K-STATE Research and Extension

Kansas 4-H Project Challenge

4-H STEM: Junk Drawer Robotics

A robot is a machine that can be programmed to perform repetitious, physical tasks, or imitate some of the things that a person can do. Scientists developed the first industrial robots in the 1950s. Today they can be programmed to do almost anything — from vacuuming the house to defusing bombs to space exploration.

We can use items found around the house, even in our "junk drawers," to begin exploring how robots work.

Starting Out

- Imagine what a robot might look like if you were the scientist designing it.
- Think about what you would like your robot to be able to do for you. . . . and no, doing your homework is not an option, as you would have to program your robot to be able to give you the correct answers!

Learning More

Study "robotic hands" and grabbers.

- How do they work?
- What makes them work well?

Look around the house and see what you might have that could become a set of grabbers. Try them out.

- What works best? Why?

Expanding Horizons

- Learn how to construct a simple circuit to power your robot by first completing the "DIY Flashlight" activity.
- Study how robots move. Look around the house and see what you might have that could become a robot mover. Try it out.
- What worked best? Why?

Inspire Kids to Do

Skill Building

- Learn about the everyday uses of robots in our lives.
- Observe the different functions of a robotic grabber.
- Study the ways robots move.

Goals

- Identify the different parts of a robot and how they work.
- Create a simple electrical circuit.
- Build a basic "junk drawer" robot.

Project Ideas

- Show your robotic creation to your 4-H club members. Tell them how it works.
- Create a display of things robots can do for us.
- Build a simple robot from a kit.

Self-Evaluation Before

Using the rating scale below, answer the following:

1 = not at all
2 = a little
3 = a lot

I know how to…

Identify the different parts of a robot ..... 1 - 2 - 3

Create a simple electrical circuit ..... 1 - 2 - 3

Build a basic "junk drawer" robot ..... 1 - 2 - 3

4-H STEM: Junk Drawer Robotics Challenge

Challenge Instructions

- Complete the Designing My Robot Worksheet, on p. 3.
- Take simple materials from around the house and from your "junk drawer" to build a prototype of your robot.
- Create a simple electrical circuit by making a "DIY Flashlight," on p. 4

When finished, please visit: www.tinyurl.com/KS4H-Challenge to tell us what you learned.

Helpful Tips

- Use old cds, plastic cups, foam or aluminum trays, straws, clothes pins, or anything lightweight to construct your "junk drawer" robot.
- Electrical tape works well to hold your circuit wires and other parts together.
- Build your circuit first. Make sure it works. Tape the connections, then attach it to your robot.

Leadership

(Suggested for Intermediate and Advanced Levels.)

- Show other 4-H members how to build a robot.
- Help lead a workshop for new robot project members.
- Other _____

_____

_____

_____

Curriculum and Resources

To learn more about the 4-H Robotics project, visit kansas4-h.org

- National 4-H Robotics Curriculum, www.4-hmall.org
- Level 1 – Give Robots a Hand
- Level 2 – Robots on the Move
- Level 3 – Mechatronics
- Youth Robotics Notebook
- Junk Drawer Robotics Toolkit

Life Skills Learned (check all that apply)

- ☐ Positive Self-Concept
- ☐ Inquiring Mind
- ☐ Concern for Community
- ☐ Sound Decision-Making
- ☐ Healthy Interpersonal Relationships

Share

- ☐ Set up a robot display at your school or public library.
- ☐ Help a younger member build a "junk drawer" robot.
- ☐ Give a talk to your class about robots.
- ☐ Demonstrate how to make a "DIY Flashlight."
- ☐ Other _____

Evaluate Your Experiences!

What did you use to create successful robotic grabbers? Why did it work? _____

_____

How did you make your robot move? _____

_____

What was your biggest challenge in creating a "junk drawer" robot?

