Egg Drop Project

Grade 7

GRADE 7 REGULATIONS AND MATERIALS

Hold an egg at ceiling's height. Drop it. What happens? Can you design a container that will prevent the egg from breaking or cracking? That's not really so hard if you think about what you will use inside the container to cushion the egg's fall.

That is the focus of the experiment, and that will be the fun part – a really "eggscellent" activity! Before you begin designing your project, however, you should review the materials provided so that you get a good idea of the science involved in the experiment. Read over all of the information provided in this packet before you start so you don't "crack" under pressure. The more knowledge you have about the science behind the experiment, the better your results will be. I am sure that we will see some very "eggstravagant" projects, and have lots of fun in the process.

INTRODUCTION

Gravity is a powerful force that has a fundamental impact on the way we live our lives. Even walking, which we take for granted, is not possible without gravity. Gravity provides the necessary downward force on our bodies which creates friction between our feet and the ground, allowing us to walk (push our body weight forward with one leg and then the other).

When astronauts tried to walk on the moon, they found it extremely difficult, as the gravity on the moon is approximately one sixth of what it is here on earth. When we jump into the air, even though it is only for a second or two, we can be said to be momentarily overcoming the force of gravity. Engineers have designed many ways to overcome the effects of gravity. For instance, in a Dodge Truck commercial, a truck is dropped to the ground from a height of perhaps three feet. The truck should be damaged by this fall, but the truck is equipped with shock absorbers and springs. The shock absorbers and springs of the truck dissipate the kinetic energy of the truck falling, compressing them almost to the point where the bottom of the truck hits the ground. The truck, because of the shocks and springs, finally returns to its designed position, with the bottom of the truck a foot or so off the ground.

When other forces are combined with gravity, such as motion (the movement of an object), inertia (the tendency of an object to resist change with regard to movement based on its mass), or power (the ability to exert energy over time), it may be impossible to prevent an impact which will cause damage.

For instance, if you roll an egg along the ground downhill at considerable velocity towards a wall, you can reasonably expect the egg to break. Your arm provided the force (power) to accelerate the egg to a certain velocity (motion). That motion is being increased due to the acceleration of the egg down the hill (gravity). The egg will not

drastically vary its direction and avoid the wall (inertia tends to keep it moving in a straight line). The combination of power, gravity, motion and inertia will probably be sufficient to result in an impact between the egg and the wall that breaks the egg. This impact is called the primary impact.

There is a further impact which takes place when the egg hits the wall; this is when the mass inside the egg impacts against the inside of the wall of the egg. The egg white and egg yolk are usually in liquid form, and though liquid has considerable mass, the liquid inside the egg will rarely be the cause of the egg shell breaking. If you put a steel ball bearing into a plastic egg, and then shake the egg, you can hear the impact of the ball bearing hitting the inside of the egg, and it is easy to imagine the egg cracking because of the steel ball bearing. The impact resulting from the ball bearing striking the inside of the plastic egg due to the motion or change in motion of the egg is called the secondary impact.

Scientists and engineers have been working for many years to reduce the effect of impacts, primarily in the automobile industry. Efforts to reduce the primary impact (energy absorbing bumpers, crumple zones, modified chassis construction) and efforts to reduce the secondary impact (airbags, padded dashboards, collapsing steering wheels, and seatbelts) are commonplace.

OBJECTIVE

The objective of the project is to successfully drop a package which contains 1 raw egg from a predetermined height without breaking the egg.

This is a group project to be constructed at school and at home. You are to design something that is the **LIGHTEST** possible weight following the constraints listed below. The project must be durable enough to protect the egg as it is dropped off a predetermined height to that the egg does not break from the fall. Think of the egg as a passenger in a car going through a crash test.

RESEARCH REQUIRED

You may decide the amount and form of research that you do prior to the experiment. You may want to research aspects of this project that you personally find interesting. Learning mathematical formulas to calculate the force of an impact, researching the impact absorbing capability of different materials, identifying the most stable geometric structures, or even studying the basic egg are all research opportunities related to this project.

