NATIONAL GEOGRAPHIC

RESOURCE LIBRARY
ACTIVITY : 1 HR 15 MINS

There's No Such Place as Away

The unit launches with students describing their favorite belonging and considering the question: *Where do the raw materials come from, and where will they ultimately end up?* Resources about mining and landfills expand their understanding of material life cycles, and a video introduces the concept of a circular economy. Finally, students learn about the unit project challenge.

GRADES

6 - 8

SUBJECTS

Conservation, Earth Science, Social Studies, Economics

CONTENTS

3 PDFs, 2 Resources

OVERVIEW

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For the complete activity with media resources, visit:
http://www.nationalgeographic.org/activity/theres-no-such-place-away/

DIRECTIONS

***Closing the Loop: Towards a Circular Economy* unit driving question**: How can we make our economy more circular, and why does it matter?

***The Circle of Stuff* lesson driving question**: How can a circular economy minimize harm to the environment and human health?

1. **Elicit students' stories about their favorite belonging. Use a flowchart to have them consider the materials that it is made of, and where those materials go when the belonging is "thrown away."**

- Ask students to close their eyes and imagine their favorite belonging. It may be an article of clothing, an electronic device, a piece of artwork, a book, or something completely different.
    - Ask: *What is it made out of?* (Responses will vary.)
    - Further probe students' thinking by asking: *Where do these materials come from?* (Responses will vary.)
    - Explain that in this unit, students will explore the Materials Economy—how things are made, how they get to us, and where they go when we are done using them.
- Distribute the *"And Before That?" Flow Chart*.
    - Direct students to write or draw their favorite belonging in the circle.
    - Have them write or draw two of the materials that make up their favorite belonging in the next two boxes.
        - Especially since there are likely more than two materials that make up the belonging, encourage students to select two of the materials with which they are most familiar.
    - Then, one step at a time, have students trace the history of these materials back as far as they can. (Possible responses:
        - My favorite belonging is my diary. It is made of paper and ink. The paper came from a paper factory, and before that, it came from a pulping plant. Before that, it came from a log, and before that, it came from a tree in the forest.
        - My favorite belonging is my sneakers. They are made from fabric and plastic. The plastic comes from a factory, and before that, it came from an oil refinery. Before that, it came from oil that was deep underground.)
    - Students may never have previously considered where products in their everyday lives come from, and they may not know where to begin. If they get stuck, prompt them to

follow the steps below, emphasizing that the goal is to start thinking about where products come from, rather than correctly identifying the materials and their sources:

  - Ask a classmate for help.
  - If your classmate doesn't know, take an educated guess.
  - If you can't think of an educated guess, write "I need to do more research."

- Once complete, have students share their work with a partner. Their partner can also help provide missing information if the student was unable to fill in any of their steps.
- Next, distribute and have students complete the *"And After That?" Flow Chart* in the same fashion. (Possible responses:

  - After I can no longer use my diary, I will keep it in a box under my bed and never share it with anyone. After that, it will be recycled in the recycling bin. After that, it will go to the recycling plant, and after that, it will be recycled into a new book for someone else to buy.
  - After I can no longer use my sneakers, I will give them to my younger sibling. After that, they will probably go into the trash can. After that, the trash truck will pick them up and take them to the landfill, where they will stay.)

- Once complete, have students share with a different partner.

2. **Use an infographic to define the linear economy, and have students identify how it applies to their belongings.**

- Elicit students' ideas about how they define *economy* and what it has to do with their *"And Before That?" Flow Charts*. Build on their thinking to provide a student-friendly definition of *economy* as a system of production, distribution, and consumption of goods and services.
- Display the Linear Economy vs. Circular Economy infographic.

  - Explain that most of our economy is linear. This doesn't mean that everything travels in a perfectly straight line, but it does mean that most materials are extracted, processed, distributed, used, and then thrown "away." In the United States, the majority of materials that are thrown "away" end up in landfills, where the materials cannot return back into the economy; hence the term "linear."
  - Ask: *What are examples of resource extraction from your "And Before That?" Flow Chart?* (Possible responses: Cutting down trees; Drilling for oil; Mining copper.)

