<u>ELEMENTARY SCIENCE PROGRAM</u>

MATH, SCIENCE & TECHNOLOGY EDUCATION

A Collection of Learning Experiences

BUOYANCY

Buoyancy Student Activity Book

Updated 6/09

Name____

This learning experience activity book is yours to keep. Please put your name on it now. This activity book should contain your observations of and results from your experiments.

When performing experiments, ask your teacher for any additional materials you may need.

TABLE OF CONTENTS

Activity Sheet for Learning Experience #2 Name________________________________

CLAY BOATS

In order for an object to be submerged in a liquid, the object must push aside or displace some of the liquid it is contained in. That is why the level of the water in a bathtub rises when you get in! You do not absorb, or soak up, the water you displace it, or push it away.

Draw your three best boat designs.	Mass of cargo
1.	____ # of ceramic cylinders held by the boat without sinking
2.	____ # of ceramic cylinders held by the boat without sinking
3.	____ # of ceramic cylinders held by the boat without sinking

What boat design out of the three your group has created held the most cargo?

____

Why does this boat design hold more cargo than the other two designs?

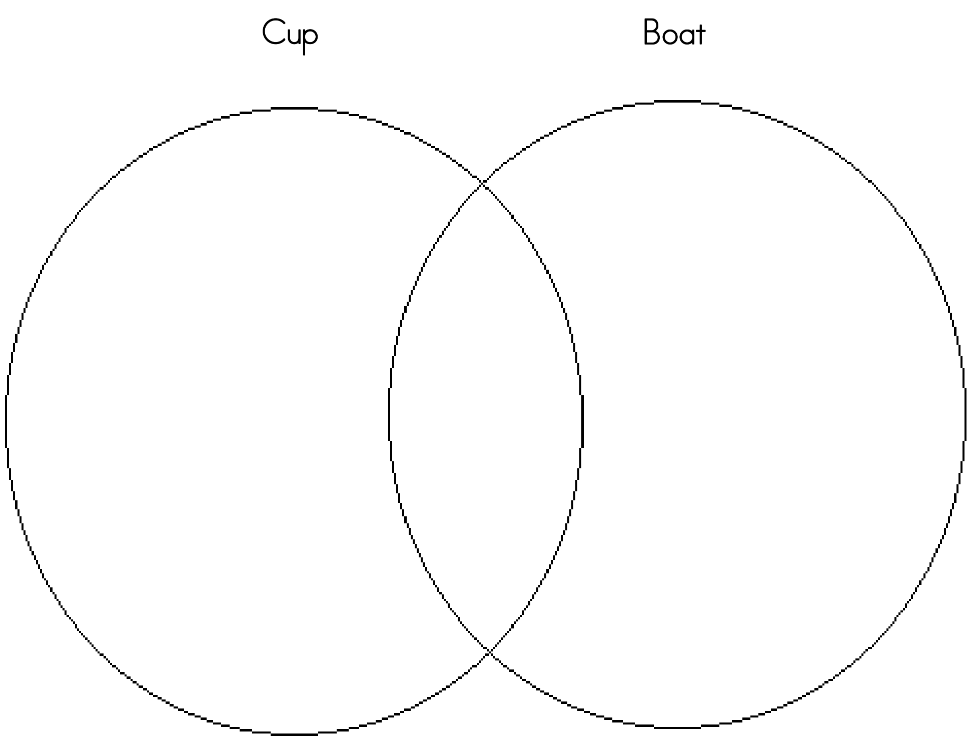
____

____

If you could create one more boat design what would it look like and why would you create it that way?

Student Observation Sheet for Learning Experience #3 Name ______________________

Observations for the Cup	Observations for the Boat
Shape:	Shape:
Height:	Height:
Width at Base:	Width at Base:
Number of cylinders held:	Number of cylinders held:
Other Observations:	Other Observations:



Activity Sheet for Learning Experience #4 Name________________________________

MEASURING MASS

Record the mass of each number of ceramic cylinders in the chart below.

