CARD 3

Discover Robotics & Physics

5 POINTS

Card 3 Overview

Electric Racer

Ever wonder how batteries work? What's going on in there? Batteries store energy as chemicals ready to react. One chemical at the anode (the - end) sends electrons to a different chemical at the cathode (the + end). That's why machines don't work if you put the batteries in the wrong way; the electrons can't flow. Circuits use this chemical reaction to generate electricity, which can do the work of propelling a racer!

P1 — Electric Racer

Using balloon power helps speed up the car, but all the drag is slowing it down! Redesign the dragster to run off an electric motor.

Stop after Step #4 and test it out!

Use Cortex to program the motor to turn on and power the racer.

Hint: look back at Yellow Cards 3 and 4 for a programming refresher course.

Compile and run to get those battery juices flowing.

You've created an electric car!

Even with the batteries at 100% the car is still pretty puny. It's going to take a few more parts to really speed things up.
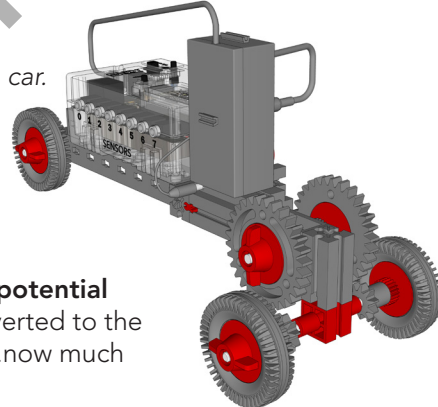
Finish the build to add gears to the car.

Run the program again to take advantage of the new gears.

Now you've got yourself a real racer!

As the car pulls forward, the **electric potential energy** stored in the batteries is converted to the kinetic energy of the wheels turning...now much quickly because of the gears!

P2 — Programming ON FOR and NUMbers!

Open the **MOTOR** command tab and click and drag the **ON FOR** command onto the user canvas in place of the **ON** command.

The **ON FOR** command has an arm extending off its side like many commands in the Cortex. This signifies that there is additional information required for the command to function.

In the blue **SENSOR** command tab find the **NUM** (number) variable. Number is a value that can be adjusted up or down by selecting the value inside.

Attach the **NUM** (number) to the **ON FOR**. Notice that the picture shows" **NUM 10**." Double click on the **NUM** command to adjust the value to **10**.
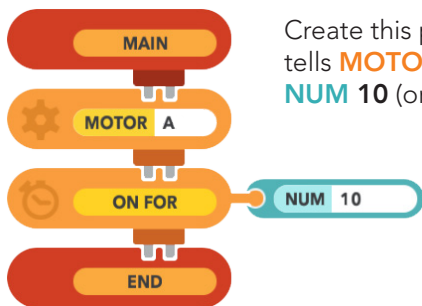
A value of **10** equals 1 second; **NUM** indicates time in tenths of a second.

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LABCards

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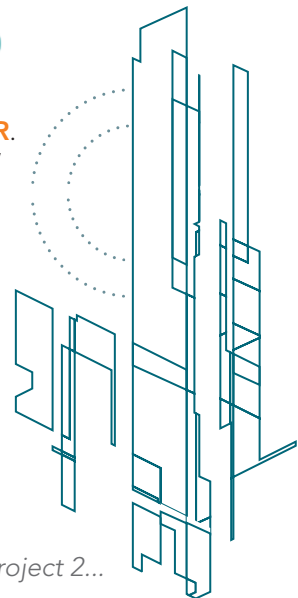
PCS

P2

Continued...

Create this program, which tells **MOTOR A** to run for **NUM 10** (one second).

MAIN

MOTOR A

ON FOR — NUM 10

END

Compile and run your program. Check your progress on the status bar in the lower right hand corner of Cortex.

If set on the floor, the racer should roll either forward or backward for 1 second. If the race rolls backward, switch the red and black motor cables and run the program again

Experiment with different **NUM** values. Remember to compile each time the program is changed!
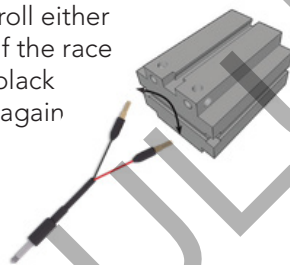
C1

There and Back Again

Use the kinetic energy of the racer to create potential energy.

Hint: How have you powered the racer with potential energy before?

C2

10 Second Dash

Program the racer to go for 10 seconds.

NUM

Hint: How many tenths of a second are in 10 seconds?

Then again for 25 seconds!

DP

Start to Finish

Program the racer to drive the same distance as five of your steps. To make a start and finish line, place a block next to your foot, pace out five steps, and put down a second block to mark the end. See how close you can get to stopping the racer right at the second block.

Key Terms

- **Circuit** – A closed path for electrons (and thus electricity) to travel around.

- **Electrical Energy** – A type of potential energy created by movement of electrons in a circuit.

- **Electron** – A negatively charged subatomic particle (or, a negative charge even smaller than an atom).

- **NUM** – A programming command that defines a numerical value, such as telling the motor how many seconds to run.

  * Remember: NUM counts in tenths of a second, so a value of 10 equals 1 second.

- **ON FOR** – A programming command that allows a motor to turn on for a set amount of time.

Check for Understanding

- Why does the racer go slower when going uphill; is the electric potential energy all converted to kinetic energy?

- How long does the **ON FOR** command tell the motors to run when a **NUM** command with a value of 20 is attached?

- How long would you need to keep the motors on to make the racer go 100? 1000 steps?