



# 6-8 Lesson Plans

## Drive It Green

### Lesson Overview:

Millions of people around the globe are moving every day, creating a myriad of energy challenges and opportunities for new innovation. In this three-part lesson, students will imagine and design greener transportation solutions for their families.

### Learning Objectives:

Students will be able to:

- Rank the importance of several car buying considerations.
- Research the fuel efficiency and environmental friendliness of their family car or another car of their choice.
- Research green transportation innovations.
- Design an environmentally-friendly transportation innovation that meets their family's needs.

### Academic Standards:

National Science Education Standards (SCES)

Science as Inquiry:

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

Physical Science:

- Properties and changes of properties in matter
- Transfer of energy

Science and Technology:

- Abilities of technological design

Science in Personal and Social Perspectives:

- Populations, resources and environments
- Risks and benefits
- Science and technology in local challenges

Time Frame: 3 class periods

### Materials:

- 7 sheets of flip chart paper
- Markers
- “What Drives You?” student activity sheet, one per student
- “Drive It Green” student activity sheet, one per student
- Calculators
- Access to the Internet



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Procedure:

## Part 1

*Note: Before students enter the room, hang the sheets of flip chart paper in different areas of the room with a marker by each one. Write one of the following words at the top of each sheet of paper: Cost, Color, Size, Fuel-Efficiency/Environmental Impact, Reliability, Safety/Reliability, Other.*

1. Ask students to imagine that they have been asked by their parents to pick out a car for their family to drive on a road trip. What would be most important to them? Color? Cost? Size? Something else?
2. Point out the 7 signs around the room. Tell students that each sign represents a different consideration they could use when selecting their car. Direct students to get out a sheet of paper and rank the considerations from 1-6 (or 1-7 if they want to add a different consideration to the “other” category).
3. When they are finished their rankings, direct them to walk around the room and write the corresponding ranking on each sheet of flip chart paper. If they have an “other” consideration they should write it and its corresponding number on the sign marked, “other.”
4. When all students are finished, analyze the results. Which category was ranked #1 most frequently? Which was ranked #6 or #7 most frequently? What conclusions can students draw based on the results? Have someone who ranked #1 in each category justify their ranking. Then ask:
  - a. Based on the justifications, do any of you want to change your #1 ranking?
  - b. Do you think these results are representative of your generation?
  - c. Do you think your parents would have the same rankings?
  - d. Do you think older teenagers would have the same rankings?
  - e. How might the results have been different if asked 50 years ago? What about 50 years into the future? What categories might become more important in 50 years? Less important?
  - f. Ask students to focus on the category of fuel efficiency/environmental friendliness. What do students think “fuel efficiency” means? *Fuel efficiency means using less gas to go farther.* Have students brainstorm all of the ways they think fuel efficiency would be important, personally and globally, when choosing a car.
5. Distribute the “Drive It Green” student activity sheet. Have students work individually or in groups to answer the questions. *Note: # 7 requires Internet access as students are asked to go to the EPA’s [fueleconomy.gov](http://www.epa.gov/fueleconomy) site to research a specific car’s fuel efficiency and carbon emissions.*

6. Once students complete the chart for their own car (or a car of their choice), have them compare their vehicle's miles per gallon and carbon emissions with other students' vehicles.
7. Review answers to the activity sheet together with the class. Which cars got the most miles per gallon? The least? Which cars had the most CO<sup>2</sup> emissions? The least? Which 3-5 cars would be considered both fuel-efficient and environmentally friendly? Which 3-5 cars would be considered least fuel-efficient and environmentally friendly? *Note: Students can view lists of the most and least fuel efficient vehicles at <http://www.fueleconomy.gov/feg/bestworst.shtml>.*
8. What conclusions can students draw about fuel efficiency and environmental friendliness? How might this information help them when purchasing a car?

## Part 2

9. Many innovations and new technologies are designed to solve a problem. Challenge students to identify current environmental problems or challenges related to today's vehicles (fossil fuel is expensive, fossil fuel is a non-renewable resource, carbon emissions from fossil fuels are bad for the environment, etc.).
10. Ask students if they know of any existing (or in development) innovations or technologies designed to address some of these problems. *Examples include alternative vehicles such as hybrid, electric and plug in. Or new clean burning fuels like methanol, ethanol, flex-fuel and hydrogen.*
11. Tell student groups that they will now act as investigators to learn about the benefits and challenges of these new technologies.
12. Have each group select one of the innovations from the list above or another innovation that has been designed to address current energy-related transportation concerns.
13. Distribute the "Drive It Green" student activity sheet. Review the directions and give students ample time to complete their research.
14. Have each group report what they've learned to the rest of the class.
15. Then discuss:
  - a. Which new innovation would you be most likely to purchase or use? Why?
  - b. Are there elements of different technologies that you would combine into a new innovation if you could?
  - c. Why is continued innovation related to transportation and energy so important?

