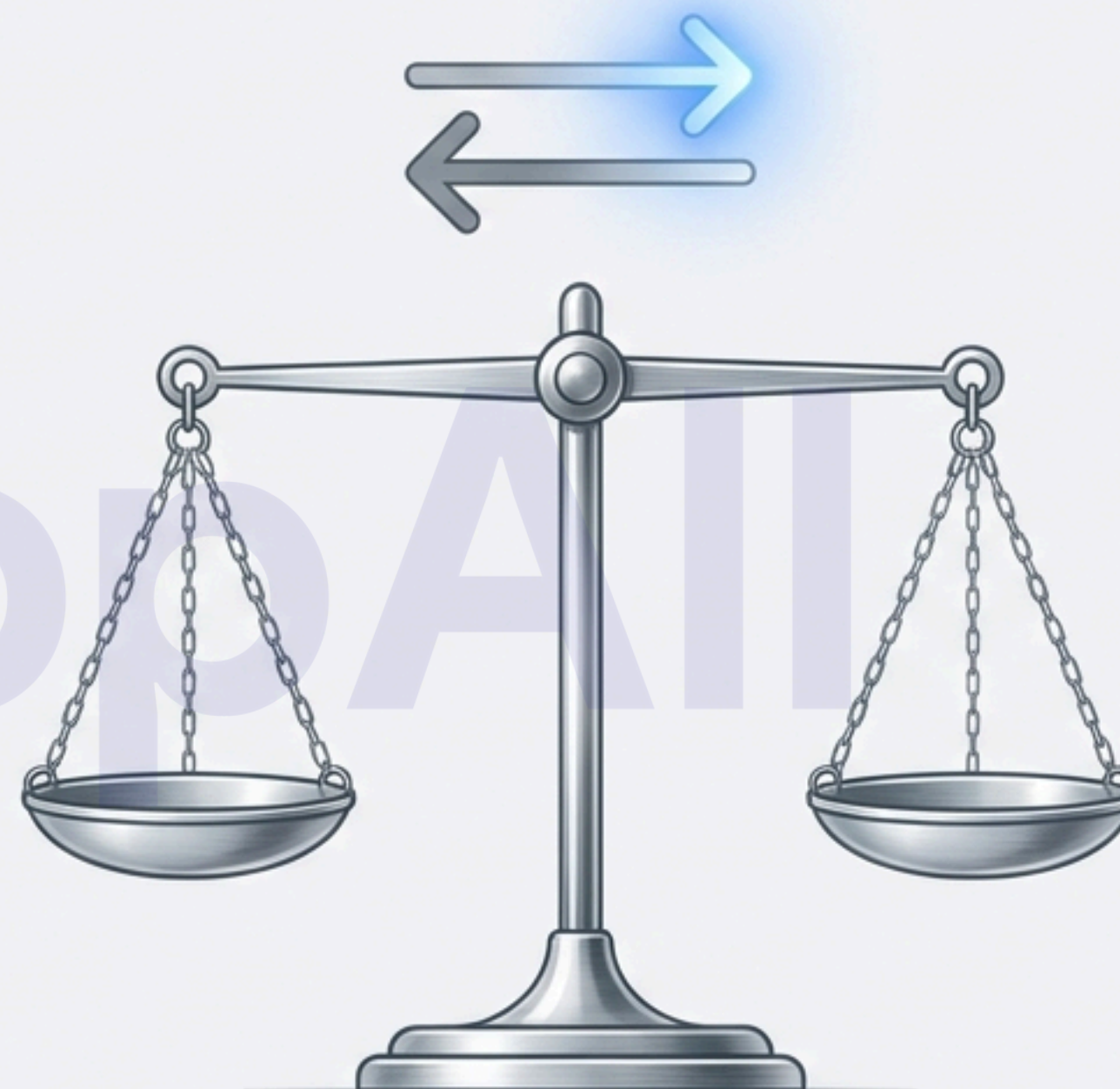
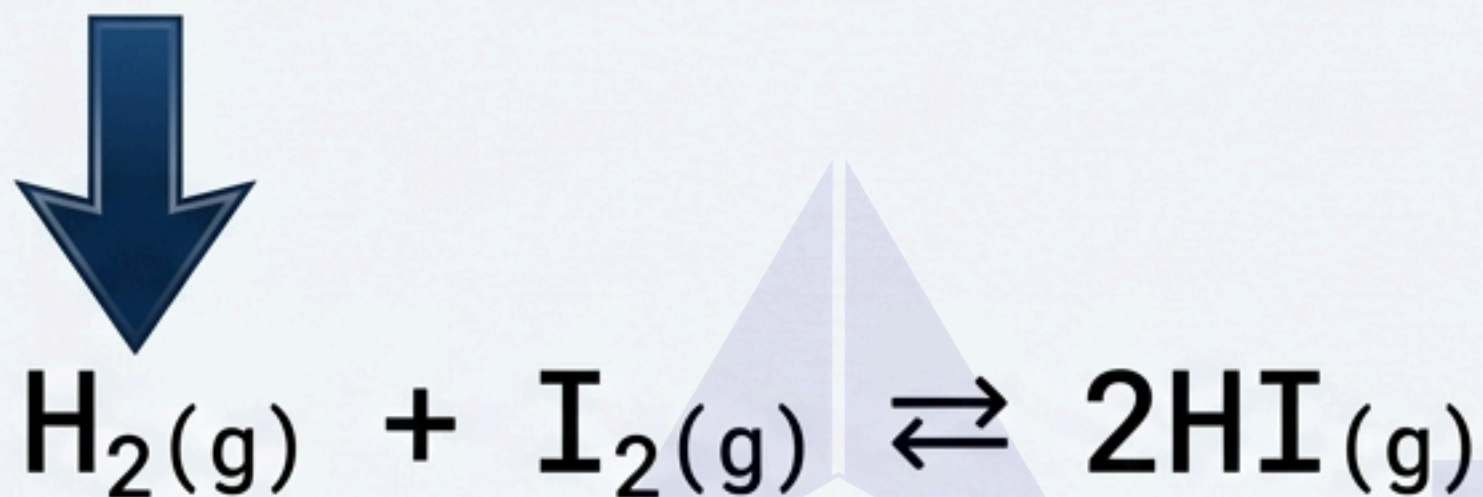


