



EGG DROP CHALLENGE

ENTRIES OPEN APRIL 15, 2019- JULY 10, 2019



SCIENCE LESSON

EGG DROP: ENERGY, SPEED, & IMPACT

Discover how your egg drop invention's energy will change from potential to kinetic energy during the drop test. Experiment with eggs to explore impact force and energy absorption.

FOR THE CLASSROOM

POSSIBLE APPROACH
FOR THE CLASSROOM



LESSON LENGTH
50-60 MINUTES



OBJECTIVE
LEARN ABOUT POTENTIAL & KINETIC
ENERGY



MATERIALS
SEE BELOW

VOCABULARY:

- Energy
- Potential Energy
- Kinetic Energy
- Impact Force
- Speed & Velocity
- Newton's 3rd Law

MATERIALS

Powerpoint, Worksheet, Computer, Internet, Eggs (raw), Plastic Sealable Sandwich Bags, Pencil/Marker, Meter Stick/Tape Measure

PROCEDURE

1. Download and teach the [ENERGY, SPEED, & IMPACT POWERPOINT](#). We have provided a Future Engineers PPT. Feel free to customize it to suit your teaching needs.

2. Student Activity: Egg Drop Energy, Impact, and Speed

Provide 4 eggs and 4 plastic bags per group, or conduct this activity as a class demonstration with student volunteers.

Demonstration #1:

Students will compare the potential energy and speed of two eggs (one that is 1 inch off of the ground, and one that is 4 feet off of the ground). Assume that both eggs have the exact same weight and size and use the worksheet as a guide to complete this activity.

- Label one egg A and the other egg B.
- Have one student hold egg A up 1 inch off the ground and another student hold egg B up 4 feet off the ground at the same time.
- Answer the following questions on the worksheet:
 - Which egg has more potential energy? Explain why.
 - Which egg will have more kinetic energy right before it hits the ground?
 - Which egg will have more speed when it hits the ground?
 - How do you think energy and speed will affect the eggs ability to survive the drop?
 - Which egg/s do you think will crack?



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LESSON PLAN CONTINUED

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PROCEDURE (Continued)

- a. Let's test it! Place each egg in a clear plastic sealable sandwich bag.
- b. Drop egg A from 1 inch and answer the following questions on your worksheet:
 - Did the egg crack?
- c. Drop egg B from 4 feet and answer the questions on your worksheet.
 - Did the egg crack?
 - How did this compare to your predictions?
 - Do you think a soft cushion would have helped?
 - Do you think a different orientation of your egg would have helped (long ways versus short ways)?
 - Do you think a slower speed of descent would have helped?

Demonstration #2

- d. Compare the following two egg drop scenarios and complete the worksheet with predictions/hypothesis.
 - Scenario 1: The egg dropped from 4 ft.
 - Scenario 2: Drop the egg from 4 ft but caught in your hands at 1 foot.
 - Will it crack?
 - What will your hands do to try and protect the egg when you catch it?
- e. Let's test it! Place your eggs in a clear plastic bag.
 - Did the egg crack when dropped from 4 ft? Why/Why not?
 - Did the egg crack when you tried to catch it? Why/Why not?
- f. Use the powerpoint presentation to explain impact absorption and how a hand helps the egg to slow down (decelerate) over a longer period of time. Other examples of impact absorption include crumple zones on cars, air bags, or even an object that rolls after it falls - like the Spirit and Opportunity rovers landing on Mars or a stunt person who breaks their fall with a safety roll.



BACKGROUND INFORMATION

ENERGY

No mechanical contraption would be any fun if it did not work. But "work," in the physics sense, takes energy. Consider a rope and pulley that brings a bucket up a well. The energy that makes this mechanical system work is provided by a person who pulls up the rope.

POTENTIAL & KINETIC ENERGY

There are two different kinds of energy: potential energy (stored energy) and kinetic energy (energy in motion).



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LESSON PLAN CONTINUED

EGG DROP: POTENTIAL & KINETIC ENERGY



BACKGROUND INFORMATION

POTENTIAL & KINETIC ENERGY (Continued)

A great example of the difference between kinetic and potential energy is from the classic "snake-in-a-can" prank. When the snake spring is compressed and secured inside the unopened can, it has potential energy (Its ready to burst!), but when the can is opened, the potential energy quickly converts to kinetic energy as the fake snake jumps out.

