WAMC Lab

Math Concept(s): Volume by Displacement and Measurements, Density and Mass

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Attach the following documents:

Student Handout: Density Lab with Thermal Cylinder.

Indicate "*SPECIFIC*" relationship to Science, Technology, or EngineeringThis lab uses engineering tools for measurement and chemistry lab equipment and formulas for density and volume.

Short Description (Be sure to include where in your instruction this lab takes place):

In this lab the students will use calipers to measure the different dimensions of each metal cylinder. They will use the volumetric cylinder with water to verify the true volume of each cylinder using displacement. They will use a scale to determine the mass of each metal cylinder. Using their knowledge of Density they can determine what material is each metal cylinder is made of.

Lab Plan

Lab Title: Density Lab with Thermal Cylinder

Prerequisite skills: basic understanding of the mass, volume formula for cylinders and Density.

Lab objective: The objective of this lab is to determine the type of material each cylinder is based on its density.

Standards:

Mathematics K–12 Learning Standards:

- G.GMD.1&3

Standards for Mathematical Practice:

- All

K-12 Learning Standards-ELA (Reading, Writing, Speaking & Listening):

- L.11-12.3

Leadership/21st Century Skills:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)

☒ Global Awareness ☐ Financial/Economic/Business/Entrepreneurial Literacy ☐ Civic Literacy

☐ Health/Safety Literacy ☒ Environmental Literacy

21st Century Skills (Check those that students will demonstrate in the above activity.)

LEARNING AND INNOVATION

Creativity and Innovation
- ☐ Think Creatively
- ☐ Work Creatively with Others
- ☐ Implement Innovations

Critical Thinking and Problem Solving
- ☒ Reason Effectively
- ☒ Use Systems Thinking
- ☒ Make Judgments and Decisions
- ☒ Solve Problems

Communication and Collaboration
- ☒ Communicate Clearly
- ☒ Collaborate with Others

INFORMATION, MEDIA & TECHNOLOGY SKILLS

Information Literacy
- ☒ Access and Evaluate Information
- ☐ Use and manage Information

Media Literacy
- ☐ Analyze Media
- ☐ Create Media Products

Information, Communications and Technology (ICT Literacy)
- ☐ Apply Technology Effectively

LIFE & CAREER SKILLS

Flexibility and Adaptability
- ☐ Adapt to Change
- ☒ Be Flexible

Initiative and Self-Direction
- ☒ Manage Goals and Time
- ☐ Work Independently
- ☒ Be Self-Directed Learners

Social and Cross-Cultural
- ☒ Interact Effectively with Others
- ☒ Work Effectively in Diverse Teams

Productivity and Accountability
- ☐ Manage Projects
- ☒ Produce Results

Leadership and Responsibility
- ☐ Guide and Lead Others
- ☒ Be Responsible to Others

Teacher Preparation: (What materials and set-up are required for this lab?)

Lab Equipment:

- Class: Two digital metric scales .01 grams
- Groups: 1 lab handout per kid, Plastic 100 mL Volumetric Cylinder, set of metal cylinders, caliper, and large red cup full of water.

Set-Up Required:

- Each station should have the group materials at it. If you are in a non-science style class, you can have the equipment available in the front of the room for students to acquire before beginning the lab.

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

-

Cooperative Learning:

- The students will work in groups and will have to use teamwork to finish the lab in a timely manner. They will have to delegate task for each person to do using our classroom norms for group work.

Expectations:

- The students will collect the data of the lab before doing any of the mathematical calculations.
- The students will abide by all lab procedures.
- The students will follow the rules of the classroom for lab time (expectations and norms are explained and a the beginning of the year for labs and instructional time)

Timeline:

- Day one - pre-Lab write up (in class or for homework)
- Day two - immediately begin the Lab portion of this lesson. It takes approximately 25 minutes. Calculation portion takes 5-10 minutes. Follow up discussion lasts 10-15 minutes. Students will finish the follow up questions in class or at home.
- Day three – collect finished lab write-up.

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- This method is used to gain the density and volume of an unknown object of irregular shape.
- This lab helps reinforce the measurement techniques used in the students science and technology classes and shows uses outside of those classroom settings.

Career Applications

- Calipers are used everyday by machinists, engineers and physicists as a very accurate measurement tool for length.

Optional or Extension Activities

- Students can bring in small irregular shapes to calculate the volume and density of.

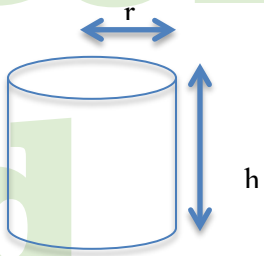
What is it Made Of??

Name_____
Date_____
Period_____

ALWAYS SHOW YOUR WORK

You are going to use the density of an object to determine what metal the material is. You will need determine the volume of the object by displacement and verify that volume using the volume formulas you have learned for different shapes.

Pre-Lab – Determine the type of material the cylinder at right is made of using the dimensions and the mass given. Use your knowledge of density and the list of material densities given to determine the material.



Radius = 1.2 cm
Height = 3 cm
Mass = 38.14 grams

Volume = _____
Mass = _____
Density = _____

What Type of material is it? (Use page 535 in your book)

Lab – Using what you have practiced in the pre-lab, find the material type of all four metal cylinders.

Step 1 - Fill in the blanks below with all measurements with the tools given. Cylinder sized from small to large.

Cylinder	Mass (grams)	Height (cm)	Diameter (cm)
Smallest			
Small			
Medium			
Large			

Step 2 – Using the space below, calculate the volume of each cylinder using the diameter and height measurements from Step 1. Record your results in the table in Step 3.

What is it Made Of??

Step 3 – Calculate the volume of each cylinder by Displacement. Copy your results from your calculated volume and measured volume. Remember 1 mL = 1 cm^3.

Cylinder	Water Volume Initial (mL)	Water Volume after Displacement (mL)	Volume by Displacement (cm^3)	Volumes from Step 2 (cm^3)
Smallest				
Small				
Medium				
Large				

Are the calculated volumes by measurement the same as the calculated volumes by displacement? If not, why do you think they are different??

Step 4 – Calculate the density of each cylinder by using your displaced volume and determine the material type based on the density of the material. (Page 535 in your book)

Show all of your work below

Cylinder	Mass	Volume by Displacement	Density	Material type
Smallest				
Small				
Medium				
Large				

What did you notice about the smallest cylinder's density compared to the largest cylinder's density?

What could you use these techniques for in some other real world application.