**Kinetics Lab/Demonstration with Alka Seltzer**

Introduction

C6H8O7(aq) + 3 NaHCO3(aq) → 3 H2O(l) + 3 CO2(g) + Na3C6H5O7(aq)

citric acid + sodium bicarbonate 🡪 water + carbon dioxide + sodium citrate



www.alkaseltzer.com

Supplies (assuming five groups of students)

21 125-mL Erlenmeyer flasks

4 1-L beakers

1 2-L or greater graduated cylinder

1-5 thermometers

> 25 balloons

3 hot plates

5 mortars and pestles

1-5 timers capable for measuring 10 seconds

>25 Alka Seltzer tablets

Ice

Tap water

Procedure

**Concentration dependence**

Each group receives three 125-mL Erlenmeyer flasks and three balloons. Tap water (75 mL) should be added to each flask. Each group should then receive 1 Alka Seltzer tablet. One of the tablets should be broken in half so that it will fit into one of the flasks. A timer needs to be ready to measure a ten second interval. Add the broken Alka Seltzer tablet to the water in the flask and place a balloon over the lip of the flask as quickly as possible. Ten seconds after adding the balloon, the ballon (just above the base of the balloon but leaving room to tie the balloon) should be twisted and pinched with one’s fingers so that no gas will escape from the balloon. The balloon then needs to be removed from the flask and tied. Repeat using half an Alka Seltzer tablet and using 2 Alka Seltzer tablets (broken in half before adding to a flask).

Fill the graduated cylinder with about 1.6 L of tap water. Record the initial volume. Submerge one of the balloons in the graduated cylinder filled measure the new volume in the cylinder. The difference between this reading and the initial reading corresponds to the total volume of the gas in the balloon and the balloon. Repeat for each balloon.

**Surface area dependence**

Each group receives an Alka Seltzer tablet to grind into a powder using a mortar and pestle. Transfer the powder to a weigh boat or piece of weighing paper so that it can be poured quickly. Each group receives a 125-mL Erlenmeyer flask and a balloon. A timer needs to be ready to measure a ten second interval. Add the ground Alka Seltzer tablet to the water in the flask and place a balloon over the lip of the flask as quickly as possible. Ten seconds after adding the balloon, the ballon (just above the base of the balloon but leaving room to tie the balloon) should be twisted and pinched with one’s fingers so that no gas will escape from the balloon. The balloon then needs to be removed from the flask and tied.

Fill the graduated cylinder with about 1.6 L of tap water. Record the initial volume. Submerge the balloon in the graduated cylinder filled measure the new volume in the cylinder. The difference between this reading and the initial reading corresponds to the total volume of the gas in the balloon and the balloon.

**Temperature dependence**

Each group is assigned a temperature at which to perform their portion of the experiment: (ice bath temperature (~0 oC), room temperature (~25 oC), 50 oC, 75 oC, and temperature of boiling water (~100 oC). For the ice bath, 1 1-L beaker should be more than half-filled with ice. Three water baths, each comprised of 1-L beakers (more than half-filled with water) and a hotplate, need to be adjusted to ~50 oC, ~75 oC, and ~100 oC with the temperature measured accurately with a thermometer. The temperatures do not need to be exact. Record the temperature.

Each group receives a 125-mL Erlenmeyer flask and a balloon. Tap water (75 mL) should be added to the flask. Each group should then receive an Alka Seltzer tablet. The tablet should be broken in half so that it will fit into the flask. A timer needs to be ready to measure a ten second interval.

Except for the group working at room temperature, the flask should be held in the bath until the flask and water are the same temperature as the bath. Add the broken Alka Seltzer tablet to the water in the flask and place a balloon over the lip of the flask as quickly as possible. Ten seconds after adding the balloon, the ballon (just above the base of the balloon but leaving room to tie the balloon) should be twisted and pinched with one’s fingers so that no gas will escape from the balloon. The balloon then needs to be removed from the flask and tied. Allow the gas in the balloon to come to room temperature.

Fill the graduated cylinder with about 1.6 L of tap water. Record the initial volume. Submerge the balloon in the graduated cylinder filled measure the new volume in the cylinder. The difference between this reading and the initial reading corresponds to the total volume of the gas in the balloon and the balloon.

For ideas, Alka Seltzer actually has student experiments on its website: <http://www.alkaseltzerplus.com/asp/student_experiments.html>