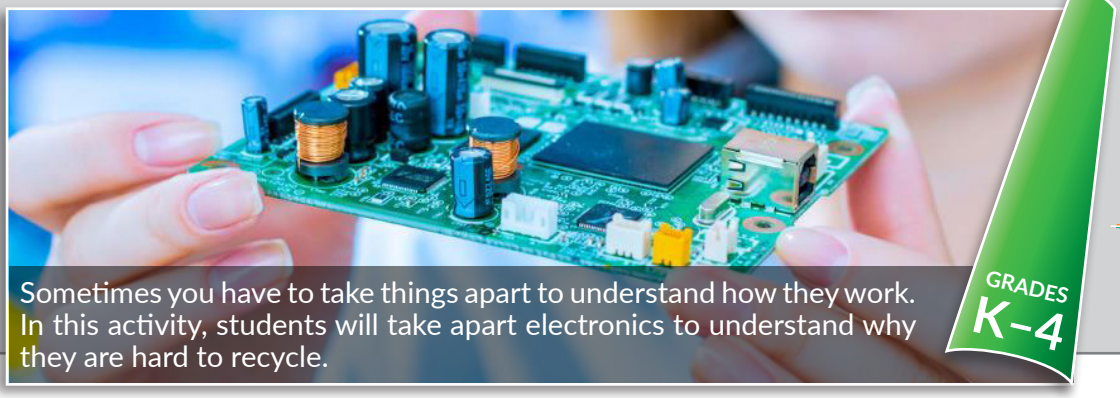
Deconstruction



Sometimes you have to take things apart to understand how they work. In this activity, students will take apart electronics to understand why they are hard to recycle.

GRADES K–4

ISRI Voice of the Recycling Industry

JASON Learning

NEXT GENERATION SCIENCE STANDARDS

- Science and Engineering Practices: Asking Questions and Defining Problems
- Crosscutting Concepts: Patterns
- Disciplinary Core Idea: PS1.A: Structure and Properties of Matter
- Disciplinary Core Idea: ESS3.C Human Impacts on Earth Systems

PREPARE

Time required: 2 to 3 class periods (90-135 minutes) without extensions

- Copy student activity sheet (1 per student).
- Gather:
  - a variety of nonfunctioning electronics, such as computers, ink jet printers, VCRs, etc.
  - an assortment of mixed recycling (paper, plastics, glass), clean and dry
  - pliers, wrenches, and screwdrivers of various types and sizes (Check the electronics you gather to see exactly what kinds of tools you will need.) You may also want to have wire cutters on hand.
  - safety goggles
  - books about recycling; Recommended for grades K-2: *Why Should I Recycle?* by Jen Green. Recommended for grades 3-4: *Recycle!: A Handbook for Kids* by Gail Gibbons

MOTIVATE

- Ask students what recycling is. Allow a few students to share their ideas. Explain that recycling is taking something that we would throw away, breaking it down, and using it to make something new.
- Ask students to discuss with a partner reasons why we might recycle. Ask several pairs to share their ideas with the class.

TEACH

Note: If possible, have students complete parts 1 and 2 in one class period. Parts 3 and 4 should each be done in one class period.

Part 1: Sorting Recyclables

- Before beginning the activity, distribute the student data sheet to each student and project it for the class. Give students a brief overview of Part 1 and go over the data sheet. Emphasize that students are looking for patterns when they group their items together. What makes the items similar, and different from the other groups? For younger children, you might use the term "traits" while for older children, you might use the term "characteristics." You might even provide them with some simple tools like magnifying glasses. For younger students, do not use the data sheet.
- Divide students into groups of no more than three and distribute recyclable items to each group. Be sure each group receives a mixture of paper, glass, and different types of plastic.
- Have students do Part 1 of the activity. You may want to have students do their sorting on the floor (with a tarp or other covering if on carpet) to reduce the chance of broken glass.
- For younger students, provide boxes, hula hoops, or other concrete items into which students can sort the recyclables.
- For older students, introduce the term "characteristic." Have students become familiar with the term by describing some of their own physical characteristics. Use this term when asking students to describe how the items they sorted are alike and different.
- Identifying patterns forms the basis for classification. As students sort the items, ask them to look for patterns in the materials.
- Older students should record their categories and characteristics on the data sheet. Younger students should discuss their ideas in their groups. When all groups have finished Part 1, ask groups to share the criteria they used to sort the recyclables.

Part 2: Sorting Electronics

- Give a brief overview of Part 2. For older students, project the data sheet again and go over Part 2 of the sheet.
- Introduce students to the term "electronics." Write the word on the board for students to reference as they read instructions.
- Distribute one electronic item to each group. Have them complete Part 2 of the activity. Be sure to provide small boxes or tubs in which to put small parts to all groups.
- As in Part 1, older students should record their categories and characteristics on the data sheet. Younger students should discuss their ideas in their groups. When all groups have finished Part 2, ask groups to share the criteria they used to sort the recyclables.

Part 3: Why is it so Hard?

