What is Ethanol?

Unit 1 Lesson 1

Precepts

E. Awareness
E1. Address issues important to the community.

National Standards

NL-ENG.K-12.6. Applying Knowledge.

Student Learning Objectives

As a result of this lesson, the student will…
1. Identify what ethanol is and its many uses.
2. Identify the need to look into fuel alternatives such as ethanol.

Time

Instruction time for this lesson: 45 minutes.

Resources

http://www.nwicc.com/pages/continuing/business/ethanol/Module1.htm
http://www.epa.gov/oecaagct/ag101/cropmajor.html

Tools, Equipment, Supplies

Writing surface
Overhead projector
Note cards for Go Get It E-Moment
Bushel of corn in a bushel basket/container (round laundry basket also works)
TM.A
TM.B
TM.C
TM.D
Assess.A

Key Terms

The following terms are presented in this lesson and appear in ***bold italics***:
Alcohol
Bushel
Ethanol
E10
Gallon
Proof
Solvent

INTEREST APPROACH

Bring in a bushel of corn and place in front of the classroom. If a bushel basket and corn is unavailable, bring in a round laundry basket to provide a visual for the students of a bushel. Ask students to write down everything that is in one bushel of corn. Remind students to think about all aspects of that corn. TM.A provides a picture of a bushel basket with corn.


Almost ten billion bushels of corn were produced in the United States in 2000. This is a ***bushel*** of corn (*set bushel basket down in front of students*). It weighs about 56 pounds depending upon the moisture content in the kernels. Take two minutes to write in your notebook what you think can be produced from one bushel of corn. Think about types of food, additives and by-products. Begin.

Tell students when they have 30 seconds left. Ask students to share an item they wrote down. Once several items have been shared, use TM.B to share the following information.


Time is complete. Look at your list and pick one answer that you will share with your classmates. As we go around the room, share one item that you wrote down. If your answer has already been said share another answer from your list. *Allow students to share their answers.* Thank you for sharing. Here are a few more items that can be created from a bushel of corn. *Share TM.B.*

31.5 pounds of starch
33 pounds of sweetener
10 one-lb boxes of cereal
15 lbs of brewer grits (enough for 1 gallon of beer)
10 eight oz packages of cheese curls
1 lb of pancake mix
22 lbs of hominy feed for livestock
0.7 lbs of corn oil
17 lbs of carbon dioxide
1.5 lbs corn oil: cooking oil, margarine, mayonnaise, salad dressing, shortening, soups, printing ink, soap, and leather tanning
2.6 gallons of Ethanol


As you can see there are a lot of different items in a bushel of corn. Today we are going to learn more about the last item on the list. Let's put our brains in exploration mode because it is time to explore the world of ethanol.

OBJECTIVE 1. Identify what ethanol is and its many uses.

Ask students if they have heard of ethanol. Then have the students write the first sentence of TM.C as a title for the notes they will be taking. Use a Go Get It Moment to complete the rest of the information presented on TM.C.


How many of you have heard of ethanol? What do you suppose it is? At the top of a page in your notebook write the following sentence to begin your notes for the day. *Post the first item from TM.C.*

I. ***Ethanol*** or ethyl ***alcohol*** is classified in the alcohol family with many distinct properties that allows it to be used in many ways.


Around the room there are 14 facts to help us learn more about ethanol. When we hear the word "explore" we will stand up, take our notebook, and explore the room for facts. When a fact is found, write it down in your notebook. When you have found all 14 facts and have written them in your notebook return to your seat and begin reviewing what you wrote. What questions do you have? Explore.

Keep students moving through the Go Get It Moment. As students finish, remind them to go back to their seat and review what they have just written. Once everyone is done post Unit 1 Lesson 1 TM 3. Have the students make sure they captured all 14 facts.


In your exploration you should have found these 14 facts. *Post TM.C.* Take one minute and make sure you captured all the facts correctly.

