Water, Water Everywhere

Overview

Water is found almost everywhere on what scientists and astronauts call our "blue planet". It covers more than seventy percent of the earth's surface and makes up approximately the same percentage of our own bodies. In this activity students explore several properties that make water unique and interesting as a substance. Many of the science concepts behind these water investigations are actually quite complex. Exposing young students to these science concepts in an exciting discovery mode, while asking questions which increase their observation skills and generalize the experience, sets the stage for a deeper understanding of the concepts upon further exposure in higher grades.

In Session 1, while sorting through a number of water-related pictures, students brainstorm their ideas about water and its importance. In Session 2, students participate in three investigative stations to explore some of the interesting properties of water. In **Sink or Float?**, students have the opportunity to first predict and then find out what happens when a variety of objects are placed in a tub of water. In **Boat Building** students explore what kinds of shapes make the best boats, and how much you can load in them before they sink. In **Water Drops,** students use water droplets and toothpicks to discover how water is attracted to itself. In Session 3, the activity **Fill 'er Up** provides students the opportunity to apply what they have learned about predictions, and how scientists work as they discover the concept of volume. Session 4 gives some suggestions for interdisciplinary follow up activities.

What You Need

For Session 1:
Water Discovery

For each small group

- ☐ 1 plastic dishpan or tub
- ☐ water to fill tub 3/4 full
- ☐ towels and sponges for cleanup
- ☐ an assortment of the following to share:
- 2 sheets of waxed paper and 4 toothpicks
- misc. kitchen tools: funnels, sieves, colanders, spoons (metal and plastic), turkey basters, measuring cups and spoons (various sizes)

- misc. materials: play dishes, play food, plastic boats, plastic and wood blocks, strawberry baskets, an assortment of candles including very large and birthday, crayons, corks, rocks, sand

Water Brainstorm

- ❑ chart paper and colored markers or chalkboard
- ❑ 1-2 pictures (per student) of water and living things using water: (See Getting Ready)

What Does it Mean to be a Scientist?

For the class

- ❑ Comparison Chart of Blue and Clear Water (See Getting Ready)
- ❑ Chart paper and colored markers

For each small group of 4 students

- ❑ 1 6-ounce clear plastic cup
- ❑ water to fill cup
- ❑ crayons
- ❑ 4 sheets drawing paper

For Session 2: Water Stations

The materials for the following stations are for small groups of six or seven students; if you have different size groups, adjust the number of materials accordingly.

Sink or Float Station

For the station

- ❑ station instruction sheet for adult or older student helper
- ❑ chart paper and colored markers
- ❑ cloth towel for clean-up
- ❑ large plastic tub filled 3/4 full with water
- ❑ variety of sinking and floating objects, including shells, various sizes of wax candles, ball that floats, cup with a removable lid, oil-based clay (plasticine), cork, rock, paper clips, marbles, pennies, popsicle sticks, crayons, Styrofoam pieces, and sand.

For each student

- ❑ sink and float worksheet
- ❑ pencil

Boat Building Station

For the station

- ❑ station instruction sheet for adult or older student helper
- ❑ cloth towel for clean-up
- ❑ tub of pennies (approximately 100)
- ❑ one plastic dishpan filled 3/4 full with freshwater

For each student
- ❑ one 10-inch-square aluminum foil. (See Getting Ready)
- ❑ aluminum boat building worksheet
- ❑ pencil

Water Drops Station
For the station
- ❑ station instruction sheet for adult or older student helper
- ❑ cloth towel for clean-up
- ❑ 2 eyedroppers (for adult)
- ❑ 2–3 small plastic cups half filled with tap water
- ❑ dish pan with water
- ❑ dropper bottle with rubbing alcohol
- ❑ 1 "boat" cut from a yogurt container lid (See Getting Ready)
- ❑ pitcher of water to fill dishpan

For each student
- ❑ 1 toothpick
- ❑ 1 laminated Drag-a-Drop worksheet
- ❑ 1 laminated maze worksheet
- ❑ 1 sheet of wax paper

For optional activity at station (See Getting Ready)
- ❑ several small cups of water
- ❑ 1 penny/student
- ❑ 1 dropper/student

Session 3:

Fill 'er Up
For the class
- ❑ clear volume set or miscellaneous clear containers (See Getting Ready)
- ❑ 2 pitchers of water
- ❑ clear measuring cup (2 cup volume) or large graduated cylinder
- ❑ 5 different colors of masking tape or post-it flags
- ❑ crayons

For each student
- ❑ Fill 'er Up Prediction sheet–"Which container will hold the most water?"

Debrief
For the class
- ❑ materials from Session 2 stations

Getting Ready

For Session 1

1. Start collecting interesting items for the sink and float activities and magazine or calendar pictures showing water and living things using water. Some ideas for pictures include bathtub, glass of water, lawn sprinkler, dripping faucet, rain, stormy night, puddles, rivers, lakes, streams, ocean, boats, ducks, people drinking, swimming bathing, and watering plants, animals drinking and swimming.

2. Make a large Comparison Chart showing two cups of water, one with blue-colored water and one with colorless water.

3. Write out the Key Concepts on sentence strips using large colored letters

- **Water is a very important and interesting liquid.**
- **Scientists make careful observations using their five senses—hearing, smelling, tasting, touching and seeing.**

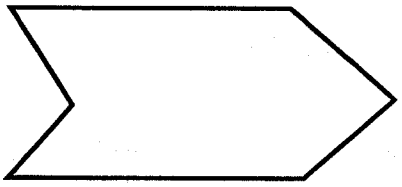
For Session 2

1. You will want to have at least one adult/parent helper or older student to assist with each of the three stations. This will give you the opportunity to direct the rotations and assist with the stations, as necessary. If you have the opportunity to provide a quick training session for the helpers, it will make the rotations go more smoothly and the students will probably get more out of each of the stations. If you don't have time to do this before the day of the class, ask that the helpers come at least 15 minutes early to read the procedure for the station they will lead, and help to set it up. Emphasize that their role is to facilitate the learning by asking some of the questions listed on the station procedure.

2. We recommend you have the students go through these activities as stations, with groups rotating from station to station every 15-20 minutes. These investigations may also be done one activity at a time with the whole class doing the same activity in small groups of 4–6 students. This requires multiple sets of each of the materials so that each small group has their own set-up. In this case the teacher leads and demonstrates each activity before the students begin.

3. Sometimes Pack and Save, Costco and other large chain stores carry boxes of pre-cut aluminum foil squares. This is a great alternative to tearing sheets of aluminum foil and saves some time.

4. Cut out a few 1–2 inch long boats from plastic yogurt container lids. See pattern:



5. Place materials for each of the three stations in separate dish pans for ease in setting up the stations.

6. Duplicate the student worksheets for each of the stations and the Fill 'er Up demonstration.

7. Decide if you want to do the optional activity in the Water Drops station. This is a very fun activity, but you may find it makes this stations run longer than the others. You might decide to use it as a Going Further or free-time activity.

8. Write out the Key Concepts on sentence strips in large colorful letters.

Station 1:

- **Some materials tend to float, other materials tend to sink.**

- **Whether or not something sinks or floats depends on the material, not on the size of the object.**

Station 2

- **The amount of weight a toy boat will be able to hold and still float can be predicted by looking at the shape and size of the boat.**

Station 3

- **Water drops seem to have a "stretchy skin."**

- **Water drops are attracted to one another.**

For Session 3

1. Clear plastic volume sets used in the Fill 'er Up activity are available through Didax Educational Resources (800-458-0024). Volume sets (item: 26-240) are $19.95 each. However, this activity can be successfully conducted using clear or translucent plastic household containers (Tupperware) of various shapes and volumes.

