

Essential Questions:

How is density determined?

How does density affect floating and sinking in water?

Enduring Understanding:

Mathematics is used in science to collect and compare data. The density of an object determines its ability to sink or float in water.

Objective:

TSWBAT measure the volume of an object using water displacement.

TSWBAT calculate an object's density and explain how it affects the object's buoyancy.

Standards:

NJ 4.1 Number and Numerical Operations

CH 5.27 The student performs science activities in a safe manner

CH 5.28 The student engages in activities using problem-solving, decision-making, information gathering, inquiry and cooperative skills.

Content:

- Volume
- Mass
- Density
- Floatability/buoyancy

Materials:

- Overhead transparency of data table
- Various objects of different sizes and materials **labeled with its mass** (Ex. Large coins, wooden blocks, rocks)
- Beakers (one per small group)
- Water
- Small tank filled with water

Anticipatory Set:

1. Ask students: *What do you know about floatation?*
2. Ask students: *What does it mean when a place is densely populated? What do you think density is?*
3. Hold up the various objects and ask: *Which items do think are very dense? Which ones might sink in the tank of water?*
4. Today we will be exploring this question through a lab experiment. You will work in small groups of 3 to do the experiment.

New Information:

- Mass—the amount of matter of an object; an object's weight without gravity
- Volume—the space a three-dimensional shape takes up
- Density—mass per volume; $m \div V = D$
- Measure the mass of an object using a balance or scale.
- Measure the volume of an object using water displacement.
- Calculate density when given the mass and volume of an object.
- Relate an object's density to whether or not it floats in water.
- The density of water is 1 g/mL

Modeling:

1. Model how to use water displacement to find an objects volume, introduce the formula for density, and review division to calculate the density of an object. Show students where to get their lab materials
2. Remind students to be careful when traveling to the sink with the beakers.

Checking for Understanding:

Ask students: *What is the mass of the quarter? What was its volume? What did you calculate as the density of the quarter?*

Observe all groups to be sure their measurements are accurate. Assist students that are not measuring volume correctly.

Student Activity / Guided Practice:

1. Review safety precautions with students
2. Students predict which objects will sink and float in a gallon of water.
3. Students work in small groups of 3-4 to conduct the lab
4. Students are assigned roles: Materials Manager, Recorder, Experimenter, Task Manager
5. Students record their observations on the handout provided
6. Students analyze and draw conclusions while thinking about and answering questions on the student sheet

Closure:

Class discussion: *What were some of your observations? What conclusions can you make regarding density and floatability?*

Assessment:

Students complete analyze and conclude questions on the student sheet for homework.

Name _____ # _____

Date _____

Science
Density Lab

Density and Floatability

Pre-lab questions:

1. What two things does density depend on?

2. If you have something with a mass of 45 g and a volume of 5 mL, what is that object's density? How did you determine its density?

3. Conduct lab and record data on the table:

- a. Gather 4 different objects to measure their volumes.
- b. Fill your beaker with 100 mL of water
- c. Carefully place one of the objects into the beaker of water.
- d. Read the volume of the water with the object in it.
- e. Subtract: the new water volume - 100 mL = the volume of the object
- f. Repeat steps c-e to find the volume of the other 2 objects
- g. Determine the density of each of the objects using the density formula: $\text{Density} = \text{mass} \div \text{Volume}$
- h. Carefully drop one item at a time into the tank of water to test its floatability.

Object	Given mass (g)	Volume (mL)	Density (g/mL)	Float or sink in tank?!

Analyze and conclude:

4. Rate the objects' densities from lowest to highest.

5. What objects floated in the tank of water?

6. What objects sank in the tank of water?

7. What do you think determined whether the object floated or sank in the tank?
