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| **Unit Overview** |
| **Unit Title:** Practicing environmental awareness to use less, recycle more, and to protect the Chesapeake Bay from pollution. |
| **Target Course/Grade Level:** 6th Grade Science |
| **Unit Summary**  Students will review natural resources, renewable resources, and non-renewable resources. Students will then learn ways to conserve natural resources through the three Rs-reduce, reuse, and recycle. Students will culminate the project by designing and implementing a recycling program for their school. |
| **Primary interdisciplinary connections:**  Government/Civic Literacy  English/Language Arts |
| **Environmental Literacy Theme:** Reduce, Reuse, Recycle |
| **Unit Rationale:**  This unit would be taught in quarter 4, unit 7. |
| **Learning Targets** |
| **Standards:** |
| **Next Generation:**  **MS.ESS-HI Human Impacts** |
| Students who demonstrate understanding can:  **a. Use system models and representations to explain how human activities significantly impact: (1) the geosphere, (2) the hydrosphere, (3) the atmosphere, (4) the biosphere, and (5) global temperatures.** [Clarifying Statement: System models and representations include diagrams, charts, and maps. Examples of human impact are changes in land use and resource development (geosphere); water pollution and urbanization (hydrosphere); air pollution in the form of gases, aerosols, and particulates (atmosphere); changes to natural environments (biosphere); release of greenhouse gases (global temperatures).]  **b. Generate and revise qualitative explanations from data for the impacts on Earth’s systems that result from increases in human population and rates of consumption.** [Assessment Boundary: Students should be provided with modified regional databases on human populations and rates of consumption. “Impacts” include changes to the appearance, composition, and structure of Earth’s systems as well as the rates at which they change.]  **c. Design engineering solutions for stabilizing changes to communities by: (1) using water efficiently, (2) minimizing human impacts on environments and local landscapes by reducing pollution, and (3) reducing the release of greenhouse gases.**  **d. Ask questions to refine and develop an explanation for the way technological monitoring of Earth’s systems can provide the means of informing the public of ways to modify human impacts on Earth’s systems.**  **e. Use empirical evidence to evaluate technologies that utilize renewable energy resources.** |
| **Unit Essential Questions**   * What are non-renewable resources? * What are renewable resources? * What is waste and where does it come from? * What are the advantages and disadvantages of waste to energy*?* * What is a landfill and how does it work? * What are the different methods of waste management and how do they help the environment? * What are the different methods of waste management and how do they help the environment? * How can we address the recycling needs of our community? * How can we create a recycling program in our school? * How can Baltimore become better at recycling? * What can we do to be an environmentally responsible person? * How can we spread the word about the school-wide recycling program? * How can we teach younger students about the school-wide recycling program? * What happens to recycled materials? |
| **Unit Learning Targets**  *Students will ...*   * Define, compare, contrast natural resources, renewable resources, and non-renewable resources. * Understand what happens to trash and effects of landfills. * Establish and implement a plan for a recycling program in their school and community. |
| **Evidence of Learning** |
| **Summative Assessment**  Students will develop and present a proposal for a school-wide recycling program. Students will implement a school-wide recycling program. |
| **Equipment needed:**  **-**Science journals  **-**Computers with internet access (for all students)  -Interactive Whiteboard  -Video Camera  -Recycling bins or cardboard boxes  -Common classroom and household items (for each group)  -Map of Natural Resources (you could also consider ordering a map through Donors Choose or a similar resource)  -Chart paper  -Markers  -Kidney beans and white beans  -Calculators  -Graph paper |
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| **Lesson Plans** |  |
| **Lesson** | **Timeframe** |
| Lesson 1  What are natural resources?  (Pretest) | 1 day |
| Lesson 2  What are non-renewable resources? | 1day |
| Lesson 3  What are renewable resources? | 1day |
| Lesson 4  Resources and Energy Consumption | 1day |
| Lesson 5  Connecting Energy to Trash | 1-2 days |
| Lesson 6  Waste and the Environment | 1-2 days |
| Lesson 7  Landfill | 1-2 days |
| Lesson 8  Carbon Foot Printing | 1day |
| Lesson 9  The 3Rs | 1 day |
| Lesson 10  Ready, Set Recycle  Quiz | 1-2 days |
| Lesson 11  Persuading Others to Recycle | 1-2 days |
| Lesson 12  Proposal for Recycling Program | 1-2 days |
| Lesson 13  Writing to City Council | 1-2 days |
| Lesson 14  Preparing Recycling Bins | 1-2 days |
| Lesson 15  Recycling Program Public Service Announcement: Video | 2 days |
| Lesson 16  Teaching Younger Students About Recycling | 2 days |
| Lesson 17  Field Trip | 1day |
| Lesson 18  Paper Making and Reflection  (Post-test) | 1-3 days |
| **Teacher Notes:** |  |
| **Curriculum Development Resources**  Click the links below to access additional resources used to design this unit: |  |

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| **Lesson Plan 1 Natural Resources** | | | | | | | | | | | | | | | |
| **SMART Objective:** By the end of today’s lesson students will be able to explain natural resources and why there is an uneven distribution of Earth’s mineral and energy resources. | | | | | | | | | | | | | | | |
| **Timeframe:** 1 hour/ 1 day | | | | | | | | | | | | | | | |
| **Standard:** NGSS Construct explanations for how uneven distribution of Earth’s mineral and energy resources, which are limited and non-renewable, are a result of past and current geologic processes, including plate motions. | | | | | | | | | | | | | | | |
| **Lesson Components** | | | | | | | | | | | | | | | |
| [**21st Century Themes**](http://www.ecu.edu/cs-educ/account/upload/21st-Century-Skills-Definitions.pdf) | | | | | | | | | | | | | | | |
|  | Global Awareness | |  | Financial, Economic, Business, and Entrepreneurial Literacy | | |  | Civic Literacy | | |  | Health Literacy |  | Environmental Literacy  x | |
| [**21st Century Skills**](http://www.21stcenturyskills.org/index.php?option=com_content&task=view&id=254&Itemid=120) | | | | | | | | | | | | | | | |
|  | | Creativity and Innovation | | |  | Critical Thinking and Problem Solving | | |  | Communication | | | |  | Collaboration  x |
| |  | | --- | |  | | **Unit Essential Question:** What are natural resources? | | **Teacher Background:**  Natural resources are naturally occurring substances that are valuable to humans. We use natural resources for everything from paper and buildings to food and water. Natural resources include both renewable and non-renewable substances. Renewable resources, such as trees and plants, oxygen, water, and sunlight, can replenish themselves naturally. These renewable resources, if harvested at sustainable levels, are capable of being extracted from nature without depleting the resource over time. Non-renewable resources cannot be remade or regenerated fast enough to keep up with human demand. These include natural gas, coal, and oil - which are fossil fuels.  Source: <http://www.calacademy.org/teachers/resources/lessons/natural-resources-bingo/>  The following items are examples of natural resources and the items that they make:   |  |  | | --- | --- | | **Natural Resource** | **Products/Services** | | Trees  Cotton  Oil/Petroleum  Natural Gas  Coal  Iron Ore  Bauxite Ore  Gold  Copper  Manganese  Cobalt  Platinum  Chromium  Diamonds | Paper, furniture, fuel  Clothing  Plastic, fuel  Fuel  Fuel  Steel products (cans, bridges)  Aluminum products (cans, car parts)  Jewelry, dental product  Wires, coins, electrical equipment  Steel, cast iron  Steel, jet engine parts, cutting tools  Air pollution control, telecommunications equipment, jewelry  Stainless steel, green glass, leather treatment  Jewelry, mechanical equipment |   Source: <http://www.scdhec.gov/environment/lwm/recycle/pubs/natural_resources.pdf> | | **Misconceptions:**  Students may think that all the earth's resources such clean water and oil are unlimited. It may be helpful to expose students to discuss other countries, where clean water and oil or wood are not a guarantee.  <http://www.scimathmn.org/stemtc/frameworks/5341-human-interaction-earth-systems> | | **Materials:**   * Science Journals * Common classroom and household items (for each group) * Graphic organizers * Map of Natural Resources (you could also consider ordering a map through Donors Choose or a similar resource) * Pre-assessment | | **5 E Lesson Plan Template** | | **Engagement :**  Ask students to answer the following prompt in their journal:  What items have you used today?  Model listing the items that you have used today such as:  Pencil, pen, marker, plastic bottle, paper, aluminum can,etc.  Distribute pre-assessment. | | **Exploration :**  Place students in groups and give students a variety of items such as paper, pencil, plastic water bottle, plastic toy, metal container, as well as any other items handy. Ask students to sort items into “natural resource” and “made from a natural resource Ask students to complete graphic organizer while sorting the items. | | **Explanation:**  After groups have sorted the objects and completed the graphic organizer, bring the class back as a whole group. Ask students to share what items they have classified as made from a natural resource and which objects they have classified as “not found in nature.”  Ask students questions such as:   * Why do you consider that item as “natural resource” or “made from a natural resource?” * How was something made from natural materials? * What are some other natural materials that we use daily? * What is a resource?   Explain to students that natural resources are materials that are naturally found in the natural environment that is valuable to humans.  Students will complete a Fryer model graphic organizer of natural resources. Students will the look at a map of natural resources and analyze why some areas have a lot of natural resources. A natural resources map can be found at:  <http://maps.howstuffworks.com/united-states-energy-minerals-map.htm>  Ask students questions about the natural resources map such as:   * What are some natural resources that can be found in the United States? * What are some natural resources found near Maryland? * Based on your research what are some of the common natural resources found in the United States? * What are some uncommon natural resources? * Why do you think natural resources are found in certain regions? * How do you think these natural resources were formed? * What are some differences between energy and mineral resources? * How do you think these resources are used? | | **Evaluation:**  To conclude the lesson, students can complete a exit ticket answering the following questions:   * What are natural resources? * What are some natural resources that can be used in our daily lives? * Why do you think it is important to conserve natural resources?   Journal Entry: Today we learned that there are certain natural resources that are common to a specific region. Consider what natural resources are common to Maryland and describe ways in which they may have been formed and how they are used. | | **Extension**  To extend the lesson, the students can watch a www.unitedstreaming.com video on natural resources: <http://player.discoveryeducation.com/index.cfm?guidAssetId=FF3B323E-0717-41C2-B178-57F9F0CB1184&blnFromSearch=1&productcode=US>; students can also complete the linked activity pages.  Students could also research a natural resource such as copper, aluminum, or other resources. Students could create a one page advertisement for this resource.  Homework: Resource Journal  Have students keep a log of how they use natural resources and energy. Make certain to include purpose and the amount of time using the resource. | |  | | | | | | | | | | | | | | | | |

