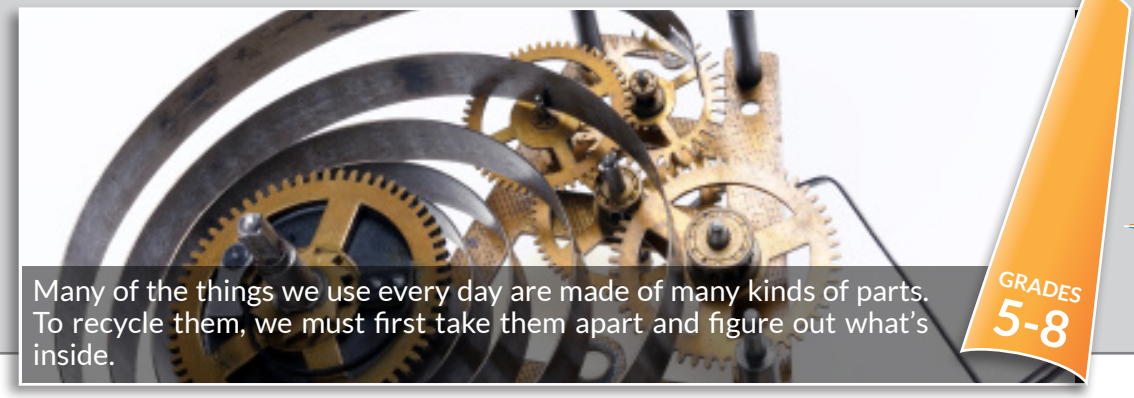
What's Inside?



Many of the things we use every day are made of many kinds of parts. To recycle them, we must first take them apart and figure out what's inside.

GRADES 5-8

ISRI
Voice of the Recycling Industry

JASON Learning

PREPARE:

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

- Gather materials (see activity pages).
- Collect a variety of old or broken toys or electronic devices that contain a variety of materials. Consider sending a note home to parents asking families to turn in their old, unwanted toys and/or electronic devices. You may need to specify that the items need to be relatively small (wind-up toys, toy phones, electronic toys like small electric pianos, or child-size computer-like games; old cell phones . . .etc.). Other items are at your discretion depending how large and complicated you are willing to get!
- If possible, enlist parent or other adult volunteers to help out on the day of dissecting the devices. This is very helpful for logistics and safety.
- Collect at least one larger, familiar object that can be disassembled like a clock or toaster. Prepare it in advance so that you can easily open it up and show students the mechanisms inside. You'll want to be sure you can actually take the item apart in a relatively short amount of time and with some ease (you don't want to be struggling with it while your students get antsy or lose interest).
- Prepare a large sorting sheet for demonstration purposes. You can construct this on 11 x 17 paper, chart paper or poster board. Categories should be: magnetic metal, non-magnetic metal, plastic, other (see Activity Pages).
- Caution ⚠ It is essential that you plan ahead to prevent shattering or accidents with sharp objects. Choose items that are easy to open. If students will be expected to crack or break the outside of a plastic toy, goggles are required. If you have younger students, you may need to split the toys in advance or choose easily disassembled items. Consider a small, plastic wind-up toy which would normally include a combination of plastic and metal parts. If you use an electric device, make sure the device is unplugged and/or remove the batteries.

MOTIVATE:

Show students a simple, familiar object that has a mechanical action. It might be a larger mechanical toy, a toaster or alarm clock. Ask students what they think is inside. Then open it up and ask students to name the materials and parts as best they can, and why they think those materials were used for those purposes (structure and function). Questions might be: "Why do you think springs are made of metal?" (They are bouncy/bend back into shape) "Why do we make some parts out of plastic?" (They are light, colorful, and easy to shape) . . . etc. In a wind-up toy, for example, the key that you turn might be made of metal for strength, but the gears inside might be plastic to make the toy light. Use a magnet to test the metal parts to see if they are ferrous (iron) compounds. Begin sorting the pieces using the sorting sheet. You may only get to a few items for the sake of time. Depending on grade level appropriateness, you might have students identify any simple machines and discuss the mechanisms.

Ask students what they should do with old or broken toys, cell phones, and or appliances from their homes when they are ready to get rid of them. Show students images of landfills by projecting them on the screen. Discuss that so many objects end up in the trash when they've reached the end of their lifetime. Ask students to share some ideas as to why this could be problematic (landfills take up lots of space; materials in the landfills begin to break down, sometimes harmful chemicals are released into the ground, water, and air). Ask students if they think any of the parts from the sample object can be re-used or recycled instead of ending up in a landfill. Have students generate ideas. What is the difficulty in recycling objects like this? (They are made from so many different materials that are hard and timely to separate and sort). How do they think the items get sorted? (The Activity, "Mix it Up, Sort it Out", explores this idea more thoroughly – through separation by density).

