Creative Sciencing

Experiments for Hands-on Learning

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GOOD YEAR BOOKS

DEDICATION

This book is dedicated to all 21st century learners, including our grandchildren. We would also like to express our appreciation to Dr. Mary Ann Grobbel and Judith Adams from Pearson Learning for their editing contributions and excellent advice in producing this book.

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WHY?

Creative Sciencing: Experiments for Hands-On Learning is a resource book for both preservice and in-service teachers. It is a valuable learning tool for the elementary science methods course, and it is a comprehensive source of ideas and activities for use in the intermediate-level classroom.

The organization of this book is based on several premises. One is that teachers want and need new, exciting science activities for their science programs. A variety of fresh, field-tested science ideas has been furnished. In Appendix A, these activities are cross-referenced according to the processes of science and the content area covered. These areas are also referenced to the National Science Education Standards.

More importantly, each activity is written to evoke ideas from the student, thus enabling each activity to serve as a springboard for further activities. This is the creative sciencing process that is featured in the "Brainstorming in Science" section.

Another premise is that teachers often have difficulty acquiring materials for successfully implementing science. The "Shoestring Sciencing" section of this book deals with doing more science for less money. "Creative Sciencing Recipes" includes useful recipes and projects that you can make with children. Appendices that provide metric conversions and sources for more ideas and activities with websites are also provided.

Numerous studies call for quality, hands-on science education experiences for children. Creative Sciencing will assist you in meeting this need. And, coupled with our companion textbook, *Activities Handbook for Energy Education,* a wealth of resources are at your fingertips.

We would like to thank the previous users of our books who for the past 24 years have supported and endorsed our creative sciencing approach to learning.

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Gerald H. Krockover

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Why Does a Burning Candle Go Out?

Materials: candle; aluminum pie plate; modeling clay; clear glass jar; matches; 2 wood blocks **More:** candles of various diameters; food-warmer candle; 3 birthday candles; matches; 3 soda straws; aluminum pie pan; modeling clay; glass jars of various heights and volumes; 1-gallon glass jar; thumbtacks; metal coffee can

Facts to know:

- Oxygen gas exists in air. A flame needs oxygen to burn.
- A burning candle gives off a gas called carbon dioxide. This gas does not keep a flame burning.
- Carbon dioxide is heavier than oxygen.

WARNING: A burning candle is dangerous. Have a fire extinguisher or a bucket of water handy in case a problem occurs. Do this activity only when an adult is present. With younger students, the teacher should light the candle for all activities.

Procedure:

- Use modeling clay to anchor a candle to the pie pan. Light the candle.
- Place the jar over the candle. Record the time it takes the flame to go out.

  What did you observe?

  Did the burning candle use all the oxygen in the jar?

  Did you see or hear anything as the candle burned and then went out?

- Repeat the activity using modeling clay to seal the bottom of the jar so that nothing can come in or go out. Record the time it takes for the flame to go out.

  What can you conclude about sealed versus unsealed jars and the length of burning time?

- Remove the clay seal. Use wood blocks to raise the jar off the bottom of the pie pan. Then pour water into the pie pan to seal the jar. Record the time it takes for the flame to go out.

  What did you observe?

  What happened to the water level?

  Did the burning candle use all the oxygen in the jar? Devise a way to support your answer.

  Is it possible that the candle drowned in its own carbon dioxide? How might you test this idea?

More:

- Use jars of different heights, volumes, and shapes to cover the burning candle. Vary the number and size of the candles. Float the food-warmer candle on water. (Place thumbtacks in the base of the candle to keep it floating upright.)
- Record the time it takes for the flame to go out in each case.

  Which variations affected the burning time of the candle—height, volume, or shape of container; size of candle, or number of candles?

  What happened to the burning candle floating in water? Did the flame go out immediately? Did the candle continue to burn? What happened to the candle as it continued to burn? Is carbon dioxide gas soluble in water? Design some action to support your statement. Remember that carbonated drinks contain carbon dioxide.

- Cut the soda straws into three different lengths. Place the base of 1 birthday candle inside each straw. Then anchor the straws in a straight line in modeling clay to keep them upright. Light the candles.
- Cover the lit candles with the 1-gallon glass jar. Predict which candle will go out first. Record the time it takes for each of the flames to go out.
- Repeat the activity with the straws arranged in a triangular pattern in the modeling clay. Record the time it takes for each of the flames to go out.

  In what order did the burning candles go out in each pattern?

  Can you explain your observations?

- Cover a burning candle with the coffee can.

  How can you determine when the burning candle goes out without using direct observation?

Related activities: BIS 21, BIS 30

Garden in a Jar–Studying Seeds and Plants

Materials: vegetable seeds such as lima bean, mung bean, or corn (for quick growth choose mung beans; for easy handling of seed and plants choose lima beans); household bleach; paper towel; glass jar; vermiculite or other absorbent material; graph paper **More:** bean seed; mimosa plant

Procedure:

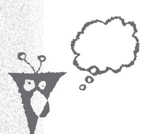
- Soak seeds in water overnight to speed up germination.
- Then soak the seeds in diluted household bleach for 10 to 15 minutes.
- Fold a paper towel into a cylinder. (The cylinder should be shorter than the height of the jar.)
- Place the cylinder in the jar. (Be sure the cylinder hugs the sides of the jar.)
- Pour vermiculite into the cylinder until it is half full.
- Pry the cylinder away from the sides of the jar and slip the seeds between the cylinder and the jar, arranging them as you like.
- Water the seeds by wetting the cylinder and vermiculite. Drain off any excess water.
- Place the jar in sunlight. Observe the jar daily and record your observations. Keep the cylinder and vermiculite moist.

