DAY 3

*Estimation game: Challenge students to estimate a volume of colored water in milliliters. (Winners will be announced at the beginning of lunch.)

TEACHER DEMO: **SINKING ICE CUBE**

OBJECTIVE(s): After completing this demo, students will be able to:

- ▹ understand that ice cubes will not float in all liquids.
- ▹ be introduce to the concept of density.

MATERIALS:	
2-250 ml plastic beakers	isopropanol (rubbing alcohol)
water	ice cubes (colored-optional)

BACKGROUND INFORMATION:

Density is the amount of matter (stuff) present in a given volume or space. Density can be obtained by dividing the mass (g) of an object by its volume (cm^3). An object's size does not necessarily indicate its density. Just because an object takes up a lot of space does not mean that it is very dense. For example, a beach ball is larger than a softball but it less dense. Two identical sized objects can have the same volume but have different densities. This is due to the fact that one of the object's molecules are more compact/heavier than the other. For example, a ball of lead and a ball of Styrofoam. Some liquids are "heavier" or more dense than others, water is more dense than oil, that's why oil floats on water.

PROCEDURE:

1. In this activity, students will observe how ice cubes "act" in two different liquids (water/isopropanol). Fill one beaker with 200 ml of water and the other beaker will 200 ml of isopropanol.
2. Hold beakers up and ask students to make observations about each beaker and its contents.
3. After students have made their observations, ask student to predict what will happen to an ice cube when placed in each of the beakers. (Students will probably say it will float.)
4. Put an ice cube in the beaker containing water. Note what happens. It will float.
5. Put an ice cube in the beaker containing alcohol. Note what happens. The ice cube will float lower in the water (sinks).
6. Ask students to explain what they see and give explanations of why it happens.

ACTIVITY 3-1: **MAGIC RISING INK**

OBJECTIVE(s): After completing the activity, students will be able to:

- ▹ understand that water is the universal solvent.
- ▹ see that water can separate water soluble ink and produce a variety of colors.
- ▹ explore the process of chromatography
- ▹ discuss how different liquid densities affect the movement of pigment.

MATERIALS:

120 strips of chromatography paper (2 cm width x 12 cm length)
water soluble markers (visa vis)-black, brown, blue, green, (15 of each)
4-16 oz bottles of isopropanol (rubbing alcohol)

15 metric rulers	60 craft sticks (notched)
15 rolls clear tape	15 scissors
60-16oz plastic cups	6 plastic pitchers

BACKGROUND INFORMATION:

A **solvent** is a liquid capable of dissolving another substance. Water is called the universal solvent because of its ability to dissolve many substances in our environment. A **solute** is a substance that is dissolved by a solvent. For example, when mixing 20 grams of sugar with 80 ml of water, the water is the solvent and the sugar is the solute.

In this activity, water soluble ink (solute) is separated using the universal solvent, water. This will be achieved by the process called **chromatography**. Chromatography is derived from the Greek words *chroma*, for color and *graphein*, to write. As the water is absorbed by the chromatography paper, the ink is separated into its different components.

Water moves up chromatography paper due to adhesion. Adhesion is the force of attraction between molecules (water/paper). Another example of adhesion is when water clings to your hands. This adhesive quality of water is also responsible for its surface tension. Surface tension is a property of a liquid caused by unbalanced molecular cohesive forces at or near the surface. As a result, the surface tends to act like a stretched membrane.

PROCEDURE:

1. This would be a good time to introduce water as being the universal solvent. The terms **solvent** and **dissolving** might be appropriate discussion items. Before starting the activity have students pair up in groups of 2.
2. Give students chromatography paper, scissors and metric ruler.
3. Student should cut one end of each strip of chromatography paper into a point as shown in the Student Activity Sheet 3-1. *Hand out colored markers while students are cutting.
4. Have students place a small dot of ink 2 cm from the pointed end of each strip. Students will need 2 strips of each of the following; black, green, blue and blue on top of brown. When finished, students should also make a pencil mark 10 cm from the pointed end of the chromatography paper.
5. Have students attach the black and blue chromatography strips to a craft stick. This needs to be done for the water and alcohol cups. Repeat this procedure using the other colors. **<u>*REMIND STUDENTS:</u>** It is important that the strips are of equal length or hang evenly in the cups.
6. Students need to suspend the strips into the cup. Students need to make sure that the tip of the strip, but not the ink dot, touches the liquid.
7. The instructor should pour the amount of water or alcohol into the appropriate cup. The liquid level should only touch the tip of the chromatography strip.
8. Remind students to remove strips when the liquid reaches the 10 cm mark. Strips need to be set aside to dry.
9. Students need to color in the strips drawn on Student Activity Sheet 3-1.
10. Extension Activity: Have students make a design with water soluble ink pens on a round coffee filter. Make a funnel with the decorated coffee filter paper. Place the funnel in a jar of water, allowing the water to touch the tip of the funnel only. A colorful design will appear as the water moves up the funnel. Students can cut the filter paper in the shape of a butterfly or other design if they wish.

