



SUPER SCIENCE



RATIONALE FOR ADVENTURE

In this adventure, Bear Scouts will get a little messy but gain a lot of knowledge! Science is an everyday wonder that Scouts can learn more about by simply using ordinary household supplies. Their *actions* will create amazing *reactions* in fun investigations exploring static electricity, oil and water, sinking versus floating, and color morphing and layering.

TAKEAWAYS FOR CUB SCOUTS

- Following directions
- Introduction to the scientific method
- Learning the scientific law of action and reaction
- Finding new ways to be creative

Bear Handbook, page 268

ADVENTURE REQUIREMENTS

Complete at least four of the following:

1. Make static electricity by rubbing a balloon or a plastic or rubber comb against another material, such as a fleece blanket or wool sweater. Explain what you learned.
2. Conduct one other static electricity investigation. Explain what you learned.
3. Do a sink-or-float investigation. Explain what you learned.
4. Do a color-morphing investigation. Explain what you learned.
5. Do a color-layering investigation. Explain what you learned.

NOTES TO DEN LEADER

This adventure has several choices based on which activities you choose to do with your den. These den meeting plans, when followed as written, meet the requirements to earn this adventure. If you choose to make adjustments, be sure you complete at least the minimum requirements.

Encourage the members of your den throughout this adventure to explore the “why” questions in each experiment: Why does static electricity happen? Why do colors separate? Why did our prediction come true? Why did it not come true?

Meeting 3 will be a den outing to a science lab, science museum, or school to learn more about static electricity as well as density and buoyancy. Identify a location well in advance of the outing and make arrangements with the staff member in charge. Confirm plans with families, including place, time, and transportation. Make sure activity consent forms are signed, distributed, and collected.

This adventure also supports STEM (science, technology, engineering, and mathematics) activities in local schools.

See the appendix for optional den meeting activities, including openings, gatherings, and closings.

MEETING 1 PLAN

PREPARATION AND MATERIALS NEEDED

- U.S. and den flags
- “Lab coats” (Use old shirts throughout this adventure, due to the risk of staining.)
- Items for Static Cling and Follow the Balloon activities (requirement 1)
 - Balloon (If there are latex allergies in the den, substitute with a rubber or plastic comb and a piece of PVC pipe.)
 - Polar fleece blanket or 1 wool sweater
 - Section of cloth
 - Tissue paper
 - Ribbon
 - Aluminum foil
 - Two aluminum cans, one empty and one full
 - Paper scraps
 - Cardboard scraps
 - Yarn or string
 - chenille stem
 - Coin
 - Pingpong ball
 - Running water
- Items for Flying Bottle Beads activity (requirement 2)
 - Empty, dry 1-liter bottle
 - $\frac{1}{4}$ cup of small Styrofoam beads (like the ones in beanbag chairs)
- One pair of goggles for each member of the den (These are optional but they add to the fun, and experiments in this adventure can get messy. However, if there are latex allergies, be sure to use nonlatex goggles.)

GATHERING: CARPET SHUFFLE SHOCK

As Scouts enter, let them shuffle their shoes along a carpet or rug to pick up extra electrons and a negative static charge. Then they touch a door knob, and zap! The electrons jump from the Scouts to the knob (a conductor), and they feel a static shock.

OPENING

- Conduct a flag ceremony of your choosing that includes the Pledge of Allegiance and the Scout Oath and Scout Law.
- Have each Scout answer the roll call with a noise they associate with science experiments (“Sploosh,” “Fizz,” “Glug,” etc.).

TALK TIME

- Carry out business items for the den.
- Allow time for sharing among Cub Scouts.
- Ask: *Have you ever heard the expression, “There is electricity in the air?” Well, in our Super Science adventure, we’re going to prove there is electricity in the air—static electricity. We’ll use our super scientist skills to show that static electricity, though invisible, can shock us, move paper, make our hair stand on end, and cause objects to fly!*

ACTIVITIES

NOTE: Use the second option for Activities 1 and 2 if anyone in the den has a latex allergy.

◆ Activity 1: Static Cling and Follow the Balloon (Requirement 1)

Option 1: Create static electricity by rubbing the balloon on the fleece blanket or wool sweater. Ask Scouts to predict which of these objects will stick to the balloon: human hair, tissue paper, aluminum foil, cardboard scrap, paper scrap, yarn/string, chenille stem, ribbon, cloth, and a coin. Discuss your findings with the den. Some objects will be more affected by static electricity than others.

Then charge the balloon again with static by rubbing it on the blanket or sweater. Predict which of these objects will follow the balloon and which ones will move away from it: pingpong ball, full aluminum can, empty aluminum can, gentle stream of tap water. Discuss the results with your den. This is another way we can prove that static electricity affects objects.

