# Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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# http://rds.yahoo.com/S=96062883/K=egg+drop+project/v=2/SID=w/l=IVI/SIG=13onpedqb/EXP=1107814820/*-http%3A//www.seattleschools.org/schools/JohnStanfordIntlSchool/announcements/2003-4/images/Eggdrop.gifPhysics Egg Drop Project

## Summary

In this project, you will build a container which can house one egg as it falls from multiple heights up to the second floor of the gym. In building the container, you should think about what effect **momentum and impulse** have on the container and on the egg.

In your design, you should choose *one variable (impact time)* and test the results of this variable on your container. Your design must not include changing the egg in any way (no tape on the egg, no nail polish on the egg, no cooking…I will provide the final egg!). Some materials you may choose are poster board, cardboard, cotton, diapers, tape, glue, socks, toilet paper, straws, Shish-kebab skewers, tape, string etc.

You will write a lab and produce a final product to describe your work. In this project, you should be trying to apply some of the knowledge about motion that you have learned so far in this course. Then, these topics should be applied to momentum and building and testing an egg crate. The goal of the project is to increase the time of impact for the egg by creating a case. If the time of impact is increased then the force of impact has to decrease. Hopefully, the force of impact will be small enough to avoid breaking the egg!

### Objectives

Students will apply the principles of momentum and impulse to build housing for an egg so that it will survive being dropped from the maximum height possible. In doing so, you should be able to:

1. Explain how momentum and impulse affect a dropped object.
2. Solve for momentum and impact force.
3. Evaluate how the impact time affects the force with which an object hits another surface as the momentum moves to zero.

**Assignment**

**Part I- Pre-lab:** Complete this in your lab in the packet (includes title, problem/question, hypothesis, materials, and procedure)

**Part II- Lab:** Follow the procedure to complete the lab. Be sure to record your data in order to complete the post-lab.

**Part III- Post-Lab:** Use the data to complete the analysis (calculating the momentum and impact force). Then write a conclusion (written explanation for lab and results) and discussion (what to do in the future).

**Part IV- Lab Report:** Type the information recorded (all pre-lab and post-lab work) to be submitted as a formal lab report, guidelines below

**Due Date(s): February 18th, the drop is Feb 19th**

Your final submission will be the typed version of all you complete in your lab document. The only things that does not have to be computer generated are the calculations for momentum and force; however, the tables for recording data must be generated in Microsoft Word, or Google docs.

1. Pre-lab due - **To be done in class**

2. Final Lab Report- To be done in class- **Finished Feb 24th**

**Checklist**

|  |  |
| --- | --- |
| **Statement** | **Completed** |
| My pre-lab includes the title, problem/question, hypothesis, materials, and procedure) |  |
| I have recorded all data for the lab in charts (including the times for each drop) |  |
| I have calculated the final velocity of each object from each height |  |
| I have calculated the **momentum and impact force** for the highest height my egg survived |  |
| I have answered **ALL** of the questions to complete my **conclusion** in paragraph form |  |
| I have answered **ALL** of the questions to complete the **discussion** in paragraph form |  |
| I have cited my work using in text citations for ideas that are not my own and included a works cited page. |  |
| I have typed the final lab report following the format provided |  |

**The Egg Drop Contest:**

1. There will be several drops from various heights. Your egg must survive lower heights to progress to the highest! We will try a few smaller heights before the drop from the second floor of the gym. Only those who survive (not leaking) the smaller drops may proceed to the higher levels.

*\* A cracked egg is defined as one that is visibly leaking its contents (did not survive). Hairline fractures are not considered cracks and may go on to a higher level.*

1. After each drop, you must be able to quickly open the container to show your egg. **Grade will drop if not able to open quickly!**
2. Container must be constructed with a hatch or a door so that the egg can be inserted or withdrawn quickly. The contestant will be required to remove the egg from the container to show judges that it did not break.

|  |
| --- |
| **The Rules:** 1. The main **egg compartment cannot be bigger than 15 x 15 x 15 cm**. All parts MUST fit within **35 x 35 x 35 cm**. Your device will be measured before dropping.
2. The container can be of any design, but may NOT include ready-made *packaging* materials (bubble wrap, styrofoam, peanuts, coffee grounds, etc.)
3. The total empty device may have a mass **no greater than 500 grams**.
4. A raw large egg will be provided.
5. The container must free-fall (no parachutes, nor helium balloons). Wings are allowed, but device should descend straight down, not to the side.

**Point Breakdown** * **5 Points – Pre Lab**
* **10 Points – Constraints (materials, dimensions, mass)**
* **25 Points – Egg Drop**
* **20 Points – Lab Report**
* **Total = 60 Points**
 |
|  |
|  |

Points for Egg drop

* 0 Points – Egg is shattered into multiple pieces
* 1 Points – Egg is broken, yolk oozing out, but only in 1-2 pieces
* 2 Points – Egg is cracked throughout, yolk is oozing out.
* 3 Points – Egg is cracked throughout, no yolk is oozing out.
* 4 Points – Hairline Crack in egg
* 10 Points – No Cracks in egg! Yay!