2. Write out the Key Concepts on sentence strips in large colorful letters.

- **We can make predictions and then measure the amount of water that different shapes will hold.**

- **The amount of water a container will hold is called the volume.**

(Into the Activity)

Session 1: What Is Water?

Water Discovery

1. Give each small group of students a tub of water, and a variety of materials for students to share. Provide students unstructured time for water exploration. Ask them to discover as much about water as they can. *Note: This can be a station that can be left set up in the room for a week or so prior to starting Session 2, and used as a free time activity or part of another activity rotation.*

Water Brainstorm

1. Give each student several water-related pictures and lead a class brainstorming session using the following questions as prompts. Record students' responses on chart paper.

- When you get thirsty, how do you put water back into your body? (*drink it in liquids, eat it in fruit, vegetables, and other foods*)
- What would happen if we never put any water back into our bodies? (*we could not live*)
- What other ways do people use water? (*bathe in it, play in it, wash clothes, swim, canoe, dive, catch food in it*)
- What other kinds of living things need water? (*dogs, cats, birds, plants, **all** living things*)
- Where are all the places that we might find water? (*kitchen faucet, toilet, puddles, pond, river, ocean, dog dish*)
- What does it mean when we say that something can float? What are some things that you think might float in water? (*you might want to demonstrate this with one of the tubs of water and a small plastic boat*)
- What does it mean when we say that something will sink? What are some things that you think might sink in water? (*you might want to demonstrate this with one of the tubs of water and a rock or other object*)

Key Concepts

1. Write the sentence starter for the Key Concept, **Water is**_____ on chart paper. Ask everyone to think silently about how he/she would complete the sentence. Then ask for volunteers to come up to the chart paper and write down a few words that would complete the sentence.

2. Tell the students that throughout this unit on Water Homes, we will be talking about key concepts. These are the really important messages that we should remember about each of the activities. We will always write them out and put them on the wall so that we can refer to them again,

3. Use sentence strips and colored markers to record a few of the ideas the students contribute to complete the sentence:
Water is _____

4. Post the students' key concepts about water on the wall next to the record of the water brainstorming.

What does it mean to be a scientist?

1. Tell the students that in the next session they will travel in small groups (scientist teams) to three different activity stations set up around the room. At each station they will work together like scientists to discover even more things about water. Tell them that scientists work in special ways to help them discover interesting things about the world. Ask the students— what do you think scientists do to help them make discoveries? Lead a short discussion and record their ideas on a white board or chart paper.

2. Tell the students that they will now do a quick activity where they will act like scientists. Afterwards we will add to our list if we discover more things that scientists do. [some ideas are: follow directions carefully, make predictions, observe using all their senses, share their discoveries with others, try to figure out how what they discover in class has something to do with the way the world works]

3. Place a clear cup of water in the center of each small group of students. Distribute one sheet of paper to each student and a bunch of crayons for them to share. Tell them that their job is to carefully draw and color exactly what they see in the cup. Tell them to draw the cup too.

4. Give the students about 5 minutes to complete the assignment and then hold up the chart of the two cups (one with blue-colored water and one with clear) you have previously colored. Ask for a show of hands of how many students colored their water blue like the blue cup in your picture. How many left their water colorless as shown in the second cup on your picture? Which one do they think is actually a better representation of what the water really looks like? [colorless] Tell them that it is of course fine if they colored the water blue, that is how we think of water—afterall, water in lakes and the ocean looks blue. But when we are acting like scientists, we need to be careful to draw just exactly what we

see, not what we think we see, or how it has looked to us in the past.

5. Tell the students that as scientists, their job will be to look very, very carefully and learn all they can about water as they rotate to each of the three activities. Scientists have a special word to describe looking very carefully. They call it **observing**. But observing is not just about looking. Can you think of other ways to observe? Record their ideas and then share that when you observe, you use your five senses—listen, smell, taste, feel and see.

6. Tell them that in the next session they will get to do many more things that scientists do. Ask the students, are there things we can add to our list about what scientists do.

7. Hold up the Key Concept, read it aloud and then have students try to help you read it aloud a second time.

➢ **Scientists make careful observations using their five senses—hearing, smelling, tasting, touching and seeing.**

8. Ask for volunteers to draw a picture to go with the key concept and then post them together on the wall.

(Through the Activity)

Session 2: Water Station Activities

Introduction to the Stations

1. Have the students seated (on the rug or at the tables). Number the students 1–3 and tell them that all the ones will work together as a scientist team and so on. Point out that there are three different activity stations set up around the room. Briefly introduce the stations and hold up a few of the materials at each of them. Also introduce the adult or older student supervisor and describe their role to the students. Tell the students that they will have about 15 minutes at each station and at the end of that time, the teacher will say rotate. That is the signal they are to go with their small group (their scientist team) to the next station. Before they leave the station though, they are to return the station to exactly how it looked when they arrived there.

2. Remind the students that their job is to work together with their team of scientists and to observe all they can about water. Review what it means to observe.

Note: Before and during the rotation, you may also find it helpful to remind the adult helpers that their job is to facilitate the student's discoveries by asking questions that help focus the students on making more detailed observations, asking follow-up questions when students make observations, and also helping the students to make generalizations about their discoveries. (Note: the station instruction sheets suggest some questions that may help to facilitate the students' discoveries and understandings.)

3. Ask the students what they think scientists would do when they first go to a station. Call on a few students and then tell them that the very first thing they should do is listen to the directions that the adult or older student will share with them. It is very important that scientists follow directions.

4. Ask if there are any questions before starting the activities. Then, dismiss Team 1 to go to Station 1, Team 2 to Station 2 and so on. After 17 minutes, give a three minute warning and suggest they start to clean up the station and get it ready for the next team.

Station 1: Sink or Float?

Part I

1. Tell students that in this activity they will explore which objects sink and which float in water. Show the students a variety of materials and tell them that before they actually try the items in water, they need to **predict** which of the items they think will sink, and which will float. Ask the students if they know what the word

predict means. Lead a brief discussion, encouraging them to share their ideas. Then share with them that a prediction is what they think will happen based on what they already know or have experienced before. Tell them that scientists make predictions and then compare what really happens to what they predicted would happen.

2. Draw a line down the center of a sheet of chart paper. Write the word **Float** on one side and **Sink** on the other side. Tell the students that before they make predictions about sinking and floating, they first have to agree as a team what they mean by sink or float. Lead a short discussion and come to consensus about what it means to float or sink.

3. Distribute the Sink and Float worksheet to each student. Tell them to circle the items they predict will float and put an X through those that they predict will sink.

4. Challenge the students to make a statement about what kinds of things float or sink. Ask, "Can you make a statement like: 'all yellow things float.' That's a silly example, because we know that all yellow things don't float. Can you think of a true statement like that that isn't silly?" Write out their statements so that you can return to them later after the students have a chance to actually try some of the items.*Examples of some possible student responses:*

metal things sink, plastic things float, big things sink, heavy things sink, small things float

5. Have the students divide the items into two piles according to their predictions. For each of their predictions, ask them what observations or statements they can make about the item that made them think that it would float or sink. Ask the students if any of them have different ideas about whether a particular item will sink or float. This is a good opportunity to add to the statements on the chart above or point out those statements that they repeat.

