

# Measure-Up with Hydrology

By Lenora Sue Yates and Eric Lowry

**Concept:** Students will discover the differences in density between ocean water and fresh water. Students will discover the affect that water temperature has on ocean water density and fresh water density.

**Grades** 7 – 12

## State Standards:

Science A2, B1, B3

Math A4, C1

## Bering Strait School District Math and Science Learning Standards

MA 8.28 Samples and records data systematically.

MA 8.29 (A6.3.1) Creates graphs, tables and charts from collected data with and without technology (histograms, scatter plots, frequency distribution).

MA 8.30 (A6.3.4) Makes projections based on available data and evaluates whether inferences can be made from the data.

## Content Standard

SC 7/8.2 Structure and properties of matter

## Process Skills

SC 6.A **Developing Questions:** Is able to convert a question into a hypothesis and a hypothesis to a question; explains what types of question science cannot answer.

SC 6.B **Designing Investigations:** Designs investigations that control all but one variable; designs inquiries that result in an accurate explanation or model.

SC 6.C **Conducting Investigations:** Works in a systematic manner; keeps neat, accurate notes while conducting self-designed investigations.

SC 6.D **Communicating Results:** Defends explanation/model orally and in writing; revises explanations based on reasoning, scientific knowledge and evidence; evaluates and adopts alternative explanations when warranted.

## Materials:

Paper, pencil, 500 mL graduated cylinder, hydrometer, thermometer, ice, heat source

## Gear- Up:

Students will take two water samples. (One will be tap water and the other will be ocean water.) Students will make as many observations as possible. Encourage students to use all senses and make both qualitative and quantitative observations. Students can report observations on a class chart that will be shared by everyone in the classroom. (Measures preconceived notions on differences in fresh water and ocean water.)

**Explore:**

Students will take both samples of water and run tests on each sample.

A.) Fill a 500 mL cylinder with fresh water to 500 mL.

B.) Gently place the hydrometer into the cylinder (do not drop)

C.) Read the scale on the hydrometer at the bottom of the meniscus and record.

D.) Use a thermometer to measure the temperature in the cylinder 10 cm below the surface and record.

E.) Use the hydrometer to measure the density of the fluid in the cylinder. Record. Repeat the procedure for Ocean Water.

Students will look up the salinity of each fluid from the table using the temperature and hydrometer reading. Record on the data table.

Sample	Temperature	Hydrometer	Salinity	Students
Fresh Water				
Ocean Water				

**Generalize:** Ask students what they think would happen to the values if the temperature were to be lowered or raised. Ask students how the samples are the same and how the samples are different. Record answers.

**Explore:** Add a three ice cubes to each sample. Repeat steps A – E. Record on the data sheet.

Sample	Temperature	Hydrometer	Salinity	Students
Fresh Water				
Ocean Water				

**Generalize:** Ask students to think of a way to test for warmer waters.

**Experiment:**

Ask them to design an experiment to test what happens to water when it is heated. They will describe the steps and record the data. Explain what variable is being tested in this test and what variables will be the same.

- Describe the steps you took to reach the following results:

Sample	Temperature	Hydrometer	Salinity	Students
Fresh Water				
Ocean Water				

Observe the third test to see if students have tested for the one variable, change in heat. Students will show results in a classroom graph display.

**Interpret:**

Students will display the data in a set of data tables.

**Apply:**

Ask students what affect the density differences might play in the oceans. (Deep ocean currents)

**Criteria for Evaluating Student Experimental Research Project:**

**Scientific Thought (possible 40 points)**

An attempt to design and conduct an experiment or project with all important variables controlled	An attempt to design and conduct an experiment or project, but with inadequate control of significant variables.
<b>40</b>	<b>10</b>

**Originality (possible 16 points)**

Original, resourceful, approach: Correct use of equipment.	Imaginative, extensions of standard approach	Standard approach	Incomplete use of resources	Lack of creativity both approach and resources.
<b>16</b>	<b>12</b>	<b>8</b>	<b>4</b>	<b>2</b>

**Presentation (possible 24 points)**

Clear, concise, Confident presentation, prepare and effective use of charts and graphs, complete understand of topic, able to extrapolate.	Well, organized, clear presentation; good use of science terms, good understanding of topic	Presentation Acceptable, adequate Use of terms and acceptable understanding.	Presentation lacks Clarity, little science vocabulary, poor understanding of topic.	Poor presentation, cannot explain Confused, lack understanding
<b>24</b>	<b>23</b>	<b>22</b>	<b>21</b>	<b>20</b>
<b>19</b>	<b>18</b>	<b>17</b>	<b>16</b>	<b>15</b>
<b>14</b>	<b>13</b>	<b>12</b>	<b>11</b>	<b>10</b>
<b>9</b>	<b>8</b>	<b>7</b>	<b>6</b>	<b>5</b>
<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>	

**Exhibit (possible 20 points)**

Self-explanatory Multi-sensory Creative Effective use of material	Logical, concise Use appropriate and materials	Acceptable layout Materials used correctly	Improvement Needed on layout And materials	Lacks organization Is difficult to Understand Poor use of materials
<b>20</b>	<b>18</b>	<b>16</b>	<b>14</b>	<b>12</b>
			<b>10</b>	<b>8</b>