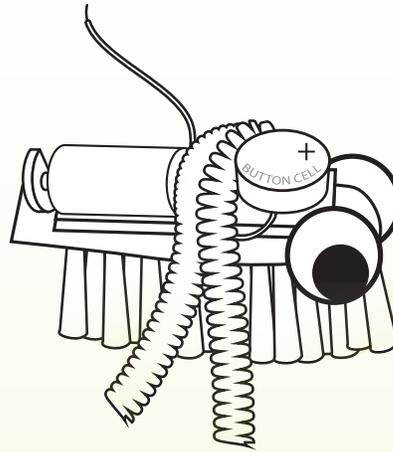


Bristlebot Challenge



Topic: Students make a simple electric circuit.

Suggested grades 3 - 5

Target standards – Grade 4

Materials/Resources needed:

- Bristlebot parts
 - Toothbrush head (toothbrush handle removed)
 - Small button battery
 - Small pager motor
 - (2) 3 inch pipe cleaner
 - (2) Googly eyes
- Attachment materials (double stick tape, tape, hot glue etc.)
- Sharpie pen

Prep time: 10 minutes

Lesson time: 20 minutes

Teacher-guided student worksheets: 15 minutes

Language arts activity: 1 hour

Outcome: Students build a robot using a simple circuit. They apply what they learn to creating challenges.

Standards:

In appendix

Vocabulary:

In appendix

Prep



- Set up each tray / group.
- If using double-sided tape instead of hot glue, pre-cut the pieces to be the approximate size of the toothbrush head.
- Set of Bristlebot parts (one for each student).
- Make additional attachment materials available.
- Make items available to create raceways or challenges at a separate table.
 - Legos
 - Blocks

Engage



- Show the story of the home companion robot, Kuri at wired.com/story/the-genesis-of-kuri/
- Ask the students if they would like to make their very own robot pet and develop games and challenges using their robot.

Teach/Build

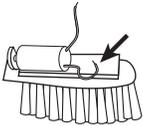
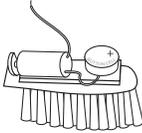
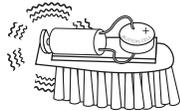
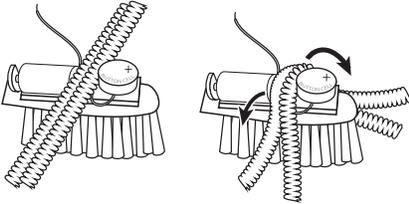


- Ask students, "What stores electricity?"
 - Write/draw the responses on the board (encourage students to notice objects that store energy in the room). Have a flashlight to demonstrate.
- Draw and label battery on the board with lines extending from the positive and negative sides.
- Ask the students to give examples of what the battery can power.
 - List examples on the board.
- Draw in a light bulb and make a complete circuit.
- Write the word circuit on the board.
- Ask the students, "How can we turn the light on and off?"
 - Write the word "switch" on the board and draw a switch on the circuit.
- Tell the students they will be making a circuit to build a robot using a motor instead of a light bulb.
 - Erase the light bulb symbol and replace with a motor symbol.
- Have the students draw and label a circuit on the student worksheet.
 - a. Wire
 - b. Battery
 - c. Load /motor
 - d. Switch
 - e. Positive
 - f. Negative

Teach/Build



- Demonstrate the Bristlebot
- Using the materials which have already been set up on a tray, help the students assemble their own Bristlebots. Walk them through the following steps:

<p>a. Using double-sided tape or hot glue, attach the motor so that the wires are facing the front of the toothbrush. Make sure that one of the wires is stuck on the front part of the toothbrush.</p> 	<p>b. Attach the button battery, positive side up. Make sure that the wire is firmly in place below the battery.</p> 	<p>c. Test the bot by taking the other wire and touching the top (+) side of the battery. The bot should vibrate.</p> 
<p>d. Attach the pipe cleaner "legs" by firmly wedging in between the motor and battery. Bend the pipe cleaners to touch the surface. They may need to be adjusted later.</p> 		<p>e. Using hot glue, attach the googly eyes.</p> 
<p>f. Using a Sharpie pen, write student initials on the cut side of the Bristlebot.</p>	<p>g. The "switch" can be a piece of clear tape to hold the wire in place on top of the battery.</p>	<p>h. Name your Bristlebot.</p>

Explore



- Have the students free play with their Bristlebots using the trays as containment.
- Help the students adjust the pipe cleaners to experiment with balance or direction.