6. Place the tub of water where all the students can have access to it. Have students take turns testing their predictions one by one by putting the items into the tub of water. Then have the students regroup the items into floaters and sinkers based on their results.

7. Ask the students: How did their predictions compare with the results? Have them refer back to their worksheets. Were they surprised with any of the results? Lead a brief discussion.

8. Challenge them to think of new statements we could add to our list about what kinds of things are floaters and what are sinkers. Ask if they think we should change some of the statements we

originally made. With each response, either ask the student(s) to demonstrate examples of their statements with the provided materials, or find examples yourself. After a few corroborating examples, demonstrate an example that doesn't fit their statement (if there is one). For example, if a student says "plastic things float", you can then show how a plastic spoon, a plastic container, and a plastic toy all float, but then demonstrate a sinking piece of plastic. You can then help them modify the statement to make it more accurately reflect the data, for example, "most of the plastics we tested float."

9. Tell them that plastic, metal, rubber are all different kinds of materials, they are made out of different things and have different properties that we can obesrve. Ask, what are some of the differences between those materials? [rubber bounces, metal makes a clang when we drop it.]

Key Concept:

- **Some materials tend to float in water, and other materials tend to sink.**

Part II

1. Show students a small piece of wax and ask them to predict whether it will sink or float. Test it in water for them, and point out that it floats.

2. Now do the same with your largest piece of wax. This time allow a few students to hold it and feel its weight before predicting. Test it, and point out that it floats. This will probably be surprising to your students.

3. Place all the other size pieces of wax in the water, and point out that wax floats, regardless of size. Tell them that even a piece of wax the size of a house would float.

4. Now show them a rock and ask them to predict whether it will sink or float. Test it, and point out that it sinks.

5. Show them some sand, and tell them that some sand is tiny pieces of rock. Ask them if they think tiny pieces or rock (sand) will float or sink. Test it, and point out that it sinks.

Key Concept:

- **Whether or not something floats or sinks depends on the material, not on the size of the object.**

Station 2: Boat Building

1. Place a tub of water and the container of pennies in the middle of the table. Ask students to describe what a boat looks like. Call on a few students to share their ideas and then ask, what is it about boats that help them to float in water? Have students share their ideas. If they say that it is the shape of boats that make them float, have them describe the shape. If they say that it is what boats are made out of, then ask for more details.

2. Give each student one sheet of aluminum foil. Tell them that their challenge is to shape their foil so that it will float like a boat. Have them make their boats and then take turns describing to their team why they made it that way.

3. Ask the group to **predict** which of their team's boats will float, which will sink and which boats will float the very best. For each prediction, ask them what observations about the boat make them think that it will sink or float.

Note: if this is the students first station and they have not yet discussed predictions, then lead a short discussion as follows: Ask the students if they know what the word predict means. Lead a brief discussion providing them the opportunity to share their ideas. Then share with them that a prediction is what they think will happen based on what they already know or have experienced before. Tell them that scientists make predictions and then compare what really happens to what they predicted would happen.

4. Have the students test their boats in the water. Did they float? If not, ask them why they think it didn't float and how they think they should change it so that it will float. Have the students reshape their boats until they do float.

5. Once all the boats are floating, ask the students if they think their boats might still be able to float if they loaded them with some pennies. Call on a few students and then ask them to predict how many pennies they think they could add to their boat before it sinks. If they say their boat will hold more than another student's boat, ask them why they think so. What observations and properties about the boats are they basing their prediction on?

6. Distribute the "Aluminum Boat Building" worksheet to each student and have them write down their prediction. Tell them to draw their boat while everyone gets a turn to test their prediction in the water.

7. Have the students count out the number of pennies that they

predict their boat can hold before it starts to sink. Then have them add the pennies to their boat, one at a time, as it is floating in the tub of water. If the boat is still floating after adding all the pennies they predicted it could hold, have them add more pennies, one at a time, just until the boat starts to sink. How many pennies did their boat actually hold before it sank? (They can count the pennies in their sunken boat to double-check the number they predicted.) How did the actual number compare to their predictions?

8. Ask the students:
• Which boat held the most pennies? Why so you think it could hold so many?
• Which held the least? Why do you think it could hold so few?
• How would you change the shape of your boat to hold more pennies?

Key Concept:

➢ **The amount of weight a toy boat will be able to hold and still float can be predicted by looking at the shape and size of the boat.**

Station 3: Water Drops

Part I

1. Give each student a toothpick, a sheet of drawing paper, a pencil, the laminated "Drag-a-Drop" worksheet and a sheet of wax paper. Have them place the wax paper over the laminated worksheet so that the figures on the worksheet show through.

2. Tell the students that you will place drops of water on the wax paper, but before you do that, they will draw a sketch of what they think the shape of the drops will look like if they get down low and look at the drop from the side. Ask—will it look like a pancake, a ball or a hill? After they have had a chance to draw it, have them describe the shape in words. Tell the students that they just made a prediction—what they thought it would look like based on experiences with water that they have already had. Tell them that scientists make predictions and then compare them to what actually happens when they try it. Tell them that now they will actually do it and observe what happens.

3. Place several small drops of water on the wax paper in the circle on each student's laminated worksheet. Now ask students to describe the shape of the drops. Remind them to make careful observations. How does the shape of the drops compare to their prediction? The students may observe that the drop has a round or hill shape.

4. Now challenge the students to use only the toothpick to

move the drops from the circle to the square. Tell them that it works better to use the side or edge of a toothpick to drag the drops—don't use the tip of the toothpick.

Ask some or all of the following questions:

- What happened to the drops?
- Did they break apart or stay together?
- Were they surprised by the results?
- Would someone like to try to explain what he/she thinks is going on with the water?

5. Now challenge the students to push or drag their drops into the square in the center. What happens when two drops get close together? Can students "cut" a drop in half with their toothpicks?

6. If you have time, distribute the maze worksheet and another sheet of wax paper to cover it to each student and challenge them to move their water drops through the maze. This time they can't use their toothpick; they need to pick up the maze and manipulate it around to get the water drop moving.

7., Ask the students if someone can describe what seems to be happening with the drops of water. [They seem to stick to each other.]

8. Tell the students that animals that live on the surface of ponds use this property of water to stay right on the surface—it looks like they are walking on the water.

Information for the Teacher: The "bubble" is caused by ***surface tension****. Surface tension is the elastic-like force that holds together and constricts the surface of any liquid. The molecules that make up water stick especially tightly together, like a skin, to make this surface layer. It is this thin, strong, surface tension that allows the water drops to be dragged with a toothpick and causes the drops to clump together as if they are attracted to each other. It is also surface tension on ponds and lakes that insects such as water striders and mayflies use to glide across the water. The plastic boat is propelled across the surface of the water (below) because the rubbing alcohol breaks the surface tension of the water.*

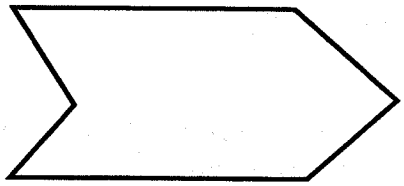
Part II

1. Tell the students that there is a cool thing that we can do to the water drops so that they will no longer "stick" to each other. Have the students move the water on their wax paper into two separate drops of water. Place one drop of rubbing alcohol on one of the water drops. Remind the students to observe very carefully. Ask—what happened to the water drop with alcohol? Does it look

different than the other drop? Challenge them to try to drag it. What seems to be happening to the drop of water with alcohol? [the drop flattens out like a pancake and it is impossible to drag it; the water is no longer "sticky."]

