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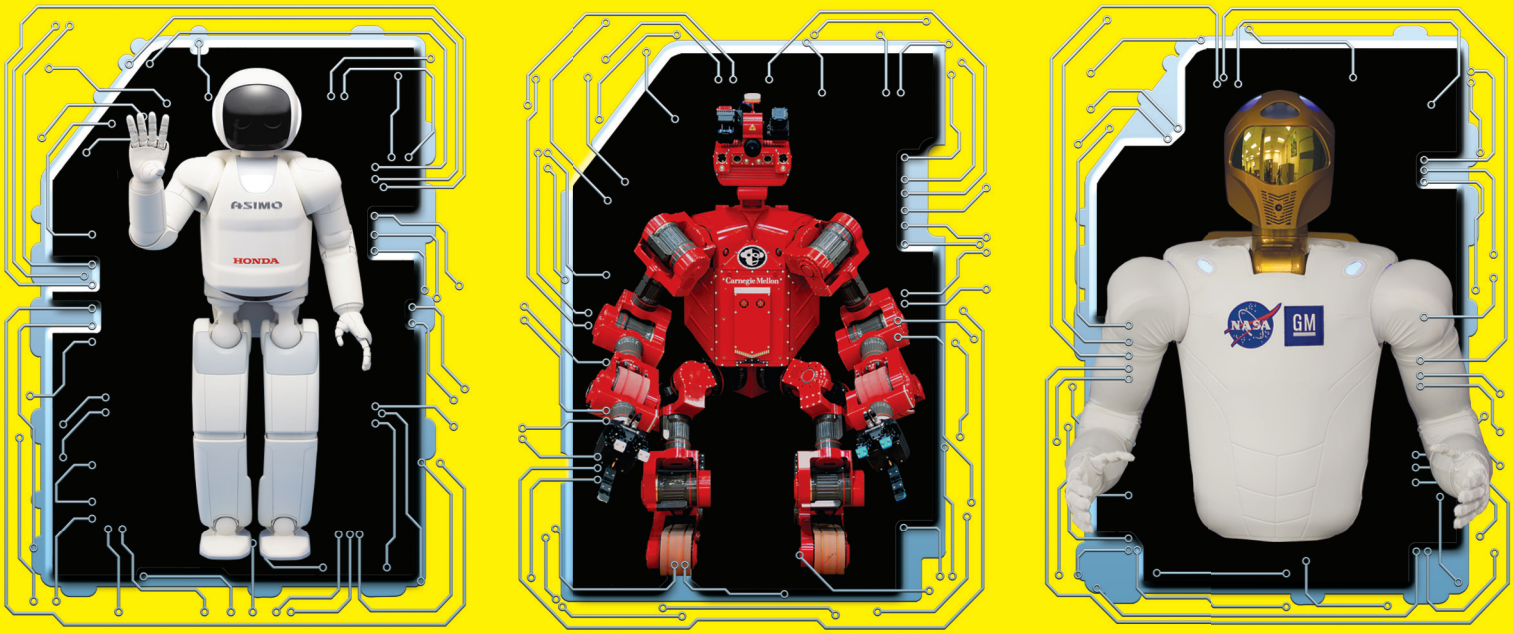
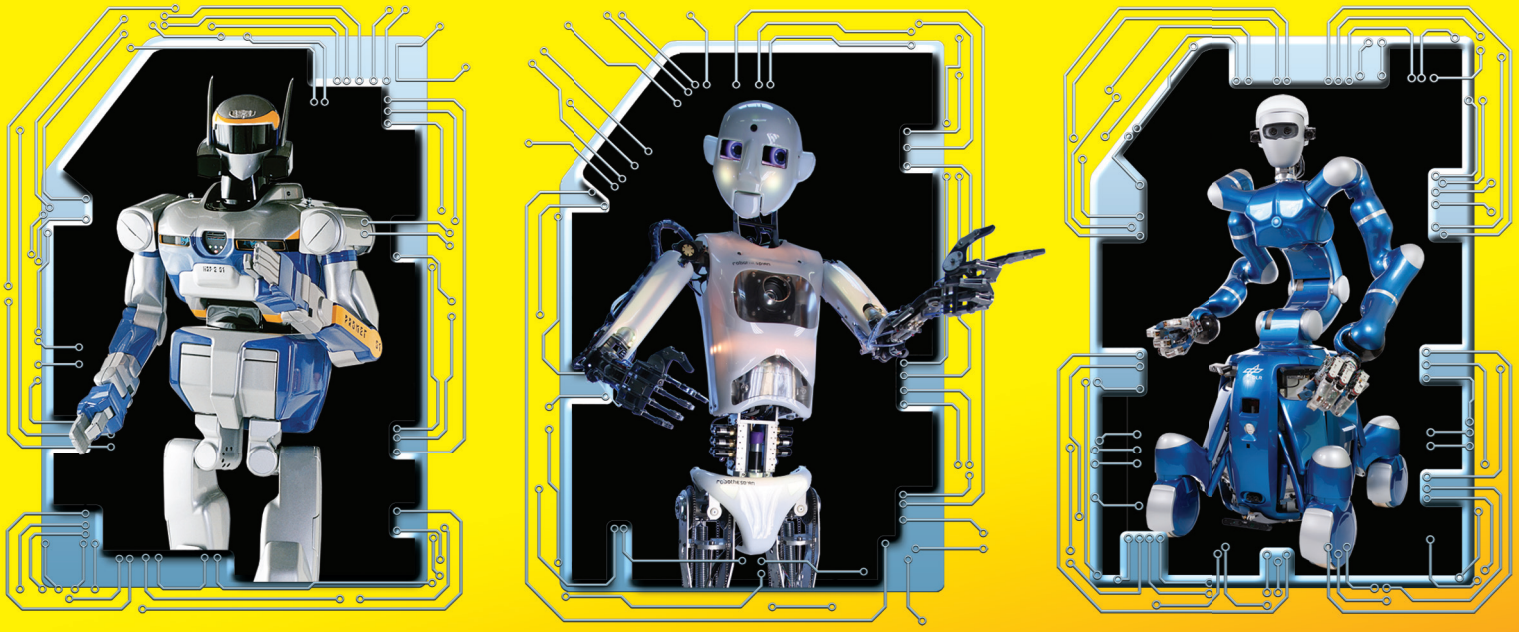


ARE YOU READY?



