

WAMC Lab Template

Math Concept(s): Make sense of problems and persevere in solving them. Construct viable arguments and critique the reasoning of others. Attend to precision.

Source / Text:

Developed by:

E-Mail: lkelly@ohsd.net

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

Students will be briefed in the classroom then enter the lab to take measurements of cylinders. Bore scopes, calipers, and micrometers are used quite frequently in the transportation repair industry to verify or check tolerances. In this lab, students have the opportunity to hone their measuring skills with practical application and use geometric equations to compare various displacements of engines in use today.

Lab Plan

Lab Title: Calculating Displacement

Prerequisite skills: Use of bore scope tool, vernier caliper, and micrometer.

Lab objective: Be able to demonstrate the ability to use precision measuring devices to collect information to solve for volume of single cylinder and multiple cylinder engines.

Standards: (Note SPECIFIC relationship to Science, Technology, and/or Engineering)

Mathematics K–12 Learning Standards:

- G-GMD Geometric Measurements and Dimension

Standards for Mathematical Practice:

- Make sense of problems and persevere in solving them. Reason abstractly and quantitatively. Attend to precision. Look for and express regularity in repeated reasoning.

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

- **RST.11-12.7** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-ETS1-1), (HS-ETS1-3)

K-12 Science Standards

HS-PS1-5. Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.

Technology

- Use calculating and precision measuring devices

Engineering

- Understanding how changing shapes and volumes effect performance outcome

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

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

Materials:

At least two open engine blocks with different sized cylinders. Or three cylindrical objects- Two with the same diameter but different heights. One with the same height as one of the others but, different diameter. Bore scope tool, vernier caliper, and micrometer.

Set-Up Required:

Place cylinders on table

Lab Instructions:

Discuss differences in cylinders, measure with tools listed, and do math...discuss/compare end results

Student Handout:

Formulas written on whiteboard

Rubric and/or Assessment Tool:

Formative Assessment: Spot checks while taking measurements. Instructor will visit each group to validate measurements are being taken correctly.

Summative Assessment: Accurately complete lab and open discussion of findings.

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

- ***Guide and Lead Others (11.A)***

Cooperative Learning:

- **Produce Results (10.B)**

Expectations:

Produce Results (10.B)

Timeline:

15 minute set up, 10 minute data collection, 30 minute computation, and 15 minute closing discussion.

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- Making hotrods, dragsters, rat-rods, etc...

Career Applications

Petroleum industry, Transportation, logistics, engineering, construction, aviation

Optional or Extension Activities

- Once students complete lab they are encouraged to assist others.

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