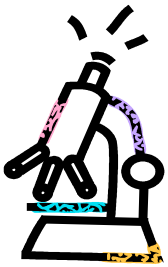
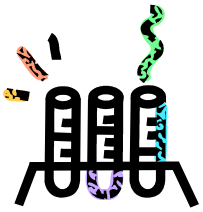


# Mini-Lab 4-01: Alka-Seltzer Eruption



## Purpose:

How much does temperature affect the speed of a chemical reaction?

## Think about this:

Alka-seltzer tablets are a mixture of different chemicals, but the main purpose is to produce carbon dioxide when they are mixed with water.

## Safety

1) Don't eat or drink anything in the lab.
2) Always wear eye protection.
3) Wear protective clothing (lab coats, etc.).
4) Don't play around – treat the lab with respect.

## Questions

1) Observe a small amount of alka-seltzer in cold water. What do you observe about the reaction?

2) Does the temperature of the water affect how fast the alka-seltzer reacts?

3) Devise an experiment to determine the relationship between water temperature and time of reaction for alka-seltzer.

    a. What things will you hold constant in your experiment? What will you vary? What will you measure?
    b. What is the relationship between water temperature and alka-seltzer reaction time?

**WAIT! Do not write down an answer to the Final question until your Instructor tells you to.**

4) **FINAL:** What is the change in temperature doing to make the reaction go faster or slower?

5) **Optional FINAL:** Do you think the alka-seltzer reaction is endothermic or exothermic? Why do you think that?

6) **Optional FINAL:** What is the numerical relationship between temperature and reaction rate?

# Instructor's Page

## 4-01: Alka-Seltzer Eruption

Source: SCALE-UP

Concepts: reaction rate, temperature dependence of reaction rate, experimental design, Optional questions: thermodynamics, graphing and graphical interpretation

Materials: alka-seltzer tablets, water, balance, hot plate, ice, beakers, metal spatulas, stopwatch, thermometer

Hints: Limit the number of alka-seltzer tablets per student to a maximum of four.

Discussion ideas: This is a good opportunity to highlight the molecular nature of matter in discussing how heating a chemical system can change the rate of reaction. The molecules begin moving more quickly and bumping into each other more often, which makes chemical reactions more likely to happen on the average. In the case of this particular reaction, you could also discuss LeChatlier's Principle and how the reaction is shifted more towards products as it is heated because carbon dioxide leaves the system faster (also due to higher average molecular speeds). Finally, if their background knowledge is sufficient, you could discuss acid-base chemistry and the formation of carbon dioxide from carbonic acid, hastened both by faster molecular speeds and by the presence of citric acid in the tablets, which keeps the equilibrium of carbonic acid shifted more towards the protonated form.