NATIONAL GEOGRAPHIC PRESENTS

ROBOTS 3D

PRESENTED BY LOCKHEED MARTIN

ACTIVITY KIT GUIDE

NATIONAL GEOGRAPHIC

Symantec.

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ROBOTS
PRESENTED BY LOCKHEED MARTIN

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Visit www.NatGeoEd.org/Robots to find more robots content.

Dear Educator,

Robots are fascinating. Students of all ages are captivated by these mechanical marvels that sometimes seem like science fiction come to life. This kit, intended for students in Grades 1-12, capitalizes on students' interest in robots to encourage them to explore related science and engineering topics. The hands-on activities in this kit cover topics ranging from circuits to simple machines to even writing algorithms. In each activity students learn simple concepts in a hands-on way and apply this information to the more complex uses of these concepts in robotics. This kit addresses the basic building blocks of robotics, so it is a useful tool for students who want to design or build their own robot.

This kit was developed as a companion to the National Geographic film *Robots 3D,* which examines advances in humanoid robots. The kit consists of ten activities that can be used individually as stand-alone activities or combined in different ways for longer, more in-depth units of study. The activities are designed around a set of common, inexpensive materials. Several of the activities use the same materials to minimize costs.

The activities in this kit are easily integrated into any STEM education program. They are designed to address Next Generation Science Standards and integrate scientific inquiry and engineering process skills into the classroom. Because the kit is customizable, you can choose the activities that work best with your classroom needs.

The following pages include information on how to use the guide and tips for using the activities in your classroom. You will also find a complete materials list for all activities, worksheets and handouts, warm-up ideas, and a list of standards addressed by the kit. A description of each activity and a link to its full text are also included.

We know these activities will really capture your students' interest and offer excellent opportunities for hands-on learning. We hope you enjoy using them.

Sincerely,

National Geographic

Table of Contents

How to Use this Guide

The hands-on activities in this kit include options for Grades 1-12 in five topic areas: Electricity and Circuits; Actuators, Mobility, and Sensors; Simple Machines and Gears; Programming and Operation; and Real-World Application. In this section of the guide you will find the activities broken down by grade level and topic. You will also find general tips for using these activities in the classroom and tips about the materials needed to conduct the activities.

Activities by Grade Level

If you choose to use multiple activities within a topic, they are listed in suggested order. Suggestions for activities from other grade levels that are adaptable as additional activities are also listed.

Grades 1-2

- Electricity and Circuits: *Circuits with Friends* (Grades 2-5)
- Actuators, Mobility, and Sensors: *Making "Sense" of Robot Sensors* (Grades 1-5)
- Simple Machines and Gears: *Simple Machine Challenge* (Grades 2-8)
- Programming and Operation: *How to Train Your Robot* (Grades 2-8)

Additional Activities:

- Extend the learning for students who need additional challenges with *Exploring How Robots Move* and *Gearing Up with Robots.*
- Use the modifications suggested in *Building Circuits* to use the activity with this age group.

Grades 3-5

- Electricity and Circuits: *Circuits with Friends* (Grades 2-5), *Building Circuits* (Grades 4-8)
- Actuators, Mobility, and Sensors: *Exploring How Robots Move* (Grades 3-8), M*aking "Sense" of Robot Sensors* (Grades 1-5)
- Simple Machines and Gears: *Simple Machine Challenge* (Grades 2-8), *Gearing Up with Robots* (Grades 3-8)
- Programming and Operation: *How to Train Your Robot* (Grades 2-8)
- Real-World Applications: *Think Like a Robot … And Stay Safe Online!* (Grades 5-9)

Additional Activities:

- Extend the learning for students who need additional challenges with *Round and Round with Simple Motors,* using the modifications suggested in the activity.

Grades 6-8

- Electricity and Circuits: *Building Circuits* (Grades 4-8)
- Actuators, Mobility, and Sensors: *Exploring How Robots Move* (Grades 3-8), *Round and Round with Simple Motors* (Grades 6-12)
- Simple Machines and Gears: *Simple Machine Challenge* (Grades 2-8), *Gearing Up with Robots* (Grades 3-8)
- Programming and Operation: *How to Train Your Robot* (Grades 2-8)
- Real-World Applications: *Think Like a Robot … And Stay Safe Online!* (Grades 5-9)

Additional Activities:

- Use *Circuits with Friends* as a quick warm-up or re-teaching activity.

Grades 9-12

- Actuators, Mobility, and Sensors: *Round and Round with Simple Motors* (Grades 6-12)
- Real-World Applications: *Think Like a Robot … And Stay Safe Online!* (Grades 5-9), Redefining Work Debate: *Are Robots Taking Over Our Jobs?* (Grades 9-12)

Additional Activities:

- Use the modification suggestions in *Simple Machine Challenge* as a cross-curricular learning extension for older students.

