Alternative Assessment

1. Design experiments for measuring your power output when doing push-ups, running up a flight of stairs, pushing a car, loading boxes onto a truck, throwing a baseball, or performing other energy-transferring activities. What data do you need to measure or calculate? Form groups to present and discuss your plans. If your teacher approves your plans, perform the experiments.

2. Investigate the amount of kinetic energy involved when your car's speed is 60 km/h, 50 km/h, 40 km/h, 30 km/h, 20 km/h, and 10 km/h. (Hint: Find your car's mass in the owner's manual.) How much work does the brake system have to do to stop the car at each speed?

If the owner's manual includes a table of braking distances at different speeds, determine the force the braking system must exert. Organize your findings in charts and graphs to study the questions and to present your conclusions.

3. Investigate the energy transformations of your body as you swing on a swing set. Working with a partner, measure the height of the swing at the high and low points of your motion. What points involve a maximum gravitational potential energy? What points involve a maximum kinetic energy? For three other points in the path of the swing, calculate the gravitational potential energy, the kinetic energy, and the velocity. Organize your findings in bar graphs.

4. Design an experiment to test the conservation of mechanical energy for a toy car rolling down a ramp. Use a board propped up on a stack of books as the ramp. To find the final speed of the car, use the equation final speed = 2(average speed) = 2(length of ramp/time). Before beginning the experiment, make predictions about what to expect. Will the kinetic energy at the bottom equal the potential energy at the top? If not, which might be greater? Test your predictions with various ramp heights, and write a report describing your experiment and your results.

5. In order to save fuel, an airline executive recommended the following changes in the airlines' largest jet flights:

a. restrict the weight of personal luggage
b. remove pillows, blankets, and magazines from the cabin
c. lower flight altitudes by 5 percent
d. reduce flying speeds by 5 percent

Research the information necessary to calculate the approximate kinetic and potential energy of a large passenger aircraft. Which of the measures described above would result in significant savings? What might be their other consequences? Summarize your conclusions in a presentation or report.

6. Make a chart of the kinetic energies your body can have. First, measure your mass. Then, measure your speed when walking, running, sprinting, riding a bicycle, and driving a car. Make a poster graphically comparing these findings.

7. You are trying to find a way to bring electricity to a remote village in order to run a water-purifying device. A donor is willing to provide battery chargers that connect to bicycles. Assuming the water-purification device requires 18.6 kW•h daily, how many bicycles would a village need if a person can average 100 W while riding a bicycle? Is this a useful way to help the village? Evaluate your findings for strengths and weaknesses. Summarize your comments and suggestions in a letter to the donor.

8. Many scientific units are named after famous scientists or inventors. The SI unit of power, the watt, was name for the Scottish scientist, James Watt. The SI unit of energy, the joule, was named for the English scientist James Prescott Joule. Use the Internet or library resources to learn about the contributions of one of these two scientists. Write a short report with your findings, and then present your report to the class.