Discussion Questions:
1. What did the liquid do when the strips were put into the cups?
2. Why did you think the spots moved?
3. Did the water and alcohol move up the strips at the same rate?
4. What colors did you observe on your strips?
5. Did you see any patterns or similarities of colors from strip to strip?
6. What caused the color to move up the paper?

TEACHER DEMO: **CONDUCTION**

OBJECTIVE(s): After completing this demo, students will be able to:

- explore thermal expansion and contraction.

MATERIALS:	
Ball and Ring apparatus	ice
Votive candle	matches

BACKGROUND INFORMATION:

Thermal expansion is the expansion of a substance due to heat. Most substances - solids, liquids, and gases - expand when their temperature is increased. The molecules in a liquid experience an increase in kinetic energy (movement) when heated. As the molecules begin to move faster they move farther apart. This causes most liquids to expand when heated. When expansion occurs the volume increases, thus decreasing the density of the liquid. (Density is defined as the amount of matter (stuff) per unit volume.) For example, a tightly closed bottle of carbonated soda left in the sun may explode or at least bubble over when opened. One exception to this rule is that water expands when it is cooled between 4 °C and 0 °C (ice). (The density of water is 1 g/cm^3 and ice is 0.92 g/cm^3.)

Solids and gases behave similarly when their temperature is increased. For example, have you ever wondered why there are cracks between the squares of concrete? Concrete expands in hot weather and without these cracks the surface of the sidewalks would buckle. A hot air balloon is a good example of how thermal expansion acts on a gas. When the air is heated, it expands lowering the density of the gas which causes the balloon to rise.

PROCEDURE:

1. In this demonstration, students will observe how a metal ball passes freely through a metal ring unless the ball is heated or the ring is cooled.
2. Experiment with the ball and ring apparatus, either heating the metal ball or cooling the metal ring.
3. Have students talk about where the process of thermal expansion can be found or used in everyday life, i.e. opening bottles, etc.

ACTIVITY 3-2: <u>**MAKING HYDROMETERS**</u>

OBJECTIVE(s): After completing the activity, students will be able to:

- ▹ understand what a hydrometer is used for.
- ▹ construct a simple hydrometer.

MATERIALS:

15 test tubes	15 sets indelible markers
5 rolls of masking tape	2 rolls of paper towels
Student Activity Sheet 3-2	15-16oz plastic cups
6 plastic pitchers	15 metric rulers/scissors

3 containers of small lead fishing weights/masses (# will vary depending on their heaviness)

BACKGROUND INFORMATION:

Scientists use an instrument called a hydrometer to measure the density or "heaviness" of liquids. This is done by comparing the level at which the hydrometer floats in a liquid, to the level at which it floats in water. The term that is used to describe this comparison is called specific gravity (density). **Specific gravity** is a comparison, or ratio, of the mass of a substance to the mass of an equal volume of water. The reason why water is used as a comparison (for liquids and solids) is because it has a density of 1 g/ml.

PROCEDURE:

1. Start by introducing a hydrometer and what it does.
2. Have students get with a partner, groups of 2.
3. Give students the materials needed (**except** weights/masses) and have them turn to Student Activity Sheet 3-2 in their workbooks.
4. After student do step one, have them raise their hands so you can fill their glasses with water and pass out lead weights/masses.
5. Have students continue with steps 3 thru 6. Remind students to dry hydrometers thoroughly before doing step 7.

ACTIVITY 3-3: <u>**USING HYDROMETERS TO TEST SOLUTION "DENSITIES"**</u>

OBJECTIVE(s): After completing the activity, students will be able to:

- ▹ use a hydrometer to test different liquids.
- ▹ compare the densities of 4 different solutions.

MATERIALS:	
30 clear, plastic straws	1 box of food coloring
2-26oz containers of salt	1 gallon of distilled water
6 plastic pitchers	60 1oz cups
20-250ml plastic beakers	Red, Yellow, Blue, & Green color permanent markers (2 sets for each station)
hydrometers from Activity 3-2	

To make solutions for this activity, prepare 1000 ml of the following:

a. 0 % salt solution-obtain distilled water
b. 5 % salt solution-mix 53 g of salt with 1000 ml of water
c. 15 % salt solution-mix 176 g of salt with 1000 ml of water
d. Supersaturated solution-mix salt (approx. 350 g) 1000 ml of water until no more salt will go into solution.

