

Aerodynamic Shape Investigation #2

Objective

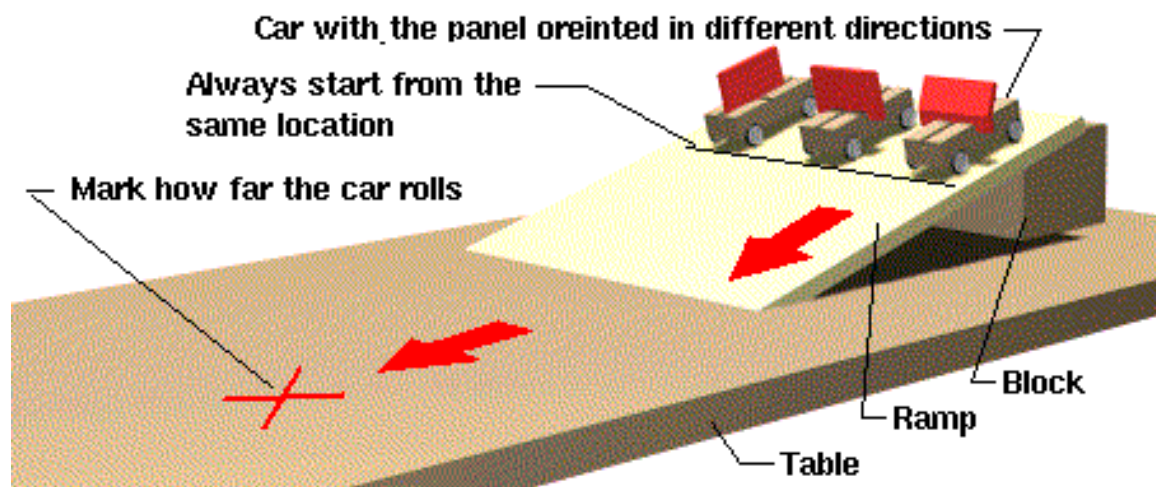
To understand how the frontal area and shape of the model solar car can affect the drag or resistance the air has on the vehicle.

Materials Needed

- Ramp (plank of wood)
- Simple car chassis (derby car)
- Different shapes to attach to chassis (blocks, streamlined shapes of paper, sheets of foamcore, etc.)
- Pieces of Foam core

Procedure

1. Explain to students that roll-down tests are used by some automobile manufacturers, race car builders, and car testing organizations (among others) to test the aerodynamic drag of a car. The idea is to roll a car (with the engine turned off and out of gear) down a hill, and see how far it rolls. A car with more drag (for example, a car with a parachute behind it) will roll to a stop faster (or in a shorter distance) than a streamlined, low drag car.
2. Have students set up a ramp as shown in the figure below.



3. Identify a starting line and release the simple car chassis until it repeatedly

rolls to the same place. Mark the location where it stops.

4. Repeat with different frontal area (sheets of foam core of different sizes and orientation), keeping the weight of the car constant. Try a very large frontal area. Mark the locations they roll to.

5. Repeat these steps using different streamlined shapes as you did with the nose cone on the soda can. Be careful to keep the other variables constant.

6. Conclude with a discussion based on these questions:

- Which tests went the farthest? Smallest frontal area or largest?
- Why would the tests be invalid if you used different test cars (chassis)?
- What other physical properties can affect the amount of distance traveled?
- What effect would a streamlined body or nose cone have on the car's top speed and its acceleration?
- How can you build an aerodynamic shape?
- How can you apply these principles to your car to make it faster?

Sources: Adapted from *Junior Solar Sprint: Classroom Investigations*, by Andrew Heafitz for NREL, 2001; and materials created by Rick Butchart for the Chimacum School District in Washington; used with permission.