Kinetic energy is the energy that a body possesses as a result of its motion. Potential energy is the energy that exists in a body as a result of its position or condition rather than of its motion.

In building the container, you should think about how the energy is converted from potential energy to kinetic energy, and the work done on the container and the work done on the eggs.

PROJECT DESCRIPTION

You might want to research the latest discoveries on how best to dissipate force. You should then decide on the concept you want to employ, and begin the design process.

Once the prototype egg container has been designed, you should sketch the design, including labels, and create a list of materials required for the construction of your design. This Materials List should be submitted to Mrs. P. prior to construction. If the materials fall within the established criteria (see Design Constraints), you may begin to construct your container.

CONSTRAINTS/RULES/GUIDELINES

1. Your egg project must fit on a regular size (8 ½ x 11) sheet of paper. (Note that the height of the container is not a factor – it can be "tall" and still fit on the paper)
2. Only raw, store bought chicken eggs - size large - may be used. Your design must not include changing the eggs in any way (no tape on the eggs, no nail polish on the eggs, no soaking the eggs in vinegar, no hollow eggs...). You must supply the eggs for the project.
3. No glass of any kind may be used in the design, for obvious reasons.
4. The egg container and all materials must remain intact. For example, no parts – inside or out - can fall or break off during flight or impact.
5. 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 the egg to be easily inserted and removed.
6. Design materials should be readily available, as you must provide what is used in your group's construction.
7. The containers will be dropped from a predetermined height.
8. Containers must be constructed prior to the school day of testing.
9. Label your container with your name – you may also assign a name to the project itself. Be creative – example: "The Eggs-terminator" (certificates will be given for the most creative name, most creative project design, etc.)
10. Once a project is in school it may not be touched by anyone other than its owners, Mr. Grant or Mr. Walters.
11. You may bring your project in early to have it weighed (without the egg) if you are considering weight as a factor in winning the competition. If you feel it is too heavy, you may take it home and make the necessary adjustments, as long as no substitutions in materials are made without Mr. Grant's "okay". Remember – if there is a "tie", the project that weighs the least (without the egg) will be named the winner!

Detailed explanations will be required on the day of the drop – you will need to write a "lab report" detailing the process of constructing your container. It might be a good

idea to keep a "journal" as you go so that writing your report is easier in the end. Include some of the following suggestions in your report:

- What materials did you want to use but couldn't? Why couldn't you use these materials? (not available, not feasible, etc.)
- What materials did you feel absolutely had to stay in your design and why?
- If you tested your container, what problems did you find with the outside construction or the materials inside the container?
- Read over the post-experiment analysis questions in this packet and include answers to any of those questions you can in your report. This will make the report very complete and concise.
- Include any research you came across that would support your idea for a successful design. In other words, tell us why you chose the materials/design you used, backing it up with research you found.

THINGS TO CONSIDER

Do keep in mind that your egg-protection device will be dropped from a significant height. Mr. Grant or Mr. Walters will be dropping them.

CONSTRUCTION AND TESTING

You will construct your impact-absorbing container according to the designs you submitted to Mr. Grant. Should you discover flaws in your design during your construction or test phase, you should go back to the drawing board and resubmit a new design or a design modification.

COMPETITION

The competition determines whose method enables the egg to survive a drop. All packages will be dropped from the same height. In the event there is more than one successful drop, winners will be based on the lightest weight package.

Egg Drop Project

PRE EXPERIMENT ACTIVITIES

1. Research
2. Decide on concept and design
3. Sketch design with labels
4. List of materials required
5. Submit list to Mr. Grant or Mr. Walters for approval
6. After approval, build your container
7. Lab Report

Lab Report: POST-EXPERIMENT ANALYSIS

In your report, answer these questions:

1. What are the forces acting on the egg as it falls?
2. How can you control the forces that cause the egg to break?
3. Was it the material, the amount of it, or its compression factor that was the key?
4. What are the common characteristics of the materials that protected some eggs?
5. Did layering of materials play a role in protection?
6. What about your design made the egg break? Not break?
7. How would you design your container differently next time?