THE CAR OF THE FUTURE?

So, now you know everything there is to know about hydrogen, right? (OK, maybe not *everything* . . .) But what does hydrogen power look like in action? Now is your chance to find out, by working with a model fuel cell car. Of course, most of the features of this car are very different from what you would find in an actual fuel cell car (for one thing, the driving distance between refuelings is pretty short), but it does include a real fuel cell that runs on hydrogen and oxygen.

From the collections of Ford Motor Company.

Ford's plug-in hybrid fuel cell-concept car, the Airstream

With your Hydrogen Technology Research team, conduct the Model Fuel Cell Car Lab. Assemble and then operate the model car, collecting data about its **fuel efficiency**—the distance a car can travel on a given amount of fuel.

DID YOU KNOW?

The "car of the future" may not be that far away. In the 1990s, scientists and engineers at the Rocky Mountain Institute in Colorado developed the idea for the Hypercar®, a lightweight, aerodynamic, hybrid-electric automobile. The Hypercar would be 3–10 times more fuel-efficient than today's cars, without compromising performance, safety, or affordability. How is that possible?

The Rocky Mountain Institute says that rather than incrementally improving the design of today's automobiles, the key to success is to start designing from scratch and to use cutting-edge technologies. For example, using lightweight composite materials (such as the carbon fiber composite used to make some high-end race cars), the mass of a car can be reduced by 50–67 percent while preserving or even improving on impact safety.

In theory, the combination of reduced weight with other technologies could make it possible for Hypercars to get as many as 200 miles per gallon of fuel. Because an actual Hypercar has not been built, critics are skeptical of these extremely optimistic numbers. However, several design elements of the Hypercar have been incorporated into prototypes and "show cars" of major automobile manufacturers.

MODEL FUEL CELL CAR LAB

In this lab, you will assemble a model fuel cell car, produce the hydrogen to fuel it, and then operate the car on a "test track."

Purpose

To observe how a hydrogen fuel cell can be used to power a vehicle and to consider some of the challenges to building real fuel cell cars.

Materials

- Model fuel cell car kit
- 1 L distilled water
- Tape measure
- Air-tight plastic bag for storing fuel cell

Procedure

1. Before beginning to assemble your car, read through all the assembly instructions. Lay out the parts listed in the instructions, and confirm that you have everything you need.

2. Assemble the car.

3. Follow the instructions in the manual for producing the hydrogen to fuel your car.
   Note: Be sure to use distilled water. Tap water or bottled water will contaminate the fuel cell and may cause it to stop working.

4. Take your car to the "test track" (a flat surface that is smooth and free from obstacles). Align the wheels as much as possible to help ensure that your car will travel in a straight line.

5. Conduct a few "trial runs," running the car as described in the instruction manual. If the car does not move immediately, give it a *slight* nudge to help it overcome the starting friction. The fuel cell must be fully hydrated in order for the car to work at maximum efficiency. Before collecting any data about fuel used or distance traveled, run your car three or four times to be certain that the membrane is fully hydrated. (Each time you run the car, you will first need to produce the hydrogen. These trial runs will also give you a chance to note and correct any problems with the car.)

6. Collect the data you need to calculate the fuel efficiency, and record the data in your science notebook.

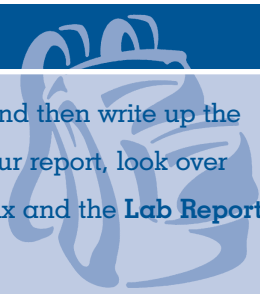
7. When you are finished using the car, remove the fuel cell and seal it in an air-tight plastic bag.

Analysis

1. Calculate your car's fuel efficiency in m/L (meters traveled per liter of hydrogen).

2. For your car to travel 300 miles, how many times would it need to stop for refueling? What volume of hydrogen would be required for your car to travel 300 miles without stopping to refuel?

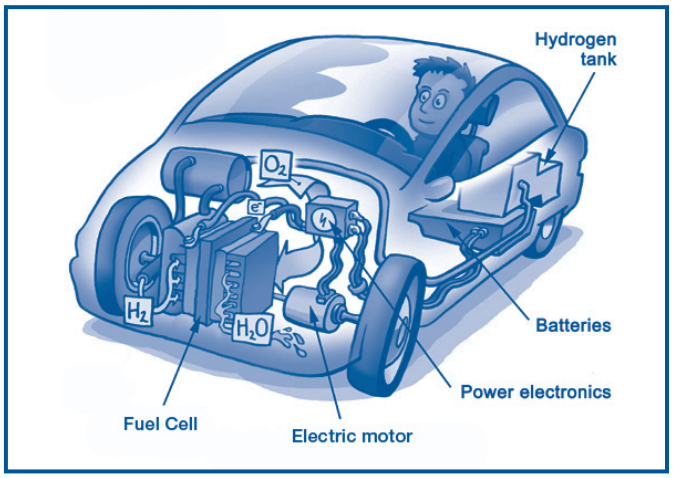
HOMEWORK 1.2



Answer the Analysis questions from **Model Fuel Cell Car Lab** and then write up the lab report for the Model Fuel Cell Car Lab. Before you begin your report, look over the **Lab Report Guidelines** on pages 89–90 in the Skill Appendix and the **Lab Report Assessment** to see how your work will be assessed.

REALITY CHECK

Building and running the model fuel cell car may have been fun, but how much did it tell you about the real challenges of building a fuel cell-powered vehicle? Consider the following and share your ideas with your classmates:



- In what ways is the car you built similar to a real hydrogen fuel cell vehicle? In what ways is it different?
- What are some of the challenges to developing hydrogen fuel cell-powered cars and to having these cars adopted on a widespread basis?
- Considering the challenges you have identified, are there other uses for hydrogen and fuel cells that might be more appropriate?