TEACH:

- Conduct lab activity as instructed on activity pages. Teams do not have to have the same objects.
- Have parent or adult volunteers help out while students are taking apart their devices.
- Be sure students are wearing goggles while "dissecting" objects.
- For older students, or where appropriate, an exploration of simple machines can be included by having students consider the wheels, gears, wedges, screws, pulleys, and levers used in the toys or objects they are dissecting. Students should also look for springs and other devices that use their elasticity to store and transfer forces. These springs are usually made of ferrous metal in small toys and simple appliances, but can be made of plastics or polymers.
- Give adequate time for students to do a "gallery walk" around the room to view the different objects and sorting sheets.
- Challenge students to generate ideas and create a class list of what the class should now do with these items (and/or their parts). What items did they see during the gallery walk? Anything that could be re-used or recycled and what are the challenges? Discuss the difficulty of recycling toys and electronics (like cell phones), and other objects because they are made up of so many different materials. In the end, all those different materials must be sorted to be recycled and reused properly. Preliminary list of ideas might include: making art from recycled items; donating unwanted toys or devices that are still usable; bringing objects to recycling centers . . . etc.).
- Show students some images of "Trash Art", and products made from recycled metals and plastics. Discuss benefits to the environment (saving landfill space; less energy to make new products from recycled materials than from raw materials; less impact on earth's natural resources and need to extract raw materials from the earth; some ores that are used to make electronics are only found in a few sensitive habitats on earth). You might also show the Interactive ScrapMaps.
- Carefully open your cell phone and show students the components inside. If your school still has large desktop computers, open the "box" and show students the motherboard. They should see parts of metal, silicone plastic, and other materials.
- Experts believe that every six months our technology doubles! "According to the U.S. Environmental Protection Agency (EPA), of the 2.25 million tons of TVs, cell phones and computer products that can be recycled, only 18 percent was collected for recycling and 82 percent was disposed of, primarily in landfills" (http://www.att.com/gen/general?pid=20369). Challenge students to conduct research on their own about how to responsibly dispose of old electronic devices like cell phones and other mobile devices.
- Facilitate class discussion about how items used for the lab activity should be disposed of and have students take part in preparing the items for recycling. This could include setting aside some of the items to make trash art, collecting all metals together and recycling, collecting plastics all together and recycling, putting anything that still works back together and donating. If any electronic devices like old cell phones were used, methods proposed by students during their presentations should be used.

REFLECT/ASSESS

Students should be able to:

- Explain why certain materials are used in toys and electronics.
- Describe some of the challenges in recycling these items.
- Propose at least 2 ways items can either be re-used or recycled.
- Make recommendations as to what people should do with their old cell phones and why. Recommendations should be based on evidence and research, and they should be able to explain the benefits to the environment.

EXTEND

Have students "build" something, create a new use for, or construct artwork from some of the materials used in the activity or from home.

JOURNAL QUESTION

Have students consider how they would design a plan to get the community involved in recycling old toys and electronic devices.

WEBLINKS

Images of landfills
http://www.google.com (image search: "landfills")

Interactive ScrapMaps
http://www.jason.org/interactive/isri/scrap_map/

Images of "Trash Art"
http://www.google.com (image search: "art made from recycled materials")

Images of products made from recycled metals and plastics:
http://www.maine.gov/dep/waste/recycle/whatrecyclablesbecome.html

Cell Phone Recycling Report Card
https://www.earthworksaction.org/files/publications/RecyclingReport_v2.pdf

Simple Machine Digital Game
http://www.msichicago.org/fileadmin/Activities/Games/simple_machines/

What's Inside?