BACKGROUND INFORMATION:

The density of a liquid can be changed by dissolving another substance (solute) into the liquid. A solution is a homogeneous mixture in which one substance is dissolved in another substance. To prepare a solution of any desired percent concentration consider the following example. A 10 % salt solution contains 10 grams of salt dissolved in each 100 grams of solution. Thus, 10 grams of salt added to 90 grams of water will yield 100 grams of 10 % salt solution.

$$\text{Percent solution} = \frac{\text{Mass of Solute (salt)}}{\text{Total Mass of Solution (solute + solvent)}}$$

PROCEDURE:

1. Set up 5 stations with the following materials:
   4-250ml beakers containing 200 ml of each of the following salt solutions:

   0 % salt, red food coloring
   5 % salt, green food coloring
   15 % salt, yellow food coloring
   Supersaturated salt solution, blue food coloring

   Hydrometers from Activity 3-2
   Paper towels
2. Students should use their hydrometers to measure and record the density of each solution.

3. Students need to place hydrometers in one of the four different solutions. Use the color pencil that matches the solution color to mark the solution/water level. Students should record their data on Student Activity Sheet 3-3.
4. Students need to **dry** hydrometers with paper towel before repeating procedure on another colored solution. Repeat step 3 with all 4 solutions.
5. When student group has completed solution testing, they need to form an hypothesis about the densities of each solution.
6. After students share hypothesis with instructor, they can test their hypothesis by using the following procedure.
7. Give each group of 2 students, four 1 oz cups and 2 clear, plastic straws. Depending on your group, have student design an experiment to test their hypothesis. *If students are having difficulties designing an experiment, demonstrate how they could test their hypothesis.
8. Closure in the form of a class discussion comparing results and asking questions.

TEACHER DEMO: **BURNING DOLLAR BILL**

OBJECTIVE(s): After completing the activity, students will be able to:

- describe how liquids with different densities are absorbed by a dollar bill.
- explain why the dollar bill does not burn.

MATERIALS:	
1-250ml plastic beaker	isopropanol/water mixture (2:1)
dollar bill	tongs
votive candle	matches
goggles	fire extinguisher

BACKGROUND INFORMATION:

An **observation** is information that is gained by using your senses. An **inference** is deriving a conclusion from past experiences and/or knowledge. Good observations lead to good inferences. For example, students may be quick to conclude that the liquid in the beaker is water because the most common clear liquid that they are familiar with is water. However, after closer observations, the students will note the distinctive odor of the clear liquid and form another hypothesis.

Why didn't the dollar bill burn? It has to do with the densities and adhesiveness of the two liquids. Since water is more dense and has a strong adhesive tendency than isopropanol, water soaks into the dollar bill first. The isopropanol, being less dense, coats the outside of dollar bill. When the dollar bill is placed in the flame, the first thing to burn off is the isopropanol. After the isopropanol has burned off, the water protects the dollar bill from going up in flames!

PROCEDURE:

1. Mix up a solution of 2/3 isopropanol and 1/3 water in the plastic beaker.
2. Show the students the solution in the plastic beaker. Ask them to make some observations only using their sense of sight (you may want to list observations on the board). Hopefully they will not **infer** automatically that it is water but will **observe** that it is a clear liquid.
3. After listing the student's observations, have the students form a hypothesis as to what the liquid might be.
4. Put on your goggles (modeling good safety procedures ☺). Ask students for a dollar bill and assure them that they will get it back. Darken the room if possible.
5. Using tongs, place the dollar bill in the beaker with solution. Make sure the bill is saturated with solution.
6. Light the candle **making very sure that it is at least 6 feet away** from the beaker.
7. With tongs, remove the dollar bill from the solution and place in the flame. It will catch on fire! You can either wait till the flame burns itself out or you can help it along. It will eventually go out by itself. Promise! ☺
8. Ask the students if they want to stay with their original hypothesis or do they want to change it.
9. Ask students if there are any other observations that could be made to determine what the liquid is. If there are no suggestions, you may want to ask them if there are any other senses they could use to help them out. (smell, touch, etc.) This is a good time to introduce the proper way to smell the odor of a liquid in the lab (using your hand to wave the odor to your nose, not deep inhaling over the container). Some students will probably suggest tasting as a sense you could use to test the liquid. Inform the students that tasting is very dangerous in lab situations because some chemicals can be very harmful if ingested.

ACTIVITY 4-4: **STACKING LIQUIDS**

OBJECTIVE(s): After completing the activity, students will be able to:

- ▹ recognize that different liquids have different densities.

MATERIALS:	
1-16oz Karo syrup	15 Styrofoam trays (from lunches)
1-16oz light cooking oil	food coloring-1 box
1-16oz glycerin	crayons
1-16oz water	paper towels
60-1oz plastic cups	balances with mass sets
4 plastic pitchers	floating items: wax, cork, fishing lead plastic bead, rubber stopper
15 soil profile tubes (or test tube w/ stoppers)	

To make the solutions for this activity, prepare 500 ml of the following:

- water with blue food coloring (medium blue color)
- glycerin with green food coloring (medium green color) (or baby oil)
- cooking oil
- Karo syrup (dark)

BACKGROUND INFORMATION:

Liquids, like many other objects, vary in "weight." Equal amounts of different liquids vary in "weight" because they have different densities. For example, when combining equal amounts of water and oil you will notice that the oil will float on top of the water. Other examples include oil floating on a puddle or an oil spill in the ocean. This occurs because one liquid is less dense than the other. The density of water is 1 g/cm^3, corn oil is .93 g/cm^3, glycerin is 1.26 g/cm^3, and Karo syrup is 1.38 g/cm^3. Other densities of different objects are: plastic 1.17 g/cm^3, rubber 1.34 g/cm^3, lead 11.3 g/cm^3, ice .92 g/cm^3.