Now rub the balloon on someone's head. Watch what happens to their hair as negative electrons build up on the balloon. After doing this for a few seconds, place the balloon near a steady, gentle stream of tap water, about $\frac{1}{8}$ -inch thick. Does the water move toward or away from the balloon?

Option 2: Vigorously rub the PVC pipe or rubber comb against the blanket or sweater. Then conduct the same investigations as in Option 1 to see which objects stick to the pipe or comb.

Conduct the same object and water investigations, substituting the comb for the balloon. For the water experiment, charge the comb by vigorously rubbing it against the blanket or sweater or running it several times through long, dry hair. Then place the comb near the stream from the tap and see how the water bends. In both options, the neutral water should be attracted to the electron-charged comb or balloon and move toward it.



◆ Activity 2: Flying Bottle Beads (Requirement 2)

Make sure the 1-liter bottle is empty and dry, then fill it with the $\frac{1}{4}$ cup of Styrofoam beads. Now rub the bottle on someone's head and watch the beads fly around inside.

Next, see what happens when you put the bottle down and touch it with your hands. Do the beads move toward or away from your hands? Run the same investigations with more objects to check the reaction of the beads.

CLOSING

Akela's Minute: As electrons move around, they go from atom to atom and from object to object. Normally, we don't even notice it. But when there are a lot of objects, they build up something called a negative charge. Picture a room getting really, really crowded. Everyone is moving around, getting squished, and they start to feel grumpy. Then the door opens, and people want to rush out to get away from the crowd!

Take that example and think about electrons: They build up their negative charge and have nowhere to go—until they meet another object. If they come near an object with fewer electrons (called a "lesser charge"), all of the extra electrons will rush over to the other object. Then you can hear a popping noise and sometimes see a spark, just like our Carpet Shuffle Shock. When you get a shock from static electricity, it's because a negative charge left an object and jumped to your body.

What a super reaction from electrons! Let us give a Bear cheer (or den yell) for the electrons. Good night, Super Scientist Bears!

AFTER THE MEETING

- Serve refreshments, if desired.
- Record completion of requirements 1 and 2.
- Work together to clean up the meeting place.
- Take a group photo of the den to be printed out and used during the opening of Meeting 2.
- Prepare thank-you notes for the Bears to sign at the next meeting. The notes should be given to anyone who helps with the outing.

MEETING 2 PLAN

PREPARATION AND MATERIALS NEEDED

- U.S. and den flags
- Photo of the den for the opening
- “Lab coats” (see Meeting 1)
- Items for Sticks and Spoons game (Gathering)
 - 10 marbles per Scout
 - Plastic straws (same size, 1 per Scout)
 - Spoons (same size, 1 per Scout)
 - Plastic cups (same size, 1 per Scout)
- Items for Bear Science Experiment (Opening)
 - One large pot
 - Index cards (1 per Scout)
 - One copy of den group photo from Meeting 1
- Items for Sink or Float investigation (Requirement 3)
 - Three eggs
 - Three drinking glasses (same size)
 - Salt (2 tablespoons, more or less, depending on size of glasses)
 - Sugar (same as above)
 - Water
 - Tablespoon
- Items for Color Morphing investigation (Requirement 4)
 - One large jar or vase (must be clear)
 - Water
 - Cooking oil
 - Liquid food coloring (blue, red, and yellow)
 - Tablespoon
 - Measuring cup
- Items for Color Layering investigation
 - Sugar (15 tablespoons)
 - Water (15 tablespoons)
 - Food coloring (blue, green, red, and yellow)
 - Six clear plastic cups (same size)
 - Tablespoon

GATHERING: STICKS AND SPOONS

As they enter, give all Scouts a straw, a plastic cup, and a spoon and have them sit on the floor with 10 marbles scattered near each of them. At the word “Go,” give them 50 seconds to pick up as many marbles as possible—using only the straw and spoon—and drop them into their cups. Each Scout keeps their own score (“a Scout is trustworthy”). After everyone has arrived and played the game, declare the winner.

