EGG DROP

Prevent a dropped egg from cracking up!

Curriculum topics:

- Motion & Forces
- Energy Transfer
- Design Challenges
- Properties of Materials
- Brainstorming
- Problem-Solving
- Creativity

Subject:

Physical Science
Engineering

Grade range: 4 – 12

Students build a “vehicle” designed to prevent a dropped egg from breaking. In the process, they discover that combining simple materials with a little creative thinking and teamwork will reveal many ways to solve this intriguing challenge!

Who we are:

Resource Area for Teaching (RAFT) helps educators transform the learning experience by inspiring joy through hands-on learning.

For more ideas visit
https://raft.net

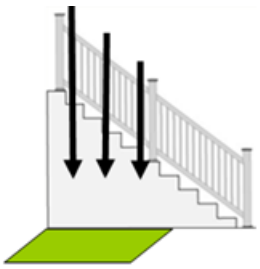
Materials required per student

- Plastic egg, standard size (x1)
- Cellophane sheet or equivalent, 2’ x 2’ (x1)
- Re-sealable bags, 3” x 5” (x3)
- Fabric/cloth pieces, 8” x 8” (x2)
- Hanging file folder hangers (x6)
- File folder (x1)
- Straws, 8” (x6)
- Craft sticks, jumbo (x6)
- Chenille stems (pipe cleaners) (x6)
- Folder labels or equivalent (x12)
- Double stick tape
- Thread or string
- Streamer or cloth, 4” x 6’ (x1)
- Balloon, 5” (x1)
- Foam, any (x4)
- Optional: Raw eggs, rulers, staplers, plastic bag or tarp (not included)

WARNING: CHOKING HAZARD – Children under 8 yrs. Can choke or suffocate on uninflated or broken balloons. Adult supervision required.

Set-Up

Create a “drop zone” with plastic bag or tarp for easier clean-up



1. Set up the test zone prior to the activity. It can be as simple as a stepstool or a stairwell. A test zone with several intermediate drop heights is ideal. Students will feel more successful if they can test their device from a low height first, and then gradually increase the height until the egg breaks.

2. Set up the workspace in advance. Students will need plenty of room to spread out their materials and share ideas with their design team.

Introduce the design challenge

Before you dive into the challenge, help students see how protecting an egg relates to real-world challenges faced by engineers who design things like bike helmets and Mars landers. Get the students to brainstorm other things that absorb impact (car bumpers, air bags, foam balls, football pads, etc.).

For students who need an extra challenge, add a few of your own unusual materials to the mix, like feathers or silk flowers. Consider including obvious cushioning materials like foam cups or cotton.

To do and notice

1. **Share the challenge and the constraints:** Express the challenge very simply: “Your team needs to drop an egg from X feet onto a hard floor without breaking it.” For younger students, “breaking” can be defined as creating a hole in the shell. For older students, a hairline crack can count as a break. Express the constraints very simply: “You can only use the materials I supply.”

2. **Reveal the materials:** The students are intrigued by the challenge and understand what their device needs to do. Show them what they must work with. This will surprise them! Distribute the materials equally so that teams start with similar types and amounts of material.

Content Standards:

NGSS

Gravity:
5-PS2-1

Definitions and Transfer of Energy:
HS-PS3-3

Forces and Motion:
3-PS2-1
3-PS2-2
MS-PS2-2
HS-PS2-1

Minimize Forces on Objects During Collisions:
HS-PS2-3

Comparing Multiple Solutions (Engineering):
3-5-ETS1-2
MS-ETS1-2
MS-ETS1-4

Design Criteria and Test Variables (Engineering):
3-5-ETS1-3
HS-ETS1-3

3 **Define success:** Provide students with illustrations (right) or examples of a pass or a no pass egg.

Facilitate the engineering process:
Phase 1 – Design: Brainstorm designs.
Phase 2 – Build: Make a quick prototype.
Phase 3 – Test: Test prototype.
Phase 4 – Refine: Modify design based on test results.

Set a short time frame for the first cycle. Each team repeats Phases 1-4 with a new or refined concept. Guide them without giving detailed instructions – no hints on how to do it.

4 **Show and Tell:** After students optimize their devices, gather teams together at the drop zone, give teams their eggs and have them describe their device and then demonstrate it for all to see. Students should "sell" the best features of their design. Celebrate examples of creative thinking and "spectacular failures" (great ideas that did not work).

5 **Reflect:** Students talk about the process. How long did they spend brainstorming? How did they react when their first prototype failed? This is the most important phase of the learning experience!

The content behind the activity

An egg raised above the ground has potential energy due to the force of gravity. When dropped, the egg's **potential energy** is converted into **kinetic energy** of motion. On landing, the egg must come to a stop without experiencing a **stress** (force / unit of area) strong enough to break the shell.

Learn more

- Add other constraints such as limits on the weight or amount or type of materials used.
- Encourage innovation by awarding prizes for the longest drop, the most successful drops with the same egg, the lightest vehicle, etc.
- Replace eggs with water balloons for a fun activity to do outside

Visit https://raft.net to view the following related activities!

Leonardo's Arched Bridge
Car on a Roll
Retractor a Go-Go Car
Rollback Can
Staple Remover Catapult

Resources

- Various egg drop designs - https://bit.ly/2BiZIhD
- Egg drop from PBS Kids - https://bit.ly/2Fu2LYv