N12 - Equilibrium

Quick Review

Chemical Equilibrium

Reversible Reactions

A chemical reaction in which the products can react to re-form the reactants

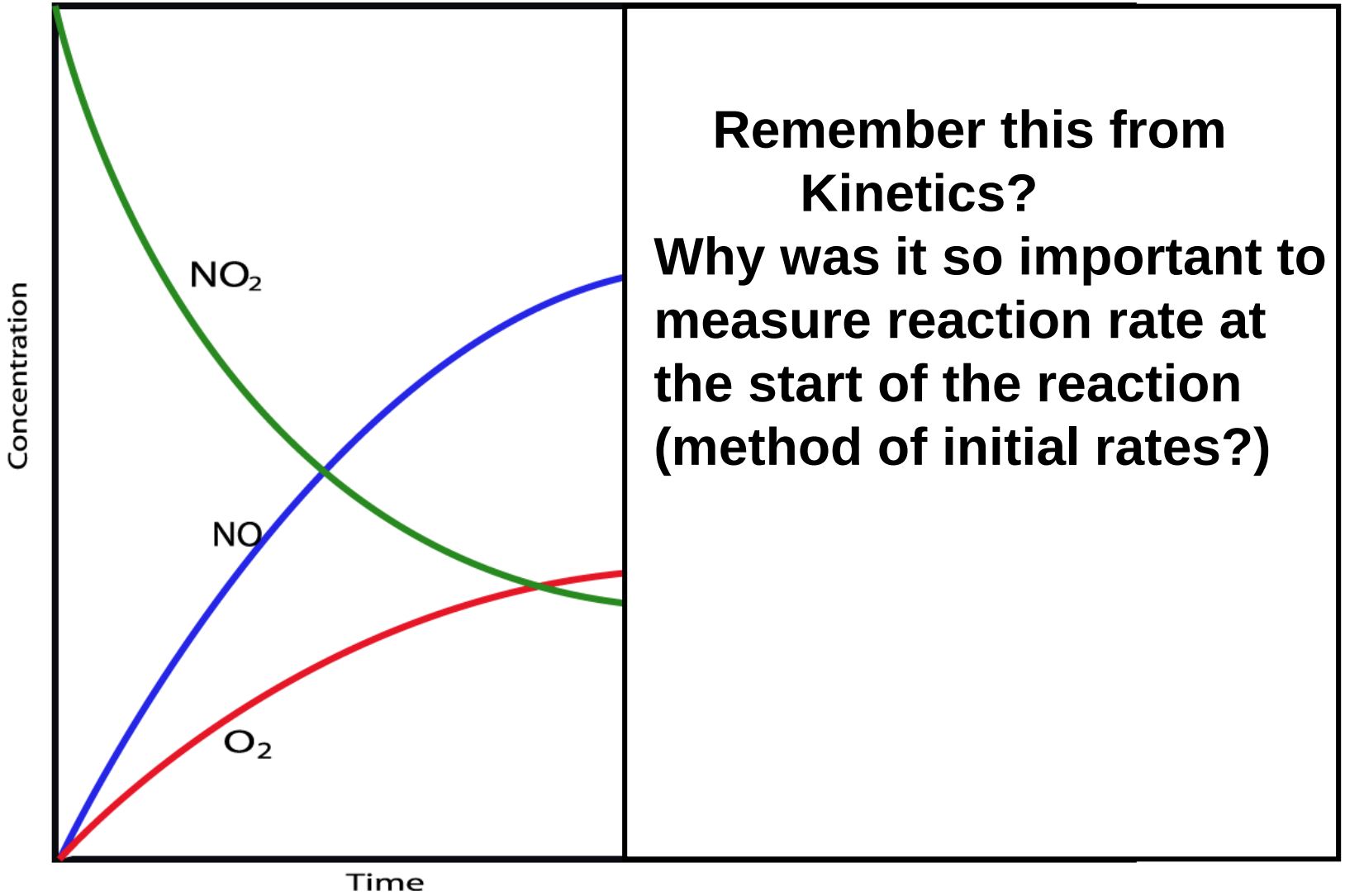
Chemical Equilibrium

When the rate of the forward reaction equals the rate of the reverse reaction and the concentration of products and reactants remains unchanged

