Lesson Title	Density
Length of Lesson	90 minutes
Created By	Cheryl McLaurin
Subject	Chemistry
Grade Level	9^{th}-12^{th}
State Standards	1.c), 2.a)
DOK Level	1, 2, and 3
DOK Application	Calculate, Measure, Predict, Compare, Interpret, Draw Conclusions
National Standards	9-12 A (Inquiry), B (Physical Science)
Graduate Research Element	Basic property of matter

Student Learning Goal:
Students will be introduced to density properties and calculation. Students should comprehend the causes of differences in density and become familiar with the effects of temperature and pressure on density. Students will also become practiced at calculating density from measured mass and volume and calculating mass and volume from density.

State Standards for 9-12^{th} Chemistry

1.c) Demonstrate the use of scientific inquiry and methods to formulate, conduct, and evaluate laboratory investigations. *Students will be conducting data compilation and calculation.*

2.a) Describe and classify matter based on physical and chemical properties and interactions between molecules or atoms. *During the introduction lecture, density will be identified as a property of matter.*

National Contents Standards 9-12
A:Inquiry: Abilities Necessary to Do Scientific Inquiry: Formulate and Revise Scientific Explanations and Models Using Logic and Evidence.

- Student inquires should culminate in formulating an explanation or model. Models should be physical, conceptual, and mathematical. In the process of answering the questions, the students should engage in discussions and arguments that result in the revision of their explanations. These discussions should be based on scientific knowledge, the use of logic, and evidence from their investigation.

B: Physical Science: Structure and Properties of Matter:

- The physical properties of compounds reflect the nature of the interactions among its molecules. These interactions are determined by the structure of the molecule, including the distances and angles between them.

Materials Needed (supplies, hand-outs, resources):
Can of regular soda and diet soda, sample of pumice and petrified wood, balances for every bench, different sized graduated cylinders, varying concentrations of salt water, data sheets.

Lesson Performance Task/Assessment:
Students will measure mass and volume of several different solutions and calculate density from those known values. They will then be given unmeasured solutions and be asked to measure mass and volume, calculate density, and calculate the amount of solute present based on the premise "a pint is a pound the world around."

Lesson Relevance to Performance Task and Students:
The performance tasks will allow the students to see the physical connection between the components of density and real-world application.

Anticipatory Set/Capture Interest:
Students will be shown a demo in which diet soda floats and regular soda sinks in water and a rock (pumice) floats but a piece of wood (petrified wood) sinks.

Guided Practice:
The teacher will conduct the anticipatory set and then explain the concept and mathematical formula of density (Density = Mass/Volume). Students will be led through the first calculation by the instructor.

Independent Practice:
All measurements and calculations after the initial data point will be student-led.

Remediation and/or Enrichment:
IEP's will be supported.
Students can be led through a more in-depth discussion on haline environments found around the world and what causes them.

Check(s) for Understanding:
The teacher will float between lab benches to make sure students are performing the calculations correctly and comprehending the relationship between mass, volume, and density. Students will complete a data sheet for densities and calculated solute mass.

- Does salt increase or decrease pure water's density?
- Is it a linear or exponential relationship between salt percentage and change in density?

Closure:
Graphs showing the relationship between percent solute and density will be created. The teacher will also discuss that, for homogenous material, density will not change as mass or volume increase or decrease.

Possible Alternate Subject Integrations:
Mathematics: This lesson will require basic algebra skills and calculating between different units systems.

Environmental Science: The teacher can talk about how pollution can cause changes in the natural water system.

Teacher Notes: