

Egg Crash! Designing a Collision Safety Device



Crash test question(s)

- How do people survive major collisions?
- How does physics explain the effectiveness of seat belts and airbags?

Purpose

- To design, build, test, and evaluate a landing pad or "safety device" to protect an egg during a collision with a hard surface
- To describe a collision in terms of changing momentum, impulse, impact force, and impact time

Materials needed

For each groups of two or three students:

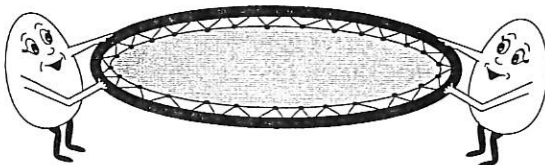
- copier paper, 10 sheets (8 1/2" x 11")
- masking tape, 1.0 meter
- scissors, one pair

Discussion

How do people survive major vehicle collisions? Scientists and engineers apply the laws of physics to reduce damage to both cars and passengers. During this activity, you will work in groups to design, build, test, and evaluate a "collision safety device" (in the form of a landing pad) to protect a raw egg during a collision with a hard surface. Hopefully, this process will help you discover the physics underlying some of the "EGGcellent" safety devices in a car!

Procedure

Using no more than 10 sheets of paper, one meter of masking tape and following the parameters listed on the back of this sheet, design, build, and test a landing pad/"collision safety device" that will protect an egg when dropped from ever increasing heights.



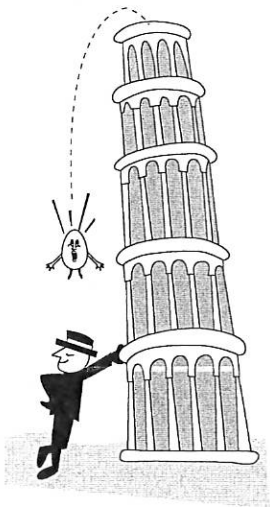


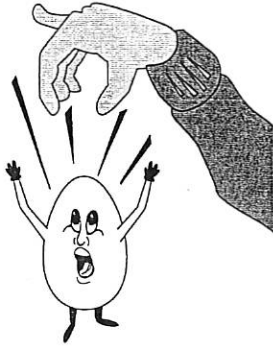
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EGG "Collision Safety Device" Parameters

1. Groups may use less, but no more than 10 sheets of paper.
 - Report to the teacher the amount of paper used to build your safety device. In the event of a tie, the device constructed with fewest sheets of paper will be declared the superior safety device.
2. Collision Safety Devices must be free-standing. Teams cannot support their devices by holding them or taping them to another structure.
3. Nothing may be attached to the egg.
4. Scissors may not be part of the Collision Safety Device.
5. Dropping height is measured from the bottom of the egg, at the release point, to the top of the Collision Safety Device.
6. Eggs will be dropped by a member of the Device's design team.
7. Eggs that miss the Collision Safety Device when dropped are eliminated.
8. Eggs will be inspected before and after each drop and must not show any cracks.
 - Eggs that survive the initial impact but roll off their device and break are eliminated.
 - Teams that break their egg by accident or carelessness are eliminated.
9. In order to simulate car collisions with greater momentum the eggs will be dropped from successively greater heights (1.0 m, 1.5 m, 2.0 m, 2.5 m)
10. Devices must be completed within the time limit of 20 minutes.





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Analysis

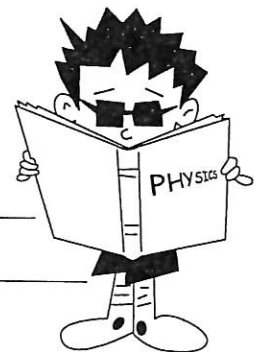
1. Draw a large diagram of your Collision Safety Device in the space below.

A large, empty rectangular box with a decorative border, intended for students to draw their collision safety device design.

2. Describe your team's Collision Safety Device, the reasoning behind your design, and its performance during the various collisions. Refer to your diagram.

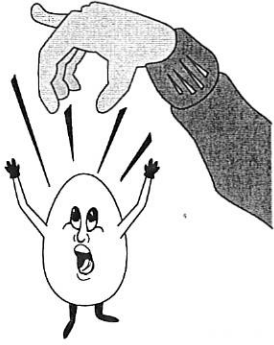
Crash questions

1. Explain how your Collision Safety Device is similar to an airbag in preventing injuries. Use the terms momentum impulse, impact force, and impact time in your response.



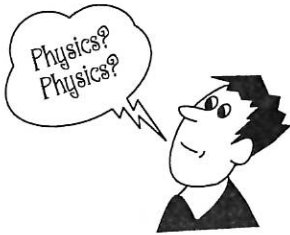


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More crash questions

2. Compare the impulses, impact forces, and impact times of the following: Race Car #1 crashes to a stop by hitting a wall head on; Race Car #2 crashes to a stop by skidding a great distance along a wall.



3. List other vehicle safety devices that reduce the impact force by increasing the time of impact.

4. Explain why airbags are not alternatives to seat belts but are intended to be used with seat belts to increase safety.