- Ask: *What are examples of production from your "And Before That?" Flow Chart?* (Possible responses: Taking the trees to a lumber mill, where they are turned into boards; Transporting oil to a refinery, where it is separated into different chemicals; Taking copper to a factory, where it is made into wires.)
- Ask: *What are examples of distribution from your "And Before That?" Flow Chart?* (Possible responses: Materials are transported from factories to stores by truck, ship, or airplane.)
- Explain that the step of consumption is where consumers like us use the object. Sometimes, as implied by the term "consumption," the material is not able to be reused in an economic sense, as in the case of food (which is converted to energy in our bodies). With more durable goods, the object is used, but still exists, although it may be damaged or in less-than-new condition.
- Ask: *What are examples of waste from your graphic organizers?* (Possible responses: I give my clothes to a younger relative; I throw my broken toys in the trash.)
- Ask: *When we put an object in the trash, we often say we're throwing it "away." But what does that really mean? Where is "away"?* (Possible responses: Sometimes people throw things away as litter, and then it stays in the environment—in streets, in parks, into rivers and the ocean; It means you throw it in the trash can and the trash truck picks it up; The trash truck takes trash to a landfill, where it is buried; Some trash is burned, which can be used for energy generation, but also contributes to climate change. This process also creates ash, which, in the United States, is usually sent to landfills.)
- Display the phrase "There's no such place as 'Away.'" Ask: *What do you think this means?* Have students discuss in small groups before sharing their answers with the class. (Possible responses: It means that when you throw your trash somewhere, it never disappears or goes away, it just goes somewhere else.)
- Introduce the vocabulary term *conservation of matter*. Conservation of matter means that matter cannot be created or destroyed. Explain that this is a scientist's way of saying that there is no such thing as "away."

- Ask: *How many of you told a story about your favorite belonging that looks similar to this image of the linear economy? What's wrong with this story?* (Possible responses:

  - We can't continue to throw everything away forever. Eventually we will run out of space in landfills.
  - We can't continue to extract resources forever. Some resources, like water and wood, are renewable, but many resources are non-renewable, such as metals and fossil fuels.)

3. **Explore the impacts of linear resource extraction and disposal. Then, show a video to introduce the concept of a circular economy.**

- Prepare students' understanding as they read about resource extraction and waste disposal, either individually or in partner groups: have half the class read the encyclopedic entry, *Mining*, and the other half read the encyclopedic entry, *Landfills*.
    - While they are reading, have students take notes on negative environmental and health impacts they learn about each process.
    - Circulate while students are working to ensure their understanding and to probe their thinking.
    - When both groups have finished reading and have a complete list of negative impacts from each process, have the two groups come together to create a shared class list of negative impacts. Record this list with the title, "Harmful Impacts of the Linear Economy," on a shared document that is visible in the classroom.

- Lead a class brainstorm about how we can address these harmful impacts of the linear economy and alternative ways to approach resource use and disposal. Segue from students' ideas, which likely will include recycling and reuse, to the idea of the circular economy by showing the video *Re-thinking Progress: The Circular Economy* (3:48).
- Display the full *Linear Economy vs. Circular Economy* infographic. Ask: *How is a circular economy different from a linear economy?* Have students discuss in pairs before sharing their answers with the class. **(**Possible responses from the video:
    - The circular economy requires less resource extraction because materials are recycled, so it decreases environmental impacts associated with resource extraction.
    - The circular economy requires less waste disposal because materials are recycled, so it decreases environmental impacts associated with waste disposal.)

- Prepare to segue to the unit's focus on e-waste and lithium-ion batteries by asking students about which electronics in their lives could become part of the circular economy.
    - Draw from the video shown previously, as well as students' favorite belongings from Step 1, focusing in on responses related to electronic devices that use lithium-ion batteries.

