Mousetrap Car Project—Teacher Directions

The Mousetrap Car project is used in many versions from middle school through graduate-level college classes. It is rich in physics, systems thinking, and engineering challenges, and it models the way an actual car works. Getting anything to travel very far (more than three hundred feet for world record holders) powered by a simple mousetrap, however, requires a good deal of physics know-how, testing, and modification.

Students need some basic knowledge about energy transfer to understand how the spring's *potential* energy becomes the car's *kinetic* energy. They need to understand a bit of rotational dynamics to choose the best wheel design. Friction comes into play, in both positive and negative ways, in terms of any contacting surfaces, including the flow of air molecules around the car (also known as *drag*).

You cannot teach all this material in less than a week, but you can introduce it and highlight where it connects to the car design in about thirty minutes. If you reinforce this by requiring connections when students make design decisions or plan modifications to their prototype, students will begin understanding the concepts better and in greater depth.

You can ask the following sample questions, appropriate for high school–level students, to further engage your class in engineering and physics concepts as part of the Mousetrap Car project.

- "One of the rules is that the spring can't be altered in any way. Why is this rule necessary? What is the role of the spring?"
- "Briefly explain what happens to the energy stored in the spring."
- "The design uses two simple machines. What are they and how are they used?"
- "Friction plays a significant role in many aspects of your car's design. What are three areas in your vehicle where friction is a concern?"
- "You must have friction between the wheels and the ground in order to start your car. Explain this in terms of Newton's Laws."
- "The friction between the wheels and the ground depends on two factors. Explain what they are and how you plan to use them in your car."
- "Wheel design is critical. In your own words, what is rotational inertia? How would you explain it in terms of the mass and size of your wheels?"
- "At what point in the motion do you expect your car to experience positive acceleration? When does negative acceleration begin?"
- "What's the difference in length of the lever arm in a mousetrap car built for speed versus one built for distance?"
- "There are some engineering design factors that we did not discuss in class. One of those is wheel-to-axle ratio. How will that affect your car?"