



## LESSON 7: Plastics

### OVERVIEW

Students will learn about the role of plastic products in our society and the benefits and potential harmful effects of plastics by creating artwork from commonly found plastic items.

### Learning Targets

- Students will examine how plastic is used in our lives every day and how plastics can help make our lives easier.
- Students will identify how some of the properties of plastic make it harmful to the environment.
- Students will develop a plan to reduce plastic use and evaluate its effectiveness by tracking plastic water bottle use.

### GLEs

See attachment

### Materials Needed

- A variety of plastic materials including bottle caps, packaging, bottles and plastic bags — enough for every student to have several options to create an art project. These can be obtained by the students from their home, the school or litter cleanups.
- Craft supplies for every student:
  - Glue
  - Markers
  - Scissors
  - Construction paper
  - Other materials that students identify as needed
- Water bottle tally sheet

### Background Information

#### What Are Plastics?

Plastics include a variety of materials that are usually made from synthetic polymers. A synthetic polymer is not naturally found in nature. The feedstock for most plastics comes from petroleum, a non-renewable resource.

#### Brief History of Plastics

While natural materials like natural rubber have been used for thousands of years, the first man-made plastic was invented in 1856. It was called nitrocellulose. This plastic was made using cellulose, which is found in plants, and could biodegrade over time. Similar products were made during this time, including celluloid and galalith. All had components that were naturally found in nature, and could biodegrade in certain conditions.

The first fully synthetic plastic, Bakelite was made in 1907. Synthetic plastic development and use exploded in the 1940s and 1950s, and became a ubiquitous part of American life.

### What Makes Plastics So Useful?

Plastics are cheap, durable, and versatile. Petroleum products and byproducts are used in the production of plastic, and are inexpensive to produce and transport in comparison to traditional materials such as metal or glass.

The chemical bonds that make plastic are not found in nature. As such, there are very few microorganisms that can break them down to use it for energy. This means a plastic packaging designed to hold food or medicine products will not spoil or degrade over time. Another way that plastics are durable is that they can be designed to deform without breaking, which comes in handy when they are dropped.

One of plastic's biggest advantages is its versatility. Plastic can be molded into almost any shape, making it useful for making the handles of scissors, telephones, steering wheels... or just about anything! Plastic can be manufactured to be flexible or stiff, is relatively lightweight for its strength, and is naturally water repellent.

### What Makes Plastics So Harmful?

Unfortunately, many of the same things that make plastics so useful are also what make it a problem. Bakelite that was made over a hundred years ago is commonly sold as a collector's item! Since plastic doesn't degrade very well it sticks around and accumulates in the environment. A variety of chemical additives are used to give plastics the variety of properties that make it useful. Many of these chemicals are toxic, and have been shown to have negative human-health and environmental consequences. Lastly, because plastic is so inexpensive, it is used as a material for nearly every object you can imagine. The amount of plastic that is produced and used each year is increasing.

### Single Use Plastics

Just as the name implies, single use plastics are those that are intended to be used once and then discarded. Plastic straws and food packaging, to disposable cups and cutlery are all examples of single use plastics. These are objects that might only be used for a few minutes, but will exist on earth for centuries. Packaging accounts for about 40% of plastic production – and is the most common type of plastic pollution found. By making choices that reduce the amount of single use plastics we use, we can have a positive impact on the environment.

### Microplastics

As plastics slowly break down they turn into smaller and smaller pieces. However small these pieces are, they're still plastic. We call pieces smaller than 5 mm microplastics, and they are becoming a pervasive problem in both terrestrial and aquatic environments. Humans also manufacture microplastics as an additive for certain cosmetics. These are called microbeads, and have been banned in many parts of the world. Microplastics are also generated by abrasion of tires during use and washing of clothing (many articles of clothing are made of synthetic fibers). In fact, synthetic fibers from clothing may be one of the largest contributors to microplastics.

