



**Teacher:**

**Class: 2nd grade**

**Duration: 3 class periods**

**Course Unit:**

**Lesson Title: Paper Marbling Investigation**

### LESSON OVERVIEW

Students will conduct an experiment to determine which liquid produces the best visual outcome through an art-making process called paper marbling. This easily controlled experiment will offer students the opportunity to learn and conduct a scientific inquiry while making beautiful designs.

### STANDARDS

#### Tennessee State Standards

##### Visual Art—Grade 2

- 1.1 Use tools and media consistently in a safe and responsible manner.
- 1.2 Demonstrate an understanding of a variety of techniques.
- 1.3 Explore a variety of processes.
- 5.1 Explain the characteristics and merits of the student's own work to the teacher and/or peers.
- 6.2 Understand connections between visual art and other disciplines in the curriculum.

##### Science—Grade 2

**GLE 0307.Inq.1** Explore different scientific phenomena by asking questions, making logical predictions, planning investigations, and recording data.

**GLE 0307.Inq.2** Select and use appropriate tools and simple equipment to conduct an investigation.

**GLE 0307.Inq.3** Organize data into appropriate tables, graphs, drawings, or diagrams.

**GLE 0307.Inq.4** Identify and interpret simple patterns of evidence to communicate the findings of multiple investigations.

##### Common Core Connections for Integrated Subjects—Language Arts & Writing

**CCSS.ELA-Literacy.W.3.2** Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

**CCSS.ELA-Literacy.W.3.2b** Develop the topic with facts, definitions, and details.

## OBJECTIVES

1. Students will be able to define *density* and *marbling*.
2. Students will be able to apply the scientific method to a question.
3. Students will be able to collect, discuss, and communicate findings from their investigation.
4. Students will be able to select their favorite work and to use elements of art definitions to explain why they chose it.

## ASSESSMENT/EVALUATION

1. Students will complete an investigation worksheet in which they define *density* and record the scientific steps for creating marbled paper.
2. Students will complete a written response in which they compare and contrast all 3 designs created in their marbled paper and offer concluding thoughts.

## MATERIALS

### **Controlled variables: things in an experiment that do not change.**

Per student:

- Three 4.5" x 6" pieces of heavy paper
- 1 piece of cardboard
- A stirrer, such as a plastic fork
- 1 apron
- 1 paper towel
- 1 Paper Marbling Investigation worksheet

Per group:

- Three 12" x 8" x 1" trays or disposable aluminum pans
- 1 food coloring set

Per class:

- Newspaper and masking tape
- A PC-to-projector connection (if you plan to play "The Scientific Method Rap" in Step 4 of the Activating Strategy)
- 1 premade example of marbled paper
- Drying racks
- 1 large trash bag

### **Independent variables: things in an experiment that change.**

Per group:

- 1/3 cup water
- Several drops of oil
- 1/3 cup whole milk
- 1/3 cup shaving cream

## ACTIVATING STRATEGY

1. Divide students into groups of 3–5 and direct each group to a designated station.
2. Define the term *marbling*. [Say:] Paper marbling is the art and science of creating colorful patterns by sprinkling and mixing colors with liquids of different densities and transferring those designs onto paper.
3. Introduce the project and state the objectives.
4. Introduce the scientific method by leading the students through "[Steps of the Scientific Method](#)" and/or

playing for them "[The Scientific Method Rap](#)." Direct them to the investigation worksheet for the definitions of *variable* and *hypothesis*.

5. Define *density* and ask students to brainstorm examples of liquid dense materials. [Say:] Density is how close together the molecules of a liquid are or how much mass a substance has in a given space.
6. Show the premade example of marbled paper. Guide students through the worksheet sections that correspond to the beginning steps of the Scientific Method:
  - a. **Ask a Question:** Explain to students that the question they will be considering is "How do I get that result? Will it be with the shaving cream, oil and water, or milk?"
  - b. **Do Background Research:** Let students examine the trays of oil and water, milk, and shaving cream at their stations by having them stir each material gently. Have them compare densities. Have students address the independent, dependent, and controlled variables of the experiment.
  - c. **Construct a Hypothesis:** A hypothesis is an educated guess about how things work. Ask students to develop a hypothesis for each variable. Examples: "If I use water and oil, then the marbling will be lighter" or "If I use shaving cream, then the marbling will have more swirls."