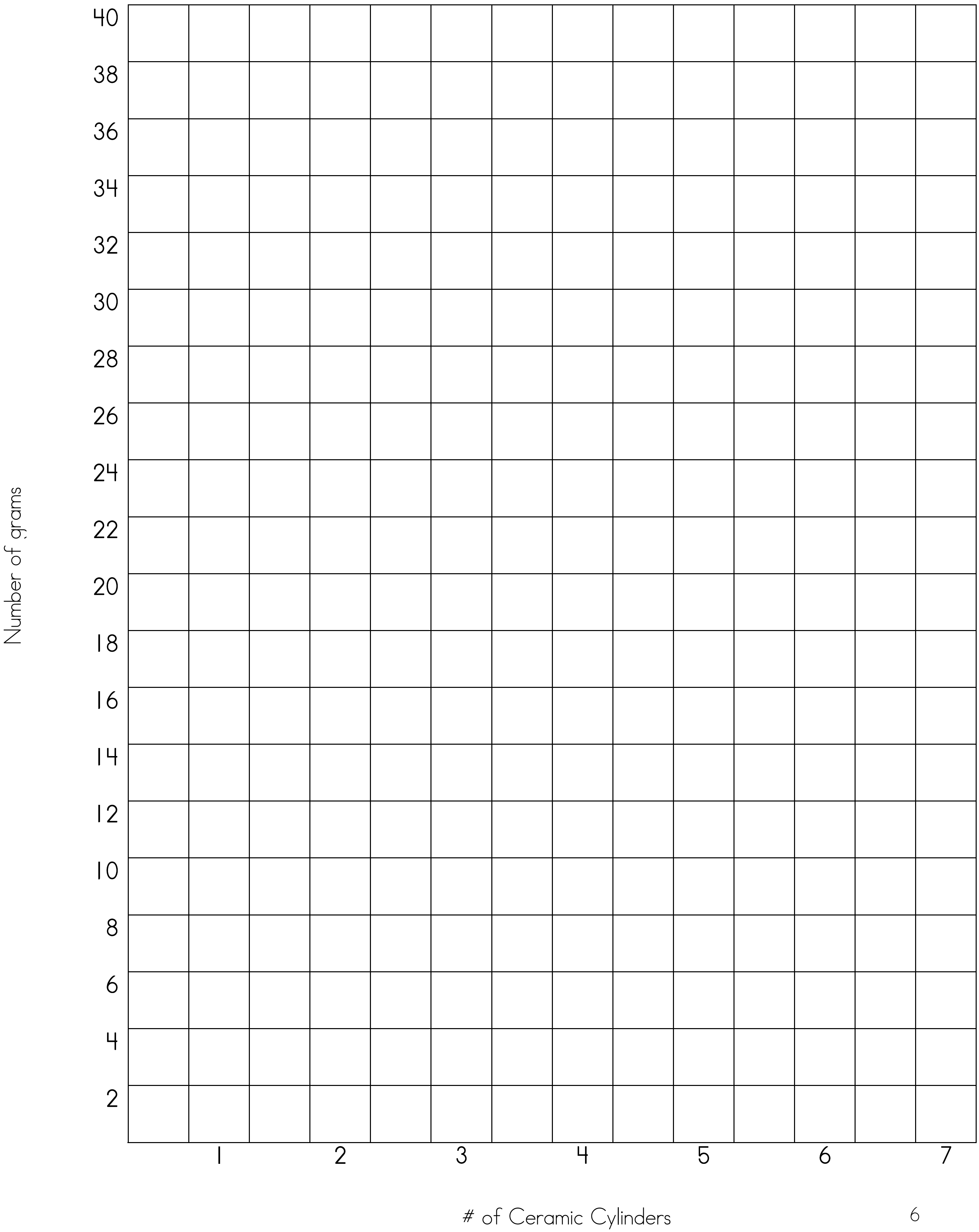
Ceramic Cylinders	Grams
1	
2	
3	
4	
5	

Create a line graph based on the data in the chart above on page 2 of this activity sheet.

