Science and Engineering Practice: ***Analyzing and Interpreting Data*** **Group Members:**

Objective:

Build a safe-drop capsule to protect your precious egg. You will have to test, observe and record data for multiple trials before you test the egg.

Physics Connection:

You will drop your capsule from a height of 3 feet, or 0.902 meters. From that height gravity will accelerate your capsule for 0.429 seconds. That will result in an impact velocity of 4.21 m/s or 15.1 km/h. Doesn't seem like much, but an impact of a vehicle at 15 km/h can cause thousands of dollars' worth of damages!

Remember, it is not the speed that will break the egg, it is the acceleration and hence the ***forces*** upon impact. You must reduce the acceleration as much as possible! But it is not just one force, we exist as three dimensional objects so we will measure accelerations in all three dimensions.

Procedure:

Each design should be tested in an experimental run to collect data and see if you are matching your design goals.

- Brainstorm with you lap group on some different design ideas, draw a rough sketch, and explain how each design works using the terms force, mass, acceleration, velocity and time.
- Each material you use costs $100. Try to make the most cost efficient capsule!

Run 1

Run 1 Sketch(s)

Mass of Capsule for Run 1: _____ Materials Cost for Run 1: $_____

Run 1 Trials	**Trial 1**	**Trial 2**	**Trial 3**	**Trial 4**	**Trial 5**	**Average Acceleration**	**Range**
Max acceleration X (m/s^2)							
Max acceleration Y (m/s^2)							
Max acceleration Z (m/s^2)							
Run 1 Observations							

Run 2

Run 2 Sketch(s), point out design changes from Run 1.

Mass of Capsule for Run 2: _____ Materials Cost for Run 2: $_____ Total Development Cost: $_____

Run 2 Trials	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Average Acceleration	Range
Max acceleration X (m/s^2)							
Max acceleration Y (m/s^2)							
Max acceleration Z (m/s^2)							

Run 2 Observations

Run 3

Run 3 Sketch(s), point out design changes from Run 2.

Mass of Capsule for Run 3: _____ Materials Cost for Run 3: $_____ Total Development Cost: $_____

Run 3 Trials	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Average Acceleration	Range
Max acceleration X (m/s^2)							
Max acceleration Y (m/s^2)							
Max acceleration Z (m/s^2)							

Run 3 Observations

Run 4

Run 4 Sketch(s), point out design changes from Run 3.

Mass of Capsule for Run 4: _____ Materials Cost for Run 4: $_____ Total Development Cost: $_____

Run 4 Trials	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Average Acceleration	Range
Max acceleration X (m/s^2)							
Max acceleration Y (m/s^2)							
Max acceleration Z (m/s^2)							
Run 4 Observations							

Did the egg break? _____ Total Capsule Cost: $_____ Total Development Cost: $_____

Follow up questions

1. Were you able to get better data by refining your design? Was it easy or hard?

2. How did the slow motion videos help?