Concentration Changes Move Equilibrium

Mastering Le Chatelier's Principle for shifts in dynamic equilibrium.



Adding a Reactant (The Forward Push)



The system relieves the stress by consuming the added substance. The equilibrium is 'pushed' to the right, forcing more H_2 and I_2 to react.

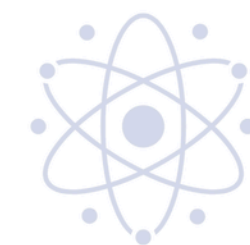
Add Reactant → Shift Forward (Right)

More HI is formed until a new equilibrium is established, at which point the concentration of H_2 is lower than the spike, but higher than the original equilibrium.



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$$E=mc^2$$



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Removing a Product (The Forward Pull)



The system relieves the stress by replenishing the removed substance. The equilibrium is 'pulled' to the right to replace what was

Remove Product → Shift Forward (Right)

Continuous removal drives a reversible reaction to near completion.



JEE TRAP ALERT

Adding or removing a pure solid or pure liquid does **NOT** change active concentration and does **NOT** shift equilibrium.

Le Chatelier concentration shifts only apply to gases and aqueous solutions!

The Mathematical Proof: Q_c vs. K_c

$$Q_c = \frac{[\text{Products}]^y}{[\text{Reactants}]^x}$$

(Evaluated at any arbitrary time 't', not just equilibrium)

Add Reactant

Math: Denominator increases.

State: $Q_c < K_c$

Result: Reaction moves Forward ($\rightarrow$) to increase numerator.

Add Product

Math: Numerator increases.

State: $Q_c > K_c$

Result: Reaction moves Backward ($\leftarrow$) to increase denominator.

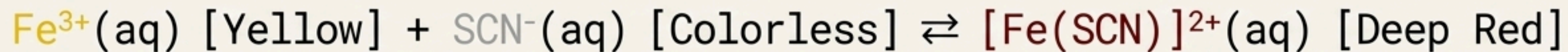
Equilibrium Restored

Math: System stabilizes.

State: $Q_c = K_c$

Result: No net movement.

Lab Application: The Thiocyanate Complex



Shift Right

Add KSCN.
Increases $[\text{SCN}^{-}]$.
Shifts Forward $\rightarrow$ Darker Red.

Shift Left (Remove Fe^{3+})

Add Oxalic acid ($\text{H}_2\text{C}_2\text{O}_4$).
Forms stable $[\text{Fe}(\text{C}_2\text{O}_4)_3]^{3-}$,
"stealing" Fe^{3+} .
Shifts Backward $\rightarrow$ Lighter Color.

Shift Left (Remove SCN^{-})

Add HgCl_2 .
Forms stable $[\text{Hg}(\text{SCN})_4]^{2-}$,
"stealing" SCN^{-} .
Shifts Backward $\rightarrow$ Lighter Color.

Exam Snapshot: Concentration Shifts

Disturbance	Effect on Q_c	Shift Direction	Result
Increase Reactant	$Q_c < K_c$	Forward ($\rightarrow$)	Product increases
Decrease Reactant	$Q_c > K_c$	Backward ($\leftarrow$)	Product decreases
Increase Product	$Q_c > K_c$	Backward ($\leftarrow$)	Reactant increases
Decrease Product	$Q_c < K_c$	Forward ($\rightarrow$)	Reactant decreases



CRITICAL RULE

Le Chatelier's Principle dictates that concentration changes alter the position of the equilibrium mixture, but the Equilibrium Constant (K_c) remains unchanged.

Only temperature changes K_c .



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