Activity



- Have each student group brainstorm a Bristlebot challenge using the materials available in the classroom. Explain the challenge as “Can you get your Bristlebot to.....?”
- Give each group 15 minutes to design and write down the rules for a challenge.
- Have one member for each group explain their challenge and pick two students to demonstrate.

Assessment



- Students apply their learning in developing a circuit by building a Bristlebot.

Crossover



- Have students write a story about the “Adventures” of their Bristlebot.
- Using classroom materials have students create scenery for their Bristlebot and photograph for a comic book storyline.
- Experiment with varying positions of the pipe cleaner legs. Journal the observations.

Accommodations and Extensions



- Have sufficient adult help on hand to help younger students with handling small parts.
- Have students write instructions for building a Bristlebot in another language.
- Have the students write a marketing campaign using their Bristlebots to encourage good teeth brushing habits.

Anticipated Misconceptions



- Students may think that robots are difficult to make.

Safety



- Have safety rules in place for using a glue gun.
- The Bristlebot is not for brushing teeth.
- Do not place small objects in mouth.

Front Loading



Read one or more of the following books:

Robots Run Wild by Jenny Feely

Boy and Bot by Ame Dyckman

Robot Bedtime Book by Daniel Errico

Oh No! How My Science Project Destroyed the City by Mac Barnett

I Like Robots by Olga Kilicci

The Robot and the Bluebird by David Lucas

References



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Additional References and Digital



Watch National Geographic Common Facts About Robots

youtube.com/watch?v=UuPALmipntw

I Love My Robot Song

youtube.com/watch?v=at92ZyiFew4

To include toothbrush habits with robots (for younger students)

youtube.com/watch?v=-aY18vhaiNo

On a rainy day, watch a Youtube compilation about a morphing pet robot

youtube.com/watch?v=MHslEingSkl

To teach the Robot Dance for older students, basic moves

youtube.com/watch?v=LY-9zbGGK44

youtube.com/watch?v=b8UeUyhx14U&list=PLxt8W8Os1kk7MdS4NK_bUEC-BXGIWEkPY

Or watch the 2005 movie Robots.

Appendix



Standards

4-PS3 Energy

Students who demonstrate understanding can:

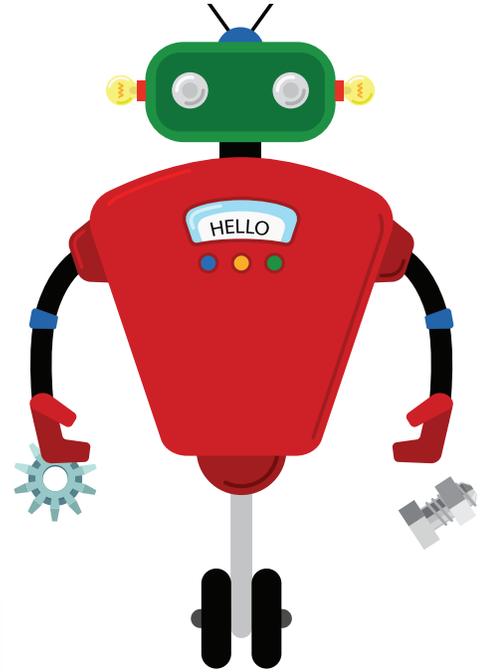
4-PS3-4 Apply scientific ideas to design, test and refine a device that converts energy from one form to another.

Common Core State Standard Connection

- Mathematical practices.
- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

Vocabulary

- Battery – Device which stores electricity.
- Circuit – Path which the electricity follows.
- Electron – A sub atomic particle with a negative charge.
- Load – Device which uses electricity on a circuit.
- Motor – Electrical device which moves something.
- Negative – Part of the battery which receives electrons.
- Positive – Part of the battery which pushes electrons.
- Switch – Mechanism which opens and closes a circuit.
- Wire – Material through which the electric current passes.



Credit



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