

PROJECT REPORT

Northern Wyoming Community College District / National Science Foundation
Summer Energy Education Program 2012

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TITLE

Where does the gasoline come from that we put in our cars?

SUMMARY

These lessons demonstrate the creation, extraction, and refinement of crude oil. Students follow this process all the way to the local gas station and into their parents' cars. To prepare the students you start with an introduction to content specific vocabulary. Then teach them about the process of mining and refinement of petroleum products. Finally, the students will use their math skills to calculate the miles per gallon of gasoline used in their parent's cars. Additional practice for the math skills will be given in class.

ENERGY CONTEXT

The formation of oil starts with the remains of animals and plants (diatoms). They lived on Earth millions of years ago in a marine (water) environment. Over many millions of years these remains were covered by silt and sand. Adding pressure and heat to the layers created the material we refer to as crude oil. Crude oil is found in underground reservoirs. Samples are taken from an area and if they seem promising, the drilling begins. Crude oil is produced in coastal waters off the United States and in thirty-one states. Most of our oil comes from the states of Texas and Alaska. After the crude is drilled, it then goes to a refinery where it is separated into usable petroleum products. A refinery is a factory that operates 24/hours a day, 365 days a year. The oil is contained in 42-gallon barrels. From a processed barrel of oil you will get 19 gallons of gasoline, 10 gallons of diesel, 4 gallons of jet fuel, 2 gallons of heavy fuel oil, 2 gallons of liquefied petroleum gases and 7 gallons of other petroleum products. This refinement process starts with separation of components based upon the differences in weight. Inside towers, the separated materials divide into fractions based on boiling point and weight. Next is conversion where the liquids are exposed to heat and pressure and the different products start to form. The final step is treatment where the final variables are determined, such as octane level in gasoline. These petroleum products are stored in tanks near the refinery until companies send tanker trucks to take the products to their final destinations. Petroleum can also be transported across the water by barges and underground using pipelines.

ANTICIPATED TIME REQUIRED

This project will require

Day 1-

- Students are given a list of content specific vocabulary terms. For the next 30 minutes they will work with a partner to define these terms.
- As a class, the definitions are discussed and the best answers are determined. 10 min.
- At the end of class, the teacher explains the homework assignment that prepares students for the lesson and gives them the worksheet & instructions. 5 min
- Student time at home 15-20 minutes

Day 2-

- Check students' homework assignment for completeness 3 min
- Students share answers with partner on right 3 min
- Students share answers with partner on left 3 min
- Show instructional video on Oil Formation & check students drawings/notes 10 min
- Show instructional video Energy in depth (Youtube) and check drawings/notes 10 min
- Have students compare their notes and drawings with their classmates 5 min
- Whole group review of the steps shown in the videos 5 min
- Final assessment 15 min

Day 3-

- This class period is practicing our math skills by determining miles per gallon for our family car and also our friend's cars. This lesson can last anywhere from 20 – 50 minutes

Total time needed for lessons is 3 hours in class and about 30 min at home.

INTENDED STUDENT LEVEL

These lessons are intended for students in the fifth grade.

ASSUMED PRIOR KNOWLEDGE

These lessons assume that students have a prior knowledge of

- That gasoline is needed to power their parents' cars.
- Most every car on the road is powered by gasoline.
- How to work with a partner
- How to take basic notes in either words or drawings
- How to do basic computational math skills at the sixth grade (or below) level.

LEARNING OBJECTIVES

The learning objectives are, that by the end of the third class, my fifth grade students will have a greater understanding of the processes involved in the creation, extraction, and refinement of crude oil. They will be able to reproduce and name (in order), the steps of this process. This includes a basic knowledge of content vocabulary and how to calculate a car's miles per gallon use of gasoline.

MATERIALS

Each student needs

- A worksheet on gasoline usage by their family
- A piece of white construction paper folded into six equal sections for their notes
- A piece of white construction paper folded into six equal sections for their assessment
- Pencil and eraser
- Crayons, colored pencils, and/or colored markers

Teacher needs

- Either a projector or smart board to view videos
- A PC or laptop computer

INTRODUCTION/MOTIVATION FOR STUDENTS

Each day as you ride to school in your parents' car you are using gasoline. I know you have all been to the gas station with them while they fill the tank, before gasoline gets to the Chevron station, where does it come from? Today we learn where that process begins.

PROCEDURE

These lessons are presented over three days. This is three class periods and about 30 minutes of homework.

