

CLASS SET
DIRECTIONS

The Bag Lab

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Purpose: To make and record observations of chemical changes. To determine if a reaction is endothermic or exothermic.

Safety: Safety goggles must be worn at all times. Calcium chloride is slightly toxic by ingestion. Matches should be lit by striking the match away from your body and other people. Wash your hands thoroughly with soap and water upon completion of the lab.

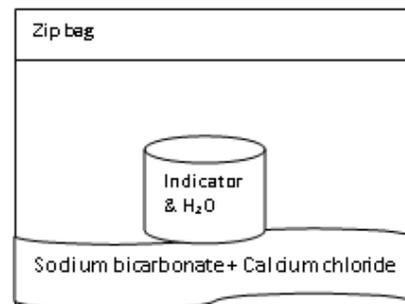
Materials:

At Your Station	To Be Shared
<ul style="list-style-type: none">• 250 mL beaker labeled "Mix #1 & #2"• 10 mL graduated cylinder• Medicine cup ("vial")• Wash bottle with distilled water• Ziploc bag• Matches• Wooden splint	<ul style="list-style-type: none">• Balance• Sodium bicarbonate (NaHCO_3), solid• Calcium chloride (CaCl_2), solid• Evaporating dishes• Scoopulas• Match waste beaker• Universal indicator

Procedure:

1. Record initial observations of each substance in Table 1.
2. Make Mixture #1
 - a. Measure 4 grams of sodium bicarbonate (NaHCO_3). Place the sodium bicarbonate into your 250 mL beaker labeled "Mix #1 & #2".
 - b. Measure 8.5 grams of calcium chloride (CaCl_2). Place the calcium chloride into the same "Mix #1 & #2" beaker.
 - c. Swirl the contents of the beaker.
 - d. Record observations in Table 2.
 - e. Save the contents of the beaker. They will be used for Mixture #2.
3. Make Mixture #2
 - a. Use the same "Mix #1 & #2" beaker containing sodium bicarbonate and calcium chloride.
 - b. Measure 10 mL of water from the wash bottle.
 - c. Pour the water into the "Mix #1 & #2" beaker containing the NaHCO_3 and CaCl_2 .
 - d. Swirl the contents of the beaker.
 - e. Record observations in Table 2.
4. Make Mixture #3
 - a. Measure 4 grams of sodium bicarbonate. Place the sodium bicarbonate into the Ziploc bag.
 - b. Measure 8.5 grams of calcium chloride. Place the calcium chloride into the same Ziploc bag.

- c. Measure 5 mL of universal indicator. Place the universal indicator into the medicine cup (“vial”).
- d. Measure 10 mL of water from the wash bottle. Place the water into the same medicine cup as the universal indicator.
- e. **VERY CAREFULLY WITHOUT SPILLING THE LIQUID**, place the cup into the bag as shown in the diagram. **DO NOT SPILL THE LIQUID.**
- f. Carefully, press as much air out of the bag as possible (without spilling the liquid) and seal the bag.
- g. **Make sure the bag is sealed.**
- h. Tip the cup over allowing the liquid to mix with the solids.
- i. Press the outside of the bag to mix the contents in the bag.
- j. Record observations in Table 2.
- k. **DO NOT OPEN THE BAG. Set it aside.**



5. Perform wooden splint test
 - a. Carefully light a match.
 - b. Use the lit match to light the end of the wooden splint.
 - c. Extinguish the match and place it into the Match Waste beaker.
 - d. One partner will open the Ziploc bag while the other will place the burning end of the wooden splint into the bag without touching the bag or its contents.
 - e. Record observations in Table 3.
 - f. Place wooden splint into the Match Waste beaker.
6. Clean-up
 - a. Wash out the Ziploc bag down the sink then throw it away.
 - b. Wash the beaker, cup and graduated cylinder with tap water.
 - c. Dry the beaker with a paper towel.
 - d. Return the beaker, cup and graduated cylinder to your station.
 - e. Use a wet sponge to wipe your lab bench.
 - f. Notify Ms. Wong for final check-out.
 - g. Wash your hands with soap and water.

