Cloverbud Investigators: STEM for Every Season

July

Geyser Soda Car

Background:

Gully Gosh, what's a geyser? A geyser is similar to a vent or hole in the Earth's surface that intermittently discharges columns of water and steam in to the air. A geyser is truly a rare site; they require precise hydrogeological conditions for them to form. They are normally found near an active volcanic area which makes them quite rare. Different size geysers can be found in different parts of the world, some of them can shoot out thousands of liters of boiling hot water, hundreds of feet up into the air. There are only about 1,000 geysers around the world and 300-500 of them can be found in Yellowstone National Park. The most famous geyser in Yellowstone is called "Old Faithful." Yellowstone is the home of the largest geyser field in the world and includes half of the world's active geysers in nine geyser basins. The world's tallest geyser is also found in Yellowstone. It's called "Steamboat" Geyser.

So what do geysers need to form? The perfect condition for a geyser to form includes a combination of water, heat and cracks in the earth's surface. The cracks make up an underground plumbing system for the geyser. The geyser starts to form when surface water seeps through the ground and comes in contact with the heated rocks in the earth's core. You must have Magma found in volcanic areas in order for the rocks to be heated at a shallow depth. The surface water collects just under the soil surface in what we call a subsurface reservoir. As the water in this reservoir begins to heat up from the rocks, pressure starts to build. As the water begins to boil, the pressure builds until the hot boiling water is forced up through the cracks of the ground, creating a geyser. With the pressure and boiling water released, the remaining water falls below its boiling point and the eruption of steam and water stops, until the whole process starts with the heating up of the water again. Because it is rare to have a volcanic area around your back yard, in today's investigation we are going to simulate the geyser effect by making a geyser car.

Geyser Cars- Hot boiling water and a race car just doesn't sound like a safe combination to me. So how are we going to make a geyser car using diet soda and Mentos, let's try it.

Question: So how can we get the best reaction to power our geyser car? Let's get to work designing our cars using the list of supplies on page three of this investigation.

Experiment: Let's test different types of soda, by measuring the distance the geyser cars travels we will be able to figure out which gave off the best eruption. Some questions to ask before we

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get started: Will diet sodas create a more powerful eruption? What about caffeine free? Are there any differences between cola and citrus sodas?

Types of Soda we want to test	**Distance the Geyser car traveled**
Example Traditional Coke	Traveled X number of Feet

Warning: Do this experiment outside! It WILL get messy!

July's Mystery: Can we make a soda car move using only Mentos?

***Supplies*:**

- 2 liter bottle of soda
- Wheels (See how below)
- Duct tape
- Mentos
- Launching Tube (See how below)

Safety -Wear Goggles- soda will go everywhere. *Note fruity Mentos do not work for this experiment*

Science Behind Geyser Soda Car:

We will use the physical reaction of the Mentos with soda to build up pressure in our soda bottle just like the boiling water does in the subsurface reservoirs of the geyser. We will then release it to simulate a real geyser. The process we are using is called rapid nucleation. The bottled soda contains elevated levels of carbon dioxide gas, CO_2 (this is what gives soda its fizz,) which is bottled under pressure. When the bottle is opened the pressure is released, allowing the gas to come out of suspension and causes the soda to become supersaturated with carbon dioxide gas. This excess carbon dioxide precipitates from solution, forming gas bubbles. It is the release of these gas bubbles that enable us to have an eruption of soda out of the bottle. This is normally a relatively slow process; most bottles of soda do not erupt when you open them. But what happens when you shake up a bottle of soda then open it? You get an explosion of soda from the top of the bottle right? The shaking gives energy to the reaction causing it to occur faster and become more volatile. Like shaking, the addition of Mentos speeds up the reaction, causing the rapid nucleation and our geyser's eruption!

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There are two reasons why Mentos work so well. First there are over 40 microscopic layers of sugar and thousands of petite pits on the shell of each candy, and second it has considerable weight for its small size. Those tiny pits located on the surface of the candy are called nucleation sites and they're perfect places for carbon dioxide bubbles to form. The moment the MENTOS hit the soda, bubbles form all over the exterior of the candy. Combine all those pits with the fact that Mentos are heavy and will sink to the bottom of the bottle. When all this gas is released and expands, it pushed the liquid up and out of the bottle in an incredible soda blast.

