Toy Cars and Collisions

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Unit Overview

Topic: Conservation of Energy and Momentum

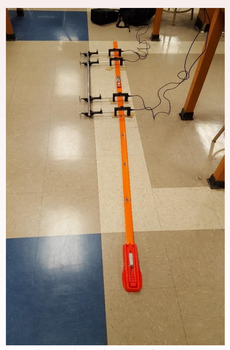
Standards: St. Xavier High School Outcomes for Physics

Activity Structure

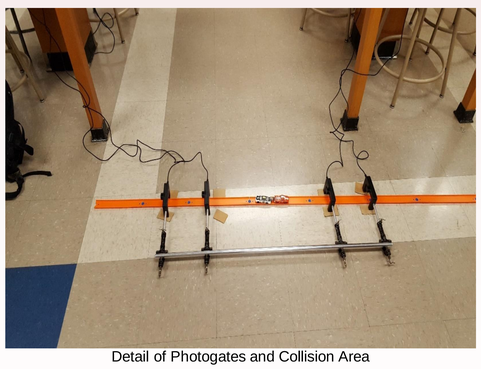
Title: Toy Cars and Collisions

Guiding Questions:
1. What is a collision? What are the characteristics of a collision?
2. What real-world purpose does this serve?
3. How can I identify different types of collisions?
4. How can I change one collision to another?
5. What are the pros and cons to different collisions?

Objectives:
The student will be able to:
- Identify inelastic and elastic collisions
- Recognize the difference between collision types
- Solve practical problems using:
  - P = mv
  - Law of conservation of momentum
  - 1- and 2-dimensional particles



View of Entire Track Setup



Detail of Photogates and Collision Area

Activity Implementation

The activity was quite easy to set up and test, although there were small parts to keep track of:
- Four test setups, consisting of Hotwheels track, two cars, two photogate series, magnets, and weights
- Students arranged themselves in groups and measured weights of cars
- Students then attached the magnets to the cars, first to repel, then to attract
- One car was launched, its speed recorded by the first photogate. It would collide with the second car, and the resultant speed would be recorded.
- Then the students would record observations and answer activity-based questions.

Engineering Design Process

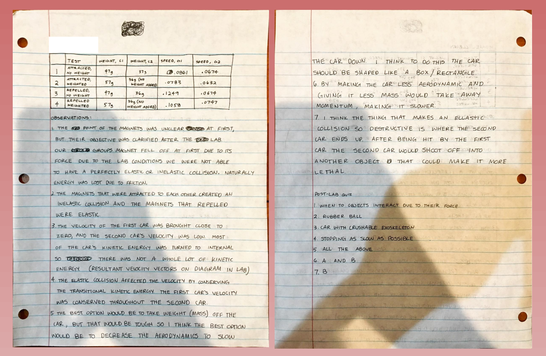
While the actual lab and execution was mostly on the rails, there are several parts of the activity that required the EDP
- Taping the magnets and weights to cars
- Finding out how to make sure the cars properly collided and remained on track
- Determining speed when the photogates malfunctioned

A: To meet the standards, this project showed how energy is conserved and transferred in collisions by measuring mass and speeds before and after impact

C: The activity taught valuable skills such as measuring and analysis used in careers such as engineering, research, and other problem-solving fields

S: Students developed problem-solving skills and scientific approaches to everyday problems through this lab, one example being trouble-shooting the photogates, and using phones and rulers to fulfill the same purpose

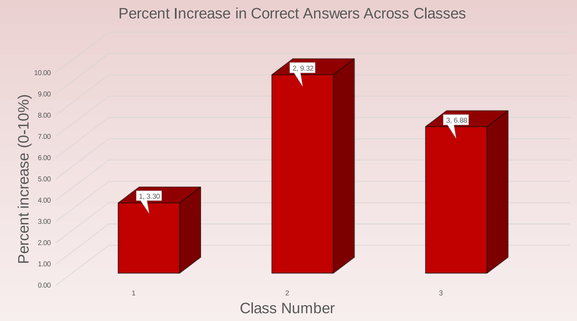
Student Work



Students in Action

Assessment Results: Impact on Student Learning

Of the three classes tested, the second class faced the most improvement. This could come from the lower initial class average, their more eager nature, or my change in teaching style across classes.



Reflection and Conclusion

For the most part, the students did not have trouble with the concepts. However, the purpose of the magnets was very difficult to relay to them, and that it was important to simulated perfect elastic and inelastic collisions. Additionally, photogates are extremely touchy and almost all of them failed, so the students had to use their phones and a fixed distance to calculate speed.