Look back to your activity sheet for Learning Experience #2. You created a chart showing your three best boat designs and how many ceramic cylinders they would hold. Let's figure how many grams each boat would hold.

Boat design	Mass of cargo in ceramic cylinders	Mass of cargo in grams
#1		
#2		
#3		

Measuring Mass of the Ceramic Cylinders

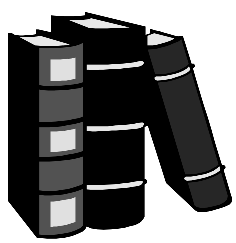


Activity Sheet for Learning Experience #5 Name______________________

WHAT MAKES A GOOD BOAT?

Use the research materials provided to fill out the chart below on your type of boat.

The boat I am researching is: ____

1. History of the boat. Who developed the boat or how was it developed? Where was this boat developed? What was the boat used for or why was it developed? 	
2. Describe the boat. What does it look like? 	

3. What is the boat made of? (Materials it is made of) 	
4. How does it move? (Propulsion) 	

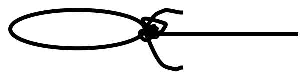
Draw a picture of your boat in the box below. Try to fill most of the box with the picture of the boat, not the water it floats on, so you can easily share your picture with the class.

*Be sure to label any special features of your boat.

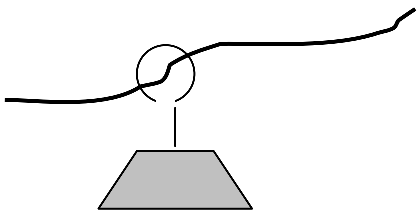
Activity Sheet for Learning Experience #7 Name______________________

MEASURING BUOYANT FORCE

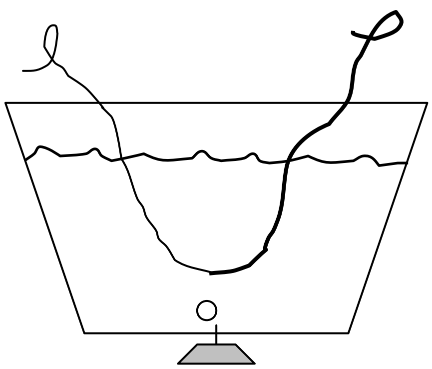
Directions for set up of activity.



1. Place the rubber band scale flat on the table so nothing is pulling down on it. Move the green or (blue) connector so it is right across or level with the gray connector. Where the green connector is located shows the point where there is no force pulling on the rubber band.



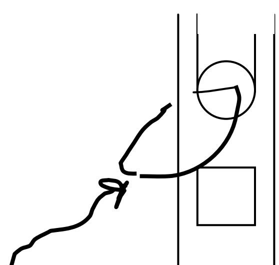
2. Tie a loop on one end of the fishing wire.



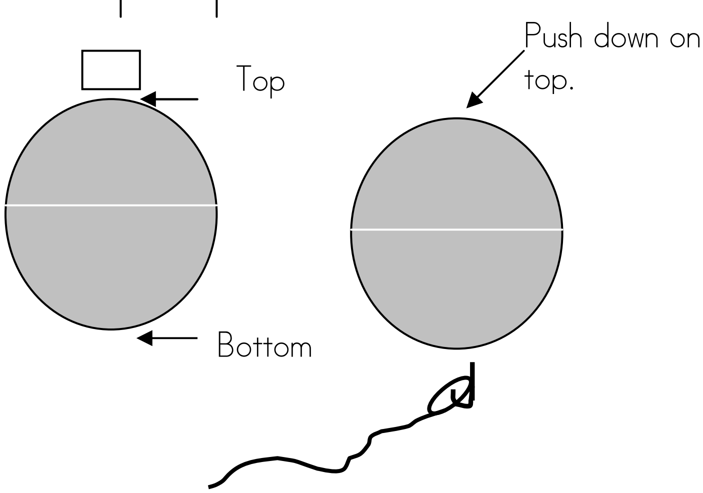
3. Thread the string through the hook in the suction cup.