A. ***Ethanol*** can be used as a fuel when blended with gasoline or when in its original state.
B. ***Ethanol*** is the most important member of a large group of organic compounds that are called ***alcohol***.
C. ***Alcohol*** is an organic compound that has one or more hydroxyl (OH) groups attached to a carbon atom.
D. ***Alcohol*** is shown as: C-O-H or C-OH.
E. In its pure form, ***ethanol*** is a colorless clear liquid with a mild characteristic odor
F. Boils at 78C. (172F.)
G. Freezes at -112C. (-170F.).
H. The molecular weight is 46.07
I. One ***gallon*** of 190-***proof ethanol*** weighs 6.8 pounds.
J. ***Ethanol*** has no basic or acidic properties.
K. ***Ethanol*** can also be used as a raw material in various industrial processes.
L. When burned ***ethanol*** produces a pale blue flame with no residue and considerable energy, making it an ideal fuel.
M. ***Ethanol*** mixes readily with water and with most organic ***solvents***.
N. ***Ethanol*** is also useful as a ***solvent*** and as an ingredient when making many other substances including perfumes, paints, lacquer, and explosives.

 What questions do you have about the facts? *Allow students to ask any questions they have for clarification.* We now understand what ethanol is and it is time to take our knowledge one step further. The next step pertains to why our knowledge about ethanol is important.

OBJECTIVE 2. Identify the need to look into fuel alternatives such as ethanol.

Ask students if they have heard of ethanol being used as a fuel? Then pose the question as to why Ethanol and other fuel alternatives are being looked into. Upon completion of the discussion have students write the information from TM.D in their notes.


Have you ever heard of ethanol being used as a fuel? Why are people looking at ethanol and other alternative fuels? *Allow students to answer the questions and briefly discuss.* Continue writing in your notes with the following thoughts and reasons behind using ethanol as a fuel. *Post TM.D.*

II. Why ethanol now?

A. Ethanol use and production has increased considerably during the 1980's and 1990's. Growth in use of the ***E-10*** blend has taken place because the fuel performs well in automotive engines and is competitively priced with "conventional" gasoline.
B. Each bushel of corn processed yields 2-½ gallons of ethanol along with several valuable byproducts.
C. It is in our state and national interest to reduce dependence on oil imports.
D. Trade deficits are decreased and it allows for a dependable source of fuel if supplies would be cut off by unfriendly countries.
E. It helps to stabilize price for the American farmer.
F. The quality of the environment improves. Carbon monoxide emissions are reduced and lead and other carcinogens (cancer causing agents) have been removed from gasoline.
G. Car owners gain from increased octane in gasoline which reduces engine knock. It also absorbs moisture and cleans the fuel system.


As you can see, there are numerous thoughts and reasons behind why ethanol could be used as an alternative fuel. In our notes and our exploratory brains we have captured what ethanol is and why we use ethanol. Keep that foundational knowledge in your mind as we continue to learn about ethanol.

REVIEW/SUMMARY

Use an Eyewitness News Moment to review and summarize the content from the lesson.


It is time for you to share your knowledge about ethanol. You will each be given two minutes to share your new wisdom with your neighbor. One of you will be a news reporter and the other an expert about ethanol. The news reporter will be reporting live and will have several questions to ask the expert. The expert will answer the questions thoroughly and confidently. The interview will last two minutes. Upon completion of the interview you will switch roles. This allows for each person to be the star of the show. When you hear the word "action" you will have three minutes to talk with your neighbor and decide who will start in each role and what questions will be asked during the interview. What questions are there? Action!

Allow students to prepare for the Eyewitness News Moment and lead them through the activity. Upon completion have the students thank each other and mention they will be learning more about ethanol in future lessons.


Tell your neighbor thank you for sharing their new knowledge about ethanol. We have a solid foundational knowledge about ethanol that we will continue to build upon in the future.

APPLICATION

Extended classroom activity: *Put students into groups of 2 or 3 and have them create a slogan or jingle for ethanol as a fuel using the identified reasons for looking into alternative fuels. Challenge students to think creatively to develop something catchy. When completed, have the students present their slogan or jingle. Have each student write down their slogan or jingle so that it can be posted in a corner of the room for later use with other lessons.*

FFA activity: *Have students develop a one page handout that tells what ethanol is and why it should be used. This promotional handout could be given out within the school to other students and to people at public events such as a county fair. The handouts would include facts and might also include pictures, websites, and contact information for those people that would like more information about ethanol.*

SAE activity: *Research more into how ethanol is made and the benefits of using Ethanol. Find out where the closest Ethanol plants are located and potentially contact the plant to plan a visit. Take all of this information and put it into a written report, video, or media presentation to present to others.*

EVALUATION

Assess.A

Answers to Evaluation:
Matching.

