October 14, 2008
Notes
TC

Key Vocabulary (from the book definitions):

- Rate Law:

an equation that relates the reaction rate to the concentrations of reactants (though not always all of them, and sometimes also other chemicals, such as intermediates). Always has the form:

> rate = k $[A]^m$ $[B]^n$
>
> where k is the rate constant, A and B are different chemicals, and m and n are the orders of the rate law with respect to A and B, respectively

- Concentration:

the quantity of solute present in a given quantity of solvent or solution.

- Catalyst:

a substance that changes the speed of a chemical reaction without itself undergoing a permanent chemical change in the process.

- Overall Order of Reaction:

The sum of the reaction orders of all the reactants appearing in the rate expression when the rate can be expressed as ($rate = k[A]^a[B]^b$...). That is, the order in this case = $a + b$.

- Order with respect to a particular reactant (Reaction Order):

The power to which the concentration of a reactant is raised in a rate law.

- Rate Constant:

The constant “*k*”.

- Half-Life:

The time required for the concentration of a reactant substance to decrease to half of its initial value; the time required for half a sample of a particular radioisotope to decay.

- Collision Model:

A model of reaction rates based on the idea that molecules must collide to react; it explains the factors influencing reaction rates in terms of the frequency of collisions, the number of collisions with energies exceeding the activation energy, and the probability that the collisions occur with suitable orientations.

- Activated Complex/Transition State:

The particular arrangement of atoms found at the top of the potential-energy barrier in a reaction’s energy profile as a reaction proceeds from reactants to products.

- Activation Energy:

The minimum energy needed to begin a reaction; the height of the energy barrier to formation of products.

- Arrhenius Equation:

An equation that relates the rate constant for a reaction to the frequency factor, A, the activation energy, E_a, and the temperature, T: ($k = Ae^{-E_a/RT}$). In its logarithmic form, it is written as ($\ln k = -E_a/RT + \ln A$).

- Reaction Mechanism:

A detailed picture or model, of how the reaction occurs; that is, the order in which the bonds are broken and formed and the changes in relative positions of the atoms as the reactions proceeds.

- Elementary step in reaction mechanism:

A process in a chemical reaction that occurs in a single event or step. An overall chemical reaction consists of one or more elementary reactions or steps.

- Rate-Determining Step:

The slowest elementary step in a reaction mechanism.

- Molecularity of a step:

The number of molecules that participate as reactants in an elementary reaction.

- Equilibrium:

The state of a chemical reaction in which its forward and reverse reactions occur at equal rates so that the concentration of the reactants and products does not change with time.

http://www.thefreedictionary.com/equilibrium

Rate of Reaction:

What affects it?

> Initial Concentration
> Temperature
> Amount of reactant
> Presence of a catalyst

"Order":

- It is the power that [A] is raised to.
- *Zero Order:* (rate = $k[A]^o$)
    > anything raised to the "0" power is always equal to "1".
- *First Order:* (rate = $k[A]^1$)
- *Second Order:* (rate = $k[A]^2$)

Important Equations to remember:

- Zero Order:

>

$$Y = a + bx$$

$$[A]_t = [A]_0 - k\,t$$

-First Order:

>

$$Y = a + bx$$

$$\ln[A]_t = \ln[A]_0 - k\,t$$

-Second Order:

>

$$Y = a + bx$$

$$\frac{1}{[A]_t} = \frac{1}{[A]_0} + k\,t$$

Connecting to the Alka-Seltzer Experiment Information:

- When Temperature is raised = ***All chemicals have higher Kinetic Energy***
- Volume of water increased = ***A lower initial reactant concentration***

Rate of Reaction:

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rate of reaction (rate) $= \dfrac{\text{Change of Chemical Concentration}}{\text{Time Elapsed}} = \dfrac{\Delta[A]}{\Delta t} = \dfrac{[A]_2 - [A]_1}{t_2 - t_1}$

Average RXN Rate:

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rate of reaction (rate) $= \dfrac{\text{(Change of chemical concentration between beginning of RXN and end)}}{\text{Total Time Elapsed}} = \dfrac{\Delta[A]}{\Delta t}$

Instantaneous RXN Rate:

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rate of reaction (rate) $= \dfrac{\text{(Change of chemical concentration over a short period of time)}}{\text{Short Time Elapsed}} = \dfrac{\Delta[A]}{\Delta t}$