Suggested Time Frame: at least 3 class periods

Class Period 1

- Engage – Self Audit worksheet
- Explore – Product Research

Class Period 2

- Explain – Share Product Research results and discuss materials life-cycle
- Elaborate – Begin market value research

Class Period 3

- Elaborate – Discuss market value research
- Evaluate – Discuss consumer choice and Self Audit

Lesson Objectives: Students will be able to:

1. List the difference between a resource and waste.
2. Define a waste hierarchy and list at least three components of that hierarchy.
3. List at least two things a person can do as a consumer to reduce the amount of waste going to a landfill.

Standards: Missouri Standards: Science

- Strand 5: Processes and Interactions of Earth's Systems
  3Ab
- Strand 7: Scientific Inquiry
  1Ba, 1Ca, 1Cb, 1Da, 1Db, 1Ea
- Strand 8: Impact of Science, Technology and Human Activity
  1Ca, 3Aa, 3Ab, 3Ba, 3Bb

Materials:

Materials Included:

- Pre and Post Assessment
- "Product Research" worksheet
- "Waste Hierarchy" resource page
- "Self Audit" worksheet

Got Gadgets?... At What Cost?

RECYCLING ECONOMICS

Suggested Grade Level: Upper Elementary and Middle School

Program Goal: Students will be more aware of the products they use, how they're made, and make the choice that will have the least impact or be more beneficial for people, the planet and the economy.

Concepts Covered: materials life cycle; resource use; waste generation; waste hierarchy; market value of products; supply and demand; recovery; disposal

Engage

Introduce the topic by having the students complete the attached self-audit.

After they complete the audit, ask the students,

- *What did you notice about your answers on the worksheet?*
- *Is there a reason you might do some of the things more than you do others?*
- *How do your choices affect the environment?*

What did each of the actions on the worksheet have in common? They reduce the amount of resources used and/or waste produced!

Explain that in the United States it is estimated that each person generates about 5 pounds of garbage each day (about 6 pounds per person in Missouri and about 9.5 pounds per person in St. Louis County!).

Tell the students that the top five items in a landfill are:

- Paper
- Organic Material (food waste)
- Plastic
- Metal
- Glass

How many of these things can be recycled? All of them, and food waste can be composted. It is estimated that about 75 percent of what goes to a landfill could be recycled. (Currently only about 25–30 percent of trash is recycled.)

Explore

In this activity, students will do research and complete a worksheet to get a more in-depth understanding of what it takes to create a product to sell to the public. Begin by having each student select one product they use every day and an alternative option for that product (i.e. plastic bag and paper grocery bag).

Have the students complete the following sentence,

"I think_____ [one of the products they chose]
is better than _____ [the other/alternate product they chose]
because_____ [students list the reason(s) they think their product is better]."

Using online resources and other reference materials (see list at the end of the activity for suggested resources to use when searching for this information), have students research each of their products and list the resources needed to make that product. Student should record their findings on the worksheet.

Once students are done with their research, have them complete the following statement on their worksheet, "My earlier prediction that _____ was better than _____ is correct/incorrect (circle one) because_____."

Explain

Have students report their findings back to the rest of the class. This can be done through oral presentations, creation of a poster or charts with their findings, or some other means.

Once students have shared their findings, ask:

- *What did you learn?*

- *How many types of resources did each product end up using? Was it more or less than you expected?*
- *Did all of those resources come from the area you live in?*
- *What types of waste were produced in the process of making the products?*
- *Which had more waste products?*
- *What is the different between a resource and waste? (A resource can be used by humans whereas waste is the unusable remains of a resource)*

Explain to the students that there are different types of waste, and various ways of handling them. Show the waste hierarchy diagram and discuss.

- *What do you notice about the diagram?*
- *According to the diagram, what's the worst choice?*
- *What's the best?*
- *Where would the wastes created from both of your products fall within this hierarchy?*

Refer to the EPA's Materials Life-Cycle Diagram (*http://www.epa.gov/statelocalclimate/documents/pdf/ResourceConservGuide.pdf*) and factor in end-of-life options for resources needed for the product. Can the recovered materials be utilized in any way?

Elaborate

Next, have the students select one or more of the resources used in their product and complete Part 2 of the Product Research worksheet.

