ISSN NO: 2770-4491
Date of Publication:10-05-2022

The Effect of Temperature on the Rate of Chemical Reactions

Omonova Maxfuza Sodiqovna
Fergana Polytechnic Institute, senior lecturer

Annotation: Chemical reactions occur at different rates. Some of them happen in a thousandth of a second, while others happen in minutes, hours, days, months and years. It is also known that such reactions can occur quickly and slowly, depending on the conditions, for example, they can be rapid at high temperatures and slow at cold temperatures. The difference between the rates of these reactions can be large. The following article is devoted to the study of the effect of temperature on the rate of chemical reactions.

Key words: chemical reaction, velocity, homogeneous, heterogeneous, reagent, catalyst, coefficient.

The concept of velocity in chemistry

The reaction rate is commonly referred to as the known change in the concentration of reactive compounds (DS) per unit time (Dt). The mathematical formula for the rate of a chemical reaction is:

v = ± DC / dt.

If it occurs in the whole volume (i.e. if the reaction is homogeneous) and in mol / m, measure the reaction rate in mol/l s.2 s if the interaction separates the phases occurs on a standing surface (i.e. if the reaction is heterogeneous). The "-" sign in the formula indicates the change in the concentration of the initial reagents, and the "+" sign indicates the variable values of the concentration of the same reaction products. Examples of reactions at different rates.

Chemical interactions can occur at different levels. Thus, the growth rate of stalactites, i.e., the formation of calcium carbonate, is only 0.5 mm per 100 years. Some biochemical reactions are slow, such as photosynthesis and protein synthesis. Corrosion of metals continues at a very low level.

The average rate can be characterized by reactions lasting from one hour to several hours. For example, it is possible to prepare a meal that is carried out with the breakdown and change of compounds in the food. The synthesis of some polymers requires heating the reaction mixture to a certain time.

An example of a chemical reaction with a much higher rate is neutralization reactions, which can serve as an interaction of sodium bicarbonate with a solution of acetic acid along with the release of carbon dioxide. You may also mention the interaction of barium nitrate with sodium sulfate, in which precipitation of insoluble barium sulfate is observed.

Numerous reactions can proceed at lightning speed and are accompanied by an explosion. A classic example is the interaction of potassium with water.

Factors affecting the rate of a chemical reaction

It is worth noting that the same substances can react with each other at different rates. For example, a mixture of gaseous oxygen and hydrogen may not show signs of interaction for a long time, but the reaction remains explosive when the vessel is shaken or struck. He therefore identified some factors that have the ability to influence chemical kinetics and the rate of a chemical reaction. These include:

the nature of the interacting substances;
concentration of reagents;
temperature change;
the presence of a catalyst;
pressure change (for gaseous substances);
contact area of substances (if we are talking about heterogeneous reactions).

Influence of the nature of matter

Such a significant difference in the rate of chemical reactions is explained by different values of activation energy (E.a). In order for this reaction to take place, a certain amount of excess energy is

ISSN NO: 2770-4491
Date of Publication:10-05-2022

understood to be compared to the average value required for the molecule in the collision. It is measured in kJ / mol and the values are usually in the range of 50-250.Usually, if Ea = 150 kJ / mol for any reaction, then at n. yes. it almost does not flow. This energy is used to overcome the push between the molecules of the substance and to weaken the bonds in the starting material. In other words, the activation energy describes the strength of chemical bonds in substances. The rate of a chemical reaction can be predicted by the value of the activation energy:

Ea <40, the interaction of substances occurs very rapidly because almost all collisions of particles lead to their reaction;

40 <> a <120, the average reaction is assumed because only half of the collision of the molecules is effective (e.g., the reaction of zinc with hydrochloric acid);

Ea> 120, a very small fraction of the particle collision causes a reaction and its velocity is low.

The effect of concentration

The concentration dependence of the reaction rate is most clearly described by the law of mass action (MAS):

The rate of a chemical reaction is directly proportional to the product of the concentration of the reactants, the values of which are obtained at forces corresponding to their stoichiometric coefficients.

This law is responsible for elementary single-stage reactions or for any stage of the interaction of substances described by a complex mechanism.

