Diaper Inquiry

Science Standard I:
Students will understand that chemical and physical changes occur in matter.

Objective 2:
Evaluate evidence that indicates a physical change has occurred.

Intended Learning Outcomes:
1. Use Science Process and Thinking Skills
2. Manifest Scientific Attitudes and Interests
4. Communicate Effectively Using Science Language and Reasoning
6. Understand the Nature of Science

Content Connections:
Math IV-2, V-1

Science Standard I

Objective 2

Connections

Background Information

Diapers contain fluffy filler that absorbs some liquid, but a white crystal mixed with the filler does most of the job. That crystal is *sodium polyacrylate,* a product developed for use in astronaut diapers. It is now used not only in baby diapers and a variety of personal products, but in gardening as well. Potting soil containing these water-holding crystals can is available at many garden centers. It is also marketed as something to be injected under lawns in our drought-prone state in order to conserve water.

A physical change is seen as the crystals absorb water. They expand to many times their original size. If left to dry out over a period of time, they decrease in size. **Because the crystals swell in water it is not be a good idea to rinse them down the sink.**

Warning: Caution students not to rub their eyes, noses, or face while working on this activity. Sodium polyacrylate has the same effect on body fluids and may be harmful to the students.

Invitation to Learn

As a class, list the physical properties of diapers in a group discussion. Physical properties may include size, shape, color, odor, or texture.

Instructional Procedures

1. Discuss any chemical properties from the *Invitation to Learn.* The diaper cover will burn or melt. Filler will burn or melt.

Materials

- ❑ Diapers
- ❑ Thermometers
- ❑ Cups
- ❑ Graduated cylinders
- ❑ Scale
- ❑ Distilled water
- ❑ Measuring tape
- ❑ Large Ziploc bags
- ❑ Other supplies may be needed depending on the direction that individual investigations take.
- ❑ *Investigation Write-up* handout

2. Separate the components of the diaper. One of the best ways to separate the crystal is to pull all the filler out of the diaper, put it in a Ziploc bag, seal it, and shake it. The crystals will separate from the filler and gather in the corner of the bag.
4. Discover the white crystals in the filler. What are these crystals? What is their function in the diaper? (absorb liquid)
5. Start to form questions to be used for class, group, or individual investigations. Questions may include, but are not limited to:
   - How much water will one diaper absorb without leaking?
   - What is the ratio of weight of water absorbed to the weight of the crystals? (good math connection)
   - Does the temperature of the water affect how quickly the water will be absorbed?
   - Do more expensive diapers contain more crystal? Will more expensive diapers absorb more water?
   - Do different sizes of diapers contain different amounts of crystal?
   - How much more water will a regular diaper hold than a swim diaper?
   - How long does it take for the waterlogged crystals to dry out?
6. Design an investigation as a class, group, pairs, or individuals.
7. Write question, hypothesis, materials, and method before beginning.
8. Distribute materials to each group according to what they've listed on the *Investigation Write-up* handout (p. 4-7).
9. Investigate!

Possible Extensions/Adaptations/Integration

Show students a baking soda and vinegar reaction. One of the most common ways this is done is with a bottle or test tube containing a small amount of vinegar and a balloon containing baking soda stretched over the bottle opening. When the balloon is tipped up and the baking soda mixes with the vinegar, a gas is formed that plumps up the balloon. Students design investigations based on this idea. Questions may include:

- How does the temperature of the vinegar affect the amount of gas produced?
- Does the amount of vinegar used affect the amount of gas produced?
- How does the type of vinegar affect the amount of gas produced?
- How does the test tube size affect the size of the blown-up balloon?
- How does the number of times the balloon is stretched affect how big it gets?

Possible Extensions/Adaptations/Integration

- Use the wet crystals as a medium for growing a plant. No dirt is needed. Water it every couple of days and include a small amount of fertilizer.
- Place students of different abilities in each group. Each student should have a meaningful role.

Assessment Suggestions

- Assess the completed *Investigation Write-up.*
- Ask students to write about what they learned.
- Have students design an investigation on another topic.
- Ask students to list evidence that the crystals change was a physical change.
- Give each group the opportunity to present their findings to the class.