General Tips

- Many of the hands-on activities in this kit are designed to be done in small groups. To facilitate group work, try the following:
  - Create groups with a variety of ability levels.
  - Have students work in the same groups throughout the different activities.
  - To ensure that all students participate, have each student in the group take on a specific role (e.g. recorder, materials manager, leader, clarifier). Have students change roles for each activity so they get a chance at every role.
  - Consider providing a simple rubric for group work and have students evaluate their own participation.
- Hands-on activities require materials. To manage those materials:
  - Arrange all materials in one location. Group each material separately and label each group with the number needed. For example, if students need one battery, four wires, and two lightbulbs for an activity, place all the batteries in one group, labeled with a "1", all wires in one group labeled with a "4", and all lightbulbs in one group labeled with a "2."
  - Have each small group send one person to gather and later return all needed materials. Students should get the number of materials indicated from each group of materials.
  - Provide a small box or tray in which students can gather their materials and transport them back to their group.
- Try out each hands-on activity yourself in advance to ensure you understand how it works and that the materials you gathered work as expected.
- Be sure to incorporate checkpoints within hands-on activities to ensure students are on the right track before they continue.
- When students have completed an activity, discuss it as a class to ensure that all students understand what they have learned and have a chance to ask.

Materials List

The materials lists below include a comprehensive master materials list for ALL activities organized by type of material and a list of materials per grade band. Use these lists to create your own custom kit.

These lists account for five small groups to complete each activity. The total quantity of each item needed for each group to participate in every activity follows its name in parentheses. When items are required for each group, the item amount per group is listed so you can customize this list to your own needs.

For materials listed by individual activity, see the Activities section.

Materials Tips

- When purchasing or gathering materials, be sure to get exactly the material described. Sometimes an activity will not work properly unless specific materials are used. If you do need to substitute a material, test the activity with the substitute first before gathering or buying enough for the class.
- Most of the materials in these activities can be found in electronics, home improvement, office supply, and craft stores. Other items can be found around home or school.
- If you are unsure what a material is, check the activity text. Some activities include photos of the materials for your reference.
- Materials such as mini lamps, wiring, battery holders, insulated wire, and other electronics components can be found at electronics stores, some hobby stores, and can be ordered online.
- Syringes can be obtained free or at a very low cost from most pharmacies. You will often have to ask for them at the pharmacy counter.
- Large peg boards can be bought at home improvement stores and cut down into smaller boards for student use.

Master Materials List (all activities, by materials type):

Electronics Components

- Alligator clip leads with wires (20 total; 4 per group)
- Batteries, D cell (5 total; 1 per group)
- Battery holders/joiners, D cell – without wires (5 total; 1 per group)
- Bulb holder for mini bulb (10 total; 2 per group)
- Donut magnets, 1¼ in. (5 total; 1 per group)
- Insulated magnetic wire/enameled copper wire, 20 gauge (1 roll total; 45-60 cm of wire per group)
- Knife switches (5 total; 1 per group)
- Mini bulb with a screw-type base, 2.5 volt/0.2 amp, or smaller (10 total; 2 per group)

General School/Craft Supplies

- Cardstock paper (1 pack)
- Masking tape (5 rolls total; 1 roll per group)
- Modeling clay (10 oz. total; 2 oz. per group)
- Paper or journal
- Paper clips (25 total; 5 per group)
- Pencils
- Rubber bands (20 total; 4 per group)
- Rulers, rigid (5 total; 1 per group)
- Safety pins, large (10 total; 2 per group)
- Spools, large – material does not matter (20 total; 4 per group)
- Spools, small – material does not matter (20 total; 4 per group)
- String (5 m; 1 m per group)

Easily Gathered Items

- Basketball (1)
- Blindfold (1)
- Books (small stack)
- Broomstick/thick dowel (1)
- Dish tubs (5 total; 1 per group)
- Erasers (5 total; 1 per group)
- Funnel, large round (1)
- Marshmallows, mini (1)
- Milk jug filled with water (1)
- Nail (1)
- Paper towels or bath towels (1 roll)
- Pennies (5 total; 1 per group)
- Plastic spoon (1)
- Straws (10 total; 2 per group)
- Tennis balls (at least 6)
- Toy car, small (1)
- Trash can (1)

Home Improvement Items

- Plastic tubing, clear, 5/16" outer diameter x 3/16" inner diameter (150 cm total; one 30 cm piece per group)
- Peg board (5 total; 1 per group)
- Rope, thin (5 m)
- Sandpaper (5 sheets total; 1 sheet per group)

Other Items

- Syringes, 30 mL Leur Lock (10 total; 2 per group)
- Syringes, 50 mL Leur Lock (5 total; 1 per group)
- Pegs (15 total; 3 per group)

Grade Level Materials List

Grades 1-2 Materials List

- Blindfold (1)
- Books (small stack)
- Broomstick/thick dowel (1)
- Cardstock paper (1 pack)
- Donut magnets, 1¼ in. (5 total; 1 per group)
- Funnel, large round (1)
- Masking tape (5 rolls total; 1 roll per group)
- Milk jug filled with water (1)
- Modeling clay (10 oz. total; 2 oz. per group)
- Paper clips (25 total; 5 per group)
- Paper
- Pencils
- Rope, thin (5 m)
- Rulers, rigid (5 total; 1 per group)
- Spools (15 total; 3 per group)
- Straws (10 total; 2 per group)
- String (5 m total; 1 m per group)
- Tennis balls (at least 6)
- Trash can (1)