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**Environmental Literacy Pre-Assessment**

1. Draw the recycling symbol and explain what it means:

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1. What are natural resources?

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1. What are the differences between renewable and non-renewable resources?

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1. What are examples of non-renewable resources?

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1. What are examples of renewable resources?

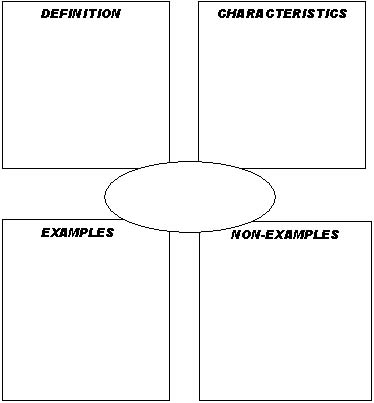
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1. What is municipal solid waste? Circle the items that might be included.
2. Appliances and furniture
3. Automobile bodies
4. Boxes, bottles and cans
5. Carpets and rugs (not from a demolition site)
6. Construction debris
7. Disposable diapers
8. Leftover industrial chemicals
9. Tires
10. You are in charge of building a new landfill. Which of these sites would you recommend to the local government?
11. Marsh at the edge of town
12. Abandoned gravel quarry
13. Edge of the river
14. A spot in the county industrial area
15. They are all great ideas
16. You haven’t found a suitable site yet
17. What does the recycling symbol stand for?
18. Reduce, Reuse, Recycle
19. Collect material, Process material, Buy material with recycled content
20. Anything with this symbol is recyclable
21. Anything with this symbol is illegal to dispose of

Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_ Class:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What are Natural Resources?

Using the objects given to your group, sort the objects into two categories: found in nature and not found in nature. List the objects in the chart below.



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| **Lesson Plan 2-- Non-Renewable Resources** | | | | | | | | | | | | | | | |
| **SMART Objective:** By the end of today’s lesson students will be able to explain non-renewable resources and examples of non-renewable resources. | | | | | | | | | | | | | | | |
| **Timeframe:** 1 hour/1 day | | | | | | | | | | | | | | | |
| **Standard:** NGSS Construct explanations for how uneven distribution of Earth’s mineral and energy resources, which are limited and non-renewable, are a result of past and current geologic processes, including plate motions. | | | | | | | | | | | | | | | |
| **Lesson Components** | | | | | | | | | | | | | | | |
| [**21st Century Themes**](http://www.ecu.edu/cs-educ/account/upload/21st-Century-Skills-Definitions.pdf) | | | | | | | | | | | | | | | |
|  | Global Awareness | |  | Financial, Economic, Business, and Entrepreneurial Literacy | | |  | Civic Literacy | | |  | Health Literacy |  | Environmental Literacy  x | |
| [**21st Century Skills**](http://www.21stcenturyskills.org/index.php?option=com_content&task=view&id=254&Itemid=120) | | | | | | | | | | | | | | | |
|  | | Creativity and Innovation | | |  | Critical Thinking and Problem Solving | | |  | Communication | | | |  | Collaboration  x |
| |  | | --- | |  | | **Unit Essential Question:** What are non-renewable resources? | | **Teacher Background:**  Nonrenewable resources are used worldwide to create electricity, heat homes, power vehicles and manufacture goods. Resources are considered nonrenewable if their quantities are limited or if they cannot be replaced as fast as they are used up. Some nonrenewable resources have been formed over millions of years and will eventually be depleted altogether.  Source: <http://greenliving.nationalgeographic.com/examples-nonrenewable-resources-2439.html> | | **Misconceptions:**  Non-renewable resources cannot be replenished when they run out. | | **Materials:**   * Science Journals * Energy Diagram * Fossil Fuels Reading * Chart Paper * Markers | | **5 E Lesson Plan** | | **Engagement**  Have students reflect and share their journals from their homework.  Ask students to write in their journals everything that they need to plug in on a daily basis. Ask students to consider their homes, schools, and communities.  Then, ask students questions such as:   * Where does the electricity for your cell phone charger come from? * How do you use non-renewable resources?   Ask students to create a table of their data and determine the average amount of time that they spend charging electronics.  You may want to record the student answers in a web on the board. | | **Exploration**  After discussing students’ journal entries, show students the following diagram:  <http://www.fife-education.org.uk/energy/Resources/non_renewable/non_renewable_energy_colour_chart.pdf>  Ask students probing questions such as:   * What are some things that you observe about this diagram? * What are fossil fuels? * How does electricity move to our homes? * What are some processes that you observe in this diagram? | | **Explanation**  Jigsaw Reading: Assign small groups parts of the reading including “Where Fossil Fuels Come From,” “Coal,” “Oil or Refineries,” “and “Natural Gas.” Each group should create a poster on chart paper explaining their fossil fuel in three to four bullet points and include a picture.  Each group of students should be responsible for creating a poster about their topic and presenting their topic to the class. Explain to students that the purpose of this activity is to inform others about fossil fuels.  The reading can also be found at: <http://energyquest.ca.gov/story/chapter08.html> | | **Evaluation**  Students should complete an exit ticket in the 3-2-1 format. The 3-2-1 format asks students to list three things that they learned today, two new words, and one question that they have about today’s lesson. | | **Extension**  For an extension activity, create an account with [www.explorelearning.com](http://www.explorelearning.com) (they offer free trial accounts) and have students complete as a whole class or individually the online simulation titled “Energy Conversions.” This lesson can be found at:  <http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=651> | |  | | | | | | | | | | | | | | | | |

