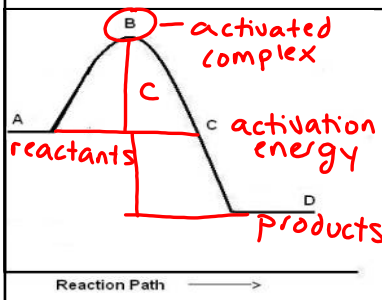
BR: April 2nd



Identify what the letters represent.

Is this an exothermic reaction or an endothermic reaction? Why? losing E P ↓ E than r

Mar 10-10:33 AM

Tuesday, April 2nd

Objective: Students will be able to determine the expression for the rate of a reaction.

1. Bellringer
2. Keq Notes
3. Worktime

Quiz tomorrow!

DUE: Kinetics Practice

HW: Keq Practice

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2 Types of Reactions:

1. Completion Reactions :

- Results in a complete conversion of reactants to products
- ex: $Pb(NO_3)_2 + 2NaI \rightarrow PbI_2 + 2\,NaNO_3$ (NaI)
- 2 indicators of a completion reaction are fomration of a precipitate (solid) or a gas
- Most reactions DO NOT go to completion.
- Have a one-sided arrow

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2 Types of Reactions:

2. Reversible Reactions :

- Can occur in both the forward and reverse directions
  ex: $N_2 + 3\,H_2 \leftrightarrow 2NH_3$
  > Equation shave a double sided arrow
- Forward Arrow: Reactants can form products
  $N_2 + 3\,H_2 \rightarrow 2NH_3$
- Reverse Arrow: Products can form reactants
  $2NH_3 \rightarrow N_2 + 3\,H_2$
- Both reactions will occur at the same time whenever all the substances are present.

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Chemical Equilibrium:

- A state in which the forward and reverse reactions take place at equal rates.

  Forward rate = Reverse rate
- The amounts of the reactants and products are constant at equilibrium.
- Equilibrium is dynamic -- reactions are still occurring, although we may not be able to see it.

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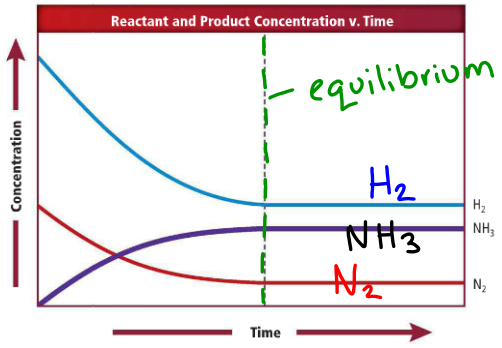
Chemical Equilibrium:

- $N_2 + 3\,H_2 \rightarrow 2NH_3$



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Law of Chemical Equilibrium:

- At a given temperature, a chemical system may reach a state in which a particular ratio of reactant and product concentrations has a constant value.

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Law of Chemical Equilibrium:

- For example, if this is a reaction:

$aA + bB \leftrightarrow cC + dD$

coefficient — R — P — chemicals

Then you get a constant

$$Keq = \frac{\text{Products}}{\text{reactants}} = \frac{[C]^c[D]^d}{[A]^a[B]^b}$$

[ ] = concentration in M

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Law of Chemical Equilibrium:

$$Keq = \frac{[C]^c[D]^d}{[A]^a[B]^b}$$

Keq

- called the equilibrium constant
- calculated by inserting the molarity of each substance
- has no unit (or label)
- changes with temperature

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Law of Chemical Equilibrium:

$$Keq = \frac{[C]^c[D]^d}{[A]^a[B]^b} \quad \frac{P}{R}$$

If Keq > 1

> more products than reactants at equilibrium
> products are favored

If Keq < 1

> more reactants than products at equilibrium
> reactants are favored

Which do you think is better for business?

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Law of Chemical Equilibrium:

$$Keq = \frac{[C]^c[D]^d}{[A]^a[B]^b}$$

Homogeneous equilibrium : when all substances are in the same state of matter.

Heterogeneous equilibrium : substances are in more than one state

if any of the substances in the reaction are liquids or solids , leave them out of the expression

--Only use gases and aqueous (s + l) solutions in the expression for Keq

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Example: $\frac{P}{R}$ $Keq = \frac{[C]^c[D]^d}{[A]^a[B]^b}$

Write the equilibrium expression for the following equation:

$1N_2O_4(g) \leftrightarrow 2NO_2(g)$

$$K_{eq} = \frac{[NO_2]^2}{[N_2O_4]^1}$$

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Example: $\frac{P}{R}$ $K_{eq} = \frac{[C]^c[D]^d}{[A]^a[B]^b}$

Write the equilibrium constant for the following equation:

~~C(s)~~ + H_2O (g) <--> CO (g) + H_2 (g)

$$K_{eq} = \frac{[CO][H_2]}{[H_2O]}$$

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Example: $\frac{P}{R}$ $K_{eq} = \frac{[C]^c[D]^d}{[A]^a[B]^b}$

Calculate the Keq for the reaction below when $[SO_3]$=0.0160M, $[SO_2]$=0.00560M, and $[O_2]$=0.0210M. Are the products or the reactants favored?

$2SO_3(g) <--> 2SO_2(g) + O_2(g)$

$$K_{eq} = \frac{[SO_2]^2[O_2]}{[SO_3]^2}$$

$$= \frac{(0.0056)^2 \times (0.021)}{(0.016)^2}$$

$$= \frac{0.0000006659}{0.000256}$$

$= 0.00257 < 1$

Reactants favored

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