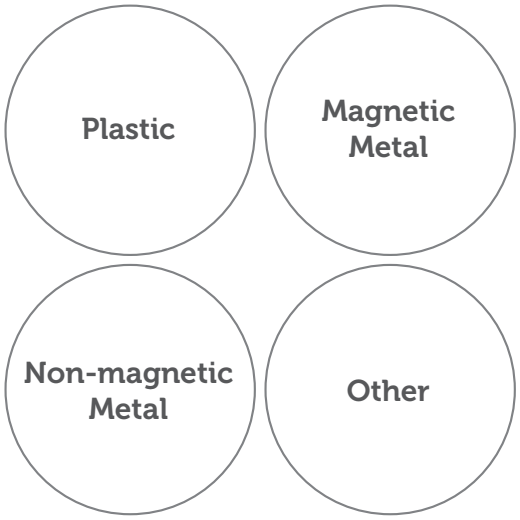
Did you know there are about 500 million outdated cell phones waiting to be recycled? A typical cell phone or computer contains steel, copper, plastic, aluminum and glass, as well as tiny amounts of silver, gold, palladium, and platinum! Like many other old and outdated electronic devices and toys, these items represent a challenge to recycle because the materials that make up the items must be identified and separated. When the amounts of recyclable materials are small and mixed with others, the cost of recycling increases. To begin to understand the challenge of recycling complex devices, you will look inside simpler devices like wind-up toys and other small appliances or electronic devices. You will then think about the many ways these items might be re-used and recycled and propose a solution for disposing old cell phones and mobile devices.

Materials

- Old or unwanted toys and/or electronics (1 per every team of 3-4 students)
- One common electronic appliance or toy for demonstration purposes like a toaster
- Goggles (required for safety)
- Screw drivers or table knives (blunt) and tweezers or forceps
- Large sheets of butcher paper or poster board per group to make sorting sheet
- Markers, crayons, or colored pencils
- Internet access
- Computers
- Projector

Part 1 Investigate What's Inside

1. In teams of 3-4, create a sorting sheet with four large circles with the following labels: magnetic metal, non-magnetic metal, plastic, other. Put your team names on the top.
2. Your teacher will give your team an object to "dissect". Add the name of the item to your sorting sheet. Hypothesize as to what's inside.
3. Put on your goggles, and open up your object as instructed by your teacher. Remove and classify the parts by placing them into the appropriate categories onto your sorting sheets. Use a magnet to help identify some of the parts as needed. List some of the structures and functions you see. Why were certain materials used?
4. Take a "gallery walk" around the room to view the different objects and sorting sheets. What items did you see during the gallery walk? Could anything that could be re-used or recycled and what are the challenges?



5. Create a list of how you think these old, broken or unwanted toys or electronic devices could be disposed of in an environmentally responsible way.

Part 2: Propose a Solution

1. Conduct some research on your own to find out how old electronic devices like cell phones can be disposed of properly. Evaluate the websites you visit to be sure they are presenting reliable information, and list these. In your teams, prepare to give a 5 minute presentation that:
   A. Discusses the negative impacts of throwing electronic devices into the trash.
   B. Presents at least 2-3 options for properly disposing of cell phones or other mobile devices.
   C. Discusses the benefits associated with the options presented in B.
   D. Makes an argument for what you think the best solution is and why.
2. Create a class plan for re-using or recycling the items used during this lab!

Reflect and Apply:

1. Why are certain materials used in toys and electronics?
2. What are some of the challenges in recycling these items?
3. Propose at least 2 ways items like these can either be re-used or recycled.
4. What do you think people should do with their old cell phones and why?

Extension:

You design it! Take a look at images of "Trash Art", and other creations made from recyclable materials. Using some of the materials you used from the lab, or other items you collect from friends or at home, create a new use for an old item. This could be a work of art or a new device with a new function. Be creative!

JOURNAL QUESTION

How would you design a plan to get your whole community involved in recycling old toys and electronic devices?

What's Inside?

Student Name: Period:

1. Name of object your team took apart:

   Complete the table below by listing the parts you found inside your object. Classify the different items you discovered in your toy or device by material type by listing them in the appropriate column:

Plastic	Magnetic Metal	Non-Magnetic Metal	Other

2. A. the structure and function of at least 3 parts found in your toy or device. Describe the properties of the materials used that make it well-suited for its purpose. An example has been done for you.

   B. Could your toy have been all plastic? Or metal? Why or why not?

Structure (Describe the part)	Function (Describe what the part does or what its purpose is)	Type of Material Used to make the part and why
Spring	Absorbs force and energy – allows you to push down on the toys without breaking it and it will spring or bounce back.	Metal – it can be shaped and bounces back when squeezed

3. Create a list of how you think these old, broken or unwanted toys or electronic devices could be disposed of in an environmentally responsible way.

4. List the 3-4 website resources you used for your presentation:

5. Summarize the major points of your presentation in writing on a separate piece of paper. Include:
   A. The negative impacts of throwing electronic devices into the trash.
   B. 2-3 options for properly disposing of cell phones or other mobile devices.
   C. The benefits associated with the options presented in B.
   D. Your argument for what you think the best solution is and why.