

# BIOFUELS

(This lesson is to be used as part of a bioengineering unit based on SPI 0607.T/E.4)

## STANDARDS:

SPI 0607.T/E.4 Differentiate between adaptive and assistive engineered products (e.g., food, biofuels, medicines, integrated pest management).

✓0607.T/E.4 Research bioengineering technologies that advance health and contribute to improvements in our daily lives.

GLE 0607.T/E.4 Describe and explain adaptive and assistive bioengineered products.

## OBJECTIVE:

To gain understanding of biofuels

## LESSON:

Intro biofuels: a type of fuel that is made from once-living things

Complete Source of Biofuels-Scavenger Hunt (attached)

Show Brainpop Video: "Biofuels"

Complete Brainpop Quiz/Vocabulary: "Biofuels" (attached)

Show the following video clips from Discovery Education:

Bio\_Fuel\_\_Growing\_Fuel\_from\_Plants (5:32)

Oil\_from\_Algae (5:27)

Converting\_French\_Fry\_Oil\_into\_Engine\_Fuel (1:46)

Complete Video Viewing Guide (attached)

Complete Activity: "This week's experiment" (attached)

Show "Biofuels Life Cycle" (attached)

## ASSESSMENT:

Multiple Choice Quiz for the bioengineering unit (attached)



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## Lesson Plan

### Source of biofuels – Scavenger Hunt

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#### Introduction

*Biofuels are an important part of today's culture. Using biofuel as an alternative to petroleum-based fuel has numerous environmental, economic, and social benefits. Today, you will participate in a Biofuels Scavenger Hunt to research different aspects of biofuels in preparation for upcoming lessons on the Source of Biofuels. You need to use a combination of resources, including the internet, books, and various trade magazines to collect information about biofuels. Using the information you collect during the scavenger hunt, you will write a one to three page report discussing alternative fuel sources, how biofuels are made, the relationship between plants and biofuels, and reasons for using alternative fuels. Your report needs to be in standard APA style formatting with proper citations. You also need to include a bibliography page in addition to your one to three pages of content.*

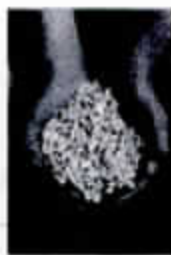
*Note: Italicized words are potential script for the teacher.*

#### Procedure

- Pass out Biofuels Scavenger Hunt.
- Remind students they need to use a COMBINATION of resources to collect their data, not just the internet.

#### Report Guidelines

- Go over standard APA formatting
- Include basic methods for in-text citations and bibliographies
- Go over grading rubric



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## Source of biofuels – Scavenger Hunt

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Name: \_\_\_\_\_

School: \_\_\_\_\_

Teacher: \_\_\_\_\_

Date: \_\_\_\_\_

Male or Female (circle one)

Grade: \_\_\_\_\_

1. What is biofuel made from?

- A. Coal
- B. Vegetable oil
- C. Petroleum
- D. Old tires

2. What is a saturated fatty acid?

- A. A compound with no double bonds
- B. A compound with one double bond
- C. A compound with more than one double bond
- D. None of the above

How are fatty acids used in the chemical process of making biofuels?

3. Why do plants produce vegetable oil:

- A. For human consumption
- B. For energy for seed germination
- C. To provide insects with food
- D. As a waste product

How do we use plant oils to produce biofuels?

4. The primary energy source for plants is:

- A. Water
- B. Fertilizer
- C. Sunlight
- D. Nutrients in the soil

5. True or False

- A. \_\_\_\_\_ Plants store energy that can be used as biofuel
- B. \_\_\_\_\_ Petroleum and biofuels come from the same source
- C. \_\_\_\_\_ Sunflower oil from the grocery store cannot produce biofuel
- D. \_\_\_\_\_ Some seeds contain oil
- E. \_\_\_\_\_ The carbon in fossil fuels comes from the soil

6. Which of the following is not a fossil fuel

- A. Petroleum
- B. Biofuel
- C. Natural gas
- D. Coal

Please discuss some environmental and economic advantages to using biofuels versus fossil fuels.

