**Eureka!**

**Teacher Notes**

**Time needed to complete the lab:**

25-35 minutes to make one boat. If glue is being used, a little more time may be needed.

Objectives: Students will gain an understanding of buoyancy and Archimedes principle. Students will learn how the design and shape of a boat is related to how well it floats and how much cargo it can carry.

**Major Concepts:**

The importance of keeping water off of the boat should be emphasized. A demonstration of Archimedes principle is helpful for students to see prior to building their boats. An understanding of balanced and unbalanced forces is also beneficial (Buoyant force versus weight). The concept of water displacement may be reviewed. When testing the boats, penny placement is important.

**Preparation:**

The aluminum foil can be cut prior to the lab in order to save time. Tape can also be precut, if needed. Materials should be readily available for all students.

**Typical Results:**

A variety of boats can be expected. Some with no sides (rafts), some with sides that are too steep, etc. The number of pennies held by each boat will also vary with a range of possibly 10 to 70.

**Sample Calculations:**

According to Archimedes principle, the buoyant force is equal to the weight of the fluid displaced by the object (boat with pennies). So, on the data table, column 5 will be equal to column 4. If the boat leaks and takes on water, then the buoyant force will not be accurate, since it was determined by massing the pennies and the boat itself with no way to determine the mass of the water that helped sink the boat.

**Answers to Questions:**

1. What is the relationship between the buoyant force and the weight of water that is displaced?

*The buoyant force and the weight of the water displaced will be equal to one another according to Archimedes principle.*

1. When will an object float? Answer in terms of buoyant force and weight

*An object will float when its buoyant force is greater than the downward force of gravity, or weight of the boat. Or weight is less than buoyant force.*

1. When will an object sink? Answer in terms of buoyant force and weight.

*An object will sink when its buoyant force is less than the downward force of gravity, or weight of the boat. Or weight is greater than buoyant force.*

1. What did you do differently when you made your second boat?

*Boats built a second time should be better than the first and hold more pennies. Hopefully students will recognize flaws in their initial design and make improvements and changes which should be noted here.*