

Lesson 4

From Oil to Plastic

v. 1.0.0



Topic(s)

Recycle
Renewable Resources
Nonrenewable Resources

Duration

Lesson Steps—45-60 minutes
Writing an Explanatory Text—ongoing
Extension Ideas—varies

21st Century Learning Skills

- Collaboration
- Communication
- Creativity
- Critical Thinking

Grade Level(s)

Fourth and Fifth

Materials and Supplies

Students

1. *From Oil to Plastic* rubric (one per student) [Page 7](#)
2. *Plastic Life Cycle Cards* (one set per group) [Pages 9](#)
3. *From Oil to Plastic Video Notes* (one per student) [Pages 11-12](#)
4. Informational Text: *Why tap water is better than bottled water*, from *National Geographic* (one per student) goo.gl/xTIFX5
5. Informational Text: *An ecosystem of our own making could pose a threat*, from the *Los Angeles Times*—two versions, adapted by [Newsela](#) (one per student).
4th grade version: goo.gl/ja7YWj
5th grade version: goo.gl/GXMkuf
6. Markers/colored pencils
7. Glue (one bottle per group)
8. Scissors (one per student)

(continued)

SUMMARY

In this lesson, students will learn about the life cycle of a plastic product and the nonrenewable resource used to make it, by watching a video showing how plastic is produced from raw material to final product. They will create posters showing the chronological steps to making a plastic product, and discuss how recycling extends a product life cycle. Finally, students will analyze fourth and fifth grade appropriate informational text and write an explanation of the life cycle of a plastic product.

CORRELATION WITH STANDARDS

NEXT GENERATION SCIENCE STANDARDS

Fourth Grade

Fifth Grade

Standard and Performance Expectation

4-ESS3-1: Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Disciplinary Core Ideas

ESS3.A Natural Resources: Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3-1)

ESS3.C Human Impacts on Earth Systems: Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1)

COMMON CORE STATE STANDARDS

Fourth Grade

Fifth Grade

Lesson Focus Standards

Reading: Informational Text

RI.4.9: Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.

RI.5.9: Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.

Writing

W.4.2: Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

W.5.2: Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

Supporting Standards

Reading: Informational Text

RI.4.1, RI.4.3

Reading: Informational Text

RI.5.1, RI.5.3

Writing

W.4.1, W.4.3, W.4.4, W.4.7, W.4.8, W.4.9

Writing

W.5.1, W.5.3, W.5.4, W.5.7, W.5.8, W.5.9

Speaking and Listening

SL.4.2, SL.4.3, SL.4.4, SL.4.6

Speaking and Listening

SL.5.2, SL.5.3, SL.5.4, SL.5.6

9. Large paper—poster board, butcher paper, construction paper, etc. (one piece per group)

Teachers

1. *Life Cycle of a Plastic Product*
Page 13
2. *From Oil to Plastic* video, running time 9 min goo.gl/Dhn32b
3. Interactive whiteboard, document camera, or overhead projector (photocopy transparencies of visuals if needed)

Vocabulary

Consumer: A person who purchases goods and services for personal use.

Energy: The capacity for doing work. Forms of energy include thermal, mechanical, electrical, and chemical. Energy may be transformed from one form into another.

Landfill: An area of land designed to handle the disposal of garbage by burial. The garbage is usually spread out, compacted and covered with dirt or other material in order to control odors and fires, prevent the garbage from blowing around, and discourage animals. Materials in a landfill cannot be used again.

Life cycle: When not referring to a series of changes that an organism undergoes throughout its life, a life cycle can also describe the steps to producing a product, which usually includes the following stages: extraction of raw materials, production, distribution, and use of a product; and final disposal or recycling of remaining materials.

Manufacture: To make or process a raw material into a finished product, usually by a large-scale industrial operation.

Natural resources: Living or nonliving materials that come from the Earth such as fossil fuels, minerals, plants, ani-

LEARNING OBJECTIVES

Students will...

1. Identify the natural resources used to make plastic products
2. Sequence and describe the steps of a plastic product life cycle
3. Analyze grade appropriate text and write an explanatory text

TEACHER BACKGROUND

All of the products we use are made from natural resources. Some of these are made from renewable resources like wood and others from nonrenewable resources such as oil. Renewable resources can be replaced over a human's lifetime whereas nonrenewable resources are finite and cannot be replaced once they are used up. All products have a life cycle, meaning there are a series of stages that a product goes through from extraction of raw materials to production and final product. A life cycle becomes incomplete when any stage of the cycle is disrupted or removed.

