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Educational Innovations, Inc.®

Fire Syringe Demo

FIR-150

When the piston in the transparent cylinder is rapidly depressed using a quick, firm stroke over dry cotton or paper tissue fibers, ignition occurs. The compression of the air causes the temperature of the gas to rise rapidly, igniting the material at the base of the cylinder resulting in a bright flash. This is one of the most impressive demonstrations of the heat produced when a gas is rapidly compressed and is the principle behind how a diesel engine functions.

Instructions

The Fire Syringe is very sensitive to moisture, so to ensure the proper results, first clean the apparatus thoroughly. No solvents are necessary. Simply wipe the piston thoroughly using a clean, dry paper towel. Next, twist a piece of paper towel into a long slender swab, and clean the chamber all the way to the bottom. The goal is to remove all the oil from inside the chamber. A small amount of oil on the O-rings is sufficient lubrication.

Next, place a small piece of dry material in the chamber of the syringe. Paper or cotton fibers are common samples. Our personal favorite is cotton from cotton balls. You want only a "thin wisp" of cotton fibers for each demonstration. Pluck it off the edge of a cotton ball and then "tease out" the fibers to maximize the surface area of your cotton sample. Push the sample to the bottom of the chamber with a pencil or other long thin object.

Place the piston into the mouth of the chamber and thread the collar back onto the syringe. Place the syringe on a sturdy table. Get a firm grip on the handle and force the piston straight down, FAST AND HARD. If it does not fire, withdraw the piston all the way until it is loose inside the collar (this allows fresh oxygen to enter the chamber through the small hole in the collar) and force the piston straight down again, FAST AND HARD. You may need to pump it repeatedly four or five times, withdrawing the piston to the collar each time, before you get a flash. This can take a little practice, so don't be discouraged if it doesn't flash the first time you try it.

If you don't get a flash after several tries you may have used up your fuel sample (you may have noticed little puffs of smoke indicating some combustion). You will need to remove the collar and retract the plunger. Use your paper towel swab or pencil to remove the used material from cylinder. The swab will also displace the "used" air from the cylinder, allowing more fresh air to refill the cylinder.

WARNING: Under NO circumstances should you use flash paper, liquid fuels, match heads, gun powder, or any fuels not specifically recommended in the instructions. Such volatile fuels could cause the Fire Syringe tube to shatter. Safety glasses are recommended for use with this product.

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NGSS Correlations

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

Elementary

The Fire Syringe Demonstration is recommended for use with students in middle school and older.

Middle School

MS-PS3-4

Students can use the Fire Syringe Demonstration in 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 temperature of the sample.

MS-PS3-5

Students can use the Fire Syringe Demonstration to construct, use, and present arguments to support the claim that when the motion of an object changes, energy is transferred to or from the object.

DCI/PS3.B: Conservation of Energy and Energy Transfer.

When the motion energy of an object changes, there is inevitably some other change in energy at the same time.

High School

HS-PS3-1

Students can use the Fire Syringe Demonstration in an investigation to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.

HS-PS3-2

Students can use the Fire Syringe Demonstration in an investigation to develop and use models to illustrate that energy at the macroscopic scale can be accounted for as either motions or particles or energy stored in fields.

DCI/PS3.A: Definitions of Energy.

At the macroscopic scale, energy manifests itself in multiple ways, such as motion, sound, light, and thermal energy.

DCI/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 between systems.

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:

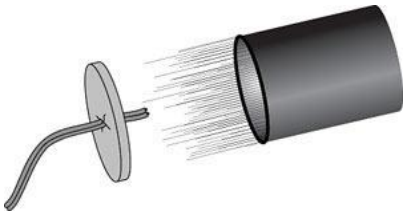
TeacherSource.com/lessons

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:

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! Kit includes piezo igniter, instructions, film canister, wire and connector.

Smashing Steel Sphere Demo Kit (HS-8)

When two 1-pound, 2-inch diameter, 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 conversion of mechanical energy into heat energy. Although there are no flames, a charred hole appears along with the odor of burnt paper. The kit contains two steel spheres and instructions.

Microscale Vacuum Apparatus (VAC-10)

Students can now safely produce a vacuum in a small bell jar right at their lab stations. By reducing the pressure in the microscale bell jar, they can expand a balloon, boil warm water, and even transfer liquids from one pipet to another. They can watch a marshmallow or shaving cream increase in volume as the pressure is reduced and learn about how extremely low pressure affects the world around them. Instead of passively observing a demonstration, students can actively experiment on their own and observe the results right before their eyes. More advanced high school and college level students can study Boyle's and Raoult's Laws and finally understand the relationship between vapor pressure, temperature, and boiling point. Included with the full instructions and guide is a bonus set of Educational Innovations ideas to challenge your students.