

Comparing Auto Racing Fuels

Student Guide - Elementary

The objective of this activity is to compare racing fuels, and list the pros and cons of different racing fuels.

Vocabulary

- alcohol
- atmosphere
- automobile
- bacteria
- biodegradable
- carbon dioxide
- chemical energy
- combustion
- E15
- E85
- efficient
- ethanol
- fermentation
- flammable
- fossil fuel
- fungi
- gasoline
- greenhouse gas
- mechanic
- motion
- nonrenewable
- organism
- performance
- petroleum
- refinery
- renewable
- thermal energy
- vapor

Student Background Information

Henry Ford didn't invent the **automobile**, he found a way to make cars at a price that most American families could pay. Henry Ford also developed race cars, and helped establish the Indianapolis 500 race. Today, many parts of the cars we drive were first developed in race cars. Stronger tires, lighter materials, better brakes, and even the rear view mirror came from the racing industry.

Improvements made to race cars also led to better fuels to power those cars. When building a race car, **mechanics** try to improve the safety of the vehicle, and how well the car performs. Cars don't play musical instruments or sing songs, so the **performance** of a race car describes how fast it goes, how easy it is to control, and how much fuel it uses.

At first, race cars, like passenger cars, ran on **gasoline**. However, as the cost of gasoline has gone up, other fuels have been used. Formula 1 racing still uses gasoline, but NASCAR and Indycar use a mixture of **ethanol** and gasoline. The fuel used in NASCAR vehicles is mostly gasoline with a small amount of ethanol (**E15**), and the fuel used in Indycar racing is mostly ethanol with a small amount of gasoline (**E85**). The number used in the fuel name tells you the percent of ethanol used.

Gasoline is a transportation fuel made from **petroleum**, or crude oil. It is produced in a **refinery** and is very **flammable**, meaning it will catch on fire very easily. Gasoline has a distinct odor, is clear but slightly yellowish in color, and can make you very sick if you breathe in the **vapors** or get it on your skin. Gasoline will not mix with water, and if it spills on the ground it is not **biodegradable**. Things that are biodegradable can be broken down by **bacteria**, **fungi**, or other **organisms**, like the way a dead tree on the forest floor rots. Gasoline is a **fossil fuel**, and is **nonrenewable**.

Ethanol is a type of **alcohol**. It is made when bacteria or yeast turn sugar or starch into ethanol and carbon dioxide. This happens in a process called **fermentation**. It is the same process that turns grape juice into wine. However, unlike

making wine, making ethanol to use in a race car requires that the alcohol be separated from everything else in the fermentation container. Extra sugar, starch, water, and the yeast or bacteria must be removed. Because ethanol is made from things we can get from plants, it is **renewable**. Even though ethanol is biodegradable, large amounts of it can make you sick. Ethanol, like gasoline, has a strong odor and is flammable, too. Hospitals and science labs use ethanol to kill unwanted bacteria.

Gasoline is a good transportation fuel because it has a lot of **chemical energy** stored in it. The engine of a car burns the fuel in a process called **combustion**. It changes the chemical energy to **thermal energy** and **motion**. Burning gasoline produces mostly **carbon dioxide** and water vapor. Carbon dioxide and water vapor are **greenhouse gases**. When energy is released into the **atmosphere**, greenhouse gases absorb the energy and get hot, just like the windows on a greenhouse keep the inside of the greenhouse warm.

Ethanol also has a lot of chemical energy, and also produces carbon dioxide and water when it burns. The biggest difference between burning ethanol and gasoline is that the carbon dioxide produced when ethanol burns was created by something recently living, and can be used by the next crop of plants used to make more ethanol. Burning a fossil fuel like gasoline produces carbon dioxide that can't be removed from the atmosphere when more gasoline is produced. The plants and animals that formed the fossil fuel died hundreds of millions of years ago.

Passenger cars and trucks use their fuel much more **efficiently** than racing vehicles. Most passenger cars can drive twenty miles or more on one gallon of fuel, usually gasoline. Race cars can only travel 3 or 4 miles on one gallon of fuel! Passenger cars are usually heavier, and of course can hold more than just one person. Race cars have only the parts necessary to make them go very fast, and don't have things like radios or air conditioners. Would you be willing to give up your favorite music to be able to drive a race car?

Teacher Demonstration: Comparing Properties of Ethanol and Gasoline



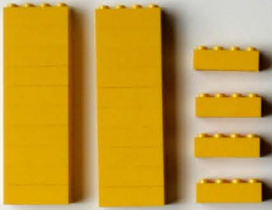
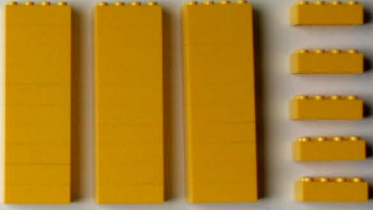
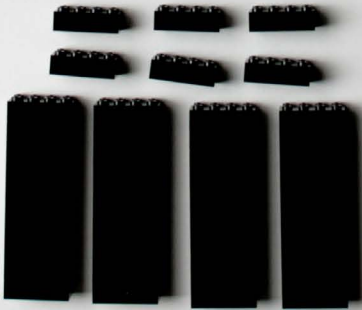
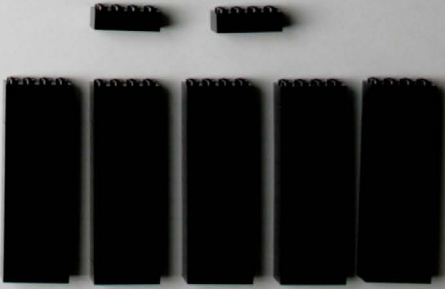
Discussion Questions

1. How are the two fuels different?

2. How are the two fuels the same?

3. Do you think ethanol can replace gasoline as a fuel? Use what you have seen in this activity to answer the question. Write specific examples of what you saw to explain your answer.

Activity: Modeling Gasoline and Ethanol Combustion

	ETHANOL	GASOLINE
One liter of fuel		
Yields this many units of energy		
And produces this many units of carbon dioxide		

Activity: Modeling Gasoline and Ethanol Combustion

Discussion Questions

1. Which fuel has more chemical energy stored in one liter?

2. Which fuel produces more carbon dioxide from one liter?

3. Which do you think is more important in one liter of fuel, producing less carbon dioxide or having more energy? Explain your answer with information from this activity and from the information you read earlier.

4. Why do you think race cars in NASCAR and Indycar use a mixture of gasoline and ethanol? Use information from this activity to explain your answer.

Venn Diagram

In the diagram below, write facts that are only true about gasoline in the oval on the left. Write facts that are only true about ethanol in the oval on the right. In the space where the ovals overlap, write facts that are true about both gasoline and ethanol.

GASOLINE

ETHANOL

