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THE RATE OF A CHEMICAL REACTION AND FACTORS AFFECTING IT

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ABSTRACT
The following article gives intro to the rate of a chemical reaction as well as states several factors which include the speed of reactions. The movement of electrons plays a key role in chemical reactions. Substances that react chemically are called reagents. The substances formed as a result of a reaction are the products of a chemical reaction. Chemical reactions are expressed by chemical formulas. Several sequences of reactions may be required to obtain the desired product, a process called chemical synthesis.
KEYWORDS: *reaction, reaction rate, concentration, collapse theory, temperature, catalyst effect, phase and surface, collision, reagents, reactants.*

INTRODUCTION

Although a balanced chemical equation for a reaction describes the quantitative relationships between the amounts of reactants present and the amounts of products that can be formed, it gives us no information about whether or how fast a given reaction will occur. This information is obtained by studying the chemical kinetics of a reaction, which depend on various factors: reactant concentrations, temperature, physical states and surface areas of reactants, and solvent and catalyst properties if either are present. By studying the kinetics of a reaction, chemists gain insights into how to control reaction conditions to achieve a desired outcome.

A chemical reaction is the process of converting one set of chemicals into another. Chemical reactions can be spontaneous or spontaneous. In the second case, some external energy (heat, light, electricity) is required to carry out the chemical reaction. The movement of electrons plays a key role in chemical reactions. Substances that react chemically are called reagents. The substances formed as a result of a reaction are the products of a chemical reaction. Chemical reactions are expressed by chemical formulas. Several sequences of reactions may be required to obtain the desired product, a process called chemical synthesis.

The rate of a reaction is the speed at which a chemical reaction happens. If a reaction has a low rate, that means the molecules combine at a slower speed than a reaction with a high rate. Some reactions take hundreds, maybe even thousands, of years while others can happen in less than one second. If you want to think of a very slow reaction, think about how long it takes plants and ancient fish to become fossils (carbonization). The rate of reaction also depends on the type of molecules that are combining. If there are low concentrations of an essential element or compound, the reaction will be slower.

There is another big idea for rates of reaction called collision theory. Collision theory, theory used to predict the rates of chemical reactions, particularly for gases. The collision theory is based on the assumption that for a reaction to occur it is necessary for the reacting species (atoms or molecules) to come together or collide with one another. Not all collisions, however, bring about chemical change. A collision will be effective in producing chemical change only if the species brought together possess a certain minimum value of internal energy, equal to the activation energy of the reaction. Furthermore, the colliding species must be oriented in a manner favourable to the necessary rearrangement of atoms and electrons. Thus,

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according to the collision theory, the rate at which a chemical reaction proceeds is equal to the frequency of effective collisions. Because atomic or molecular frequencies of collisions can be calculated with some degree of accuracy only for gases (by application of the kinetic theory), the application of the collision theory is limited to gas-phase reactions.

The collision theory says that as more collisions in a system occur, there will be more combinations of molecules bouncing into each other. If you have more possible combinations there is a higher chance that the molecules will complete the reaction. The reaction will happen faster which means the rate of that reaction will increase. Think about how slowly molecules move in honey when compared to your soda even though they are both liquids. There are a lower number of collisions in the honey because of stronger intermolecular forces (forces between molecules). The greater forces mean that honey has a higher viscosity than the soda water.

Factors affecting the rate of a chemical reaction concentration of reagents. High concentrations of reagents lead to more efficient collisions per unit time, leading to increased reaction rates (excluding zero-level reactions). Similarly, high concentrations of products are associated with low reaction rates. Use the partial pressure of the reagents as a concentration measure in the gaseous state.
Concentration Effects. Two substances cannot possibly react with each other unless their constituent particles (molecules, atoms, or ions) come into contact. If there is no contact, the reaction rate will be zero. Conversely, the more reactant particles that collide per unit time, the more often a reaction between them can occur. Consequently, the reaction rate usually increases as the concentration of the reactants increases.

Temperature. Typically, an increase in temperature increases the reaction rate. Temperature is a measure of the kinetic energy of a system, so high temperature means the average kinetic energy of molecules and more collisions per unit time. The general general rule for most (all) chemical reactions is that the reaction rate should be approximately doubled for every 10 ° C increase in temperature. When the temperature reaches a certain point, some chemical species can be changed (e.g., denaturation of proteins) and the chemical reaction slows down or stops.

MATERIALS AND METHODS

A catalyst is a substance that participates in a chemical reaction and increases the reaction rate without undergoing a net chemical change itself. Consider, for example, the decomposition of hydrogen peroxide in the presence and absence of different catalysts. Because most catalysts are highly selective, they often determine the product of a reaction by accelerating only one of several possible reactions that could occur. Most of the bulk chemicals produced in industry are formed with catalyzed reactions. Recent estimates indicate that about 30% of the gross national product of the United States and other industrialized nations relies either directly or indirectly on the use of catalysts.

Catalysts (e.g., enzymes) reduce the energy of chemical reaction activation and increase the rate of the chemical reaction without being consumed in the process. Catalysts increase the frequency of collisions between reagents, change the direction of the reactants, increase the efficiency of further collisions, reduce the intermolecular bonding within the reactant molecules, or provide electron density to the reactants. The presence of a catalyst helps the reaction to transition to equilibrium faster. In addition to catalysts, other chemical species can affect the reaction. The amount of hydrogen ions (pH of aqueous solutions) can change the reaction rate. Other chemical species can react for the reaction or compete for the direction of exchange, bonding, electron density, etc., thereby reducing the reaction rate.

Pressure affects the rate of reaction, especially when you look at gases. When you increase the pressure, the molecules have less space in which they can move. That greater density of molecules increases the number of collisions. When you decrease the pressure, molecules don't hit each other as often and the rate of reaction decreases. Pressure is also related to concentration and volume. By decreasing the volume available to the molecules of gas, you are increasing the concentration of molecules in a specific space. You should also remember that changing the pressure of a system only works well for gases. Generally, reaction rates for solids and liquids remain unaffected by increases in pressure.

RESULTS AND DISCUSSION

When two reactants are in the same fluid phase, their particles collide more frequently than when one or both reactants are solids (or whenvthey are in different fluids that do not mix). If the reactants are uniformly dispersed in a single homogeneous solution, then the number of collisions per unit time depends on concentration and temperature, as we have just seen. If the reaction is heterogeneous, however, the reactants are in two different phases, and collisions between the reactants can occur only at interfaces between phases. The number of collisions between reactants per unit time is substantially reduced relative to the homogeneous case, and, hence, so is the reaction rate. The reaction rate of heterogeneous reaction depends on the surface area of the more condensed phase. Automobile engines use surface area effects to increase reaction rates. Gasoline is injected into each cylinder, where it combusts on ignition by a spark from the spark plug. The gasoline is injected in the form of microscopic droplets because in that form it has a much larger surface area and can burn much more rapidly than if it were fed into the cylinder as a stream. Similarly, a pile of finely divided flour burns slowly (or not at all), but spraying finely divided flour into a flame produces a vigorous reaction.

CONCLUSION

In conclusion, simply saying, the reaction rate is generally highest at the beginning of a reaction, when the concentration of the substances reacting is highest. We can identify 5 different factors affecting the speed of chemical reactions, namely temperature, pressure, catalist effects, phase and surface effects as well as the concentration of reagents. Reaction rate increases when temperature increases, when concentration increases, and when solid reactants have more surface area available (e.g., when the reactants are in smaller pieces).Catalysts are chemicals that raise reaction rates without being consumed in the reaction.

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