Tell the students they need to research the market value of that resource. Once they have completed their worksheets, discuss their findings, including the following questions.

- *How does this cost affect the cost to the producer?* Have to pay more to purchase the resource to make your product. *The consumer?* The increased cost to the producer may force the producer to raise their prices, which means the consumer will pay more.
- *Does that affect how a product is made?* The producer may try to look for a substitute resource that is cheaper. *How would this new option impact people?* This could affect jobs if the producer decides to get the resource from someone else. Also, the new option may not be as healthy for the consumer (i.e. substituting cheaper oils instead of natural ingredients in food). *The environment?* Depending on the change the consumer makes, they may switch to cheaper, non-renewable resources (further depleting non-renewable resources) or get the resources from farther away (increased air pollution from increased shipping distance).

- *Does the value of that resource always stay the same? How does it change?* No, the value fluctuates depending on availability and demand for that resource.
- *How would that affect the cost?* The cost would keep changing depending on availability and demand.
- *How do you think that will affect what people might purchase?* People might want to save money and buy something cheaper if it serves the same purpose, regardless of the effect on the environment and, eventually, themselves.

Refer back to the end-of-life options for resources discussion you had earlier. *Is this resource completely used during the process or are waste materials generated? If there is waste generated, what happens to it? Can the recovered materials be used in any way? If so, how would that affect the costs?* If the waste materials can be reduced, reused, or recycled the producer could save money by using fewer resources, using them over, or possibly even selling them to another vendor that can reuse or recycle them. In addition, if the producer can keep these materials out of the waste stream, they won't have to pay their waste hauler as much, and will save additional money. These savings could help keep the cost of the product down.

Discuss the cost of disposal vs. the cost of recovery for this resource. Would it be cheaper to recover the resources or simply dispose of the waste materials?

- *What does it cost to dispose of an item?* It depends on the type of item to be disposed of, and the disposal fees for that area.
- *What are the costs associated with recovery?* It depends on how easy or difficult that resource is to recover from the waste stream and any factors that might be associated with preparing it to be reused or recycled.
- *How might these costs affect the price of the product?* Increased cost to the producer will typically result in increased costs to the consumer.
- *Are there any alternatives? Can the producer use less of the resource to reduce the waste? Can another resource be used instead?*

Evaluate

Ask the students how they think consumers can make a difference in the types of products that are sold? Discuss the students' thoughts, including:

- Being more aware of products and how they're made, and making choices that will have the least impact or be more beneficial for people, the planet, and the economy.
- Understanding that each time you purchase a product you are, essentially, casting a "vote" for that product and the producer will continue to make it as long as people are willing to buy

it—the basis of the concept of supply and demand.

- Trying to use less of a product.
- Reusing or recycling a product.
- Telling others!

Ask the students if, based on what they've learned, they will make choices in their personal lives differently?

A few weeks or months after the students complete this activity, have them complete the self-audit again. Has anything changed?

Extensions

- Refer to "Waste Watchers" activity in the Community to Classroom 3R's Education Lessons found on the St. Louis County Resourceful Schools website: http://www.resourcefulschools.org/teachers/lesson-plans/grade-5-pick-up-a-new-attitude-waste-watchers-recycling-rules for more activities about reducing waste.
- Repeat the process in the "Elaborate" section, but ask the student to now become the producers and design a product they would like to sell. They should then determine the resources needed and environmental impacts of their resource. *Based on their findings, what will they charge the consumer? Do they think people will pay for it? Why or why not? Do they think most businesses do this with each of the products they create?*
- Research which regions in the world are the largest emitters of CO_2? Compare to regions' GDP.
- Complete the "Let Them Eat Cake" activity from the BeadforLife curriculum available at http://www.beadforlife.org/en/take-action/educate-engage/teach-our-curriculum. (Facing the Future—http://www.facingthefuture.org—also has a version of this activity in their book *Engaging Students through Global Issues*). Once you've completed the activity, ask the students the following questions:
  - *How do the students think different types of environments have an effect on a culture and the choices the citizens make?*
  - *What resources are available?*
  - *Does this affect diet? Clothing? Transportation? Architecture?*
  - *Is it the same for everyone on the planet?*
  - *What if those resources were no longer available or altered in some way?*
- Once you've reviewed the waste hierarchy diagram, assign each student one of the options to learn more about. Have the students debate the pros and cons of each option.