Additional Resources

Books

Kitchen Chemistry: Science Experiments to Do at Home, by Robert Gardner and Jane Steltenpohl; ISBN 0671677764

Sciencesaurus: A student handbook, (Great Source Education Group); ISBN 0669481920

States of Matter Files: Transform!, (Discovery Communications, copyright 2000, http://school.discovery.com/); Student Resource Guide Item #739581, Teacher Resource Guide Item #742452

Teacher Resource Book 3, State Science Core Teacher Text Grade Five, "What's the Matter?" Student Literacy section 8.1.1 to 8.1.4, available from Jordan School District

Family Connections

- Science Fair Experiments follow this basic idea. A question is formed and investigated, and then data is gathered and analyzed.
- Investigate dishwashing liquid. How long will the bubbles last? Do they last longer if you start with cold water or hot water?

Name _____

Investigation Write-up

Question: _____

Hypothesis: _____

_____

Materials: _____

_____

Procedure: _____

_____

_____

_____

_____

_____

_____

_____

Observations: _____

_____

_____

Measurable Results: _____

_____

_____

Conclusion: _____

_____

_____

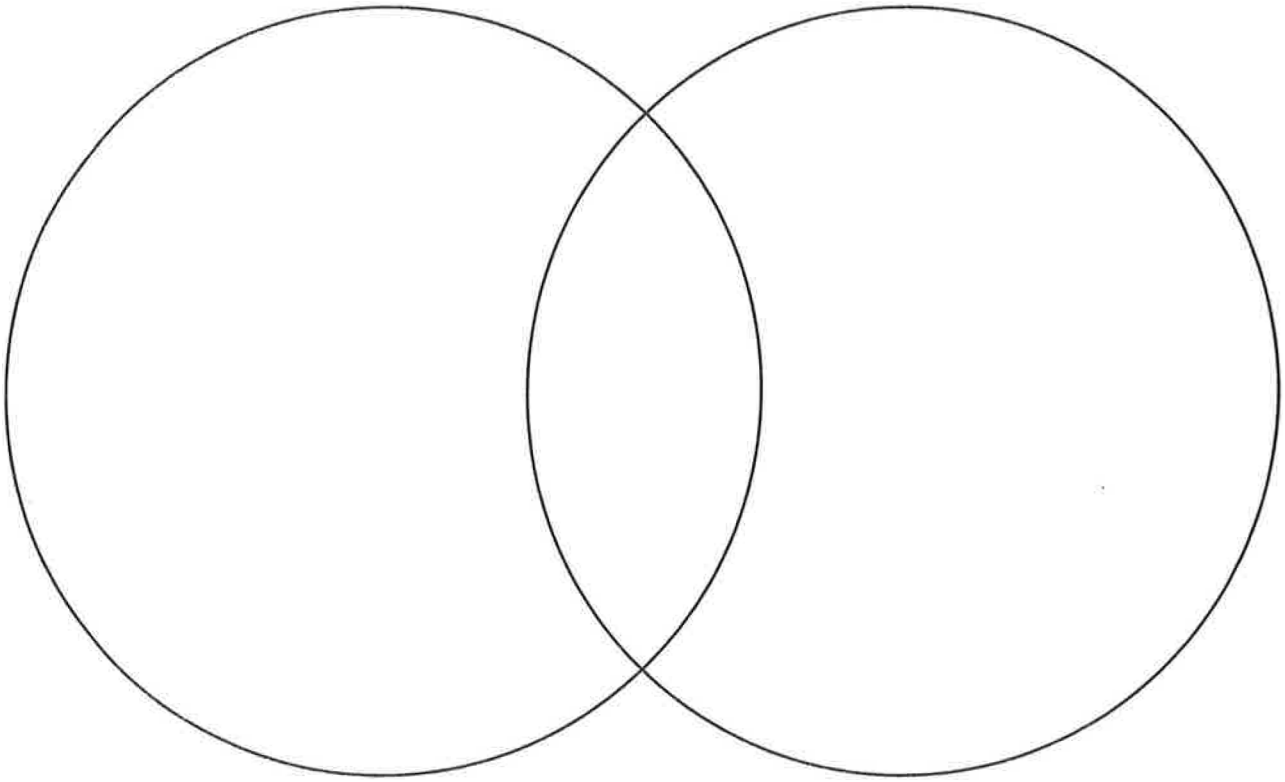
Application: _____

_____

_____

Name _____

What's the Matter?



Physical Change *Both* *Chemical Change*

Cut out the words and place them on the diagram where they belong.

Changes size only	Products	Heat absorbed	Burn a piece of paper
Changes state only	Change physical properties	Rocket fuel combined with oxygen	Produces a gas
Matter stays the some	Reactants	Baking cake batter	Surprise color change
Changes texture only	Heat given off	Tear a paper	Produces a new solid