2. Tell the students that you have a final challenge for them. Put the plastic "boat" (made from the lid of a yogurt container) in the tub and watch it float. Tell the students that you want them to figure out a way to make the boat skim across the water. They can't touch the boat with anything, or pick up the tub or touch the water and they can only use materials here at this station. Lead a brief discussion about their ideas and then ask, what do you think will happen if we put rubbing alcohol in the water? Call on a few students and for every idea, ask them why they think that. Remind them how the drop of water spread out when you added a drop of alcohol.

3. Say, let's try it. Place a drop of rubbing alcohol behind the boat and watch the boat skim across the tub.



4. Ask, who would like to try to explain how the alcohol moved the boat? [the water lost its "sticky skin" and spread out. When the water started to spread, it moved the boat.]

Optional activity to use if the station runs shorter than the other stations. Challenge the students to predict how many water drops they can drop on a penny before the pile of drops spills off. After they predict, let them try it. You will be amazed! (Note: you will probably need to spend some time helping the students practice with the droppper.)

Key Concept:

- **Water drops seem to have a "stretchy skin."**
- **Water drops are attracted to one another.**

Session 3

Fill 'er Up Teacher Demonstration

1. Set up five plastic volume shapes at the front of the room on a demonstration table. Also set up, but keep hidden under a towel for now, two pitchers of water, a 2 cup clear measuring cup (or graduated cylinder) and five different colors of masking tape (or Post-it flags). Give each student a prediction sheet and a crayon.

2. Introduce the demonstration by reviewing the names of all the different shapes of the volume set—sphere, cube, pyramid, cylinder, and cone. Draw and label each shape on chart paper.

3. Explain that they will be practicing making predictions in this activity. Have students recall what a prediction is. Call on a few students to share their ideas. Then ask the students to predict which shape will hold the most water.

4. Distribute the worksheet "Which container will hold the most water?" to each student. Ask students to color-in the shape that they predict will hold the most water. Take a poll as to who voted for each shape. Ask students to explain why they think their prediction is correct.

5. Ask the students, now that they have made predictions, what should we do next? [Try it and compare what actually happens to what we predicted.]

My Buddy Says

This activity structure gives the students the opportunity to use language in meaningful ways, to increase their active listening skills and to hear language on a specific topic. It also encourages language risk–taking in a non–threatening environment. For the teacher, it provides an opportunity to determine what the students already know about a specific topic.

1. Group students in pairs at their seats and assign each student to be either #1 or #2.

2. Tell the students that each of them will have their turn to share their ideas about a question you will ask them, but first Buddy #1 will be given a question and Buddy #2 will just listen to their ideas and then share them with the whole class. Review with students what it means to really listen to a classmate, and how active listening looks.

3. Ask Buddy #1 the following question:

How would you figure out which shape holds the most water? Be really, really specific about the things you would need to use for your experiment.

4. Give Buddy #1 30 - 60 seconds to talk about their ideas to Buddy #2 (who listens only).

5. Ask several Buddy #2's what their Buddy #1 said about the question. Buddy #1 may correct misstatements by the reporting buddy, but cannot add new information. As they share, list their responses in words or pictures on the board.

6. Switch roles and remind the students that only one person in each pair is talking at a time - the other person is actively listening. Pose the following question for Buddy #2 to answer:

Now that you have heard some of the ideas of your classmates, how do you think you would figure out how much water each shape holds. What do you think of some of your classmates ideas? How would you add to them or change them in some way to make the experiment work even better?

7. Ask several Buddy #1's what their Buddy #2 said about the question. As they share, list their responses in words or pictures on the board.

Revealing the Materials for the Investigation

1. Tell the students that they are acting like scientists because they are asking a question and planning an investigation to find out the answer.

2. Tell them that you have brought in some materials that they could use to investigate their question about which shape holds the most water. Remove the towel covering the materials and hold up and describe each item. Point out which items were mentioned by students in the class, and which are additional items that you thought would work to answer the question.

My Buddy Says

1. Repeat My Buddy Says as above, but this time use the following two prompts:

Buddy #2 Prompt:

Describe to your buddy how you might use these items to figure out which shape holds the most water.

Buddy #1 Prompt:

> **Now that you have heard some of the ideas of your classmates, how do you think you would use these materials to figure out how much water each shape holds. What do you think of some of your classmates ideas? How would you add to them or change them in some way to make the experiment work even better?**

Let's Try the Investigation

1. Tell the students that based on their ideas, here is what we will do. Refer back to the students' ideas as you go through the following procedure.

2. Place a different color of tape or post-it flag on each shape. Point out to students that each shape has a special color. Have them circle each different shape on their prediction sheet with the corresponding color. This is how we will keep track of each shape and later match it to the amount of water it can hold.

3. Fill the cylinder shape with water from a pitcher. Allow each student the opportunity to observe and agree that the shape is filled. Now pour the water from the cylinder into a measuring cup or graduated cylinder. Mark the top of the water line on the measuring cup with the corresponding color of tape or post-it flag for the cylinder. This is how much water the first shape can hold (it's volume). Remind students that each shape has a special color and we are using that color to mark how much water the shape can hold.

4. Now do the same with the remaining shapes asking for volunteers to help you fill, pour and measure the amount of water that each shape can hold.

5. Have each student number the drawings on their prediction sheet, labeling the shape that could hold the most water #1 and the least #5 (depending on the number of shapes you are using.)

6. Have students write down on their worksheet which shape held the most water.

7. Finally, have volunteers come up to the front and working together, place the shapes in order from largest volume to smallest volume. Ask students what they observe. Do any shapes hold the same volume? Did anyone's prediction match the final result?

8. Hold up the key concepts and read them aloud.

- **We can make predictions and then measure the amount of water that different shapes will hold.**

- **The amount of water a container will hold is called the volume.**

Debrief

1. Tell the students that we have really been learning a lot about water and doing what scientists do. Let's review what we have learned so far.

2. Divide the class into four groups and tell them that each group will be given the materials for one of the water activities. Their job will be to remind the rest of us about what we did and learned at that station. They will also be given the key concept for their station and will need to draw a picture that illustrates the big idea. We will display the key concepts and pictures on our concept wall.

Group 1: Fill 'er Up
Group 2: Sink and Float
Group 3: Boat Building
Group 4: Water Drops

3. Allow time for the students to review and discuss their assigned activity and then illustrate the associated key concept.

4. After the groups have completed their drawing, give them the opportunity to share with the class. Ask the class if they have any questions or comments for each group after they present.

5. Ask—how have we been acting like scientists in the water activities we have been doing? Call on a few students to share as you record their ideas. [observe, measure, describe, do experiments, communicate, predict]

6. Tell the students that we will be learning a lot more about water and continue to do what scientists do as we do more activities from *Water Homes*.

(Beyond The Activity)

Session 4: Going Further

Where Is Water?

Look on local and regional maps to find the lakes, streams, rivers, marshes, bays, and ocean nearest your school. Have the class keep a running log on the wall or a bulletin board, listing all the places with water they see in their community. Visit one or more water sites as a class.

Water On the Web

You can explore more about water by visiting the website http://ga.water.usgs.gov/edu/index.html. Go to Activity Center and as one of the many choices, your class can vote for your favorite body of water (ocean, bay, pond, creek, etc.) and then find out how your vote compares to other people in your state.

