

Makey Makey

Distance Rate and Time for Math, Science, and Physics

Measure the change in rate over your desired distance and catch the correct time as your toy car drives over simple DIY switches.



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Distance Rate and Time for Math/Science/Physics With Makey Makey



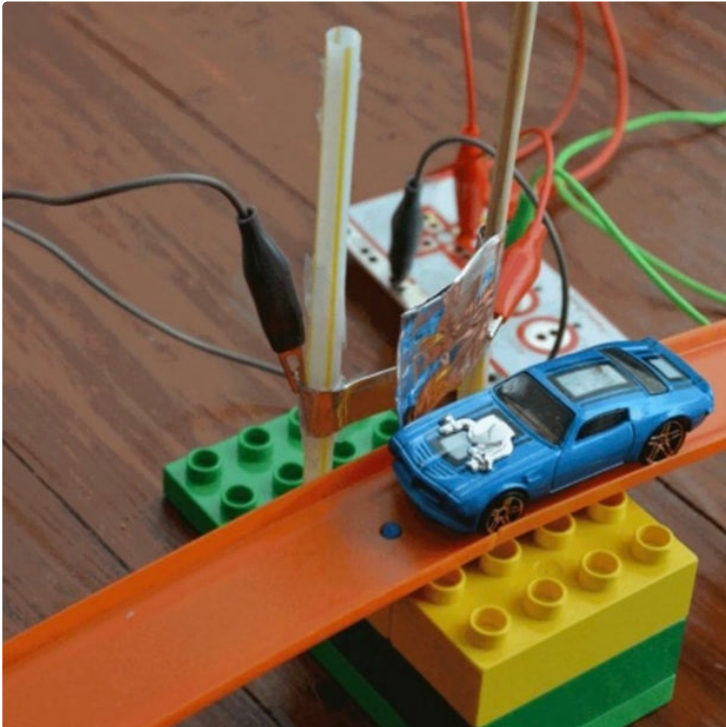
by MakeyMakey

Written collaboratively with Aaron Graves

How does acceleration change from a downward drop, to a flat surface, to an uphill ramp? With Makey Makey and Scratch you can measure the change in rate over your desired distance and catch the correct time as your toy car drives over simple DIY switches.

Supplies:

Makey Makey Classic, Hotwheels Track, Toy Cars, Magnetic weights to add to cars, DIY Switches - foil, copper tape, paper clips, coffee stirs, straws, legos, Telephone wire or hookup wire



Step 1: Building a Track

Use the Makey Makey to effectively time your car's speed- Students will use this [Scratch game](#) (or create their own game) to record the amount of time the car travels over a given distance.

1. Students will set up ramps for the toy car. Make sure they create a potential and kinetic energy scenario by having a downward ramp at the start and an upward ramp near the middle or at the end of each track.
2. Demonstrate how to measure the slope for each ramp and record data on the experiment log.
3. Create DIY switches to start and stop each experiment. In the game we've created, there is a start/stop for acceleration and a start/stop for deceleration. (That makes four switches total.)

<https://www.youtube.com/embed/mubxBIUqGsl>

Educator Tip:

Note on Standards

These lessons were developed with the idea that teachers all over the globe and a variety of grade levels could hack the lesson plan to meet their students' needs. Therefore, these are just some of the standards the lessons are based on, and not an all-inclusive list. Many of the CCSS align by grade level, so if you teach 9th grade, you could find the stair-stepped standard for CCSS.ELA-LITERACY.W.8.6 by looking at CCSS.ELA-LITERACY.W.9-10.6.

Step 2: Get Inventive With DIY Switches: Tip #1

Ideas for DIY Switches

Let your students get inventive with the switches for their car track. Here are some things to think about when designing switches.