If you want to determine the rate of a chemical reaction, its equation can traditionally be written as follows:

aA + bB = sS, then,

velocity according to the above formula of the law can be found by the equation:

Where V = k · [A] a · [B] b

a and b are stoichiometric coefficients,

[A] and [B] are the concentrations of the initial compounds, k is the rate constant of the reaction under consideration. The meaning of the rate coefficient of a chemical reaction is that if the concentration of compounds is equal to one, its value is equal to the rate. It should be noted that the aggregation state of the reagents must be considered in order to calculate correctly using this formula. The concentration of a solid is taken as a unit and is not included in the equation because it remains constant during the reaction. Thus, only the concentrations of liquid and gaseous substances are included in the calculation for ZDM. Thus, for the reaction of obtaining silicon dioxide from simple substances described by the equation

Si (television) + O_2 (d) = SiO_2 (television), velocity is determined by the following formula:

$V = k \cdot [O_2]$.

The temperature dependence of the rate of a chemical reaction was empirically determined by Dutch scientist J. H. Van't Hoff. He found that the rate of multiple reactions increased 2-4 times as the temperature rose for every 10 degrees. There is the following mathematical expression for this rule:

$v_2 = v_1 \cdot g (T_2-T_1) / 10$ where

v1 and v2 are the corresponding velocities1 and T_2 at temperatures;

g - temperature coefficient, equal to 2-4 .

However, this rule does not explain the mechanism by which temperature affects a particular reaction rate value and does not describe the whole set of laws. It is logical to conclude that as the temperature rises, the chaotic motion of the particles increases and this leads to an increase in their collisions. However, this does not particularly affect the collision efficiency of the molecules, as it is mainly dependent on the activation energy. Also, their spatial correspondence to each other plays an important role in the efficiency of particle collisions. Given the nature of the reagents, the temperature dependence of the chemical reaction rate obeys the Arrhenian equation:

k = A0 · Where E-Ea / RT

A - multiplier;

Ea is the activation energy.

Effects of catalysts

ISSN NO: 2770-4491
Date of Publication:10-05-2022

In physical chemistry, the rate of chemical reactions is also actively studied by a department called catalysis. He is interested in how and why relatively small amounts of some substances increase the rate of interaction of others. Such substances that can accelerate the reaction but are not consumed in it are called catalysts.

Catalysts have been shown to change the mechanism of chemical interaction on their own, helping to create new transition states characterized by low energy barrier heights. That is, they contribute to a decrease in activation energy and therefore an increase in the number of particle shocks. The catalyst cannot cause a reaction that is energetically impossible.

Thus hydrogen peroxide decomposes to form oxygen and water:

$H_2O_2 = H_2O + O_2$.

But this reaction is very slow and in our first aid kit it has not changed for a long time. If you open very old bottles of peroxide, you will feel a slight pop that causes oxygen pressure on the walls of the container. The addition of only a few grains of magnesium oxide stimulates the evolution of the active gas.

The same reaction of peroxide decomposition, but occurs in the treatment of wounds under the influence of catalase. Living organisms contain many different substances that increase the rate of biochemical reactions. They are called enzymes.

Inhibitors adversely affect the reaction process. However, this is not always a bad thing. Inhibitors are used to protect metal products from corrosion, prolong the shelf life of food products, for example, to prevent oil oxidation.

Reference

1. Асраев З. Р. LMS MOODLE ДАН ФОЙДАЛАНИБ «АМАЛИЙ МЕХАНИКА» КУРСИНИ ЎҚИТИШДА ТАЛАБАЛАРНИНГ ЎЗ-ЎЗИНИ РИВОЖЛАНТИРИШИНИ ФАОЛЛАШТИРИШ //Academic research in educational sciences. – 2020. – №. 4. – С. 114-123.
2. Асраев З. Р. ПЕРСПЕКТИВЫ ПРИМЕНЕНИЯ ИННОВАЦИОННЫХ ОБРАЗОВАТЕЛЬНЫХ ТЕХНОЛОГИЙ ПРИ ОБУЧЕНИИ ПРИКЛАДНОЙ МЕХАНИКИ //Образование и проблемы развития общества. – 2021. – №. 4 (17). – С. 22-27.
3. Zaynobiddinov D. K. PREVENTION OF DISEASES AND STRENGTHENING THROUGH PHYSICAL EDUCATION CLASSES AND SPORT //Berlin Studies Transnational Journal of Science and Humanities. – 2021. – Т. 1. – №. 1.5 Pedagogical sciences.