_____

_____

To complete the Challenge, take a selfie while doing the activity. Upload the photo and take the survey about your Challenge experience.
www.tinyurl.com/KS4HChallenge

Self-Evaluation After

Using the rating scale below, answer the following:

1 = not at all
2 = a little
3 = a lot

I know how to…

Identify the different parts of a robot ..... 1 - 2 - 3

Create a simple electrical circuit ..... 1 - 2 - 3

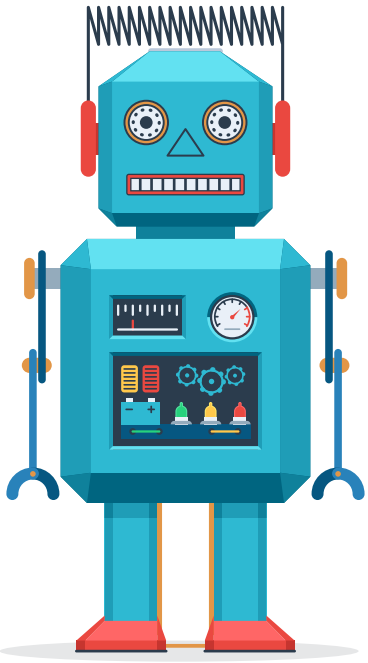
Build a basic "junk drawer" robot ..... 1 - 2 - 3

Local Contact Information

Kansas Clover Classroom
Adapted from NW 4-H Advisory Challenge created by
Susan Schlichting,
4-H Youth Development Agent,
Cottonwood Extension District

Designing My Robot

New robots are invented by robotics engineers every day. Your ideas on paper have the possibility to become a real, working robot one day. Dream big!



Draw a picture of a robot. Think about what tasks your robot can do and what you would name your robot.

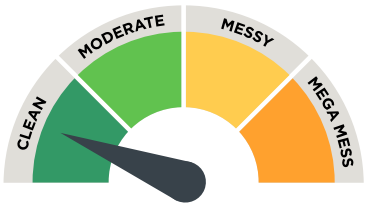
My robot is named:

My robot can do these things:

DIY Flashlight

In this activity, kids will learn about electrical energy using batteries and conductors. Kids will use the materials to create a battery-powered flashlight with an on/off switch.

This activity requires use of scissors and wire strippers.



The Messy Meter

Recommended Grades:
4 - 7

Estimated Time:
1 Hour

Subject:
Electrical Engineering

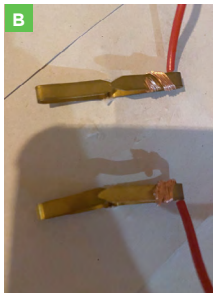
WHAT YOU'LL NEED

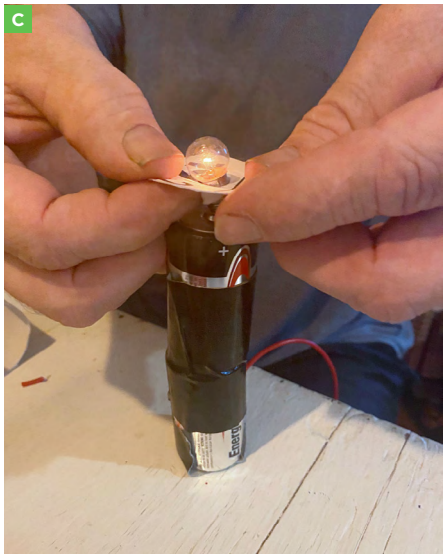
- Cardboard paper towel roll
- Small piece of additional cardboard
- Two large brass fasteners
- Red and blue copper wire (or one wire labeled red/blue by coloring scotch tape with marker)
- 1.8W lightbulb
- 2 D cell batteries
- Electrical tape
- Scissors
- Wire strippers
- Paper cup

Bonus Fun:

See what happens when you try using batteries with different voltages. How does that change how the light looks?

