

CSI



GRADES
5-8

In this activity you'll use some great web resources to answer a big question—and save energy as you do.



PREPARE:

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

- Gather materials (refer to activity pages).
- Make copies of the activity pages (one per student).
- Arrange for Internet access for research.
- Preview the ISRI website and scan the [Fact Sheets](#) to have a sense of information covered.
- Review graphing through excel or other software as applicable.



MOTIVATE:

Tell students you came to school with some interesting questions on your mind. The questions can be anything that might be interesting, like.

- Is there life in clouds?
- How many national championships has your favorite team won?
- Who was the first permanent resident of your community?

Ask students where they might help you find the answers. For most students today, the first answer that would come up would be the Internet. One of the most crucial issues for human communities today involves the use of our planet's resources. As populations grow, we are constantly challenged to find new sources of minerals and energy, and to conserve and re-use those we have already found. It's a big and complex problem with many components—a systemic problem. Misinformation abounds. But there are many clues to a solution, and some can be found with Internet research



TEACH:

- Pass out Activity Pages.
- Have students consider the question, "Why is recycling important?" Explain that this will be the focus of today's quest for information.
- Review with students how to search and how to determine whether an Internet site is providing reliable information.
- Have students gather data from ISRI's [Fact Sheets](#). Provide help and guidance where needed.
- Provide guidance as students create their graphs. You may differentiate as needed based on student abilities and experience (some students might be using computer software; others may be drawing on graph paper). Students may find that the scale of recycled plastic and tires is so much greater than the tonnage of other materials that their

graphs don't show the smaller quantities. You might choose to have students create two separate graphs to allow for the different data ranges.

- Assign teams one of the five questions under Part 2: Investigate Further. You might also give teams choices or have them come up with their own question. Have students record the websites they use and indicate sources on their presentations.
- Facilitate class presentations. Students should explain their poster, chart or graphic to other groups.
- Emphasize that these presentations contribute to a broader understanding of the issues involved. This models how real-world scientists collaborate.



REFLECT/ASSESS

Students should be able to:

- Compare and contrast the data they collected in part 1 by using the graph they created in part 2. Which materials represent the highest data points? Which materials represent the lowest data points?
- Explain what could be misleading when using a measurement like weight to compare amounts of recycled materials. How does one ton of paper with one ton of steel compare? Students should discuss how this may not adequately provide a comparison. Since paper is so much lighter than steel, one ton of paper is actually bigger in volume than one ton of steel. Using weight also does not illustrate the importance of recycling each material. For example, lead is recycled in fewer quantities than steel or copper. Yet, because lead is very toxic to the environment and to human health, it is even more important that people recycle it.
- Discuss how recycling is related to issues like energy and global climate change.
- Write a compelling statement as to why recycling is important. Students should use specific examples or data from their graphs or from other classmates' presentations.



EXTEND

Have students imagine that a public hearing has been called by the town to discuss the cost-benefits of recycling and whether or not there should be more community action. Have students create a one page statement that argues for civic action. Students should be using evidence to support their claims. Have them use their data collected during the activity as key to arguments they present. Further research regarding a cost-analysis of recycling may be necessary.



JOURNAL QUESTION

What kinds of things could students change at home to encourage their families to recycle?



WEBLINKS

ISRI's Fact Sheets

<http://www.isri.org/recycling-industry/commodities-specifications/recycling-fact-sheets#.VoLccYrLIU>

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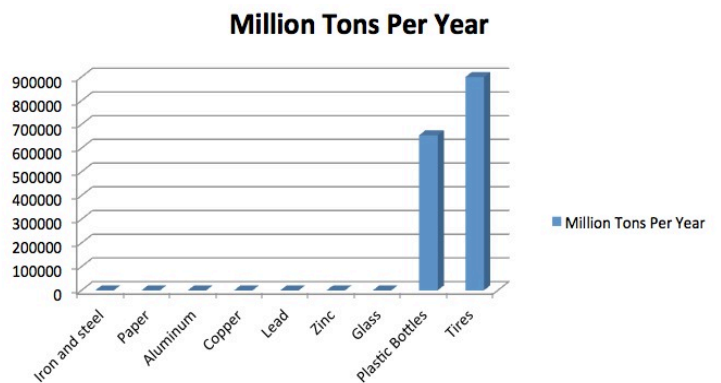
Background

Students often associate recycling with the blue bin at the curb or a receptacle in the cafeteria. But that’s just the beginning. Every year scrap recyclers transform more than 135 metric tons of used materials into new, useful products. In a world where both raw materials and energy are in short supply, this is a vital component of both conservation and economic growth.

In this activity, students build understanding through research to answer a question with four subcomponents. Their research begins with data tables provided on the activity sheet and resources from ISRI, the Institute of Scrap Recycling Industries, Inc. They then use a spreadsheet to compile and graph their data. Directions are given for Excel software, but they can easily be changed to accommodate other software that might be available at schools.

Teacher Notes

To complete the spreadsheet from ISRI data, students will have to be alert for several conversions. First, the data for lead is sometimes provided in tons, not millions of tons, so the decimal must be moved. The data on tires is sometimes given in numbers of tires, so students will have to estimate. If the average tire weighs 20 pounds, then they may have to take the number of tires x 20/ pounds in a ton to fill in the spreadsheet. Finally, some tables separate stainless steel from other forms; they can be combined for the purposes of this activity.



Hand graphing, or graphing the lower-volume quantities separately helps. While a material like lead may not be recycled in the quantities of steel or copper, its high toxicity makes recycling even more important.

Finally help students conceptualize the time scales mentioned in the texts. For example, plastic might last for 500 years in a landfill; glass for a million!