Name: _____ Date: _____ Block: _____

The Bag Lab

Data and Observations:

Table 1: Initial observations of substances **BEFORE** any mixing occurs.

Substance	Observations (color, state of matter, etc.)
Sodium bicarbonate (NaHCO ₃)	White, powdery solid
Calcium chloride (CaCl ₂)	White, granular solid, pebble-like
Water (H ₂ O)	Colorless liquid
Universal indicator	Dark green liquid

Table 2: Observations **AFTER** making each mixture.

Mixture #	Contents of Mixture	Observations AFTER mixing (color, state of matter, temperature change, etc.)
1	Sodium bicarbonate (NaHCO ₃) + Calcium chloride (CaCl ₂)	No observable reaction
2	Sodium bicarbonate (NaHCO ₃) + Calcium chloride (CaCl ₂) + Water (H ₂ O)	Fizzing (gas production), increase in temperature, solids dissolved
3	Sodium bicarbonate (NaHCO ₃) + Calcium chloride (CaCl ₂) + Water (H ₂ O) + Universal indicator	Fizzing and bag expanded (gas production), increase in temperature, solids dissolved, solution turned red in color

Table 3: Observations upon placing the wooden splint into the bag.

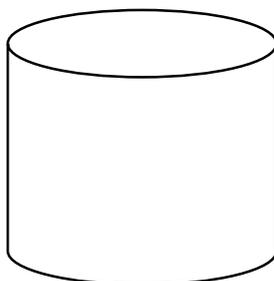
Event	Observations
Wooden splint on fire placed into the bag without touching any liquid or sides of the bag.	The match was extinguished when placed inside the bag

Data Analysis:

1. Which mixture(s) resulted in a chemical change? Cite specific evidence/observations to support your answer.
2. Which mixture(s) did not result in a chemical change? Cite specific evidence/observations to support your answer.

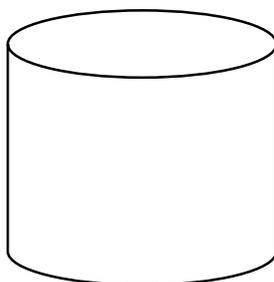
Discussion Questions:

3. When calcium chloride is dissolved in water, an aqueous CaCl_2 solution is created. In the beaker, draw the particles as they exist in an aqueous solution of CaCl_2 (omit water molecules).



$\text{CaCl}_2(\text{aq})$

4. When sodium bicarbonate is dissolved in water, an aqueous $\text{Na}(\text{HCO}_3)$ solution is created. In beaker, draw the particles as they exist in an aqueous solution of $\text{Na}(\text{HCO}_3)$ (omit water molecules).



$\text{Na}(\text{HCO}_3) (\text{aq})$

5. Why does the mixing of aqueous ionic compound solutions result in a chemical reaction whereas the mixing of solid ionic compounds does not?

6. Write the BALANCED chemical equation for the reaction that takes place:

Aqueous sodium bicarbonate reacts with aqueous calcium chloride to produce solid calcium carbonate, aqueous sodium chloride, liquid water and gaseous carbon dioxide.

7. Is the reaction endothermic or exothermic? Cite specific evidence/observations to support your answer.

8. Draw a reaction path diagram for this reaction. Label the x and y axes, reactants, products, activated complex, activation energy (E_a) and ΔH .



9. What is the chemical formula of the gas produced? Why was the flame extinguished when the wooden splint was placed in the bag?

10. Indicators are used to determine the pH of a solution. Use the information below to classify the resulting solution as either strongly acid, acidic, neutral, basic or strongly basic.

Strongly Acidic	Acidic	Neutral	Basic	Strongly Basic
Red	Orange/Yellow	Green	Blue	Purple

11. Would the pH of the solution be equal to 7, less than 7 or greater than 7? Explain your reasoning.