

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.

- 1) Assemble the weighted jumper
 - a) Get an egg and a harness (wood enclosure). Insert the egg into the harness.
 - b) Add approximately 200g of mass. Evenly distribute the mass, so that the jumper will fall straight.
 - c) Secure the jumper with a small amount of tape.
- 2) Bungee data collection
 - a) Make a table with columns; one to record hanging masses, and one to record bungee heights from the floor.
 - b) Hang your bungee from the ceiling with a paper clip.
 - c) If you tug downward on the bottom of the bungee, measure the height of the bottom end when the bungee begins to offer resistance. Enter this height into your table across from a mass of zero.
 - d) Add a variety of masses and measure the height of the bungee end for each one. It's a good idea to take your measurements as quickly as you can without sacrificing accuracy and remove the masses between measurements. Leaving them on the bungee too long may permanently stretch out the bungee.
- 3) Other data collection. Measure and record...
 - a) Ceiling height.
 - b) Jumper height (from the tip of the egg to the top of the highest point in the harness).
 - c) Jumper mass
- 4) Calculations and solution
 - a) Use your table of hanging masses and bungee heights to create a graph of *work done stretching bungee vs. bungee height*.
 - b) Prepare to add "PE_{grav} lost by the jumper" to the same graph
 - i) 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.)
 - ii) Calculate the amount of PE_{grav} 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.
 - iii) Calculate the amount of PE_{grav} that the jumper would lose at other bungee heights, and add these to your graph.
 - c) 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, only spring energy.
 - d) 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.
- 5) Decisions
 - a) Choose a conservative and a risky height for the floor tile that will be placed below your falling jumper.
 - b) Conservative Height: _____
 - c) Risky height: _____