**BUOYANCY AND**

**DENSITY KIT**



**A Teacher’s Guide**

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**BUOYANCY AND DENSITY**

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**LESSON #1**

**DENSITY OF LIQUID**

***Content***

Have you ever experimented while cooking and tried to mix oil and water? What did you observe? Did the two solutions mix together evenly or did one float on top of the other? Throughout this lesson you will be able to experiment with the density of various liquids and the effects they have on each other.

## Standards:

* + - 1. Observe and describe different types of force and motion.

OBJECTIVES:

*Students will* see the effects of density when a variety of liquids are poured on top of each other.

*Students will understand* the properties of density.

MATERIALS:

* + - * + Light Corn Syrup
        + Lamp Oil
        + Milk
        + 30 Plastic Cups (3 cups per group)
        + Masking Tape
        + Worksheet Activity 1 \*
        + Container for Used Oil

PROCEDURE:

Do this activity as a whole class demonstration or in small groups.

1. Rip off a piece of tape and place a piece in front of each cup. On the tape label Cup A, Cup B, and Cup C.
2. Next, in Cup A pour a small amount of oil into the cup.
3. Now, also in Cup A, pour milk on top of the oil that is already in the cup. Observe – What happens? Do the two liquids mix?
4. Finally, in Cup A, pour some corn syrup on top of the oil and milk. Observe – Now what happens? Draw your observations on the worksheet.
5. From your observations decide what liquid is most dense.

HINT: You should be able to see some layers clearly because each liquid has a different density. If the layers combine then the top layer has the heavier density than the one that was poured on top of it.

1. Now, experiment with changing the order of how the liquids are poured into the cups.
2. Take Cup B, and first pour in the corn syrup. Next, pour the oil and then pour the milk. Observe – What did the liquids do? Draw your observation on the worksheet.
3. Prior to pouring the liquids into Cup C, take a minute to predict and draw what you think will happen with the liquids now that you know their density. The order of the liquids in the finally cup will be: milk, then corn syrup, and finally the oil.
4. Once your drawing is complete, take Cup C and begin pouring in the liquids. Remember to pour the milk first, then the corn syrup, and last the oil. Check your prediction and draw what you observe.
5. Review as a class how you can tell what liquid is denser in the above experiments. (If layers combine then the Top Layer has the heavier density than the one it was poured on top of.)
6. Rinse out the cups. Pour the used oil into the used oil container can and save the cups for the next lesson.

# Worksheet Activity 1

Name:

**Directions:** Record your observations in the boxes below. Remember to predict what Cup C will look like in the lower left box before doing the actual experiment.

|  |  |
| --- | --- |
| Cup A | Cup B |
| Cup C (PREDICTION) | Cup C (ACTUAL) |

## LESSON #2

**BUOYANCE AND DENSITY OF OBJECTS IN LIQUID**

**Content**

Most people always suspect that heavy objects will always sink and the light ones will always float. For example, one assumes a rock will always sink in a pond or lake and we assume leaves or feathers float on the surface of water. Now, it is time to test our predictions and find out if they have been right.

## Standards:

3.4.4.C Observe and describe types of force and motion.

* + - 1. Identify and explain the principles of force and motion.

OBJECTIVES:

*Students will* explore with various objects to determine the density of each object in different liquids.

*Students will* understand that different liquids have different densities.

MATERIALS:

* + - * + 6 Pieces of Metal
        + 6 Plastic Balls
        + 6 Golf Tees
        + 3 Pumice Rocks
        + 3 Talc Rocks
        + Paper Towels \*
        + Latex Gloves
        + Water \*
        + Lamp Oil
        + Container for used oil
        + Milk
        + Corn Syrup
        + 24 Plastic Cups (4 cups per group)
        + Worksheet Activity 2\*

PROCEDURE:

1. Pour a small amount of each liquid into a cup. (1 cup with oil, 1 with milk, 1 with corn syrup, and 1 with water)
2. Begin by picking up a piece of metal and place it into the center of one of the cups. Observe – Does it sink or float? Record your answer on - Worksheet Activity 2.
   * Assign one student to wear a glove to remove the objects out of the cups, especially the cup with oil. The oil may irritate the students’ skin if the student does not wash his/her hand right away.
3. Now, remove the metal from the cup and wipe it off with a paper towel. Then place it into the center of a different cup. Observe and record your answer.
4. Repeat step number 3 for two more times, so the piece of metal enters each cup. Remember to always record your observation as to whether or not the object sank or floated.
5. Next, take a plastic ball and drop it into the center of each cup one at a time. Observe, record your observation on the worksheet, then remove the object and wipe it off before putting it into another cup.
6. Repeat the same steps for the remaining objects: a golf tee, pumice rock, and talc rock.
   * Remember to always dry off the object prior to placing it in a different cup and record your observations.
7. Once all the objects have been tested in each liquid and recorded – Discuss your answers as a whole class.

* Which objects floated?
* Which objects sank?
* Use your recorded information to organize the objects from the densest to the least dense on your worksheet.

