

# Losing It

Original Activity by Gail Blouin

### Focus on Inquiry

The student will collect and analyze data to determine how acid affects the mass of a carbonate object.

### Lesson Overview

In this activity, students determine the effects of acid on calcium carbonate in the form of chalk. Students relate this information to the damage done to building stones by acid rain.

<b>Duration</b> 2- 45 minute periods	<b>Setting</b> Classroom	<b>Grouping</b> Small cooperative groups	<b>PTI Inquiry Subskills</b> <b>1.3, 2.1, 2.5, 3.1, 3.2, 3.5, 3.7, 4.2, 4.3, 5.2, 5.3, 7.2, 7.3</b>
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Lesson Components	Estimated Time	Inquiry Subskills Used	Technology Used	Level of Student Engagement	Brief Description
<i>Day 1 Engage</i>	10 min	4.2, 5.3	None	2	Students use images of statues to make inferences on how weathering affected them.
<i>Explore</i>	45 min	1.3, 2.5, 3.1, 3.2, 3.5, 3.7	None	3	Students conduct an experiment to understand how acid affects the mass of a carbonate object (chalk).
<i>Day 2 Explain</i>	10 min	4.3, 5.2, 7.2, 7.3	None	3	Students make explanations based on their results, as well as identify faulty reasoning not supported by their data.
<i>Expand</i>	15 min	2.1, 4.2, 5.3	None	3	Students discuss their findings and consider other ways to redesign this experiment.
<i>Evaluate</i>	10 min		None	3	Students answer questions about what they learned.

**Level of Student Engagement**

1	Low	Listen to lecture, observe the teacher, individual reading, teacher demonstration, teacher-centered instruction
2	Moderate	Raise questions, lecture with discussion, record data, make predictions, technology interaction with assistance
3	High	Hands-on activity or inquiry; critique others, draw conclusions, make connections, problem-solve, student-centered

#### National Science Education Standards – Inquiry

Use appropriate tools and techniques to gather, analyze, and interpret data.  
 Develop descriptions, explanations, predictions, and models using evidence.  
 Think critically and logically to make the relationships between evidence and explanations.  
 Communicate scientific procedures and explanations.



#### National Science Education Standards – Earth Science

Land forms are the result of a combination of constructive and destructive forces. Constructive forces include crustal deformation, volcanic eruption, and deposition of sediment, while destruct forces include weathering and erosion.

#### Louisiana Grade Level Expectations – Inquiry

- Gr. 8, Inquiry GLE#4 – Design, predict outcomes, and conduct experiments to answer guiding questions (SI-M-A2)
- Gr. 8, Inquiry GLE#6 – Select and use appropriate equipment, technology, tools, and metric system units of measurement to make observations (SI-M-A3).
- Gr. 8, Inquiry GLE#7 – Record observations using methods that complement investigations (e.g., journals, tables, charts) (SI-M-A3)
- Gr. 8, Inquiry GLE#8 – Use consistency and precision in data collection, analysis, and reporting (SI-M-A3)
- Gr. 8, Inquiry GLE#11 - Construct, use, and interpret appropriate graphical representations to collect, record, and report data (SI-M-A4)
- Gr. 8, Inquiry GLE#12 – Use data and information gathered to develop an explanation of experimental results (SI-M-A4)
- Gr. 8, Inquiry GLE#13 – Identify patterns in data to explain natural events (SI-M-A4)
- Gr. 8, Inquiry GLE#16 – Use evidence to make inferences and predict trends (SI-M-A5)
- Gr. 8, Inquiry GLE#19 – Communicate ideas in a variety of ways (e.g., symbols, illustrations, graphs, charts,



spreadsheets, concept maps, oral and written reports, equations) (SI-M-A7)  
 Gr. 8, Inquiry GLE#22 – Use evidence and observations to explain and communicate the results of investigations (SI-M-A7)  
 Gr. 8, Inquiry GLE#23 – Use relevant safety procedures and equipment to conduct scientific investigations (SI-M-A8)

**Louisiana Grade Level Expectations Earth Science**

Gr. 8, GLE#14 – Distinguish between chemical and mechanical (physical) weathering and identify the role of weathering agents (e.g., wind, water, ice, gravity) (ESS-M-A4)  
 Gr. 8, GLE#16 – Compare the physical characteristics of rock and mineral specimens to observe that a rock is a mixture of minerals (ESS-M-A5)

**Materials List (per group)**

- vinegar solution – minimum of 35 ml per group
- chalk (4) pieces - (be sure you purchase the calcium carbonate type)
- four containers (plastic cups)
- balance scale
- marker
- graduated cylinder

**Advance Preparation**

1. Confirm that you actually have chalk made of calcium carbonate. Test you chalk by placing it in vinegar. If it reacts with the vinegar (fizzes and bubbles), then it is made of calcium carbonate (at least partially). Many chalk products are not actually made of calcium carbonate and will not react with vinegar.
2. Obtain pictures of weathered gravestones or use **Blackline Master #1**.
3. Run **Blackline Master #2**.
4. Create data table on large paper, on the chalkboard, or on an overhead transparency (**Blackline Master #3**).
5. Assign group numbers for lab activity.

**Other Information**

**Objective**

The learner will...

- explore the chemical reaction of chalk and vinegar to simulate the chemical weathering of limestone.
- explain the effect of acid rain on limestone buildings and statuary.

**Prior Knowledge Needed by the Students**

- Mechanical Weathering

**Procedure**

**Engage**

1. Show students pictures of statues and/or gravestones that have been weathered both mechanically and chemically. See **Blackline Master #1** for an example.
2. What do you observe about these pictures that indicate gravestones have changed over time?
3. Generate a list of causes of weathering. Accept all student answers. Post this list in the classroom.

