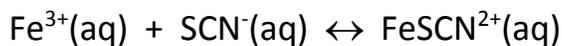


Lab 8: Equilibrium & Le Chatelier's Principle



Pre-lab: Write the Kc expression for the reaction. $K_c = \frac{[\text{FeSCN}^{2+}]}{[\text{Fe}^{3+}][\text{SCN}^{-}]}$

Data:

Table 1: Color of Reactants & Products

Substance	Color
FeCl ₃	Yellow
KSCN	Colorless
FeSCN ²⁺	Dark red

Table 2: Observations When a Stress is Applied

Stress	Observation
Add FeCl ₃ (aq)	Dark red in color
Add KSCN(aq)	Dark red in color
Add NaOH(aq)	Yellow in color
Ice Bath (Decrease T)	Darker in color

Data Analysis:

Table 3: Shifts upon Application of Stress

Stress	Shift	Δ [FeSCN ²⁺]	Explanation
Addition of FeCl ₃ (aq)	Forward	Increases	Fe ³⁺ is a reactant. Systems shift away from additions, thus with additional Fe ³⁺ the system shifts forward to reestablish equilibrium. With additional Fe ³⁺ , Q < K. Thus, to reestablish equilibrium, Q must increase to equal K. Therefore, more products must be made and a forward shift will occur.
Addition of KSCN(aq)	Forward	Increases	SCN ⁻ is a reactant. Systems shift away from additions, thus with additional SCN ⁻ the system shifts forward to reestablish equilibrium. With additional SCN ⁻ , Q < K. Thus, to reestablish equilibrium, Q must increase to equal K. Therefore, more products must be made and a forward shift will occur.
Addition of NaOH(aq)	Reverse	Decreases	OH ⁻ causes some Fe ³⁺ to precipitate out of solution as Fe(OH) ₃ (s). [Fe ³⁺] decreases. Systems shift toward removals, thus with removal of some Fe ³⁺ the system shifts reverse to reestablish equilibrium. With less Fe ³⁺ , Q > K. Thus, to reestablish equilibrium, Q must decrease to equal K. Therefore, more reactants must be made and a reverse shift will occur.

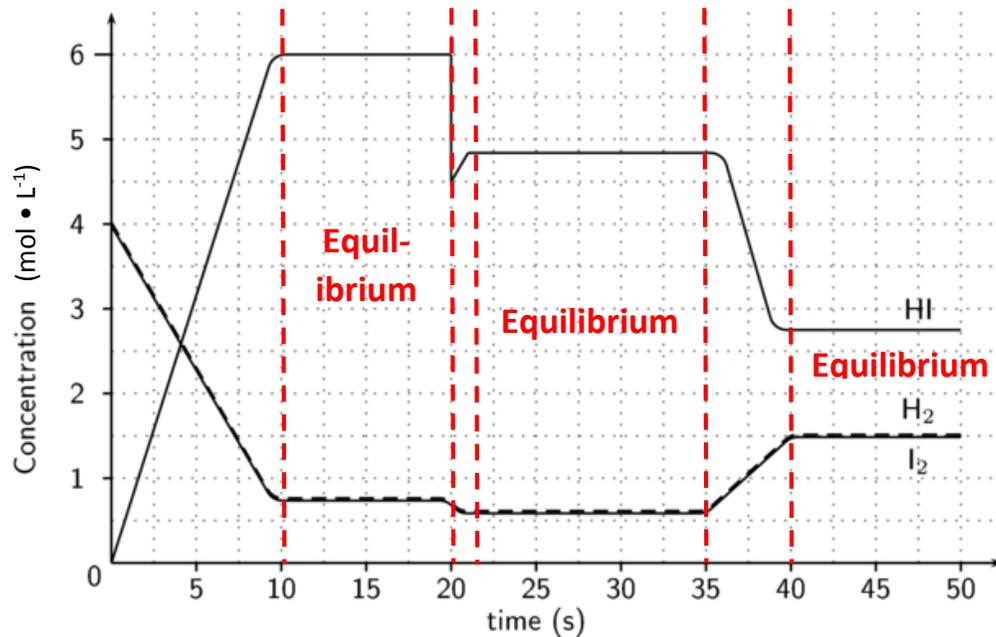
Post-lab:

1. Is the reaction endothermic or exothermic? Explain your reasoning using specific data from the observations.

Exothermic because the decrease in temperature caused the solution to become darker in color, indicating a forward shift. Thus, heat is a product and the removal of heat induced by the ice bath caused the system to shift and favor the side with the heat. Since heat is a product, the reaction is exothermic.



- a) Label the points of equilibrium on the graph below.



- b) Describe what kind of stress could cause the observed change in concentrations at time = 20 seconds. Explain your answer.

A forward shift occurs at time = 20 seconds because [HI] increases and both [H₂] and [I₂] decrease. The drastic decrease in [HI] at t=20 s indicates the removal of HI. The system responds to this stress by shifting forward to make more HI until equilibrium is reestablished.

- c) If the change at t = 35 s is due to an increase in temperature, is the reaction exothermic or endothermic? Explain your answer.

Exothermic. At t = 35 s, a reverse shift occurs as indicated by the increase in [H₂] and [I₂] and the decrease in [HI]. Heat must be a product because an increase in temperature is causing a reverse shift away from the addition to the system.