

An Introduction to Kinetics Using Alka-Seltzer

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Materials needed

Alka-Seltzer tablets
Hydrochloric acid solution, 0.1 M or 1.0 M (can substitute vinegar, acetic acid)
Ice
2 or 3 beakers, 250-mL or 400-mL
Graduated cylinder, 100-mL or 250-mL
Thermometer
Mortar and pestle
Hot plate
Stopwatch or watch with a second hand

Procedure

1. Weigh two Alka-Seltzer tablets separately. Use the average mass of the tablets for your calculations in this experiment.
2. Measure 100 mL room temperature water into a beaker. Measure the temperature of the water. Add one Alka-Seltzer tablet to the water. Measure the time it takes for the tablet to dissolve. Determine the rate of the reaction using the formula:

$$\text{Rate} = \frac{\text{mass of Alka - Seltzer tablet, g}}{\text{time, s}}$$

3. Measure 100 mL room temperature water into a beaker. Measure the temperature of the water. Break one Alka-Seltzer tablet into pieces. Add the pieces of the Alka-Seltzer to the water all at once. Measure the time it takes for the tablet to dissolve. Determine the rate of the reaction using the formula given above.
4. Measure 100 mL room temperature water into a beaker. Measure the temperature of the water. Crush one Alka-Seltzer tablet into a powder using the mortar and pestle. Add the crushed Alka-seltzer tablet to the water all at once. Measure the time it takes for the tablet to dissolve. Determine the rate of the reaction using the formula given above.
5. Repeat one of the experiments in procedures 2 to 4, above, using two Alka-seltzer tablets. Measure the initial temperature of the water. Determine the rate of the reaction.
6. Repeat one of the experiments in procedures 2 to 4, above, using warm water, at least 20°C above room temperature. Measure the initial temperature of the water. Determine the rate of the reaction.
7. Repeat the same experiment as in procedure 6, above, using warm water, at least 40°C above room temperature. Measure the initial temperature of the water. Determine the rate of the reaction.
8. Cool some water using ice. Repeat the same experiment as in procedure 6, above, using cold water, between 0° and 5°C. Measure the initial temperature of the water. Determine the rate of the reaction.
9. Repeat at experiment 2 using 100 mL of either 0.1 M HCl or 1.0 M HCl (check with your instructor) in place of the water. Determine the rate of the reaction.
10. Compare the rates of the reactions you carried out. What factors affect the rate of reaction?