- Discuss with students the different kinds of items they identified in parts 1 and 2 of the activity. Draw connections between the items they sorted in part 1 and the pieces of the electronics they sorted in part 2.
- Explain that some items are more difficult to recycle than others. The items students sorted in part 1 can usually be recycled at home or at school. Other items, such as electronics, are harder to recycle.
- Have students work with their groups to write a hypothesis about why electronics are harder to recycle. Older students can write their hypothesis on their data sheets. For younger students, have each group tell their hypothesis to the class and write them on the board.
- Read a book about recycling to students. Recommended books are listed in the materials section, but any book about recycling that describes how items are sorted, broken down, and used to make other materials will work. Since this is a read-aloud, you can also adlib a well-illustrated book intended for older students. As you read, emphasize how different materials are sorted and then broken down and made into something new.
- After reading, discuss how the information in the book relates to groups' hypotheses. Does the information support their hypothesis? Does it contradict it?

Part 4: Take Action!

- Have older students do research to find out how electronics, and – if desired – other hard to recycle materials can be recycled in your area. For younger students, share information about how to recycle electronics, rather than having students conduct research.
- Have students design a poster first on paper. Make sure they include all the information listed on the data sheet. Then have students create a final poster on poster board or other large paper.

REFLECT/ASSESS

Students should be able to:

- Identify items they can recycle at school or at home.
- Explain why electronics are harder to recycle and ways they can be recycled responsibly.

EXTEND

Students can go one step further by creating a campaign around hard to recycle materials. This can include electronics, as well as other items that can't be recycled at the curb. These include hardback books, plastic grocery bags, Styrofoam, bubble wrap, batteries, and empty gift cards. Student campaigns may include flyers, phone calls, public service announcements, newspaper ads, talks to the PTO or other civic groups, or other ways to get information about hard to recycle items to their school or the general public.

JOURNAL QUESTION

Ask students to think about what they have learned about recycling electronics. Recycling your old electronics isn't as simple as setting it out on the curb. Ask students to explain why it is important to recycle these items even though it is more difficult.

WEBLINKS

ISRI News Releases about Electronics Recycling (teacher background resource): http://www.isri.org/news-publications/newsroom/2013/12/11/-tis-the-season-to-recycle-project-reboot-launched-to-increase-electronics-recycling#.WE9At-Fz52ZI

Sesame Street – Recycling Aluminum Cans: http://www.sesamestreet.org/videos?vid=2165

A Look at the Recycling Process: http://www.factmonster.com/ipka/A0934633.html

How Materials are Recycled: http://www.recycling-guide.org.uk/science.html

Electronics Donation and Recycling: https://www.epa.gov/recycle/electronics-donation-and-recycling

TEACHER TIPS

Note: You may want to have students complete the related activity "Test Your Metal," which is a nice companion to the sorting students do in this activity

Background

While curbside recycling has become more common in the U.S. in recent years, many people still do not know how to recycle items that cannot be left at the curb. Electronics are one example. According to a study by the United Nations, 41.8 million tons of electronic waste was thrown away in 2014. They also estimate that only 10 to 40 percent of this waste was disposed of correctly. According to ISRI, about 31% of Americans have never recycled electronics. Many people polled weren't aware that electronics couldn't be thrown away, didn't realize electronics could be recycled, or didn't know how to recycle electronics.

It isn't as easy to recycle electronic items as to recycle paper, plastic, metal, and glass, but there are good reasons to do it. In many places, it is illegal to put electronics in the trash because electronics may contain toxins that can leak into the landfill. Electronics also contain parts, such as metal and plastics, that won't break down quickly in the landfill. In addition, as with all recycling, reusing the parts in electronics saves valuable resources and consumes less energy than manufacturing items using new materials.

Some common places that electronics can be recycled include scrap yards, electronics manufacturers and retailers, and, in some areas, designated hard to recycle events. If a search doesn't bring up this information for your area, you can contact your local trash and recycling provider to ask. The EPA's Electronics Donation and Recycling resource, listed in the Weblinks section, offer some specifics about where to recycle electronics nationally

Tips for finding and using electronics:

- You can often find used electronics at thrift stores. You can also ask repair shops for items they cannot repair. You can also ask families to send in electronics they no longer use.
- Do not use items with a monitor.
- Some electronic items, particularly older ones, can also be a good way to see simple machines in action.

Safety tips:

- Be sure students are wearing safety goggles as they deconstruct the items.
- Cut the cords off of all items so students can't plug them in.
- Remove all batteries.
- Avoid having students deconstruct monitors. Those with CRT (cathode-ray tubes) can be dangerous. They can carry a charge long after they are unplugged.
- Instruct students to only take apart things they can unscrew or easily pull apart. They should not cut into any pieces.
- Students may want to cut wires (for example, to remove a circuit board). In this case either monitor closely or do the cutting yourself. Do not give wire cutters to groups when distributing the other tools.
- Have students wash their hands after deconstruction.
- For younger students, ask for adult volunteers to more closely monitor groups or to take apart items as small groups of students watch. If using this option, be sure to allow students to direct the deconstruction. Do not allow adults to simply take the item apart.