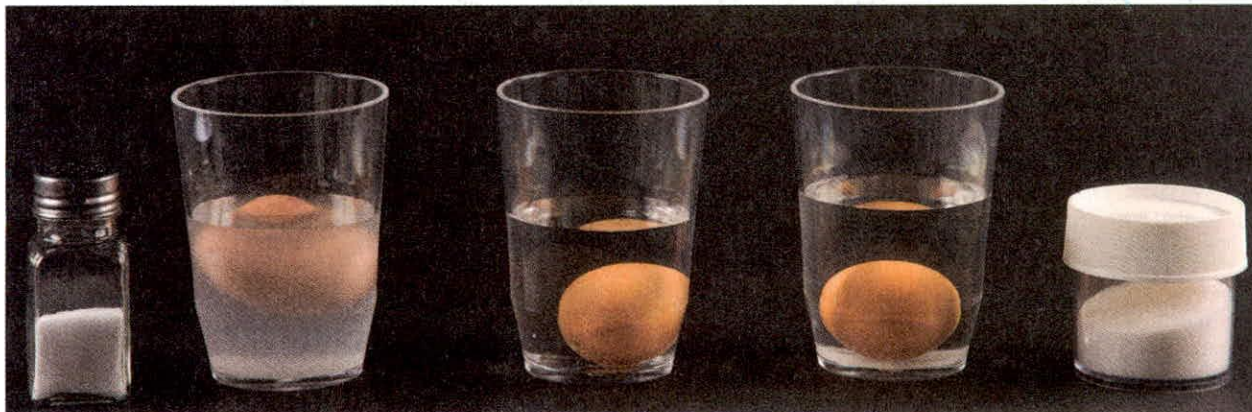
OPENING

- Conduct a flag ceremony of your choosing that includes the Pledge of Allegiance and the Scout Oath and Scout Law.
- **Bear Science Experiment:** Give each Scout an index card with one or points of the Scout Law written on it. In turn, have each Scout name the point they are holding and drop it into the pot. Then reach into the pot and pull out last week’s picture of the den. Explain that all of us together, by following the Scout Law, create a den that does great things!

TALK TIME

- Carry out business items for the den.
- Allow time for sharing among Cub Scouts.
- Ask if they have seen any static electricity in their homes or at school since the last meeting. Have them share any stories.
- Review plans for Meeting 3, an outing to a science lab, science museum, or school.
- Tell the Scouts: *At this meeting, we will discover how we can make eggs sink or float, suspend colors in water, and make a rainbow in a cup of water!*

ACTIVITIES



◆ Activity 1: Sink or Float (Requirement 3)

Ask Bears: *Can you guess—or use your Super Science to “hypothesize”—whether an egg will sink or float in water that is salty? What if the water is filled with sugar? And what if the water has nothing added? Well, we can use our Super Science to find out.*

Now conduct the investigation. Fill all three glasses with water. Have the Scouts leave plain water in the first glass, stir salt into the second one, and stir the same amount of sugar into the third glass. Can the Scouts predict what will happen when they add an egg to each glass? Let them try it and see if the eggs sink or float.

Then continue: *In this adventure, we experimented with what scientists call “variables.” We left plain water in the first glass, but we stirred salt into the second glass and sugar into the third one. Salt makes water denser so the egg floats at the top. Using the same amount of sugar, the egg still floats, but not as well. In plain water, it doesn’t float at all. Did your findings support your hypothesis or should you have made a different prediction?*

♦ Activity 2: Color Morphing (Requirement 4)

Ask: Have you ever heard the saying “Oil and water don’t mix”? Let’s use our Super Science to find out if that is true. Then we’ll experiment more by adding colors to the liquid. What do you predict will happen?

Have the Scouts fill the jar or vase with water. Then add exactly 3 drops each of red, blue, and yellow food coloring to the oil (no more or it will turn black). Stir the color and oil together—you will see it break up into little droplets. Slowly pour the mix into the water and watch the show begin!

Now ask: What is happening? Did you guess right? Oil and water do not mix. When stirred together in the same container, they will actually push away from each other once the motion stops. When you added the food coloring to the oil, you stirred it, mixing the two together. Once this is added to the water and allowed to be still, the water and oil start to separate. Liquid food coloring is water-based. This causes the colors to push away from the oil. As the colors move through the water, it causes a beautiful color morphing effect. If you have more time for this activity, try it with different color combinations.



♦ Activity 2: Color Layering (Requirement 5)