## Part 3

16. Direct students to review the car purchasing considerations they ranked at the beginning of the lesson. Given what they've learned, would their considerations change or remain the same?
17. Finally, challenge students to use all they've learned to design one transportation innovation that would be environmentally friendly while still meeting the purchasing criteria that is most important to them. This could be a gadget, device, type of fuel, vehicle feature, type of vehicle, etc.
18. Have them draw a sketch of their innovation and write a one paragraph description that explains their innovation and how it could work, and the advantages and disadvantages it would offer.

## Extensions

- Have students develop a presentation to persuade others in the class to purchase or use their new innovation.
- Have students track the miles per gallon, fuel costs, and CO<sub>2</sub> emissions (using the formula above) of their family car or a school bus for one month. Have them analyze the data including which vehicles were most and least fuel efficient during this time.
- Have students brainstorm other innovations related to "How We Move."

## Additional Resources:

Clean Vehicle Education Foundation: [www.cleanvehicle.org](http://www.cleanvehicle.org)

U.S. Department of Energy site for fuel efficiency information: [www.fueleconomy.gov](http://www.fueleconomy.gov)

U.S. Department of Energy renewable energy/energy efficiency site:

<http://www.eere.energy.gov/topics/vehicles.html>

U.S. Environmental Protection Agency student site: <http://www.epa.gov/students/>

3M Transportation innovations:

[http://solutions.3m.com/wps/portal/3M/en\\_US/Products/ProdServ/Dir/Trans/](http://solutions.3m.com/wps/portal/3M/en_US/Products/ProdServ/Dir/Trans/)



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## Student Activity Sheet: What Drives You?

Read the following scenario. Then answer the questions that follow.

*You and your parents go to the gas station and put 21 gallons of gas in the tank. Each gallon is \$3.00. You look at the odometer when you are finished filling up and it reads 4,200 miles. Your family drives the car for a few days, and your Dad says he needs more gas because there is only 1 gallon left. You look at the odometer again and it reads 4,500 miles.*

1. How many miles have you driven?
2. How many miles per gallon did your car get?
3. Imagine if the car got 20 mpg, how far would your family have been able to drive?
4. If your family drove 250 miles each week and gas was \$3.00 per gallon, how much money would you save on gas by driving a car that got 20mpg vs. 15mpg? Given the calculation in #4, how much money would your family save each year?
5. In addition to costing money, each gallon of gas we burn releases 20 lbs of CO<sup>2</sup> into the environment. CO<sup>2</sup> is the gas that comes out of the exhaust pipe when your car burns the fuel it needs to move. CO<sup>2</sup> causes air pollution and has been called the main cause of global warming. How many lbs of CO<sup>2</sup> did your family release into the environment in the scenario above?
6. How do you think your car (or a car of your choice) ranks in terms of fuel-efficiency and CO<sup>2</sup> emissions? In the chart below, write the model and year of your family's car (or choose another car to research). Then predict the car's MPG and CO<sup>2</sup> emissions and go to <http://www.fueleconomy.gov/feg/findacar.htm> to find your vehicle's data.

Make/ Model/ Year	Predicted MPG	Actual MPG	Predicted Annual Fuel Cost	Actual Annual Fuel Cost	Predicted Annual Tons of CO <sup>2</sup> emissions*	Actual Annual Tons of CO <sup>2</sup> emissions

\*Average passenger vehicle emits 5.20 metric tons of CO<sup>2</sup> each year.

7. Why is fuel efficiency and environmental friendliness important, personally and globally, when choosing a car?



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Select one new technology or innovation that has been designed to address current energy-related transportation problems. Then research the description/status, science behind, advantages and challenges of the technology you've chosen. Highlight the information that is most important and be prepared to present your information to the class.

<b>Name of Technology/Innovation:</b>	
<b>Description:</b>	
<b>Science Behind/How It Works:</b>	
<b>Advantages</b>  1.  2.  3.	<b>Challenges</b>  1.  2.  3.
<b>Would you/your family consider using this technology? Why or why not? Consider the advantages and challenges, and your family's needs.</b>	