Day 1:

- On the white board the teacher will list the content vocabulary terms that the students need to know for these energy lessons. My list includes: *clay, sand, kerogen, fossil fuel, plankton, sapropel, anaerobic bacteria, petroleum*. You should add any others as you need.
- Students may work on their own or in pairs, using computers and textbooks to look up and define these content specific terms.
- After about 25 – 30 minutes the teacher stops the class and they review the terms to make sure everyone has the correct definitions.
- For the last minutes of class the teacher will introduce the topic of energy as it relates to putting gasoline in the family car.
- Hand out the worksheet for homework and give directions they are to complete it with the help of their parents if they do not know the answer to a particular question.

Day 2:

- As students enter class have them take out their completed homework assignment. Turning to their partner (child on their right), compare and contrast their answers.
- Turning to their other partner (child on their left), compare and contrast their answers.
- Teacher collects the homework. It may be used at another date for a continuing lesson.
- Teacher hands out a large piece of construction paper and instructs students to fold it into 6 equal boxes. These boxes are for taking down important facts from today's lesson. If there is something important from the lecture or video the student will write it down either with words or a labeled drawing.
- Students watch an instructional lesson, led by the teacher, on oil formation while they are taking notes. <http://www.sciencelearn.org.nz/Contexts/Future-Fuels/Sci-Media/Animations-and-Interactives/Oil-formation>
- Let students do a shout-out (moderate voices calling out things they learned)
- Students will watch a youtube video <http://www.youtube.com/watch?v=9OlgOuWlo6Q>
- Student will then compare and contrast their notes with partner while the teacher checks to see each student took notes.
- Teacher conducts a whole group review of major topics covered.
- Final assessment given for the remainder of class.

Day 3:

This third class period is all about the math skills needed to calculate miles per gallon in their parents' cars. As all children may not have this portion of their initial homework assignment complete, we will do several together and then have students switch cars to work on as many problems as needed. This will take as much time as needed, the entire class possibly. I will display on the white board the directions for calculating mpg, after I have explained it and shown examples, in case they need additional support. This can be found at http://www.ehow.com/how_4484159_calculate-miles-per-gallon.html

SAFETY ISSUES

There are no particular safety issues for these lessons

TROUBLESHOOTING TIPS

Trouble shooting

- Check for homework to be completed
- While the lessons on oil formation and energy production are playing, make sure students are taking notes by walking around the classroom. These notes may be key words or pictures
- Using a calculator, check their mathematical calculations for accuracy.

ASSESSMENT

Pre-Activity Assessment

On the white board have students list what they know about the oil industry and production of gasoline.

During Class Assessment

As students are taking notes and talking to their classmates, monitor them making sure they have correct information and drawings on their papers. Additionally, students need to stay on task.

Final Assessment

Using a piece of white construction paper, students will complete six boxes showing the formation, extraction, refinement, and transportation of oil. The first box starts with organic matter and the sixth box shows a car at the gas station. As this is an introductory lesson, no formal rubric is needed. Students are able to share ideas with their classmates. My goal is to have each child leave class with a completed paper showing some of the steps in gasoline production. As I review the papers that night, I will check for correctness and meet with a student individually the next day to correct. If the whole class or, a large percentage, need review I will do a review of this lesson within the week.

Teacher could prepare a check list that he/she carries around on a clipboard. This assures the students participation in all areas of assessment.

Pre-Activity: Did the student contribute an idea about the oil industry process?

During Class Assessment: Did the student take clear, sequential notes?

Final Assessment: Did the student include the steps from the decay of organic material to the pumping of gasoline in their parents' car and record those on the assessment paper.

There is no final assessment for the math portion of the lesson. I will work with the math teacher to know where the students are in their studies and if I need to make modifications, I will.

SUGGESTED EXTENSIONS

As these are introductory lessons, there are several extensions that might be necessary for student understanding. We currently do not have an energy unit for the fifth grade so I will continue with this concept by adding it to the end of our geology unit.

Some ideas may include:

- What other products are made from petroleum products?
- Where are good areas for drilling?
- Using content vocabulary for a spelling test, word search, or journal writing.
- Have students do further research on related topics

RESOURCES

In the preparation of these lessons I used the following resources:

http://www.ehow.com/how_4484159_calculate-miles-per-gallon.html

http://www.petrostrategies.org/Learning_Center/oil_transportation.htm

http://www.eia.gov/kids/energy.cfm?page=oil_home-basics

<http://www.youtube.com/watch?v=9OlqOuWIo6Q>

<http://www.sciencelearn.org.nz/Contexts/Future-Fuels/Sci-Media/Animations-and-Interactives/Oil-formation>