4. **Introduce the unit driving question and final product of the unit project.**

- Display the unit guiding question: *How can we make our economy more circular, and why does it matter?* Distribute or provide access to the *Final Product Checklist and Rubric.*

    - Explain that the final product for this unit will be a video challenge for students to create and share on social media. The aim of the challenge will be to encourage the target audience to take part in the circular economy by recycling the lithium-ion batteries found in devices such as cell phones, also known as e-waste. Students will work in groups of 2-4 to create these videos, which should be 60-90 seconds long and include information about the harm caused by the linear economy and the solutions offered by a circular economy. The videos will also include information about how, when, and where to recycle electronic waste, with an emphasis on National Battery Day on February 18 and International E-Waste Day on October 14.
    - Provide students time to read over the rubric and answer any questions they have about it. Then, have students store the rubric in their project folder because they will need to refer to it several times over the course of the unit as they complete their work.
    - Finally, facilitate the creation of a *Know and Need to Know* chart to provide students a road map of guiding questions that will lead them to a successful final product of the unit project. Use the process below to elicit and record students' ideas and questions, which will be revisited throughout the unit.

- Have students discuss the following questions with a partner, and then share their thoughts with the class:

    - What do we already know about making our economy more circular and recycling lithium-ion batteries?
    - What do we need to know about making our economy more circular and recycling lithium-ion batteries in order to create a successful final product of the unit project?

Modification

Step 1: Some students may find it helpful to see a model of a completed *"And Before That?" Flow Chart*. Consider filling out your own copy before teaching this lesson to share with students who have trouble visualizing the origin and fate of the materials in their favorite belonging.

Step 3: The narrator in this video has a British accent which may be challenging for students to understand. Consider turning on closed captions.

Tip

Step 2: Some students may not be familiar with the meanings of the terms in the *Linear Economy vs. Circular Economy* infographic. Define *resource extraction, production, distribution, consumption,* and *waste* as necessary for your class.

Informal Assessment

The *"And Before That?" Flow Chart* and the list of mining and disposal impacts provide evidence of students' initial ideas and understanding of human impacts on the environment, as well as the sources and fates of natural resources. The *Know and Need to Know* chart demonstrates students' ability to ask questions and define problems.

Extending the Learning

Challenge students to learn more about the extraction and/or waste disposal impacts of the materials in their favorite belongings. The website *Material Life Cycles* and the video series *How It's Made* can help students pursue this line of research. Use the EPA's *Facts and Figures About Materials Waste and Recycling* to further explore the data about the increasing amount of waste that is produced in the United States.

OBJECTIVES

Subjects & Disciplines

- Conservation

  Earth Science

  Social Studies
  - Economics

Learning Objectives

Students will:

- Brainstorm the origin and fate of raw materials found in everyday objects.
- Identify how the law of conservation of matter relates to the resource economy.
- Describe environmental and health impacts associated with mining and disposal.
- Explain how a circular economy is different from a linear economy.

- Understand the project challenge they will take on for the Closing the Loop: Towards a Circular Economy unit.

Teaching Approach

- Project-based learning

Teaching Methods

- Brainstorming
- Discussions
- Reading

Skills Summary

This activity targets the following skills:

- 21st Century Themes
  - Environmental Literacy
  - Global Awareness
- Critical Thinking Skills
  - Applying
  - Remembering
  - Understanding
- Science and Engineering Practices
  - Asking questions (for science) and defining problems (for engineering)
  - Developing and using models
  - Obtaining, evaluating, and communicating information

National Standards, Principles, and Practices

NATIONAL GEOGRAPHY STANDARDS

• **Standard 11:**
The patterns and networks of economic interdependence on Earth's surface

• **Standard 14:**
How human actions modify the physical environment
• **Standard 16:**
The changes that occur in the meaning, use, distribution, and importance of resources

NATIONAL SCIENCE EDUCATION STANDARDS

• **DCI ESS3.A::**
Natural Resources: Humans depend on Earth’s land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes.

