**Lesson Topic**

 Density

**State Standard**

GM: G-MG.A.2

**Relation to USS Kidd**

The USS Kidd has a displacement of 2,050 tons. You need 363,000 pennies (at 2.5 grams each) to make a ton, and the value of the pennies is $3,632.

To equal the displacement of the Kidd you would need 744150000 pennies.

**Lesson Goal**

In this lesson students will start with the same raw materials and come up with a wide variety of results in the use of density and the displacement of water.

**Objectives**

The student uses a variety of measurements to compare and contrast the physical properties of matter.

**Materials needed for lesson**

-Aluminum foil

-Shallow pan of water
-Pennies
- notebook paper
-Checklist duplicated for each student (see associated file)

Lesson

1. Ask the students what would happen if they threw a log in the water.

2. Ask why they think a boat will float but a small log will sink. Is the boat lighter in weight?

3. Tell the students that they are going to each build a boat from the same materials. Their goal is to see who can design a boat that will hold the most pennies without sinking.

4. Discuss the reasons a boat float.

5. Divide the class into groups.

6. Student should distribute the aluminum foil.

7. Student should receive the pan of water and take it to the work area.

8. Student will act as recorder and record the number of pennies each person’s boat will support.

9. Before measuring each student will estimate the number of pennies their boat will hold. The recorder will record this information.

10. The students will design their boats. When the boat is ready the student will float his boat adding pennies slowly to see how many pennies it will hold.

11. After all students have completed their boats and measurements, they will discuss the results. Why did the boat that held the most pennies do so? How was its design different from the design of the others in terms of (a) length, (b)width, (c) area of the bottom, and (d) height of the sides.

12. On notebook paper each student will make a chart showing the estimates and actual results of his group’s work. Then they will each write their explanations of the results.

**Assessments**

This activity addresses density in terms of the length, width, height of sides, and area of the bottom of the container. Assess the student charts showing the result of each group's work and the explanation of why particular boats could hold more cubes than others. Use the checklist in the file.

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Checklist:

1. Student designs boat from materials provided.

2. Student estimates number of centimeter cubes his boat will hold.

3. Student experiments to find out exactly how many centimeter cubes his boat will hold.

4. Student completes the group task assigned to him

5. Student makes chart of his team results.

6. Student provides written response to explain why the boat which held the most cubes did so