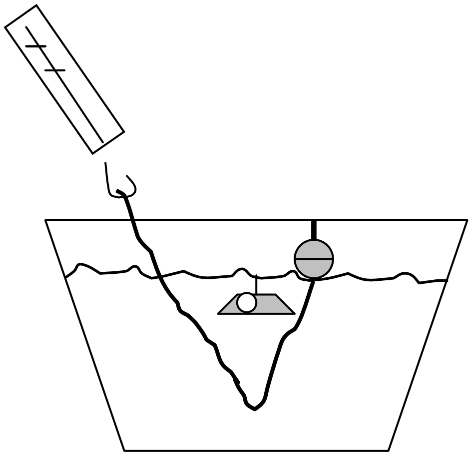
4. Suction the cup to the bottom of the container filled with water.

5. Tie the other end of the string to the bottom of the Knex rubberband scale (orange Knex piece).



6. Attach the loop that was tied on the other end of the string to the fishing bobber. (Start with the smaller bobber.) Push down on the top of the bobber to make the hook on the bottom of the bobber come out.





7. Use the rubberband scale to pull the bobber slowly under water. You will notice that the gray connector has moved downward from the green (or blue) connector due to the force that is needed to pull the bobber under water.

8. Move the tan connector so that it is across from where the gray connector is after the bobber is pulled under water.

9. Measure the distance in millimeters between the green (or blue) connector and the tan connector. You will need your partner to help you! The greater the distance between the two connectors, the greater the force needed to pull the bobber underwater.

10. Repeat Step 7 several times and record your results on the chart below.

11. When you have completed all your trials with the medium bobber, switch to the large bobber. Record your results on the chart.

Size of Bobber	Floating Force of Fishing Bobbers Trial 1	Trial 2	Trial 3
Medium (4.5 cm or 1 ¾")	mm.	mm.	mm.
Large (5 cm or 2")	mm.	mm.	mm.

12. Which bobber has the greatest buoyant force pushing against it?

____

____

13. Why do you believe this bobber has the greatest buoyant force pushing against it?

____

____

____

Activity Sheet for Learning Experience #8 Name____________________

WEIGHT OF AN OBJECT IN WATER

1. Lay the Knex rubber band scale on the desk so there is no force acting on it, and move the green connector so it is right across from the gray connector. This indicates where there is no force acting on the rubber band.

2. Attach one end of a line to the end of the rubber band scale and the other end to the eye hook on the top of the white plastic jar weight filled with iron filings.

3. Move the tan connector to where the gray connector falls.

4. Measure the distance in millimeters between the green and tan connector at this time. You will need your partner to help you. This is showing how far the rubber band is stretching with the jar filled with iron filings attached to it. The farther the rubber band stretches the heavier the object.

5. Record the distance in the "out of water" column on the chart below.

	Out of Water	Partially Submerged	Submerged
Jar filled with iron filings	mm.	mm.	mm.

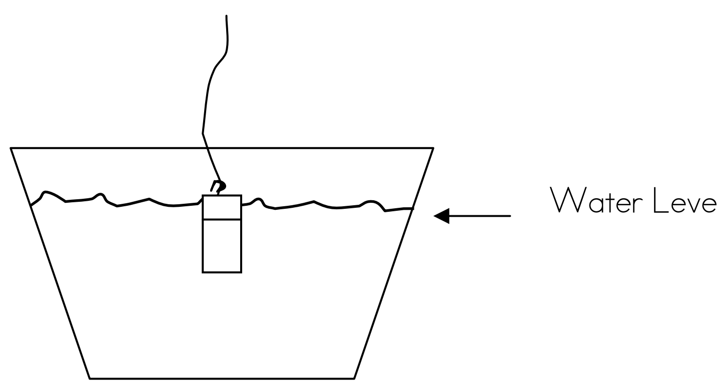
7. Predict what will happen to the weight of the object (the stretch of the rubber band) when it is placed halfway in water and explain your prediction?

