WAMC Lab Template

Math Concept(s): Volume of Cylinders
Source / Text: Cord Applied Mathematics
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Date: Summer Conference 2016

Attach the following documents:

Lab Instructions:
Students will be placed in groups of 3-4 and be given a tuna fish can, a pop can, and a three-pound. Students will then measure the inside diameter and height of each can to the nearest tenth of a centimeter (write these values on a separate sheet of paper). Once values have been recorded, fill each can with water using the graduated cylinder. Record the measured volumes in millimeters on your data paper.

Student Handout(s)
Students will be given a handout that has a 4 x 4 table on it. Within those cells, students will fill in their data for their various cans (inside diameter, height, volume (cm), measured volume (ml).
Additionally, students will also have the volume formula at the top of their paper for reference (Π r squared x height) as well as 1cm = 1ml.

Rubric and/or Assessment Tool
Students will be assessed formatively and at the end of the lab, we will come together and determine our results.
Answers: The inside diameter and height for typical cans are:
- 3-lb coffee can: Inside diameter = 15.4cm Height = 16.7cm Volume = 3110.63cm cubed
- Tuna Fish Can: Inside diameter = 8.8cm Height = 3.8 cm Volume = 200.71 cm cubed
- Pop can: Inside diameter = 7.2cm Height = 11 cm high Volume= 447.87 cm cubed
- 1 cubic cm = 1 milliliter

Indicate "*SPECIFIC*" relationship to Science, Technology, or Engineering
Math, Plumbing, Engineering, Health Occupations, Home Economics, Industrial Technology

Short Description (Be sure to include where in your instruction this lab takes place):
In the classroom and in your group, you will measure the diameter and height of the three different sizes of cans. You will then use these dimensions to calculate the volume of the cans. As a group, you will then measure the volume using water from your graduated cylinder and compare it to the calculated volume.

Lab Plan
Lab Title: Measuring volume of cans

Prerequisite skills:

- Area of a circle
- Circumference/Radius
- Multiplication
- US Standard/ Metric Measurements
- Volume of a cylinder formula

Lab objective: Find precise measurements of the base and height of cylinders, accurately calculate the volume of those cylinders, and ensure that the volume is valid by filling them with the given amount of water.

Standards:

Mathematics K–12 Learning Standards:

- G-GMD.1 Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder.
- G-GMD.3 Use Volume formulas for cylinders to solve problems.

Standards for Mathematical Practice:

- MP.1 Makes sense of problems and persevere in solving them
- MP.2 Reason abstractly and quantitatively
- MP.3 Construct viable arguments and critique reasoning of others
- MP.5 Use appropriate tools strategically
- MP.6 Attend to Precision
- MP.7 Look for and make use of structure
- MP.8 Look for and express regularity in repeated reasoning

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

- L 9-10.6 Acquire and accurately use general academic words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level.
- RST.9-10.1 Cite specific textual evidence to support analysis of technical texts, attending to the precise details of explanations or descriptions.
- RST.9-10.3 Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
- RST.9-10.4 Determine meaning of symbols, key terms, or other domain specific words and phrases as they are used in specific technical context
- RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form and translate information expressed verbally or mathematically into words.
- W.9-10.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- SL.9-10.1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners building on others' ideas and expressing their own clearly and persuasively.

SL.9-10.4 Present information, findings, and supportive evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

Leadership/21st Century Skills:

