Soybeans Are Everywhere!

Beans About Water Activity Guide

INSIDE

YOU WILL FIND:

- 5 Experiments About The Properties Of Water
- 5 E's Learning Cycle
- Resources/Web Sites
- Soy Facts
- Science Fair Ideas

Soybeans are everywhere!
Check ingredient labels on a variety of cookies, peanut butter, soups, chips, chocolate candy, microwave popcorn, and other processed snacks. Many of the foods kids eat include soy ingredients: soy protein, soy flour, soy grits, soy lecithin, soybean oil. Learn about the properties of water to discover why food technologists use soy products.

SHOPPING LIST

(listed per classroom of 30 students)

- 15 copies of experiments #1 – #5
- 1 roll of paper towels
- 45 plastic cups (9 oz. clear)
- 30 6" plates (plastic or styrofoam)
- 30 toothpicks
- 15 pipettes or eyedroppers
- 1 container NesQuik™
- 1 container baking cocoa
- 5 hand pump soap dispensers to be shared
- 5 pepper shakers to be shared
- 5 small bottles food color to be shared
- Soybean lecithin granules (a pinch per team) (available at local health food stores)
- 1 carton soy milk – less than 1/4 C. per team
- 15 pennies

SOY OHIO
Ohio Soybean Council
www.soyohio.org

Brought to you by Ohio's Soybean farmers and their checkoff.

5 E's Learning Cycle

ENGAGE

Begin with Experiment #1 to discover why food technologists use soy as an ingredient in many foods.

Engage
- Create interest
- Raise curiosity

Experiment #1, Penny Prediction, investigates surface tension by counting the number of water drops students can get on a penny. They will **predict, observe,** record **data,** and identify **variables** and **controls.** Introduce this activity with a discussion about science skills: following directions, making good observations and being safe. Students work in paris to read directions, perform the investigation and record their results. Data can be collected on a classroom chart, graphed and calculated in terms of median, mean and average. Data from different classrooms can form large samples for study. Differences in data results lead to a discussion on variables (i.e., clean coin vs. dirty coin, heads vs. tails, size of water dropped, height from which water is dropped, etc.) Students should control variables and test their ideas.

Henry Ford built a car out of soybean plastic in 1935.

EXPLORE

Learn about soy lecithin, a surfactant used in many food and industrial products such as chocolate, candy, paints, adhesives, vitamins and medicines.

Explore
- Test predictions
- Record observations

Experiment #2, Attractive Molecules explores other properties of water: **molecules** and **cohesion.** Students will observe the nature of water cohesion as they try to move drops of water with toothpicks.

Experiment #3, Dancing Pepper and **Experiment #4, Color Swirls** test two **surfactants,** wetting agents that break surface tension and water cohesion. **Dancing Pepper** tests the surfactant, soap. **Color Swirls** tests lecithin, a soybean surfactant used in many food products such as chocolate. In both experiments students can observe the movement of water molecules when surface tension and cohesion are broken.

Soy ink is used by more than 90% of our nation's newspapers

EXPLAIN

Students can demonstrate the way soy lecithin disrupts the surface tension of water.

Explain
- Share ideas
- Listen to others' ideas

Kinesthetic Model:
Students "act out" their observations. They might link arms to show that water molecules are cohesive. Student "water molecules" can fly apart when a student "surfactant" is added to visually demonstrate the **Dancing Pepper** activity.

Artistic Model:
Students can draw models of their observations. What do water molecules look like? How can movement be shown?

SOY OHIO
Ohio Soybean Council
www.soyohio.org

5 E's Learning Cycle

Representative Materials Model:
Students can use a variety of materials to create models of their observations. Use small candies to illustrate cohesion of water molecules. How can the model show what happens when surface tension is broken by a surfactant?

Verbal or Written Model:
Students can use scientific language to create a model of their observations. Teacher criteria can establish the length of writing and the choice of vocabulary words. Students can make oral presentations combined with one of the above models for demonstration purposes.

ELABORATE

Soybeans are used in biology, chemistry, food technology and engineering. Many new products are being developed by soybean scientists.

These optional activities can be used to extend concepts before or after evaluation.