STEPS:





1. First, read to your group the background information in the Explanation section below to understand how electrical currents work, and how this flashlight will work.
2. To begin the activity, take a piece of cardboard and trace a circle using the end of the opening cardboard paper towel roll. Cut this circle out.
3. Cut a small hole in the center of the cardboard circle and carefully place the lightbulb through it.
4. Then take the cardboard paper towel roll and cut it lengthwise.
5. Using two brass fasteners, insert the first fastener inside the seam you just cut, approximately 2 inches below the top edge of the cardboard. Then, place the paperclip around it and insert the second brass fastener close enough for the paperclip to reach it. (see image A for reference)
6. Next, take two pieces of individual copper wires and strip them so that approximately two inches of copper is exposed on both ends. Use different colors or label them 'red' and 'blue'
7. Wrap the red wire around the first brass fastener and the blue wire around the second, and fold the fasteners over to secure the wire (see image B for reference).
8. Place the two D cell batteries on top of each other with the opposite terminals touching and secure them together tightly with electrical tape (see image C for reference).
9. Take the lightbulb in the cardboard circle and place it at the opening of the cardboard roll.
10. Lay the batteries flat on top of the brass fasteners and secure them in place with duct tape. Make sure the positive battery terminal makes contact with the metal tip of the lightbulb.
11. Wrap the exposed red wire on the first fastener around the metal base of the lightbulb and secure it with electrical tape.
12. Now, it's time to turn your flashlight on! Take the exposed blue wire connected to the second brass fastener and secure it to the bottom of the second battery using electrical tape. Once you connect the paperclip to the second fastener, the lightbulb should light up! To turn the lightbulb off, simply disconnect the paperclip.
13. Roll the cardboard roll together and secure using electrical tape. Flatten and cut the bottom off the paper cup to fit around the top to focus the light from the lightbulb. Secure using electrical tape.

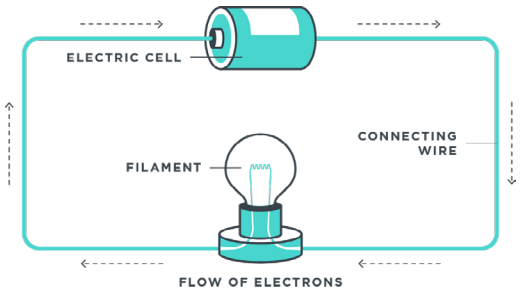
Questions to Engage Youth:

1. Why do the wires need to be stripped to make the lightbulb light up?
2. Why do the batteries need to touch the brass fasteners?
3. Is the circuit "open" or "closed when the paperclip touches both brass fasteners and the light is on?
4. Why is it important for the metal tip of the lightbulb and the positive battery terminal to touch?
5. How does the paper cup change how the light looks?

Explanation:

How Electrical Currents Work:

For electricity to work, electrons flow (electric current) must make a complete path, returning to the starting point. This path is called a circuit. What does the word circuit mean? The word circuit comes from the word circle since the electrons must travel in a circle to keep flowing.



The electrical current's path of circuit is considered to be closed if electrons are allowed to flow completely through the cycle. An electric circuit is considered open if the electrical path is broken and electrons are not allowed to flow to complete the cycle.

How batteries work: Batteries are a way to store electrical energy. In order to access that energy, you need to create a circuit using the battery's direct current.

How This Flashlight Works:

When you taped the batteries together, and attached the wires to the negative terminal and to the metal base of the lightbulb, you created a closed circuit which allowed energy to flow from the batteries into the lightbulb and light it.

The brass fasteners act as conductors of electricity. When you touched the metal paperclip to both fasteners, this created another closed circuit to act as a switch. Finally, the paper cup helped to illuminate the lightbulb by diffusing the light it emits.

Career Connections:

If you enjoyed working with electricity and building a circuit, you might want to explore becoming an electrical engineer. Check out our interview with Martin Nelkie, an electrical engineer in South Dakota at **4-H.org/ElectricalEngineer**.

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DIY Flashlight activity used with permission of University of Florida IFAS Extension.

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Kansas State University Agricultural Experiment Station and Cooperative Extension Service

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