Fossil Fuels - Coal, Oil and Natural Gas

Source: <http://energyquest.ca.gov/story/chapter08.html>

http://energyquest.ca.gov/images/-X-button.png Where Fossil Fuels Come From

There are three major forms of fossil fuels: coal, oil and natural gas. All three were formed many hundreds of millions of years ago before the time of the dinosaurs – hence the name fossil fuels. The age they were formed is called the Carboniferous Period. It was part of the Paleozoic Era. "Carboniferous" gets its name from carbon, the basic element in coal and other fossil fuels.

The Carboniferous Period occurred from about 360 to 286 million years ago. At the time, the land was covered with swamps filled with huge trees, ferns and other large leafy plants, similar to the picture above. The water and seas were filled with algae – the green stuff that forms on a stagnant pool of water. Algae is actually millions of very small plants.

Some deposits of coal can be found during the time of the dinosaurs. For example, thin carbon layers can be found during the late Cretaceous Period (65 million years ago) – the time of Tyrannosaurus Rex. But the main deposits of fossil fuels are from the Carboniferous Period. For more about the various geologic eras, go to[**www.ucmp.berkeley.edu/help/timeform.html**](http://energyquest.ca.gov/story/www.ucmp.berkeley.edu/help/timeform.html)

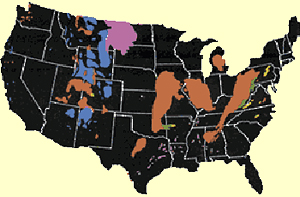
As the trees and plants died, they sank to the bottom of the swamps of oceans. They formed layers of a spongy material called peat. Over many hundreds of years, the peat was covered by sand and clay and other minerals, which turned into a type of rock called sedimentary.

More and more rock piled on top of more rock, and it weighed more and more. It began to press down on the peat. The peat was squeezed and squeezed until the water came out of it and it eventually, over millions of years, it turned into coal, oil or petroleum, and natural gas.

http://energyquest.ca.gov/images/-X-button.png Coal

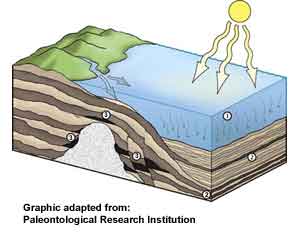
Coal is a hard, black colored rock-like substance. It is made up of carbon, hydrogen, oxygen, nitrogen and varying amounts of sulphur. There are three main types of coal – anthracite, bituminous and lignite. Anthracite coal is the hardest and has more carbon, which gives it a higher energy content. Lignite is the softest and is low in carbon but high in hydrogen and oxygen content. Bituminous is in between. Today, the precursor to coal—peat—is still found in many countries and is also used as an energy source.

The earliest known use of coal was in China. Coal from the Fu-shun mine in northeastern China may have been used to smelt copper as early as 3,000 years ago. The Chinese thought coal was a stone that could burn.

Coal is found in many of the lower 48 states of U.S. and throughout the rest of the world. Coal is mined out of the ground using various methods. Some coal mines are dug by sinking vertical or horizontal shafts deep underground, and coal miners travel by elevators or trains deep underground to dig the coal. Other coal is mined in strip mines where huge steam shovels strip away the top layers above the coal. The layers are then restored after the coal is taken away.

The coal is then shipped by train and boats and even in pipelines. In pipelines, the coal is ground up and mixed with water to make what's called a slurry. This is then pumped many miles through pipelines. At the other end, the coal is used to fuel power plants and other factories.

http://energyquest.ca.gov/images/-X-button.png Oil or Petroleum

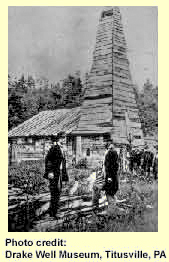
Oil is another fossil fuel. It was also formed more than 300 million years ago. Some scientists say that tiny diatoms are the source of oil. Diatoms are sea creatures the size of a pin head. They do one thing just like plants; they can convert sunlight directly into stored energy.

