

## Cost Effective Egg Drop

### **Grade Levels Targeted: 5-8**

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This activity can be extended to higher grades by having students develop packaging for different fragile objects; can be used in lower grades by eliminating the cost detail of the exercise.

### **Educational Standards:**

National Science Standards: Content Standard A, Science as Inquiry: all students should develop abilities necessary to do scientific inquiry and understandings about scientific inquiry.

National Science Standards: Content Standard B, Physical Science: all students should develop an understanding of properties and changes of properties in matter, transfer of energy, motions and forces.

National Science Standards: Content Standard E, Science and Technology: all students should develop abilities of technological design and understandings about science and technology.

National Science Standards: Content Standard F, Science in Personal and Social Perspectives: all students should develop understanding of personal health, populations, resources and environments, natural hazards, risks and benefits, and science and technology in society.

National Science Standards: Content Standard G, History and Nature of Science: all students should develop an understanding of science as a human endeavor, nature of science, and history of science.

**Engineering Connection:** Mechanical Engineering

**Success Indicator:** Upon completion of the activity, students will have a better understanding of the factors involved in designing cost conscious packaging for fragile objects and how objects absorb impact.

### **Setting up the Activity (for facilitator):**

The facilitator needs to designate a "Trump Tower" drop area. Suggestions include from the top of a slide or out a one story window.

The facilitator also needs to set up a materials store. The 'store' is the area where the packaging materials are 'bought' by the group. It should be operated by an adult and include some or all of the following materials:

Eggs, enough for one per student and some extra (in case the egg breaks before dropping)

Tape: Duct tape, masking tape, clear tape, packaging tape etc.

Glue

Bubble wrap (6 inch squares)

Scissors

Cotton Balls

String

Balloons

Rubber bands

Cardboard Boxes

Ziploc bags

Plastic Cups

Styrofoam

Coffee Cans

Foam rubber

**Introduction (for youth):** You are on a team on the TV show "The Apprentice." Donald Trump explains your task, "The business world is always about one thing, money. However, not only do products from companies have to be of quality, but they must also be cost-effective. Your task is

to create a container protective enough that an egg placed inside will not break if dropped at the lowest possible price. At the end of the task, all teams will test their packages by dropping them from a window of "Trump Tower." The team with lowest cost but effective packaging will win the task. The rest of you, I will see in the board room, and someone will be fired."

**Do the Activity (for youth):**

1. Work in a group of two or three. Each group will get an egg.
2. Use the Materials Cost Record activity sheet and plan a package that your group feels will protect the egg when dropped from "Trump Tower." Plan the materials needed and calculate the cost per item as well as the total cost of the package.
3. Submit your activity sheet to a facilitator for approval. The facilitator will be checking to make sure you've thoroughly thought out your plan before purchasing.
4. Upon approval, take your Materials Cost Record and 'purchase' the materials listed on your sheet. Construct your package.
5. Clean up. Then as a whole group, go to 'Trump Tower' and test your package.

**Finishing it up (for facilitator):** After testing, have each group present their design. Have groups open packages to see if their eggs broke. Lead a discussion comparing the different designs. Which designs protected the egg? Which ones had the lowest cost? Of the packages with eggs in tact, compare prices and declare winning team.

**Talking it Over:**

**a. Share what you did:**

**Does your design make sense in terms of balancing protection and cost?** *(Answers vary.)*

**What would you change next time?** *(Answers will vary. Possible answers include using different materials, different exterior package, etc.)*

**What surprised you about your group's results?** *(Answers will vary. Possible answer includes that the most expensive packaging is not always the best.)*

**b. Process what's important:**

**For the packages that worked, what characteristics did they have in common?**

*(Answers will vary. For example, the packages that worked all had some material absorb the impact so that the egg would not.)*

**What do you think has a greater impact on the speed at which the egg's package hits the ground, the weight of the package or the size of the package?** *(The size because the greater the surface area, the greater the resistance on the object.)*

**The Law of Conservation of Energy states that energy cannot be created or destroyed. If this is true, then where does the kinetic energy of the egg package go?** *(A possible response would be that the packaging absorbed it at first, but then the egg was suspended in such a way that it was able to bounce softly on the inside until slowed to potential energy by friction. Eggs held in too rigid would be more likely to break.)*

**c. Generalize to your life:**

**How well do you think the egg carton protects eggs? What would you change if anything?** *(Answers vary.)*

**What other products can you think of that are over- or under-packaged? What changes would you make to these?** *(Answers vary.)*

**d. Apply what you learned:**

**How does cost affect how well products are protected in packaging?** *(If packaging is too cheap, it may not protect the product which would cost the company more to replace. If packaging is too expensive, the product's profit would be marginalized.)*

**What products might use the same principals as the egg drop packages?** *(Possible responses include airplanes that drop off food and medical supplies to inhospitable countries. fragile products that contain glass, etc.)*

**More Challenges:**

Youth can continue to learn about how objects absorb impact by researching real-world examples or objects that work on the same scientific principals such as seat belts, air bags and other safety equipment. They can also learn try the egg drop package with a hard-boiled egg and observe differences.

**Background knowledge (for facilitator):**

The Law of Conservation of Energy states that energy cannot be created or destroyed. It simply changes forms from kinetic to potential or vice versa. Kinetic energy is the energy of motion. Potential energy is the energy at rest.

Newton's first law of motion states that "An object at rest tends to stay at rest and an object in motion tends to stay in motion with the same speed and in the same direction unless acted upon by an unbalanced force." (<http://www.glenbrook.k12.il.us>) Newton was the first Scientist to explain that the reason objects with kinetic energy change to potential energy is because of friction.

There are three major types of packaging materials for food: flexible, semi-rigid, and rigid. Egg cartons are in the semi-rigid category because they are made out of formed plastic, cardboard or polystyrene.

*While many items that are shipped are not fragile, such as paper documents, effective packaging in terms of minimizing waste is still an important criterion.*

*Safe shipment of fragile items is critical to businesses and consumers. The design of effective packages includes structural support and cushioning for the item.*

*Cost effective packages use a single type of cushioning that is light and easy to manufacture or obtain. Some examples include*

- *foam peanuts,*
- *small, linked airbags*
- *blowing a foam that hardens in the container around the item (which is wrapped in plastic to protect it.)*
- *pre-formed styrofoam molds to hold the item (most often found for packaging of electronics such as TVs, radios, stereos, etc.)*

*Packaging ideas that are good for recycling include shredded newspaper, popcorn and packing peanuts made out of potato starch. ("Designing a Package that Works," [www.wepan.org](http://www.wepan.org), copyright 2001.)*

Resources:

<http://en.wikipedia.org>

[www.fhedc.org](http://www.fhedc.org).

<http://www.glenbrook.k12.il.us>

[www.wepan.org](http://www.wepan.org)

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