

# Integrated Project-based Learning: Combining PTE Standards and Academic Standards

Use this template for planning and sharing ideas for projects. This template is based on the 6 A's:

*Authenticity\* Academic Rigor\* Applied Learning\* Active Exploration\* Adult Connections\* Assessment*

## Project

|   |   |
|---|---|
| <b>Title of Project</b>                           | <b>Calculating Engine Displacement</b>  |
| <b>Project Developed by</b>                       | Pat Van Patten and Drew Barnes  |
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| <b>School</b>                                     | Buhl High School  |
| <b>Pathway / Small Learning Community/Academy</b> | Grades 11-12  |
| <b>Course Title(s)</b>                            | Auto II, Algebra Topics   |
| <b>Time Frame</b>                                 | 1 Day   |

## Authenticity

*Briefly describe your project. Include the key question and provide an overview of what students do and learn. Tell why the question is meaningful to the students and where one might see a similar question tackled by an adult in the workplace.*

|                     |   |
|---------------------|---|
| <b>Key Question</b> | <b>Calculate the volume of a cylinder</b>   |
| <b>Overview</b>     | <b>Calculate the volume of a cylinder in an automotive engine to determine total displacement. Determine necessary action. Write a repair order detailing total cost including parts and labor.</b> |

## Vocabulary/Key Terms

*List vocabulary words and key terms essential to student understanding.*

**Diameter**  
**Cylinder**  
**Volume**  
**Radius**  
**Top Dead Center**  
**Bottom Dead Center**

## Vocabulary/Key Terms

**Depth (Height)**

**Displacement**

**Cubic inch**

**Liter**

**Engine**

## Active Exploration \* Applied Learning \* Adult Connections

*What classroom-based, community-based, and career-based activities does the project involve? Include a description of the active exploration, applied learning, and adult connections in the project (as needed).*

**Active Exploration** How does the project engage students in real investigations using a variety of methods, media and sources? What field-based work will students perform? How does student learning and service support active career exploration? Students will examine real models of homes. Math will explain scaled units in architecture. They will have lessons on home construction and the building codes for bids. How knowledge is used in industry?

**Applied Learning** How do students apply what they have learned and researched to a complex problem (e.g. designing a product, improving a system, creating an exhibit, organizing an event)? Lecture on industry usage of this concept i.e. model designs. Application with their own proportions also will be explored along with industry standards.

**Adult Connections** Who from the community, workplace, postsecondary and/or industry partnership works with students on the project? Lecture from local industry and community in home design.

### Classroom Activities

**Calculating the volume of a cylinder. ( $v=\pi r^2h$ )**

**Converting cubic inch to liter (c.i. \* .016387064=liters)**

### Community Activities

**Communicating with various automotive repair facilities to determine actual cost of repair.**

**Job shadowing engine repair/machining facility.**

### Career Activities

**Calculating Engine displacement**

**Writing a repair order**

**Customer service**

## Academic/PTE Rigor

**Standards** Use the space below to list the state content standards and PTE industry standards addressed by the project. (A list of the content standards is available at <http://www.sde.idaho.gov/ContentStandards/default.asp>. This page, which includes selected high school level standards, is designed to let you easily create a list of standards you are addressing. You may then copy and paste the list into this template.)

## Academic/PTE Rigor

### ISDE Math Standards

AI.2.1.1 Make decisions about units and scales that are appropriate for a given problem.

AI.2.2.1 Convert rates using dimensional analysis

G.1.3.1 Judge the reasonableness of numerical computations and their results

G.2.1.1 Select appropriate units for problems involving measurement

G.2.2.1 Understand and use formulas to calculate the perimeter, circumference, area, surface area, and volume of geometric figures.

### NATEF Automotive Standards

Inspect and measure cylinder walls for damage and wear; determine needed repairs. [P-2]

01.08 TASK: Communicate properly on the job

01.09 TASK: Maintain professionalism on the job

01.12 TASK: Demonstrate the ability to work as a team member

01.13 TASK: Demonstrate proper work ethics and behavior

01.14 TASK: Demonstrate the ability to solve problems and apply critical thinking skills

02.01 TASK: Apply shop safety rules and procedures

04.01 TASK: Apply basic math skills

04.04 TASK: Demonstrate the use of shop manuals and tune up charts

B1.02 TASK: Demonstrate knowledge of shop repair order writing, customer complaint, and repair verification

### School to Career Competencies *Please check (x) the competencies addressed by the project*

Communicate and understand ideas and information

Collect, analyze and organize information

Identify and solve problems

Use technology

Initiate and complete entire activities

Act professionally

Interact with others

Understand all aspects of an industry

Take responsibility for career and life choices

**Student Goal(s) Once the project begins, ask students to generate one or two personal goals.**

## Assessment

*How do you and the students know the project is a success? What are your criteria for measuring students' achievement of the disciplinary knowledge and applied learning goals of the project? What evidence do they use to demonstrate their progress? What deliverables do they need to complete prior to the final exhibition? How will students self-assess?*

Answer calculations correctly, evaluate presentation by use of a rubric, properly progress through project by completing task sheet, self assess by comparing answers to manufacturer service information.

## Recommended Resources / Sample Products

### Software or Materials Needed

*(Examples)*

Calculator, micrometer, telescoping gauge, depth gauge, paper, pencil, shopkey service information

### Teacher-Developed Materials

*(Examples of materials that can be shared with other classes. Please attach samples.)*

Any related worksheets, handouts, rubrics, templates,

### Student-Developed Materials

*(Examples of products that can be shared with other classes. Please attach samples.)*

Sample repair orders

### Websites Used

*(Examples)*

[www.shopkey5.com](http://www.shopkey5.com)

<http://www.sde.idaho.gov/ContentStandards/default.asp>

[http://www.pte.idaho.gov/Forms\\_Publications/SkilledTech\\_Sciences/STS/Curriculum%20Guides/autotech.pdf](http://www.pte.idaho.gov/Forms_Publications/SkilledTech_Sciences/STS/Curriculum%20Guides/autotech.pdf)

### Final Words

*(In a sentence or two, highlight your project's overall value.)*

Students will develop a working knowledge of measurements, volume, and proper use of units as well as learn valuable workplace skills.

### Teacher Tips/Extensions

*(Use the first person to share a useful idea that helps with implementation and ensures success. Make it chatty, informal.)*

### Extensions

*(List any ideas for students who may want to go deeper into the learning standards.)*

Job shadowing opportunity.

Explain how increasing engine displacement affects torque and horsepower, and how will it affect engine efficiency.

## Timeline

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*What sequence of teaching and learning experiences will equip students to develop and demonstrate the PTE standards and the Academic standards?*

- Participating students have already been introduced to the mathematic concepts in geometry. This project will demonstrate real world application by: taking measurements, using formulas, developing a repair order, determining necessary action. Auto II, semester 1. Approximately 3 hours.

(Adapted from the Boston Public Schools Signature Projects.)