In the graphic on the left, as the diatoms died they fell to the sea floor (1). Here they were buried under sediment and other rock (2). The rock squeezed the diatoms and the energy in their bodies could not escape. The carbon eventually turned into oil under great pressure and heat. As the earth changed and moved and folded, pockets where oil and natural gas can be found were formed (3).

Oil has been used for more than 5,000-6,000 years. The ancient Sumerians, Assyrians and Babylonians used crude oil and asphalt ("pitch") collected from large seeps at Tuttul (modern-day Hit) on the Euphrates River. A seep is a place on the ground where the oil leaks up from below ground. The ancient Egyptians, used liquid oil as a medicine for wounds, and oil has been used in lamps to provide light.

The Dead Sea, near the modern Country of Israel, used to be called Lake Asphaltites. The word asphalt was derived is from that term because of the lumps of gooey petroleum that were washed up on the lake shores from underwater seeps.

In North America, Native Americans used blankets to skim oil off the surface of streams and lakes. They used oil as medicine and to make canoes water-proof. During the Revolutionary War, Native Americans taught George Washington's troops how to treat frostbite with oil.

As our country grew, the demand for oil continued to increase as a fuel for lamps. Petroleum oil began to replace whale oil in lamps because the price for whale oil was very high. During this time, most petroleum oil came from distilling coal into a liquid or by skimming it off of lakes – just as the Native Americans did.

Then on August 27, 1859, Edwin L. Drake (the man standing on the right in the black and white picture to the right), struck liquid oil at his well near Titusville, Pennsylvania. He found oil under ground and a way that could pump it to the surface. The well pumped the oil into barrels made out of wood. This method of drilling for oil is still being used today all over the world in areas where oil can be found below the surface.

Oil and natural gas are found under ground between folds of rock and in areas of rock that are porous and contain the oils within the rock itself. The folds of rock were formed as the earth shifts and moves. It's similar to how a small, throw carpet will bunch up in places on the floor.

To find oil and natural gas, companies drill through the earth to the deposits deep below the surface. The oil and natural gas are then pumped from below the ground by oil rigs (like in the picture). They then usually travel through pipelines or by ship.

Oil is found in 18 of the 58 counties in California. Kern County, the County where Bakersfield is found, is one of the largest oil production places in the country. But we only get one-half of our oil from California wells. The rest comes from Alaska, and an increasing amount comes from other countries. In the entire U.S., more than 50 percent of all the oil we use comes from outside the country... most of it from the Middle East.

Oil is brought to California by large tanker ships. The petroleum or crude oil must be changed or refined into other products before it can be used.

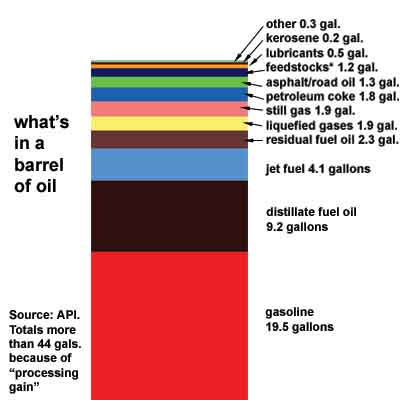
http://energyquest.ca.gov/images/-X-button.png Refineries



Oil is stored in large tanks until it is sent to various places to be used. At oil refineries, crude oil is split into various types of products by heating the thick black oil.

Oil is made into many different products – fertilizers for farms, the clothes you wear, the toothbrush you use, the plastic bottle that holds your milk, the plastic pen that you write with. They all came from oil. There are thousands of other products that come from oil. Almost all plastic comes originally from oil. Can you think of some other things made from oil?

The products include gasoline, diesel fuel, aviation or jet fuel, home heating oil, oil for ships and oil to burn in power plants to make electricity. Here's what a barrel of crude oil can make.



Sometime between 6,000 to 2,000 years BCE (Before the Common Era), the first discoveries of natural gas seeps were made in Iran. Many early writers described the natural petroleum seeps in the Middle East, especially in the Baku region of what is now Azerbaijan. The gas seeps, probably first ignited by lightning, provided the fuel for the "eternal fires" of the fire-worshiping religion of the ancient Persians.

Natural gas is lighter than air. Natural gas is mostly made up of a gas called methane. Methane is a simple chemical compound that is made up of carbon and hydrogen atoms. It's chemical formula is CH4 – one atom of carbon along with four atoms hydrogen. This gas is highly flammable.

Natural gas is usually found near petroleum underground. It is pumped from below ground and travels in pipelines to storage areas. The next chapter looks at that pipeline system.

Natural gas usually has no odor and you can't see it. Before it is sent to the pipelines and storage tanks, it is mixed with a chemical that gives a strong odor. The odor smells almost like rotten eggs. The odor makes it easy to smell if there is a leak.

