

## NO CREATION-NO DESTRUCTION--ALL IN A BAGGIE

### Performance Standard 12C/11A/11B/13A.H

Students will apply the processes of scientific inquiry and technological design to support the concept of conservation of mass accordingly:

- *Knowledge*: Correlate the basic concepts associated with simple chemical reactions and the conservation of mass.
- *Application*: Devise strategies to test the law of conservation of mass in experimental and application settings.
- *Communication*: Report findings of experimental and application design investigations for common and unique factors for further investigation.

### Procedures

1. ***In order to know and apply concepts that describe the properties of matter and energy and the interactions between them (12C) and the concepts, principles and processes of scientific inquiry (11A) and technological design (11B) and apply the appropriate principles of safety (13A)***, students should experience sufficient learning opportunities to develop the following:
  - Formulate inquiry questions for initial investigation of closed system chemical reactions.
  - Differentiate qualitative and quantitative data and their applicability.
  - Use physical and conceptual models to test hypotheses.
  - Design and conduct initial inquiry investigation with appropriate safety considerations.
  - Vary appropriate variables for evaluation of impact of each one.
  - Collect and analyze quantitative and observational data.
  - Generate strategies and determine necessary materials for application of closed system chemical (endothermic or exothermic) reactions.
  - Design and conduct tests of designs, with appropriate safety considerations.
  - Collect, record, and analyze finding.
  - Report the process and results of the investigation.
  - Generate additional design modifications which can be tested later.

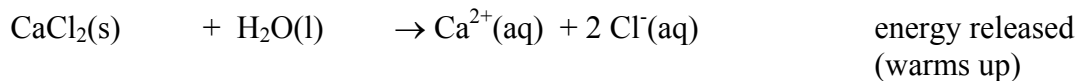
Note to teacher: This activity relates to knowledge associated with standard 12C, while addressing the performance descriptors for stage H within standard 11A and 11B. The principles of safety are addressed in 13A.

2. Have students review and discuss the assessment task and how the rubric will be used to evaluate their work.
3. Set stage for investigation with references to commercial hot and cold packs and inquiry questions about how they work and how they can be made. Proceed with Parts A-E of the activity by testing the reactivity of combinations of the suggested chemicals (on student task sheet) in sealable plastic bags. Direct students to follow instructions and record qualitative and quantitative observations in each variation of the inquiry investigation. (Part A is qualitative; Part B investigates reactivities; Part C is quantitative; Part D varies concentrations; Part E encourages reflections and proposes additional questions.) Continue activity by applying this understanding to the design of hot or cold packs for potential “commercial” use with success criteria (Parts F-H, separate pages). Students should evaluate “product” designs according to their established criteria and discuss the findings of the individual group efforts.
4. Evaluate each student’s work using the Science Rubric as follows and add the scores to determine the performance level:
  - *Knowledge*: the correlation of the basic concepts of mass conservation in simple chemical reactions was complete and accurate.
  - *Application*: the strategies to test the law of conservation of mass in both investigation settings and data collection and analysis records were complete and correct.
  - *Communication*: the findings of both investigations were thorough, coordinated, well-detailed and well-reasoned.

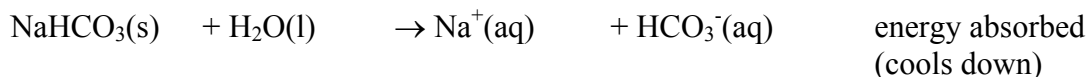
## Teacher Notes:

### Temperature Change

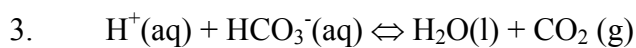
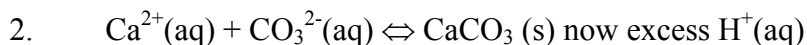
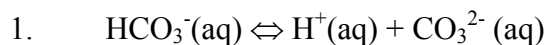
1. calcium chloride + water → calcium ions + chloride ions



2. sodium bicarbonate + water → sodium ions + bicarbonate ions

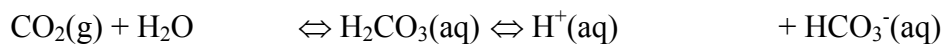


### Gas Produced



### Color Change

1. carbon dioxide + water ⇌ carbonic acid ⇌ hydrogen ions + bicarbonate ions



The additional  $\text{H}^{+}$  ions change the color of the indicator (universal indicator or cabbage juice).

