

## Lab 6: There's no such thing as a free launch (Part 1)

You decide to quit this whole school thing and work for a circus. Because of your extensive background in the physics lab, the head clown asks you to design an event called “The Human Cannon.” One of the clowns will be placed inside a cannon and launched from high up, landing in a small swimming pool on the ground. However, you will not be able to actually test the cannon once it is assembled. You must be able to predict where the clown will land using measurements performed in the laboratory, and using the physics you know.



Your first step is to design and test a system that will launch a marble from a table. You must be able to predict roughly where the marble will land based on measurements made on the floor or on the table. *You may not launch the marble through the air.*

### Question:

Where will the marble land?

*How did you determine where it would land? (This is the most vital part of the lab, coming up with a reliable method of *determining* the spot.)*

<b>I. Introduction</b>	<b>10 min</b>	<b>Whole class</b>
<b>II. Brainstorm and plan</b>	<b>15 min</b>	<b>Groups of 4</b>
<b>III. Carry out the measurements and analysis</b>	<b>80 min</b>	<b>Groups of 4</b>

Write the lab report as you go.

<b>IV. Evaluate your prediction</b>	<b>15 min</b>	<b>Groups of 4</b>
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Next week, you will use your work from this week to design a game – don't submit a lab report today.

### Excel Hint: More Error Bars

When you graph your data, it is possible to make error bars in both the x- and y-directions. This may be useful for determining a possible “target space” for where you think the marble will land.

#### MAJOR GOALS:

- *Determine the uncertainty in a calculated result based on the uncertainty in experimental data.*
- *Identify the kind of uncertainty that can be minimized with experimental design or technique, and minimize it.*
- *Improve your visual representations for comparing data sets.*