Name: _____ Date: _____ Hour: _____

Egg Drop Project

Background: The prospect of driving can be an exciting time, after all you get to take into account all of the wonderful physics applications that you have learned. As you think more about topics like velocity, acceleration, braking, momentum and impulse (all terms that relate to a collision) you soon realize driving can be a scary thing, especially if you were to get into a car accident. In a collision, the impulse that is the most threatening to drivers and passengers is called the second collision.

The second collision occurs when an individual hits an object like the steering wheel, windshield, tree, or any other rigid object. To bring a moving object, such as a passenger thrown from a car, to rest, an impulse is required to reduce the momentum to zero. Since impulse is the product of F · t (Force multiplied by time), when a person collides with a fixed object, the duration of time is very small and the force is very large. This causes damage and severe personal injury.

To protect passengers in moving vehicles, engineers try to "cushion" the blow. That is, a cushioning effect increases the duration of time during which the force is applied, to reduce the momentum. Since the same impulse is required, increasing the time of impact reduces the force of the impact. Many technologies have been developed to cushion the impact of the second collision, including seat belts, padded dashboards, crumple zones in the car, and air bags to name a few.

Problem: The problem is to ensure that your cargo, a raw egg, survives a fall from a specified drop. While the egg falls in a vertical fashion, there is still a collision with the ground and momentum and impulse are both at play. The egg in this scenario is not so different from a person involved in a car crash. It is up to you to design a container to protect your egg!

Materials: I will provide the following materials: straws, tape, toothpicks, paper, cotton balls, rubber bands, paper bags, and a folder. You may want to bring in additional materials but carefully read through the following list of rules:

Rules: -All eggs will be dropped from the same height!
-No balloons or parachutes are allowed!
-The container must have a mass of no more than 50 grams (excluding the egg).
-I will supply the eggs. Your group gets 1 egg!
-Your egg project must fit on a regular size sheet of paper (8 ½ x 11) and be no taller than 1 foot.
-You may not use nerf balls, pillows, or stuffed animals to protect your egg.
-Some class time will be allotted to work on the container but you may find that more time is needed and you might have to work on it at home.
-A project may not be touched by anyone other than its owner(s). Please have your name and class period written on it.

-The container must be able to be opened once we return to the classroom so that we may check on the condition of the egg. The inside materials must be designed to allow raw egg to be easily inserted and removed.
-Containers must be constructed prior to the school day of testing.
-Success is considered a drop where the egg is still intact. If more than one group achieve this, the group with the lightest container is deemed the winner.

Identify The Problem: Identify the problem and information you need to understand the problem.

Hypothesis: Form a hypothesis based on how you will fix the problem presented in this project. (IF I DO THIS THEN THIS WILL HAPPEN)

Drawings: Sketch a side view and a top view of your container and label all materials that you will need for your container in your drawings.

Side View

Top View

Initial Questions:

What are Newton's 3 laws of motion?

1._____

_____

2._____

_____

3._____

_____

What are variables? What is a dependent and independent variable?

Draw a free-body diagram of the egg container as it falls.

What is momentum? How can it be changed?

What is an impulse? What role does it play in collisions?

What would be the primary and secondary collisions in the egg drop scenario?
Primary collision:

Secondary collision:

Measurements and Calculations:

1. Mass of the finished project in grams (maximum weight of 50 grams allowed) _____
2. Convert the mass from grams to kilograms _____
3. Mass of the egg in grams _____
4. Convert the mass of the egg from grams to kilograms _____
5. Mass of the egg and the project in kilograms _____

   This total mass will be used to determine Force and Momentum in the chart below

6. You will record data on the graph below for the various heights that the egg/project successfully completed.

TEST	DISTANCE TO GROUND (m)	TIME TO HIT GROUND (s)	VELOCITY V=D/T (m/s)	ACCELERATION $A=V_F-V_I/T$ (m/s^2)	FORCE F=ma (N)	MOMENTUM P=mv (kg*m/s)
1						
Other						
Groups						
1						
2						

Reflection Questions:

1. Was your hypothesis correct? Did you correctly state a hypothesis that was true after you dropped your egg?

2. Was your egg container successful? If so why? If not, why not?

3. How did you try to control the forces that could cause your egg to break?

4. What could you have done to make your container more successful?

5. After watching the egg drops, who had the best design? What was different about their design compared to yours?

6. What do you think the overall purpose of this project was?

7. How does the egg drop project relate to real life situations?

8. State one new thing you learned from this project.

9. What things did you like about the project? What changes would you make to the project?