PROCEDURE:

1. In this activity, students will be experimenting with liquids of different densities. After stacking the four liquids, students will drop different common objects into the stack of liquids to see where they "float." Objects with similar densities as the liquids will group together.
2. Have students work in groups of 2. Two groups will share one balance and mass set.
3. Prepare the solutions in large plastic pitchers. Styrofoam trays should be set up with 15-1 oz plastic cups for each solution.
4. Pour out equal amounts (1/4 oz) of each solution into the small plastic cups.
5. Distribute one cup of each solution to each group of 2 students.
6. Students should predict by observation (sight, lifting) the order of "heaviness" of each liquid. Students should record predictions on Student Activity Sheet 4-4.

7. After making predictions, students should use their balances and mass sets (the ones they made on Day 1) to check their predictions. Each student should mass out one of the solutions.
8. Students should pour solutions into the soil profile tube in decreasing order of density or "heaviness." Instructor should demonstrate how to carefully pour solutions into the profile tube so liquids don't mix. For example, the "heaviest" first, then so on. Record results on Student Activity Sheet 4-4.
9. Each group of students will need a set of floating items (cork, lead fishing weight, plastic bead, wax, rubber stopper).
10. Students should drop each item in and observe what occurs. They should note where each item "floats" in the tube and record their observations.
11. The soil profile tubes and the floating items all need to be cleaned for the next camp.

DISCUSSION QUESTIONS:

1. Which solution was the most dense? How do you know?
2. Which solution was the least dense? How do you know?
3. Discussion of where they see examples of different liquid densities in their environment, i.e. oil on a puddle, etc.
4. What if ice was denser or "heavier" than liquid water? What would happen to a pond or lake during the winter?

DAY 6

*Estimation game. Challenge students to guess the number of marbles present in the plastic container. (Winners will be announced at the beginning of lunch.)

TEACHER DEMO: **FLOATING EGG**

OBJECTIVE(s): After completing this demo, students will be able to:

- discover that salt water is more dense than freshwater.
- explain why an object floats higher in salt water than it does in freshwater.

MATERIALS:	
6-9oz plastic cups	1-26oz container of salt
6-16oz plastic cups	6 plastic spoons
6 fresh eggs	6 plastic pitchers

BACKGROUND INFORMATION:

Objects float more easily in the ocean than in lakes. Each gallon of sea water contains approximately 1/4 pound (113.5 grams) of sea salt. The presence of salts in sea water causes the density to be greater than that of freshwater. Therefore, an object is more buoyant in sea water than it is in freshwater. Buoyancy is the force of a fluid that pushes an object up. An object floats in fluids because the buoyant force (the upward push) on the object is equal to or greater than the object's weight (downward push).

PROCEDURE:

1. In this demonstration, the students will observe a fresh egg sinking in freshwater. (If the egg is not fresh, the egg will float in freshwater.) They will also observe the fresh egg floating in a denser solution, salt water.
2. This demonstration will be done in small groups (5 students), each led by an instructor. Therefore, 6 stations will need to be set up.
3. Fill both containers (16oz & 9oz cups) 3/4 full of water.
4. Place egg in the 9oz cup and discuss observations with students.
5. Use plastic spoon to remove egg and place it into the 16oz cup.
6. Add salt to the 16oz cup, stirring occasionally, until the egg starts to float.
7. Pull all groups together and conduct a group discussion.
8. Optional: Coloring the egg before using it will make it easier to see.

DISCUSSION QUESTIONS:

1. Why did the egg sink in freshwater?
2. Why did the egg float as we added salt to the water?
3. Which would be easier for you to do, back float in a swimming pool or back float in the Pacific Ocean? Why?

ACTIVITY 6-1: **SINK OR FLOAT**

OBJECTIVE(s): After completing the activity, students will be able to:

- discover why some items sink and others float.

MATERIALS:	
10 small bottles of white glue	100 pennies
10 corks	10 crayons
10 rubber bands	10 plastic spoons
10 clear film canisters w/lids	10 small pieces of sponge (2"x2")
10 twist ties	10 pencils
10 small pieces of ivory soap	10 small pieces of Jergens soap
10 small balls of aluminum foil	10 large paper clips
10 plastic dish tubs	6 plastic pitchers

BACKGROUND INFORMATION:

An object will usually float in a liquid that is more dense (heavier) than the object and will usually sink in a liquid that is less dense (lighter) than the object. If the density of an object and a liquid is similar, the object will be "suspended" at some level in the liquid.