Sample answers to data sheets:

Note, only a few samples for each table have been provided. Answers will vary. Groupings should be accepted as long as they are backed up by evidence, or observations. Have students think about what traits or characteristics the items in any one group have in common. What makes them different from other groups?

Part 1: Sorting Recyclables

What patterns do you notice? How did you sort the items?

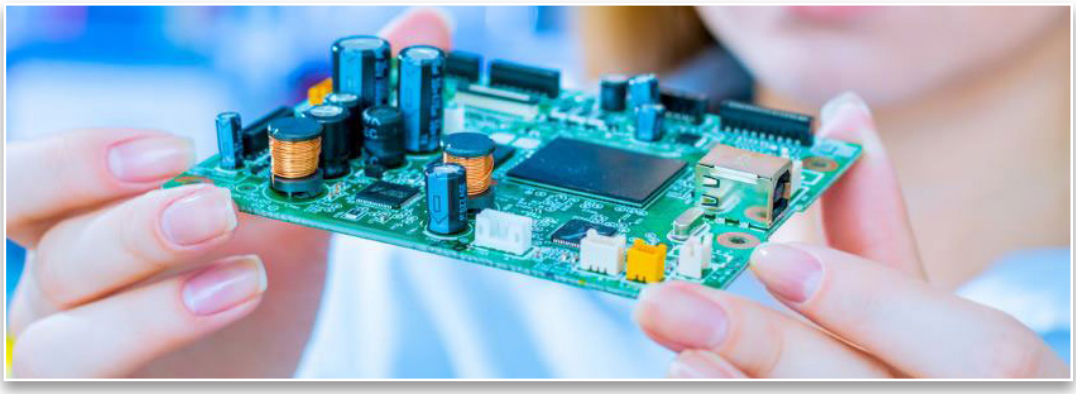
Group	Patterns & Observations (How are items alike and how are they different from other groups?)
plastics	sturdy but slightly bendable or flexible, can't usually see through them but sometimes you can, can be scratched with your fingernail, come in many different colors
cans/tin	Hard, cannot bend, silvery/shiny, cannot see through them (they are opaque). Make sounds when gently hit together
glass	Hard, cannot bend, can see through them (transparent), make clinking sounds when gently hit together

Part 2: Sorting Electronics

What patterns do you notice? How did you sort the parts?

Group	Patterns & Observations (How are items alike and how are they different from other groups?)
green boards	green, have lots of wires and metal parts attached
wires	flexible/bendable, long, wrapped in red, white or green rubbery materials, can see metal inside

Deconstruction



You can't put some things in a recycling bin. Have you ever wondered why? Let's take apart some items to find out.

Materials:

- Electronic items, like computers or printers
- Recycling items
- Tools, like wrenches and screwdrivers
- Safety goggles

Part 1: Sorting Recycling

1. Your teacher will give you a box of things that are recycled. Sort the items into groups.
2. Look at each group you made. How are the items in this group alike? How are they different from the items in other groups?

Part 2: Sorting Electronics

1. Your teacher will give you tools and goggles. Your teacher will also give you an electronic item. Use the tools to take this item apart.
2. Sort the pieces of the electronic items into groups.
3. Look at each group you made. How are the items in this group alike? How are they different from the items in other groups?

Part 3: Why is it so Hard?

1. Recycling items like the ones you sorted are easier to recycle. Electronic items like the ones you took apart are harder to recycle. Why? Use evidence from this activity to write a hypothesis.
2. Your teacher will read you a book about recycling. What did you learn? What does this tell you about your hypothesis?

Part 4: Take Action!

1. Research ways to recycle electronic items in your town.
2. Make a poster. Your poster should tell how to recycle electronic items. What other ways can you tell people about this?

Reflect and Apply

1. List items you can recycle at home or school.
2. Explain how you can recycle electronics.

Extension:

What else could you do to teach others how to recycle their electronics? Make a radio ad? Send home notes to parents? Use your imagination! Use recyclable items to make something new.

JOURNAL QUESTION

It is harder to recycle electronics. Why is it important to do this anyway?

Data Sheet

Deconstruction

Part 1 Sorting Recyclables

What patterns do you notice? How did you sort the items?

Group	Patterns & Observations (How are items alike and how are they different from other groups?)

Part 2 Sorting Electronics

What patterns do you notice? How did you sort the parts?

Group	Patterns & Observations (How are items alike and how are they different from other groups?)

Part 3 Make a Guess

Items like the ones you sorted are easier to recycle than the electronic items you took apart. Why do you think this is? Write your hypothesis.

Part 4 Poster Power

People who see your poster should know these things.

What do you want them to do? _____

_____

Why should they do it? _____

_____

How do they do it?_____

_____

Draw your idea for a poster here.

Reflect and Apply

1. List items you can recycle at home or school._____

_____

2. Explain how you can recycle electronics _____

_____