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Part I:
Introduction to the Great Salt Lake and Buoyancy

Abstract: Through demonstration and experimentation, students will come to understand why ships float and what causes buoyancy in the Great Salt Lake.

Grade Level: Fourth

Utah Elementary Core Curriculum Standards:

Standard: 3040-01
Students will analyze the diversity of plant and animal life in Utah.

Objective: 3040-0101
Describe Utah's biomes (e.g. desert, forest, aquatic, alpine)

In-class instruction time: 30 minutes

Terminology:

Buoyancy- is a function of density. Buoyancy is the ability for an object to be lifted up, or to float, because of the greater density of the water.
Density- is a measurement of the quantity (weight) of matter contained in a given volume of space.
Biome- a division of the world's vegetation that corresponds to a particular climate and is characterized by certain types of plants and animals, for example, tropical rain forest or desert. The world's lakes and oceans may also be considered biomes, although they are less susceptible to climatic influences than terrestrial biomes.
Displacement- the fluid, for example, water that is forced to move by an object floating or submerged in it. It is often used as a measure of a ship's size.
Salinity- level of salt content dissolved in water.

Intended Learning Outcomes:

Students will:

Explain why boats float.
Explain why the Great Salt Lake is unique in buoyancy and salinity.

Background information:

A ship will float as long as it weighs less than the water it pushes out of the way (displacement). There must be air within the ship, since air weighs less than water; it lowers the weight of the ship compared to the same volume of water. For an object to float, it must have a lower density and therefore, greater buoyancy, than the liquid it is floating on.

The Great Salt Lake is the 4th largest terminal lake (no outlet) in the world. It is typically 3 to 5 times saltier than the ocean. The Great Salt Lake is fish free, the

largest aquatic critters are brine shrimp and brine flies. The lake exists within the Desert Biome and is a unique ecosystem within that because people have liked to swim in the salty water of the Great Salt Lake for 150 years. Almost anyone can easily float in the salty water**.**

Materials:

KWL sheets, pictures of things floating (people, boats or birds.) Set of weights that are the same size but have different weights. Container of water. Clay

Prior knowledge Assessment:

The students will fill out a KWL chart listing all that they know about the Great Salt Lake, all that they want to know, and at a later time, they will list what they have learned. They will also be asked what they know about density, and buoyancy. Students will also be asked to write down why they think boats float.

Procedures:

The lesson begins when the teacher asks why boats float. When the students answer, the teacher can gauge where the students are in their understanding of buoyancy and use this information when facilitating discussions. Ask the students if they can define buoyancy, density, biome, displacement and salinity. Introduce the terminology and explain each one. Do a demonstration showing how clay rolled into a ball will sink, yet when it is shaped into a round cup with a small lump on the bottom as a keel, it will float. Add water to the cup of clay, does it sink? It should, when the cup is filled with water the clay ship weighs more than the water it displaces and sinks. Do another demonstration with the weights, ask the students to make a hypothesis regarding the weights and the water. What do they think will happen with each weight? Finish the demonstration and have the students write down if they accept or deny their hypothesis.

Closure:

The students will add to the KWL chart listing what they have learned.

Assessment:

The KWL sheets will serve as a measurement of the students' growth of understanding of buoyancy. Let the students select different items found in the classroom, and experiment with them to see if they will float or not. Before they experiment, be sure that they write down what they think will happen with each object.

Part II:
Great Salt Lake- Checking Density and Buoyancy With a Homemade Hydrometer

Abstract: This lesson will introduce students to density and buoyancy. Students will construct a hydrometer and test different levels of salt water for buoyancy and use it as a means to check for different levels of density.

Grade Level: Fourth

Utah Elementary Core Curriculum Standards:

Standard: 3040-01
Students will analyze the diversity of plant and animal life in Utah.

Objective: 3040-0101
Describe Utah's biomes (e.g. desert, forest, aquatic, alpine)

In-class instructional time: 30 to 60 minutes

Terminology:

Hydrometer - an instrument used to measure density of a liquid.
Evaporation- the process by which water, heated by the sun, changes into vapor and rises into the air.
Solute- a substance dissolved in another substance
Solvent- able to dissolve substances
Solution- a substance consisting of two or more substances mixed together and uniformly dispersed.