Location of Object and Potential Energy

The position of an object on Earth can influence the amount of potential energy it has. For example, objects at various heights on shelves have different amounts of potential energy. The higher the object, the more potential energy it has. In the case of the egg drop, when an egg is held up 4 feet from the ground, it has less potential energy than when it is held up 8 feet from the ground.

IMPACT FORCE

Impact force is a force that delivers a high impact in a relatively short period of time. It occurs when two entities collide. This collision is the result of one object falling onto, or slamming into, another object

When the egg drop contraption hits the ground, there will be a and impact force to the ground and the ground will have an equal and opposite reaction. The egg drop contraption will absorb the forces from the collision and react.

NEWTON'S THIRD LAW

"For every action, there is an equal and opposite reaction"



ADDITIONAL TEACHING RESOURCES:

- The Physics of Car Crashes: <https://www.youtube.com/watch?v=v9ML4GA47Rg>
- Newton's Laws: Crash Course Physics #5 <https://www.youtube.com/watch?v=kKKM8Y-u7ds>



NEXT GENERATION SCIENCE STANDARDS

[MS-PS2-1](#) Motion & Stability: Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

PS2.A: Forces and Motion

- For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction.



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[MS-PS3-2](#) Energy: Develop a model to describe that when the arrangement of object interacting at a distance changes, different amounts of potential energy are stored in the system.

PS3.A Definitions of Energy

- A system of objects may also contain stored (potential) energy, depending on their relative positions.

PS3.C Relationships Between Energy and Forces

- When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object.

[MS-PS3-5](#) Energy: Construct, use and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.



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SCIENCE LESSON WORKSHEET

EGG DROP ENERGY, IMPACT & SPEED

No mechanical contraption would be any fun if it did not work. But “work,” in the physics sense, takes energy. Energy can either be potential (non moving) or kinetic (moving). Explore how the energy of an egg changes when it is dropped from various heights.

VOCABULARY

- **Potential Energy:** The stored energy and object has because of its position or state. For example, a bicycle at the top of a hill, egg held above the ground and stretched spring all have potential energy.
- **Kinetic Energy:** The energy of and object due to its motion.
- **Impact force:** A force that delivers a high impact in a relatively short period of time. It occurs when two entities collide. This collision is the result of one object falling onto, or slamming into, another object.

DEMONSTRATION #1:

Compare the potential and kinetic energy of an egg dropped from 1 inch versus an egg dropped from 4 feet.

Procedure

Label one egg A and the other egg B. Hold egg A up 1 inch off the ground and egg B up 4 feet off the ground.

Answer the following questions:

1) Which egg has more potential energy? Explain why.

Predictions:

2) Which egg will have more kinetic energy right before it hits the ground? Explain why.





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DEMONSTRATION #1 CONTINUED

Predictions:

3) Which egg will have more speed when it hits the ground?

4) What do you think the relationship between energy and speed is? How will this will affect the eggs ability to survive the drop?

5) Which egg do you think will crack?

LET'S TEST IT!

Place Egg A in a plastic bag and seal it. Drop Egg A from 1 inch and answer the question below.

Observation:

1) Did it crack?

Place Egg B in a plastic bag and seal it. Drop Egg B from 4 feet and answer the following questions.

Observation:

2) Did the egg crack?

Conclusion:

3) How did the results compare to your predictions?





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DEMONSTRATION #1 CONTINUED

Conclusion:

4) Do you think a soft cushion would have helped?

5) Do you think a different orientation of your egg would have helped (long versus short)?

6) Do you think a slower speed of descent would have helped?

DEMONSTRATION #2

Compare the impact absorption of the following scenarios. #1 An egg dropped form 4 feet off the ground. #2 An egg dropped form 4 feet off the ground caught by two hands.

Answer the following questions before the drops to make your predictions:

1) Will the eggs crack? If so, which ones?

2) What will your hands do to try and protect the egg when you catch it?





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DEMONSTRATION #2 CONTINUED

LET'S TEST IT!

Place Egg A in a plastic bag and seal it. Drop Egg A from 4 feet. Place Egg B in a plastic bag and seal it. Drop Egg B from 4 feet and have another student catch it by placing their hands at approximately 1 foot from the ground.

Observations:

1) Did Egg A crack when dropped from 4ft?

2) Did Egg B crack when dropped and caught?

Conclusion:

1) How did the results compare to your predictions? Explain your results. What did your hands do to catch the egg? Why did the egg/s crack or not crack?