Grades 3-5 Materials List

- Alligator clip leads with wires (20 total; 4 per group)
- Basketball (1)
- Batteries, D cell (5 total; 1 per group)
- Battery holders/joiners, D cell – without wires (5 total; 1 per group)
- Blindfold (1)
- Books (small stack)
- Broomstick/thick dowel (1)
- Bulb holder for mini bulb (10 total; 2 per group)
- Cardstock paper (1 pack)
- Dish tubs (5 total; 1 per group)
- Donut magnets, 1¼ in. (5 total; 1 per group)
- Erasers (5 total; 1 per group)
- Funnel, large round (1)
- Knife switches (5 total; 1 per group)
- Marshmallow, mini (1)
- Masking tape (5 rolls total; 1 roll per group)
- Milk jug filled with water (1)
- Mini bulb with a screw-type base, 2.5 volt/0.2 amp, or smaller (10 total; 2 per group)
- Modeling clay (10 oz. total; 2 oz. per group)
- Paper clips (25 total; 5 per group)
- Paper
- Paper towels or bath towels
- Peg board (5 total; 1 per group)
- Pegs (15 total; 3 per group)
- Pencils
- Pennies (5 total; 1 per group)
- Plastic tubing, clear, 5/16" outer diameter x 3/16" inner diameter (150 cm total; 1 30 cm piece per group)
- Rope, thin (5 m)
- Rubber bands (20 total; 4 per group)
- Rulers, rigid (5 total; 1 per group)
- Spools, large – material does not matter (20 total; 4 per group)
- Spools, small – material does not matter (20 total; 4 per group)
- Straws (10 total; 2 per group)
- String (5 m total; 1 m per group)
- Syringes, 30 mL (10 total; 2 per group)
- Syringes, 50 mL (5 total; 1 per group)
- Tennis balls (at least 6)
- Trash can (1)
- Water

Grades 6-8 Materials List

- Alligator clip leads with wires (20 total; 4 per group)
- Basketball (1)
- Batteries, D cell (5 total; 1 per group)
- Battery holders/joiners, D cell – without wires (5 total; 1 per group)
- Broomstick/thick dowel (1)
- Bulb holder for mini bulb (10 total; 2 per group)
- Cardstock paper (1 pack)
- Dish tubs (5 total; 1 per group)
- Donut magnets, 1¼ in. (5 total; 1 per group)
- Erasers (5 total; 1 per group)
- Funnel, large round (1)
- Insulated magnetic wire/enameled copper wire, 20 gauge (1 roll total; 45-60 cm of wire per group)
- Knife switches (5 total; 1 per group)
- Marshmallow, mini (1)
- Masking tape (5 rolls total; 1 roll per group)
- Milk jug filled with water (1)
- Mini bulb with a screw-type base, 2.5 volt/0.2 amp, or smaller (10 total; 2 per group)
- Modeling clay (10 oz. total; 2 oz. per group)
- Nail (1)
- Paper clips (25 total; 5 per group)
- Paper or journal
- Paper towels or bath towels
- Peg board (5 total; 1 per group)
- Pegs (50 total; 10 per group)
- Pencils
- Pennies (5 total; 1 per group)
- Plastic spoon (1)
- Plastic tubing, clear, 5/16" outer diameter x 3/16" inner diameter (150 cm total; 1 30 cm piece per group)
- Rope, thin (5 m)
- Rubber bands (20 total; 4 per group)
- Rulers, rigid (5 total; 1 per group)
- Safety pins, large (10 total; 2 per group)
- Sandpaper (5 sheets total; 1 sheet per group)
- Spools, large – material does not matter (20 total; 4 per group)
- Spools, small – material does not matter (20 total; 4 per group)
- Straws (10 total; 2 per group)
- String (5 m total; 1 m per group)
- Syringes, 30 mL (10 total; 2 per group)
- Syringes, 50 mL (5 total; 1 per group)
- Tennis balls (5; 1 per group)
- Toy car, small (1)
- Water

Grades 9-12 Materials List

- Batteries, D cell (5 total; 1 per group)
- Battery holders/joiners, D cell – without wires (5 total; 1 per group)
- Donut magnets, 1¼ in. (5 total; 1 per group)
- Insulated magnetic wire/enameled copper wire, 20 gage (1 roll total; 45-60 cm of wire per group)
- Masking tape (5 rolls total; 1 roll per group)
- Nail (1)
- Paper
- Pencils
- Plastic spoon (1)
- Rubber bands (5 total; 1 per group)
- Safety pins, large (10 total; 2 per group)
- Sandpaper (5 sheets total; 1 sheet per group)
- Toy car, small (1)

Warm-Up Activities

Use these warm-up activities to get your students excited about robots.

Grades 1-2

Ask each student to draw a picture of a robot and then draw a picture of something that robots can do. Have students get into groups of three and share their drawings. Ask each group to identify similarities and differences in the robots they drew and the tasks they showed their robots doing.

Show students the video "Robot vs. Tiger": **http://video.nationalgeographic.com/video/ng-live/winter-bonus2-nglive?source=relatedvideo**. Ask students what task the robot in the video is doing. Ask them to describe the robot. Ask: *Why do you think the robot looks that way? How does the way it looks help it do its job? As a class, discuss other tasks robots might do and what those robots might look like. Have students compare the robots to their own bodies.* Ask: *How are robot arms like human arms? Do robot arms and human arms do the same tasks? What body parts help humans move? Do robots also use legs to move? Why or why not?*

Grades 3-5

Ask students: *What does a robot do? What does it look like?* Accept several answers and discuss how these responses are similar and how they are different. Ask: *Do you think robots are cool or creepy? Why? Is this different depending on the type of robot? Which kinds are cool and which are creepy? Why?* Explain that there is a hypothesis called the uncanny valley that describes the comfort level humans tend to feel around robots (and certain other objects) as they begin to look and move more like humans. According to the theory, there is a point at which robots can become human-like enough to make people uncomfortable. However, as they become even more human-like, people actually begin to feel more comfortable around them.

