Educational Innovations, Inc.

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Smashing Steel Sphere Demo Kit

HS-8

Introduction

When objects collide, the kinetic energy transforms into sound, heat, and kinetic energy in the opposing direction. It can be difficult, however, to show the heat produced through energy transformations. These steel spheres show how energy "loss" is actually energy being released as heat!

The Smashing Steel Sphere Demo Kit is a wonderful demonstration that shows how energy is never "lost," but rather it is transformed to another form of energy.

When these two chrome steel spheres are smashed together, enough heat is generated at the point of contact to burn a hole in a piece of ordinary paper! This amazing demonstration graphically illustrates the Law of Conservation of Energy as mechanical energy is transformed into heat energy. Although there are no flames, a charred hole appears along with the odor of burnt paper.

Discussion

1. **How do the spheres colliding demonstrate the Law of Conservation of Energy?**
   When the spheres collide, their kinetic energy is transferred into heat energy and sound energy.

2. **Why is it that if you hit the two spheres together multiple times, they do not feel warm to the touch?**
   The point at which the spheres collide is very small, which is why the energy is enough to burn the paper.

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NGSS Correlations

Our Smashing Steel Sphere Demo Kit and these lesson ideas will support your students' understanding of these Next Generation Science Standards (NGSS):

Elementary

4-PS3-2
Students can use the Smashing Steel Spheres in an investigation to make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

4-PS3-3
Students can use the Smashing Steel Spheres in an investigation to ask questions and predict outcomes about the changes in energy that occur when objects collide.

DCI-4/PS1.B: Conservation of Energy and Energy Transfer.
Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, typically also transferred to the surrounding air; as a result, the air gets heated and sound produced.

Middle School

MS-PS3-1
Students can use the Smashing Steel Spheres in an investigation to construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

MS-PS3-4
Students can use the Smashing Steel Spheres in the plan of an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

MS-PS3-5
Students can use the Smashing Steel Spheres in an investigation to construct, use and present arguments to support the claim that when the motion energy of an object changes, energy is transferred to or from the object.

High School

HS-PS3-1
Students can use the Smashing Steel Spheres in an investigation that also includes a computational model to calculate the change in the energy of one component in a system when the change in energy of the other components and energy flows in and out of the systems are known.

HS-PS3-2
Students can use the Smashing Steel Spheres to illustrate that energy at the macroscopic scale can be accounted for as either motions of particles or energy stored in fields.

DCI-HS/PS3.B: Conservation of Energy and Energy Transfer.
Energy cannot be created or destroyed, but it can be transported from one place to another and transferred into or out of a system.

Activities

Materials:

- Two 1-pound, 2-inch diameter chrome steel spheres
- Sheet of paper
- Sheet of aluminum foil
- Safety glasses

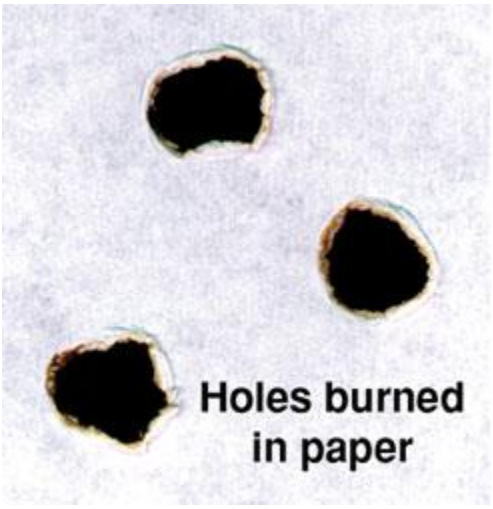
NOTE:

It is always wise to perform an experiment ahead of time to be able to best present it to the class.

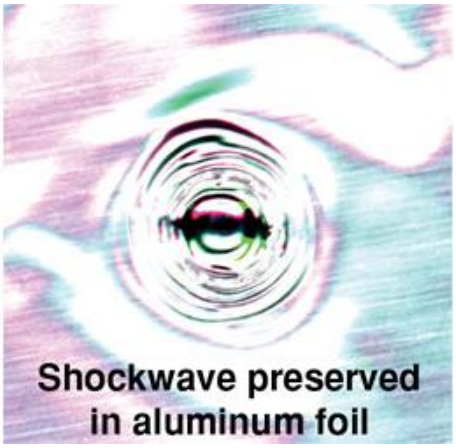
Class Activity 1:

Teacher and participating student should wear safety glasses. Have a student hold a piece of paper in front of his/her body so the paper is perpendicular to the floor. The teacher should position the spheres on either side of the paper and carefully but firmly smash them together, with the paper in between.

Ask the class to make observations of the paper. There should be a small hole where the spheres collided. Some students may speculate that the hole was ripped by the motion of the spheres. To confirm that the hole was actually burned into the paper, have them sniff the paper and smell the smoke.



Class Activity 2:



Repeat the experiment with a sheet of aluminum foil instead of paper. A number of concentric rings can be observed in the foil!

The interesting aspect of this is that you are seeing the tops of the shock waves on one side of the foil, and the bottoms of the waves on the opposite side of the foil. This is much like the ripples you see in water when a stone is tossed in.

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:

TeacherSource.com/lessons

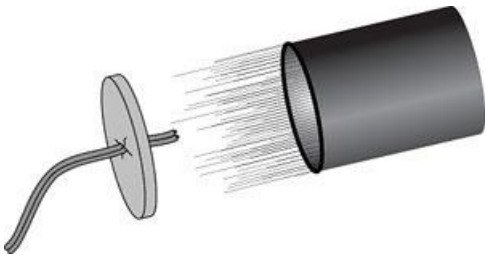
Check our blog for classroom-tested teaching plans on dozens of topics:

http://blog.TeacherSource.com

To extend your lesson, consider these Educational Innovations products:

Fire Syringe Demo (FIR-150)
When the plunger in the transparent cylinder is rapidly pushed down over a piece of cotton or paper towel, ignition occurs. This is one of the most impressive demonstrations of the heat produced when a gas is rapidly compressed - the principle of the Diesel engine ignition.

Piezo Popper Kit (HS-2A)



These amazing piezoelectric devices generate a few thousand volt sparks at the touch of a button. No batteries required. The discharge is created when a small hammer inside the device strikes a quartz crystal. It can be used as a safety lesson to demonstrate the flammability of alcohol or perfume. Igniting two drops of alcohol in a film canister will cause the canister to fly more than 20 feet into the air!

Seismic Accelerator (SS-150)
The Seismic Accelerator illustrates the laws of conservation of momentum and energy during the creation of a supernova. Several balls are threaded on a plastic shaft. 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's happened due to the Law of Conservation of Energy. Comes with safety glasses.