Recycling involves a series of activities by which material that has reached the end of its current use is processed into material utilized in the production of new products. A product that gets recycled may not always get remanufactured into the same product again. Recycling products conserves the resources and energy used during the early parts of the manufacturing process; however, the process of remanufacturing recycled products still requires energy and resources. If a product is not recycled after use, it will most likely end up in the landfill, which ends the life of the product and the natural resources used to make it. If the product is recycled, the natural resources and energy used to make the product will continue to be used in making a new product from the recycled material. Plastic is made from fossil fuels (oil and natural gas), which are nonrenewable resources. Recycling conserves these resources, which cannot be replaced over a short period of time.

LESSON STEPS

Activating Prior Knowledge

1. Explain to students that many of the things we use every day are made or manufactured in factories using some kind of raw material.
2. Ask students to collaborate with a partner to determine examples of products they use every day that are manufactured. Provide students with a sentence frame to start their conversation: "An example of a product that is manufactured, or made in a factory using some kind of raw material, is _____." (Partner A and Partner B each state one example.)
3. Solicit answers from several students using a strategy that encourages active participation, such as [Numbered Heads Together](#) (link is <http://goo.gl/5651G1>), Numbered Sticks, etc.

Building Background

4. Explain to students that in this lesson, they will identify which raw materials these everyday products came from, and what processes were involved in getting them to consumers. Ask students to consider paper as an example. Ask the students what raw material paper is manufactured from. [Trees.] What about glass? [Sand.]

mals, water, air, sunlight, and other forms of energy.

Nonrenewable resources:

Minerals or sources of energy that can be extracted or collected from the Earth, such as coal, petroleum, iron ore, copper, etc. The processes of their formation are so slow that these resources may be considered gone forever once they are used up.

Oil: A liquid substance naturally occurring in the earth, usually black and sticky, that is used to produce fuel and products such as plastic.

Plastic: A material made from petroleum. It can be molded, extruded, or cast into a desired shape.

Products: Something produced by human or mechanical effort or by a natural process.

Raw materials: A material or natural resource that is mined or harvested for use in producing a product such as bauxite (aluminum), iron ore, silica, or trees.

Recycle: A series of activities by which material that has reached the end of its current use is processed into material utilized in the production of new products.¹ Some recycled materials become new versions of the same thing, such as used aluminum cans being made into new aluminum cans. Others are made into entirely new items, such as used car tires being made into rubber mats or a playground surface.

Refine: The process of purification or transformation of a substance. Refining is often used with natural resources that are almost in a usable form but that are more useful in pure form. For example, most types of petroleum will burn straight from the ground but will burn poorly and

5. Explain that the process of manufacturing, or making things for people to use, has several steps. Draw a T-chart on board as shown below, and fill in the first column only.

Manufacturing Steps (General)	Manufacturing Steps (Plastic)
1. Extract raw materials	
2. Transport raw materials	
3. Clean raw materials (“refine”)	
4. Process raw materials	
5. Make item	
6. Transport item to stores	
7. Transport item to store	
8. Item is purchased and used	

6. Explain that both nonrenewable and renewable resources are used as raw materials to make products. Show a clear plastic bottle. Ask the students what the bottle is made from. Explain that plastic bottles are made from the black, liquid oil that is pumped out of the ground. The atoms in the oil are rearranged and combined with other things during manufacture to make plastic solid but somewhat flexible, and fairly clear. Ask students if oil is a nonrenewable or a renewable resource. [Nonrenewable.] Unlike glass and paper, which are made from renewable resources (sand and trees, respectively), plastic is made from oil—a nonrenewable resource that cannot be replaced over a short period of time.
7. Display the visual *Life Cycle of a Plastic Product*, temporarily covering step nine. Complete the T-chart by writing down the steps to manufacturing a plastic bottle.