## INSTRUCTIONS

1. Prior to class, set up stations for each group as follows:
  - a. Using newspaper and masking tape, cover working surfaces.
  - b. At each station, add the following items per student: 3 pieces of paper, 1 piece of cardboard, 1 stirrer, 1 apron, 1 paper towel, and 1 worksheet.
  - c. At each station, place 3 trays and a food coloring set. Pour the shaving cream into the first tray. Pour the water into the second tray and add several drops of oil to it. Pour the milk into the third tray.
2. Students will begin by smoothing the shaving cream surface with a piece of cardboard.
3. Once the shaving cream is smooth, students will add 3–4 drops of food coloring to it. Encourage students to think about their design. [Say:] What sort of pattern will you choose to create? How will you use the tools to manipulate the different materials?
4. Students will use a stirrer to make swirls and patterns of color. Remind students not to mix the colors too much, because the pattern will be less defined.
5. Next, each student will lay one of their pieces of heavy paper on the shaving cream surface and rub their hand over it gently.
6. The student should then slowly lift the paper and use their piece of cardboard to scrape off the extra material.
7. Students will place their papers on the drying rack and record their observations in the Data Sheet section of the worksheet.
8. To test another hypothesis, students will add 3–4 drops of food coloring to the oil and water. Encourage students to think about their design. [Say:] What sort of pattern will you choose to create? How will you use the tools to manipulate the different materials?
9. Students will use a stirrer to make swirls and patterns of color.
10. Next, each student will submerge a piece of heavy paper into the oil and water, using their stirrer.
11. The student should then slowly lift the paper and use the paper towel to dab away the excess liquid.
12. The student will place the paper on a drying rack and record their observations in the Data Sheet section.
13. To test the remaining hypothesis, students will add 3–4 drops of food coloring to the milk. Encourage students to think about their design. [Say:] What sort of pattern will you choose to create? How will you use the tools to manipulate the different materials?
14. Students will use their stirrers to make swirls and patterns of color. Remind students that if they mix the colors too much, the pattern will be less defined.
15. Next, each student will lay their final piece of heavy paper on the milk surface and rub the paper gently.
16. The student will then slowly lift the paper and scrape off the extra material. As before, the student will place the paper on a drying rack and complete the Data Sheet section.
17. To clean up:
  - a. One student will gather stirrers, paper towels, and cardboard scrapers into a large trash bag.
  - b. The teacher will gather the pans of liquid and place them in the sink to wash.

- c. The students at each table will roll up the newspaper and tape into a tight ball and place it into the large trash bag.

### ALTERNATE/EXTRA ACTIVITIES

- Students may test 2 of the variables instead of all 3.
- For a student with special needs, demonstrate the process and provide a hands-on experience by assisting with food color drops and cardboard scraping. Allow the student to touch each independent variable to feel the difference in density.
- Students could experiment with other materials, like Vaseline, shampoo, lotion, or crayons. Let them choose one thing to change; ask them to predict what they think will happen.

### CLOSURE

Each student will finish the concluding section of the worksheet. They will then present their favorite marbling to the class and explain why.

### CROSS-CURRICULAR CONNECTIONS

Language Arts

Science

### EXTENDED LEARNING

Activities:

- [“Color Splash”](#) (activity sent in by Sara of NB), *ZOOMSci*, pbskids.org
- [“Easy Paper Marbling”](#) (activity by Anne McNeary, posted by Diana MacKenzie), *Making Art with Children* (Eric Carle Museum of Picture Book Art blog), May 20, 2013, carlemuseum.org
- [“Potion Commotion,”](#) *Fetch!*, pbs.org
- [“Water Density”](#) (activity sent in by Mrs. Darden’s Science Class in Thomson, GA), *ZOOMSci*, pbskids.org

Articles and books:

- Camilla de la Bédoyère, *The Science of a Piece of Paper: The Science of Materials* (Pleasantville, NY: Gareth Stevens, 2009)
- Jennifer Boothroyd, *How Big? How Heavy? How Dense? A Look at Matter* (Minneapolis: Lerner, 2011)
- Gwen Diehn, *Making Books That Fly, Fold, Wrap, Hide, Pop Up, Twist and Turn* (Asheville, NC: Lark, 2006)

Videos:

- Folio Society, [“The Art of Marbling: Jemma Lewis”](#) (2014; available at foliosociety.com and YouTube.com)
- Frist Center for the Visual Arts, [“Creating Marbled Paper,”](#) *ArtQuest: Art Is All Around You* (2014; available at fristkids.org)
- DanEllie Rubillis and class, [“The Scientific Method Rap,”](#) (2012; available at YouTube.com)

Webpage:

- Science Buddies, [“Steps of the Scientific Method,”](#) sciencebuddies.org

For additional lesson plans and activities, visit us at fristkids.org. This lesson plan was created by an art education student in the Frist Center for the Visual Arts’ Teaching Assistant Program under the guidance of education department staff and/or a mentor teacher. The Teaching Assistant Program is designed to introduce participants to museum education by providing unique teaching experiences in an informal learning environment. For more information about this program or other educational opportunities offered by the Frist Center, please visit fristcenter.org.



Name: \_\_\_\_\_

Date: \_\_\_\_\_

## Paper Marbling Investigation

### Vocabulary

*variable*: anything that is a part of the experiment

Types of variables:

independent—things that change

dependent—the results

controlled—things that do not change

*hypothesis*: an educated guess about how things work

### Ask a Question

Which material will give me the same result as the teacher's example? Will it be the shaving cream, oil and water, or milk?

### Do Background Research

Look at the oil and water, milk, and shaving cream. Stir each material gently. Fill in the blanks:

\_\_\_\_\_ is the thickest in density.

\_\_\_\_\_ is the thinnest in density.

\_\_\_\_\_ is the most like a solid.

### Construct a Hypothesis

Develop one hypothesis per variable. For example, "I think the oil and water will..."

## Data Sheet

<b>Independent Variable</b>	<b>Density (Low, Medium, or High)</b>	<b>Dependent Variable or Results (Value, Color, Texture)</b>
Shaving cream		
Oil and water		
Milk		

### Conclusion

Let's compare our marbled papers. How are the colors, values, or textures different with each independent variable? How are they similar?

Which design do you like best? Why?

Describe the scientific steps you took to make your marbled papers.