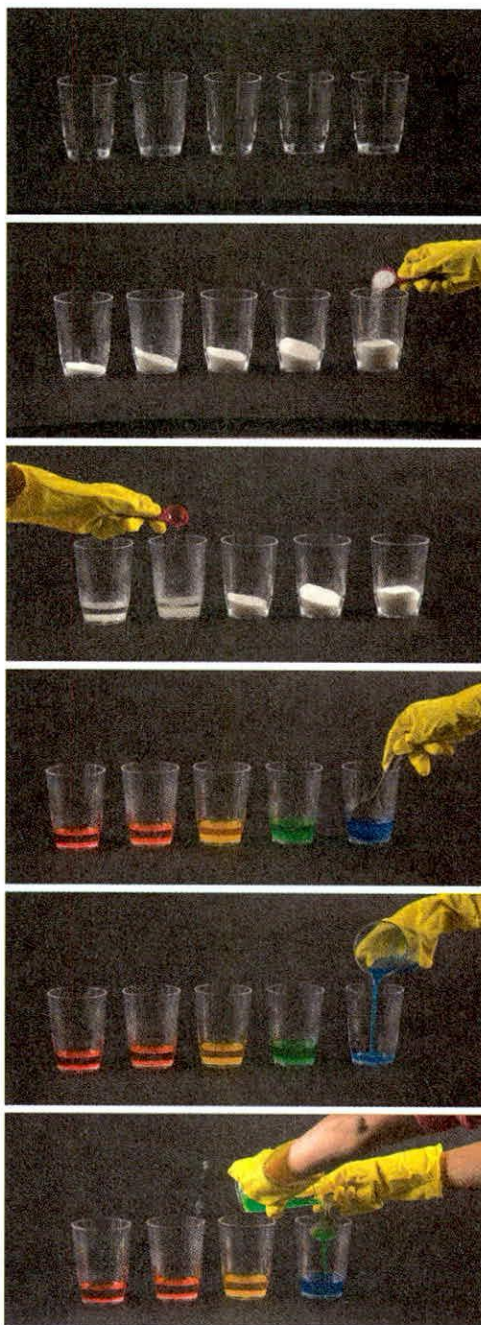
Set out the materials for this investigation, and say: We found out how to create unique designs with colors in liquid. Now, can we put those colors together in layers to create a rainbow effect? Let’s use Super Science to see.

Place five of the cups in a row. Keeping the cups in order, add 1 tablespoon of sugar to the first cup, 2 tablespoons to the second, 3 tablespoons to the third, 4 tablespoons to the fourth, and 5 tablespoons to the fifth cup. Keep the sixth cup empty.

Pour 3 tablespoons of lukewarm water on top of the sugar in the first five cups, and stir until the mix dissolves. Now add a different food color to the first four cups and combine two of the colors in the fifth cup. Stir the five cups again.

Now, pour half the contents of the fifth cup into the sixth cup. Take the spoon and place it against the inside of the cup, bowl side up. (Note: Using a spoon diffuses the force of the liquid pouring into the cup. This will let the colors layer on top of one another instead of mixing.) Be sure to pour gently, creating the first layer, and continue doing this with the remaining three cups. Enjoy the rainbow in your sixth cup!

Explain: Adding sugar to the water causes it to become thicker as the sugar molecules take over the space. The more sugar you add, the denser the water becomes. This lets you stack the colored water as long as you pour it gently.



CLOSING

- **Den Electricity:** Have Bears stand in a circle facing inside. Ask each Scout to turn all the way to their right and place both hands on the shoulders of the person in front of them. Everyone starts walking slowly, shuffling their feet. Tell the den: *When we work together, we create electricity. Not only the static electricity that gives a little spark when we shuffle on carpet, but the giant spark when we learn and grow together as Scouts.*
- Pass out activity consent forms for Scouts to have signed by a parent or guardian before Meeting 3, the den outing. Confirm the location and transportation plans.

AFTER THE MEETING

- Serve refreshments, if desired.
- Record completion of requirements 3, 4, and 5.
- Work together to clean up the meeting place.
- Have the Scouts sign thank-you notes for anyone helping with the outing.

MEETING 3 PLAN (Den Outing)

PREPARATION AND MATERIALS NEEDED

- Be sure all arrangements are made for the den to visit a science lab, science museum, or school to learn more about static electricity, and density and buoyancy. Contact the location well in advance and confirm all plans with the staff member in charge. Check to see if the physics department at a local college or university might be willing to assist in the tour.
- Confirm that transportation to and from the site is in place. Secure signed activity consent forms.
- STEM activities (science, technology, engineering, and mathematics) may also be included in this outing.

GATHERING

- Remind Scouts to be courteous during the outing.
- Remind everyone of the importance of staying together and being on their best behavior.
- Use the buddy system.
- Review any questions the Scouts want to ask to make certain all are appropriate.

OPENING

- Assemble the group, and review any conduct rules and the buddy system.
- Say the Pledge of Allegiance.
- Ask Scouts to name points of the Scout Law they will demonstrate during the outing (friendly, courteous, etc.).

TALK TIME

- Carry out business items for the den.

ACTIVITY

◆ Activity 1: Outing (Optional)

- Ask the professional guiding the tour to share about the different jobs available in the field of physics. Perhaps the guide can tell the Scouts about educational requirements for those jobs and what classes in school might help prepare them.
- Ask the guide if he or she knows of a science club for young people in the area.

CLOSING

- Plan a cheer in advance to give to helpers at the facility, including the tour guide.

AFTER THE MEETING

- Serve refreshments, if desired.
- Ensure cleanup takes place, if needed.

Upon completion of the Super Science adventure, your Bears will have earned the adventure loop shown here. Make sure they are recognized for their completion by presenting the adventure loops, to be worn on their belts, as soon as possible according to your pack's tradition.

