**SPH4U0**

**Summative A - Designing a Bumper**

**What design features for a bumper will produce a safer collision for a dynamics cart?**

**Materials you many need:** Dynamics cart with a spring, force censor, ramp, Capstone software etc.

Using a dynamics cart with a spring bumper on the front, design a bumper that attach to the back of the cart. Roll the cart down (height = ~ 15.0 cm) the ramp and let the spring hit the force censor. Repeat your experiment by rolling the dynamics cart down the ramp from the same height but let the new bumper (the one that you have designed) hit the force censor. Examine the graphs for evidence of a safer collision. Repeat the experiment as many times as needed by modifying the bumper to improve the results.

**Calculating the score for each design**

Record the area for the collision. Make sure you highlight the appropriate data.

Record the maximum value of the force.

Score = Area x Maximum force

Keep a log and a table of all testing done during this activity.

**Questions:**

1. Describe the criteria used to indicate a ‘safer collision’ and explain why this criteria can be used to indicate the safer collision. Are there any other criteria that could be used? Justify your reasoning.
2. What design features of your bumper improved the results? Why did they work?
3. What design features of the bumper didn’t work well? Why did this happen?
4. Briefly describe the design of the best bumper for the cart and include your reasoning (theoretical and experimental) behind these design features.

**Marking Scheme:**

Log of design ideas, modifications, reasoning.  **/20 (C)**
(may include dated pictures, minimum 1 modification/class time provided)

Experimental data collected and score calculations **/20 (T/I)**
( Each trial will have two graphs – Control and Bumper that you have designed)

(For score use Capstone software to calculate the area)

Ingenuity, originality and quality of construction of bumper design. **/20 (T/I)**

(Interesting design features, durability, use of readily available (repurposed) inexpensive materials etc.)

Questions and Conclusion **/10 (C)**

**Total: \ T/I: /40 C: /30**

**Mystery Mass Lab Activity**

**Introduction**

You will be given a small bag that has the same mass as the bag of yummy treats. Your goal is to find the mass of the small bag as accurately as possible. The group who gets the best results, receives the bag of goodies!

You have to set up a track with two motion sensors on either end. Use the two carts, any masses as you feel suitable, your knowledge of conservation of momentum, and your experience using datastudio to get graphs, datatables, etc… to determine the mass of the ziplock bag.

To increase the challenge, you will only have *30 minutes* to set-up, collect your results, analyze them, and tell your teacher the mass of the ziplock bag!

**Purpose**: to determine the mass of given ziplock bag with conservation of momentum using Pasco probeware and Datastudio

**Materials**

1 track

2 motion sensors

2 USB cables

2 carts

Masses

Datastudio Software

**Method**

Uch…that’s up to you!

**Results**

Make a table or use printscreen of graphs, data tables,…

**Discussion**

Explain your methodology

Make sense of your results

Share how you determined the mass from your results

**Conclusion**

The mass of the bag of treats is …..

Please submit the following:

* At the end of your 30 minutes, tell your teacher the mass of the ziplock bag
* Complete a report with title, names, date, intro, purpose, materials, method, results, discussion, conclusion

**Mystery Mass Lab - Rating Scale**

**Communication (10 marks)**

* MUGS (= **M**echanics **U**sage **G**rammar **S**pelling) 0 1 2
* Presentation is organized and follows Scientific Method 0 1
* Method is clear and concise 0 1 2 3 4
* Results: Printscreens clearly show data used in analysis 0 1 2
* Conclusion addresses purpose and includes results 0 1

**Thinking / Inquiry (10 marks)**

* Results: sufficient trials and quality data obtained 0 1 2 3
* Discussion: methodology explained at 4U level 0 1 2
* Discussion: results are accurate 0 1 2 3
* Discussion: clearly explained how results were obtained 0 1 2