In the ocean, microplastics are often mistaken for food by other organisms. When they are ingested, they can leach chemicals, block digestive tracks, and lead to malnourishment. As these plastics break into smaller pieces, they are capable of being incorporated into the body mass of invertebrates like oysters. If you have eaten an oyster lately, you've likely eaten plastic! Plankton can also mistake microplastics for food, further introducing plastics into the food chain.

These microplastics can both leach and adsorb toxic chemicals in the environment. Some ocean currents circulate in such a way to trap microplastics, and create “plastic soup.” The Great Pacific Garbage Patch is an example of this. Louisiana is not immune to the problem of microplastics. The Gulf of Mexico has some of the highest microplastic concentrations in the world.

Microplastics have become pervasive. They are found in bottle and tap water, beer, sea salt, air, honey, sugar, chicken... and you. Our understanding of the magnitude of this problem is new and rapidly growing, and it is unknown what health effects may result from people being exposed and consuming microplastics.

### Bioplastics

Bioplastics are made from renewable resources, like cornstarch or cellulose. The chemical bonds created during the manufacture of bioplastics much more closely resemble those found in nature. As a consequence, many can decompose more quickly than conventional plastics. Some bioplastics are marketed as compostable and or biodegradable. It is important to recognize that these plastics must be composted at a commercial facility that can attain the correct environmental conditions, burying them in your back yard will have not effect.

### What Do We Do About the Plastic Problem?

Once a product must be discarded, the best choice is to either recycle it or incinerate it at a waste-to-energy facility. What is the best choice will depend upon the location. The last option is to landfill the plastic. Unfortunately, this is still where most plastic ends up.

The most important thing you can do to help with the plastic problem is to reduce use, especially of single use plastics. Forgoing a straw when you eat out, using a reusable grocery bag, and choosing to purchase bulk products over individually wrapped ones can all have a positive impact. By reducing use, you are keeping more plastics out of the environment, and reducing demand for manufactures to create them. When you do need to use a plastic item, think about how you can reuse it. For example, reusing a plastic shopping bag as a garbage bag is an environmentally friendly practice. Many food packaging containers can also be reused.

### Sources

- <https://news.nationalgeographic.com/2018/05/plastics-facts-infographics-ocean-pollution/>
- <https://www.nature.com/articles/s41598-017-14588-2>
- <http://agro.icm.edu.pl/agro/element/bwmeta1.element.agro-953d4b4d-549a-4bc6-9d95-2b10030b7552>
- <https://www.tandfonline.com/doi/abs/10.1080/19440049.2014.945099>
- <http://www.professionalabstracts.com/ueg2018/iplanner/#/presentation/819>
- <https://storyofstuff.org/wp-content/uploads/2017/02/IUCN-report-Primary-microplastics-in-the-oceans.pdf>

### ACTIVITY

#### Part I

1. A few days before the activity, have students collect plastic items that would have been thrown away. Have them bring them to school the day of the activity.
2. Have students examine their trash. What were the items used for? Plastics have many beneficial uses, and students should be aware of how they are used in their homes and communities. Explain to students some of the properties of plastic that make it so useful.
3. Show the kids the video, The Majestic Plastic Bag <https://www.youtube.com/watch?v=GLgh9h2ePYw>. What are the properties of plastic that are beneficial to us when we use them, but harmful to the environment?
4. Briefly discuss with students how plastic can be harmful to the environment (review background info from Lesson 6 – Trash Effects on Wildlife).
5. Because plastic can be harmful to the environment, encourage students to identify ways to reduce the use of the plastic items they brought in. For example, they can use reusable containers for their lunch instead of plastic bags.
6. Continue to have students examine their trash and identify materials that may have been reused or repurposed. For example, plastic bottles can be turned into bird feeders.

#### Part II

1. Another way to reuse plastic is to turn it into art. You may want to show students some examples of trash that has been turned into art from the resources below. Explain to students that they will be creating “Plastic Art” in order to reuse the plastic and keep it out of the landfill. They will be using the plastic materials gathered to create an animal of their choosing.
2. Allow the students to pick several different plastic media to create their own plastic art animal
3. After the students have worked on their creation, allow them to share with the class what type of animal they made and how they have saved this animal from the harmful effects of plastics by working on this project.

