



## LESSON 8: Recycling

### OVERVIEW

In this lesson students will learn about the process of recycling through modeling and class discussion. Students will then go on to classify items as recyclable, compostable, reusable or as trash, as well as identify plastics by their identification code. Finally, students will develop an informational flier of recycling opportunities in their area.

### Learning Targets

- Students will explain three elements of recycling: collecting recyclable materials, taking old material and making it into new products and buying products made from recycled materials.
- Students will identify and categorize plastic products that are recyclable according to the identifying symbol and number on the product.
- Students will distinguish between multiple ways to recycle by creating an information flier of recycling opportunities in their community.
- Recycling helps to reduce the amount of trash that ends up in the landfill, and it is important for young people to help keep trash from ending up in landfills by finding out whether their city or town offers recycling opportunities.

### GLEs

See attachment

### Materials Needed

- A variety of plastic containers with recycling symbols
- Glass bottles
- Plastic water bottles
- Detergent bottles
- Cereal boxes
- Newspapers
- Magazines
- Plastic yogurt cups
- Plastic wrap/film
- Banana peel
- Disposable diaper
- Modeling clay (to represent aluminum soda cans)

### Background Information

#### What Is Recycling?

Recycling takes waste objects, breaks them down into separate raw materials, and then uses the material to create new objects. There are many benefits to recycling, including reducing the amount of energy needed to create objects, reducing amounts of pollution, and helping to eliminate waste.

### Curbside vs Drop off

There are various ways to collect recycling. Some communities participate in curbside recycling, in which recyclable materials are set out for pick-up by collection trucks. Communities that do not participate in curbside recycling rely on drop off centers (although drop off centers also exist in communities with curbside pick-up). Different centers will accept different types of materials. Drop off centers are often able to accept materials that would be rejected by curbside recycling programs, like batteries or plastic grocery bags. Some drop off centers will even pay for the materials, like aluminum cans, that you bring.

### Single Stream Recycling

In single stream recycling systems, multiple kinds of materials are allowed into a single container that is sent to a materials recovery facility (MRF). The materials must then be sorted by machines and workers. The advantage of single stream systems are that it is easy, and therefore has high participation rates. However, the cost of recycling is higher due to the need to sort the materials and from higher levels of contamination – materials that should not be in the recycling stream.

### Material Recovery Facilities (MRFs)

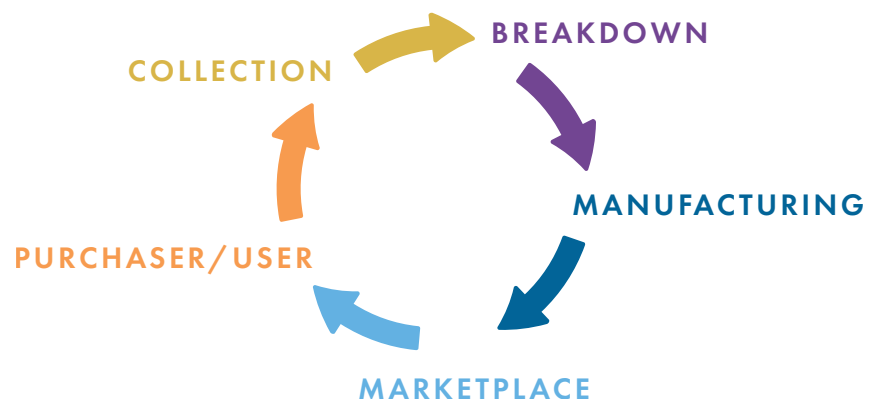
In single stream recycling, materials are collected at a MRF where a combination of human workers and machinery separate the materials. MRFs are not capable of sorting all recyclable materials, and some can even slow down or damage machinery. Plastic grocery bags are an example of this. These bags are usually made out of a highly recyclable plastic (HDPE), but they get caught in the machinery, forcing workers to stop materials processing as they unclog the machine. The materials capability of MRFs will often play a major role in what items are allowed in single stream recycling systems.

### Dual Stream Recycling

Dual stream or multi-stream recycling systems require that materials be separated into different containers. For example, paper and cardboard may go in to one container while containers (metal and plastic) go in another. This form of recycling produces higher quality materials. The disadvantage of this system is that as the complexity of sorting increases, recycling participation rates decrease.

### The Recycling Loop

Recycling is more than just putting your used materials out for collection, it's a process. For an object to truly be recycled it must go through a variety of steps that "closes the loop," and each stage in the loop has its own economic and sociological factors. For example, the collection stage in the loop requires the correct materials to enter the stream. Incorrect materials can increase the cost of recycling to the point where it is no longer profitable.



Some materials are difficult to breakdown, such as electronic waste. Electronic waste is usually rich with valuable metals such as copper, gold, and silver. However, these metals are often embedded with other materials that makes their extraction difficult or hazardous. This is why electronic waste (or e-waste) must be sent to specialized recyclers.