Manufacturing Steps (General)	Manufacturing Steps (Plastic)
1. Extract raw materials	1. Crude oil is extracted from the earth
2. Transport raw materials	2. Crude oil is transported to refineries by pipelines, ships, trucks, and rail cars
3. Clean raw materials (“refine”)	3. Crude oil is refined.
4. Process raw materials	4. Plastic pellets are made from oil or recycled plastic products
5. Make item	5. Plastic pellets are made into plastic products
6. Transport item to stores	6. Plastic products are transported to stores
7. Transport item to store	7. People buy plastic products, and products contained in plastic bottles
8. Item is purchased and used	8. End-of-life for plastic products

8. Point out to students that although the T-chart stops at Step 8 (end-of-life for plastic products and empty plastic bottles), we make choices every day about what to do with manufactured products when we’re finished using them. Ask students what they might do with a plastic bottle when they’re finished

quickly clog an engine with residues and byproducts, so it's refined.

Renewable resources: Naturally occurring raw materials or form of energy that has the capacity to replenish itself within a relatively short amount of time (e.g., a human lifetime) through ecological cycles and sound management practices, e.g., trees, agricultural crops, grasses.

Reuse: Extending the life of an item by reusing it again as it is or creating a new use for it.

Trash: Material that is worthless and is to be disposed of.

Additional Resources

<http://www.newsela.com> A website containing current news articles at upper elementary and middle school reading levels. Sign-up required.

<http://www.rewordify.com> A website for translating difficult text into easier reading levels.

<http://www.cde.ca.gov/be/st/ss/index.asp> California Department of Education, Content Standards Page (<http://goo.gl/i96fuh>)

How Stuff Works Videos

Plastic Substitutes: <http://science.howstuffworks.com/environmental/green-tech/sustainable/5-plastic-substitutes.htm> (<http://goo.gl/1wQNeA>)

How Plastics Work: <http://science.howstuffworks.com/plastic.htm> (<http://goo.gl/JkCER2>)

Great Pacific Garbage Patch: <http://science.howstuffworks.com/environmental/earth/oceanography/great-pacific-garbage-patch.htm> (<http://goo.gl/y2Xp4K>)

How Recycling Works: <http://science.howstuffworks.com/environmental/green-science/recycling.htm> (<http://goo.gl/KgqEUs>)

drinking or using the contents. Record their answers on a chart to save. (Note: It's likely that some students will share that they *recycle* plastic bottles when they are finished with them. If not, suggest adding *recycle* to the chart).

9. Explain that the products we use have a life cycle, meaning that all products originate from somewhere and often, after use, have an end of life. Tell the students they will be learning about the plastic life cycle.
10. Explain that recycling extends the life of a product by keeping recycled materials available to make a new product. When the bottle gets recycled, it will go back to the manufacturing (processing raw or recycled materials) part of the process to get made into new things, instead of having to pump more oil to make more plastic. This not only extends the life of the plastic product, but also the natural resources and energy used to make it. This is especially important because oil is a nonrenewable resource—when it's gone, it's gone.
11. Refer to the T-chart. Add #9 to the T-chart (Left side—*Item is recycled*; Right side—*Plastic product or empty plastic bottle is recycled so it can be turned into something new*). Ask students to consider and discuss the following question with a partner: “When we recycle a product after using it, which steps are eliminated from the manufacturing process?” As students share responses, cross out the steps in the manufacturing process that are no longer necessary when we recycle used plastic bottles. Draw an arrow to show how recycling a bottle returns it to Step 4 (processing raw or recycled materials).

Manufacturing Steps (General)	Manufacturing Steps (Plastic)
1. Extract raw materials	1. Crude oil is extracted from the earth.
2. Transport raw materials	2. Crude oil is transported to refineries.
3. Clean raw materials (“refine”)	3. Crude oil is refined.
4. Process raw materials	4. Plastic pellets are made from oil or recycled plastic products.
5. Make item	5. Plastic pellets are made into plastic products.
6. Transport item to stores	6. Plastic products are transported to stores.
7. Transport item to store	7. People buy plastic products, and products contained in plastic bottles.
8. Item is purchased and used	8. End-of-life for plastic products.
9. Item is recycled	9. Plastic product or empty plastic bottle is recycled so it can be turned into something new.

12. Return to the *Life Cycle of a Plastic Product* visual to further students' understanding of how recycling extends the life cycle of a plastic bottle. Students will note that the addition of recycling (step 9) allows the life of the plastic bottle to continue. Explain that a cycle can be disrupted if any step in the process is disturbed or removed. Explain to students that the plastic life cycle can be incomplete or disrupted when a plastic product ends up in the landfill. That is the end of life for that plastic bottle.