- Challenge students to find other water-soluble drinks on grocery shelves. Do they contain soybean surfactants? Why or why not?
- Explore other properties of water using soybeans such as: adhesion, absorption, density, specific gravity, solution, emulsion, and coagulation.
- Provide opportunities for older students to teach younger students these activities.
- Create soybean science fair experiments related to these concepts.

EVALUATE

What makes NesQuik™ quick? Soy lecithin! Soy lecithin acts as a surfactant to mix the chocolate into the water easily.

Experiment #5, Why is NesQuik™ quick? provides an opportunity for authentic assessment. Each team performs the experiment and answers the question, "What makes NesQuik™ quick?"

Vocabulary Words

- **WATER:** chemical compound comprised of two elements, hydrogen and oxygen
- **WATER MOLECULE:** the tiniest possible drop comprised of one atom of oxygen and two atoms of hydrogen
- **COHESION:** the attractive force between water molecules that holds water together.
- **SURFACTANT:** wetting agent that will break surface tension and cohesiveness of water
- **SURFACE TENSION:** the attractive force of water molecules displayed in the "skin-like" surface of a water drop

SCIENCE SKILLS

- predict
- observe
- record data
- identify variables and controls

George Washington Carver discovered the soybean was a good source of protein and oil in 1904.

Elaborate
- Extend concepts
- Apply skills

Every person in the U.S. consumes an average of 260 pounds of soy each year.

Evaluate
- Demonstrate understanding
- Ask related questions

Soy crayons are made in Sandusky, Ohio

SOY OHIO™
Ohio Soybean Council
www.soyohio.org

Experiment #1
PENNY PREDICTIONS

Gather these materials: 1 pipette • 1 penny

1. Predict how many drops of water you can fit on the penny. _____
2. Use the pipette to add drops of water to the top of the penny.
3. Count each drop until the water leaks off the side of the penny.
4. Were your predictions correct? ***yes*** ***no*** (circle one)
5. Repeat this test 3 times and record your data on the chart.

TEST 1	TEST 2	TEST 3

Draw here

6. Look at the water on top of the penny. Draw what you see here.
7. Compare your test results to other teams. Why are the results different? Be ready to discuss variables.
8. Try more experiments, changing only one variable each time. The other things in the experiment will stay the same. These are the controls.

Control: things that stay the same—*person using the pipette; height of pipette from coin; size of drop, type of coin*

Variable: thing that changes—*side of the coin*

DATA	TEST 1	TEST 2	TEST 3
	Heads		
	Tails		

Now try your own! Change one variable only.

Control: things that stay the same _____

Variable: thing that changes _____

DATA	TEST 1	TEST 2	TEST 3

Control: things that stay the same _____

Variable: thing that changes _____

DATA	TEST 1	TEST 2	TEST 3

Surface Tension and Cohesion: Water molecules like to stay together. They are cohesive. The surface tension can be seen in the little dome of water on top of the penny.

Experiment #2
ATTRACTIVE MOLECULES

Gather these materials: 1 empty plastic cup
1 cup with water
1 pipette • 2 toothpicks

1. Turn over the empty plastic cup.
2. Use the pipette to place 2 drops of water about 1 inch apart on the bottom of the cup.

3. Use the toothpicks to try to move one drop of water over to touch the other drop. How easy was that?
4. Next, use the toothpicks to separate the one big droplet back into 2 drops. How easy was that?
5. Dry off the bottom of the cup and try this again.

Cohesion: This investigation demonstrates cohesion. Water molecules like to stay attached and are hard to separate.

One bushel (60 pounds) of soybeans produces 2,112 soy crayons.

Try This!! STICKING TOGETHER

Gather these materials:
2 pieces of aluminum foil or paper
1 cup water

1. Hold the pieces of foil or paper up and place them side-by-side. Do they stick together?
2. Rub water onto one side of each piece of foil.
3. Place the two wet sides together and hold them up. Now do the pieces of foil or paper stick together?

Cohesion: Two pieces of foil or paper do not stick together when they are dry. When coated with water, the water molecules on each surface join together and hold the pieces in place. Water molecules are cohesive. They stick together.

Can you think of other ways to demonstrate cohesion?