What to Do:

Step 1: Decorate your plain 2 liter bottle of soda; this will be the body of your car.

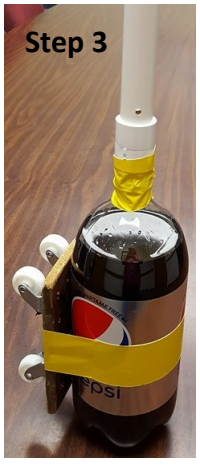
Step 2: Tape the wheels to the middle of the bottle making sure to balance your car so it moves smoothly.

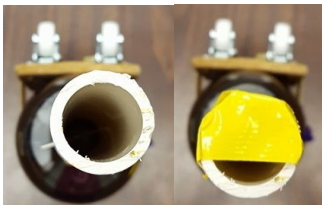
Step 3: Once outside, remove lid from bottle and use duct tape to secure Launching Tube (PVC pipe) to the 2 liter bottle. Place the trigger pin in the drilled holes of the tube and load 6 Mentos into the pipe.

Step 4: Place an extra piece of duct tape on half of the opening at the end of the lunching tube. This will help launch the car so that too much soda is not lost all at one time.

Step 5: Be sure investigators are wearing safety glasses. Hold the car at an angle and simply pull the string to launch car. The Mentos will fall into the bottle, and then quickly lay the car on all four wheels. Careful the soda will spray everywhere!

Step 2





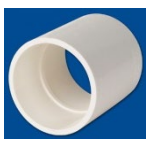
Step 4

How to build your own Launching Tube

You will need:

¾ inch PVC pipe cut to the length of 8 inches

¾ inch PVC Coupling



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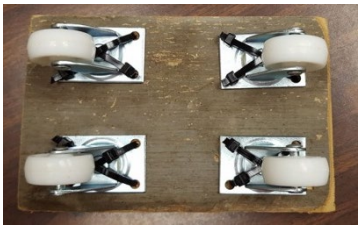
PVC Glue
Trigger Pin (A Nail with String)

Step 1: Glue together the PVC pipe and coupling.
Step 2: Drill a hole through both sides of PVC pipe about a ½ inch above the coupling.
Step 3: Be sure your Trigger Pin slides in and out of the drilled hole smoothly. For the Trigger Pin, we used a Nail tied to a string. Be sure the pin is strong enough to hold the Mentos from dropping into the soda early.

How to build your own wheel set platform

You will need:
Small Set of 4 caster wheels
A 6 inch long by 4 inch wide board (any board that can hold the weight of the 2 liter bottle will work)
Zip ties
Drill

Step 1: Cut and sand board.
Step 2: Drill holes for wheels and insert zip ties.
Step 3: Attach Wheels to board with zip ties.



Go Over Findings:

What is a geyser?

Where can you find geysers in the United States?

How did we replicate a geyser eruption?

Did using different flavors of soda make a difference?

Which soda went the farthest distance?

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What type of career might explorer geysers?

Investigate, Create, & Take: Investigators can take with them:

- ✓ An Empty Decorated Rocket Car Bottle
- ✓ Test tube of sprite and skittles-to see the reaction on a small scale

Sources:

Geysers for Kids by Science for Kids Free Science Network for Kids: http://www.scienceforkidsclub.com/geysers.html

Steve Spangler Science, Mentos Diet Coke Geyser: https://www.stevespanglerscience.com/lab/experiments/original-mentos-diet-coke-geyser/

Eepybird.com, The Science of Coke and Mentos: http://www.eepybird.com/featured-video/coke-and-mentos-featured-video/science-of-coke-mentos/

Additional Links:

How Geysers Erupt: https://www.youtube.com/watch?time_continue=159&v=_gyhvqbIaOE

Yellowstone National Park: How Geysers Work: https://www.youtube.com/watch?v=ep0pxe1gz9Q

How to build a Geyser Tube, Soda Geyser Tube: https://www.youtube.com/watch?time_continue=2&v=Y_8FfiWzCNU

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