Physics Laboratory Activity

Impulse, Momentum, and Car Crashes

In this experiment, we'll use an online simulation to explore how impulse and momentum play out during a car crash. After following the instructions below you will write a full lab report. Be sure to follow all instructions on, complete, and include a Lab Report Checklist.

Equipment:

A computer or other device to run a simulation.

Procedure:

Go to https://interactives.ck12.org/simulations/physics/crash-test-dummy/app/index.html?screen=sandbox, sign in using your lyjusd.org email account and open up the simulation.

- 1. Set the velocity of the car to -30 m/s. (The negative sign simply indicates the car is moving toward the left.
- 2. Set the mass of the dummy to 70 kg.
- 3. Set the type of restraint as "None"
- 4. Press play to simulate a crash.
- 5. Observe the graph of force versus time. The time here refers to the experience of the crash test dummy inside the car. The area underneath this graph is equal to the total impulse experienced by the dummy during the collision. Use this graph to record the following in Table 1 below: The impulse of the collision, the duration of the crash, and maximum force exerted on the dummy. (Be careful converting units!)

Type of Restraint	Impulse (Ns)	Duration (s)	Maximum Force (N)	Average Force (N)
None				
Seatbelt				
Air Bag				

- 6. Use your impulse and duration to calculate the average force exerted on the dummy during the collision. Record this value in Table 1. (Be sure to show this calculation in your lab report)
- 7. Repeat the above steps after setting the type of restraint to "Seatbelt" and then to "Air Bag".

Analysis:

- 1. What was the initial momentum of the dummy in each collision?
- 2. What was the final momentum of the dummy in each collision?
- 3. What was the change in momentum of the dummy in each collision?
- 4. Is your answer to #3 consistent with your data in Table 1 and the Impulse-Momentum Theorem? Explain.
- 5. Which quantity recorded in Table1 did not depend on type of restraint? Why did changing the type of restraint not affect this quantity?
- 6. Which type of restraint was most effective at protecting the crash test dummy. Explain why.