Soy can be found in:

- crayons
- sunscreen
- lip balm
- building materials
- protective coating on CDs
- ink base for 80,000 newspapers

SOY OHIO
Ohio Soybean Council
www.soyohio.org

Experiment #3
DANCING PEPPER

Gather these materials: 1 small plate • water pepper • 1 soap dispenser

> **Clean-up hint:** Don't pick up the plate of water. Slide it to the edge of the table and into a waste can.

1. Fill the plate with water.
2. Sprinkle pepper evenly over the surface of the water.
3. Using the soap dispenser, squirt one drop into the middle of the pepper.
4. What happens?
5. Draw a picture of the plate, pepper and water **before** adding the soap

6. Draw a picture of the plate, pepper and water **after** adding the soap.

Surfactant: Soap contains a surfactant. A surfactant causes water molecules to separate. It breaks surface tension. By watching the pepper, you can see the water molecules moving apart.

Experiment #4
COLOR SWIRLS

Gather these materials: 1 small plate • soy milk 1 bottle food coloring • lecithin

1. Fill the plate with soy milk.
2. Place 3 equally spaced drops of food coloring in the soy milk.
3. Predict: You are going to add a **surfactant** to the soy milk. Remember what happened to the pepper when you added the soap surfactant? What do you predict will happen when you add the lecithin surfactant?

4. Write your prediction here: _____
5. Add a little bit of lecithin onto each drop of food coloring. What happens? Was your prediction correct?
6. Draw a picture of the plate, milk and food coloring **before** adding the lecithin.

7. Draw a picture of the plate, milk and food coloring **after** the lecithin.

Surfactant: Lecithin, a surfactant, separated the water molecules in the milk causing the color to move. Lecithin, made from soybeans, is used when fats and oils need to be mixed with water and other ingredients. It is found on ingredient labels of chocolate candy because it keeps the candy smooth and creamy.

SOY OHIO
Ohio Soybean Council
www.soyohio.org

Experiment #5
WHY IS NESQUIK™ QUICK?

Gather these materials: 2 empty plastic cups
1 pipette • water
1 container baking cocoa
1 container NesQuik™

1. Turn over the empty plastic cups.
2. Use the pipette to place 1 large drop of water on the bottom of one cup.
3. Use your fingers to pinch a small amount of cocoa and sprinkle it on the drop. What happens?

4. Use 3-4 words to describe the cocoa when you sprinkled it on the water:

_____

5. Now use the pipette to place another large drop of water on the bottom of the second cup.
6. Use your fingers to pinch a small amount of NesQuik™ and sprinkle it on the drop. What happens?
7. Use 3-4 words to describe the NesQuik™ when you sprinkled it on the water:

_____

8. Think about what you have learned and answer the question: Why is NesQuik™ quick? Use 2-3 of these science vocabulary words in your answer: cohesion, surfactant, water molecules, surface tension.

   Why is NesQuik™ quick?

_____

_____

_____

NesQuik™ is a registered trademark of Nestle.

Science Fair Ideas!

Projects in the areas of food technology, soybean germination and plant science, industrial and other non-food uses of soybeans:

Is the soybean crayon a better crayon?

Environmentally Friendly: Soy Ink vs. Petroleum Ink.

Kitchen as Lab: Experiments with Soy Snacks.

Non-Stick cooking sprays: Does Soybean Lecithin Make it Work?

SOY OHIO™
Ohio Soybean Council
www.soyohio.org

Cruising Clipboard CHART

Gathering Information

Names	Follows directions	Makes careful observations	Collects and records data	Asks questions	Works well with others		

NOTES:

ONLINE

Ohio Soybean Council
www.soyohio.org

Ohio Farm Bureau Federation
www.ofbf.org

Our Ohio Grow it. Know it. Live it.
www.ourohio.org

United Soybean Board
www.unitedsoybean.org

Soyfoods Association of North America
www.soyfoods.org

The Solae Company
www.solae.com

ADM
www.admworld.com

RESOURCES

Breads of the Harvest
www.ag.ohio-state.edu/~breads

Project Food, Land & People
www.foodlandpeople.org

SOY OHIO

Ohio Soybean Council
918 Proprietors Rd., Suite A
Worthington, Ohio 43085
www.soyohio.org

PRINTED WITH SOY INK

02-12