$$2HgO_{(s)} \rightleftarrows 2Hg_{(l)} + O_{2(g)}$$

(⇆) indicates equilibrium in a chemical equation

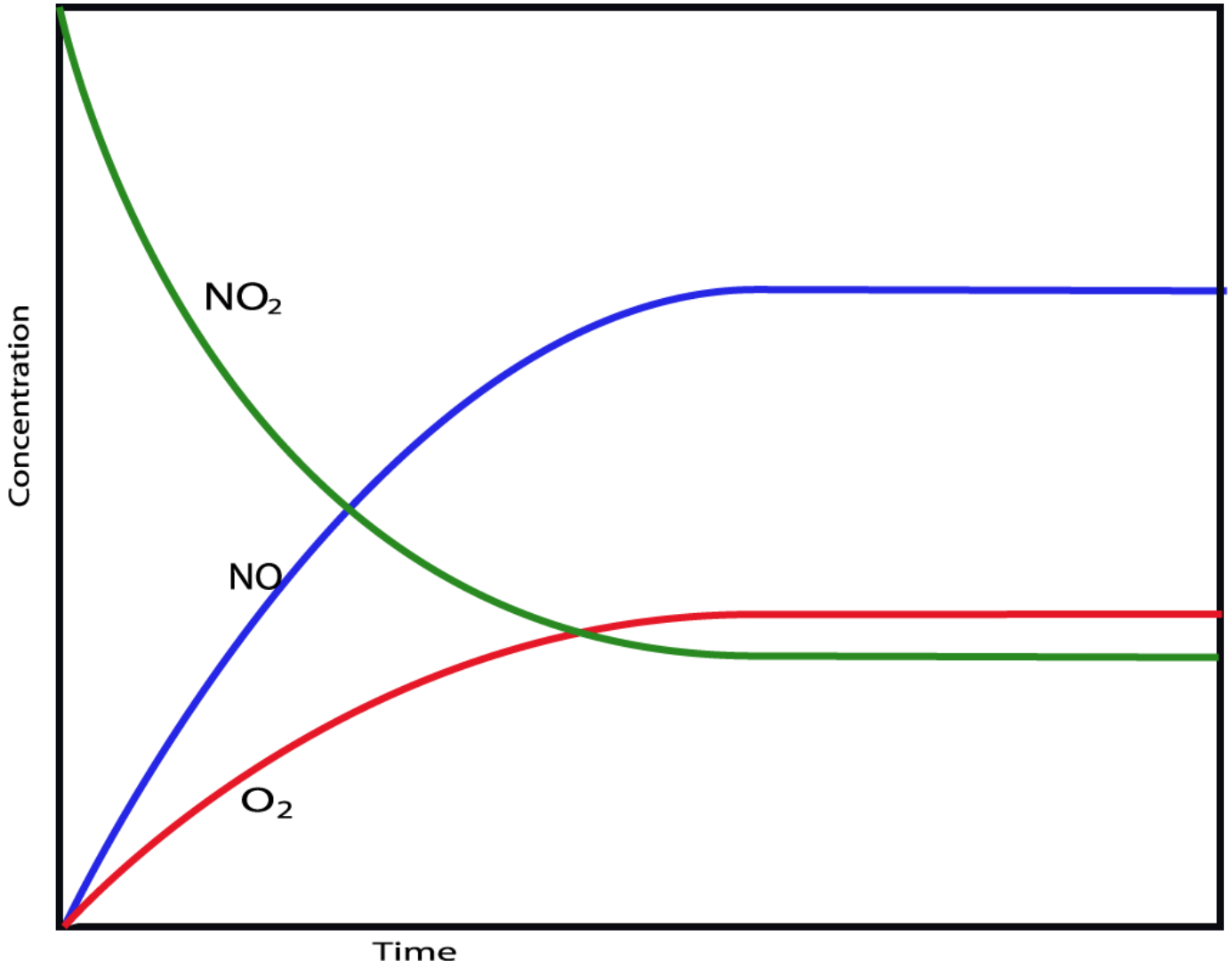
$2NO_2(g) \rightarrow 2NO(g) + O_2(g)$



Remember this from Kinetics?