Pre and Post Assessment

These questions can be used to assess the students' understanding of the topics discussed. Ask the students the same questions before and after the unit using the Student Copy Page. Answers are provided on the Teacher Answer Page.

Suggested Research Resources

- You Tube (*http://www.youtube.com*) has a number of "How It's Made" videos on all sorts of products from the Discovery/Science Channel.
- "How Products are Made" website: *http://www.madehow.com*
- "How Everyday Things are Made" website: *http://manufacturing.stanford.edu/*

Name:_____

Student Copy Page

Pre and Post Assessment Questions for *Got Gadgets?...At What Cost?*

Short Answer Questions

1. What is the difference between a resource and waste? (2 points)

   A resource is:

   Waste is:

2. List three possible options in a waste hierarchy. (3 points)

3. List one thing that can affect the market value of a product. (1 point)

4. List one way the market value of a resource can affect a product. (1 point)

5. List three things you can do to reduce the amount of waste going to a landfill. (3 points)

Teacher Answer Page

Pre and Post Assessment Questions for *Got Gadgets?...At What Cost?*

Short Answer Questions

1. What is the difference between a resource and waste? (2 points)

   A resource is:

   something that can be used by humans.

   Waste is:

   the unusable remains of a resource.

2. List three possible options in a waste hierarchy. (3 points)
   - Reduce
   - Reuse
   - Recycle and compost
   - Disposal with energy recovery
   - Disposal without energy recovery

3. List one thing that can affect the market value of a resource. (1 point)
   - Availability of the resource
   - Demand for the resource

4. List one way the market value of a resource can affect a product. (1 point)
   - Can cause the price to increase or decrease
   - If a resource is too costly, the producer might look for other resources to be used in its place

5. List three things you can do to reduce the amount of waste going to a landfill. (3 points)
   - Reduce consumption
   - Reuse
   - Recycle
   - Learn more to make more informed choices
   - Tell others

Student Copy Page

Self Audit

See just how "green" you are—and discover ways you can be even more so! Answer the following questions.

How often do I…	Always!	Sometimes	Never	Comments
Recycle.				
Turn off lights when I leave a room.				
Unplug chargers for my cell phone, ipod, and other gear.				
Use reusable containers when I bring a lunch to school, and throw away as little as possible.				
Compost food scraps and yard waste.				
Turn off the water when I am brushing my teeth.				
Ask myself, "Do I really need to buy that?"				
Reuse something instead of throwing it away.				
Donate things I don't want or need anymore to a resale shop or a family member.				
Buy products that are made with recycled content.				
Use rechargeable batteries.				
Other:				

Name:_____

Student Copy Page

Product Research Worksheet, Part 1

1. Select an object you use every day and list that below in #1. Now, think of another product that can be used in the same manner as your first object and list that in #2. (for example: plastic bag and paper bag)

   #1:

   #2:

2. Referring to the two products you chose, complete the statement below:

   "I think _____ is better than _____ because…" (list your reasons below)

3. Research each of your products, to **complete the grid on the following page** to the best of your ability.

4. Based on your research, which product is best:

   a. For the environment?

   b. For the business person (most economical)?

   c. For the consumer?

   Why do you think so?

4. Complete the following statement:

   "My earlier prediction that _____ was better than _____ is correct/incorrect (circle one) because… " (list your reasons below)

Name:_____

Student Copy Page

Product Research Worksheet, Part 1 (continued)

	Product #1:	Product #2:
What is this product made of?		
What sorts of resources are used to make this product?		
Where do these resources come from? Are they found locally or outside the region?		
What are the steps to produce this product?		
How much do the resources cost to create this product?		
How much energy does it take to make this product?		
Does the production of this product affect the environment? If so, how, and during what steps of production.		
What kinds of waste materials are generated from the production of the product? (be sure to include wastes generated throughout the whole process)		
Are there other options for handling those waste materials? Can they be reduced in any way? Reused? Recycled?		

Name:_____

Student Copy Page

Product Research Worksheet, Part 2

Choose one resource from your research to look at more in-depth.

The resource I choose to study is:

Where is this resource found?

