Title: Reaction Rate Lab Report

Introduction

Chemical kinetics is a study of the chemical reactions in terms of rates of reaction and factors that affect them. The chemical reaction rate can be altered by changing the different conditions such as concentration, temperature, surface area and pressure. The collision theory represents the way in which these factors affect the rate of reaction at molecular level. A chemical reaction is defined as a process in which one or more reactants are converted into different products or substances(Yang, Clary and Neumark) . In order for a chemical reaction to occur, it is necessary that particles collide with each other with sufficient energy to break bonds(Kolomuc and Tekin). This lab report will demonstrate the effect of temperature and reactant size on the rate of reaction.

Purpose of Report

The purpose of this lab report is to explore the chemical reaction rate at different temperature and with a different particle size of reactant

Questions

What is the effect of different temperature on the chemical reaction rate?

What is the effect of different particle size of a reactant on a chemical reaction rate?

Hypothesis

Hypothesis #1

The increase in temperature will increase the chemical reaction rate as particles will experience more collisions

Hypothesis #2

The decrease in particle size of a reactant will increase the chemical reaction rate as more surface area of reactants will be exposed that will allow more particles to be in contact with.

Variables

Dependent variables

Chemical Reaction Rate

Independent Variables

Temperature

Particle Size

Material

- 50 mL graduated cylinder
- Distilled Water
- Thermometer
- 250 ml Beakers
- Ice Cube
- Stop Watch
- Effervescent tablet
- Filter paper

Procedure

By using a graduated cylinder of 250ml, 200ml of cold water, room temperature water and hot water were added into three separate 3 beakers. The temperature in each beaker was

measured by the help of thermometer as shown in table 1. The effervescent tablet was then placed in each beaker and reaction time was recorded with the help of the stopwatch. For this whole tablet was used and not crushed and partially broken. The timer was stopped when the tablet was dissolved completely and the reaction time was noted. Reaction time was noted in seconds as represented in table 1.

***T*able 1: Effect of Temperature on Reaction time of effervescent tablet.**

	Reaction temperature	Volume of water	Tablet Mass(mg)	Reaction time
	Room temperature	0.2	1000	35 sec
	Warm	0.2	1000	14 sec
	Cold	0.2	1000	139 sec

Hypothesis 2 procedure

In each beaker, the effervescent tablet was added in a crushed, partially broken and full tablet form. The tablet was broken on the piece of filter paper and all pieces of tablets were added into the beaker at the same time. The reaction time for each tablet was measured

Table 2: Effect of Reactant Particle Size on the Reaction Rate.

	Particle Size	Volume of water	Tablet Mass(mg)	Reaction time
	Full tablet	0.2	1000	34.5
	Partially broken tablet	0.2	1000	29
	Crushed tablet	0.2	1000	23.1

Analysis and Results

The chemical reaction that occurred when an effervescent tablet is added in to the beaker containing 200ml of water is represented below

$H20+NaHCO3 \rightarrow NaOH+H20+C02$

The CO2 is produced in the above reaction that can be observed in the form of bubbles. The reaction completed when the bubbling stops. The results have shown that the dependent variable, in this case, the reaction rate is proportional to the independent variable, which is the temperature in this experiment. As shown in the above table, by increasing the temperature reaction decreases and hence reaction rate increases. This is due to the disproportionately large increase in the high energy collision number. The increase in temperature has resulted in the increased kinetic energy of molecules of reactant thus increasing in the collision of molecules. According to the old thumb rule, an increase of 10 °C temperature doubles the reaction rate.

It was observed that with small particle size the reaction is completed faster. This is because the small size of particle reactants provides a greater surface area that increases the particle collisions and hence reaction rate increases. This shows that the reaction rate is inversely related to the rate of reaction.

Errors

Overall, the experiment of the effect of temperature and reactant particle size on the reaction rate was successful in supporting the hypothesis. However, some minor faults were present that would have impacted the results of the experiment due to the presence of systematic errors. Due to limited time, the experiment was only done once. It would have been more reliable if the experiment was repeated three times and the average was taken. Secondly, the measuring

cylinder was not washed completely which may have some impact on the result of an experiment. This could have been improved by being more patient and mindful.

Conclusion

Based on the results of an experimental data, the reaction rate increases as the temperature increases and particle size decreases which supports the hypothesis.

"Collision Theory." *The Editors of Encyclopædia Britannica*1995. Print.
Kolomuc, Ali, and Seher Tekin. "Chemistry Teachers' Misconceptions Concerning Concept of Chemical Reaction Rate." *Eurasian journal of physics and chemistry education* 3.2 (2011): 84-101. Print.
Yang, Xueming, David C Clary, and Daniel M Neumark. "Chemical Reaction Dynamics." *Chemical Society Reviews* 46.24 (2017): 7481-82. Print.