LCM Formal Loop Lesson Plan: Density

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Exploring Density Biology Grades 9-10
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Standards:
Science: A8, C1, B1
Math: A2, A3, A6, D2,
Cultural: B1, B2

Science Concept: Density can be calculated
Density is a dimension that can be used to identify elements, compounds, and minerals with known chemical formulas.

New Vocabulary:
Mass, volume, density, accuracy

(timeline: 1.5 block periods with a 1 hour metric lesson prior) 55 minutes of follow up on graphing & results

Activity	Process Skills	Materials
Gear up: Hand out specimens of cool minerals, (metallic ones like galena and pyrite are popular) and rock specimens of pure composition (quartz, obsidian etc.. around the lab station. Ask students to discuss the minerals among the group and **generate a list of** observations for the specimens. **Question:** What observations were made? What are other names given for these observations? (properties) **Q;** What is unique about the way you arrived at this list? Some are measured, others are observed **Q:** Can water be included in this list? Add the same observations to the list for water.	Observation Communication Predicting Making graphs B1., B2, D1, D4	Mineral Specimens, triple beam balances, plastic beakers, grad cylinders, wood blocks

Activity	Process Skills	Materials
Explore: Ask students to identify which properties or dimensions they can measure and which they cannot. What tools could you use to measure these properties? To what degree of precision can each instrument measure its respective property? Are there properties which cannot be used across the board to examine these specimens? Is water a mineral? Does water posses the same ability to be evaluated as the minerals have?	Observing Investigating	Background information from previous labs
Generalize: Discuss the concepts of mass, especially as it relates to weight What is mass? How is it calculated? What is weight? How is it calculated? How are mass and weight the same? How are mass and weight different? What is volume? How is it calculated? If 2 objects are the same size, must they have the same weight? If no, which dimension must be different?(mass) Design an experiment to look at the differences between minerals if the volumes are left the same and the masses are calculated. What would the formula for this comparison look like? Write a procedure for calculating the volume of an irregularly shaped object	Hypothesizing Communicating Making models Defining operationally	

Activity	Process Skills	Materials
Experiment: Students design a lab to accurately measure the mass and volume of their specimens. They should be able to use the triple beam balance for calculating mass. They should use displacement of water for calculating the mass of an irregularly shaped object. The specimens need to be small enough to fit in a graduated cylinder, or large enough to fit in a beaker so they will show noticeable change. Students construct a data table for collecting measurements. Students will make a bar graph showing the densities for each of the minerals. Emphasis on accuracy in graphing and a small increment on the experimental axis is important as the results are going to be close for some of the minerals.	Hypothesizing Controlling variables Predicting Investigating Experimenting Collecting data Measuring	➢ Triple beam balance ➢ Plastic beaker calibrated to 1 ml increments if possible ➢ **Graduated cylinder calibrated to .5ml or smaller if possible** ➢ Mineral specimens

Activity	Process Skills	Materials
Interpret: Students compile their data on the board. Class averages are determined and graphed as well. At this point we discuss experimental error for the lab What does the density of the mineral say about its mass? What does mass say about what makes up the mineral? How does the density of water compare to the densities of the other minerals? How does the density of these minerals compare with their molecular weight? (they will not find one) **Insist on the greatest amount of accuracy possible in calculating the density as the results are close**	Making graphs Interpreting data Inferring Communicating Generalizing	
Apply/Assess: Identify many areas of science where density plays a role ie weather—clouds formation and height How is the density of water important when it comes to rivers and lakes freezing? What would the earth be like if ices density were greater than that of liquid water? Life science- plankton, Geology- ID of minerals	Predicting Generalizing Inferring Predicting	
Extensions: Ask students how density is significant to a phlebotomist? How is density important to a geologist analyzing country rock for a mining company? **What are the effects on the oceans created by saltwater with different densities? How have organisms adapted to the density of water?**	Predicting Generalizing Using mathematical models Measuring Experimenting Hypothesizing	

LCM SCORING GUIDE
DENSITY

5 **EINSTEIN** Can manipulate density equation to find any dimension. Correctly ID's units for all dimensions and converts to other forms (in metric) Can discuss scenarios of events in nature where densities role is critical.

4. **PROFESSOR**: Calculates density when given mass and volume. Can explain most nature density scenarios. Can manipulate equation to solve with some assistance.

3. **Grad Student**: Can explain mass, more difficulty grasping volume. Density formula can be solved but nature applications are difficult to explain. Understands why wood floats.

2. **Offensive line candidate**. Can measure mass; can measure volume with help.
Cannot see the relationship between mass/ volume.
Has difficulty seeing how units apply to formula.

1. **Gomer Pyle** Needs complete help to plug numbers into formula. Does not understand the concept of mass, or volume. Division of the 2 variables is difficult