

MIDDLE SCHOOL CHALLENGE: EGG DROP PACKAGE

Core Outcomes:

In building their egg drop package, students will explore and investigate the following terms: Newton's First Law, acceleration, constant speed, terminal speed, balanced forces, unbalanced forces, force, and opposing force. Students will incorporate an "environmentally friendly" design in their project.

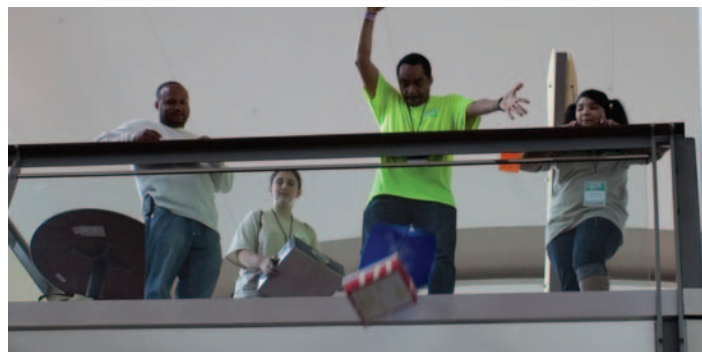
Challenge:

Students are challenged to design, construct, evaluate, test and enter a package that will prevent an egg or eggs from breaking after a 5 meter or 16.5 foot drop. All egg drop packages must be designed using ONLY biodegradable materials. Projects not using biodegradable materials will be disqualified. Each student must be prepared to explain why they used the materials they selected.

Rules:

- The package must hold 2 raw chicken eggs.
- The only materials that can be used are biodegradable.
- Students are encouraged to use their ingenuity and creativity to choose the appropriate packaging materials and the best design for their project.
- All egg drop projects must be fully packaged with eggs and ready for competition upon arrival for CPEP Day.
- Packages will be dropped from a height of at least 5 meters or 16.5 feet and the package must land on a target below the designated drop area.
- The eggs cannot be coated or boiled. Each egg may be individually wrapped but the wrapping must not include any type of tape.
- No remote controlled devices nor tethers (ropes, chains, etc.) are permitted
- A design which poses a safety hazard will be subject to disqualification.
- Each package, including the eggs, shall not exceed 1.8 kilograms or 4 pounds and must completely fit in a 1 ft. x 1 ft. x 1 ft. box.

Each package will **be dropped once**. Judges will inspect the contents after each package has been dropped and will use the following equation to calculate the score:



$$SCORE = \frac{30N^2}{Tm(L+10)} - C$$

T = Time in seconds that the package stays in the air (i.e. time till impact)

m = Mass, in kilograms, of the package and the eggs together

L = Length in centimeters that the egg package finally comes to rest from center of the target. Distance will be measured from the closest edge of the package to the center of the target.

N = Number of eggs that DO NOT crack or break

C = Number of eggs that DO crack or break

Example: A package of mass $m = 0.75\text{kg}$ (including eggs) contains 2 eggs. The package takes $T = 1.3$ seconds to fall to the ground and lands a distance $L = 32\text{cm}$ from the center of the target. Both (2) of the eggs survive the fall intact and none of the eggs crack or break.

$$\frac{30(2)^2}{(1.3)(0.75)(32+10)} - 0 = 2.93$$

Biodegradable refers to organic material that has the ability to break down, safely and relatively quickly, by biological means (by living organisms like bacteria) into the raw materials of nature and disappear into the environment. Some items are not biodegradable such as the Styrofoam peanuts commonly used in packaging. Other examples of other non-organic material which are considered non-biodegradable would include:

Plastics (polyethylene, nylon, rayon, polyester, Lexan, PVC, Dacron) For example, plastic bags

Metals (iron, platinum, steel, tin, aluminum, lead, silver, gold, mercury, arsenic, bismuth, zinc, chromium...)

Composites (carbon Fiber, Fiberglass, Kevlar)

Ceramics (plaster, cement, limestone, glass)

Foams (cups, coolers), glasses

Circuit boards/silicon based materials

Noble gases and more

HIGH SCHOOL CHALLENGE: EGG DROP PACKAGE

Core Outcomes:

In building their egg drop package, students will explore and investigate the following terms: Newton's First Law, acceleration, constant speed, terminal speed, balanced forces, unbalanced forces, force, and opposing force. Students will incorporate an "environmentally friendly" design in their project.

Challenge:

Students are challenged to design, construct, evaluate, test and enter a package that will prevent an egg or eggs from breaking after a 5 meter or 16.5 foot drop. All egg drop packages must be designed using ONLY biodegradable materials. Projects not using biodegradable materials will be disqualified. Each student must be prepared to explain why they used the materials they selected.

Rules:

- The package must hold 5 raw chicken eggs.
- The only materials that can be used are biodegradable.
- Students are encouraged to use their ingenuity and creativity to choose the appropriate packaging materials and the best design for their project.
- All egg drop projects must be fully packaged with eggs and ready for competition upon arrival for CPEP Day.
- Packages will be dropped from a height of at least 5 meters or 16.5 feet and the package must land on a target below the designated drop area.
- The eggs cannot be coated or boiled. Each egg may be individually wrapped but the wrapping must not include any type of tape.
- No remote controlled devices nor tethers (ropes, chains, etc.) are permitted
- A design which poses a safety hazard will be subject to disqualification.
- Each package, including the eggs, shall not exceed 1.8 kilograms or 4 pounds and must completely fit in a 1 ft. x 1 ft. x 1 ft. box.

Each package will **be dropped once**. Judges will inspect the contents after each package has been dropped and will use the following equation to calculate the score:



$$\text{SCORE} = \frac{30N^2}{Tm(L+10)} - C$$

T = Time in seconds that the package stays in the air (i.e. time till impact)

m = Mass, in kilograms, of the package and the eggs together

L = Length in centimeters that the egg package finally comes to rest from center of the target. Distance will be measured from the closest edge of the package to the center of the target.

N = Number of eggs that DO NOT crack or break

C = Number of eggs that DO crack or break

Example:

Example: A package of mass $m = 0.75\text{kg}$ (including eggs) contains 5 eggs. The package takes $T = 1.3$ seconds to fall to the ground and lands a distance $L = 32\text{cm}$ from the center of the target. 3 of the eggs survive the fall intact but 2 of the eggs crack or break.

$$\frac{30(3)^2}{(1.3)(0.75)(32+10)} - 2 = 17.78$$

Biodegradable refers to organic material that has the ability to break down, safely and relatively quickly, by biological means (by living organisms like bacteria) into the raw materials of nature and disappear into the environment. Some items are not biodegradable such as the Styrofoam peanuts commonly used in packaging. Other examples of other non-organic material which are considered non-biodegradable would include:

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