Show students the robots in the video clips below, in the order given. After each clip, use the following questions to discuss the variety of robots and robot tasks and how the appearance of a robot is related to its function. Ask: *Do you think this looks like a robot? Why or why not? What job does this robot do? How does its design (shape, appearance) help it do that job? Why do you think a robot is used for this job?*

Robot vs. Tiger:
http://video.nationalgeographic.com/video/ng-live/winter-bonus2-nglive?source=relatedvideo

From Automaton to Robot:
http://channel.nationalgeographic.com/channel/the-link/videos/from-automaton-to-robot/
(just watch the first minute)

The X3 Robot:
http://channel.nationalgeographic.com/channel/ultimate-factories/videos/the-x3-robot/

Flexible Rubber Robot:
http://video.nationalgeographic.com/video/news/flexible-robot-vin?source=relatedvideo

Next, have students "dissect" a robot. Divide students into small groups, and give each group a photo of a robot. You can use the same photo for all groups or give each group a different photo, but the photo should be as detailed as possible. Ask students to circle and label the different parts and/or simple machines they see in the robot. When students have finished, discuss what they found. Encourage them to be as detailed as possible. If groups had different photos, compare the parts/machines found in each.

Have each group come up with a task they would rather not do and design (on paper) a robot that could do that task. Encourage them to include parts they identified in their robot dissection. Allow groups to share their ideas with the class.

Grades 6-8

Place a label on one wall of the classroom that says "science fiction." Place a label on the opposite wall that says "science reality." Explain to students that you are going to describe some robots. If students think the robots you are describing currently exist, they should move to the wall labeled "science reality." If they think those robots don't yet exist, they should move to the wall labeled "science fiction." Have students stand in the middle of the room and read the items on the list one at a time, allowing time for students to move to the wall of their choice. After students move to the wall, briefly discuss the item and why they made the choice they did. Do not tell them if they are right or wrong.

Items:

Robots that can assemble a car.

Robots that can change colors to camouflage themselves.

Humans that have robotic limbs.

Robots that travel to other planets.

Robots that clean your floors.

Robots that can forage for their own food.

Robots that can identify different kinds of cheese.

Robots that can run.

Robots that can catch a ball.

Help soldiers carry equipment

Robots that can officiate at weddings

Robots that can trap home invaders in a net

Small robots that can swarm to create shapes.

When you have finished the list, have students return to their seats. Tell them that all the robots you described currently exist. Explain that there have been many recent advances in robotics. Show the video "Can Robots Learn to be More Human?": **http://video.nationalgeographic.com/video/news/jenkins-robot-vin?source=relatedvideo**

Discuss the video with students. Ask: *What are some of the barriers to common-place robotics mentioned in the video? What are some ways Chad Jenkins and his team are addressing these barriers? Do you think robots will become more common in daily life in the next ten years? Why or why not? Do you think they should be? Why or why not? What daily tasks would you like a robot to do for you?*

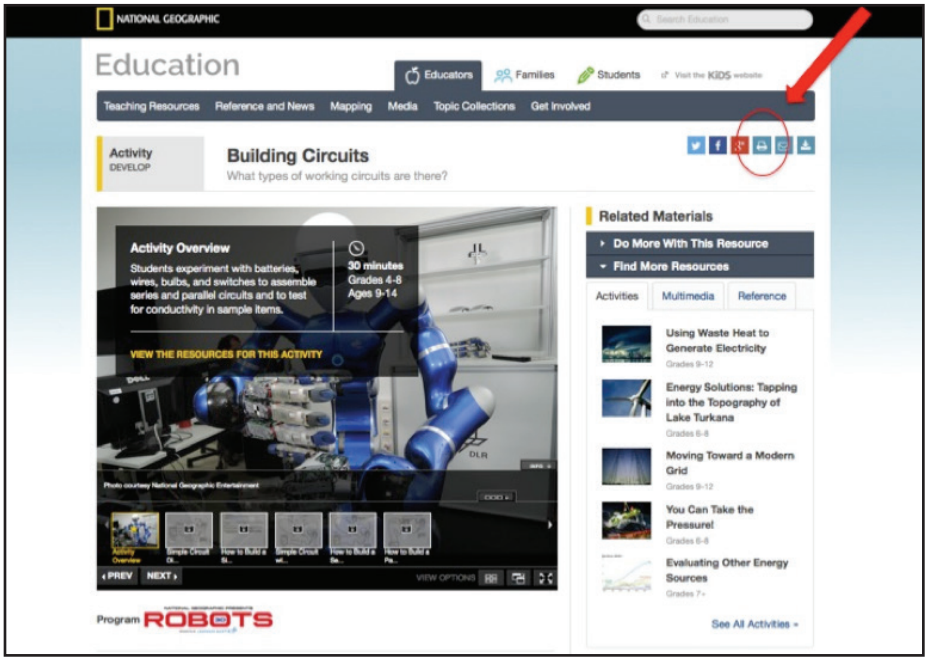
Grades 9-12

Get students' attention by asking them to raise their hands if they think robots will someday take over the world. Ask students to explain their responses. Prompt students by asking: *What would be necessary for robots to take over the world? How are robots integrated into our daily lives? To what extent do robots that exist today "think" for themselves? Learn?*

Tell students that some scientists are working on ways to further integrate robots into our daily lives. Show students the video "Chad Jenkins: Robots Among Us": **http://video.nationalgeographic.com/video/ng-live/jenkins-robots-lecture-nglive?source=relatedvideo.** Discuss the video as a class. Ask: *What are some barriers Jenkins mentioned to integrating robots into our daily lives? How are they working to lower these barriers? What are some reasons he mentioned for integrating robots more into daily life? Do you think robots should become more common in daily life? Why or why not? What are some important tasks robots could perform?*

Activities

In this section, you will find summaries of each activity to help you choose which activities are right for your classroom. You can find the full activities online at **NatGeoEd.org/Robots**. Once you have selected the activities you want to use in your classroom, you can use the print button in the upper right corner of each activity to print it and add it to this guide.