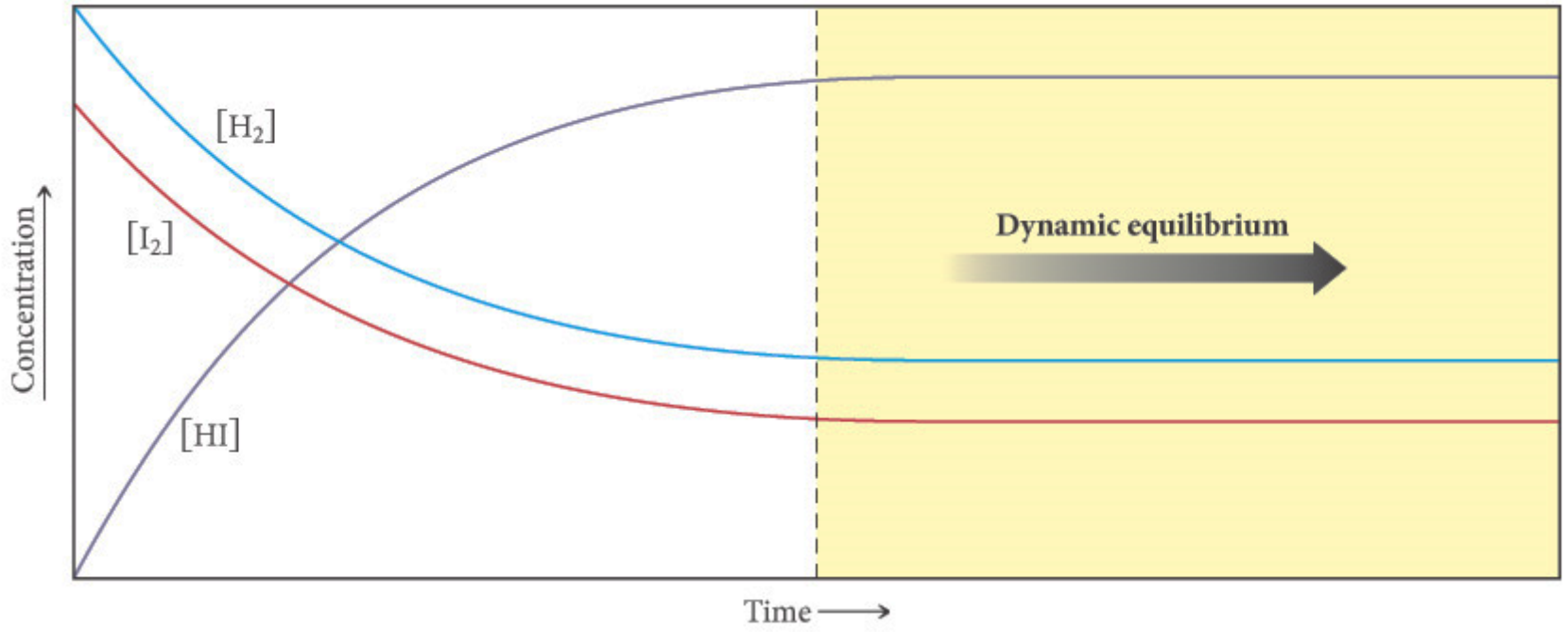
Why was it so important to measure reaction rate at the start of the reaction (method of initial rates?)