**Energy Safety Note!**

**If you smell that rotten egg smell in your house, tell your folks and get out of the house quickly. Don't turn on any lights or other electrical devices. A spark from a light switch can ignite the gas very easily. Go to a neighbor's house and call 9-1-1 for emergency help.**

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| |  | | --- | | Making A Poster : Fossil Fuels Student Name:     \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |

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| CATEGORY | **4** | **3** | **2** | **1** |
| **Required Elements** | The poster includes a title, more than three to four points about the fossil fuel, and more than one picture. | All required elements are included on the poster. | All but one of the required elements are included on the poster. | More than one required element is missing from the poster. |
| **Content - Accuracy** | At least four accurate facts are displayed on the poster. | Three accurate facts are displayed on the poster. | Two accurate facts are displayed on the poster. | Less than two accurate facts are displayed on the poster. |
| **Mechanics** | Capitalization and punctuation are correct throughout the poster. | There is 1 error in capitalization or punctuation. | There are 2 errors in capitalization or punctuation. | There are more than 2 errors in capitalization or punctuation. |
| **Grammar** | There are no grammatical mistakes on the poster. | There is 1 grammatical mistake on the poster. | There are 2 grammatical mistakes on the poster. | There are more than 2 grammatical mistakes on the poster. |
| **Attractiveness** | The poster is exceptionally attractive in terms of design, layout, and neatness. | The poster is attractive in terms of design, layout and neatness. | The poster is acceptably attractive though it may be a bit messy. | The poster is distractingly messy or very poorly designed. It is not attractive. |

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| **Lesson Plan 3—Renewable Resources** | | | | | | | | | | | | | | | |
| **SMART Objective:** By the end of today’s lesson students will be able to explain renewable resources and examples of renewable resources. | | | | | | | | | | | | | | | |
| **Timeframe:** 1 hour/1 day | | | | | | | | | | | | | | | |
| **Standard:** NGSS Construct explanations for how uneven distribution of Earth’s mineral and energy resources, which are limited and non-renewable, are a result of past and current geologic processes, including plate motions. | | | | | | | | | | | | | | | |
| **Lesson Components** | | | | | | | | | | | | | | | |
| [**21st Century Themes**](http://www.ecu.edu/cs-educ/account/upload/21st-Century-Skills-Definitions.pdf) | | | | | | | | | | | | | | | |
|  | Global Awareness | |  | Financial, Economic, Business, and Entrepreneurial Literacy | | |  | Civic Literacy | | |  | Health Literacy |  | Environmental Literacy  x | |
| [**21st Century Skills**](http://www.21stcenturyskills.org/index.php?option=com_content&task=view&id=254&Itemid=120) | | | | | | | | | | | | | | | |
|  | | Creativity and Innovation | | |  | Critical Thinking and Problem Solving | | |  | Communication  x | | | |  | Collaboration  x |
| |  | | --- | |  | | **Unit Essential Question:** What are renewable resources? | | **Teacher Background:** Renewable resources are an important aspect of sustainability. According to the U.S. Energy Information Administration, the most frequently used renewable resources are biomass, water, geothermal, wind and solar. Unlike fossil fuels, we can regenerate or replenish these resources. Although biomass in the form of wood once supplied 90 percent of U.S. energy needs, all renewable energy sources combined supplied only about 8 percent of in 2009 With the rising cost and decreasing availability of nonrenewable fossil fuels, renewable resources are receiving increasing attention.  Source: <http://greenliving.nationalgeographic.com/definition-examples-renewable-resources-2504.html> | | **Misconceptions:**  Renewable resources are not scarce and are able to be incorporated in everyday life. | | **Materials:**   * *Powering the Future: The Energy Planet* video on unitedstreaming.com * Science Journals * Pinwheel print out * Straws * Scissors * Paper fastener * Paper for flipbook * Renewable Resources Reading | | **5 E Lesson Plan** | | **Engagement**  Show students a clip from the unitedsteaming.com video: *Powering the Future: The Energy Planet*. The first clip is about three minutes long and can be found at: <http://player.discoveryeducation.com/?guidAssetId=1a539895-c04c-4fe2-b0aa-2eb7949f2482>  Ask students to record their ideas about how to conserve energy in their science journals. | | **Exploration**  Ask students to create a simple pinwheel individually or in pairs. After students have made the pinwheel, give students time to explore their pinwheel by a window, outside, with a fan, or hairdryer.  Directions on how to make a pinwheel can be found at the following websites:  <http://www.pinwheelsforpeace.com/pinwheeltemplate.html>  <http://www.janbrett.com/piggybacks/piggybacks_the_hat_pinact.htm>  For an additional challenge, students could make a pinwheel bottle:  <http://family.go.com/recycled-crafts-contest/decoration/colorful-bottle-pin-wheel-5333/> | | **Explanation**  Ask students to read the renewable resources reading independently or in pairs. This reading can be found at:  <http://greenliving.nationalgeographic.com/definition-examples-renewable-resources-2504.html>  Students will then complete a concept map about renewable resources. | | **Evaluation**  Create a flipbook that includes each type of renewable resource: biomass, hydropower, geothermal, wind, and solar. Ask students to explain the renewable resource in three to four sentences and include a picture.  Directions on how to make a flipbook can be found at: <http://www.netc.org/classrooms@work/classrooms/fernan/images/makeflipbook.pdf>  An electronic flipbook can be found at: <http://www.readwritethink.org/files/resources/interactives/flipbook/> | | **Extension**  Finish watching *Powering the Future: The Energy Planet* to learn more about renewable resources. | |  | | | | | | | | | | | | | | | | |

