

UOP: Water Bead Activity

State Math Standards Addressed:

G.6.C Apply formulas for surface area and volume of three-dimensional figures to solve problems. G.6.E, G.7.A, B, & C Reasoning, Problem Solving and Communication-Analyze, Select, & Evaluate, Alg2.1.A Select and justify functions and equations to model and solve problems.

Goal: Given a water bead, an empty jar, and a micrometer caliper calculate how many beads will fit into the empty jar.

Step 1: Estimate how many beads will fit. Turn your answers into the teacher before doing step 2.

Step 2: Write a detailed paragraph explaining how you'd solve the problem. Use Microsoft Word to type it.

Sample: In order to complete this lab activity, you will need to find the volume of your water bead and the volume of your jar. To find the volume of the water bead you will use your micrometer caliper to measure its diameter and apply the formula $\frac{4}{3}\pi r^3$. You will have to make sure to find the radius of our water bead, label your answer, and round your answer to the correct significant figure. For the jar, you will measure the height, length and width, and apply the correct formula given on your Geometry formula sheet. You will then need to take the volume of your jar and divide it by the volume of your water bead. The answer will need to be rounded to the nearest whole number. (Remember the significant figure for the number of water beads is a whole number.)

Step 3: Carry out the activity. Organize your data in a spreadsheet. Remember to label each of the units.

Step 4: Fill your jar with water beads. Count the water beads.

Answer: _____ water beads.

Step 5: Answer the following in your final write-up and label it Evaluation:

If your answer is close. What special methods did you use to make sure the volume of your jar was close to the actual jar capacity? If your answer is not close, give some reasons why you could be off.

When revising your Microsoft Word write-up, make sure your description contains all your steps, diagrams and appropriate labels. Show all your work and label your answers. Remember to add pictures of your supplies and or diagrams. The final write-ups will be displayed in the classroom.

Washington Applied Math Council

<https://wa-appliedmath.org/>

Washington

UOP Water Bead Activity



Name: _____

Teacher: Mrs. Davidson

Date : _____

Title of Work: _____

	Criteria				Points
	1	2	3	4	
Paragraph Explanation	Misses key points. Grammar rules not followed	Explanation is unclear. Grammar rules followed somewhat.	Good solid response with clear explanation. Very few grammar errors.	A complete response with a detailed explanation. No grammar errors.	—
Appropriate Presentation of data. Use of Microsoft Excel.	No chart. Work not organized. Wrong measurements.	Inappropriate or unclear chart.	Clear diagrams.	Clear diagram with measurements correctly written.	—
Mechanics and labels	Major math errors or serious flaws in reasoning.	May be some serious math errors of flaws in reasoning	No major math errors or serious flaws in reasoning.	No math errors.	—
Group behavior	Didn't contribute to group	Minimal help with group activity.	Helped with group activity but interrupted other classmates	Exceptional behavior and work.	—
Follow up activities	Way off on answer.	Off a little from actual answer. Labels not correct.	Close to true answer and can offer answer to why you are	Little difference between lab answer and true answer	—
				Total---->	—

Teacher Comments:

<https://wa-appliedmath.org/>

Rubric adapted from: Connie Gretschmann

Username: Loretta Davidson

UOP Title: Learning with Metric Calipers and Micrometers

Subjects: Applied Math 2, Applied Math 3, Science, and English/Language

Level: High School

Content Standards:

- **Geometry G.6 Additional Key Content: Measurement**
- **G.6.C** Apply formulas for surface area and volume of three dimensional figures to solve problems.
- **G.6.E** Use measurements with degrees of precision in measurement, explain the reasons for using a certain degree of precision, and apply estimation strategies to obtain reasonable measurements with appropriate precision for a given purpose.
- **G.7 Core processes: Reasoning, Problem Solving, and Communication**
- **G.7.A** Analyze a problem situation and represent it mathematically.
- **G.7.B** Select and apply strategies to solve problems.
- **G.7.C** Evaluate a solution for reasonableness, verify its accuracy, and interpret the solution in the context of the original problem.
- **Alg.2.1 Core Content: Solving Problems**
- **A.2.1.A** Select and justify functions and equations to model and solve problems.

Content Objectives:

- 1) Identify cylinders, rectangular solids, cones and spheres.
- 2) Calculate surface area and volume for rectangular solids, cones and spheres.
- 3) Solve problems that involve rectangular solids, cones and spheres.

Author: Loretta Davidson

Abstract:

The students will learn how to read vernier calipers and micrometers. They then will apply this knowledge to solve the empty jar activity.

Anticipatory Set:

How many times have we been to a fair and been asked to guess how many items are in the jar? We throw a guess in the jar and walk away. Was our guess close or not? In this activity students will again be asked this question, however; they won't have the chance of just walking away. The students will actually calculate how many items are in a given jar using a vernier caliper and a water bead.

Situations:

The students will be in both our computer lab and the classroom for this 14-day unit. The activity itself will probably take only 4 or 5 days, but I plan on using it in conjunction with the unit I teach on Surface Areas and Volumes. Each day is based on a 50-minute class period.

Tasks:

The students will watch a video introducing surface area and volumes.

The students will complete a study guide, surface area and volume worksheet, skill drill worksheet, and a unit test.

The students will work individually on assigned story problems with class discussion to follow on the more difficult problems.

The students will learn how to use metric calipers and micrometers through interactive PowerPoint presentations.

The students will complete practice activities with calipers and micrometers.

The students will work in groups of 2 or 3's to complete a given lab activity.

The students will use word processing to write a paragraph explaining how to solve the water bead problem, carry out the activity organizing their data using a spreadsheet, and answer questions about the lab.

Interactions:

Students will work on some projects individually.

The lab activities will be completed in groups of 2 or 3.

Questions over assigned problems will be answered as a class.

The teacher will act as a facilitator making sure students can read calipers and checking over their lab activities

Assessment:

Lab Activities: participation and behavior in group

How precise their answer is to water bead problem.

Measuring correctly and showing work solving problems.

labeling their answers correctly.

Teacher Graded Activities: Study guides, assigned problems, worksheets, and unit test

Tools:

- 1) Microsoft PowerPoint presentations, video introducing unit, Microsoft Excel to record, and organize, data, Microsoft Word to type explanation paragraph.
- 2) Other tools: Cord Mathematics textbook & resource materials, micrometers, vernier calipers, scientific calculators, empty jar, and water beads.

Project:

Completion of the following activities: (Based on 50 minute class periods)

Day 1: Watch video and start study guides.

Day 2: Complete studies guides and answer any questions.

Day 3: Discuss surface area and volume formulas. Give handout with all geometric formulas listed. Complete practice worksheet.

Day 4: View PowerPoint presentation on reading a Micrometer Caliper. Assign textbook problems. (Problem set # 1)

Day 5: Complete lab activity given with textbook.

Day 6: Group discussion over problem set #1. Assign problem set # 2.

Day 7: Microsoft PowerPoint tutorial on the micrometers. Complete activities in groups of 2.

Day 8: Introduce water bead contest. Work with partner to write out detailed process. Hand in estimate.

Day 9: Complete activity. Use Microsoft Excel to record and organize data.

Day 10: Turn in answers. Fill jar with water beads to find the true answer. Explain why the calculated answer could be off. Was your original estimate reasonable?

Days 11 and 12. Word process you write up including pictures, diagrams, labeling of units to explain your process and results. Turn in with this packet for grading.

Day 13: Discuss problem set # 2. Assign problem # 3.

Day 14: Complete skill drill worksheet. Work on problem set # 3.

Day 15: Review for test.

Day 16: Unit test.

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