TEACHERS Serving TEACHERS!®

Educational Innovations Inc.®

Dropper Poppers

POP-100

Introduction

When this small "half ball" is turned inside out and then dropped onto a hard surface, it releases its stored potential energy and "jumps" far higher than the point from which it was released.

Here's Why:

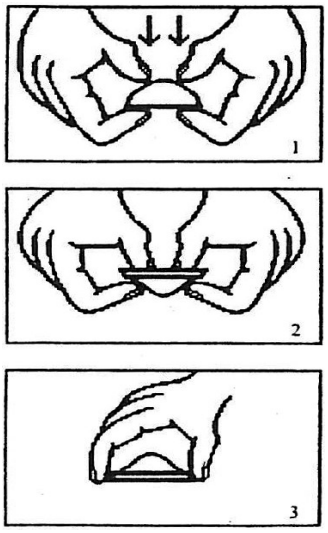
- ✓ **Elastic potential energy** is stored as a result of deformation of elastic objects like springs or rubber bands.
- ✓ **Gravitational potential energy** is stored as a result of an object's position above the ground.

How to Use Your Dropper Popper:

1. To activate the Dropper Popper, press your thumbs into the center and press firmly. Be sure to point the popper away from your face and other people *(figure 1)*.

2. As you continue to press, the popper will turn inside out, creating a "bulge" in its center. At this point, it has stored its potential energy *(figure 2)*.

3. Hold the popper in one hand and drop it onto a hard, flat surface. Be sure to drop the popper with its flat side facing down *(figure 3)*.



Warning:

Use extreme caution. Do not place your head above an activated or moving popper. If an activated popper does not release its energy, reach from the side and deactivate it, or step on the activated popper to release the energy.

Troubleshooting:

If the popper does not pop, or will not stay turned inside out long enough to drop to the floor, simply bend the edges inwards from each side two or three times to "break the rubber in."

5 Francis J. Clarke Circle, Bethel, CT 06801

Phone (203) 74-TEACH (83224)
www.TeacherSource.com

NGSS Correlations

Our Dropper Popper and these lesson ideas will support your students' understanding of these Next Generation Science Standards (NGSS):

Elementary

K-PS2-1
Students can use the Dropper Popper to plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.

4-PS3-4
Students can use the Dropper Popper to design, test, and refine a device that converts energy from one form to another.

3-5-ETS1-3
Students can use the Dropper Popper to plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Middle School

MS-PS3-5
Students can use the Dropper Popper to construct, use and present arguments or experiments to support the claim that when the motion energy of an object changes, energy is transferred to or from the object.

MS-ETS1-4
Students can use the Dropper Popper to develop a model or experiment to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

High School

HS-PS3-4
Students can use the Dropper Popper to design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

** NGSS is a registered trademark of Achieve. Neither Achieve nor the lead states and partners that developed the Next Generation Science Standards were involved in the production of, and do not endorse, this product.*

Suggested Science Idea(s)

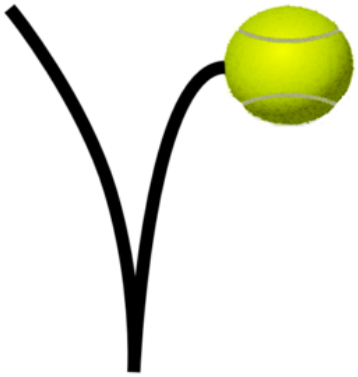
K-PS2-1 • 3-5-ETS1-3 • 4-PS3-4 • MS-PS3-5 • MS-ETS1-4 • HS-PS3-4
Using a Dropper Popper in combination with a ping pong ball creates a dramatic demonstration of energy transfer—and much more.

Activity 1
How High Will It Bounce?

Show your students a regular ball such as a super bounce ball or a ping pong ball.

Pass it around to a few students to confirm that it is just an ordinary ball.

Survey the class to determine how high they predict the ball will bounce if it is dropped straight down without adding any additional energy. (You may be surprised to learn that some students will predict that the ball will bounce *higher* than the point from which you drop it.)



Holding the ball, raise your hand straight in front of you. Then count to three and drop the ball. Keep your hand in the same position. How high does it bounce?

Repeat the ball drop several times to ensure that your students understand the ball will never reach the same height from which it was dropped. **As long as no additional force is used (i.e., slamming the ball down), it is impossible for the ball to bounce back up to its original height.**

The Law of Conservation of Energy states that energy cannot be created or destroyed; it can only be transferred as alternate forms of energy. The energy that initially went into the system was transferred out as sound energy and heat energy. **The ball will never bounce higher than the initial drop point because the energy that comes out of a system can never exceed the energy that goes in.**

Explain to your students that the ball's energy was stored because of gravity and its position above the ground. The ball falls due to the force of gravity—basically, it is attracted to the earth.

In the absence of friction, a perfectly elastic ball would have bounced back to the exact height from which it was dropped, but in real-world conditions, a dropped ball will never bounce higher than its original drop point.

Main Points:

- ✓ **Elastic potential energy** is stored as a result of deformation of elastic objects like springs or rubber bands.
- ✓ **Gravitational potential energy** is stored as a result of an object's position above the ground.

Activity 2
Introducing the Dropper Popper

Show your students the Dropper Popper and ask them to predict how high it will bounce if you drop it straight down, as you did with the regular ball in Activity 1.