____

____

____

8. Place the white plastic jar weight filled with iron filings that is attached to the Knex rubber band scale in the water so it is partially submerged.



9. Move the tan connector so that it is across from the gray connector.

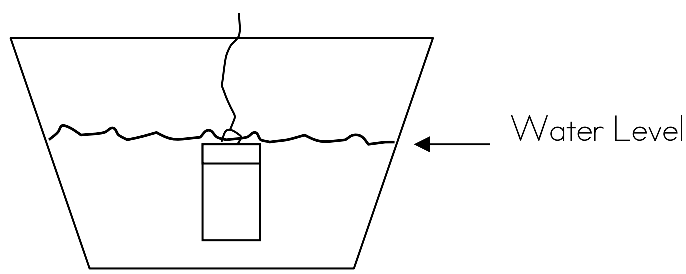
10. Measure the distance in millimeters between the green and tan connectors and record the distance on the chart in the "partially submerged" column.

11. Predict what will happen to the weight of the object (stretch of the rubber band) when the ball is placed completely underwater and explain your prediction.

____

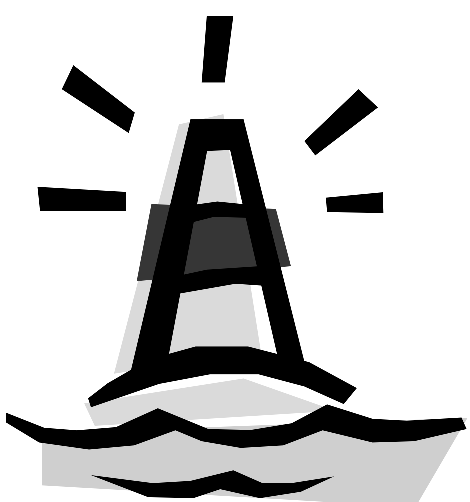
____

12. Place the jar filled with iron filings that is attached to the Knex rubber band scale in the water so it is completely submerged. Be sure its not touching the bottom!



13. Move the tan connector so that it is across from the gray connector.

14. Measure the distance in millimeters between the green and tan connector and record the distance on the chart in the "submerged" column.



15. Graph the results from the completed chart.

Choose a color for each item in the key and create a bar graph from the data in the chart.

Key

- ☐ Out of Water
- ☐ Partially Submerged
- ☐ Submerged

Stretch of rubber band in millimeters

10			
9			
8			
7			
6			
5			
4			
3			
2			
1			
0			
	Out of Water	Partially Submerged	Submerged

Jar Filled With Iron Filings

16. Compare the results on the graph. What do you notice about the weight of the object as it is submerged in the water? (Remember: the greater the distance between the green and tan connectors = the greatest weight.)

____

____

17. Why do you think these results occurred? (Hint: Think back to Learning Experience #7)

____

____

18. Have you ever had a real life experience like this? Have you ever been able to pick something up in water and you were not able to outside of the water? Explain.

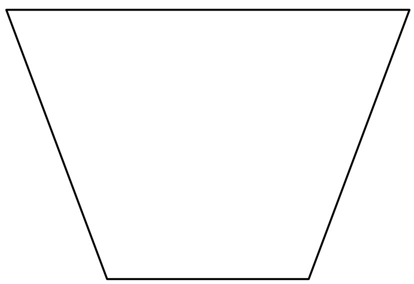
Activity Sheet for Learning Experience #9 Name______________________

FRESH WATER VS. SALT WATER

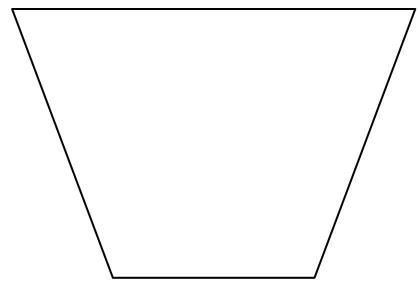
Place each of the balls in the fresh water and draw the results in the cup labeled "fresh water." Do the same for the cup labeled "salt water."

