

Lesson 9- Prevention

Going Green

Background Information

In many cities across the country, the personal automobile is the single greatest polluter. The power to move a car comes from burning fuel in an engine. Pollution from cars comes from by-products of this combustion process (exhaust) and from evaporation of fuel itself. Gasoline and diesel fuels are mixtures of hydrocarbons, compounds that contain hydrogen and carbon atoms. In a "perfect" engine, oxygen in the air would convert all the hydrogen in the fuel to water and all the carbon in the fuel to carbon dioxide. Nitrogen in the air would remain unaffected. In reality, the combustion process cannot be "perfect" and automotive engines emit several types of pollutants.

Some fuels are inherently cleaner than gasoline because they emit less nitrogen oxides or hydrocarbons and because the hydrocarbons they do emit are less likely to react in the atmosphere to form ozone. These fuels include alcohols, electricity, natural gas, liquid petroleum gas (propane), and reformulated gasoline. **ALCOHOLS:** Methanol (made from natural gas, coal, or biomass) and ethanol (made from grains or sugar) are high-octane liquid fuels. Cars designed to run on pure alcohol fuels have the potential to emit 80% to 90% less reactive hydrocarbons than advanced-technology gasoline cars. **ELECTRICITY:** Battery-powered cars have the potential for zero tailpipe and evaporative hydrocarbon and nitrogen oxide emissions though power plant emissions must be accounted for. Today's electric vehicle technology is limited but promising recent developments may lead to more widespread use in the future. **NATURAL GAS:** Compressed natural gas is also an excellent automotive fuel particularly for fleet vehicles where long driving range is not important. Natural gas vehicles have the potential to emit 85% to 95% less reactive hydrocarbons than advanced-technology gasoline vehicles. **LIQUID PETROLEUM**

GAS (PROPANE): Propane is a byproduct of petroleum refining and natural gas production. Propane vehicles emit considerably less ozone-forming hydrocarbons than do vehicles fueled with conventional gasoline. **REFORMULATED GASOLINE:** The petroleum industry is studying ways to change refinery procedures to make a cleaner-burning gasoline. A number of "clean" gasolines have recently been introduced into the marketplace and research is continuing to develop even cleaner fuels. Reformulated gasoline, capable of reducing hydrocarbon emissions by at least 15%, is required in some high ozone areas. Cars are a major source of air pollution in the United States. Vehicle emissions contribute environmental problems such as urban smog, air toxins, and global warming.

Several different types of alternative vehicles are being produced today. **ALTERNATIVE FUEL VEHICLES:** As combustion of petroleum-based fuel creates emissions, one obvious way to deal with pollution is to power cars with less-polluting fuels. These "alternative" fuels can be combined with "regular" petroleum to produce a less polluting combination. Some of the fuels (propane, natural gas) could be used on their own (while these produce emissions, the amount of emissions is lower than in conventional gasoline-powered vehicles). **ELECTRIC VEHICLES:** Electric vehicles can now travel as quickly as gasoline-powered cars but travel distance is a problem. A car can travel much further on a tank of gas than it can on batteries and refueling a car with gasoline takes a lot less time than recharging an electric vehicle. However, electric vehicles might be well suited for local travel. The best selling points of electric vehicles are that they produce no emissions and are classified as zero emission vehicles. They are also quiet contributing to a decrease in noise pollution. The future of the electric vehicle depends entirely on the development of more efficient, smaller batteries. **FUEL CELL VEHICLE:** Fuel cell vehicles could potentially produce no emissions. Fuel cell vehicles might run on pure hydrogen instead of gasoline. The only byproduct that would be produced would be water. Hydrogen fuel cell cars are considered Zero Emissions Vehicles. The fuel cell creates electricity for the battery so the car does not need to be

“plugged in” to recharge. Other fuel cell vehicles might convert chemicals into hydrogen. While converting another fuel into hydrogen would produce some emissions, this process would be far less polluting than today’s gasoline powered vehicles. It is believed that fuel cell vehicles will be available for general purchase after 2010. HYBRID VEHICLE: Hybrids are combinations of two types of vehicles (gasoline and electric). While the engines of hybrids are combustion-based, the battery and motor are both electric. It is estimated that hybrids are about twice as fuel-efficient as gasoline-powered vehicles, can travel further, and create far fewer emissions (at present, one-third to one-half as many; in the future, maybe more). By having gasoline and electric components, a hybrid offers a reasonable compromise between the needs of travelers and the needs of the environment.