Archimedes' Principle states that the buoyant force on an object is equal to the weight of the fluid displaced by the object. An object floats because it displaces a weight of fluid equal to or greater than its own weight.

PROCEDURE:

1. In this activity, students will predict which of the objects will float or sink in water. Using a tub of water, students will test their predictions.
2. Students will work in groups of 3. If weather permits, this activity can easily be done outside.
3. Students should follow the directions on Student Activity Sheet 6-1 to complete the activity.

DISCUSSION QUESTIONS:

1. Why did some object floats while others didn't?
2. Why doesn't a large, metal ship sink in the ocean?
3. In Part B of the activity, how can you explain that a penny can float when it's inside a canister?
4. In Part C of the activity, did anyone succeed in sinking the cork without touching it?

ACTIVITY 6-2: **FRUITY ADVENTURE**

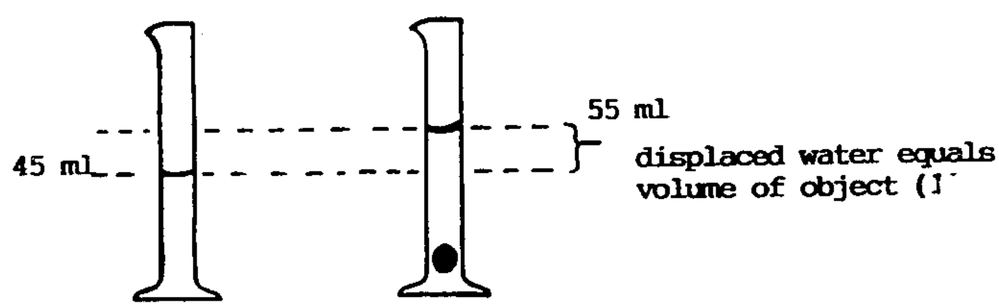
OBJECTIVE(s): After completing the activity, students will be able to:

- observe the difference that a peel or shell has on the density of fruits.
- explore a method of finding the volume and the density of irregular shaped objects.

MATERIALS:	
10 small lemons	1 apple/1 banana
1 bag of peanuts w/shells	10 calculators
10-50 ml graduated cylinders	10 balances
10-10 ml graduated cylinders	Student Mass Sets (Day 1)
10-250ml plastic beakers	

BACKGROUND INFORMATION:

The volume of an irregularly shaped object (peanut or lemon) can be measured with a graduated cylinder or beaker. The object should be lowered into a predetermined volume of water. When the object is lowered into the water, it will displace a certain amount of water. The increase in the water level is the volume of the object in milliliters. To measure the volume of an object that floats in water, you need to submerge it. You can push it just beneath the surface of the water with the tip of a pencil.



$$\text{Density (g/cm}^3) = \frac{\text{Mass (g)}}{\text{Volume (cm}^3)} \qquad 1\ \text{cm}^3 = 1\ \text{ml}$$

* See background information on Conduction Demo and Sinking Ice Cube Demo (Day 3).

PROCEDURE:

1. In this activity, students will find the density of irregular shaped objects using a balance and graduated cylinder. They will also observe the difference a peel/shell has on the ability of certain fruits to float or not.
2. Students will be working in groups of 3. For added assistance during this activity, each instructor should be assigned 2 groups.
3. Have students use their mass sets to find the mass of a small lemon and a peanut with shell. Record their results on Student Activity Sheet 6-2.
4. Have students use the graduated cylinders and beakers to find the volume of the same lemon and peanut (w/shell). The students will need to use the water displacement method in order to complete this section.
5. Have students peel the lemon and remove the shell from the peanuts. Repeat steps 3 and 4 with the peeled lemon and shelled peanuts.

6. Using the formula above and the calculators, have students calculate the density of the lemon (with peel and without peel) and the peanut (with shell and without). **Instructor assistance crucial.**
7. After calculations are completed, pull students back into large group to discuss results. (Instructors may want to find an average density for each object.)
8. If time permits, use an apple and a banana for additional demonstrations.

DISCUSSION QUESTIONS:

1. Ask students to predict what would happen to other common fruits in water. Would they float or sink?
2. Can you make them sink? Float?
3. Discuss dispersal techniques of seeds (fruit).

ACTIVITY 6-4: **CLAY BOATS**

OBJECTIVE(s): After completing the activity, students will be able to:

- design a boat that floats with 50 grams of clay.
- understand the relationship between surface area and buoyancy.

