



CHEDD-ANGIER



SCIENTIFIC AMERICAN

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Cars That Think

Activity 1: Grades 9-12

Model Car Design

As you observed in this segment of Scientific American Frontiers, engineers are continually trying to improve the efficiency and environmental sustainability of automobiles. Radical changes such as a hybrid engine that uses both gasoline and electric fuel help on both fronts. New materials used in both engine design and chassis construction not only improve mileage, but also insure a safer ride.

This activity page will offer:

- A hands-on experience in model car design
- An opportunity to engage critical thinking, analysis and process skills
- An experience for engineering application, critique and improvement

Model Racers

Before a new car makes it to the showroom, various prototypes must be tested and evaluated. In this activity, you'll get a chance to design your own model car. You'll use a variety of materials to construct a vehicle that travels the greatest distance on balloon power. During your trials, you'll use what you observe to update and improve your design and understanding of model car mechanics.

Materials

- Milk carton
- 1.5-volt DC motor
- Connecting wire
- Switch 1.5-volt AA cell
- Wheels from a toy car (or heavy stock paper disks)
- Paper clips
- Clay
- Tape
- Assortment of construction materials

Procedure

Basic Prototype

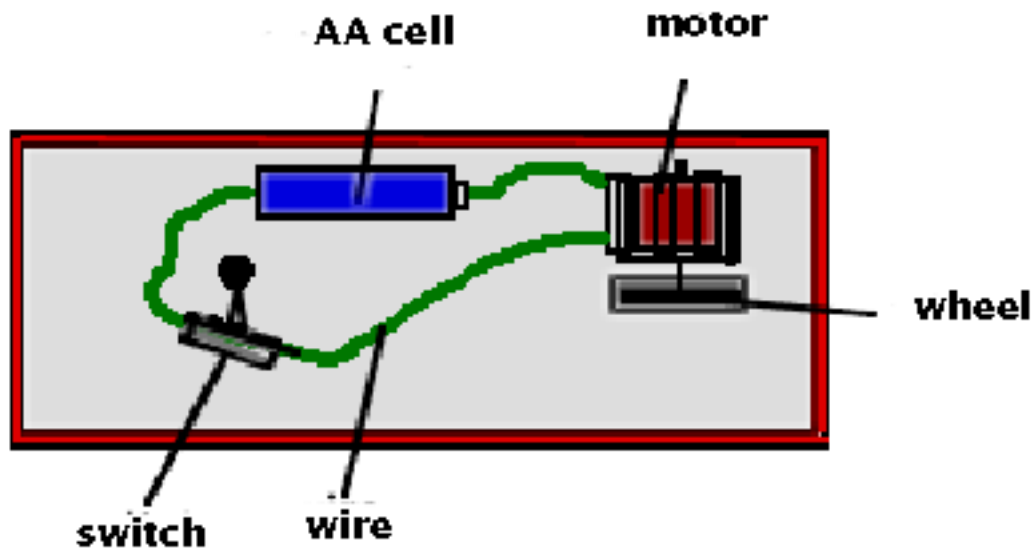
1. Work in teams of two. Use a scissors to cut away the sides of a milk carton to form a basic chassis design that resembles the illustration show here. Cut a slot toward the front end of the chassis through which the "power" wheel will extend.



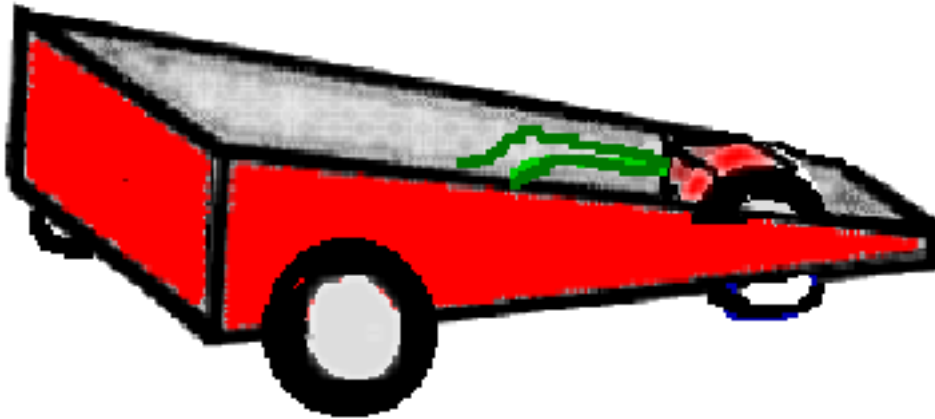
slot for wheel



2. Position a DC motor and 1.5-volt AA cell within the chassis. Attach a wheel to the motor shaft and position the motor so that the wheel extends out of the cut slot and makes contact with the surface beneath the chassis. Secure with tape.



3. For a basic tricycle wheel arrangement, add two additional wheels to the rear end of the chassis. You can use bent paper clips as axles and lumps of clay as hubs to secure the wheels in place. You could also cut and slot the position of these rear wheels similar to the front power wheel.



4. Position your car on a test track. Turn on the motor and release the vehicle. Observe and analyze its progress along the floor.
5. What design changes would improve its performance? With your instructor's approval, update your design. Analyze the new model's performance. Did the changes help? If so, how?

Questions

1. What is the stored source of power for your model car?
2. What are the three most important factors you uncovered that affect the performance of your vehicle?
3. What design factors are least applicable for transfer between your scale model and a full-sized vehicle? Explain.

Front Wheel Driving

The model you constructed had front wheel drive. How might powering the rear wheels affect the car's performance? Develop an investigation that would compare and contrast front wheel and rear wheel drive in these model racers.

Solar Extension

Suppose your next design challenge is to replace balloon power with solar power. What new components would you need for your model vehicle? How would they affect the design of your current car? Create a set of blueprints that illustrate your new solar car and share them with classmates. With your teacher's approval and available classroom materials, assemble your new vehicle.

Submersible Connection

Like the proposed hybrid engines for cars, the power plants of pre-nuclear submarines included both diesel and electric engines. Use Internet and print resources to learn more about these dual power sources for submersible boats.

Compare and contrast their use with the proposed hybrid engines for cars. How were they similar? How were they different? Are hybrid engines used in nuclear submarines? Explain.

Sexy Sales

How would you best describe print and broadcast advertisements used to sell new cars? Do they focus more on the mechanics or the appearance of the vehicle? Do they target a specific gender? In the "eyes" of Madison Avenue, what features make an automobile a guys' or gals' car? Do you think that gender-specific ads reinforce stereotypes or do they cater to new markets? In an open classroom forum, discuss and debate these issues.

Web Connection

National Middle School Science Bowl

<http://www.scied.science.doe.gov/nmsb/default.htm>

Science Bowl information that includes solar power and hydrogen fuel car competitions for students.

Mousetrap Car

<http://users.bigpond.net.au/mechtoys/mouse.html>

Basic overview of the construction of a model car that is powered by a mousetrap engine.

Rocket-Science Museum of Minnesota

<http://www.smm.org/sln/tf/r/rocket/rocket.html>

A site that illustrates how to use balloon power to move a rocket along a string.

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Questions

1. What is the stored source of power for your model car?
(The stored charges contained in the AA cell.)
2. What are the three most important factors you uncovered that affect the performance of your vehicle?
(Accept all reasonable answers such as larger motor, bigger wheels, etc.)
3. What design factors are least applicable for transfer between your scale model and a full-sized vehicle? Explain.
(Accept all reasonable answers such as electric motor, no model load, etc.)