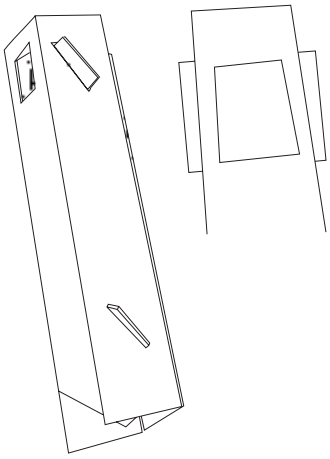
# OVERVIEW

## IDEAS AND INVENTIONS

### GOALS

The **Ideas and Inventions Module** consists of four sequential investigations that promote student creativity and inventiveness. Each investigation provides valuable science content while introducing a conventional technique for revealing the unseen.



### FOSS EXPECTS STUDENTS TO

- Use techniques to see details about the world that would otherwise be difficult to observe.
- Explore the techniques of chromatography, rubbing, carbon printing, and mirror imagery.
- Solve problems using the techniques of chromatography and carbon printing.
- Record and compare patterns observed in leaf veins, fingerprints, and ink pigments.
- Gain experience with texture and pattern in a variety of materials.
- Express individual and group creativity through open-ended discoveries and inventions.
- Invent applications to extend the use of specific techniques.
- Acquire the vocabulary associated with texture and patterns of materials and exercise language in the context of science.
- Use scientific thinking processes to conduct investigations and build explanations: observing, communicating, comparing, and organizing.

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# IDEAS AND INVENTIONS MODULE MATRIX

| SYNOPSIS | SCIENCE CONTENT | THINKING PROCESSES |
|---|---|---|
| **1. RUBBINGS** | | |
| The rubbing technique reveals textures and patterns that are not readily visible. Students make rubbings of leaves to observe and compare venation patterns. They look for patterns and hidden messages in a variety of other materials and invent games and organizing systems based on rubbings. | • Texture refers to the surface features of a material.<br>• Pattern is a design or arrangement of objects.<br>• Veins transport materials in a leaf.<br>• Leaf-venation patterns can be organized into three types: parallel, palmate, and pinnate. | • Observe rubbings of textured objects.<br>• Record properties of textured objects using rubbing.<br>• Compare venation patterns in leaves.<br>• Sort patterns.<br>• Communicate observations.<br>• Invent new ways to use a technique. |
| **2. CARBON PRINTING** | | |
| Students use the carbon-printing technique to reveal the fine structure of textured objects. They make and compare prints of their fingers to reveal the finger patterns of whorl, arch, and loop. Students use the carbon-printing technique in creative and inventive ways. | • Carbon printing is a technique used to make fine textures visible.<br>• Fingerprints can be sorted into three groups based on pattern: whorl, arch, and loop.<br>• No two people have the same fingerprints. | • Observe patterns made using the carbon-printing technique.<br>• Record data.<br>• Compare fingerprints.<br>• Sort patterns.<br>• Invent new ways to use a technique. |
| **3. COLOR WRITING** | | |
| Students use the technique of paper chromatography to investigate hidden pigments in water-soluble ink. After observing pigment separation, students invent applications for this process and share their ideas and products with the class. | • Chromatography uses water to carry pigments from one place to another.<br>• Paper chromatography reveals pigments in watercolor inks.<br>• The process of water moving through paper is called wicking. | • Observe wicking and the separation of pigments in ink pens.<br>• Record data.<br>• Compare prints made by pigments.<br>• Communicate observations.<br>• Invent new ways to use a technique. |
| **4. REFLECTING** | | |
| Students explore mirrors to see things that they don't normally see—their eyes and activities going on behind them. Students explore mirror images, including reversals and lines of symmetry in objects. They investigate how to reflect images from one mirror to another and assemble a periscope. Finally, they use mirrors to be inventive. | • Light travels in straight lines.<br>• Symmetry is an arrangement in which the parts on opposite sides of a center line are the same.<br>• Mirror images are the result of light reflected from a surface.<br>• An image produced by something that reflects, such as a mirror, is always reversed right to left.<br>• Mirrors can be used to determine symmetry in objects. | • Observe things in and about the environment that are not easily seen.<br>• Use mirrors to manipulate light and images.<br>• Compare objects using symmetry as a property.<br>• Invent ways to use mirrors to produce useful or aesthetically pleasing products. |



