Lab: Chemistry in a Bag

FOR THE TEACHER

Summary
In this lab, students will observe and identify chemical and physical changes contained inside a plastic bag. Students will also use this lab to understand the Law of Conservation of Mass.

Grade Level
High and Middle School

Objectives
By the end of this lab, students should be able to
- Distinguish between chemical and physical changes.
- Identify the indicators of a chemical change.
- Understand the difference between exothermic and endothermic reactions.

Chemistry Topics
This lab supports students’ understanding of
- Chemical Reactions
- Chemical Change
- Physical Change
- Conservation of Mass
- Balancing Equations
- Exothermic & Endothermic Reactions

Time
Teacher Preparation: 60 minutes
Lesson: 50 minutes

Materials (per group)
- Universal indicator & indicator chart
- 50 ml graduated cylinder
- 10 ml graduated cylinder
- Wash bottle with distilled water
- 4 re-sealable plastic bags (i.e. Ziploc sandwich size)
- 1 gram (or approximately 3 nuggets) Calcium
- 7 grams Anhydrous Calcium Chloride
- 6 grams of Ammonium Nitrate
- 5 grams of Ammonium Chloride
- Electronic balance or Triple beam balance
- 4 weigh boats
- Black permanent marker
- Spatula
- Thermometer (optional)

Safety
- Always wear safety goggles when handling chemicals in the lab.
- Students actually handling the solid substances should wear gloves.
- Students should wash their hands thoroughly before leaving the lab.
• When students complete the lab, instruct them how to clean up their materials and dispose of any chemicals.
• SDS sheets for Calcium metal, Anhydrous Calcium Chloride, Ammonium Chloride, and Ammonium Nitrate.

Teacher Notes
• Chemical reactions background information may be helpful based on your experience.
• Teachers should carefully read the SDS sheets for Calcium metal, Anhydrous Calcium Chloride, Ammonium Chloride, and Ammonium Nitrate. Links for each substance are listed in the safety section.
• Review the terms exothermic and endothermic.
• Review students on the process of using a triple beam balance or an electronic balance
• Be sure students have access or a copy of the Universal Indicator Chart. You may want to explain how the indicator demonstrates a chemical reaction by showing a color change and a change in pH.
• Classroom management tips: This lab may be utilized best if students are in groups of 4
• Differentiation ideas:
  o May want to use thermometer to achieve precise measurements of change in heat.
  o Have students write balance equations of each reaction.
  o Have students write energy equations of each reaction.
  Ex. Solute + Solvent → Solution + heat

FOR THE STUDENT

Lesson

Chemistry in a Bag

Pre-lab Questions
1. List all the possible indicators of a chemical reaction:

2. Compare and contrast: physical change versus chemical change.

3. Define endothermic and exothermic in terms of chemical reactions.

4. In chemistry, what is an indicator?

Objective
In this lab, you will determine the difference between chemical and physical changes, identify indicators of a chemical change and understand the difference between exothermic and endothermic reactions.

Materials
• Safety goggles
• Gloves
• Universal indicator & indicator chart
• 50 ml graduated cylinder
• 10 ml graduated cylinder
• Wash bottle with distilled water
• 4 re-sealable plastic bags
• 1 gram Calcium
• 7 grams Anhydrous Calcium Chloride
• 6 grams of Ammonium Nitrate
• 5 grams of Ammonium Chloride
• Electronic balance or Triple beam balance
• 4 weigh boats
• Permanent marker
• Thermometer (Optional)

Safety
• Always wear safety goggles when handling chemicals in the lab.
• Wear gloves when handling the solid substances.
• Wash your hands thoroughly before leaving the lab.
• Follow the teacher’s instructions for clean-up of materials and disposal of any chemicals.

Procedure
1. Label each of the baggies 1-4.
2. Measure 30 mL of distilled water and pour it into bag 1. Repeat for bags 2-4.
3. Add 5 ml of the universal indicator to each bag. Note the color in your data table.
4. Squeeze out the any excess air and seal the bags.
5. Measure 1 gram (or use 3 nuggets) of Calcium, and add it to bag 1.
6. Make sure the bag is tightly sealed. Gently shake it until solid dissolves. Record your observations in the data table, including temperature change. Caution: Some reactions may be extremely hot or extremely cold to the touch.
7. Measure 7 grams of Anhydrous Calcium Chloride (CaCl₂), and add it to bag 2.
8. Make sure the bag is tightly sealed. Gently shake it until solid dissolves. Record your observations in the data table, including temperature change. Caution: Some reactions may be extremely hot or extremely cold to the touch.
9. Measure 5 grams of Ammonium Chloride (NH₄Cl), and add it to bag 3.
10. Make sure the bag is tightly sealed. Gently shake it until solid dissolves. Record your observations in the data table, including temperature change. Caution: Some reactions may be extremely hot or extremely cold to the touch.
11. Measure 6 grams of Ammonium Nitrate (NH₄NO₃) and add it to bag 4.
12. Make sure the bag is tightly sealed. Gently shake it until solid dissolves. Record your observations in the data table, including temperature change. Caution: Some reactions may be extremely hot or extremely cold to the touch.
13. Disposes of the contents and the baggies as instructed by the teacher.

Data

<table>
<thead>
<tr>
<th>Bag &amp; Contents</th>
<th>Initial Water Color (Universal Indicator added)</th>
<th>Observations (Color change After Reaction? Heat released or absorbed? Other?)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bag 1: Calcium (Ca)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bag 2: Anhydrous Calcium Chloride (CaCl₂)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bag 3: Ammonium Nitrate (NH₄NO₃)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bag 4: Ammonium Chloride (NH₄Cl₂)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Analysis**

1. When the universal indicator was added to the water, was this a *physical* or *chemical* change? Explain.

2. What is the purpose of the universal indicator? How does it help indicate a chemical reaction? Does the indicator give any particular indication for exothermic or endothermic reactions?

3. In each bag, what were signs of a chemical change?

**Conclusion**

Discuss in paragraph form how the Law of the Conservation of Mass (Matter) was demonstrated throughout this lab.