Clicking the print button will produce a PDF version of the activity that you can download and print.

Circuits with Friends

Grades: 2-5
Duration: 15-25 minutes

Students explore the parts of a circuit by modeling, as a group, a “human” circuit.

Materials:

- Tennis balls (at least 6)
- Trash can (1)
- Books (small stack)

Building Circuits

Grades: 4-8
Duration: 25-35 minutes

Students experiment with batteries, wires, bulbs, and switches to assemble series and parallel circuits and to test for conductivity in sample items.

Materials:

- Batteries, D-cell (1 per group)
- Battery holders/joiners, D-cell – without wires (1 per group)
- Mini bulb with a screw-type base, 2.5 volt/ 0.2 amp, or smaller (2 per group)
- Bulb holder for mini bulb (2 per group)
- Alligator clip leads with wires (4 per group)
- Knife switches (1 per group)
- Items to test for conductivity: paperclip, piece of string, eraser, rubber band, penny (1 set per group)

Exploring How Robots Move

Grades: 3-8
Duration: 30-40 minutes

Students experiment with pneumatics and hydraulics and apply these systems to produce movement.

Materials:

- Marshmallow, mini (1)
- Syringes, 30 mL (2 per group)
- Syringes, 50 mL (1 per group)
- Plastic tubing, clear, 5/16" outer diameter x 3/16" inner diameter (30 cm per group)
- Dish tubs (1 per group)
- Paper towels or bath towels
- Paper
- Pencils
- Water

Gearing Up with Robots

Grades: 3-8
Duration: 30-40 minutes

Students experiment with gear motion to understand how gears work to change the amount of force, speed, or direction of motion in machines.

Materials:

- Tennis balls (3)
- Basketball (1)
- Peg board (1 per group)
- Pegs (at least 3 per group)
- Spools, small – material does not matter (8 per group)
- Rubber bands (4 per group)

How to Train Your Robot

Grades: 2-8
Duration: 30-40 minutes

Students apply logic and sequencing skills to write instructions, called an algorithm, for a student to complete a simple task acting as a robot.

Materials:

- Paper
- Pencil
- Objects needed for tasks (will vary based on student-selected task)

Making "Sense" of Robot Sensors

Grades: 1-5
Duration: 15- 30 minutes

Students discuss the importance of senses and experiment using echolocation as an example.

Materials:

- Paper
- Pencils
- Masking tape
- Blindfold (1)

Redefining Work Debate: Are Robots Taking Over Our Jobs?

Grades: 9-12
Duration: 3-4 hours

Students investigate conflicts surrounding the issues of robots and automation replacing human jobs by participating in a debate on the issue.

Materials:

- Paper
- Pencils

Round and Round with Simple Motors

Grades: 6-12
Duration: 60 minutes

Students forge a hypothesis about how motors make things move, and then build a simple electric motor using wire, a magnet, and a D cell battery to explore how motors convert electrical energy into mechanical energy.

Materials:

- Paper
- Batteries, D cell (1 per group)
- Battery holders/joiners, D cell – without wires (1 per group)
- Safety pins, large (2 per group)
- Rubber bands (1 per group)
- Insulated magnetic wire/enameled copper wire, 20 gauge (45-60 cm of wire per group)
- Sandpaper (1 sheet per group)
- Toy car, small (1)
- Plastic spoon (1)
- Masking tape (1 roll)
- Nail (1)
- Pencils
- Donut magnets, 1¼ in. (1 per group)

Simple Machine Challenge

Grades: 2-8
Duration: 45-60 minutes

Students are challenged, using everyday objects, to create simple machines to complete specific tasks.

Materials:

- Paper or journal
- Pens
- Rulers, rigid (1 per group)
- Masking tape (1 roll per group)
- Tennis balls (1 per group)
- Milk jug filled with water (1)
- Broomstick/thick dowel (1)
- Rope, thin (5 m)
- Spools (3 per group)
- String (1 m per group)
- Pencils, round (3 per group)
- Donut magnets, 1¼ in. (1 per group)
- Paper clips (5 per group)
- Funnel, large round (1)
- Modeling clay (2 oz. per group)
- Straws (2 per group)
- Cardstock paper (1 pack)

Think Like a Robot . . . And Stay Safe Online!