$$2NO_2(g) \leftrightarrows 2NO(g) + O_2(g)$$



$$H_2(g) + I_2(g) \Leftrightarrow 2\ HI(g)$$

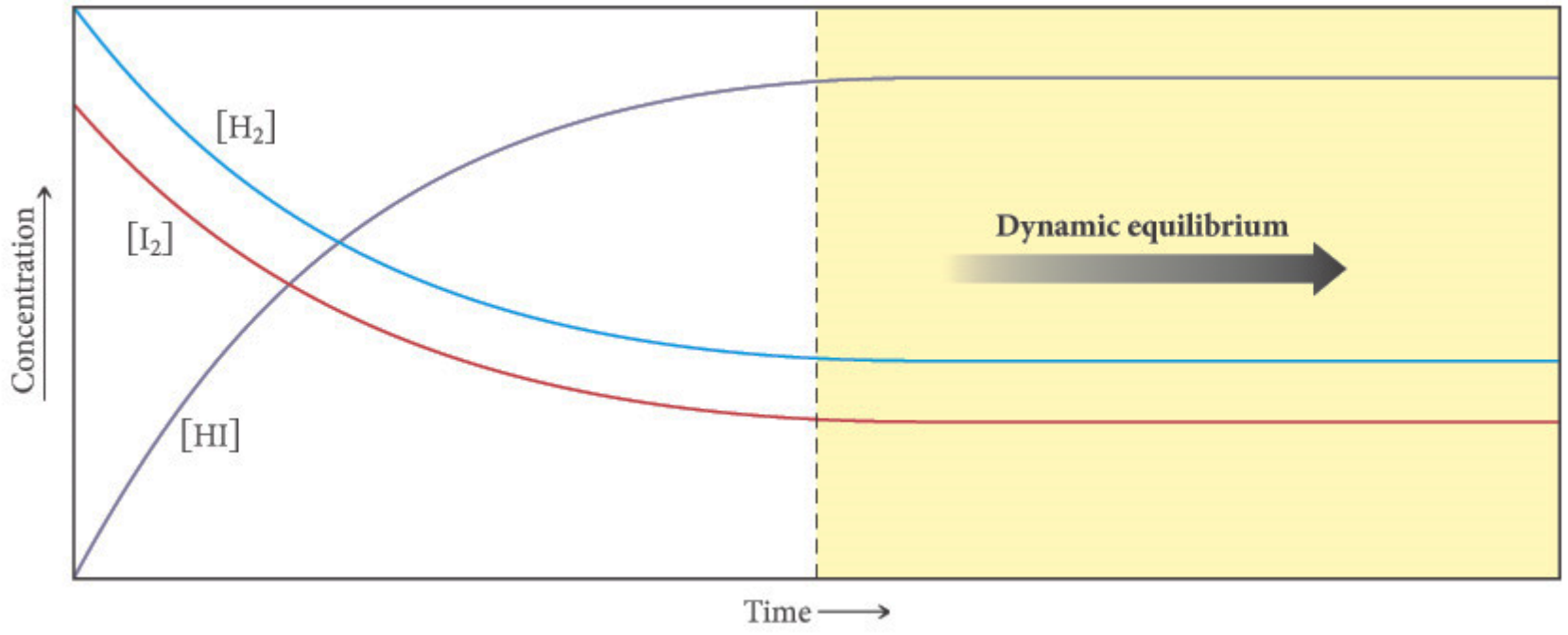
As the concentration of product increases and the concentrations of reactants decrease, the rate of the forward reaction slows down, and the rate of the reverse reaction speeds up.



$H_2(g) + I_2(g) \Leftrightarrow 2\ HI(g)$

At dynamic equilibrium, the rate of the forward reaction is equal to the rate of the reverse reaction.

