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

Title of Project Combustion and Energy

Project Developed by Matt Tierney , Brad Lancaster

E-mail Address Mtierney@buhlschools.org
Blancaster@buhlschools.org

School Buhl High School

Pathway / Small Learning Community/Academy

Course Title(s) Chemistry/Auto Tech

Time Frame 5 days

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.

Key Question What would the world be like without Crude Oil and the process of refining crude oil?

Overview **In this block of instruction students will learn about the process of refining crude oil, using the products, and responsibly disposing of the petroleum products. An investigation into the oil industry will illuminate some of the ways crude oil is obtained from the earth. Students will research the massive list of products that come from refining crude oil. Combustion Basics will be covered. Students will conduct volatility tests between four different refining products.**

Vocabulary/Key Terms

List vocabulary words and key terms essential to student understanding.
Combustion, Reactant, Product, By-Product, Octane, Cetane, Evaporation, Concentration, Additive, Stabilizer, Combustion Knock, Pinging, Flame Rate, Thermal Energy, Chemical Energy, Mechanical Energy. Jet Fuel, Diesel Fuel, Kerosene, Aviation Gasoline, Gasoline. Propane, Methane, Butane, Paraffin, Coke, crude oil, Fracking, Karosene, Distillation. Bitumen, Stoichiometric Ratio

Active Exploration * Applied Learning * Adult Connections

Classroom Activities	Community Activities	Career Activities

The Chemistry of Combustion discussion—focus on available oxygen and the formation of different products. The process of Distillation with be showed to students by reducing cola to the solids by distillation through heat. Volatility tests (gas vs diesel vs butane vs karosene). Students will predict which type of fuel is more volatile.	Recycling petroleum products. A discussion will be held in which the recycling process will be investigated.	Investigate career opportunities in the Petroleum industry.

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.)*

11-12.C.1.3.1 Identify, compare and contrast physical and chemical properties and changes and appropriate computations.
11-12.C.1.3.6 Express concentrations of solutions in various ways including molarity
11-12.C.1.6.1 Demonstrate an understanding of the scientific method.
11-12.C.1.6.2 Select and use appropriate scientific equipment, materials and techniques.
11-12.C.1.8.1 Correctly write symbols, formulas and names for common elements, ions and compounds.
11-12.C.1.8.2 Communicate scientific investigations and information clearly
11-12.C.2.1.3 Predict physical properties of compounds based upon the attractive forces between atoms and molecules.

School to Career Competencies *Please check (x) the competencies addressed by the project*
[x] Communicate and understand ideas and information
[x] Collect, analyze and organize information
[x] Identify and solve problems
[x] Use technology
[x] Initiate and complete entire activities
[x] Act professionally
[x] Interact with others
[ ] Understand all aspects of an industry
[x] 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?

Students will choose from a list of petroleum refining products to research. Students will identify the molecular formula of that material. They will identify how that specific material is refined; what step in the refining process does their material come from. They will research the recycling potential of that material and state whether nor not it can be recycled and what products are made from the recycled material.

Recommended Resources / Sample Products

Software or Materials Needed

Chromebook, Internet

Teacher-Developed Materials
Fuel, spray bottle, torch, glass petri dishes with lids, 2 Jars with lids, propane torch, graduated cylinders, timers

Student-Developed Materials
(Examples of products that can be shared with other classes. Please attach samples.)

Websites Used
Wikipedia, YouTube, innovativewealth.com

Final Words
Students gain an understanding of different fuel grades and the varied uses each has.

Teacher Tips/Extensions
Due to the nature of these activities, safety precautions should be taken.
Keep fuel supply away from testing area
Always have appropriate fire extinguisher readily available.
Eye and hand protection should be used at all times (PPE)

Extensions
Interested students may want to investigate alternative/bio-fuels, which is not covered in this lesson.

Timeline

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

Day 1: Intro to combustion. Fire triangle will be used as a visual aid. Examples of combustion chemical equations ($CH_4 + O_2$ --> $H_20 + CO_2$). Students will be able to identify "combustion" chemical equations by their products and reactants.

Day 2: Lab. A volatility test will be conducted between Jet Fuel, Gasoline, and Diesel. Students will predict which of the three is more volatile. Instructor will place a lit match into a container of each fuel to demonstrate the volatility of each fuel. The Jet fuel will not light with a match (you can put the match out in the liquid fuel). The diesel fuel will light with the aid of a propane torch but not with a match (again you can put the match out in the liquid fuel). The gasoline will definitely light with a match. Be carefull!!
The instructor will then take a spray bottle with the "un-lightable" jet fuel and spray into a lit propane torch. This demonstrates atomization of the fuel as accomplished by the fuel injectors in a standard vehicle.
Day 3: Types of fuels will be discussed. Octane (gasoline) and Cetane (diesel) ratings will be presented. Octane and cetane are standardized rating systems that indicate burn rate of the different types of gas. For octane a higher number indicates a slower, more even burn rate. For cetane, a lower number indicates a slower, more even burn rate.
Other components of fuel will also be investigated. Leaded vs Unleaded gas will be discussed as well as different additives that are used in fuels and why they are used.
Day 4: Lab. Students will conduct two tests
Lab 1: This is a timed burned test. They will place 5 ml of different grades of fuels (different octane ratings) in glass petri dishes with lids. They will lite each fuel sample and time how long it burns for.
Lab 2: Instructor demonstrates the flame and smoke colors of new "good" fuel vs old "bad" fuel.

Day 5-6: Review & assessment.