After objects have been broken down and converted into raw materials, manufactures must purchase the materials to make new objects. Some materials are no longer maintain their original properties after breakdown (more below), and so manufactures are unable to use them to create new products. Paper and many plastics are example of this.

Recycled products must also compete with other products in the open marketplace. Consumers want these products to be affordable, with the same or enhanced features and benefits of conventional products. Unless a consumer chooses to purchase goods made from recycled materials, the loop doesn't close.

### **Recyclability of Materials**

Not all materials are alike in terms of their recyclability. The two main factors that affect recyclability are the economic value of its materials, and the stability of the materials during breakdown.

### **Economic Considerations**

Some materials are cheaper to recycle than others. Metals are fairly easy to separate and break down, and transportation costs are comparable to that of virgin raw material. The ease of recyclability results in high-value products that make metals a highly recyclable item. On the other hand, expanded polystyrene (EPS), although recyclable, is an extremely low-density material that is mostly air. The air must be compressed out before it can be recycled. It is prohibitively expensive to transport EPS because of its structure, so there are few recycling option for it. Additionally, EPS also suffers from high contamination rates (eps is used in a variety of food packaging applications), reducing value even further.

### **Material Stability**

The chemical and physical structure of the materials being recycled also helps to determine the recyclability of a material. Metals and glass are indefinitely recyclable, meaning they can be recycled over and over again with no loss in quality. In contrast, the fibers that make up paper are shortened during the recycling process. As a result, paper can be recycled about 5 to 7 times. Plastics are made of long molecules called polymers. Different polymers make different kinds of plastic, each with their own properties. There can also be different additives added to give the plastics additional properties. A high amount of contamination occurs during recycling that reduces the quality of the polymers, limiting how many times it can be recycled. It is estimated that the majority of plastics are only recycled once or twice before they end up in a landfill or incinerated.

### **Sources**

- <https://archive.epa.gov/wastes/conserve/materials/paper/web/html/faqs.html#times>
- <https://ourworldindata.org/faq-on-plastics#how-many-times-can-plastic-be-recycled>

### Plastic Identification Codes



#### **PET or PETE: Polyethylene Terephthalate**

PET is commonly used for soft drink and water bottles, cooking oil bottles, peanut butter containers. It is the most widely recycled plastic.



#### **HDPE: High-Density Polyethylene**

Identifies milk, cider and water jugs, detergent, fabric softener and bleach bottles. HDPE is slightly waxy and semi-rigid. It does not crack. It floats in water.



#### **PVC: Polyvinyl Chloride**

Also abbreviated V, PVC is used in salad dressing bottles, vegetable oil bottles and mouthwash bottles. PVC is smooth, scratches easily and sinks in water.



#### **LDPE: Low-Density Polyethylene**

LDPE is used in flexible bags for dry cleaning, trash, produce, bread and shrink wrap. Recycled LDPE is often used to make grocery bags.



#### **PP: Polypropylene**

PP is usually found in drinking straws, battery cases, some dairy tubs, bottle labels and caps, and rope. PP stretches into filaments and emits a chemical smell when burned.



#### **PS: Polystyrene**

PS and Expanded Polystyrene (EPS) are both number 6 plastics. PS and EPS are commonly used in packaging peanuts and other packaging materials and in plastic utensils and egg trays. PS sinks in water; EPS floats.



#### **Other**

Other plastics often are made of multiple resins or layers of different types of plastics. These may include microwave packaging, snack bags and industrial plastics.

### ACTIVITY

**Note:** Send a note home with students a few days before the activity asking them to collect cleaned plastic containers from their homes. Have students bring these containers in on the day of the activity.

#### Part I (Suggested for grades 1 to 4)

1. Introduce students to the recycling symbol by drawing one on the board. Ask students if they know what the symbol represents. Explain that this is a symbol that represents recycling, and that recycling occurs in three main steps, just like the three arrows on the symbol.
2. Show your class the chunk of modeling clay. Explain that this represents all the aluminum available to make soda cans, aluminum foil, airplanes, etc. Aluminum is a very durable material that can be used over and over again.
3. Ask students if they would like a soda (organic and sugar free of course!). Give each student who raised their hand a piece of the clay. Have students observe how much "aluminum" is left. What will happen as students continue to drink more soda? Continue until all the clay is gone.
4. Ask students to brainstorm how they are going to get more aluminum to make more soda cans. An appropriate student response would be to give their soda cans back to the factory. This is the first step of recycling! Label the first recycling symbol arrow "Collect recyclable materials." (There are several different ways to collect recyclable materials, and this will be covered later). Collect the used "soda cans" from the students.
5. Ask students what the factory should do with all these cans? They should turn them into new ones! This is the second step of recycling, and you can now label the second arrow on the symbol, "Turn used materials into new products." Mash the "soda cans" into a solid clay ball, and divide them out into individual cans.
6. Finally, ask students what they think the last arrow will represent. Thirsty students will want to get a new can of soda — this is the last step of recycling. Label the last arrow of the symbol "Purchase products made from recycled materials." Ask students what happens to the aluminum used to make the cans if any part of the recycle symbol is broken. It winds up in the landfill, and now we have less aluminum!

