

# Eggstreme Project

**Overview:** The goal of the Eggstreme Project is to help students see how science and experimenting can lead to knowledgeable predictions about how the world works. Students will create a bungee rope for an egg that will be dropped from over 15 feet high and create a software program to calculate the specific amount of rope needed to have the egg stop only inches from the floor. After creating a bungee rope from braiding ordinary rubber bands together, students will design their own experimental regimen to measure how the rubber band bungee responds to increasingly stronger forces. They will then create a software program that allows them to immediately calculate how much their cord will stretch given the mass of the egg and the exact jump height, which will be only be revealed on Jump Day. That day the egg will be weighed and placed at the end of their bungee cord with only a few minutes to have their software program produce the necessary calculations and for them to then make the required adjustments to their rubber band bungee before the egg takes the plunge. Its survival depends on the bungee cord and the wits of the students.

**Scope of Work:** In teams of 3, students will create their bungee rope from rubber bands. Then they will design and conduct experiments to determine how the bungee cord stretches under different amounts of force. In addition, the group will create a software program that utilizes their experimental findings combined with the knowledge of the mass of the egg and the jump height to determine how much rope is needed to have the egg safely come within inches of the floor.

## **What You Will Deliver (and how much of the grade it will count for):**

(33%) *Bungee Cord* – A cord that will safely bring the egg within 25cm of the ground.  
(within 25cm = full credit, 50cm = 2/3 credit, 75cm = 1/2 credit, more than 75cm = 1/3 credit, broken egg = 1/3 credit)

(33%) *Software Program* – Groups will produce a Excel program that will calculate the spring constant of the bungee cord and the amount of rope needed.

(33%) *Self and Peer Evaluation* – Students will evaluate themselves and their teammates with regard to their contribution and the effort they put into the project.

## **Roles:**

There are three roles available to team members. Each role corresponds to managing a certain area of the project. These roles DO NOT mean that the person in the role is responsible for completing the entire task. Rather, that person is responsible for making sure that the task gets done (that is why each role is referred to as a manager). The third role is only for groups of three.

1. **Experimental Design Manager** – This person is responsible for managing the design of the experiments. Remember, this does not mean designing it alone, just managing the design process. This may include overseeing the production of the data table.

2. **Software Development Manager** – This person is responsible for managing the production of the software program. Remember, this does not mean they build it alone, but manage the production process. This may also include overseeing the production of a user-friendly user interface.
3. **Personnel/Deadline Manager** – This person is responsible for making sure the group meets the deadlines and has a tracking system for peer evaluation.

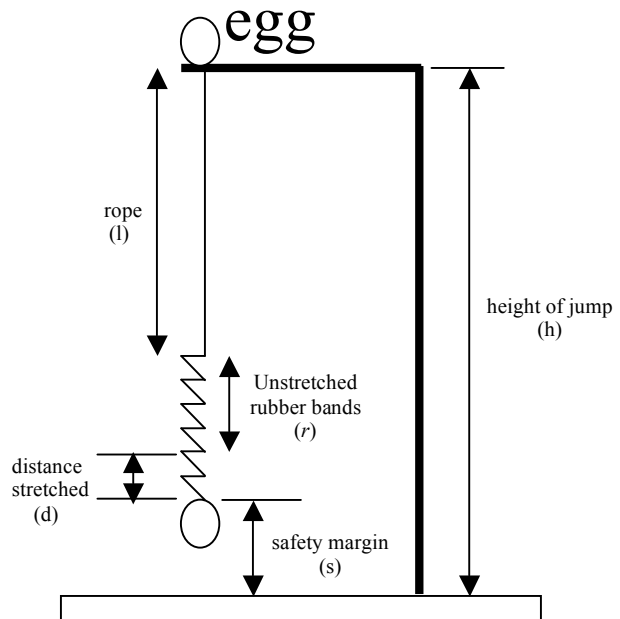
## Requirements:

### The rubber band bungee:

1. Must safely bring the egg within 10 inches (25 cm) of the floor.
2. The braided rubber bands must be between 12-30 inches (30-80 cm) long.
3. Must have a calculated spring constant  $k$  (note: the stretch of the rope part of the bungee cord is negligible).
4. Have hook up loops at both ends

### The Software Program must:

1. Include a graph of the force of the bungee cord versus the distance stretched with 10 data points over a broad range of forces.
2. Include a best-fit line for the above mentioned graph and an explanation of what the slope of this line tells us about the rubber band bungee.
3. Have input fields for the acceleration of gravity ( $g$ ), the mass of the egg ( $m$ ), the unstretched length of your rubber band bungee ( $r$ ), spring constant of your bungee cord ( $k$ ), your safety margin ( $s$ ), and the height of the jump ( $h$ ).
4. Calculate and display the gravitational potential energy ( $E_g$ ) of the egg before it jumps.
5. Calculate and display the elastic potential energy ( $E_{\text{elastic}}$ ) of the fully stretched rubber band bungee cord.
6. Calculate and display how much your bungee cord will stretch ( $d$ ).
7. With the above-mentioned inputted and calculated information, it must calculate and display the length of rope ( $l$ ) needed to have the egg safely jump within 25cm of the floor.



### The Self and Peer Evaluation must:

1. Be fair and based on performance.
2. Divide up a total of 30 points per team between the 3 or 4 group members.