Music

Teach the songs "Itsy Bitsy Spider" or "Row, Row, Row Your Boat" to the class. Have students bring in other water songs as they hear them.

Water Collage

Using old magazines, have the students cut out pictures and make collages that illustrate all the various ways water is used by living and non-living things (machines, cars, fire hydrants, drinking fountains, hoses). Have the students share their collages with the class and display them around the room.

Water Is.....

Ask students to come up with as many different sentences as they can starting with "Water Is _____." Record their sentences about water on the chalkboard, or on chart paper.

With adult help, have each student record one of their favorite water sentences on the bottom of a piece of paper. Ask students to illustrate their water sentence. Create a water bulletin board or make a class book on water. Read the book to the class, and check it out to students to read themselves.

Graphing

The boat building station provides a good opportunity to introduce graphs. How many students were able to float 20 pennies, how many could float 30 and so forth.

RESOURCES

For more information and materials on water and water conservation contact:

The California Department Of Water Resources
1416 Ninth Street, Room 338, P. O. Box 942836

Sacramento, CA 94236-0001
(916) 445-9371

- For information on how to adopt a local stream send for a free Save Our Streams booklet:
  The Izaak Walton League of America
  1401 Wilson Blvd., Level B
  Arlington, VA 22209

Station 1: Sink or Float
Instruction Sheet

Part I

1. Tell students that in this activity they will explore which objects sink and which float in water. Show the students a variety of materials and tell them that before they actually try the items in water, they need to **predict** which of the items they think will sink, and which will float. Ask the students if they know what the word predict means. Lead a brief discussion, encouraging them to share their ideas. Then share with them that a prediction is what they think will happen based on what they already know or have experienced before. Tell them that scientists make predictions and then compare what really happens to what they predicted would happen.

2. Draw a line down the center of a sheet of chart paper. Write the word **Float** on one side and **Sink** on the other side. Tell the students that before they make predictions about sinking and floating, they first have to agree as a team what they mean by sink or float. Lead a short discussion and come to consensus about what it means to float or sink.

3. Distribute the Sink and Float worksheet to each student. Tell them to circle the items they predict will float and put an X through those that they predict will sink.

4. Challenge the students to make a statement about what kinds of things float or sink. Ask, "Can you make a statement like: 'all yellow things float.' That's a silly example, because we know that all yellow things don't float. Can you think of a true statement like that that isn't silly?" Write out their statements so that you can return to them later after the students have a chance to actually try some of the items. *Examples of some possible student responses:*
metal things sink, plastic things float, big things sink, heavy things sink, small things float

5. Have the students divide the items into two piles according to their predictions. For each of their predictions, ask them what observations or statements they can make about the item that made them think that it would float or sink. Ask the students if any of them have different ideas about whether a particular item will sink or float. This is a good opportunity to add to the statements on the chart above or point out those statements that they repeat.

6. Place the tub of water where all the students can have access to it. Have students take turns testing their predictions one by one by putting the items into the tub of water. Then have the students regroup the items into floaters and sinkers based on their results.

7. Ask the students: How did their predictions compare with the results? Have them refer back to their worksheets. Were they surprised with any of the results? Lead a brief discussion.

8. Challenge them to think of new statements we could add to our list about what kinds of things are floaters and what are sinkers. Ask if they think we should change some of the statements we originally made. With each response, either ask the student(s) to demonstrate examples of their statements with the provided materials, or find examples yourself. After a few corroborating examples, demonstrate an example that doesn't fit their statement (if there is one). For example, if a student says "plastic things float", you can then show how a plastic spoon, a plastic container, and a plastic toy all float, but then demonstrate a sinking piece of plastic. You can then help them modify the statement to make it more accurately reflect the data, for example, "most of the plastics we tested float."

9. Tell them that plastic, metal, rubber are all different kinds of materials, they are made out of different things and have different properties that we can obesrve. Ask, what are some of the differences between those materials? [rubber bounces, metal makes a clang when we drop it.]

Key Concept:

- **Some materials tend to float in water, and other materials tend to sink.**

Part II

1. Show students a small piece of wax and ask them to predict whether it will sink or float. Test it in water for them, and point out that it floats.

2. Now do the same with your largest piece of wax. This time allow a few students to hold it and feel its weight before predicting. Test it, and point out that it floats. This will probably be surprising to your students.

3. Place all the other size pieces of wax in the water, and point out that wax floats, regardless of size. Tell them that even a piece of wax the size of a house would float.

4. Now show them a rock and ask them to predict whether it will sink or float. Test it, and point out that it sinks.

5. Show them some sand, and tell them that some sand is tiny pieces of rock. Ask them if they think tiny pieces or rock (sand) will float or sink. Test it, and point out that it sinks.

Key Concept:

- **Whether or not something floats or sinks depends on the material, not on the size of the object.**

Station 2: Boat Building
Instruction Sheet

1. Place a tub of water and the container of pennies in the middle of the table. Ask students to describe what a boat looks like. Call on a few students to share their ideas and then ask, what is it about boats that help them to float in water? Have students share their ideas. If they say that it is the shape of boats that make them float, have them describe the shape. If they say that it is what boats are made out of, then ask for more details.

2. Give each student one sheet of aluminum foil. Tell them that their challenge is to shape their foil so that it will float like a boat. Have them make their boats and then take turns describing to their team why they made it that way.

3. Ask the group to **predict** which of their team's boats will float, which will sink and which boats will float the very best. For each prediction, ask them what observations about the boat make them think that it will sink or float.

Note: if this is the students first station and they have not yet discussed predictions, then lead a short discussion as follows: Ask the students if they know what the word predict means. Lead a brief discussion providing them the opportunity to share their ideas. Then share with them that a prediction is what they think will happen based on what they already know or have experienced before. Tell them that scientists make predictions and then compare what really happens to what they predicted would happen.

4. Have the students test their boats in the water. Did they float? If not, ask them why they think it didn't float and how they think they should change it so that it will float. Have the students reshape their boats until they do float.

5. Once all the boats are floating, ask the students if they think their boats might still be able to float if they loaded them with some pennies. Call on a few students and then ask them to predict how many pennies they think they could add to their boat before it sinks. If they say their boat will hold more than another student's boat, ask them why they think so. What observations and properties about the boats are they basing their prediction on?

6. Distribute the "Aluminum Boat Building" worksheet to each student and have them write down their prediction. Tell them to draw their boat while everyone gets a turn to test their prediction in the water.

7. Have the students count out the number of pennies that they predict their boat can hold before it starts to sink. Then have them add the pennies to their boat, one at a time, as it is floating in the tub of water. If the boat is still floating after adding all the pennies they predicted it could hold, have them add more pennies, one at a time, just until the boat starts to sink. How many pennies did their boat actually hold before it sank? (They can count the pennies in their sunken boat to double-check the number they predicted.) How did the actual number compare to their predictions?

8. Ask the students:
• Which boat held the most pennies? Why so you think it could hold so many?
• Which held the least? Why do you think it could hold so few?
• How would you change the shape of your boat to hold more pennies?

Key Concept:

➢ **The amount of weight a toy boat will be able to hold and still float can be predicted by looking at the shape and size of the boat.**

Station 3: Water Drops
Instruction Sheet

Part I

1. Give each student a toothpick, a sheet of drawing paper, a pencil, the laminated "Drag-a-Drop" worksheet and a sheet of wax paper. Have them place the wax paper over the laminated worksheet so that the figures on the worksheet show through.

