

Rate Of Reaction

Rate $-\Delta \text{Reactants} / \Delta t = \Delta \text{products} / \Delta t$

Reactants are *negative*

Collision Theory states that particles must collide for a reaction to occur, and must have the right orientation and enough energy

Activated Complex a complex that exists very briefly in the time between the breaking down of reactants and forming of products

Activation Energy the minimum amount of energy needed to form the activated complex

Exothermic Reaction a reaction that releases energy; the products end up having less energy than the reactants

Endothermic reaction a reaction that must absorb enough energy to overcome the energy barrier; the products have more energy at the end

Factors that affect the rate catalysts - the nature of the substances - Concentration - Surface Area - Temperature

Factors Affecting Equilibrium

Characteristics of equilibrium 1- fixed ratio, 2- closed system, 3-fixed temp, 4- dynamic equilibrium

Le Chatelier's Principle a change in one variable that describes a system produces a shift in the position of the equilibrium, countering the change

Effects of Changing Concentration: higher reactant concentration = reaction shifts to the right, and vice versa

Effects of Changing Temperature adding heat to an exothermic reaction = more reactants; adding heat to an endothermic reaction = more products

Factors Affecting Equilibrium (cont)

Effects of Changing Pressure and Volume Higher pressure + lower volume = lower number of moles; lower pressure + higher volume = more moles

if the number of moles are equal on both sides, pressure and volume will have no effect

Rate Law

Rate Law $R = k [A]^x [B]^y$

Order of the reaction $x+y$

Rate Constant (k) is only affected by temp

Rate Constant Units s^{-1} , $L/mol.s$, $L^2/mol^2.s$

A and B are the molar concentrations of reactants; the rate is directly proportional to the concentrations

the coefficients are the exponents

Reversible Reactions and Equilibrium

Complete Reaction when reactants change to products ($\rightarrow$)

Reversible reaction can go both ways ($\rightleftharpoons$)

Equilibrium when the rate of the forward reaction equals the rate of the backwards one

Chemical Equilibrium Law states that at a certain temperature, the ratio of the reactants and products can remain constant

for $aA + bB = cC + dD$

Chemical Equilibrium Law Formula $K_{eq} = \frac{[C]^c [D]^d}{[A]^a [B]^b}$

if $K_{eq} > 1$, the products have a higher concentration, if $K_{eq} < 1$ the reactants have a higher concentration

Homogeneous Equilibrium when the reactants and products are in the same state of matter

Heterogeneous Equilibrium when the reactants and products are in multiple states (the pure solid and liquids are removed from the equation)



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Page 1 of 2.

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Temperature and The Equilibrium Constant

K eq is directly proportional to temp id the equation is:

endothermic

K eq is inversely proportional to temp id the equation is:

exothermic

catalyst

increases the speed at which a reaction reaches equilibrium, but does not change the equilibrium

K sp = solubility product constant

Q sp = ionic product

if K sp > Q sp

unsaturated, no precipitate

if K sp = Q sp

saturated, no precipitate

if K sp < Q sp

saturated, precipitate is formed

Temperature and The Equilibrium Constant

K eq is directly proportional to temp id the equation is: endothermic

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Page 2 of 2.

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