

Egg Car: Newton's Laws PBL



Show: IIHS videos and images; could discuss old cars vs. new cars, big cars vs. small cars; [aside: accidents and fatalities have been pretty constant for a number of years until recent advances in accident *avoidance*.]

Discuss: Newton's Laws, particularly define inertia (dishes and tablecloth demo!) and acceleration. What is damaging? You keep moving forward (Newton's First Law). $F=ma$ (Newton's Second Law): For a given force, the smaller the mass, the bigger the 'a' (change in velocity), and the more damaging. Your car feels that same force as what you hit (Newton's Third Law), but if you are a smaller mass car, you will have a bigger 'a'. Changes in velocity of your body is damaging when things move relative to each other. When you move relative to the car is a problem, too. [crushing is a problem, too: but cars are made to have a very strong passenger cage and to crush around you]

Task: You are going to be given a car, and your job is to protect the passengers in the compartment. What are the things that cars have to protect people in accidents? [seat belts, airbags]

Why do race car drivers survive horrendous crashes (show video?) Because of 5 point harnessing, better seatbelts than you have in your car.

If we have time, talk about Colonel John Stapp and his campaign to make airforce jets safer and to get seatbelts in cars. Show video of his experiments.

Your passenger in the car will be this egg. [The egg must be removable? Do we want to make any stipulations such as the egg has to be able to see?]

Put the egg in a ziplock baggie before putting it in the car! You can decorate the egg to give it a personality.

In order to protect your passenger, you will be given:

- 8 straws
- 4 cotton balls
- 4 popsicle sticks
- 4 rubber bands
- 1 balloon
- scissors

Working in groups of 2-4, You have 20-30 minutes to build your protection system. If you want to try it out to see what happens in a crash, you can use a pingpong ball in place of the egg. Must be able to see the egg!

We will test the car by rolling it down a ramp and crashing into a wall. All cars will be tested at each angle. We will increase the angle of the ramp until all eggs are broken. [be sure to put down drop cloth/trash bags at end of ramp; use boards or table with foldable legs; be sure to wash cars at the end]