Check for Understanding

- Students describe to a partner one choice that will help continue the cycle besides putting a plastic bottle in the garbage. Provide a sentence frame to scaffold as needed. (For example, “One choice I can make besides putting my plastic bottle in the garbage is _____. This will extend the life cycle of the plastic bottle by _____.”) Listen to students’ responses and provide support as needed.
- Solicit answers from several students using a strategy that encourages active participation. Before moving forward, reinforce the concept that recycling extends the cycle because a new plastic product can be made from the recycled material.

Activities

- Show the lesson rubric and review the expectations for this lesson.
- Inform students that they will be learning more about the life cycle of a plastic product by watching a video of how a plastic is made.
- Distribute the *From Oil to Plastic Video Notes*. Read through the directions as a class. Make sure students understand that during the video, they should be looking for information on the steps required to produce a plastic product, as well as evidence to support facts when possible. Review the example given on the video notes.
- Show the video *From Oil to Plastic*. Pause after each section to allow students ample time to update their notes. (The video shows gray recycling carts in Alameda County. Point out that here in Napa County our recycling carts are blue.)
- Put the students in groups of four. Tell the students that each group will receive a set of *Plastic Life Cycle Cards*. Their job is to put the cards in chronological order on a large paper (poster board, butcher paper, construction paper, etc.) representing how a plastic product is made. Each step should be numbered. They should also write a brief description of what happens at each stage of the life cycle based on what they saw in the video.
- Explain to students that when they are finished with their collaborative work, they will begin to read, take notes, and write a summary individually. Students will integrate knowledge from the lesson, the *From Oil to Plastic* video, their video notes, and two articles (“Why tap water is better than bottled water,” *National Geographic*, and “An ecosystem of our own making could pose a threat,” adapted from the *Los Angeles Times* by Newsela) in order to

write an explanatory text that answers the following prompt:

Your principal would like to start a recycling program for plastic bottles at your school. Before she can start the program, she wants to inform teachers, students, and parents how plastic bottles are made, as well as the various choices a student can make when he or she is done using a plastic bottle.

She has asked all 4th and 5th grade students to write one to three paragraphs explaining the life cycle of a plastic bottle, including the choices people can make when they are done with their plastic bottle, and the consequences of those choices. The best explanation will be included in the school newspaper! Good luck.

(Note: If you have not yet instructed your students how to take notes on informational text or write an informative/explanatory text, take additional time to model your expectations.) Review with students the portion of the rubric pertaining to reading and writing about informational text.

- Pass out one set of *Plastic Life Cycle Cards*, a large piece of paper, markers, glue and scissors to each group. As groups finish their posters, students will begin their individual task of reading, taking notes, and writing an explanatory text.
- Ask each group to present their plastic life cycle poster to the rest of the class.

Wrap-Up

- Ask the class how the cycle would change if someone chose to throw away a plastic product instead of recycling it.
- Ask the students whether they think that product life cycles using nonrenewable resources like oil can continue forever. Why or why not?

Extension Ideas

- Students will research more innovative products made from recycled plastic, and prepare a short presentation for the class.
- Students will research the life cycle of another recyclable product, from raw material to consumption. They will write an informative text explaining the life cycle, and the various ways in which the product’s life cycle can be extended through the 4Rs.
- Students write a narrative of a plastic product’s life from production to final bottle from the perspective of the bottle. They should write it as an autobiography so the reader can imagine what it is like to be a plastic product.

- Students will invent and market an innovative product created using recycled plastic. They can present this product to the class and/or write an opinion piece on why their product is an acceptable, economical, and innovative use of recycled plastic.
- Students will research the creative ways in which neighboring communities are using scientific principles to encourage community members to recycle. Then, they will write an opinion piece to argue for the changes necessary to encourage better recycling practices in their own community.

REFERENCES

Sahagun, Louis, *The Los Angeles Times* via Newsela (Ed. Newsela staff. Version 2310). "Studying the mysterious plastisphere at sea." 13 Jan. 2014. Web. Accessed 19 May 2014. <<https://newsela.com/articles/plastic-ocean/id/2310/>>.