Objectives

After completing the lesson, the students will be able to:

1. State the characteristics of four different types of green vehicles.
2. Describe how green vehicles help the environment.
3. Create an advertisement for a green vehicle.

Materials

1. Computers with Internet access
2. Variety of art materials for use in making props and displays
3. Poster board for signs
4. Diagram of an internal combustion engine (optional)

Procedure

1. Tell the students that transportation planners work to improve air quality by decreasing congestion and finding ways to use vehicles that create less pollution per person. Tell the students that today they are going to go vehicle shopping. They will need to "think green"- not because they are necessarily going to buy a green colored vehicle but because green is now used to mean environmentally friendly. Ask the students to explain why the typical automobile used today is not "green." Tell the students that most cars use internal combustion engines. These engines essentially combust, or burn up, fuel to produce energy to move the car forward. If possible, show a drawing of an internal combustion engine and outline the steps involved in converting gasoline into energy to move the car. Explain that pollutant gases are produced in that process. Tell the students that people have been using this type of engine for over 100 years. Ask them why it seems to be a problem now. Guide the students to discuss the impact of widespread use of motor vehicles over time, increasing the number of fuel-burning vehicles, decreasing the amounts of oil on Earth, and growing knowledge of the effects of engine emissions on health and the environment.

2. Tell the students that researchers and car manufacturers have looked at this growing problem and are developing more and more green vehicles. Tell the students that there are four general categories of green vehicles today- alternative fuel vehicles, electric vehicles, fuel cell vehicles, and hybrid vehicles. Each type of green vehicle is a bit different. Tell the students that good shoppers research what's out there before they buy. Have the students brainstorm a list of characteristics they would look for in a green vehicle if they were going to buy one. Record the answers on the board; answers will likely include color, speed, cost, and extra features. Guide the students to consider "green" characteristics such as how much gas it uses, the cost of the fuel, and how much air pollution is produced. Introduce the term "fuel efficient."

3. Tell the students that because buying a vehicle is a big decision, it is important to do comparison shopping. Many websites rate and compare vehicles. Have the students search the Internet for green vehicle information. They are to list the characteristics and benefits of each of the four different types of green vehicles.

4. Have the students share what they have learned. Have the students choose the type of green vehicle that they would prefer to buy and state the reasons why.

5. Have the students get into groups of 4-5. This could be based on their green vehicle preferences or just random. Assign a different type of green vehicle to each group.

6. Using the researched information, have the groups plan and prepare a television commercial for their green vehicle. In the commercials, they should creatively state the characteristics as well as the benefits to the consumers and the environment. The students will need to have some type of jingle or slogan. The commercial needs to be at least one minute long. (Since the students are not actually paying for the commercial, they can make it longer. They just need to make sure the commercial is still interesting.)

7. Give the students time to practice. They can make props and posters.

8. Have the groups present their commercials. Have the students state what they liked about each commercial and how each commercial could be improved.

9. Have the students discuss the reasons why they feel that selling a green vehicle to all consumers might be difficult. What are some of the problems or disadvantages of green vehicles? How can the green vehicle designs be improved?

Extensions

1. Ask a local auto dealer who sells a green vehicle to come and speak to your class (and bring a vehicle too!).
2. Videotape the performances and share with other classes. Have the students explain what green vehicles are and how the vehicles help the environment before each viewing.

Sources

"Green Vehicles" *Georgia Clean Air Campaign*.
www.cleanair.com/index.php/cac/for_school.

"Teacher Resource Manual" *Georgia Clean Air Campaign*.
www.cleanair.com/index.php/cac/for_school.