2. Tell the students that you will place drops of water on the wax paper, but before you do that, they will draw a sketch of what they think the shape of the drops will look like if they get down low and look at the drop from the side. Ask—will it look like a pancake, a ball or a hill? After they have had a chance to draw it, have them describe the shape in words. Tell the students that they just made a prediction—what they thought it would look like based on experiences with water that they have already had. Tell them that scientists make predictions and then compare them to what actually happens when they try it. Tell them that now they will actually do it and observe what happens.

3. Place several small drops of water on the wax paper in the circle on each student's laminated worksheet. Now ask students to describe the shape of the drops. Remind them to make careful observations. How does the shape of the drops compare to their prediction? The students may observe that the drop has a round or hill shape.

4. Now challenge the students to use only the toothpick to move the drops from the circle to the square. Tell them that it works better to use the side or edge of a toothpick to drag the drops—don't use the tip of the toothpick. Ask some or all of the following questions:

- What happened to the drops?
- Did they break apart or stay together?
- Were they surprised by the results?
- Would someone like to try to explain what he/she thinks is going on?

5. Now challenge the students to push or drag their drops into the square in the center. What happens when two drops get close together? Can students "cut" a drop in half with their toothpicks?

6. If you have time, distribute the maze worksheet and another sheet of wax paper to cover it to each student and challenge them to move their water drops through the maze. This time they can't use their toothpick; they need to pick up the maze and manipulate it around to get the water drop moving.

7., Ask the students if someone can describe what seems to be happening with the drops of water. [They seem to stick to each other.]

8. Tell the students that animals that live on the surface of ponds use this property of water to stay right on the surface—it looks like they are walking on the water.

Information for the Teacher: The "drops" are caused by ***surface tension****. Surface tension is the elastic-like force that holds together and constricts the surface of any liquid. The molecules that make up water stick very tightly together, like a skin, to make this surface layer. It is this thin, strong, surface tension that allows the water drops to be dragged with a toothpick and causes the drops to clump together as if they are attracted to each other. It is also surface tension on ponds and lakes that insects such as water striders use to glide across the water. The plastic boat is propelled across the surface of the water (below) because the rubbing alcohol breaks the surface tension of the water.*

Part II

1. Tell the students that there is a cool thing that we can do to the water drops so that they will no longer "stick" to each other. Have the students move the water on their wax paper into two separate drops of water. Place one drop of rubbing alcohol on one of the water drops. Remind the students to observe very carefully. Ask—what happened to the water drop with alcohol? Does it look different than the other drop? Challenge them to try to drag it. What seems to be happening to the drop of water with alcohol? [the drop flattens out and it is impossible to drag it; the water is no longer "sticky."]

2. Tell the students that you have a final challenge for them. Put the plastic "boat" (made from the lid of a yogurt container) in the tub and watch it float. Tell the students that you want them to figure out a way to make the boat skim across the water. They can't touch the boat with anything, or pick up the tub or touch the water and they can only use materials here at this station. Lead a brief discussion about their ideas and then ask, what do you think will happen if we put rubbing alcohol in the water? Call on a few students and for every idea, ask them why they think that. Remind them how the drop of water spread out when you added a drop of alcohol.

3. Say, let's try it. Place a drop of rubbing alcohol behind the boat and watch the boat skim across the tub.

4. Ask, who would like to try to explain how the alcohol moved the boat? [the water lost its "sticky skin" and spread out. When the water started to spread, it moved the boat.]

Optional activity to use if the station runs shorter than the other stations. Challenge the students to predict how many water drops they can drop on a penny before the pile of drops spills off. After they predict, let them try it. You will be amazed! (Note: you will probably need to spend some time helping the students practice with the droppper.)

Key Concepts:

- **Water drops seem to have a "stretchy skin."**
- **Water drops are attracted to one another.**

Background

Water is everywhere. It covers more than seventy percent of our planet's surface and makes up approximately the same percentage of our bodies. Life first appeared on this planet in the salty water of the ocean and as a fundamental part of all life, no living thing on earth can survive without it. As the most common substance on earth, we find it in the foods we eat and drink and the plants that grow around us. Earth is the only planet in our solar system known to contain water as a liquid. Astronauts passing over the earth from space have called it the "blue planet", describing the appearance of the world's ocean from a great distance. Our world ocean tempers the earth's climate so that life here can exist, keeping things from getting too hot during the day or too cold at night.

Water is composed of hydrogen and oxygen molecules. As temperatures change, these water molecules bind together in different forms. This change of structure is the reason for the different states of water: as a solid in ice, a liquid in water, and as a gas in steam or humidity. Seasonal changes bring us water with our weather in the forms of fog, rain, and snow that help to erode, sculpt, and shape the earth's continents.

There is a finite amount of water on earth. It is not "made" during rain and snowstorms, rather, the same water is recycled year to year and takes on each of its forms depending on seasonal changes. You may have heard some of the fanciful examples about how the same water we have today might have been wallowed in by dinosaurs or sipped by Cleopatra. The bad news is that water can be polluted in all the different stages of the water cycle—by an oil spill, acid rain, pesticides, etc.. We need to be aware, as the stewards of this water planet, not only of the many uses and properties of water, but also the limits of this precious resource, so that we are able to manage it wisely.

Water Water Everywhere
Home Activities

How Do Boats Float?
One of the classroom activities from this unit of study has your child exploring some of the interesting properties of water. One very popular segment of this activity has to do with boat building and floating. To try this at home you will need a dish tub filled with water, several pieces of aluminum foil, and 20 or so pennies. To begin you should each take a piece of aluminum foil and fold it into a shape that looks like a boat. Place them on the water to see if your boat floats. Next, make a prediction about how many pennies each of your boats will hold before they sink. Add pennies, counting them out one at a time, until the boats sink. How close did you come to your predictions? Could you make a different shape that could hold more pennies? Try again and see. Try other objects around the house that might float in your boats. Discuss the importance of not loading a boat so full that it will sink. Boats have lines on the side that tell boat owners how much can be loaded onto a boat before it will sink. Take a field trip to visit a body of water with boat travel (ocean, bay, river or lakes) and see if you can see a line on the side of a boat. A ride on a ferry boat affords a good look at boat travel. If you live near a seaport you might want to visit the docks to take a look at one of the huge cargo ships that travel international waters.

Where Is Water?
Visit a local lake, pond, creek, river, stream, bay, ocean or other body of water. If possible, try to see where the water came from (the mountains, a river, run-off from rain, etc.) and try to see where it might be heading (river to the ocean, creek to the bay, etc.). Try to figure out if the water is salty or fresh (bay and ocean would be salty). If you have a waste water treatment center near where you live, make a visit to find where our water goes when it leaves our homes.