1. Rinse out cups and pour the used oil into the container to be recycled.

# Worksheet Activity 2

Name:

**Directions:** Record in the chart whether the object sank or floated.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Oil** | **Milk** | **Corn Syrup** | **Water** |
| **Metal** |  |  |  |  |
| **Plastic Ball** |  |  |  |  |
| **Golf Tee** |  |  |  |  |
| **Pumice Rock** |  |  |  |  |
| **Talc Rock** |  |  |  |  |

## Below – Organize the objects from the densest to the least dense. (1 being the most dense and 5 the least dense)

1.

2.

3.

4.

5.

## LESSON #3:

**BUOYANCE AND DENSITY CUBES**

**Content**

If I have 10 blocks that are all the same length, height, and width then they should all react the same if I place them in water, correct? Well before you rush ahead and assume you are correct, take a minute to think; what if they are made up of different materials? Hmm . . . will the weight of the block make a difference?

Well, you will soon find out once you begin experimenting with the cubes.

## Standards:

* + - 1. Observe and describe different types of force and motion.

OBJECTIVES:

*Students will* be able to determine if an object will float or sink.

*Students will* know density is mass per unit volume.

*Students will* be able to calculate the density of the blocks by measuring the blocks mass and volume.

MATERIALS:

* + - * + 10 Plastic Cups
        + Water \*
        + Worksheet Activity 3 \*
        + Buoyancy and Density Cubes
        + Paper Towels \*
        + 5 Electric Balances (4 per group)
        + 5 Rulers (cm)
        + 10 Rubber bands

PROCEDURE:

1. Write the names of the ten different cubes on the board:

Oak, Nylon, Pine, Poplar, PVC, Aluminum, Steel, Brass, Copper, Acrylic

1. Have students predict what material will be:
   * The most dense .
   * The least dense .

\* Write answers down on worksheets and then discuss as a class and take note of which material gets the highest vote for most and least dense.

1. Find the volume of the density cubes: (pick one block to start with and then switch with another person or group when finished – students will have to share the blocks).
2. Record information accurately and correctly on the worksheet. Record: The Type of Material: \_

Volume: length x width x height Volume of cube:

HINT: Measure the sides of the cubes in centimeters to calculate the volume.

1. Now, place the density cube on the electric balance and find its mass in grams. Mass of cube:
2. Now, find the cubes density.

You may want to have your students show their work on a separate piece of paper incase they make an error in their calculations or allow them to use a calculator for accuracy.)

Density of Cube: \_

1. Finally, drop the cube in the cup of water. Does the cube sink or float?
   * Record your observations on your chart.
2. Complete the steps above until all density blocks are tested and recorded on your chart.
3. When the chart is completely filled out with all the data and numbers - take a look at the chart:
   * What cube was the most dense?
   * What cube was the least dense? \_

(Look at your individual predictions as well as the classes predictions that were made at the beginning of the lesson)

## Extension:

Do they sink or float?

- Use a rubber band to connect two blocks together.

* Experiment and figure out what combinations will sink? Why?
* Which combinations float? Why?



# Worksheet Activity 3

Name:

## Predict:

**~** What material will be the most dense?

~ What material will be the least dense?

**Directions:** Calculate the volume, mass, density, and determine if the materials will sink or float in water – record your measurements and observations below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Material of Cube** | **Volume (cm3)** | **Mass (g)** | **Density (g/cm3)** | **Sink or Float?** |
| **Oak** |  |  |  |  |
| **Nylon** |  |  |  |  |
| **Pine** |  |  |  |  |
| **Poplar** |  |  |  |  |
| **PVC** |  |  |  |  |
| **Aluminum** |  |  |  |  |
| **Steel** |  |  |  |  |
| **Brass** |  |  |  |  |
| **Copper** |  |  |  |  |
| **Acrylic** |  |  |  |  |

## Materials Need For Buoyancy and Density Kit

## Lesson #1: Density of Liquids

~ Light Corn Syrup

~ Lamp Oil

~ Milk

~ 30 Plastic Cups (3 cups per group)

~ Masking Tape

~ Worksheet Activity 1 \*

~ Used Oil Container

## Lesson #2: Buoyancy and Density of Objects in Liquid

~ 6 Pieces Metal

~ 6 Plastic Balls

~ 6 Golf Tees

~ 3 Pumice Rocks

~ 3 Talc Rocks

~ Paper Towels \*

~ Water \*

~ Lamp Oil

~ Latex Gloves

~ Used Oil Container

~ Milk

~ Corn Syrup

~ 24 Plastic Cups (4 cups per group)

~ Worksheet Activity 2 \*

## Lesson #3: Buoyancy and Density Cubes

~ 10 Plastic Cups

~ Water \*

~ Worksheet Activity 3 \*

~ Buoyancy and Density Cubes

~ Paper Towels \*

~ 5 Electric Balances (4 per group)

~ 5 Rulers (cm)

~ 10 Rubber bands