**Egg Bungee Contest**

**Goal:** Adjust the height of a floor tile below a bungee-jumping weighted egg so that the egg comes as close as possible to the floor tile without suffering any damage. The tile must be adjusted without conducting any practice jumps. Masses, lengths, and static bungee forces may be measured.

**\*\*No practice jumps are allowed. Any group that drops a mass and lets it fall to its low point will be disqualified for contest purposes.**

**First, Mr. Stapleton will demonstrate how to take measurements, determine stopping height using a spreadsheet, and drop the egg.**

1. Bungee data collection
   1. Choose a location to hang your bungee. A good location is about 1 foot away from a lab table. This will allow you to stand on the lab table while dropping the jumper, without having to worry that your jumper will hit the table. Note that the ceiling height may vary somewhat in different parts of the room.
   2. Hang your bungee from the ceiling with a paper clip. Measure and record the distance of the top of the bungee from the ceiling. You will need to remember this height if you do not complete this activity in one class.
   3. Gently tug downward on the bottom of the bungee until it just begins to offer noticeable resistance. Enter this height (**the height of the end of the bungee above the floor**) into the data table height column. In the hanging mass column, enter zero.
   4. Add a variety of masses and measure the height of the end of the bungee for each one. Make sure that you collect data for a broad range of heights, all of the way down to where your weights touch the floor. It’s a good idea to take your measurements quickly and efficiently, and to remove the masses between measurements. Leaving them on the bungee too long may permanently stretch out the bungee.
2. Other data collection. Measure and/or record…
   1. Bungee number
   2. Ceiling height (to the floor)
   3. Jumper Data
      1. Assemble your jumper: 1 egg, 1 wooden enclosure, 1 enclosure hook. Don’t break your egg!!!
      2. Measure and record the total mass of all of the parts. Add \_\_\_\_\_\_ of mass that will be attached when you drop the jumper. Estimate the mass of the tape that you will add to secure the masses to the jumper.
      3. Measure and record the height of the jumper, from the top of the enclosure hook to the tip of the egg.
      4. Record your egg and enclosure numbers -- in case they become separated before you complete this activity.
3. Calculations and solution
   1. Use your table of hanging masses and bungee heights to create a graph of *work done stretching bungee vs. bungee height*.
   2. Prepare to add “PEgrav lost by the jumper” to the same graph
      1. Calculate the distance the jumper will fall before stretching the bungee. (Note that, if you hold the jumper as close as possible to the ceiling, the bottom of the bungee will be about 0.5cm from the ceiling)
      2. Calculate the amount of PEgrav lost by the jumper as it falls this distance, and add that point to your graph. It should correspond to the height at which your bungee begins to stretch.
      3. Calculate the amount of PEgrav that the jumper would lose at other bungee heights, and add these to your graph.
   3. Fit curves to both graphs. The solution is the height where the curves intersect. When **the end of your bungee** is at this height, PE lost by the jumper = work done on bungee. There is no KE; there is only spring energy.
   4. Now that you know the height at which the end of your bungee will come to rest, use the jumper height to determine the **height of the bottom of your egg** when the jumper comes to rest.
4. Decisions
   1. Choose a conservative and a risky height for the floor tile that will be placed below your falling jumper.
   2. Conservative Height: \_\_\_\_\_\_\_\_\_\_
   3. Risky height: \_\_\_\_\_\_\_\_\_\_
5. Preparing for the jump:
   1. Preparing the Earth’s surface.
      1. The tile that will be beneath your egg is 1cm thick. Create a stack of books or other objects below your jumper at a height 1cm lower than your conservative height.
      2. Prepare to adjust your stack of books to 1cm lower than your risky height.
      3. Get some tape to attach the extra 140g of added mass.
6. The jump: announce that you’re ready; attach the extra masses with tape; add the tile to your stack; wait for the video to begin recording; drop your egg.
7. What to turn-in (Paper or Digital)
   1. This sheet, with data entered
   2. Graph of PE lost and Work Done on Bungee vs. Bungee height

**Data:**

Distance of top of bungee from ceiling: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Bungee Number: \_\_\_\_\_\_\_\_\_ Egg Number: \_\_\_\_\_\_\_\_\_\_ Enclosure Number: \_\_\_\_\_\_\_\_\_

Jumper parts mass: \_\_\_\_\_\_\_\_\_ + 140g + estimated tape mass (\_\_\_\_\_\_\_) = total jumper mass: \_\_\_\_\_\_\_\_\_\_\_

Jumper Height (top of wooden enclosure to tip of egg): \_\_\_\_\_\_\_\_\_

**Weight and Stretch Data**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Required | | Extra columns, in case you want to use them | | | | | | | |
| Added Mass (g) | Bungee Height (cm) |  |  |  |  |  |  |  |  |
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