MATERIALS:	
30 bags of clay	5 rolls of paper towels
10 balances	10 plastic tubs
Student mass sets	20 boxes of paper clips
30 certificates	6 prizes (for top 2 teams of 3)

PROCEDURE:

1. In this activity, students will design a boat made up entirely of clay.
2. Students should be divided into teams of 3. Each student will construct their own clay boat. Prizes will be awarded to the team whose boat can carry the most cargo (paper clips).
3. Students should obtain a bag of clay, their mass sets, and two boxes of paper clips.
4. Students should follow directions on Student Activity Sheet 6-3 to complete the activity.
5. Instructors should set up balance and tub stations where students can mass out their clay (50 g) and test their boats. Instructors should also set up an official balance and plastic tub for the final cargo testing.
6. Students should be given approximately 1 hour to have your boats in line for official testing. Remind students to name their vessel!
7. Any boat that masses out greater than 50 grams at the official mass in, students will be allowed 5 minutes to make necessary adjustments.

DISCUSSION QUESTIONS:

1. What is the best shape or design from carrying the largest amount of cargo?
2. What types of boats have you seen carrying large loads of cargo up the Columbia or Willamette Rivers?
3. Why are the bottoms of barges so wide?
4. How could **you** construct a vessel that could act like a barge and carry a large load of cargo?

ACTIVITY 9-4: **HYDROMANIA RAFT REGATTA**

OBJECTIVE(s): After completing the activity, students will be able to:

- ▷ construct a raft capable of holding one of their team members.
- ▷ work as a team to reach a common goal.

MATERIALS:	
24-3/8" wooden dowels	24-gallon milk jugs with lids
Duct tape-2 1/2" rolls	string

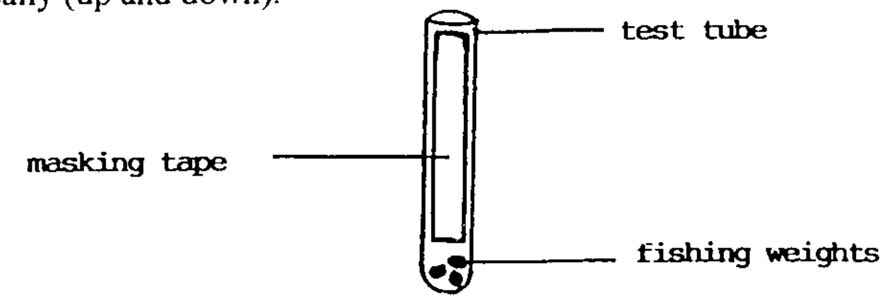
PROCEDURE:

1. In this activity, a team of 5 students will work together to construct a team raft capable of holding 1 team member. Students will race these rafts against other teams from both Hydromania Summer Camps.
2. Instructors should give a brief explanation of this activity, stressing the materials each team has at their disposal and the importance of team work.

Student Activity Sheet 3-2

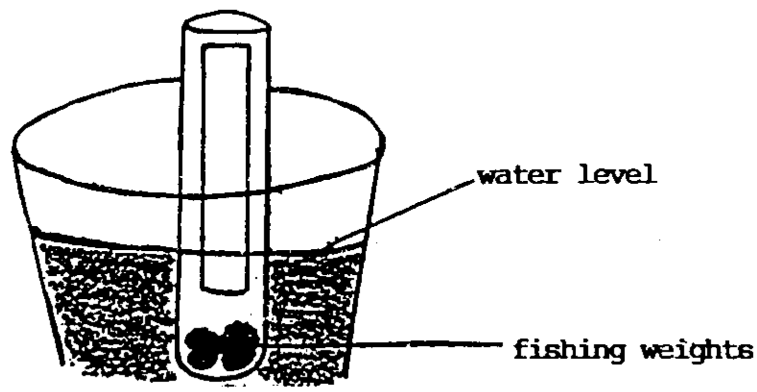
MAKING HYDROMETERS

1. Put a masking tape label on your test tube. The label should be attached vertically (up and down).

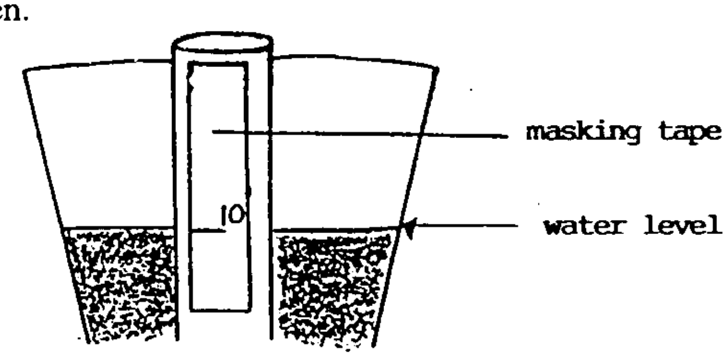


2. Carefully, drop a few fishing weights into the test tube.

3. Put the test tube in the water and add more weights until the test tube floats in an upright position (not tilted). How many weights did it take?____________

