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Educational Innovations, Inc.®

Putt-Putt Steam Boat

SB-100

Originally called 'Putt-Putt Steam Boats' in the 1920's, these reproduction toys can be used to teach many scientific principles. Using a small flame from a candle or a few drops of cooking oil, these little boats will chug along for hours. They are great for demonstrating the transformation of heat energy to mechanical energy. More advanced students can be given the problem of explaining how it works. Fascinating to watch in a circular pan of water.

How do they work?

A heat source (small candle, or cooking oil and wick) heats the water in the boiling chamber, creating a brief burst of steam that is expelled through the pipes in the rear of the boat. The force of the expanding gas (steam) pushes the boat forward. Since there is a limited amount of water in the chamber to start with, the exit of the gas creates an area of lower pressure in the boiling chamber.

This allows the atmospheric pressure that is pressing down on the water to force more water into the chamber, allowing it in turn to be heated to boiling, and repeating the process again and again until the fuel is exhausted.

A Note on Conservation

Perhaps we should call this section "A Note on CANservation." Take a close look at your boat—you will discover that it is made from metal stamped out of a wide variety of cans and containers (some will be misprinted paint cans, others holiday gift tins, still others can be very hard to figure out). This is a wonderful example of how materials that might have had to be re-melted or even end up in landfills can be used to make products that are fun and interesting.

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Suggested Classroom Activities

NOTE:
Use caution! Your boat will get hot.

NOTE:
For younger students, use two different boats to compare variables. Have the boats race each other, changing only one variable at a time.

1. Run your Putt-Putt boat in a small pool or washtub. Have students predict how many times the boat will travel around the washtub using just one candle. They can also calculate the amount of time each trip will take.

2. Have your students calculate the average speed of the boat by measuring the distance around the test chamber and timing each revolution.

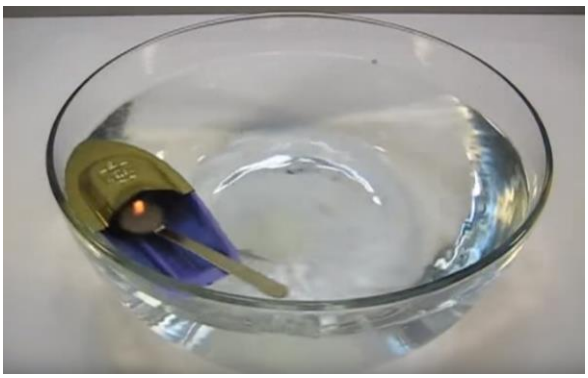
3. Have students determine if the speed of the boat changes as the fuel is consumed. Does it move more quickly at the beginning, middle, or end of the life of the candle? Other variables could include adding extra weight to your steamboat or changing the temperature of the water your boat travels through. Ask students to brainstorm additional variables that could potentially affect the speed of the boat as it travels through the water.

4. Use alternate fuels in your boat. Cooking oil and a scrap of cotton fabric works well, and so do small wood shavings. Does the type of fuel affect the speed at which the boat travels?

5. Do some fuels make the boat go further? Go faster? Both? Neither? Make a graph of fuel type vs. speed and distance.

Check out our Putt-Putt Steam Boat blog!

The Power of Steam
http://blog.teachersource.com/2009/05/28/the-power-of-steam-putt-putt-steam-boat/



NGSS Correlations

Our Putt-Putt Steam Boat and these lesson ideas will support your students' understanding of these Next Generation Science Standards (NGSS):

Elementary

K-PS2-2
The Putt-Putt Steam Boat can be loaded with water and candle fired up to investigate movement. Students can analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.

2-PS1-2
The Putt-Putt Steam Boat can be loaded with water and candle fired up to investigate movement. Students can analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.

3-PS2-2
The Putt-Putt Steam Boat can be loaded with water and candle fired up to investigate movement. Students can make observation and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

Middle School

MS-PS2-2
The Putt-Putt Steam Boat can be loaded with water and candle fired up to investigate movement. Students can plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

High School

HS-PS2-1
The Putt-Putt Steam Boat can be loaded with water and candle fired up to investigate movement. Students can plan an investigation; analyze data to support the claim that Newton's Second Law of Motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

Suggested Science Idea(s)

The Putt-Putt Steam Boat can be used to demonstrate basic principles of Newton's Laws to students.

K-PS2-2
2-PS1-2
3-PS2-2
MS-PS2-2
HS-PS2-1

The Putt-Putt Steam Boat can be loaded with water and candle fired up to investigate movement. Students can run trials to determine which variable gives the best push to the boat. Races are a natural way for students to test their ideas.

Students can make observations and/or measurements of the boats' motions to find pattern that can be used to predict future motion and provide evidence that the change in an object's motion is related to the sum of the forces on the object and the mass of the object.

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:

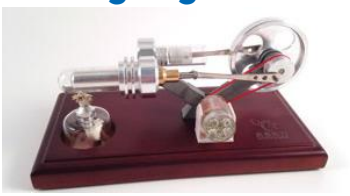
http://blog.TeacherSource.com

To extend your lesson, consider these Educational Innovations products:

Diving Submarine (SUB-10)

Remember the submarine toys you used to find in cereal boxes? This little submarine works the same way. Powered by baking powder *(not baking soda)*, it dives and surfaces just like a real submarine. As the baking powder reacts with the water, carbon dioxide is produced. This gas forces water out of the submarine decreasing its density and allowing it to surface. This is much the same way a real sub surfaces by purging its ballast tanks. After the sub reaches the surface, the gas bubble is allowed to escape, water takes its place, and the sub dives again. A great science toy for discussing buoyancy, density and the production of CO_2.

Stirling Engine with Alcohol Burner (ENG-300)



Our desktop model allows your students to witness thermodynamics in action! The Stirling Engine Model uses a closed-cycle system in which air is compressed and expanded at different temperatures to create energy. Vividly demonstrates how thermal expansion and cold shrinkage can create enough mechanical energy to power an engine, and then have that mechanical energy converted to electrical energy to light four LEDs. The alcohol burner heat source is secured in a recessed well on the finished wooden base for safety. Engine can be run repeatedly for a memorable lesson in thermodynamics.

Multi-Project Solar Kit (ROB-550)

Mini Solar building kits teach students the benefits of solar energy while they create a toy that is both fun to play with and requires no batteries. An excellent beginner building kit designed to teach how solar power is used to drive a small motor. Use solar energy to power a motor that can be used to build any of six different devices: an air boat, windmill, robotic puppy, moving car, a stationary plane, or a revolving plane. This kit includes a solar cell, motor, and 21 snap together parts.

Blob-a-Lamp (DEN-455)

Our Blob-a-Lamp is more than a mesmerizing motion light—it's a complete lesson on density! At room temperature, the colored wax blobs are denser than the liquid. But turn the lamp on and soon enough, the questions begin: which material really is denser—the liquid or the wax blobs? What makes the blobs rise? Why do they then descend back toward the lamp's base? And what does the incandescent bulb in the lamp's base have to do with any of this? Students at all grade levels will be engaged by this retro object, and are sure to be eager to learn about heat, expansion, and density.