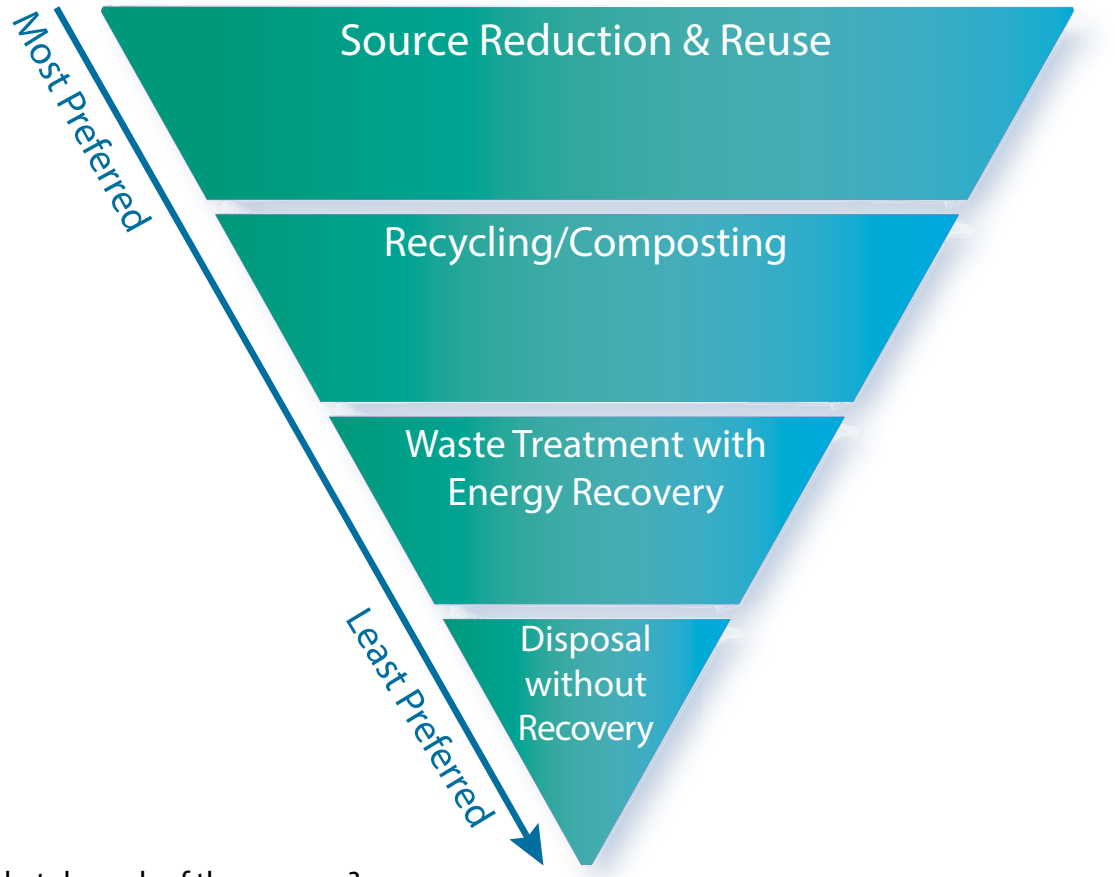
How do we get this resource?

What is the value of this resource? Does the value ever change? (if so, why?)

Can this resource be reused or recycled?

Student Copy Page

The Waste Hierarchy



But what do each of these mean?

Source Reduction and Reuse: Cutting back on waste at the source. It can take many forms such as buying things in bulk, reducing packaging, using safer alternatives for cleaning and hobbies, limiting use of single-use products, and donating items.

Recycling/Composting: Recycling is a series of activities that includes collection of used, reused, or unused items that would otherwise be considered waste; sorting and processing the materials into raw materials that can be made into new products. Composting food scraps and yard waste, and other organic materials is also a form of recycling that turns organics into a useful soil amendment.

Waste Treatment with Energy Recovery: Heat generated through combustion (incineration) is converted into useable heat, electricity, or fuel. This process is often called waste-to-energy (WTE). Capturing methane gas from a landfill and using it for energy is another example of energy recovery.

Disposal without Recovery: Burying waste in landfills without recovering the gases generated by the decomposing wastes, or incinerating wastes without energy recovery.

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