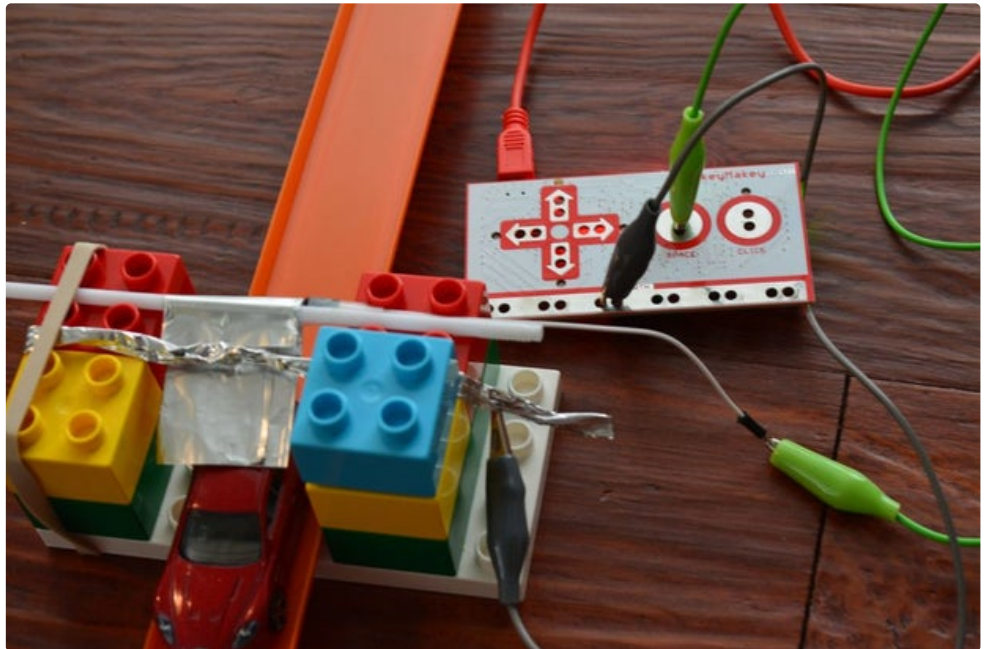
- Do I want the car to roll over a pressure switch? (Share ideas like this [air gap switch](#) by Josh Burkert)
- Do I want the switch to be activated by the motion of the car?
- Can I create a flag that makes a connection when the car drives past?

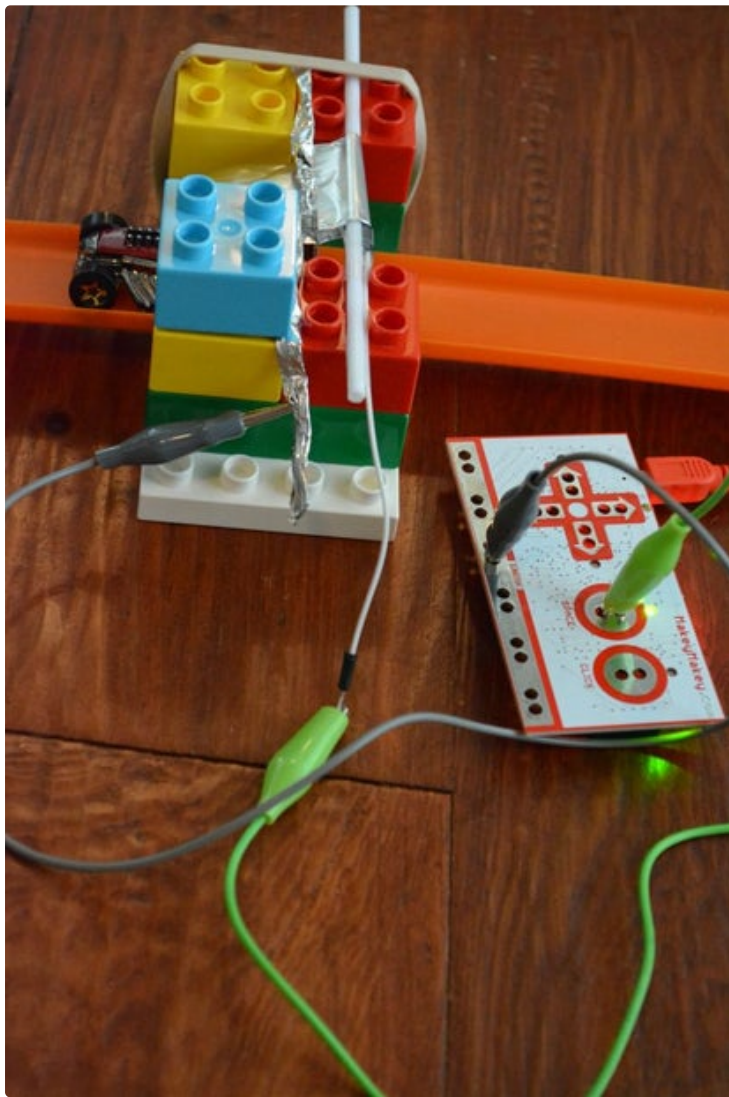
This game has a timer that starts when the car begins to accelerate and when the car hits the lowest point of the track. At that point, we set up another switch to time the deceleration of the car. You need to make four switches total.