Glass Ball

1.



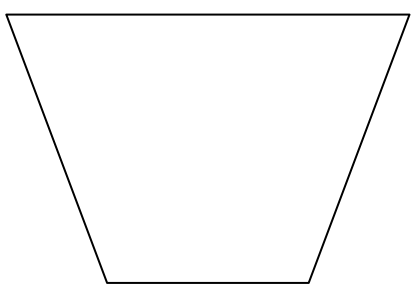
FRESH WATER



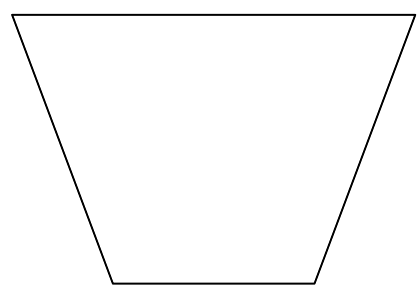
SALT WATER

Nylon Plastic

2.



FRESH WATER



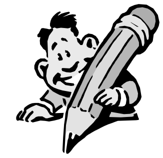
SALT WATER

3. Describe what happened when you placed the different balls into the fresh water then in the salt water. Be sure to include information about each ball you tried.

4. How does the salt change the water when it is added?

5. Explain why the nylon plastic ball is able to float in salt water and not in fresh water?

BUOYANCY STUDENT SELF-ASSESSMENT



Name:__________________________________

Date:___________________________________

1. What do you now know about the reasons some objects float while other objects sink that you didn't know before?

2. What do you know about the difference between salt water and fresh water?

3. How do you think you and your partner(s) worked together? Give some examples.

4. What learning experiences did you enjoy? Explain why did you liked them.

5. Were there any learning experiences in the unit you didn't understand or that confused you? Explain your answer.

6. Take another look at your activity sheets and science notebook. Describe how well you think you recorded your observations and ideas.

GLOSSARY

Attach:	to fasten or join.
Balance:	an instrument for determining mass by the equilibrium weights suspended from opposite ends of a horizontal bar.
Bobber:	a float for a fishing line.
Buoyancy :	is an upwards force acting on all objects in fluids, whether they are floating or submerged.
Ceramic:	of products made of clay and similar materials.
Compare:	to examine for similarities and differences.
Contrast:	to compare to show differences.
Cylinder:	a solid that has two parallel circles of the same size and shape as bases and one curved surface.
Density:	the ratio of mass of an object to its volume (D=M/V)
Detach:	to unfasten and separate.
Displacement:	an object pushes aside (displaces) amount of liquid in a container by taking up the space the liquid once held.
Fair Test:	to conduct a scientific test where there are specific items that remain constant.
Float:	objects that are less dense than water that overcome the force of gravity.
Force:	an influence on a body or system producing a change in movement or shape.
Gravity:	the force of attraction by which objects fall toward the center of the earth.
Horizontal:	parallel to floor or table.

Hull: the watertight frame of a vessel/boat.

Level: a horizontal position or condition.

Mass: the amount of matter in an object (grams).

Materials: the items needed to make or do something.

Optimize: the best or most favorable condition for obtaining a given result.

Propulsion: the act of being driven forward or onward.

Research: an inquiry into a subject to discover or check facts.

Shape: to give form to.

Sink: objects that are more dense than water that are forced by gravity.

Structure: the manner in which something is constructed.

Submarine: a warship designed to operate under the sea.

Submerge: to sink below the surface of any liquid or to cover with a liquid.

Trials: the act of trying or testing.

Vertical: an upright position – at approximate right angles to the plan of the horizon.

Weight: the measure of gravitational pull on an object