NEXT GENERATION SCIENCE STANDARDS

• **Science and Engineering Practice 1:**
Asking questions and defining problems
• **Science and Engineering Practice 8:**
Obtaining, evaluating, and communicating information

Preparation

What You'll Need

MATERIALS YOU PROVIDE

- Project folders for each student

REQUIRED TECHNOLOGY

- Internet Access: Required
- Tech Setup: 1 computer per pair, Projector, Speakers

PHYSICAL SPACE

- Classroom

GROUPING

- Large-group instruction
- Large-group learning
- Small-group learning
- Small-group work

ACCESSIBILITY NOTES

Step 1: Some students may find it helpful to see a model of a completed *"And Before That?" Flow Chart*. Consider filling out your own copy before teaching this lesson to share with students who have trouble visualizing the origin and fate of the materials in their favorite belonging.

Step 3: The narrator in this video has a British accent which may be challenging for students to understand. Consider turning on closed captions.

BACKGROUND & VOCABULARY

Background Information

The term "circular economy" has developed and grown only since the 1970s, but the idea has been around for much longer. The concept is rooted in the guiding principles of continuing to use products and the materials of which they are made, designing processes and products that minimize waste and pollution, and regenerating natural systems, which aligns with indigenous and non-Western approaches to resource consumption.

Implementing circular economies helps to address a myriad of societal and economic issues, including the threat of resource depletion and minimizing waste production. Depletion of key resources (such as minerals, fossil fuels, or water) has been a growing concern in light of the exponential growth of human population. In response, new technologies have been developed for extraction or substitution of key resources. For example, a classic example in the United States is the use of "unconventional" new oil extraction techniques (offshore and fracking), which increased the available supply in response to the concerns of peak oil from 1970s-2000s. When a resource becomes limited, extractive industries have a greater financial incentive to explore previously untouched areas and to develop new technologies to extract

previously unreachable deposits. Developing more circular economic systems, however, allows for fewer resources needing to be extracted in the first place, which is a more sustainable way to address resource depletion.

In terms of waste production, an estimated 267 million tons of municipal solid waste (MSW) is produced annually in the United States, with the largest amount of waste produced per person in the world. Although this figure has leveled off over time, it is a massive amount of waste, with the majority (52 percent) sent to landfills. With the severe environmental and health hazards that are produced by landfills, it is vital to decrease the amount of waste that ends up there. An estimated 25 percent of MSW is recycled, 10 percent is composted, and 13 percent is incinerated for "waste-to-energy," but an important aspect of the circular economy that students will learn about in subsequent activities is to minimize the amount of waste we each produce in the first place.

Prior Knowledge

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Recommended Prior Activities

- None

Vocabulary

Term	Part of Speech	Definition
circular economy	*noun*	a system of production that extends the lifespan of consumer goods by maximizing reusing and recycling, and minimizing throwing things away.
conservation of matter	*noun*	principle that matter cannot be created or destroyed; it can only change form.
consumption	*noun*	process of using goods and services.
distribution	*noun*	the way something is spread out over an area.
economy	*noun*	system of production, distribution, and consumption of goods and services.
e-waste	*noun*	electronic devices or their parts that have been thrown away.
extraction	*noun*	process by which natural resources are extracted and removed from the earth.

Term	Part of Speech	Definition
landfill	*noun*	site where garbage is layered with dirt and other absorbing material to prevent contamination of the surrounding land or water.
linear economy	*noun*	system where raw materials are collected and transformed into products, which are eventually discarded as waste.
mining	*noun*	process of extracting ore from the Earth.
natural resource	*noun*	a material that humans take from the natural environment to survive, to satisfy their needs, or to trade with others.
production	*noun*	making or manufacturing of a product from parts or raw materials.
raw material	*noun*	matter that needs to be processed into a product to use or sell.
waste	*noun*	material that has been used and thrown away.

For Further Exploration

Reference

- US EPA: Advancing Sustainable Materials Management: 2017 Fact Sheet

Websites

- Science Channel: How It's Made
- Pratt Center for Sustainable Design Studies: Material Life Cycles