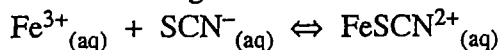


1. Consider the following reversible reaction:

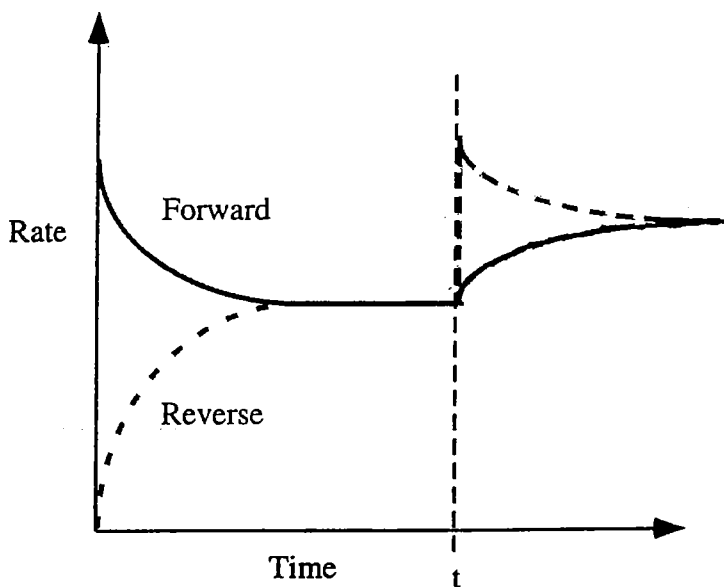
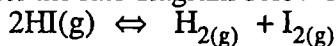


A solution of  $\text{Fe}(\text{NO}_3)_3$  is added to a solution of  $\text{KSCN}$ . Which one of the following statements describes the changes in forward and reverse reaction rates as the reaction moves towards equilibrium?

*\* the  $\text{NO}_3^-$  and  $\text{K}^+$  ions are spectator ions.*

- A. Forward and reverse rates increase.  
 B. Forward and reverse rates decrease.  
 C. Forward rate increases and reverse decreases.  
 D. Forward rate decreases and reverse increases.  
 E. Forward and reverse rates remain constant.

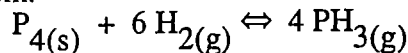
2. Consider the rate diagram below for the following reaction:



Which of the following occurs at time  $t_1$ ?

- A. addition of  $\text{H}_2$                       B. addition of  $\text{HI}$                       C. addition of a catalyst  
 D. a decrease in volume.              E. a decrease in pressure.

3. Consider the following system:



Which of the following changes would cause the above system to shift right?

- A. Add more  $\text{P}_4$                       C. Increase pressure  
 B. Add a catalyst                      D. Increase surface area

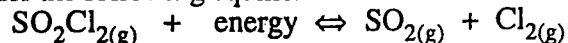
4. consider the following equilibrium:



In which of the following will both stresses shift the equilibrium left ?

- A. a decrease in temperature and a decrease in volume.  
 B. an increase in temperature and a decrease in volume.  
 C. a decrease in temperature and an increase in volume.  
 D. an increase in temperature and an increase in volume.  
 E. an increase in temperature and a decrease in  $[\text{H}_2\text{O}]$

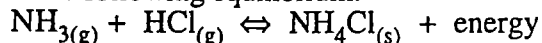
5. Consider the following equilibrium:



When the temperature is increased, the equilibrium shifts....

- A. left and  $[\text{SO}_2\text{Cl}_2]$  increases.      D. right and  $[\text{SO}_2\text{Cl}_2]$  decreases.  
B. left and  $[\text{SO}_2\text{Cl}_2]$  decreases.      E. right and  $[\text{SO}_2\text{Cl}_2]$  remains constant.  
C. right and  $[\text{SO}_2\text{Cl}_2]$  increases.

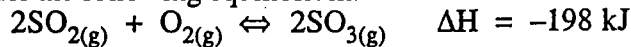
6. Consider the following equilibrium:



Which of the following will result in a decrease in the mass of  $\text{NH}_4\text{Cl}$ ?

- A. adding  $\text{NH}_3$       D. decreasing the temperature  
B. removing  $\text{HCl}$       E. add a catalyst.  
C. decreasing the volume

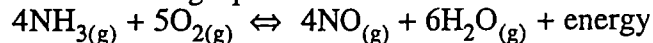
7. Consider the following equilibrium:



There will be no shift in equilibrium when.....

- A. more  $\text{O}_2$  is added.      D. the temperature is increased.  
B. a catalyst is added.      E. the temperature is decreased.  
C. the volume is increased.

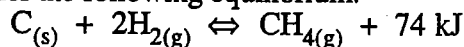
8. Consider the following equilibrium:



Which of the following will cause the equilibrium to shift to the left?

- A. adding  $\text{H}_2\text{O}_{(g)}$       D. decreasing the temperature  
B. removing some  $\text{NO}_{(g)}$       E. adding a catalyst.  
C. increasing the volume

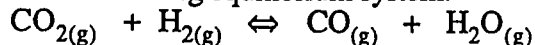
9. Consider the following equilibrium:



When a small amount of solid C is added to the system ...

- A.  $[\text{H}_2]$  decreases.  
B.  $[\text{CH}_4]$  increases  
C. the temperature increases.  
D. all concentrations remain constant.  
E.  $[\text{C}]$  increases.

10. Consider the following equilibrium system:



Which of the following, when added to the system above, would result in a net decrease in  $[\text{H}_2\text{O}]$ ?

- A.  $\text{CO}_2$       C.  $\text{CO}$   
B.  $\text{H}_2$       D.  $\text{H}_2\text{O}$