**Lesson Plan**

**Density Lab**

**NGSS Standard: MS-PS1-7 (MA).** Use a particular model of matter to explain that density is the amount of matter (mass) in a given volume. Measure the mass and volume of regular and irregularly shaped objects and calculate their density.

**Vocabulary (review these words prior to activity):**

Mass

Volume

Density

meniscus

Also review metric measurements and tools:

milliliters graduated cylinder

grams triple beam balance

**Overview:** Student will measure the mass and volume of a piece of modeling clay to determine its density. They will then break the clay into two unequal pieces and measure them to find the density. Students will need to determine if changing the volume of an object affects the density of that object.

**Objective:** Students will:

1. Discover that a change in volume will also change mass, resulting in no change to the density.

2. Measure objects using metric measure

3. Calculate volume using water displacement

4. Calculate density

5. Record and interpret data

**Students will work in teams of 2-3. Each team will need:**

Triple beam balance Modeling clay

Chart, pencil, calculator 50 or 100 mL graduated cylinder

Beaker with at least 100 mL water blue tweezers

1 Chromebook in the lab to record data (day 1)

1 Chromebook per team to answer analysis questions (day 2)

**Procedure: Day 1 (Data collection)**

Review the procedures with students before going to the lab!

1. Model for students the correct way to use a graduated cylinder to measure volume using water displacement
2. **Student Procedures:** Use a triple beam balance to find the mass of the modeling clay. Record the mass in the data table.
3. Use water displacement to measure the volume of the clay. Measure to the nearest milliliter. To measure:
	1. Measure approximately 30 mL of water into the graduated cylinder. Note exactly how much water is in the graduate. Make sure you read the bottom of the meniscus.
	2. Place the clay in the graduate. Make sure it is completely covered with water. (If it is not, remove it and add more water to the graduate. You may have to get a larger graduate).
	3. Read the new measurement on the graduate. Record your readings from a. and c. in your data table and calculate the volume of the clay.

3. Break the clay into 2 pieces. The pieces should not be the same size.

4. Repeat steps 2-3 with each of the two pieces separately, recording the data on the data table.

5. Complete the density calculations. Students may use a calculator but must also show the formula you used to get their answer.

6. \*\* Before students input their data into the data sheet, review their information to confirm that the mass and volume of the smaller piece plus the larger piece generally match the mass and volume of the full piece. In addition, make sure that density calculations are correct and are similar for the small, large, and full pieces.

7. Students may go to the Chromebook and input their results into the Google Student Data Sheet. The team name should be the first names of their team members, with no punctuation between names.

**Procedure: Day 2 (Analysis):**

1. In preparation for Day 2: check the student data for accuracy. You may need to “adjust” for outliers (inaccurate data).
2. Upload the student data into iSENSE
3. Create visualizations for: 1) bar graph of mass, volume, and density by type, 2) bar graph of mass by type, 3) bar graph of volume by time, 4) bar graph of density by type, 5) scatter plot of mass, volume, and density by type
4. Have students briefly analyze their own data and draw conclusions based on the questions provided on the Student sheet.
5. Review with class (on the Smartboard) each visualization, explaining which visualization is best used for each question.
6. Give each team a chromebook. Allow students time to answer the assessment questions, using the visualizations provided. They may work with their lab partners.