Name_____ Period _____ Date _____

Fleet Manager

STEM Sims

Lesson 2: Carbon Dioxide Problems

One of the major problems with engines that are found in most current vehicles is the amount of carbon dioxide the engine releases after the fuel is burned. Can you convert a vehicle's engine type to reduce the carbon dioxide emissions?

Here are some definitions to help you in your investigation.

Vehicle -	a car, truck, or SUV
Gasoline -	a common fuel used in many vehicles. Gasoline is made by refining oil removed from the ground.
Combustion -	a chemical reaction when a fuel is burned with oxygen making heat, light, and other new substances
Carbon dioxide (CO_2) -	a product of a combustion reaction
Emission -	to give off from a chemical reaction
Fleet -	a group of vehicles owned by a company
Natural resource -	materials and/or substances that occur in nature
Depletion -	to use up a natural resource
Degradation -	to lower the quality of a natural resource
Efficient -	preventing the waste of a resource

Doing the Science

1. Start the Fleet Manager Simulation by clicking on the "Simulation" tab.

2. Click on one of the vehicles in the fleet.

3. Click the "Use" button, then the "Drive" button. When the vehicle completes the route, click the "Status" button.

4. Record in Table 1 the Vehicle name, Engine Type, Vehicle Color, and CO_2 Emissions released annually by the vehicle.

5. Close the box by clicking the "X" in the upper right-hand corner, and then click the "Fleet" button.

6. Select a different vehicle and repeat steps 3-5. Test a total of three different vehicles.

7. Select one of the same vehicles you previously tested (use the vehicle's color if you can't remember the names of the vehicles) and click the "Convert" button at the bottom of the screen.

8. Select one of the engine conversions. Make sure to record the engine conversion type in Table 2. Click the "Make Conversion" button.

9. Repeat steps 3 – 5 to test drive your converted vehicle.

10. Repeat steps 7 – 9 for a total of three converted vehicles.

Table 1.

Vehicle	Engine Type	Vehicle Color	CO_2 Emissions (tons/year)

Table 2.

Vehicle	Vehicle Color	Conversion Type	CO_2 Emissions (tons/year)

Do You Understand?

1. When oil is removed from the ground to make gasoline, is this mainly an example of depletion or degradation of a natural resource? Please support your answer with a reason.

2. The main chemical reaction when gasoline is used to provide energy to move a vehicle is given by the following:

   Gasoline and oxygen forms carbon dioxide and water and heat

   Where does the oxygen come from that reacts with the gasoline?

3. One gallon of gasoline can ruin 1,000,000 gallons of fresh drinking water. Is this an example of depletion or of degradation of the drinking water?

4. Gasoline stations are required to have a special collection system for gasoline that spills on the ground during vehicle fill ups. What is the purpose of this special collection system?

5. Which vehicle that you tested released the most carbon dioxide into the air on a yearly basis?

6. Calculate the percentage the carbon dioxide emission was *reduced* for each conversion. To find this value use the following formula:

   [(gasoline CO_2 emission - converted engine CO_2 emission)/converted engine CO_2 emission] x 100%

7. Which engine conversion was most effective at reducing the amount of carbon dioxide released by the vehicle? Provide a reason for the improved air quality rating of this vehicle's engine.

8. State a possible problem that might arise with the engine conversion you described in question #7.

9. Carbon dioxide is a greenhouse gas that has been shown to affect climate change on Earth. Describe how the engine conversion you described in question #7 might help reduce the effects of climate change.