Renewable Resources

<http://greenliving.nationalgeographic.com/definition-examples-renewable-resources-2504.html>

Renewable resources are an important aspect of sustainability. According to the U.S. Energy Information Administration, the most frequently used renewable resources are biomass, water, geothermal, wind and solar (see References 1). Unlike fossil fuels, we can regenerate or replenish these resources. Although biomass in the form of wood once supplied 90 percent of U.S. energy needs, all renewable energy sources combined supplied only about 8 percent of in 2009 (see References 1). With the rising cost and decreasing availability of nonrenewable fossil fuels, renewable resources are receiving increasing attention.

**Biomass**

Biomass resources include trees, food crops, algae, agricultural and forestry byproducts, and even Methane fumes from landfills. These biomass resources provide fuels, power production and products typically made from nonrenewable fossil fuels. Such bioproducts include plastics, insulation, adhesives and fabric. Energy production from biomass is important because it can help reduce dependence on foreign oil. In addition, it has the potential to reduce greenhouse gas emissions. The agricultural and forestry industries also benefit from the demand for biomass. (See References 3)

## Water

Water, or hydropower, is the renewable energy source that produces the most electricity in the United States. In 2009, it accounted for 7 percent of total U.S. electricity generation and 35 percent of generation from renewables in 2009, according to the U.S. Energy Administration. Like wood, water has a long history as an energy source. Paddle wheels used to grind grain are an early example. In the 1880s, the Wolverine Chair Factory in Michigan made use of a water turbine and the first hydroelectric plant was built on Wisconsin's Fox River to harness the power of swiftly-moving water. Hydroelectric power plants proliferated with the ability to transmit electricity over longer distances. The release, as needed, of water stored in reservoirs behind dams produces electricity by spinning turbines as it flows through pipes. (See References 4)

## Geothermal

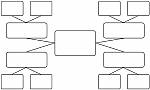
Geothermal energy comes from harnessing heat from the Earth. A large utility company, for example, can directly use a geothermal reservoir to drive generators and produce electricity for their municipality. In contrast, residential heat pumps use the shallow ground temperature of the Earth to heat and cool a home on a smaller scale. The shallow ground temperature remains between 50 and 60 degrees Fahrenheit. Other applications put geothermal heat to use in commercial buildings, roads, agriculture and industrial factories. (See References 5)

## Wind

Wind is just moving air created as the sun heats the Earth's surface. As long as the sun is shining, the wind remains an infinite, renewable resource. Wind power is clean energy because wind turbines do not produce any emissions. The classic Dutch windmill harnessed the wind's energy hundreds of years ago. Modern wind turbines with three blades dot the landscape today, turning wind into electricity. Although wind only generated little power in the United States in 2009, it is the fastest-growing source of new electric power, according to U.S. Energy Information Administration. (See References 6)

## Solar

The sun has produced energy in the form of heat and light since the Earth formed. Solar energy systems do not produce emissions and are often not harmful to the environment. Thermal solar energy can heat water or buildings. Photovoltaic devices, or solar cells, directly convert solar energy into electricity. Individual solar cells grouped into panels range from small applications that charge calculator and watch batteries, to large systems that power residential dwellings. PV power plants and concentrating solar power plants are the largest solar applications, covering acres. (See References 2)