Holding the popper, raise your arm straight in front of you. Tell your students to observe the height at which the popper returns after it has been dropped. Then count to three and drop the popper *without turning it inside out*. Keep your hand in the same position after you drop the popper. Ask students:

Did the popper bounce back to its original height?

Next, turn the Dropper Popper inside out.

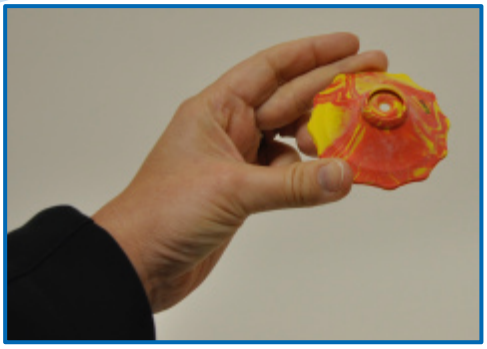
Explain to your students that by doing work on the popper, you are storing energy in it. *

Again, ask the class to predict the return height of the popper after it is dropped.

This time, drop the popper with the "bulge" pointing upward. Ask students:

What happened? Did the popper reach the height you expected?

What do you think caused it to bounce higher than its original drop height?



Hold the Dropper Popper with the "bulge" pointing upward. Its stored energy will be released when you drop it, causing the popper to bounce up beyond the height at which it was dropped.

Before you conclude your class discussion, make sure students understand this concept:

When the popper hits the ground, its stored elastic energy was released. This is what caused the popper to bounce higher than the point from which it was dropped.

* **In chemistry, this is referred to as ACTIVATION ENERGY. The term was introduced by the Swedish scientist Svante Arrhenius in 1889. It refers to the minimum energy that must be input to a chemical system with potential reactants in order to cause a chemical reaction.**

Activity 3
Adding a Ping Pong Ball

For this activity, please ensure that your students use protective eyewear.

NOTE: This activity works best when each student has his/her own Dropper Popper and ping pong ball.

Distribute the Dropper Poppers and ping pong balls to students.

Show your students how to turn the poppers inside out. Remind them that this step allows the popper to store its potential energy.

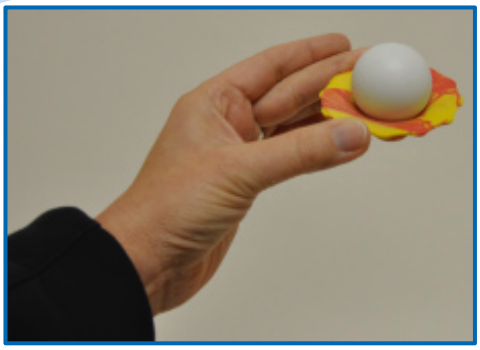
When the popper is inside out with its "bulge" pointing down, instruct students to carefully place the ping pong ball in the "bowl" of the popper. The ping pong ball should fit securely.

Before proceeding, ask students:

How high do you predict your popper will go?

How high do you predict the ping pong ball will go?

Which do you think will bounce higher—the popper or the ping pong ball?



Place the ping pong ball inside the popper's "bowl." Hold the popper so its "bulge" is pointing downward.

Now it's time to drop the poppers onto a hard surface. Instruct your students to raise their arms straight, holding the popper in one hand in such a way that the ping pong ball remains securely inside of its "bowl."

3, 2, 1... Drop!

The ping pong balls typically reach heights that will be truly impressive to your students!

Allow students to repeat the demonstration several times, testing out different variables. For instance, what happens if they change the height at which they drop their poppers?

During your discussion, remind students of the forces exerted by **gravitational potential energy** and **elastic potential energy.** Which one do they think played a bigger role in making the ping pong ball travel so far?

Take Your Lesson Further

As science teachers ourselves, we know how much effort goes into preparing lessons. For us, "*Teachers Serving Teachers*" isn't just a slogan—it's our promise to you!

Please visit our website for more lesson ideas:

www.TeacherSource.com

Check our blog for classroom-tested teaching plans on dozens of topics:

http://blog.TeacherSource.com

To extend your lesson, consider this Educational Innovations product:

Seismic Accelerator (SS-150)
Several balls are threaded on a wire. When the apparatus is dropped straight downward onto a hard surface, the top ball can rebound to a height equal to five times the original drop. WOW! Leads into an interesting discussion of what has happened due to the Law of Conservation of Energy. Comes with safety glasses.

Reaction Rocket (RKT-625)
Appearances can be deceiving. This rubber ball launcher and foam rocket may look simple, but they're a sure-fire way to provoke a WOW reaction—and introduce students to Newton's Laws. Hold the launcher by its straw and drop straight down onto a hard surface. The rocket shoots up dramatically higher than its original drop height. Explaining energy conversion was never this easy... or this much fun! Comes with one launcher, two rockets. Class Kit includes 15 launchers and 40 rockets.

3-2-1 Blast Off! Kit (KIT-321)
Over the years, hundreds of teachers have asked us to develop a kit that bundles our much-loved demonstrations of things that go "bump" in the day! Kit includes comprehensive teaching instructions and enough hands-on components for up to 10 students. (Safety glasses recommended.) We've also created memory-refresher videos that walk you through each of the demonstrations, so you'll be up to speed and ready to Blast Off in just minutes!