

Investigation of Chemical Reactions – A Green Approach

When chemicals are mixed it is important to closely observe the results and when experimenting to determine reactive properties the scientific method must be followed keeping some components constant while varying others to determine *specifically* which substance combination is responsible for *each* observed change. This experiment should result in at least three observed chemical changes.

Learning Objectives:

1. The scientific method will be explored.
2. Experimental design will be learned.

MATERIALS

Calcium chloride, CaCl_2	2- 10 mL graduated cylinders
Sodium bicarbonate, NaHCO_3	1- 50 mL beaker
Phenol red or universal indicator	zip-lock baggies
Scoops	deionized water

Waste:

Description of Material (include concentration)	Quantity per student	Hazard	Disposal Method
Chemicals	~100 mL	Various, find below.	Combine, neutralize and drain dispose if approved in your water district.
Baggies	-	-	Rinse and reuse until wear becomes obvious.

Hazard Information: Please consult MSDS for further information.

Chemical Name	Health Hazards	Physical Hazards	Environmental Hazards
Calcium Chloride	Listed as a skin, eye, ingestion, and inhalation irritant. HMIS - 2	None listed	LC 50 100 mg/L 96 hours in fish
Sodium Bicarbonate	Low	Low	Low
Phenol Red	Chronic toxicity to lungs and mucus membranes. Listed as a skin, eye, ingestion, and inhalation irritant. HMIS - 2	May be combustible at high temperature.	Not available

PROCEDURE

Be sure to read the entire procedure before beginning the experiment. Make a data table.

I. OBSERVATIONS OF EACH SUBSTANCE –

Create a data table to for these observations.

Describe the properties of each substance you will be using during the experiment

II. MIXING OBSERVATIONS - Create a data table to for these observations.

1. Put on lab goggles and gloves.
2. Mix 2 scoops of calcium chloride and 1 scoop of sodium bicarbonate in a zip-lock bag. Shake and list your observations.
3. In a small beaker, mix 10 mL of water with indicator [5 drops of phenol red **or** 5 drops of universal indicator]. Record your observations.
4. Now pour the liquid mixture into the zip-lock bag containing the two solids. Squeeze out as much air as possible from the zip-lock bag and seal it. Make complete and detailed observations.

III. STUDENT EXPERIMENTATION –

Did you need all four chemicals to see the changes in step 3 from above?

1. At your lab table, design a series of experiments to determine *specifically* which combinations of substances are responsible for *each* of the observed changes. You will need to include your procedure in the write-up.
2. Have your experiments approved by your teacher. Conduct experiments and record the observations.

CLEANUP: Materials should be drain disposable in most water districts. Final determination should be made with assistance from local regulations.

Student Name: _____

Date: _____

Observations

Data Summary

Fill in the following table with the data gathered from the experiment.

Water	CaCl ₂	NaHCO ₃	Phenyl Red	Observations

Lab Questions

1. Describe the difference between a chemical and a physical property.
Give 2 examples of each.

2. Describe the difference between a chemical and a physical change.
Give 2 examples of each.

3. Identify the *three changes* observed at the end of Part II and the minimum combinations of substances (Part III) that are responsible for *each* change.
You should have 3 results and 3 combinations.
Explain if these are chemical or physical changes.

References

Flinn ChemFax™ Labs Publication No. 91419 Reaction in a Bag; Flinn Scientific: 2009, pp. 1-9