  How long did it take your seeds to germinate? Compare your germination time with your classmates. What can you conclude?

  What happened to plants that dried out? Plants that were watered too much?

  What happened to a plant when portions were snipped off?

- Graph the growth of the plant over time. Graph the growth of various parts of the plant over time.



The mimosa plant is often called the sensitive plant. When you touch its leaves, they fold gently under your fingers. Mimosa leaves also fold at night and open again in daylight.

More:

- Soak a bean seed in water for 6 to 8 hours. Separate the two halves of the seed and look inside.

    Can you identify the parts of a plant—leaves, stem, and root system?

- Use the plant grown in the jar to examine plant reactions to one of these factors: geotropism, sound, electrical stimulation, magnetism, pressure, various soil types, varying degrees of salinity, and various amounts of fertilization.

    What materials do you need to test the plant's reactions?

    Plan an experiment using these materials.

- Touch a leaf on a mimosa plant.

    What do you observe?

- Place the mimosa plant in the dark for several hours. Look at the leaves. Then put the plant in sunlight and observe the leaves again.

    What did you notice about the leaves?

Related activities: BIS 24, BIS 43, BIS 58, BIS 78, SS 18.

A Milky Change or Surface Tension Swirls

BIS 3

Materials: milk; aluminum pie pan; red, yellow, green, and blue food coloring; clear or white liquid dishwashing soap; metric ruler

Procedure:

- Pour milk into the pie pan to a depth of 2 to 2.5 cm.
- Carefully place drops of red, yellow, green, and blue food coloring spaced evenly on the milk.
- Squeeze the soap around the rim of the pie pan.

    What did you observe?

    Why do you think it happened?

Related activity: BIS 4

Measuring Surface Tension of Liquids

Materials: two 6-inch lengths and one 12-inch length of 1 x 2-inch wood; 4 x 4-inch wood block about 1-inch thick; nails; hammer; plastic container; plastic lid; 6-oz paper cup; paper clips; metal washers for weights; string; scissors; ruler; water (rainwater, tap water); vinegar; apple juice; cooking oil; metric balance **More:** several brands of liquid dishwashing soap; 3 plastic lids

Facts to know:

- When water molecules contact air or other matter, they squeeze together, forming a dense layer called surface tension.

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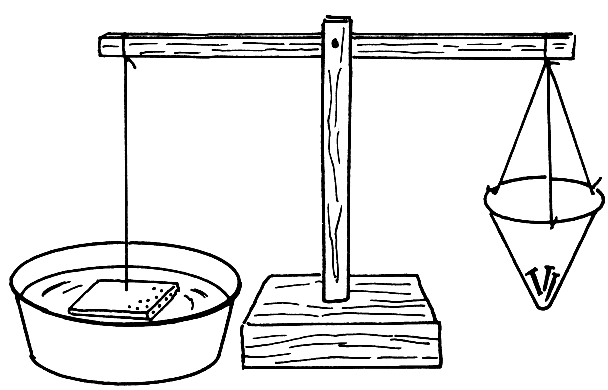
Procedure:

- Construct an instrument to measure surface tension—a tensiometer—by nailing the 6-inch lengths of wood about 4 inches from one end of the 12-inch piece (see illustration). The 12-inch length should be between the two 6-inch pieces. (The tensiometer will have a long arm and a short arm.)
- Then nail the other end of the 6-inch pieces to the wood block so that the balance stands upright.



- Cut a 1-inch square from the plastic lid. Make a small hole in the center of the square.
- Suspend the square from the long arm of the tensiometer.
- Suspend a paper cup from the short arm of the tensiometer.
- The paper cup will outweigh the plastic square; use paper clips on the lighter side to make both arms equal in weight.
- Fill the plastic container with water and place it beneath the square on the long arm.
- Carefully push down on the arm until the square touches the water. Your tensiometer will now be out of balance. If you gently tap the opposing balance arm, you will feel a grabbing attraction between the square and the water. (This attraction is called *surface tension* and can be measured.)

- With the square in contact with the water, carefully add the metal washers to the paper cup. Record the number of washers needed to break the surface tension.
- Express surface tension in washers used per square inch, or weigh the washers on a metric scale to express the surface tension in grams per square inch.
- Repeat the activity with hot, lukewarm, and cold water in the container. Measure the surface tension with each.
- Replace the water in the container with other liquids, such as rainwater, vinegar, apple juice, and cooking oil. Measure the surface tension with each.

  Does the temperature of the water affect its surface tension?

  Do all liquids exhibit the same surface tension?

  How do they compare to one another?

More:

- Vary the geometric shape of the piece of the plastic, but keep the same surface area as the 1-inch square. Try measuring the surface tension with a 1 x 2-inch triangle, a $\frac{1}{2}$ x 2-inch rectangle, or a 1-inch-diameter circle.

  Does the geometric shape affect surface tension? Does it increase, decrease, or remain the same?

  Would a 2-inch plastic square require twice the measure of weights to break the surface tension? What about a 3-inch square?

- Add a few drops of liquid soap to the water in the container and measure the surface tension. Repeat with different brands of detergent. Again measure the surface tension.

  How does the soap affect surface tension?

  Which soap reduces surface tension the most?

Related activity: BIS 47