



☞ **Dear students: - Copy the note and do the given homework on your exercise book!**

Subject: chemistry

Grade & section 11(B – E)

Unit:

Main topic: Chemical Kinetic

Sub topic/s: 0th order Reaction

Page range from:

Thursday, April 2, 2020

Zero-Order Reactions

First- and second-order reactions are the most common reaction types. Reactions whose order is zero are rare. For a zero-order reaction.

$$\begin{array}{ccc} & \text{A} & \text{product} \\ \text{the rate law is given by} & & \\ \text{Rate} & = k[A]^0 & \\ & = K & \end{array}$$

Thus, the rate of a zero-order reaction is a constant, independent of reactant concentration. Using calculus, we can show that

$$[A]_t = -kt + [A]_0 \quad \dots\dots\dots(14)$$

Equation (14) has the form of a linear equation. As Figure below shows, a plot of

$[A]_t$ versus t gives a straight line with slope $= -k$ and y - intercept $= [A]_0$.

A plot of $[A]_t$ versus t for a zero-order reaction. The slope of the line is equal to $-k$.

To calculate the half-life of a zero-order reaction, we set $[A]_t = [A]_0/2$ in Equation (14) and obtain

$$t_{1/2} = [A]_0 \dots\dots\dots(15)$$

$$2k$$

Many of the known zero-order reactions take place on a metal surface. An example is the decomposition of nitrous oxide (N₂O) to nitrogen and oxygen in the presence of platinum (Pt):



When all the binding sites on Pt are occupied, the rate becomes constant regardless of the amount of N₂O present in the gas phase. Also, another well-studied zero-order reaction occurs in enzyme catalysis.

Summary of the Kinetics of Zero-Order, First-Order, and Second-Order Reactions.

Order	Rate Law	Integrated equation	Half-life
0	Rate = K	$[A]_t = -kt + [A]_0$	$t_{1/2} = [A]_0/2k$
1	Rate =K[A]	$\ln[A]_t/ [A]_0 = -kt$	$t_{1/2} = 0.693/k$
2	Rate = K[A] ²	$1/[A]_t = kt + 1/[A]_0$	$t_{1/2} = 1/k[A]_0$

Homework

Exercise 4.8 # 1 a and b

Friday, April 3, 2020

The Collision Theory of Chemical Kinetics

Collision Theory

Collision theory qualitatively explains how chemical reactions occur and why reaction rates differ for different reactions.

- This theory is based on the idea that reactant particle must collide, but that only a certain fraction of the total collisions have the energy to connect effectively and cause the reactants to transform into the products.
- The minimal amount of energy needed for this to occur is known as activation energy.
- If the particles collide with less energy than the activation energy, nothing important happens, the particles bounce apart.
- We can think of the activation energy as a barrier to the reaction, because only those collisions which have energies equal to or greater than the activation energy result in a reaction.