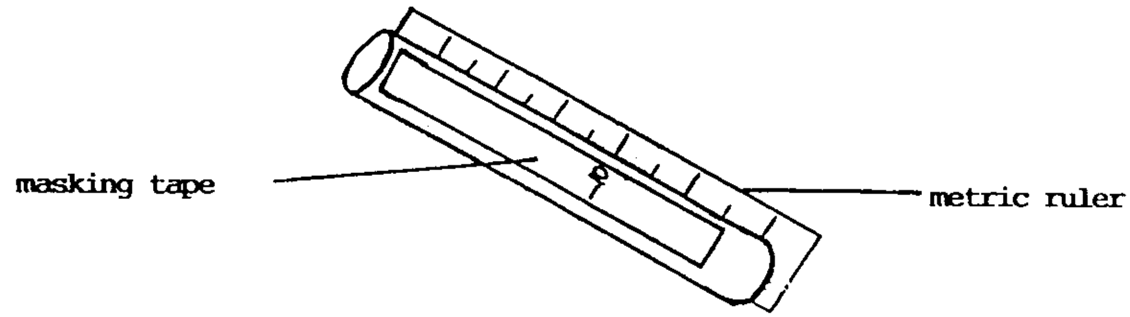


4. Holding the test tube gently against the cup, mark the water level on the tape with a marking pen.

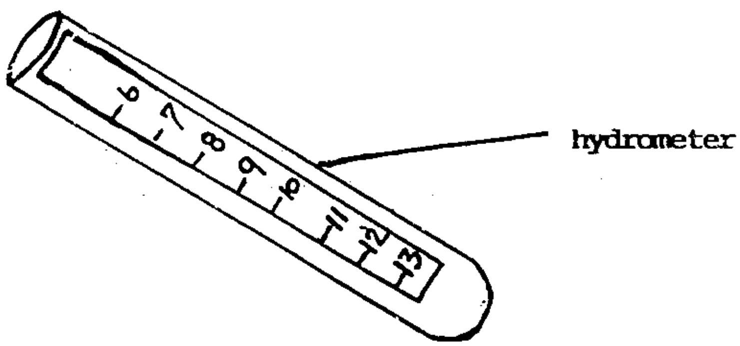


5. Write the #10 next to the water level mark you made.

6. Using the metric ruler and pen, put a mark 1 cm apart, above and below the #10.



7. Write numbers less than 10 (9,8,7,etc.) next to the marks **above** the 10 mark. Put numbers greater than 10 (11,12,13,etc.) next to the marks **below** the 10 mark.



In the next activity you will use your hydrometers to determine which liquids are denser then others!

Student Activity Sheet 3-3

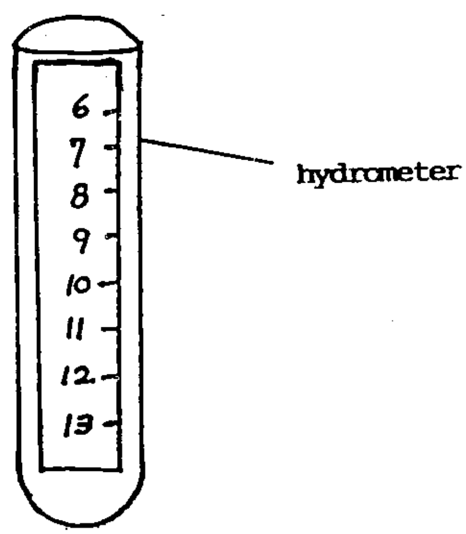
USING HYDROMETERS TO TEST SOLUTION "DENSITIES"

Use your hydrometer to determine the density of the four colored solutions.

1. Choose 1 beaker containing a colored solution. Place your hydrometer into the beaker and observe how low/high it floats in the solution. Place a mark on your hydrometer that represents the solution's level. Use a permanent marking pen that matches the color of the solution to make your mark.

***DRY HYDROMETER WITH PAPER TOWEL BETWEEN SOLUTIONS.**

2. Mark all 4 levels with the appropriate colors on the hydrometer below. For example, **red** solution-**red** permanent marker, **green** solution-**green** permanent marker, etc. The hydrometer should have 4 different colored marks when you are done.

