Bimetallic Jumping Disk

HEA-450

Why Does the Disk Jump?

The Bimetallic Jumping Disk is made from "bi-metal"—actually two pieces of thin metal fused together in the middle. When the temperature changes, the two metals expand differently and bend the curve in either direction. When the disk is warmed to body temperature, you can "click it" into its loaded position and then carefully place it on a hard surface. At this point, your disk has **potential energy**. When the disk cools to room temperature, it suddenly snaps back to its original position, spontaneously propelling it about 12 inches into the air!

The same principle applies to a thermostat in your home or a shunt-valve in your car: a piece of bi-metal moves when the temperature changes. For instance, when the temperature drops in your home, the bi-metal in your thermostat cools, moves slightly, hits a contact, and activates the heater. This way, the temperature won't fall below the desired level. In a car, the bi-metal reacts to heat by opening or closing the valve to the radiator, allowing the engine to warm up quickly, before starting the cooling process.

In the case of the jumping disk, the bi-metal stays in one position when at room temperature, and in another temperature when at approximately 98 degrees F. First you warm it to the appropriate temperature in your hand, and then snap the disk between your fingers. If the metal is warmed enough, the disk will remain in the "inverted" position until it cools down. If your hands are too cool, you may need an outside heat source. Holding the disk against the outside of a warm cup of water or placing it on top of a room heater usually works. (Please caution students NOT to place the disk in their mouths to warm it.) Now, carefully and quickly, slide the disk onto a hard surface like a table. In a few seconds after the disk cools off, it will suddenly snap back into its original position and with a loud click it will fly into the air. Students can adjust the variables to test the difference between the temperature of the disk vs. the temperature of the surface it is placed upon and the time it takes for the disk to jump or the height to which it jumps.

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NGSS Correlations

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

Elementary

K-PS2-1
Students can use the disk to plan and conduct an investigation to compare the effects of pushes and pulls on the motion of an object.

2-PS1-4
Students can use the disk in an investigation to construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.

3-PS2-2
Students can use the disk to make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

4-PS3-2
Students can make observations of the disk to provide evidence that energy can be transferred from place to place by heat.

4-PS3-4
Students can use the disk in an investigation to apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

5-PS1-3
Students can use the disk to make observations and measurements to identify materials based on their properties.

Middle School

MS-PS1-4
Students can use the Bimetallic Jumping Disk in an investigation to develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

MS-PS3-2
Students can use the Bimetallic Jumping Disk in an investigation to develop a model to describe that when the arrangement of objects interacting, different amounts of potential energy are stored in the system.

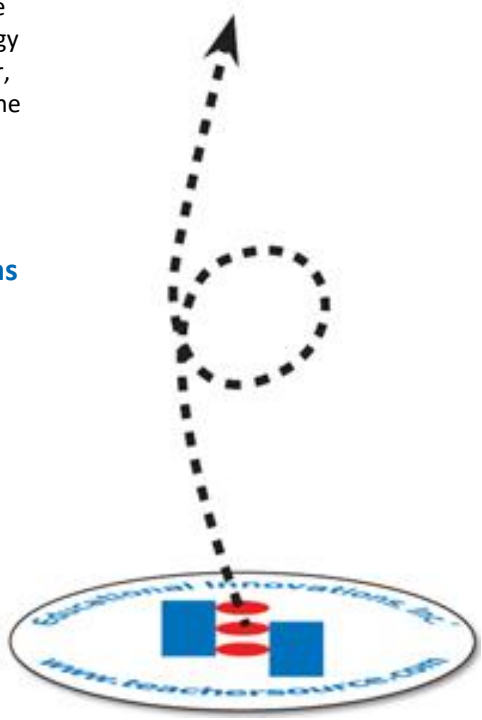
MS-PS3-4
Students can use the disk in an investigation to determine the relationships among the energy transferred the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

DCI-MS/PS3A: Definitions of Energy.
A system of objects may also contain stored (potential) energy, depending on their relative positions.

High School

HS-PS2-6
Students can use the Bimetallic Jumping Disk in an investigation to observe and communicate scientific information about why the molecular-level structure is important in the functioning of a material.

HS-PS2-6
Students can use the Bimetallic Jumping Disk in the design of a device that works with given constraints to convert one form of energy into another form of energy.



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:

Thermoplastic Polymer (HEA-500)
This amazingly versatile polymer can be heated and molded over and over again! It falls into a class known as thermoplastics. The melting point for this material is quite low, only 58oC to 60oC, so it can be melted in hot water and molded by hand. It can also be cut or extruded. Safe and biodegradable. 250 g.

Fortune Fish (SS-40B)
The Fortune Fish is a very thin piece of red cellophane in the shape of a fish, 8.9 cm (3.5 inch). When placed in the palm of a hand it twists and curls. It seems to move magically, different for different people.

Heat Pipe Demo (HP-100)
Hold the end of each piece of copper in different hands and immerse the ends into a container of hot water or ice water. It is amazing how quickly heat transfers in the heat pipe and how slowly it transfers in the solid copper. Heat pipes are used in laptop computers and other devices for cooling. They work on the principle of the heat capacity of water and a wick. Explanation included.

Chemical Heat Pack (HEA-400)
Click a metal disk and watch the liquid crystallize. Younger students can safely feel the heat of a physical change. Advanced students can determine the heat of fusion of hydrated sodium acetate (fp = 54 C). Great for calorimetry experiments! Bending the metal disk initiates the crystallization of super-cooled sodium acetate and water; boiling in water returns the solid to a liquid. Can be used over and over. Instructions and lesson ideas provided!