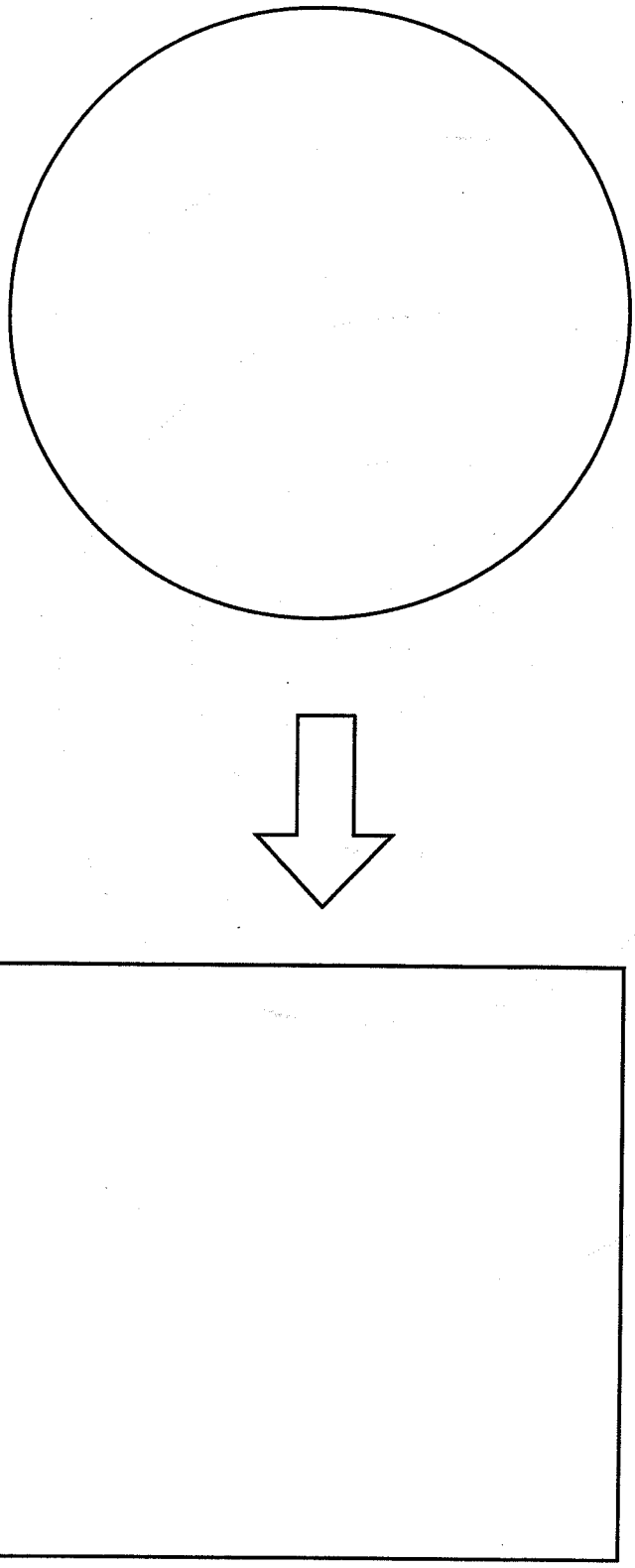
Water On The Web
How many faucets do you have that drip in your house? Where does the water in your home come from? What kind of water do you drink in your house, bottled or tap? If you have internet access visit the web site **http://ga.water.usgs.gov/edu/index.html.** Go to the Activity Center and click on "Questions" and learn more about water. Participate in some fun and interesting surveys that will give you information about the water use in your state.

Grocery Store Scavenger Hunt
Go to the grocery store and find as many different food items as you can that came from or lived in the water. See if your child can guess what kind of water home it came from, and have a brief discussion about the origins of each. Some of the items might include obvious ones like canned tuna fish, shrimp, crabs or lobsters. More surprising ones might include items that contain seaweed

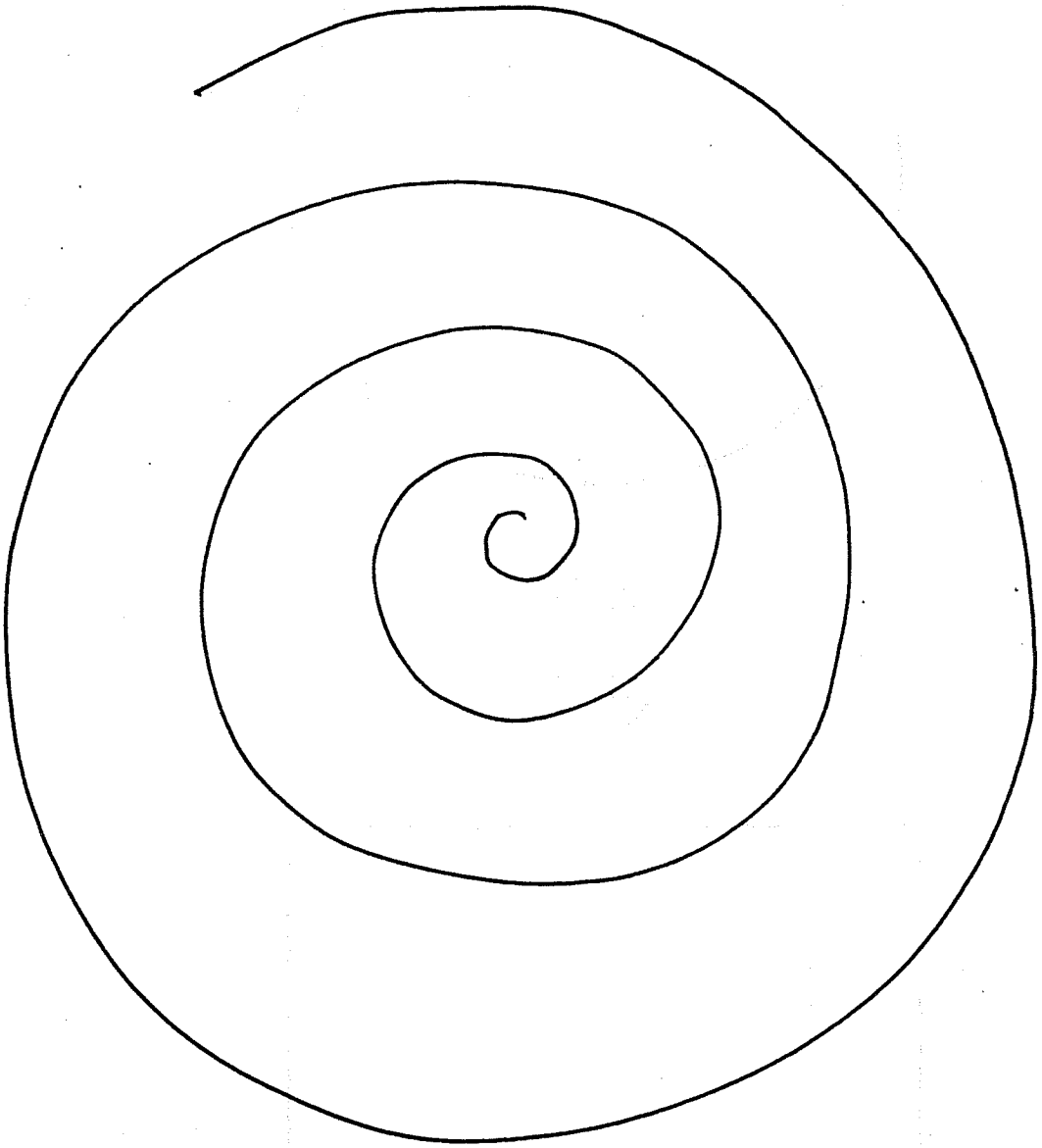
derivatives and have words like algin, sodium alginate, agar, or carageenan on the ingredients label. These might include macaroni and cheese, yogurt, and chocolate milk. Your youngster might be surprised to find out that favorites like "Fruit By The Foot" and even some ice creams have seaweed in them! Make a list of items you have found and to take to school and share with your class.