Sahagun, Louis, *The Los Angeles Times* via Newsela (Ed. Newsela staff. Version 2309). "Man-made marine ecosystem may pose threat." 13 Jan. 2014. Web. Accessed 19 May 2014. <<https://newsela.com/articles/plastic-ocean/id/2309/>>.

Dell'Amore, Christine, and Eliza Barclay, *National Geographic*. "Why tap water is better than bottled water." Web. Accessed 28 July 2014. <<http://environment.nationalgeographic.com/environment/green-guide/bottled-water/>>.

Alameda County Waste Management Authority and Recycling Board. *Doing the 4Rs – A Classroom Activity Guide to Teach Reduce, Reuse, Recycle and Rot*. 2010. Web. 18 November 2014. <<http://www.stopwaste.org/recycling/schools/curriculum-and-videos>>.

City of Napa, County of Napa, and Napa Recycling & Waste Services. *Reduce, Reuse, Recycle Guide for Napa County*. 2016. Web. 19 July 2016. <<http://schools.naparecycles.org/wp-content/uploads/2016/09/Napa-Recycle-Guide-2016.pdf>>.

From Oil to Plastic

Rubric

A rubric is a scoring tool that helps you understand how your work will be evaluated. This rubric is provided to show you the expectations for your performance and engagement during the lesson based on specific tasks.

Name _____ Date _____

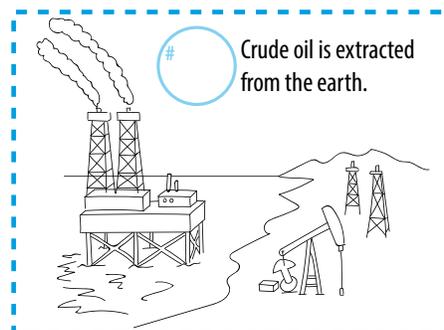
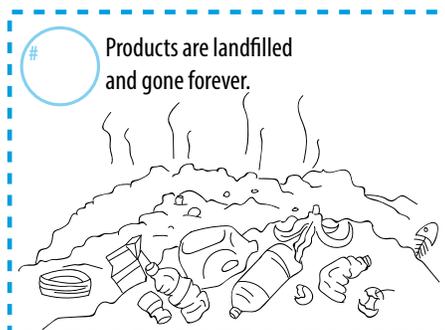
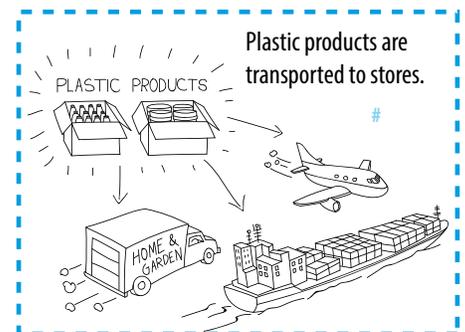
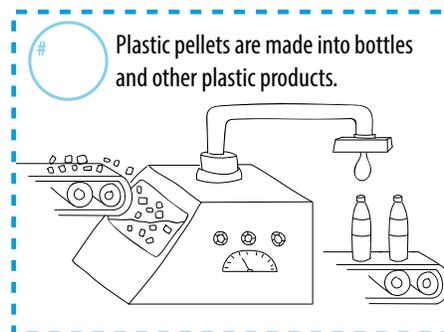
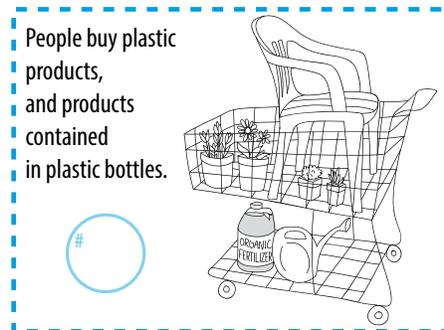
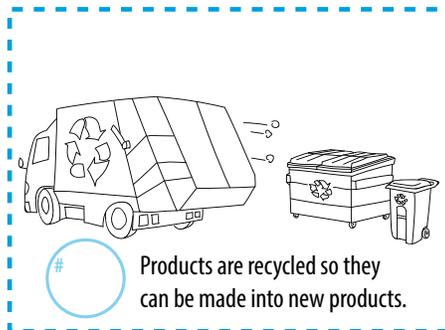
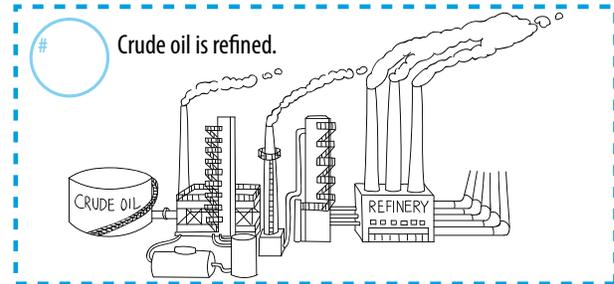
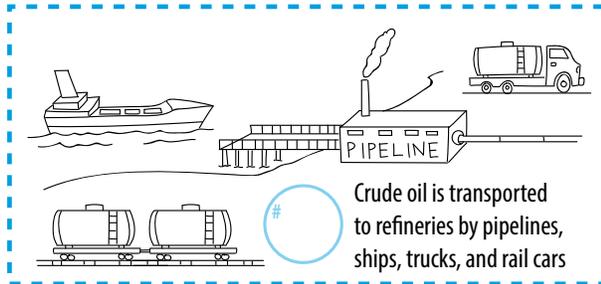
Task	4	3	2	1
<i>From Oil to Plastic Video Notes</i> (Individual)	Notes are detailed, complete, and neat. Responses to focus questions are thorough and correct.	Notes are mostly detailed, complete, and neat. Responses to focus questions are correct, though may lack some detail.	Notes lack detail or are difficult to read. Some responses to focus questions are incorrect.	Notes are incomplete.
<i>Plastic Life Cycle Poster</i> (Group)	The group's poster includes all of the steps for making plastic in the correct order, with a thorough description of each step.	The group's poster includes all of the steps for making plastic; most are in order, with an accurate description of each step.	The group's poster includes all of the steps for making plastic, although a few are not in order and/or missing descriptions.	The group's poster is incomplete; or, if it includes all the steps for making plastic, many are out of order and/or missing descriptions.
<i>Life Cycle of a Plastic Bottle</i> Summary (Individual)	Summary thoughtfully explains the all of the steps in the life cycle of a plastic bottle, including the choices people can make when they are done with their plastic bottle, and the consequences of those choices. Facts from video and text are integrated as supporting evidence.	Summary correctly sequences all of the steps in the life cycle of a plastic bottle, including the choices people can make when they are done with their plastic bottle, and the consequences of those choices. Some facts from video and text are integrated as supporting evidence.	Summary correctly sequences some of the steps in the life cycle of a plastic bottle; only briefly addresses the choices people can make when they are done with their plastic bottle, and the consequences of those choices. Few facts from video and text are integrated as supporting evidence.	Summary incorrectly or superficially sequences the life cycle of a plastic bottle; does not contain facts or evidence drawn from the lesson.