7. Canola is:

- A. A source of biofuel
- B. A can of oil
- C. A plant from Canada
- D. Some of the above

8. Ethanol is:

- A. Made from wood
- B. Made from corn
- C. A source of biofuel
- D. All of the above

9. Biofuels can be obtained from:

- A. Soybean
- B. Safflower
- C. Flax seed
- D. All of the above
- E. None of the above

Based on the last three questions, please discuss reasons/benefits for using different plants to make biofuels.

10. Give 3 reasons why we need alternative sources of energy.

11. Discuss the potential environmental, economic, and social benefits of using biofuels?

12. Are there drawbacks to using biofuels? For example, are there any counter arguments to using biofuels or byproducts associated with making biofuel?

Name: .....

Date: October 22, 2013

**TECHNOLOGY > ENERGY TECHNOLOGY > BIOFUELS****DEFINE** Can you explain the terms below in your own words?**BIOMASS:**  
.....  
.....**RENEWABLE:**  
.....  
.....**OFFSET:**  
.....  
.....**DERIVE:**  
.....  
.....**FERMENT:**  
.....  
.....**PURIFY:**  
.....  
.....**EFFICIENT:**  
.....  
.....**BIODIESEL:**  
.....  
.....**CELLULOSE:**  
.....  
.....**IMPORT:**  
.....  
.....Choose an additional term from the movie to define.  
.....  
.....

# Brain POP<sup>™</sup> BIOFUELS

Date: \_\_\_\_\_

Name: \_\_\_\_\_

Class: \_\_\_\_\_

**1 What is one major difference between fossil fuels and biofuels?**

- A** Burning fossil fuels releases greenhouse gases; burning biofuels releases no greenhouse gases
- B** Fossil fuels exist in unlimited supply; our supply of biofuels may run out someday
- C** Fossil fuels are very expensive to manufacture; biofuels are very inexpensive to manufacture
- D** You can drive farther on a single tank of fossil fuel than you can on a single tank of biofuel

**2 Ethanol is frequently made from which of the following?**

- A** 
- B** 
- C** 
- D** 

**3 When a source of energy is described as renewable, it means:**

- A** It emits no pollution
- B** It's made out of organic material
- C** It can be mixed with gasoline
- D** Humans won't run out of it

**4 What is one negative effect of producing more ethanol for use as fuel?**

- A** An increase in air pollution
- B** People buying fewer cars
- C** Rising prices of certain food crops
- D** Having to import more oil from abroad

**5 The process by which microbes convert sugar to alcohol is called:**

- A** Fermentation
- B** Distillation
- C** Remediation
- D** Calibration

**6 In the movie, Tim mentions that a popular blend of ethanol is called E-10. What can you infer about the blend called E-20?**

- A** It's 20 percent ethanol and 80 percent gasoline
- B** It's 80 percent ethanol and 20 percent gasoline
- C** It's 20 percent ethanol and 80 percent biodiesel
- D** It's 80 percent ethanol and 20 percent biodiesel

**7  What advantage does biodiesel have over ethanol?**

- A** It is 100 percent carbon neutral
- B** It can be manufactured from non-organic material
- C** It requires less energy to produce
- D** It can be used in any gasoline-burning engine

**8 What part of a corn plant is most likely to be used in the manufacture of cellulosic ethanol?**

- A** The kernels
- B** The stalk
- C** The oil
- D** The roots

**9 Which of the following is an opinion about biofuels?**

- A** They're usually not 100 percent carbon neutral
- B** They are superior to fossil fuels in most ways
- C** Many of them emit low amounts of greenhouse gases when burned
- D** Scientists are currently researching new sources of biofuel

**10 Which term best describes the current state of algae-based biofuel?**

- A** Impossible
- B** Widely available
- C** In development
- D** Inexpensive

Name \_\_\_\_\_

Date \_\_\_\_\_

## BIOFUELS

### Video Viewing Guide

**Interesting Facts:**

1.

2.

3.

4.

5.