#### Part III

1. Organize a litter cleanup on the school campus or at another site (see Lesson 1: What is Litter?). Use the collected plastic litter to create artwork.
2. Let students get creative with their art. Works may be of wildlife, landscapes or abstract creations of how the litter has made the students feel, etc.
3. Have students research and create small educational statements about the harm plastic and litter can cause in the environment.
4. Display the students’ artwork and educational statements around campus to create awareness about plastic.

### Part IV – Plastic Assessment

1. In this plastic assessment, students will calculate how many plastic water bottles they use in a year, and develop an action plan to reduce their use.
2. Using the plastic bottle tally sheet, have students count how many water bottles they used the previous week. Use the sheet to help calculate how many pounds of CO<sub>2</sub> were used to make those plastic bottles.
3. Continue this process each Monday for one month. At the end of the month, use the tally sheet to help estimate how many plastic bottles the students use during the year along with how much CO<sub>2</sub> was used to make those bottles.
4. Have students make a commitment and develop a plan to use fewer water bottles by reusing their water bottles, using refillable bottles, etc.
5. After a month, have students complete steps 2 and 3 again, and calculate the difference in plastic water bottle use.
6. How much CO<sub>2</sub> did the students save? The class? What if the whole school made efforts to reduce plastic use?
7. As a school-wide extension, students can lead an assessment of plastic use in the cafeteria.

Optional: Younger students may find it easier to graph their water bottle usage over time, while older students can graph as an extension of the activity.

### CALL TO ACTION

1. Many large grocery stores and some stores such as Target, Wal-Mart, Lowe's and Home Depot have collection bins for plastic bags. Programs that collect grocery bags also recycle other plastic bags and wraps including: Newspaper Bags – Dry Cleaning Bags – Bread Bags – Produce Bags – Toilet Paper Wraps – Napkin Wraps – Paper Towel Wraps – Furniture Wrap – Electronics Wrap – Plastic Retail Bags – Grocery Bags – Food Storage Bags – Cereal Box Liners – Diaper Wrap – Plastic Shipping Envelopes – Case Wrap – Ice Bags – Bags Labeled #2 or #4
2. Plastic bags and wraps can be recycled into plastic lumber that is used to make park benches, backyard decks and fences – even playground equipment. They also can be recycled into new plastic bags – and then be recycled again. Start a collection program at your school for these plastic items to be dropped off for recycling.
3. Research a way to start a plastic bag recycling program at your school. The Plastic Bag Challenge is a competition to see which school can collect the most recycled plastic bags to recycle with Trex, a company that makes lumber out of used plastic and wood. Trex used more than three billion plastic bags last year to make its products. Go to Trex.com to learn more.
4. Learn more about “plarn” (plastic yarn) and how you can use it to make items, such as sleeping mats for the homeless.

### OTHER RESOURCES

- See KLB Lesson 6: Trash Effects on Wildlife
- Plastic Planet Video <https://www.youtube.com/watch?v=73sGgmZoMBQ>
- Louisianan Marcus Erikson's work on plastic in our waterways <http://www.5gyres.org/>
- 40 Terrific works of art made from common trash <http://www.noupe.com/inspiration/showcases/40-terrific-works-of-art-made-from-common-trash.html>
- <http://www.healthguidance.org/entry/14901/1/The-Effects-of-Plastic-Bags-on-Environment.html>

- **Learn about Keep Oklahoma Beautiful's Plastic Bottle Cap Art Competitions** <http://www.keepoklahomabeautiful.com/end-litter-5th-grade-elementary-contest>
- **Keep Louisiana Beautiful Website** <http://keeplouisianabeautiful.org/>
- **Keep America Beautiful Website** <https://www.kab.org/>
- **Background information taken from Keep America Beautiful, Waste in Place Curriculum, Lesson: Plastics By the Numbers.**