# Kinetics chemistry lab

Science, Chemistry

Rachel Smith Design Lab: Kinetics Lab Introduction: ! Background Information- Effervescent tablets reduce stomach acid and help treat upset stomachs. The familiar zzing you hear when you drop an Alka-Seltzer tablet into a glass of water is the result of a chemical reaction. After dropping the tablet into the water, the reaction causes the solid tablet to become dissolved and releases tiny bubbles of carbon dioxide. This reduces the time it takes for the medicine to work as it does not need to dissolve inside the body. Research Question: How does the surface area affect the rate of the reaction?

## Varaibles

- Independent: Surface Area

- Dependent: Rate of Reaction (time)

- Controlled: Water temperature, Volume of water, Concentration, Still water, and One tablet.

Hypothesis: Increasing the surface area of the tablet will increase the rate of the reaction.

## Materials

- Effervescent Tablets (12) - 4 Per Trial, 3 Trials

- 150mL Beaker

- 80mL of Water per trial (3 trials)

- Mortar and Pestle

- Scalpel

- 100mL Graduated Cylinder (error + 0. 5)

- Stopwatch (error + 0. 1)

- Thermometer Procedure-! 1. Gather all materials needed for experiment.

2. Measure 80mL of water in the 100mL graduated cylinder.

3. Pour the 80mL of water from the 100mL graduated cylinder into the 150mL beaker

4. Let the water sit until it reaches the room temperature, use the thermometer to measure the temperature until it reaches around 26 degrees celsius.

5. Retrieve 4 effervescent tablets (for ? rst trial), prepare tablets:

1. leave it whole,

2. cut the tablet in half using the scalpel,

3. cut the tablet into fourths using the scalpel, and 4) completely grind up the last tablet with the Mortar and Pestle.

6. Place the whole tablet in the 80mL water in the beaker and immediately start the timer.

7. Wait until the tablet is no longer visible and stop the timer; record time in the data table, report any qualitative observations.

8. Pour the solution into the sink

9. Repeat steps 2-4 to prepare the water. Rachel Smith

10. Place the two halves of the tablet in the 80mL water in the beaker and immediately start the timer.

11. Repeat steps 7-9 to ? nish the reaction.

12. Repeat steps 2-4 to prepare the water.

13. Place the four quarters of the tablet in the 80mL water in the beaker and immediately start the timer.

14. Repeat steps 7-9 to nish the reaction.

15. Repeat steps 2-4 to prepare the water.

16. Place the completely ground tablet in the 80mL water in the beaker and immediately start the timer.

17. Repeat steps 7-9 to ? nish the reaction.

18. Clean up the work station and put all materials back in their correct place.

19. Using the data collected on the data table, calculate the average rate of reaction for each type of tablet to complete the reaction - keep in mind the uncertainties.

20. Make sure to show your work for step 19.

21. Then using the averages that were calculated in step 19, make a bar graph to show the relationships between the tablets.

22. When making the graph the BLANK goes on the x axis and the BLANK goes on the y axis.

23. Using the information from the relationships of the tablets in the graph and the averages, determine the relationship between surface area and the rate of the reaction. Data Collection: Rates of Reaction in Seconds (+0. 1)

Whole Half Quarter Trial #1 Trial #2 Trial #3 Average in Sec Calculations:

Step: Whole Half Quarter Powder Average Rates if Reactions in Seconds Add Divide

57. 0+55. 3+58. 5= 42. 2+41. 5+43. 2= 34. 9+41. 1+38. 4= 24. 3+25. 0+24. 6= 170. /3 126. 9/3 114. 4/3 73. 9/3

Final Average 56. 9 42. 4 38. 1 24. 6 57. 0 sec 55. 3 sec 58. 5 sec 56. 9+0. 175% 42. 2 sec 41. 5 sec 43. 2 sec 42. 4+0. 236% 34. 9 sec 41. 1 sec 38. 4 sec 38. 1+0. 263%

Powder 24. 3 sec 25. 0 sec 24. 6 sec 24. 6+0. 406%

Average Rate of Reaction in Seconds 60. 0000 Rachel Smith 45. 0000 30. 0000 15. 0000 0

Whole Half Quarter Powder Surface Area of the Tablet Percent Uncertainty Calculations Step: Error / Time Multiplied by Percent Error Add Percent 100 Uncertainty Divide by Three Final Percent Uncertainty Whole 1)0. 1/57. 1). 00175 2)0. 1/55. 3 2). 00181 3)0. 1/58. 5 3). 00171 1)0. 1/42. 2 1). 00237 2)0. 1/41. 5 2). 00241 3)0. 1/43. 2 3). 00231 1)0. 1/34. 9 1). 00287 2)0. 1/41. 1 2). 00243 3)0. 1/38. 4 3). 00260 1)0. 1/24. 3 1). 00412 2)0. 1/25. 0 2). 00400 3)0. 1/24. 6 3). 00407 1). 175% 2). 181% 3). 171% 1). 237% 2). 241% 3). 231% 1). 287% 2). 243% 3). 260% 1). 412% 2). 400% 3). 407% . 175+. 181 +. 0. 527/3 171= 0. 527 . 237+. 241 +. 0. 709/3 231= 0. 709 . 287+. 243 +. 0. 790/3 260= 0. 790 . 412+. 400 +. 1. 219/3 407= 1. 219 +. 175% Half +. 236% Quarter +. 263% Powder . 406%

Graph: Graph Comparing Surface Area to the Average Rate of the Reaction Qualitative Data: ! When the tablet was dropped into the water the tablet

began to quickly dissolve resulting in bubbles and the ? zzing of the water. Error Analysis: Rachel Smith ! Systematic errors include

1. The experimenter not reading from the meniscus line, when determining the amount of water in the graduated cylinder was 80mL and when measuring the temperature of the water,

2. Not allowing the water to reach room temperature

3. The experimenter not completely ling the 100mL graduated cylinder with 80mL of water and

4. The experimenter not starting/stopping the timer at the right moment. ! ! Random errors include

   1. The experimenter incorrectly reading the graduated cylinder

   2. The experimenter losing some of the tablet while trying to cut the tablet into smaller pieces and

   3. The experimenter not cutting the tablets into precise pieces. Conclusion & Evaluation: ! The goal of this experiment was to and the relationship between the increasing surface and time.

The hypothesis was that as the surface area increased the rate of the reaction would also increase. Through the experiment performed, it is visible through the graph that the hypothesis was proved to be correct. As the surface area of the tablet increased the rate of reaction did as well. From the original size of the tablet to when the tablet was completely crushed into a powder the amount of time needed to complete the reaction diminished. Ultimately the hypothesis proved to be correct based upon the data retrieved from the experiment.