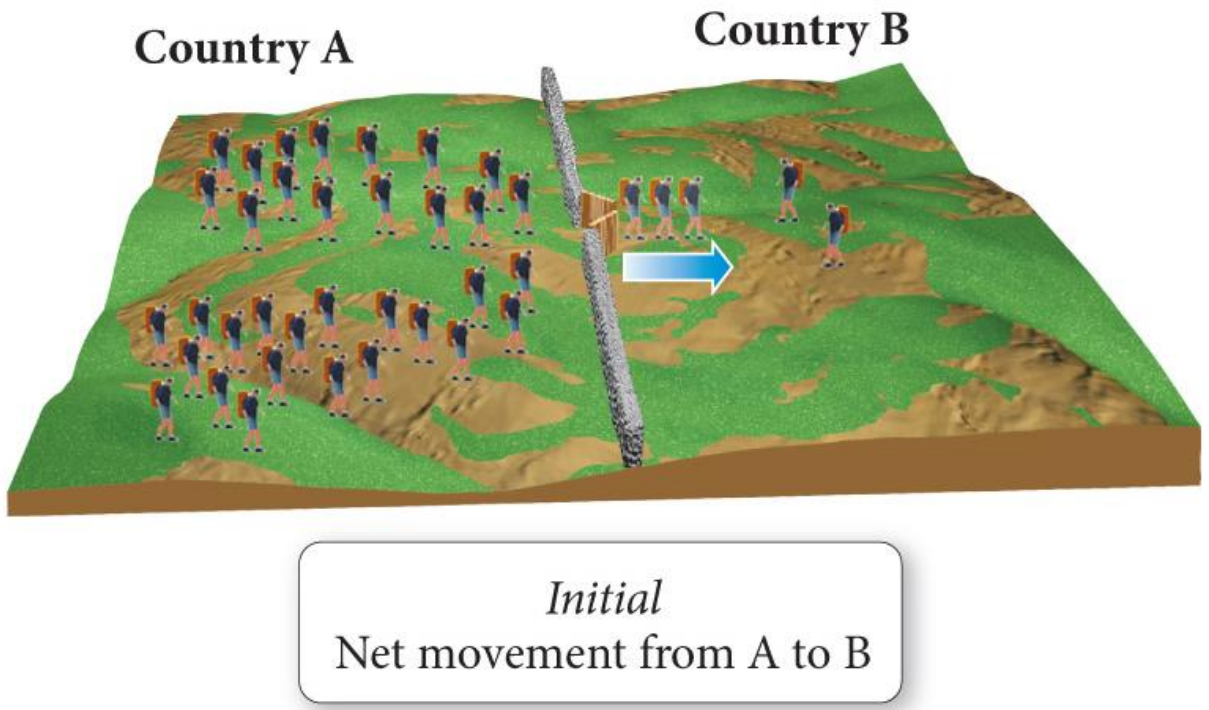
The concentrations of reactants and products no longer change.



Equilibrium ≠ Equal Concentrations!

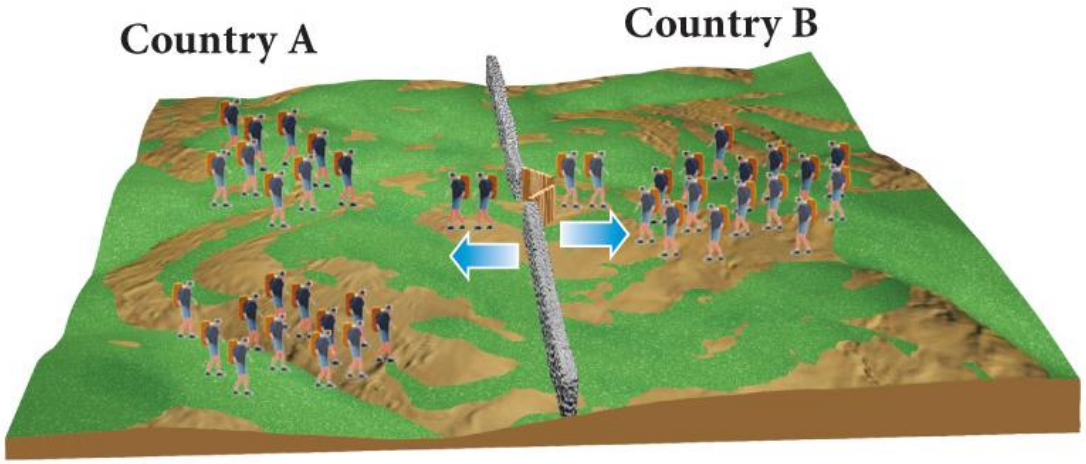
- The rates of the forward and reverse rxns are equal at equilibrium.
- But that does ***NOT*** mean the *concentrations* of reactants and products are equal.
- **Product Favored -** Some reactions reach equilibrium only after almost all the reactant molecules are consumed; we say the position of equilibrium favors the products.
- **Reactant Favored -** Other reactions reach equilibrium when only a small percentage of the reactant molecules are consumed; we say the position of equilibrium favors the reactants.

An Analogy: Population Changes



When Country A citizens feel overcrowded, some will emigrate to Country B .

An Analogy: Population Changes



However, after a time, emigration will occur in both directions at the same rate, leading to populations in Country A and Country B that are constant, but not necessarily equal.