Investigation 2-D

Exothermic and Endothermic Reactions

Materials:

Part 1	**Part 2**
• 10mL of copper (II) chloride • 50 mL beaker • Thermometer • 1 piece of aluminum foil • Stirring rod	• 20mL of water • Erlenmeyer flask • Thermometer • 2-3 g of baking soda ($NaHCO_3$) • 2-3 g of citric acid ($C_6H_8O_7$) • Timer or stopwatch • Electronic balance • 2 DRY 50mL beakers • scoopula

Safety!!

- Wear Safety goggles

Intro

Evidence that suggests a chemical change has occurred includes a change in temperature of the chemical reaction mixture. This temperature change is associated with energy changes that accompany chemical reactions. The overall energy change is the NET result of energy that is absorbed to break chemical bonds and energy that is released when a new chemical bond forms.

In this investigation, you will measure the changes in temperature during a chemical reaction to determine if there is an OVERALL release or absorption of energy. Based on your results, you will classify each reaction as endo or exothermic.

Procedure:

Part 1

1. Record all data in the following table
2. In a 50 ml beaker, use 10 ml 0.2M $CuCl_2$. Insert thermometer (Ensure one student is holding thermometer so it does not tip over and break). Record temperature to the nearest tenth of a degree and any observations.
3. Obtain one square of aluminum foil and rip up into small pieces. Add aluminum foil to copper (II) chloride solution. Monitor the chemical reactions that is occurring in the beaker. Record temperature changes every 30 seconds and any observations you may have.
4. Clean your work area and dispose of the materials into the waste container.

Copper(II) chloride solution & aluminum foil									
Time:	**Initial**	**30s**	**1min**	**1min30**	**2 min**	**2min30**	**3min**	**3min30**	**4min**
Temperature (degree Celsius)									
Observations:									

Part 2

1. Record all data in the following table
2. Add 20 mL of water to an Erlenmeyer flask. Place the thermometer in the flask and record the temperature.
3. Place 2.5 g of baking soda into the Erlenmeyer flask. Swirl to dissolve the solid and record the temperature.
4. Add 2.5 g of citric acid to the flask and mix the contents. Record Temperature. Record temperature every 15 seconds using a stopwatch to monitor time. Record any changes you observe as the reaction proceeds.
5. Clean up your work area and dispose of materials into the correct waste container.

	Temp (Degrees C)
Temperature of water (step 2)	
Temperature of baking soda (step 3)	

Citric acid ($C_6H_8O_7$) and Baking soda ($NaHCO_3$)									
Time:	**Initial**	**15s**	**30s**	**45s**	**1 min**	**1min15**	**1min30**	**1min45**	**2min**
Temperature (degree Celsius)									
Observations:									

Process and Analyze

1. **Did a chemical reaction occur in Part 1? In Part 2? What observations support your answer?**

2. **Graph the data you collected in Part 1 and two (separate piece of paper)**
3. **What is the overall change in temperature for the reaction you performed in part 1?**

4. **What is the overall change in temperature for the reaction you performed in part 2?**

Conclude and Communicate

1. **Identify each reaction as either exothermic or endothermic? Provide evidence that supports your claim.**
2. **The reaction for part 1 is as follows:**

   aluminum + copper (II) chloride → aluminum chloride and copper

   a. **Write out the balanced formula equation**

   b. **What did you notice about the colour of the solution during the reaction? Propose an explanation**

   c. **What happened to the aluminum? Propose an explanation.**

   d. **Based on the observations and explanations, describe what you think is happening to the atoms and ions in the reaction between aluminum and a solution of copper ions and chloride ions. What bonds are broken, which new bonds form?**