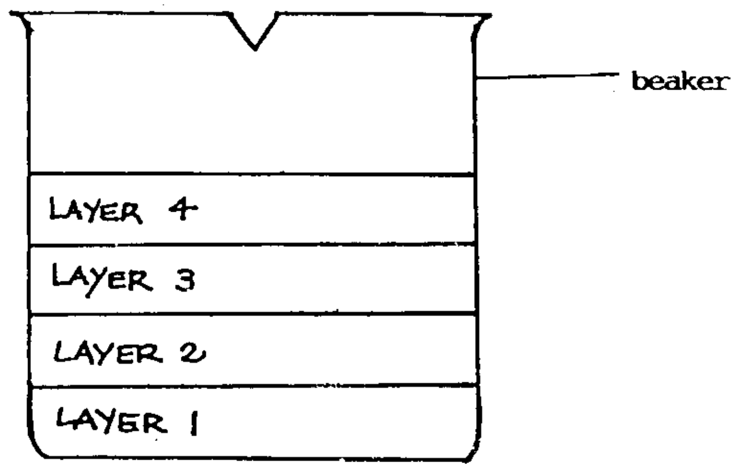


3. Now that you have finished your testing, form a hypothesis comparing the densities of each of the four solutions.

MY HYPOTHESIS IS____

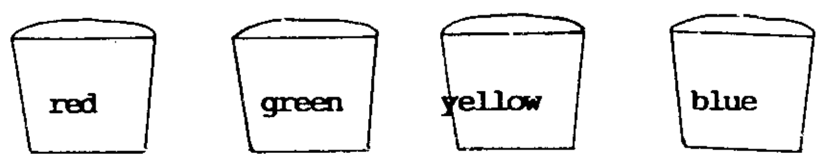
____

4. Using your hypothesis, color the diagram below to show how the solution would stack in a beaker.



5. After having your hypothesis checked by an instructor, obtain 2 clear, plastic straws and four 1 oz cups.

6. Your instructor will fill the 1 oz cups with different colored solutions.



7. Using the straws and colored solutions, design an experiment that will test your hypothesis. Use the space below to describe your experiment. You may use diagrams.

8. After experimenting with the straws and solutions, are you confident with your hypothesis or would it be necessary to change it and retest?

Student Activity Sheet 6-1

SINK OR FLOAT

ACTIVITY 6-1, PART A.

1. List each of your "sink or float" items under the "object" column below.

2. Before testing each object be sure that you predict whether it will sink or float in the prediction column. You may use S for sink and F for float.

	OBJECT	PREDICTION	ACTUAL RESULT
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
15.			

3. Fill the plastic tub with water and test each of the objects by placing them in the tub full of water. Record the results with a S or a F in the actual result column.

ACTIVITY 6-1, PART B.

4. Remove all objects from the plastic tub.

5. Place the film canister w/ lid in the water. Does it sink or float?_______

6. Drop a penny in the water. Does it sink or float?_______

7. How many pennies do you predict can be placed into the film canister before it sinks?_______

8. Add one penny at a time to the canister until it sinks. You will need to replace the lid after adding each penny.

9. How many pennies did the canister actually hold?_______

ACTIVITY 6-1, PART C.

10. Make sure the plastic tub is cleared of all materials.

11. Drop a cork in the water.

12. Try to sink the cork without touching it. Can it be done?

Student Activity Sheet 6-2

FRUITY ADVENTURE

1. Obtain a balance, your mass sets, a lemon and a peanut.

2. Use the balance and your mass sets to find the mass of the lemon and the peanut in grams. Record your results in the space provided below, Data Table 1.

3. Use the a beaker and graduated cylinder to find the volume of the lemon and the peanut. Record your results in the Data Table. **(Your instructor will demonstrate the water displacement method of finding volume.)**

4. Now, peel the lemon and take the peanut(s) out of its shell. Mass each object using the balance and record your results in the Data Table.

5. Find the volume of the peeled lemon and shelled peanut(s) using a beaker and the graduated cylinder. Record your results in the Data Table.

Data Table 1

OBJECT	MASS (g)	VOLUME (ml)	DENSITY (g/ml)
LEMON (with peel)	g	ml	g/ml
LEMON (without peel)	g	ml	g/ml
PEANUT (with shell)	g	ml	g/ml
PEANUT (without shell)	g	ml	g/ml

6. What happened to the **volume** of the lemon and peanut when you removed their peel/shell?

7. What happened to the **mass** of the lemon and peanut when you removed their peel/shell?

8. When did the lemon/peanut float in water, with or without the peel/shell?

9. Why did the objects float when they had a peel or shell on them?

10. What do you think would happen if you put a unpeeled banana in water? an unpeeled apple?

11. OPTIONAL: Can you make a banana/apple sink in water?

Student Activity Sheet 6-3

CLAY BOAT REGATTA

NAME OF BOAT____

AMOUNT OF CARGO______________________________

PURPOSE: To build a boat made <u>entirely</u> from clay that will carry in addition to its own weight, 100 grams of cargo (paper clips).

RULES:

1. Work in groups of 2. Each person will make a boat of their own.
2. All boats will be made with 50 grams of clay (no more).
3. All boats will be constructed <u>entirely</u> of clay.

SCORING: The team of boats that carries the most cargo (combined paper clips) will be the winners!

Prizes will be given for first through fourth place teams.

PROCEDURE:

1. You will have 30 minutes to construct and test your clay boat. (make sure it floats ☺ !)
2. After you are satisfied with your design, turn in your boat to the instructor. Be sure you have a **name** for your boat.
3. The order of cargo testing will be decided by which teams turn in their boats to the instructor first, second, and so on.
4. When each team has turned in their boats, we will begin cargo testing. The owner of the boat will be the person who will deposit the cargo on the boat.
5. Prizes will be awarded to the four teams that carry the most cargo with their boats.