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Physics **Formal Lab Report Rubric- Egg Drop** PROJECT

Science Process Rubric: \_\_\_\_/

|  |  |  |
| --- | --- | --- |
| **Categories (5 pts each)** | **Yes** | **No** |
| **Problem/ Experimental Question / Purpose:**  A concise (1 sentence) description/question of the experiment. Includes proper terminology and addresses the correct problem. |  |  |
| **Materials:** A comprehensive list of all materials used in the laboratory experiment, so detailed that a stranger could easily replicate your experiment.  |  |  |
| **Hypothesis** - Correctly stated as an if/then statement. Includes an identification of the independent and dependent variables, control group, and at least two controls.  |  |  |
| **Data/Results:** Includes a table that correctly accounts for all observations and measurements in the correct format.  |  |  |
| **Formatting:** Paper correctly includes all of the guidelines: correct cover page, section headings, double-spaced, Times New Roman, Pt. 12 font |  |  |

**Pre and Post Lab**

**Pre-lab**

Complete the following pre-lab work below. This must be completed in order to participate in the lab!

**The Egg Drop Lab**

**Problem/ Question**

As the momentum moves to zero, how does the impact time affect the force with which an object hits another surface as the momentum moves to zero?

**Hypothesis**

You will need to write a hypothesis which addresses the question below as an “If…then…” statement

“As the momentum moves to zero, how does the impact time affect the force with which an object hits another surface as the momentum moves to zero?”

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**Materials**

1. stopwatch
2. meter stick
3. large egg

 LIST ALL the MATERIALS REQUIRED TO MAKE the CONTAINER

**Procedure**

What is the independent variable? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is the dependent variable? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What are the controls? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Describe how you built your container- VERY DETAILED

1.

2.

3.

Draw a labeled picture of your container OR include an actual labeled photograph

|  |
| --- |
|  |

**END OF PRE-LAB WORK**

**Recording Results**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Mass of container (g) | Mass of container (kg) | Mass of egg (g) | Mass of egg (kg) | **Mass of container and egg (kg)** |
|  |  |  |  |  |

|  |  |  |
| --- | --- | --- |
| **Distance (m)** | **Time (s)** | **Did the Egg Break?** |
| 1 |  |  |
| 3 |  |  |
| 10 |  |  |

**Post-lab**

**Analysis: Analyze Results**

For **each drop**, you must calculate the final velocity (vf). Use the free fall equations to solve using the data collected from the lab. **Be sure to show your work!**

**vf = vo + gt**

|  |  |  |
| --- | --- | --- |
| **Highest Distance that the egg survived (m)** | **Time (s)** | **Final velocity (vf)** |
|  |  |  |

**Solving for Momentum (p = mv)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Highest Distance that the egg survived (m)** | **Mass of the container and egg (kg)** | **Final velocity (m/s)** | **Momentum (kg m/s)** |
|  |  |  |  |

**Solving for Force (Impulse = Ft)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Highest Distance that the egg survived (m)** | **Force (N)****(F = w= mg)** | **Time (s)** | **Impulse (Ns)** |
|  |  |  |  |

**Conclusion**

1. Section 1: An introduction of the lab
	1. What was the purpose of the lab?
		1. Physics concepts learned (these should be the concepts discussed in the body paragraphs)
	2. How was the lab completed?
	3. What was the hypothesis?
	4. What was the independent and dependent variables? What were the controls?
	5. How was the container built in order to manipulate the independent variable?
	6. What was the highest height that the egg survived?
2. Section 2- Momentum and Impulse
	1. What is momentum?
		1. What data was collected in order to solve for momentum from the highest height from which your egg survived?
		2. What was the momentum of the container as it hit the ground?
	2. What is impulse? How did you determine it?
		1. What data was collected in order to solve for impulse from the highest height from which your egg survived?
		2. What was the impulse of the container as it hit the ground?
	3. Why are the momentum and Impulse the same? **WHY?**
	4. Describe whether the impact time must be (greater/less than) the impact force from the highest height that the egg survived or not.
		1. Consider impulse and the relationship between impact force and time.
3. Section 3 - Concusion:
	1. What was the highest height(s) that the egg survived?
	2. Was the container effective? **WHY or WHY NOT?**
		1. BE SPECIFIC about time, force, momentum and impulse!!!!
	3. What errors may have been made in the lab?
	4. Why should the hypotheses be accepted or rejected
		1. Be sure to confirm with the data
		2. Discuss how impact time affects whether the egg breaks or not

**Discussion**

1. How could the container be modified to improve results in the future?