#### Part II (Suggested for grades 1 to 4)

1. Now that students are familiar with recycling, it is time to learn about which materials can be recycled.
2. Present students with the items you brought to class and ask them which ones can be recycled, and which ones cannot. The only ones that cannot be recycled are the plastic film, disposable diaper and banana peel.
3. Have students look at how much material could be kept out of the landfill by recycling. Older students can calculate percentages or fractions based on the amount of material that cannot be recycled compared to the total amount of material.
4. What should students do with items that can't be recycled? Have students discuss what can be done about these items, such as composting the banana peel, reducing or not using plastic wrap for food, and using washable diapers.

### Part III (Suggested for grades 1 to 4)

1. How can students easily tell if something can be recycled? Most items that can be recycled will have the recycling symbol on it, or will ask them to recycle. However, not all cities are able to recycle the same kinds of materials and students must check with their waste officials to learn what can be recycled where they live. Have students look at the plastic containers they brought to class for the recycling symbol. Many will notice that these symbols have a number included with them.
2. One item that can be confusing to recycle is plastic because not all plastics are made the same way. Plastic codes were developed to make recycling plastics easier. Share the plastic codes provided with this lesson with your class.
3. Have students sort their plastic containers by their code numbers. Of all the plastic codes the students looked at, which one was the most common?
4. The last step of recycling is to purchase items made out of recycled materials. Have students look at their items again, this time looking for the phrase "post-consumer content." Explain that this number can tell students what percentage of the object was made out of recycled materials. Unfortunately, not all manufacturers label their products with post-consumer content, so it is up to students to research what items are commonly made out of recycled materials!
5. Visit these websites to learn more:

<http://www.maine.gov/dep/waste/recycle/whatrecyclablesbecome.html>

[http://www.recycleforyourcommunity.com/about\\_recycling/what\\_does\\_it\\_get\\_turned\\_into/](http://www.recycleforyourcommunity.com/about_recycling/what_does_it_get_turned_into/)

<http://www.recycleeverywhere.ca/what-they-become/>

### Part IV (Suggested for grades 2 to 4)

1. Have students explore recycling options in your area.
2. Students should identify if the recycling options are single or dual stream, and who offers them. They may check with local retail or grocery stores, or the online resources provided below.
3. If your city offers recycling services, find out what plastic numbers are recyclable in your area and have the kids sort the plastic items into those that can be recycled and those that can be reused. To find out the services in your area go to <http://search.earth911.com/>
4. Direct students to make an informational flier that can educate their parents and/or other community members about recycling opportunities in the community. Encourage students to share their fliers with friends and family to help others learn about recycling opportunities.

### CALL TO ACTION

1. Ask the students if they could imagine only having one trash bag of trash at their house for one entire year? Show the students the video: <https://www.youtube.com/watch?v=yNloyhhHyYA> which features an ABC News story on a family household that works on recycling and reducing in their own home every day.
2. Challenge the class to see if they can reduce the classroom waste for one month. Weigh your classroom waste each week to see whether there is a reduction.
3. Older students can assess what items at school can be recycled and use this information to develop a proposal for a school-wide recycling program. The school may choose to participate in America Recycles Day as part of its efforts.
4. In communities that offer curbside recycling, create a classroom goal to have a 100 percent recycling participation rate from students.

### OTHER RESOURCES

- **Keep Louisiana Beautiful** <http://keeplouisianabeautiful.org/>
- **Keep America Beautiful** <https://www.kab.org/>
- **Recycle Bank – an online tool that rewards recycling and learning about recycling** <https://www.recyclebank.com/>
- **Terracycle – online recycling options** <https://www.terracycle.com/en-US/>
- **Keep America Beautiful's America Recycles Day:** <http://americarecyclesday.org/>
- **"How this Japanese town is working to produce no trash"** <http://thekidshouldseethis.com/post/how-this-japanese-town-works-to-produce-no-trash>
- **Top 10 Recycling Websites for Kids** <http://www.more4kids.info/704/top-10-recycling-websites-for-kids/>
- **Recycling Computer Game** <http://fergusonfoundation.org/hbf-kids-zone/take-out-the-trash/>
- **Show them the Reading Rainbow Video, The Lifecycle of Recyclables.** <http://thekidshouldseethis.com/post/84528738617>