Intended Learning Outcomes:

Students will:

- Explore the Great Salt Lake and its unique qualities
- Build a hydrometer
- Use a hydrometer for measuring water density
- Describe the relationship between density and buoyancy in a liquid
- Practice science process skills such as estimating, measuring, hypothesizing, making observations, and testing hypotheses.

Background:

The Great Salt Lake receives its water from a drainage area of more than 20,000 square miles. Once the water enters the lake, it has no way out except by evaporation. This fact, combined with all of the universal characteristics of water -its ability to dissolve substances, its ability to change from one state to another, its heat retaining qualities - make the Great Salt Lake truly unique.

Materials:

Drinking straws
Modeling clay
Graduated cylinder or empty water bottles with tops cut off
Water
Salt-water of varying salinities (5%, 10%, 15%, 20%, and the GSL water approx. 9%)
Mystery water (Great Salt Lake water)
Worksheet

Prior Knowledge Assessment:

Students will list what they know about salt, density and buoyancy. This will lead into the lesson about the GSL and its salt content, density and buoyancy.

Procedures:
Have students make a hydrometer by taking a piece of modeling clay and molding it onto the bottom of a drinking straw. The clay should completely cover the bottom of the straw so that water may not enter the straw.
Straws will be calibrated in ½ inch increments.
Pour water into containers marked with its salinity level. (1 teaspoon equals 10 grams salt, for 5% solution, mix 5 grams salt with 95 milliliters of water)
Students will write down on the worksheet, what they think will happen to the hydrometer, will it sink or float?
Next the students will place the hydrometer into the water and write down the results. They will continue this with each water container. The last container is the mystery water (the Great Salt Lake water) students will hypothesize what will happen in this mystery water, with their knowledge of what has happened with the other water containers. This should be repeated 3 times so that they results may be validated, and also to get an average.

Closure:
Review the unique qualities of the Great Salt Lake, add to the KWL chart listing what the students learned through this lesson. Review density and buoyancy and tell the students why they were taught this lesson. This lesson can be used to compare different bodies of water. You can make a salt water solution to be the GSL and compare it to distilled or tap water that can represent a fresh water lake.

Assessment:
Collect KWL charts and "My hypothesis. . ." worksheets. Did the students understand the experiment? Are you able to see that they understand density and buoyancy, through the experiment, their hypothesis and the results? Did they write a conclusion about whether or not the hypothesis as supported?

References:
The Great Salt Lake Story, The Introduction.

The Great Salt Lake Story, Utah Museum of Natural History

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http://www2.sptimes.com/aquarium/FA.4.2.4.html
http://www.unmuseum.org/exboyant.htm
http://wwwdutslc.wr.usgs.gov/greatsaltlake/index.html

Experimentation with a Hydrometer

Name_____

Having just learned about density and buoyancy, make a prediction about what will happen when you place your hydrometer in different percentages of salt-water.

What is your prediction about what will happen? Percentage:

I predict

What are your observations?

What actually happened, and why?

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What is your prediction about what will happen? Percentage:

I predict

What are your observations?

What actually happened, and why?

****

What is your prediction about what will happen? Percentage:

I predict

What are your observations?

What actually happened, and why?

****

What is your prediction about what will happen? Percentage:

I predict

What are your observations?

What actually happened, and why?

****

What is your prediction about what will happen? Percentage:

I predict

What are your observations?

What actually happened, and why?

Name_____

1. Would you be more likely to float in the Great Salt Lake or in a fresh water lake? Explain.

2. What is density?

3. What is buoyancy?

4. Complete the chart:

Write down the percentage.	My hypothesis is:	The results:	I accept or deny my hypothesis, because
Solution A ____%			
Solution B ____%			
Solution C ____%			
Solution D ____%			
Solution E ____%			

Explain what you learned from this activity: