

# **Mrs. Hutchins-Trapp's 7<sup>th</sup> Grade Honors Science**

## **Elite Scholars Academy Middle School**

### **Introducing a STEM lab with the following objectives:**

- 1. To research and understand sports related head injuries such as concussions, Chronic Traumatic Encephalopathy (CTE) and Traumatic Brain Injury and apply these injuries to Newton's 3<sup>rd</sup> law dealing with the conservation of momentum and collisions.**
- 2. To apply the research found to an egg drop experiment. Students will design and engineer a safety transporting device that allows a raw egg to drop from approximately 15 meters without cracking.**
- 3. To calculate the speed and force at which the egg dropped to the ground within the safety transporting device.**
- 4. To apply the understanding of Newton's Laws in this activity and identify how the information you learned in the egg drop activity can be applied to future sports helmet engineers working toward preventing athlete head injuries.**

**Name:** \_\_\_\_\_

**Team Members:** \_\_\_\_\_

**I started this STEM lab on: May 18<sup>th</sup>-19<sup>th</sup>, 2017**

**The due date of this STEM lab is: May 30<sup>th</sup>, 2017**

Name \_\_\_\_\_ Period \_\_\_\_\_ Date \_\_\_\_\_

### Sports-Related Head Injuries

Directions: Circle the sports-related injury from the list below that you will conduct research on.

1. Concussions
2. Chronic Traumatic Encephalopathy (CTE)
3. Traumatic Brain Injury

**Record notes for the selected sports-related head injury in each category. Identify your sources.**

<b>Definition</b>	<b>Symptoms and Diagnostic Test</b>
<b>Causes</b>	<b>Prevention</b>

**Interesting Facts:**

**Research a helmet from a specific sport**

I choose to research the helmet for the sport of \_\_\_\_\_.

Sketch a picture of the helmet	Identify the safety features of this helmet	Explain how this design reduces injury

**Sources you may want to use:**

- **Head Injuries Websites**  
Sports-Related Head Injuries:
  - <http://www.aans.org/Patient%20Information/Conditions%20and%20Treatments/Sports-Related%20Head%20Injury.aspx>
  
- **Concussions:**
  - <http://www.cdc.gov/concussion/sports/>
  - [http://www.cdc.gov/concussion/HeadsUp/sports\\_specific.html](http://www.cdc.gov/concussion/HeadsUp/sports_specific.html)
  - <http://www.concussiontreatment.com/concussionfacts.html>
  
- **Chronic Traumatic Encephalopathy (CTE):**
  - <http://www.bu.edu/cste/about/what-is-cte/>
  - [http://www.ninds.nih.gov/news\\_and\\_events/proceedings/201212\\_CTE\\_workshop\\_report.htm](http://www.ninds.nih.gov/news_and_events/proceedings/201212_CTE_workshop_report.htm)
  
- **Traumatic Brain Injury:**
  - <http://www.cdc.gov/traumaticbraininjury/>
  - <http://www.mayoclinic.com/health/traumatic-brain-injury/DS00552>

**The sources I used were:**

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_



## Procedure:

- Using the research from your sports related head injuries, discuss with your team the materials you would want to use to construct your egg safety device.
- Before the design process you and your partners must decide on what materials you will be using for this experiment. (Once you specify your materials you cannot change them)  
**REMEMBER: YOUR TEAM IS RESPONSIBLE FOR BRINGING IN ALL MATERIALS!**
- Each team member must FIRST sketch their own design for their egg safety device.
- Once each member of the team is finished designing their safety device you will meet and decide on which design(s) you will use as a team.
- Once the prototype egg container has been sketched/designed as team, please see Mrs. Hutchins-Trapp to move on. **MAKE SURE ALL MATERIALS ARE LABELED ON THIS SKETCH** This materials List should be submitted to Mrs. Hutchins-Trapp prior to construction. If the materials fall within the established criteria (see Design Constraints), you may begin to construct your container.
- Construct your safety device.
- After you construct your device, you should sketch the final design, including labels.

## ***Constraints/Rules/Guidelines:***

- 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)
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- No glass or liquids of any kind may be used in the design, for obvious reasons.
- 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.
- The containers will be dropped from the top of the stairwell (approximately 15 meters down)
- Label your container with your team name – be creative!
- All eggs must first survive the trip in a box to the stairwell. Any egg that does not survive will be disqualified from the competition.
- You must weigh your safety device (without the eggs) prior to the egg drop. Remember, force and mass are directly related!

**Data and Observations:**

<b>During:</b>	
How much time did it take from when the safety device was released to when it hit the ground?	
How did it fall?	
Sound of impact	
What occurred at impact?	

<b>Before:</b>	
Length of device	
Width	
Height	
Mass	
Distance that the object will fall	

<b>After:</b>	
Describe the condition of the device.	

Describe the condition of the egg.	
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Calculate the Force in which the device hits the floor.

Calculate the Speed in which your device fell to the floor.

**Analysis**

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. What about your design made the egg break? Not break?
6. How would you design your container differently next time?

**Conclusion**

- Identify the purpose of this lab
- Identify your hypothesis and explain whether it was correct or incorrect. (Use information from your data and observations to explain why your egg broke or did not break)
- Explain how this lab relates to EACH of Newton's three laws.
- Identify what you would have done differently if you got to construct a new safety device.
- How could the information you learned in this activity apply to future sports helmet engineers working toward preventing head injuries?

Rough Draft Conclusion:

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## Engineering and Design

**Team Members:**

**Team Name:**

**Period:**

Decide as a group what materials you want to use. Remember: You CANNOT change the materials once you specify them as a group!

**Materials:**

**YOUR (individual) sketch using the above materials. Label all parts.**

**As a group decide which sketch or parts of different sketches you want to use. Draw and label parts of your TEAM design. Label all parts.**

**Sketch and label the FINAL design of your egg transporting safety device.**