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From Oil to Plastic

Plastic Life Cycle Cards

Directions: Cut out each card and glue the cards in chronological order to show how a plastic bottle is made and how it can be used again to make a new product. Arrange the cards on your poster to show a cycle (in a circle).



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From Oil to Plastic

From Oil to Plastic — Notes During the Video

Videos and other multimedia can be an effective way to learn information on a topic. Before the video begins, read the entire notes page thoroughly. As a result, you'll know what information you should be watching and listening for. Then, pay close attention to the information presented in the video, and take notes on what you see and hear. These notes will be an important resource for you later in the lesson. There's a place at the bottom for questions you have during the video.

Name _____ Date _____

Video Topic _____

Throughout the video, the narrator will state facts and details supported by evidence. Use the boxes below to write down important facts relevant to the topic, as well as the evidence given to support each claim.

<p>1. Example:</p> <p>Fact: Many of the products we use every day are made of plastic.</p> <p>Evidence: 90% of the products we use every day are made with some type of plastic.</p>	2.	3.
4.	5.	6.
7.	8.	9.

Questions?

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From Oil to Plastic

From Oil to Plastic — After the Video

Name _____ Date _____

Video Topic _____

What was the main idea or central message of the video?.....
.....
.....

Using your list of facts and details above, choose the 3 most important facts that you believe best support the main idea.

1).....
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2).....
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3).....
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Summarize the information presented in the video. If you need help, paraphrase your main idea and supporting details outline above.

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From Oil to Plastic