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| INTERDISCIPLINARY EXTENSIONS | FOSS SCIENCE STORIES | TECHNOLOGY/HOME CONNECTION |
|---|---|---|
| **Language Extensions**<br>• Make a list of texture words.<br>• Research texture words.<br>• Write a procedure.<br>• Research food inventions.<br>**Math Extension**<br>• Problem of the week.<br>**Art and Science Extensions**<br>• Make a rubbing collage.<br>• Make clay mandalas.<br>• Search for hidden messages on food containers, sidewalks, and telephone poles.<br>• Investigate tree bark. | See the Science Stories folio.<br>• *Creative Solutions*<br>• *Looking at Leaves*<br>• *Rubbings*<br>• *A Close Look at the World*<br>• *A Self-Made Inventor* | www.fossweb.com<br>Check the FOSS website for interactive simulations, to write questions to a scientist, for teaching tips, and to talk with other classes using FOSS.<br>Home/School Connection: Students make texture rubbings at home, bring them to class, and have other students guess their origins. |
| **Language Extensions**<br>• Write about uniqueness.<br>• Write and display essays.<br>**Math Extensions**<br>• Problem of the week.<br>• Graph fingerprints.<br>**Art Extensions**<br>• Make fingerprint art.<br>• Make printing blocks.<br>**Science Extension**<br>• Research fingerprint history. | See the Science Stories folio.<br>• *Fingerprints*<br>• *Super Twins*<br>• *Covering Up Her Mistakes*<br>• *An Inventive Farmer* | Home/School Connection: Students make fingerprints of family members, analyze the prints, and compare them to each other. |
| **Language Extensions**<br>• Research sensory extenders.<br>• Write a letter about discovery.<br>• Explore word roots.<br>**Math Extension**<br>• Problem of the week.<br>**Art and Science Extensions**<br>• Put on an art exhibit.<br>• Color a drawing.<br>• Change the water in chromatography.<br>• Investigate pigments in foods.<br>• Research traditional dyes. | See the Science Stories folio.<br>• *Chromatography*<br>• *Shoes for the World*<br>• *Improving the Computer* | Home/School Connection: Students make chromatograms at home, using different kinds of paper and pens. |
| **Language Extensions**<br>• Travel through a looking glass.<br>• Write mirror messages.<br>**Math Extension**<br>• Problem of the week.<br>**Art and Science Extensions**<br>• Create mirror pictures.<br>• Use mirrors to direct a flashlight beam.<br>• Look at symmetry in faces. | See the Science Stories folio.<br>• *Throw a Little Light on Sight*<br>• *Into the Shadows*<br>• *Light and Reflection*<br>• *Making Mirrors*<br>• *Looking at the Sky*<br>• *Kid Inventors* | Home/School Connection: Students work with mirrors at home to find out what happens as they view their image from different distances from the mirror. Students work on projects at home. |



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# FOSS AND NATIONAL STANDARDS

The **Ideas and Inventions Module** emphasizes the development of observation and description skills and building explanations based on experience. This module supports the following National Science Education Standards.

### SCIENCE AS INQUIRY

Develop students' abilities to do and understand scientific inquiry.

- Ask and answer questions.
- Plan and conduct simple investigations.
- Employ tools and techniques to gather data.
- Use data to construct reasonable explanations.
- Communicate investigations and explanations.
- Understand that scientists use different kinds of investigations and tools to develop explanations using evidence and knowledge.

### CONTENT: PHYSICAL SCIENCE

Develop students' understanding of light and reflection.

- Light travels in a straight line until it strikes an object; light can be reflected by a mirror.

Develop students' understanding of materials.

- A mixture of substances can often be separated into the original substances.

### SCIENCE AND TECHNOLOGY

Develop students' abilities in technological design.

- Identify a simple problem and propose a solution.
- Evaluate a product or design.
- Communicate a problem, design, and solution.

Develop students' understandings about science and technology.

- Scientists work collaboratively in teams and use tools and scientific techniques to make better observations.

### HISTORY OF SCIENCE

Develop an understanding of science as a human endeavor.

- Science and technology have been practiced by people for a long time.
- Men and women have made a variety of contributions throughout the history of science and technology.



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