**Explore**

1. Discuss proper safety procedures prior to beginning experiment. If students have safety glasses, have students wear them. Do not allow students to get vinegar solution in their eyes.
2. Assign each student group a group number. Have students follow procedure on **Blackline Master #2** to complete the investigation. Make sure the groups have properly labeled all their containers and have students set the containers aside. On DAY 2, have the students retrieve, lightly dry and mass the chalk from each of their containers. Students should record the resulting masses on their lab sheets and finish the activity as it is written on the sheets. As students complete the investigation, have them record their group results on the class chart (**Blackline Master #3**).

### Explain

1. Have students explain what they understand about weathering based on their data.
  - How did the acid solution (vinegar) affect the mass of the chalk? (*Caused a loss of mass*)
  - Which one caused the largest loss of mass? (*100% solution*)
  - WHY? (*The other two were diluted*)
  - What happened to the mass that was lost? (*Changed to a different substance/became sediments.*)
2. Review causes of weathering and clarify any misconceptions.

### Expand

1. Have student apply what they learned by asking the following questions:
  - Are there other variables that could be tested? (*Surface area and temperature.*)
  - How would having more exposed area affect the rate of weathering on the chalk? (*Speed up the rate of weathering.*)
  - What would happen if you increased the temperature of the acid solution? (*Speed up the rate of weathering.*)
  - Why? (*Because of the additional of moisture and increased temperature.*)
2. Show the original pictures of the weathered gravestones (**Blackline Master #1**). Based on what you have learned about weathering of calcium carbonate, what might be some things that consumers might consider when purchasing a marble gravestone?
3. How can chemical weathering be prevented? (*By adding a protective finish to the material.*)

### Evaluate

1. Evaluate responses to the student lab report.
2. Have students answer the following questions on a sheet of loose-leaf or in a Science journal.
  - a. Describe **two** effects of chemical weathering on an object. (*Oxidation and the change of one substance to another.*)
  - b. How is chemical weathering different from mechanical weathering? Justify your answer. (*Mechanical weathering breaks apart rocks by physical processes such as wind and water. Chemical weathering changes the chemical composition of a material such as when objects are exposed to acid rain.*)

### Blackline Masters

1. Pictures of Marble Gravestones
2. *Losing It* Lab Report
3. *Losing It* Classroom Data Chart

### Supplementary Resources

#### Mechanical and Chemical Weathering

<http://www.ux1.eiu.edu/~cfjps/1300/weathering.html>

This website provides background information on weathering.

#### PhysicalGeography.net - Weathering

<http://www.physicalgeography.net/fundamentals/10r.html>

This website gives an overview of the five types of weathering.

#### Tiscali Reference on Chemical Weathering

<http://www.tiscali.co.uk/reference/encyclopaedia/hutchinson/m0035027.html>

This site provides reference information on chemical weathering.

### Gravestones

These photos are of marble gravestones that are in a local graveyard.



Photos by Pam Blanchard

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Class Hour: \_\_\_\_\_

## Losing It Lab Sheet: Group # \_\_\_\_\_

**Problem/Purpose:** How does acid affect the mass of a piece of chalk?

**Hypothesis:** \_\_\_\_\_

**Materials:** Four beakers or cups, a graduated cylinder, container of water, container of vinegar, four pieces of chalk (calcium carbonate), balance, marker.

**Procedure:**

**Day 1**

1. Obtain the materials listed above. Label each of your four containers with the following: Control (0% solution), 25% solution, 50% solution, 100% solution.
2. Mass piece of Chalk #1. Record the mass in the chart below before placing it in the beaker. Measure 20 ml of water into the beaker that is labeled **0% solution**. This will be your **control**.
3. Mass piece of Chalk #2. Record the mass in the chart below. Place Chalk #2 into a beaker that contains 5 ml of water and 15 ml of vinegar (acid solution). This will be your **25% solution**.
4. Mass piece of Chalk #3. Record the mass in the chart below. Place Chalk #3 into a beaker that contains 10 ml of water and 10 ml of vinegar (acid solution). This will be your **50% solution**.
5. Mass piece of Chalk #4. Record the mass in the chart below. Place Chalk #4 into a beaker that contains 20 ml of vinegar (acid solution). This will be your **100% solution**.
6. Make sure all of your containers are labeled both with your group name and with the % Solution. Set these aside overnight.

**Day 2**

7. Retrieve your containers. Beginning with your control, retrieve the chalk and gently roll it on a paper towel to dry. In your data table, record a description of the remaining solution in the beaker and then set the beaker aside. Mass the chalk and record the mass under "ending mass". Do this for each of your beakers. Calculate the difference in mass.
8. Record your group's information in the appropriate place on the classroom data sheet.
9. Discard your solutions and chalk pieces as your teacher directs. Clean up your station.

**Data table:**

Acid Solution	Chalk Mass (g)		Difference in Mass (Beginning – Ending Mass)	Description of "ending" solution
	Beginning Mass	Ending Mass		
Control (0%)				
25%				
50%				
100%				

**Other observations:** \_\_\_\_\_  
\_\_\_\_\_

**Analysis:**

On a separate sheet, graph the **ending mass** for all four acid solutions. Staple your graph to this lab report.

In one or two sentences, describe the graph of your data: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Conclusion:**

1. Was your hypothesis supported or not? \_\_\_\_\_ Why or why not? \_\_\_\_\_  
\_\_\_\_\_
2. What did you learn by doing this experiment? \_\_\_\_\_  
\_\_\_\_\_

CLASS DATA TABLE

## Losing It Lab

Acid Solution	Difference in Mass (Beginning-Ending Mass)					Average Difference in Mass
	Student Group 1	Student Group 2	Student Group 3	Student Group 4	Student Group 5	
Control (0%)						
25%						
50%						
100%						