<table>
<tr><td colspan="4">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</td></tr>
<tr><td colspan="4">21st Century Skills (Check those that students will demonstrate in the above activity.)</td></tr>
<tr>
<td>LEARNING AND INNOVATION
<u>Creativity and Innovation</u>
☒ Think Creatively
☒ Work Creatively with Others
☐ Implement Innovations
<u>Critical Thinking and Problem Solving</u>
☒ Reason Effectively
☒ Use Systems Thinking
☒ Make Judgments and Decisions
☒ Solve Problems
<u>Communication and Collaboration</u>
☒ Communicate Clearly
☒ Collaborate with Others</td>
<td>INFORMATION, MEDIA & TECHNOLOGY SKILLS
<u>Information Literacy</u>
☐ Access and Evaluate Information
☐ Use and manage Information
<u>Media Literacy</u>
☐ Analyze Media
☐ Create Media Products
<u>Information, Communications and Technology (ICT Literacy)</u>
☐ Apply Technology Effectively</td>
<td>LIFE & CAREER SKILLS
<u>Flexibility and Adaptability</u>
☒ Adapt to Change
☒ Be Flexible
<u>Initiative and Self-Direction</u>
☒ Manage Goals and Time
☐ Work Independently
☒ Be Self-Directed Learners
<u>Social and Cross-Cultural</u>
☒ Interact Effectively with Others
☒ Work Effectively in Diverse Teams</td>
<td><u>Productivity and Accountability</u>
☒ Manage Projects
☒ Produce Results
<u>Leadership and Responsibility</u>
☒ Guide and Lead Others
☒ Be Responsible to Others</td>
</tr>
</table>

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

Materials

- Graduated Cylinder (approx.. 12)
- Pop Cans (approx. 12)
- Tuna fish cans (approx. 12)
- Three-pound coffee cans (approx. 12)
- Water
- Ruler/ measuring tape (with centimeters)
- Calculators

Set-Up Required:

- Ensure that each group of 4-5 students has one of each can, a measuring tool, and a graduated cylinder filled with water. Each group will also need a calculator to calculate their findings.

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

- 1.A Think Creatively
- 1.B Work Creatively with Others
- 1.C Implement Innovations
- 2.A Reason Effectively
- 2.C Make Judgements and Decisions
- 2.D Solve Problems
- 3.A Communicate Clearly

- 3.B Collaborate with Others
- 4.B Use and Manage Information
- 7.B Be Flexible
- 8.A Manage Goals and Time
- 8.C Be Self-Directed Learners
- 9.A Interact Effectively with Others
- 9.B Work Effectively in Diverse Teams
- 10.A Manage Projects
- 10.B Produce Results
- 11.A Guide and Lead Others
- 11.B Be responsible to others

Cooperative Learning:

- Students will need to work effectively and collaboratively in groups to ensure that the assignment gets completed.

Expectations:

- Students are expected to work effectively in groups and develop accurate measurements and calculations of volume.

Timeline:

- This lab should take approximately 57 minutes (1 class period) with at least the last 5 minutes to be allocated for clean-up/ organization of materials.

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- Being able to determine just how much matter can fit into a cylinder by determining it's volume. Example: how much water can I place into that bucket if I didn't know that it was a 5-gallon bucket?

Career Applications

- Plumber, engineer, mechanic, designer, construction

Optional or Extension Activities

- Students can complete the same calculations with an object at home, document the procedure in detail and turn in the following day for 5 points extra credit.

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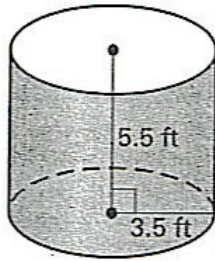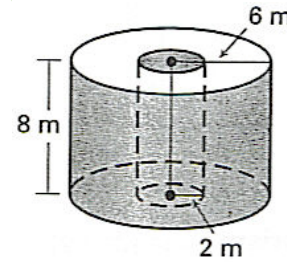
Name:

Date:

Period:

Quiz: Use volume formulas for cylinders to solve problems.

Find the <u>Volume</u> of each figure to the nearest tenth.

1.

5.5 ft

3.5 ft

2.

6 m

8 m

2 m

3. A cylinder has a diameter of 4.8 cm and a height of 8 cm. Use the volume formula to determine how many ml can fit into the cylinder (1cm = 1ml)?

4. A company packages juice in a cylindrical can that has a radius of 3 in. and a height of 6 in. How much juice can they fit into the can?

Write the name of each of your group members in a separate column, including yourself. For each person, indicate the extent to which you agree with the statement on the left, using a scale of 1-4 (1=strongly disagree; 2=disagree; 3=agree; 4=strongly agree). Total the numbers in each column.

Evaluation Criteria	You:	Group member:	Group member:	Group member:
Contributes meaningfully & equally to group discussions and work.				
Prepares work in a quality manner.				
Demonstrates a cooperative and supportive attitude.				
Contributes significantly to the success of the group.				
TOTALS				

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