HONORS PHYSICS **NAME:**

Crash Cart Cushion Lab

Introduction

Each year, millions of people are injured in car accidents worldwide, according to the World Health Organization. In order to reduce traffic injuries, high-speed roadways must be made safer. Building crash cushions along highways that reduce the impact force experienced by the passengers of the car in a crash can save lives. But how should these cushions be built.

You are a team of engineers that works for the imaginary Department of Highway Safety. Your team's job is to find ways to make roadways safer for drivers and passengers. You have been assigned the 105/110 Freeway Interchange in Los Angeles. Drivers tend to take the turn fast, often slamming into the cement wall. Your team must design a cushion that will be placed in front of the wall to reduce the force felt by passengers if a car were to crash into the wall. Your design will make the freeway safer.

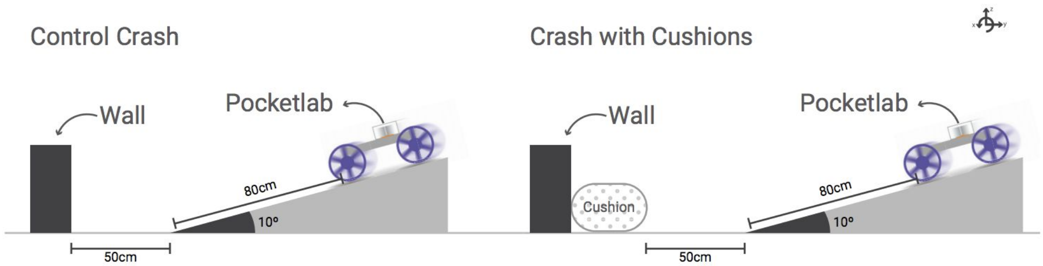
Materials

Pocket Lab
Cart
Wall
Ramp
Straw Bale
Snow
Styrofoam Rectangle

Objective

Using the available materials, build a crash cushion that will reduce the force experienced by the cart as it crashes into the wall. You must build at least two models. You will test each model with your team by collecting acceleration data with the Pocket Lab. Using the data you collected from your crash cushion models, you will then draw a conclusion about how to design optimal crash cushions to prevent traffic injuries.

Problem
What will your crash cushion need to do during the crash in order for it to reduce the force experienced by the cart?



Procedure
Part 1: Control Crash Without Cushion
1. Set up the control crash as shown in the diagram above.
2. **Option #1:** Sync the Pocket Lab to your device, select the Acceleration Graph, and change the data rate to the fastest available.
3. Begin recording data and release the cart down the ramp. Be sure to start the cart from the same position each time.
4. After the crash, stop recording and identify which spike in the graph was the actual collision.
5. Complete a total of five trials. Record the results of each trial in your data table and average the trials.
6. **Option #2:** Roll the cart down the ramp. Be sure to start the cart from the same position each time.
7. Measure the recoil distance of the cart.
8. Complete a total of five trials. Record the results of each trial in your data table and average the trials.

Part 2: Control Crash With Cushion
1. You will need to design a simple cushion using: straw bale, styrofoam brick and snow.
2. Place the cushion in the location shown in the diagram above.
2. **Option #1:** Sync the Pocket Lab to your device, select the Acceleration Graph, and change the data rate to the fastest available.
3. Begin recording data and release the cart down the ramp. Be sure to start the cart from the same position each time.
4. After the crash, stop recording and identify which spike in the graph was the actual collision.
5. Complete a total of five trials. Record the results of each trial in your data table and average the trials.
6. **Option #2:** Roll the cart down the ramp. Be sure to start the cart from the same position each time.
7. Measure the recoil distance of the cart.
8. Complete a total of five trials. Record the results of each trial in your data table and average the trials.

Data

Part 1: Control Crash Without Cushion

Trial	Acceleration (m/sec^2)	Recoil Distance (m)
1		
2		
3		
4		
5		
Average		

Part 2: Control Crash with Straw Bale Cushion

Trial	Acceleration (m/sec^2)	Recoil Distance (m)
1		
2		
3		
4		
5		
Average		

Part 2: Control Crash with Styrofoam Cushion

Trial	Acceleration (m/sec^2)	Recoil Distance (m)
1		
2		
3		
4		
5		
Average		

Part 2: Control Crash with Snow Cushion

Trial	Acceleration (m/sec^2)	Recoil Distance (m)
1		
2		
3		
4		
5		
Average		

Analysis

1. Which method did you use to measure the effectiveness of the collision cushion?
2. Which of the materials was most effective at making the most optimal crash cushion and why? Support your conclusion with evidence that you gathered from the lab and the scientific reasoning that explains why the data support your conclusion?
3. If you wanted to make cars safer during head-on collisions with other cars, what would you design the front of the car to do at impact? Relate your answer to your conclusions about the crash cushion.