Tip #1: In this switch, we used a foil strip for **EARTH** and made a foil flag over a coffee straw for the key press input (in this case **SPACE**.) When the car drives down the track, it pushes the flag up and completes the circuit when the flag touches the **EARTH** foil strip.

Educator Tip:

Feel free to use or [remix this project in Scratch](#) for timing acceleration and deceleration.





Step 3: Get Inventive With Switches: Tip #2

Tip #2: This switch is a nod to a common start gate in Hot Wheels and uses a contact flag switch. This contact switch is also similar to an electronics component often called a snap action SPDT or roller lever switch.

To build this switch, we used straws as the flag post since they fit perfectly in a Duplo LEGO. Then we made one steady aluminum flag for **EARTH** (on the right with the grey alligator clip in the picture), and one moveable aluminum flag connected to the up arrow key press. The moveable flag is rapped around a wooden dowel and placed into a straw which allows the flag to move easily when the car hits the flag.

As the car passes this switch, the key press flag

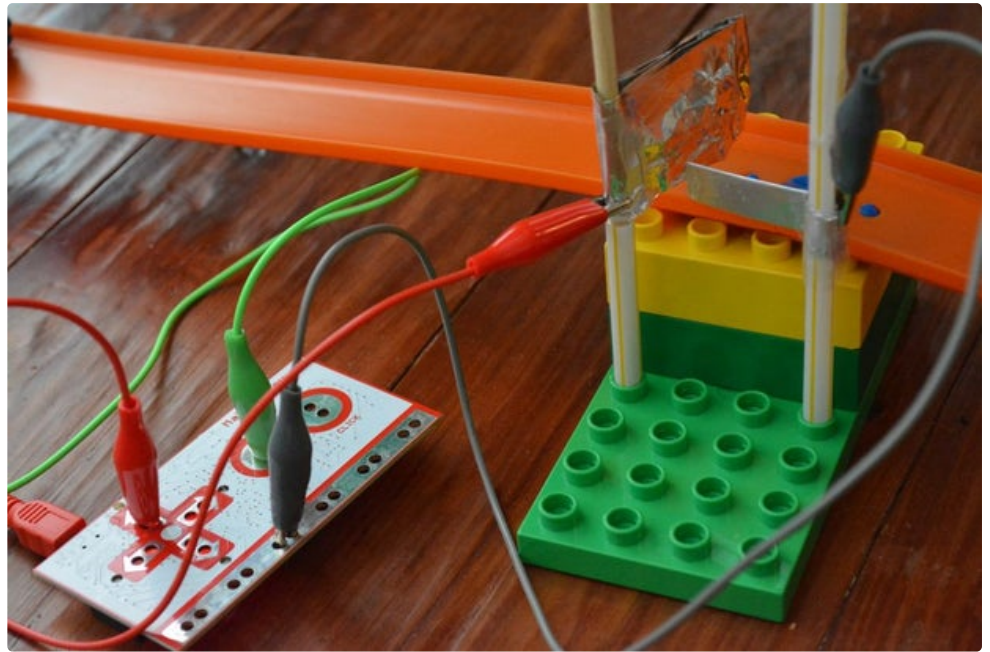
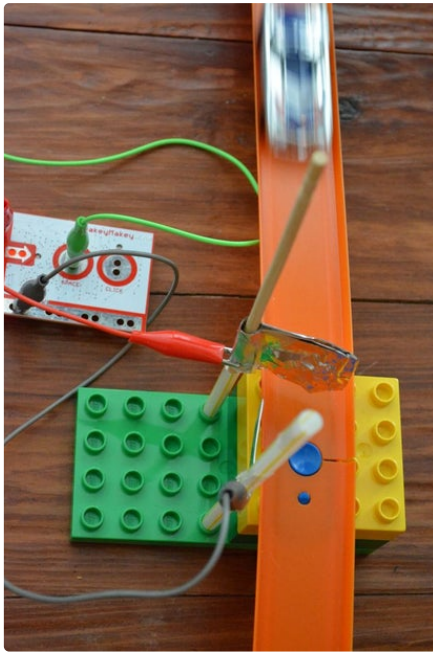
rotates and hits the steady flag connected to **EARTH** thus completing the circuit and allowing Scratch to start or stop the timer.