1. Ethanol
2. Alcohol
3. Octane rating

Completion.

1. 2.5
2. 78C or 172F
3. increases
4. stabilize
5. colorless

Short Answer
1. Reduce foreign oil imports, corn stabilization of price, cleaner burning fuel, higher octane, lower emission rates.

TM.A

What's in a Bushel of Corn?

TM.B

What's in a Bushel of Corn?

31.5 pounds of starch

33 pounds of sweetener

10 one-lb boxes of cereal

15 lbs of brewer grits

10 eight oz packages of cheese curls

1 lb of pancake mix

22 lbs of hominy feed for livestock

0.7 lbs of corn oil

17 lbs of carbon dioxide

1.5 lbs of corn oil: Cooking oil, Margarine, Mayonnaise, Salad dressing, Shortening, Soups, Printing ink, Soap, Leather Tanning

2.6 gallons of Ethanol

TM.C

Ethanol or ethyl ***alcohol*** is classified in the alcohol family with many distinct properties that allows it to be used in many ways.

Uses and characteristics:

- A fuel when blended with gasoline or when in its original state
- Most important member of a large group of organic compounds that are called ***alcohol***
- ***Alcohol*** is an organic compound that has one or more hydroxyl (OH) groups attached to a carbon atom
- ***Alcohol*** is shown as: C-O-H or C-OH
- In its pure form, ethanol is a colorless clear liquid with a mild characteristic odor
- Boils at 78C. (172F.)
- Freezes at -112C. (-170F.)
- The molecular weight is 46.07
- One ***gallon*** of 190-***proof*** ethanol weighs 6.8 pounds
- ***Ethanol*** has no basic or acidic properties
- It can also be used as a raw material in various industrial processes
- When burned ***ethanol*** produces a pale blue flame with no residue and considerable energy, making it an ideal fuel
- ***Ethanol*** mixes readily with water and with most organic ***solvents***
- It is also useful as a ***solvent*** and as an ingredient when making many other substances including perfumes, paints, lacquer, and explosives.

TM.D

Why *ethanol* now?

- Ethanol use and production has increased considerably during the 1980's and 1990's. Growth in use of the E-10 blend has taken place because the fuel performs well in automotive engines and is competitively priced with "conventional" gasoline.
- Each bushel of corn processed yields 2-½ gallons of ethanol along with several valuable byproducts.
- It is in our state and national interest to reduce dependence on oil imports.
- Trade deficits are decreased and it allows for a dependable source of fuel if supplies would be cut off by unfriendly countries.
- Helps to stabilize price for the american farmer.
- The quality of the environment improves. Carbon monoxide emissions are reduced and lead and other carcinogens (cancer causing agents) have been removed from gasoline.
- Car owners gain from increased octane in gasoline which reduces engine knock. It also absorbs moisture and cleans the fuel system.

Assess.A

Part One: Matching
Instructions: Match the term with the correct response. Write the letter of the term by the definition.

Octane Rating Ethanol Alcohol

____ 1. Can be used as a fuel when blended with gasoline or when it is in its original state.
____ 2. An organic compound that has one or more hydroxyl groups attached to a carbon atom.
____ 3. The measure of the resistance of gasoline and other fuels to auto ignition in spark-ignition internal combustion engines.

Part Two: Completion
Instructions: Provide the word or words to complete the following statements.

1. Each bushel of corn processed yields _____ gallons of ethanol gasoline.
2. Ethanol boils at _____.
3. Ethanol _____ octane in gasoline which reduces engine knocks.
4. Ethanol helps to _____ price for the American farmer.
5. In its pure form, Ethanol is a _____, clear liquid with a mild characteristic odor.

Part Three: Short Answer
Instructions: Provide information to answer the following question.

1. Give two reasons why Ethanol needs to be further researched to serve as a fuel alternative?