RISKS	BENEFITS
1.	1.
2.	2.
3.	3.



## **This Week's Experiment - #238 Emergency Light**

This week's experiment is thanks to Tropical Storm Gabrielle. It came right over our house Friday night, leaving us with LOTS of rain, LOTS of wind, and no electricity.

Luckily, the power was back on within hours, but in the mean time it was getting very dark. Living in Florida (hurricane territory), we always have plenty of candles, but we wanted a little extra light. While adding a little extra illumination, I also managed to find an idea for this week's experiment. To try this, you will need:

vegetable oil

a paper towel

a glass or ceramic bowl (Not the good china!)

matches or a lighter

Warning! This experiment uses fire. Be sure that you have permission and that there is an adult present to help. Most of all, be sure to be careful, be safe and use common sense. Pour about 1/2 an inch of vegetable oil into the bowl. You can use regular cooking oil, canola oil, peanut oil or any other kind of vegetable cooking oil. Tear a paper towel into four quarters. Crumple one of the quarters into a ball and place it into the bowl with the oil. You want the oil to soak the entire ball of paper, but you also want the paper to stick up above the surface of the oil.

Place the bowl on a table where it will not be bumped or disturbed. Use a match or lighter to carefully light the top edge of the paper towel. It should easily catch fire. Now watch carefully. The fire continues to burn, but the paper towel does not burn up. As long as there is oil in the bowl, the flame will continue without burning up the paper.

How can that be? What you have just made is an oil lamp, very similar to the ones that have been used for thousands of years. The flame of the match does not have enough heat to set a pool of vegetable oil on fire. In fact, if you stuck the match into the oil, it would go out. The paper towel serves as a wick, to carry the oil up to the flame. Since there is only a small amount of oil in the paper, and it is spread out very thin, it can get hot enough for something to happen. The flame causes the oil in the paper to break down, forming a flammable gas. This gas is what you are burning. As the oil in the paper changes and is burned, more oil soaks up into the paper. The oil actually keeps the paper cool enough so that it does not burn, except at the very edge where you first lit it.

This is a good experiment to know about when the lights go out. The light from the oil is brighter than a candle, and even if you are out of candles, almost everyone has some cooking oil in the kitchen. The vegetable oil burns very cleanly, and should not produce smoke or bad smells. The one draw back is that every once in a while, you may get a whiff of something that reminds you of cooking popcorn. If you have an electric stove, this can drive you crazy with a craving for popcorn while you are waiting for the power to come back on. Luckily, the wonderful folks at Florida Power and Light had the electricity flowing again before I resorted to trying to pop corn over my homemade oil lamps.

