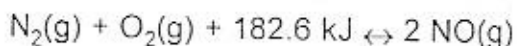
9. Given the reaction at equilibrium:



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

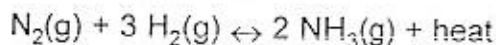
10. Given the reaction:



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 N<sub>2</sub>(g)
- (C) decreasing the reaction temperature
- (D) decreasing the reaction pressure

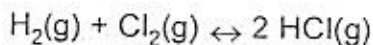
11. Given the Haber reaction at equilibrium:



Which stress on the system will decrease the production of NH<sub>3</sub>(g)?

- (A) increasing the concentration of N<sub>2</sub>(g)
- (B) increasing the pressure on the system
- (C) decreasing the concentration of H<sub>2</sub>(g)
- (D) decreasing the temperature on the system

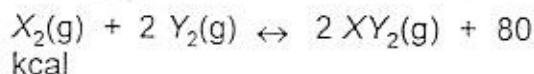
12. Given the reaction at STP and at equilibrium:



Which change will result in an increase in the concentration of Cl<sub>2</sub>(g)?

- (A) decreasing the pressure of the system
- (B) decreasing the concentration of HCl(g)
- (C) increasing the concentration of H<sub>2</sub>(g)
- (D) increasing the concentration of HCl(g)

13. Given the reaction at equilibrium:



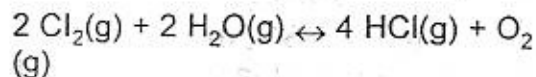
The equilibrium point will shift to the right if the pressure is

- (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