How Much Do We Use Water?
Keep track of all the ways that you and your family use water around the house for a whole weekend. Have a family discussion on Sunday evening about some of the ways that you could use less water in your house on a regular basis (turn off the faucet while brushing teeth, take a bath with your brother or sister, check for dripping faucets and fix ones that leak, etc.) Make a list with your child of the various ways that you used water, and include a few ideas about how your family is going to try to use less water. Send it to school to share with the rest of the class.

Drag-a-Drop Worksheet



MAZE Student Worksheet



_____

_____'s Experiment

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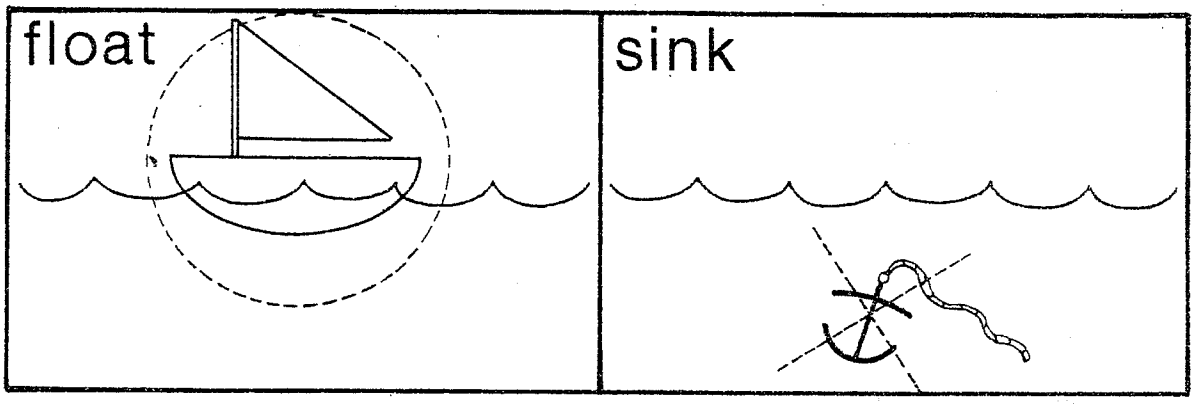
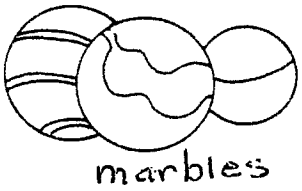
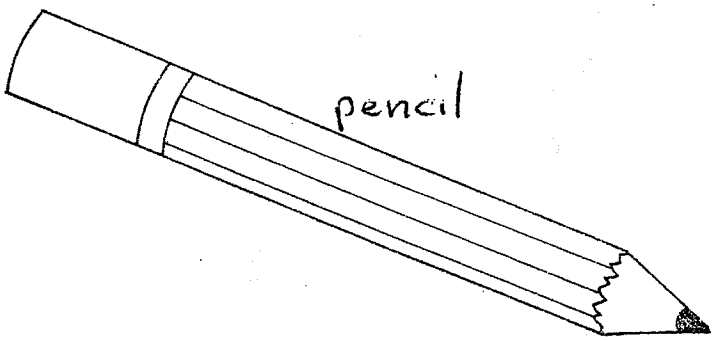
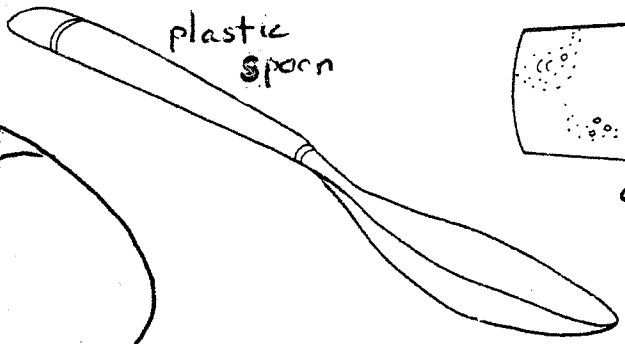
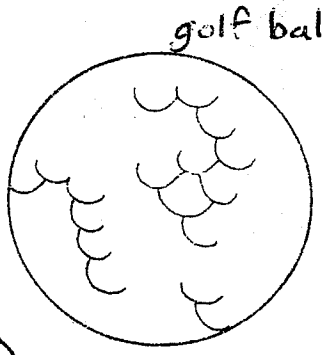


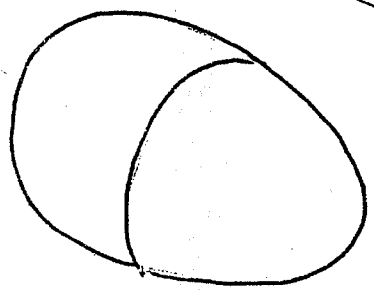

marbles

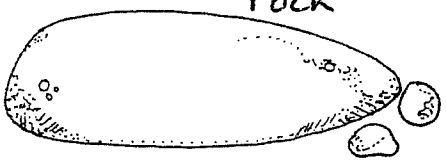

pencil


plastic spoon

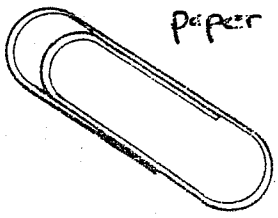

cork


golf ball


egg


rock


shell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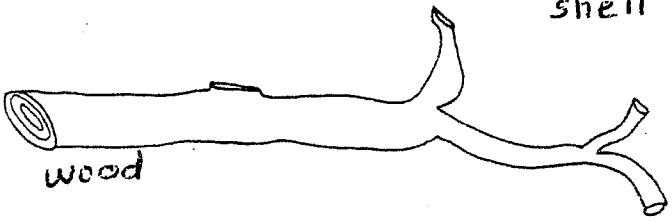

wood

Aluminum Boat Building

I predict my boat will float with _____ pennies.

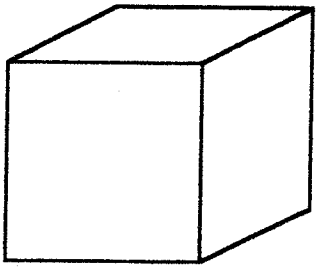
Here is my boat.

My boat floats with _____ pennies.

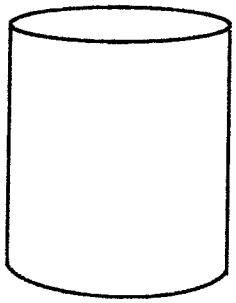
Name _____

Which container will hold the most water?

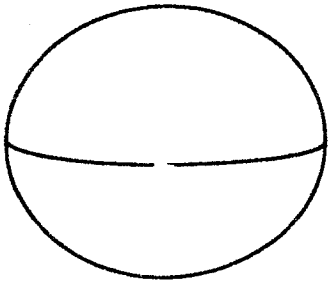
Color in your prediction.



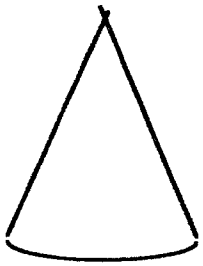
Cube



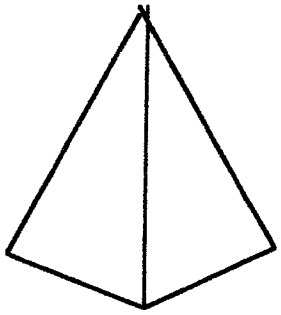
Cylinder



Sphere



Cone



Pyramid

The _____ held the most water.