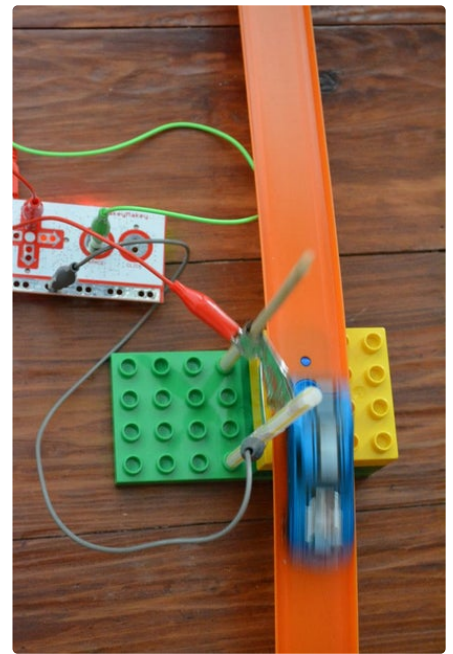
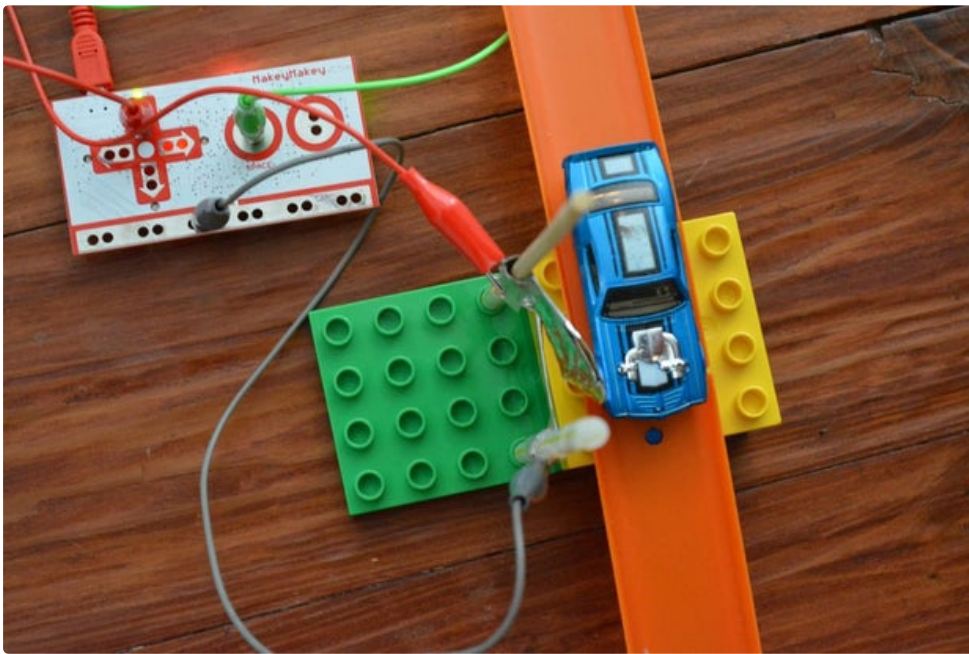
We used this particular switch to stop the timer for the end of the car's acceleration on the track.

Rapid Education built a pretty cool switch idea for Hot Wheels timing gates. Check it out!

Educator Tip:

Feel free to use or [remix this project in Scratch](#) for timing acceleration and deceleration.





https://www.youtube.com/watch?time_continue=93&v=hKzZKgLKiks

Step 4: Wiring Switches

Feel free to use or remix [this project in Scratch](#) for timing acceleration and deceleration.

To wire your switches, attach alligator clips to switches and Makey Makey as follows:

- Acceleration Start- Spacebar (and earth)
 - Acceleration End- Up Arrow (and earth)
 - Deceleration Start- Down Arrow (and earth)
 - Deceleration End- Right Arrow (and earth)
-

Step 5: Log Distance and Rate in Time With Scratch

Students can use [this chart](#) or create their own to log the dedicated distance, changes in slope, time of travel, and added weight for each experiment.

Students will need to log the time for each car trip and hit the green flag to reset the time. They can run as many experiments as you desire.

Utilizing Distance Formula to find Rate

[The Scratch game](#) has a formula built in and is programmed to run the equation 10 times.

- To use the built-in formula have your students connect the 'w' key to an 'equation' switch.
- If students want to log more than 10 answers, they can hit the 'w' key again to start the equation over.

Step 6: Extensions (Optional)

Here are some ideas for Extensions!

- Convert rate from inches per second to miles per hour.
- Change the slope of the ramp and perform the experiment over again! How much did the rate change in conjunction with the change in slope? Create a line graph of your experiments.
- Create a word problem based on this experiment.
- Use a small ball or marble to recreate the experiment.
- Add friction to the track with strips of double stick tape or adhere sections of paper to the track.
- Create a jump on the track between two timers. Does the car travel faster or slower now? Why?