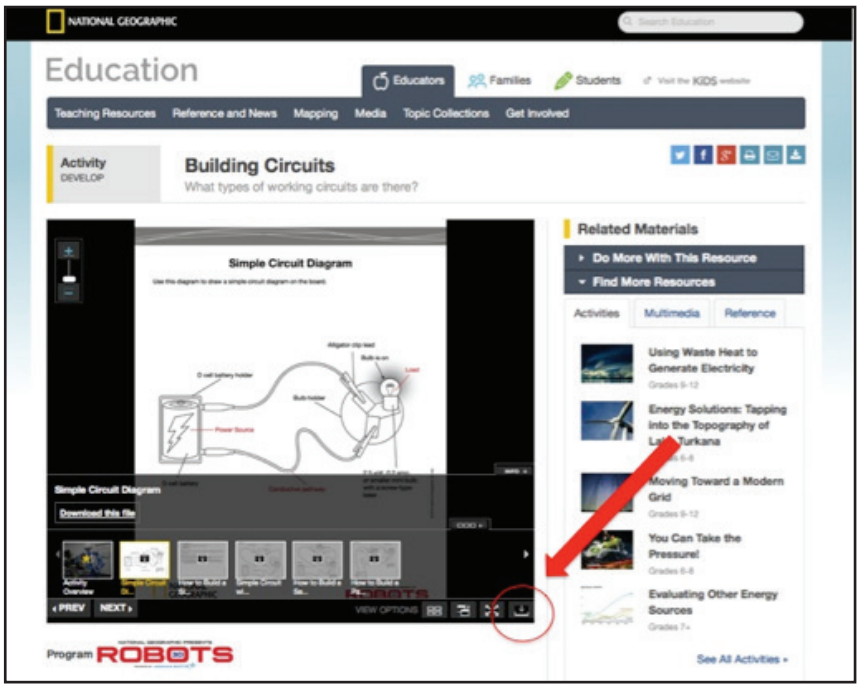
Grades: 5-9
Duration: 4 hours

Students explore common robotic programming strategies as well as one of the principles of mindfulness. They identify three dangers in online communications and develop a three-step decision-making strategy for avoiding unsafe online and social networking situations.

Materials: None

Worksheets and Handouts

Worksheets and handouts for all activities are available online. Once you have selected the activities you want to use in your classroom, you can use the download button in the lower right corner of the activity's media carousel to print the necessary worksheets and add them to this guide.



Clicking the download button will produce a PDF version of the worksheet that you can print.

Standards

The chart below shows which activities align with National Science Education Standards, Next Generation Science Standards, Common Core State Standards, IRA/NCTE English Language Arts Standards, National Geography Standards, and ISTE Standards for Students.

Standard	Activities
CCSS (6-12) - Speaking and Listening Standards SL.11-12.4 - Presentation of Knowledge and Ideas	Redefining Work Debate: Are Robots Taking Over Our Jobs?
CCSS (6-12) - Speaking and Listening Standards SL.9-10.4 - Presentation of Knowledge and Ideas	Redefining Work Debate: Are Robots Taking Over Our Jobs?
CCSS (6-12) - Writing Standards W.11-12.1 - Text Types and Purposes	Redefining Work Debate: Are Robots Taking Over Our Jobs?
CCSS (6-12) - Writing Standards W.9-10.1 - Text Types and Purposes	Redefining Work Debate: Are Robots Taking Over Our Jobs?
IRA/NCTE - Standard 7 - Students conduct research on issues and interests by generating ideas and questions, and by posing problems. They gather, evaluate, and synthesize data from a variety of sources (e.g., print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.	Redefining Work Debate: Are Robots Taking Over Our Jobs?
IRA/NCTE - Standard 8 - Students use a variety of technological and informational resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.	Redefining Work Debate: Are Robots Taking Over Our Jobs?
IRA/NCTE - Standard 12 - Students use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).	Redefining Work Debate: Are Robots Taking Over Our Jobs?
ISTE - Standard 4 - Critical thinking, problem solving, and decision making	Think Like a Robot… And Stay Safe Online!

Standard	Activities
ISTE - Standard 5 - Digital citizenship	Think Like a Robot… And Stay Safe Online!
ISTE - Standard 6 - Technology operations and concepts	Think Like a Robot… And Stay Safe Online!
NGS - Standard 16 - The changes that occur in the meaning, use, distribution, and importance of resources	Redefining Work Debate: Are Robots Taking Over Our Jobs?
NGSS - Science and Engineering Practices 1: Asking questions and defining problems	Build a Simple Motor, Building Circuits, Circuits with Friends, Exploring How Robots Move, Gearing Up with Robots, How to Train Your Robot, Making "Sense" of Robot Sensors, Simple Machine Challenge
NGSS - Science and Engineering Practices 2: Developing and using models	Build a Simple Motor, Building Circuits, Circuits with Friends, Exploring How Robots Move, Gearing Up with Robots, How to Train Your Robot, Simple Machine Challenge
NGSS - Science and Engineering Practices 3: Planning and carrying out investigations	Building Circuits, Circuits with Friends, Exploring How Robots Move, Gearing up with Robots, How to Train Your Robot, Simple Machine Challenge
NGSS - Science and Engineering Practices 4: Analyzing and interpreting data	Gearing Up with Robots, Simple Machine Challenge
NGSS - Science and Engineering Practices 5: Using mathematics and computational thinking	Gearing Up with Robots, How to Train Your Robot, Simple Machine Challenge
NGSS - Science and Engineering Practices 6: Constructing explanations and designing solutions	Build a Simple Motor, Exploring How Robots Move, Gearing Up with Robots, How to Train Your Robot, Making "Sense" of Robot Sensors, Simple Machine Challenge