Sample Answers to Group Questions:

How much energy is saved when we use recycled aluminum, paper, copper, steel, plastic and glass? Make a bar graph to show the energy savings. **Aluminum 92%, Paper 68%, Copper 90%, Steel 56%, Plastic 87%, Glass 34%**

Where do our recycled materials go? Color a world map to show the main countries that buy our products. **Leading countries include China, South Korea, Turkey, Taiwan, Canada, and India**

How much space can we save in landfills by recycling paper? (You’ll need two clues—how much paper we use and how much space a ton of paper takes up.) Draw a landfill with paper and one without. **Using 2011 as a reference, 47.9 million tons of paper were recovered. One ton of paper reduces 3.3 cubic yards of landfill space. That would reduce a landfill by about 169 million cubic yards or a cube almost a mile on each side!**

How could recycling help reduce carbon dioxide emissions into our atmosphere? Create a poster showing the emissions from making new bottles and recycling older ones. **For every six tons of recycled glass used, one ton of carbon dioxide emissions is reduced.**

When a tire blows, it might be sent to a landfill What can recycling tires save? Make a wheel diagram to show the answer. **Tires contain not only rubber but steel belts, bead wire, carbon black. The process of manufacturing also includes the forestry, transport and energy for vulcanization.**

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Imagine you are collecting the used bottles, cans and paper in your school cafeteria for recycling. A visitor approaches you to ask: “Why are you doing that?” You know it is good for the environment. But now, when challenged to present the facts, you’re not really certain how or why. It seems almost a mystery. We often associate recycling with the blue bin at the curb or a receptacle in the cafeteria. But that’s just the beginning. Every year scrap recyclers transform more than 135 metric tons of used materials into new, useful products. What are the real benefits to our society and the environment? In this activity, you will investigate the importance of recycling through internet detective work. You will discover how much different materials are recycled and then compile and graph your data. Finally, you will imagine you are going to testify at a public hearing where you will prepare a statement as to why your community should recycle.

Materials

- Computers with internet access
- Excel (or other graphing software, or graph paper)
- Poster board
- Markers
- World map (for one group)
- Rulers, as needed

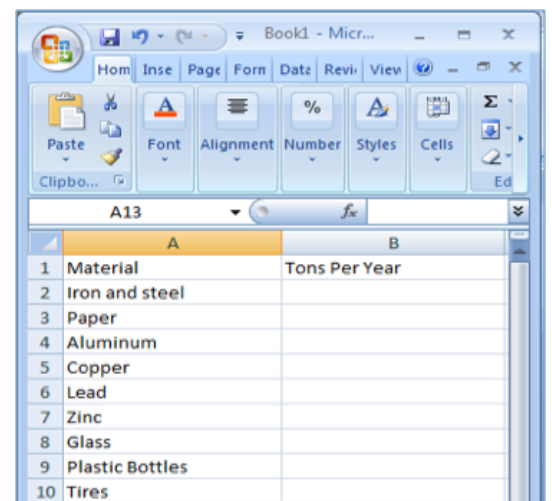
Part 1: Gather Data

1. Using the [Fact Sheets](#) on the Institute of Scrap Recycling Industries, Inc. website, conduct research to find out how many tons of the following materials are recycled in one year. Note, you may need to convert some of the measurements you find

- Iron and steel
- Paper
- Aluminum
- Copper
- Lead
- Zinc
- Glass
- Plastic bottles
- Tires

2. Using spreadsheet software, create a graph to illustrate the data. Here are some hints to begin with if you are using excel:

- Open your spreadsheet program.
- Type in the titles: “Material” and “Tons per Year” in columns A & B as shown to the right.
- Use your data to fill in the columns
- Highlight your data. Click the “Insert” tab and choose a bar graph (histogram) format.
- If the scale of your graph makes some columns so tiny you can’t see them, you can change it. You may also make two graphs: one for the larger scale data, and another for the smaller scale data.



Part 2: Investigate Further

1. Your teacher will assign your group one of the following questions to investigate. Using the [Fact sheets](#) on ISRI's website, and 2-3 additional websites, create a graph, chart, or poster to show your results to the class. List the websites you find. Questions for Investigation:
 - A. How much energy is saved when we use recycled aluminum, paper, copper, steel, plastic and glass? Make a bar graph to show the energy savings.
 - B. Where do our recycled materials go? Color a world map to show the main countries that buy our products.
 - C. How much space can we save in landfills by recycling paper? (You'll need two clues—how much paper we use and how much space a ton of paper takes up). Draw a landfill with paper and one without.
 - D. How could recycling help reduce carbon dioxide emissions into our atmosphere? Create a poster comparing the emissions from making new bottles and recycling older ones.
 - E. When a tire blows, it might be sent to a landfill! What can recycling tires save? Make a wheel diagram to show the answer.
2. Present your findings to the class.

Reflect and Apply

1. Compare and contrast the data you collected in part 1 by using the graph you created in part 2. Which materials represent the highest data points? List the top 3. Which materials represent the lowest data points?
2. What could be misleading when using a measurement like weight to compare amounts of recycled materials? How does one ton of paper with one ton of steel compare?
3. Discuss how recycling is related to issues like energy and global climate change.
4. What would you say now to the school visitor who asked you why recycling was important? Use specific examples or data from your graphs or from other classmates' presentations.



Members of our community want more recycling. But that's expensive! Why should we do it?

Extension

Imagine your community is having a public hearing to decide whether there should be more recycling. You are going to testify at that hearing. Pick one of the sets of facts you've collected in this activity and prepare a one-page statement to make to your Board. Include graph(s) and/or other pieces of evidence to be as convincing as you can.



JOURNAL QUESTION

What kinds of things could you change at home to encourage your family to recycle?