### Examples of Student Work not available

#### Time Requirements

- 30 minutes

#### Resources

- Copies of the “Chemistry in Baggies” task sheets
- Classroom quantities for group investigations:
  - Calcium chloride
  - Water
  - Universal indicator
  - Sodium bicarbonate
  - Plastic baggies
- Science Rubric
- Teacher notes:

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**Chemistry in Baggies**

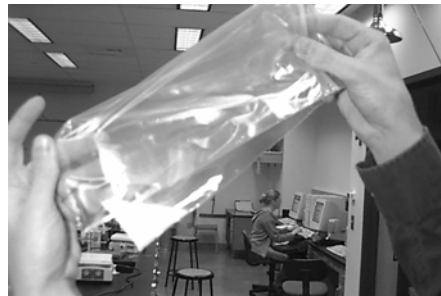
**Materials**

- calcium chloride -  $\text{CaCl}_2$  (Prestone Driveway Heat)
- water -  $\text{H}_2\text{O}$
- universal indicator
- sodium bicarbonate -  $\text{NaHCO}_3$  (baking soda)
- Ziplock<sup>®</sup> bag

**Instructions**

**Part A**

1. As demonstrated, take the Ziplock<sup>®</sup> bag and place a small amount of each compound in its own corner.
2. Carefully close the bag.
3. Mix thoroughly.
4. Record all observations you make in the table below.




**Part B**

5. Using the same bag if possible, plan and carry out a series of experiments to determine the combinations of compounds that account for each of your observations. (i.e. *Which combinations caused each change you previously observed?*)


**Part C**

6. Prepare another Ziplock<sup>®</sup> bag for reaction.
7. Carefully try to determine the mass of the Ziplock<sup>®</sup> bag and all its contents. Mass \_\_\_\_\_
8. Allow the compounds to mix again.
9. Record the mass of the Ziplock<sup>®</sup> bag and all its contents. Mass \_\_\_\_\_

• *What do you notice about the mass of the bag before and after the mixing?*

Please write a sentence to describe what you learned about the mass before and after the chemical reactions.

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**Part D**

10. Using a pair of beakers, plan and carry out a series of experiments to determine if combinations of compounds you tried in **Part B** produce similar results in terms of their mass before and after the reactions.

Compounds mixed	Mass before mixing	Mass after mixing

11. On the board add your results to those obtained by others in the group.

**Part E**

12. Carefully clean and dry your equipment. Dispose of your waste materials as directed.
13. Offer to help those around you with cleaning up.
14. Feel free to help them understand the chemical changes, but try not to simply tell them the answer you believe to be true.
15. Write a few sentences to describe or summarize what you learned as a result of this exercise.

*Conclusion:* \_\_\_\_\_

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16. Please write about any changes you would suggest for doing this activity. What would you do different next time? Why? What should we do differently next time? Why?

*Suggestions:* \_\_\_\_\_

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## Hot and Cold Packs By Technological Design



Have you ever used an ice pack on an injury? I wonder how they work? Using the materials from our previous experiment, could you make a cold pack? Could you make a hot pack?

### Materials:

- calcium chloride -  $\text{CaCl}_2$  (Prestone Driveway Heat)
- water -  $\text{H}_2\text{O}$
- universal indicator
- sodium bicarbonate -  $\text{NaHCO}_3$  (baking soda)
- Ziplock<sup>®</sup> bag

### Part F

#### Instructions

Please write down the steps you and your partner are going to use for making the cold pack or hot pack?

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Please check your plans with your instructor. Make your pack. Did you get what you expected? Please write down any important things you found out.

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**Part G.**

Mr. Quiles tripped while walking into school this morning. His ankle is really painful. Do you think he would buy your cold pack or hot pack? How much is it worth?

Please make a list of the things that would characterize the “best” hot or cold pack?

- 1.
- 2.
- 3.
- 4.
- 5.

**Part H.**

Please make a plan to make the best hot or cold pack you can. Be prepared to defend why yours is the “best”.

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