Standard	Activities
NGSS - Science and Engineering Practices 7: Engaging in argument from evidence	Gearing Up with Robots
NGSS - Science and Engineering Practices 8: Obtaining, evaluating, and communicating	Build a Simple Motor, Gearing Up with Robots, Making "Sense" of Robot Sensors, Exploring How Robots Move, Simple Machine Challenge
NGSS - Standard 1.PS4-4 - Waves and their Applications in Technology for Information Transfer	Making "Sense" of Robot Sensors
NGSS - Standard 1-LS-1-1 - Structure, Function, and Information Processing	Making "Sense" of Robot Sensors
NGSS - Standard 3-5-ETS1-1 - Engineering Design	Building Circuits, Gearing Up with Robots, How to Train Your Robot, Simple Machine Challenge
NGSS - Standard 3-5-ETS1-2 - Engineering Design	How to Train Your Robot, Simple Machine Challenge
NGSS - Standard 3-5-ETS1-3 - Engineering Design	Building Circuits, How to Train Your Robot, Simple Machine Challenge
NGSS - Standard 3-PS2-1 - Motion and Stability: Forces and Interactions	Simple Machine Challenge
NGSS - Standard 3-PS2-2 - Motion and Stability: Forces and Interactions	Simple Machine Challenge
NGSS - Standard 4-LS1-1 - Structure, Function, and Information Processing	Making "Sense" of Robot Sensors
NGSS - Standard 4-LS1-2 - Structure, Function, and Information Processing	Making "Sense" of Robot Sensors
NGSS - Standard 4-PS3-2 - Energy	Building Circuits, Circuits with Friends
NGSS - Standard 4-PS3-4 - Energy	Building Circuits
NGSS - Standard MS-ETS1-1 - Engineering Design	Build a Simple Motor, Building Circuits, Exploring How Robots Move, Gearing Up with Robots, How to Train Your Robot, Simple Machine Challenge

Standard	Activities
NGSS - Standard MS-ETS1-2 - Engineering Design	Build a Simple Motor, Building Circuits, Exploring How Robots Move, How to Train Your Robot, Simple Machine Challenge
NGSS - Standard MS-ETS1-3 - Engineering Design	Build a Simple Motor, Building Circuits, Exploring How Robots Move, How to Train Your Robot, Simple Machine Challenge
NGSS - Standard MS-ETS1-4 - Engineering Design	Build a Simple Motor, Exploring How Robots Move, Simple Machine Challenge
NGSS - Standard MS-PS2-2 - Motion and Stability: Forces and Interactions	Exploring How Robots Move, Simple Machine Challenge
NGSS - Standard MS-PS2-3 - Motion and Stability: Forces and Interactions	Build a Simple Motor
NGSS - Standard MS-PS2-5 - Motion and Stability: Forces and Interactions	Build a Simple Motor
NGSS - Standard HS-ETS1-1 - Engineering Design	Redefining Work Debate: Are Robots Taking Over Our Jobs?
NGSS - Standard HS-ETS1-3 - Engineering Design	Redefining Work Debate: Are Robots Taking Over Our Jobs?
NGSS - Standard HS-PS2-5 - Motion and Stability: Forces and Interactions	Build a Simple Motor
NGSS - Standard HS-PS3-3 - Energy	Build a Simple Motor
NGSS - Standard HS-PS3-5 - Energy	Build a Simple Motor
NSES (K-4) - Standard A-1 - Abilities necessary to do scientific inquiry	Making “Sense” of Robot Sensors, Building Circuits, Exploring How Robots Move, Gearing Up with Robots, Simple Machine Challenge, Circuits with Friends
NSES (K-4) - Standard A-2 - Understandings about scientific inquiry	Building Circuits, Circuits with Friends, Making “Sense” of Robot Sensors, Exploring How Robots Move, Gearing Up with Robots, Simple Machine Challenge

Standard	Activities
NSES (K-4) - Standard B-1 - Properties of objects and materials	Building Circuits
NSES (K-4) - Standard B-2 - Position and motion of objects	Exploring How Robots Move, Gearing Up with Robots, Making "Sense" of Robot Sensors, Simple Machine Challenge
NSES (K-4) - Standard B-3 - Light, heat, electricity, and magnetism	Building Circuits, Circuits with Friends
NSES (K-4) - Standard C-1 - Characteristics of organisms	Making "Sense" of Robot Sensors
NSES (K-4) - Standard C-3 - Organisms and environments	Making "Sense" of Robot Sensors
NSES (K-4) - Standard E-1 - Abilities of technological design	Exploring How Robots Move, Gearing Up with Robots, Making "Sense" of Robot Sensors, How to Train Your Robot
NSES (K-4) - Standard E-2 - Understanding about science and technology	Exploring How Robots Move, Gearing Up with Robots, Simple Machine Challenge, Making "Sense" of Robot Sensors, How to Train Your Robot
NSES (K-4) - Standard E-3 - Abilities to distinguish between natural objects and objects made by humans	Making "Sense" of Robot Sensors
NSES (5-8) - Standard A-1 - Abilities necessary to do scientific inquiry	Build a Simple Motor, Building Circuits, Exploring How Robots Move, Gearing Up with Robots, Simple Machine Challenge
NSES (5-8) - Standard A-2 - Understandings about scientific inquiry	Build a Simple Motor, Building Circuits, Exploring How Robots Move, Gearing Up with Robots, Simple Machine Challenge
NSES (5-8) - Standard B-2 - Motion and Forces	Exploring How Robots Move
NSES (5-8) - Standard B-2 - Motion and Forces	Gearing Up with Robots
NSES (5-8) - Standard B-2 - Motions and Forces	Simple Machine Challenge

Standard	Activities
NSES (5-8) - Standard B-3 - Transfer of Energy	Exploring How Robots Move, Gearing Up with Robots, Build a Simple Motor, Building Circuits, Circuits with Friends
NSES (5-8) - Standard C-3 - Regulation and behavior	Making “Sense” of Robot Sensors
NSES (5-8) - Standard C-5 - Diversity and adaptations of organisms	Making “Sense” of Robot Sensors
NSES (5-8) - Standard E-1 - Abilities of technological design	Exploring How Robots Move, Gearing Up with Robots, How to Train Your Robot
NSES (5-8) - Standard E-2 - Understanding about science and technology	Exploring How Robots Move, Gearing Up with Robots, How to Train Your Robot, Making “Sense” of Robot Sensors
NSES (9-12) - Standard F-6 - Science and technology in local, national, and global challenges	Redefining Work Debate: Are Robots Taking Over Our Jobs?