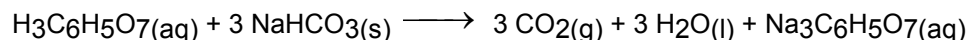


Endothermic and Exothermic Reactions

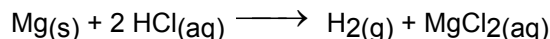
PRE-LAB DISCUSSION

Many chemical reactions give off energy. Chemical reactions that release energy are called *exothermic* reactions. Some chemical reactions absorb energy and are called *endothermic* reactions. You will study one exothermic and one endothermic reaction in this experiment.

In Part I, you will study the reaction between citric acid solution and baking soda. An equation for the reaction is:



In Part II, you will study the reaction between magnesium metal and hydrochloric acid. An equation for this reaction is:



PURPOSE

To study changes in temperature associated with chemical reactions, and to learn to identify processes as endothermic or exothermic based on the temperature change.

MATERIALS

10 mL pipet and pump
balance
ignition tube
citric acid, $\text{H}_3\text{C}_6\text{H}_5\text{O}_7$, solution

baking soda, NaHCO_3
hydrochloric acid, HCl , solution
magnesium, Mg

PROCEDURE

1. Obtain and wear goggles.

Part I Citric Acid plus Baking Soda

2. Pipet out 10 mL of citric acid solution into an ignition tube (large test tube) and then place the ignition tube in a ring stand with a clamp. Place the thermometer into the citric acid solution, and record the initial temperature (t_1).
4. Weigh out 3.000 g of solid baking soda on a piece of weighing paper.
5. Add the baking soda to the citric acid solution, while leaving the thermometer in place. Gently stir the solution with a stir rod (NOT the thermometer) to ensure good mixing. Don't worry if the reaction foams over and out of the test tube! When the reaction begins to slow, remove the thermometer and record the new temperature (t_2).
6. Dispose of the reaction products down the sink at your lab station, using lots of water.

Part II Hydrochloric Acid Plus Magnesium

- Measure out 10 mL of HCl solution into a clean ignition tube (large test tube). Place the thermometer into the HCl solution and record the temperature (t_1).
- Obtain a piece of magnesium metal from your instructor.
- Add the magnesium ribbon to the HCl solution while leaving the thermometer in place. Gently stir the solution with a stir rod to ensure good mixing. **Caution:** Do not breathe the vapors. When the reaction is nearly complete, remove the thermometer and record the new temperature (t_2).
- Dispose of down the sink with lots of water. Any unreacted magnesium should be returned to your instructor. Thoroughly wash both test tubes and return them to your drawer. Wipe down your lab counter with a cloth towel.

RESULTS:

Observations and Data

- Describe any chemical changes that you observe during the reaction of citric acid and baking soda.
- Describe any chemical changes that you observe during the reaction of hydrochloric acid and magnesium metal

	Part I	Part II
Final temperature, t_2	_____°C	_____°C
Initial temperature, t_1	_____°C	_____°C

Calculations

In chemistry and math, the Δ sign means "Change." When calculating change, the initial condition is ALWAYS subtracted FROM the final condition. It is expected that you may get a negative answer. DO NOT change the sign from negative to positive.

$$\Delta = \text{Final} - \text{Initial}$$

	Part I	Part II
Temperature change, Δt		
$\Delta t = t_2 - t_1$	_____°C	_____°C