Transportation

Feedback

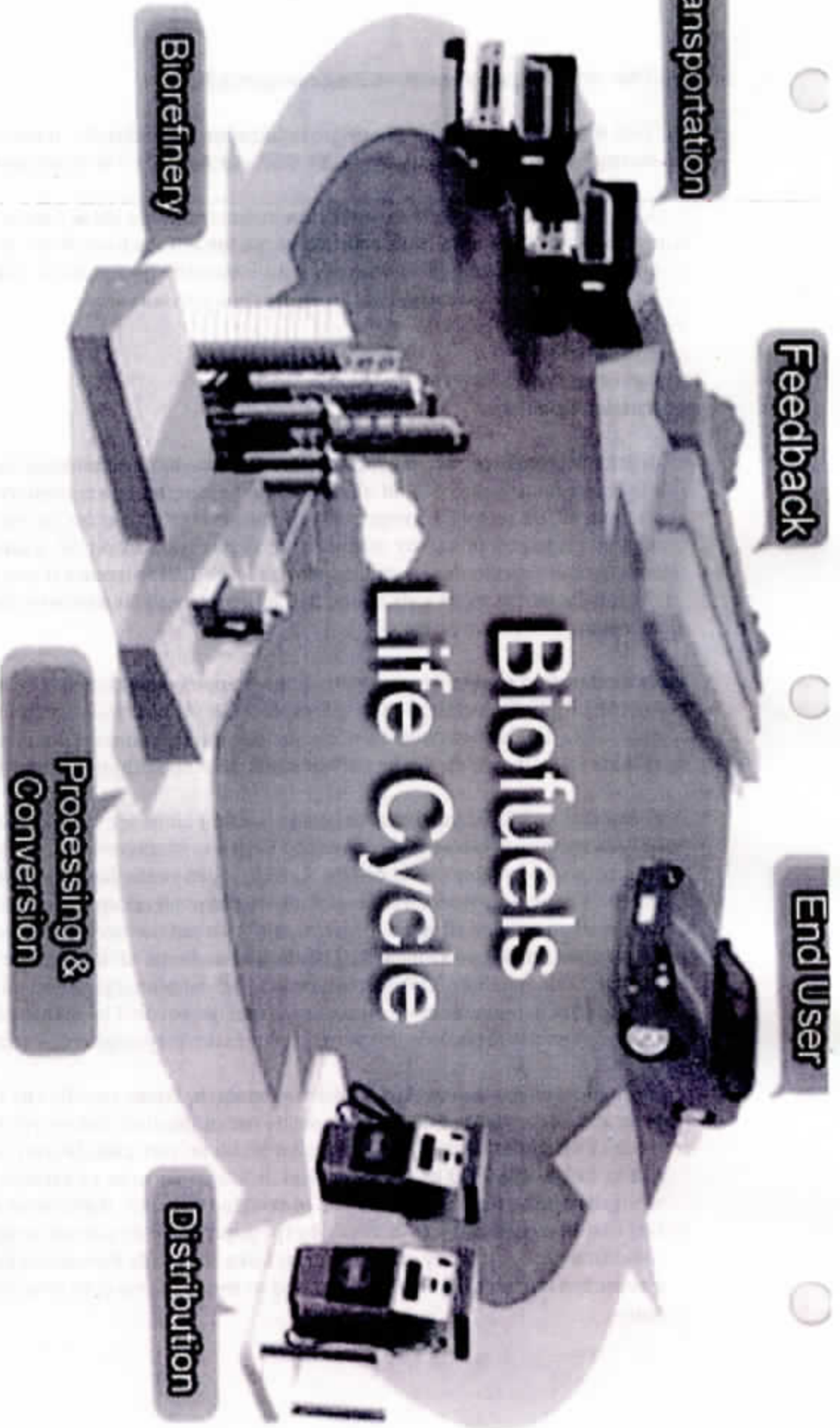
End User

# Biofuels Life Cycle

Biorefinery

Processing &  
Conversion

Distribution



1. Which of these is NOT a product of biotechnology?
- A. an MRI machine
  - B. a wild strawberry plant
  - C. human insulin made by bacteria
  - D. a hearing aid
2. Which of these is a biofuel?
- A. ethanol
  - B. gasoline
  - C. corn
  - D. insulin
3. Which sentence is TRUE?
- A. Developing products through biotechnology has only benefits.
  - B. Developing products through biotechnology has only risks.
  - C. Developing products through biotechnology has both benefits and risks.
  - D. Developing products through biotechnology does not have benefits or risks.

4. Which is the BEST example of adaptive biotechnology?
- A. coobware made of cast iron
  - B. treating a headache with aspirin
  - C. measuring volume in a beaker
  - D. doorbells that flash a light when activated
5. Which is the BEST example of an assistive biotechnology product?
- A. a rosebush that is bred to have roses of a particular color
  - B. a computer program that helps a paralyzed person control a wheelchair
  - C. a pesticide produced from the compounds of a plant
  - D. a bacterium that generates oil byproducts in the presence of sunlight
6. What is one negative effect of producing more ethanol for use as fuel?
- A. an increase in air pollution
  - B. people buying fewer cars
  - C. rising prices of certain food crops
  - D. having to import more oil from abroad

KEY

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## Resources

### Scavenger Hunt

<http://www.toshiba.com/taf/common/docs/Biofuels.pdf>

### Videos

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

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

### Activity

<http://nicholasacademy.com/scienceexperiment238emergencylight.html>