

NAME: _____

DROP IT LIKE IT'S HOT!

INTRODUCTION:

This Lesson is based upon the Impulse/ Change in Momentum Theorem. This inquiry lesson will allow students to explore the Impulse/ Change in Momentum Theorem using a force plate sensor and energy dampening materials to distribute the force of a falling mass over time. An acrylic cylindrical tube will be utilized as a container for each chosen material. A mass that fits the tube well will be dropped from a particular height. The force plate will register the force peak from the drop and the change in time in which this force was imparted. Students will be able to quantify Force and Change in time data as the materials are changed in order to record them in a data table for analysis. Each material will be given a specific cost. This is to ensure that students remember that in engineering ideas are meant to be scaled up and cost effective so they do not go overboard out of the gate. Through this Inquiry, students will learn the necessary content as well as working “like and engineer”.

GOALS:

- ✓ Students will be able to measure force peaks and change in time using electronic sensors and software.
- ✓ Students will be able to calculate Impulse using force peaks and change in time measurements.
- ✓ Students will be able to organize data through creation of their own data tables.
- ✓ Students will be able to create a graph that represents their data properly.

- ✓ Students will be able to determine the independent and dependent variable/s within their experimental design.
- ✓ Students will be able to work successfully as a team in order to reach all goals set.

$$\underset{\text{big force}}{F} \cdot \underset{\text{short time}}{\Delta t} = \Delta p = \underset{\text{small force}}{F} \cdot \underset{\text{long time}}{\Delta t}$$

MATERIALS:

- Vernier Force Plate Sensors
- Vernier Logger Pro Software
- 2 3/4" Outside Diameter x 2 1/2" Inner Diameter Clear Extruded Plexi-glass Acrylic Tube x 6ft long (to be cut into 3' sections)

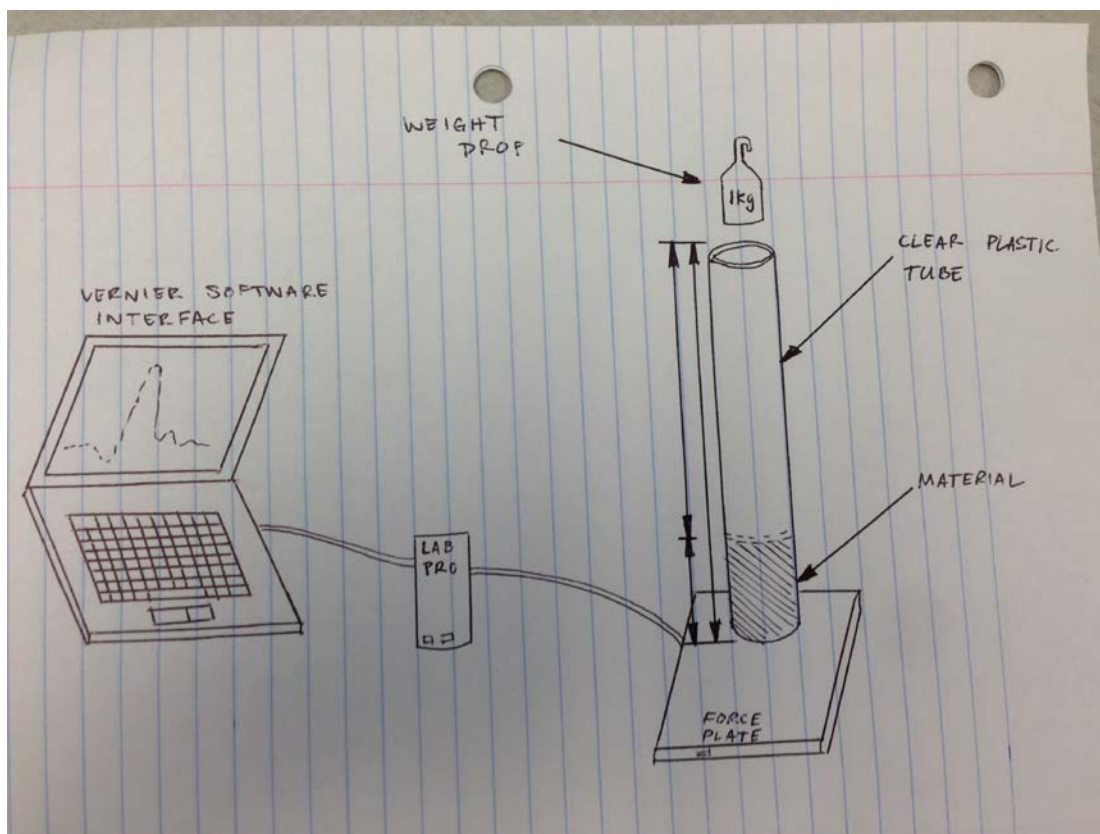
- Water Beads or Water Pearls
- Polystyrene Foam Beads
- Corn Starch
- Water
- Balloons
- Polyurethane egg crate foam
- Spaghetti
- Rigitoni

PROCEDURE:

Students will use the materials given to develop a research plan to dampen the impact force of the falling mass. Each group will work to acquire the lowest value.

The groups will not be allowed to collaborate with each other and must keep all findings secret. The group with the lowest affordable force peak will win the competition. NOTE** (Material Depth No Greater Than 12")

Basic Apparatus Setup



Students will develop a Research Plan must include:

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Testing procedure (Apparatus sketch, materials, Step by Step instructions on what you did)

Data tables to be used

Graph type/s chosen to represent the data

****RESEARCH PLAN AND FINDINGS WILL BE PRESENTED IN CLASS USING A POWERPOINT/WORD DOCUMENT PDF, PRESENTATION.**

ANALYSIS QUESTIONS

Answer the following questions completely.

1. Give a scientific explanation for why 1 material choice worked best and 1 material choice worked worst. Include properties about the material.

2. Why is cost so important?

3. What might you do differently? Give at least 3 examples.

4. What was the most challenging part of this lab and why?

5. Why is dampening material important? What role might it play? Think big picture and give an example of 1 use from everyday life. ***It does not have to be a material from this lab.