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| **Lesson Plan 4-- Renewable and Non-Renewable Resources** | | | | | | | | | | | | | | | |
| **SMART Objective:** By the end of today’s lesson students will be able to explain the differences between renewable and non-renewable resources. | | | | | | | | | | | | | | | |
| **Timeframe:** 1 hour/1day | | | | | | | | | | | | | | | |
| **Standard:** NGSS Construct explanations for how uneven distribution of Earth’s mineral and energy resources, which are limited and non-renewable, are a result of past and current geologic processes, including plate motions. | | | | | | | | | | | | | | | |
| **Lesson Components** | | | | | | | | | | | | | | | |
| [**21st Century Themes**](http://www.ecu.edu/cs-educ/account/upload/21st-Century-Skills-Definitions.pdf) | | | | | | | | | | | | | | | |
|  | Global Awareness | |  | Financial, Economic, Business, and Entrepreneurial Literacy | | |  | Civic Literacy | | |  | Health Literacy |  | Environmental Literacy  x | |
| [**21st Century Skills**](http://www.21stcenturyskills.org/index.php?option=com_content&task=view&id=254&Itemid=120) | | | | | | | | | | | | | | | |
|  | | Creativity and Innovation | | |  | Critical Thinking and Problem Solving  x | | |  | Communication | | | |  | Collaboration |
| |  | | --- | |  | | **Unit Essential Question:** What are the differences between renewable and non-renewable resources? | | **Teacher Background:**  Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth’s mean surface temperature (“global warming”).  Reducing the amount of greenhouse gases released into the atmosphere can reduce the degree to which global temperatures will increase.  Renewable energy resources and the technologies to exploit them are being rapidly developed. | | **Misconceptions:**  Nonrenewable resource are those natural resources that cannot be replaced once they are used up. Some examples include:  oil  coal  gas  uranium  Renewable Resources Renewable resources are those resources that can be replaced as they are used up. Some examples include:  soil  air  water  wood  sunlight  source: <http://library.thinkquest.org/CR0210243/Science%20Station/How%20living%20things%20interact%20with%20their%20environment/renewable%20and%20nonrenewable%20resources.htm> | | **Materials:**  Per Group of Two-Three Students:   * One brown bag containing 90 brown kidney beans (representing non-renewable   energy resources) and 10 white beans (representing renewable energy resources).   * Calculator * Pencil | | **5 E Lesson Plan** | | **Engagement**  Show students the alternative energy map found at : <http://www.nrdc.org/energy/renewables/energymap.asp>  Ask students some of the following questions:   * Where do you see most of the alternative energy? * What alternative energy sources do we have in Maryland? * What is the closest alternative energy source to Baltimore? * Where could additional alternative energy sources be built? | | **Exploration**  Students will participate in the “Renew A Bean” activity which shows how non-renewable resources are exhausted over time.  The full lesson can be found at: <http://www.starkscenes.org/wp-content/uploads/2012/06/Renew-A-Bean.doc.pdf>  Divide students into groups of two-three and give each group a bag filled with 90 brown kidney beans and 10 white beans.  Ask one student from each group to pick out ten energy beans from the bag without looking. This represents one year of energy.  Count the number of one and brown beans and record the data on the data sheet.  Brown beans represent non-renewable energy, so do not replace the brown beans in the bag. Place the rest of the white beans in the bag.  A second group member will pick ten beans out of the bag and record those beans on the data sheet for year two. Again, record the beans on the data sheet and return the white beans in the bag.  Continue until there is twenty years of data collected.  *This lesson can also include a part ii. The part ii would consider the growing use of power and energy over time. Repeat the process but increase the amount of energy use by picking out 5 additional “energy beans” each year (pick 10 beans in year 1, 15 beans in year 2, 20 beans in year 3, etc.). Record information on the attached data collection sheet.* | | **Explanation**  Ask students the following questions via a concluding question sheet or through a class discussion.   * How many years did it take for the non-renewable energy sources to run out when you used 10 energy beans per year? * How many years did it take for the non-renewable energy sources to run out when you   increased the rate at which we consumed resources each year (part ii)?   * What are some examples of renewable and non-renewable energy sources? * What does this activity demonstrate about our consumption of resources - what will   happen if we keep using non-renewable resources?   * Describe what happens to the proportion of renewable vs. non-renewable energy   sources that remain available, as energy is used over time. | | **Evaluation**  Ask students to complete a Venn Diagram comparing renewable and non-renewable energy. A Venn Diagram can be found: <http://www.eduplace.com/science/hmsc/content/organizer/6/org_6c_10.pdf>  In addition to the graphic organizer, students should complete the attached quiz. | | **Extension**  As an extension activity, students can make a solar oven out of pizza boxes. A lesson plan can be found at:<http://www.nmsea.org/Curriculum/4_6/pizza_box_oven/pizza_box_ovens.htm>  If your class has food allergies, you may want to consider cooking s ‘mores or hot dogs. | |  | | | | | | | | | | | | | | | | |

Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Natural Resources Quiz**

**Part I: Free Response**

*Answer each question in complete sentences. Each question is worth five points*

1. What are natural resources? Give three examples.

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1. What are non-renewable resources? Give three examples.

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1. What are renewable resources? Give three examples.

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**Fill In the Blank**

*Match each definition with a word from the word box. (There is one extra word)Each question is worth three points.*

|  |
| --- |
| fossil fuels natural resources biomass  geothermal natural gas coal |

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: energy from harnessing heat within the Earth.
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: is a hard, black colored rock-like substance. It is made up of carbon, hydrogen, oxygen, nitrogen and varying amounts of sulphur.
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: A material source of wealth, such as timber, fresh water, or a mineral deposit, that occurs in a natural state and has economic value.
4. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: A natural fuel such as coal or gas, formed in the geological past from the remains of living organisms.
5. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_: Plant material, vegetation, or agricultural waste used as a fuel or energy source.

Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Renew-A-Bean**

Adapted from: <http://www.starkscenes.org/wp-content/uploads/2012/06/Renew-A-Bean.doc.pdf>

**Question**: What type of energy source will remain after twenty years of energy usage?

**Materials**:

* One brown bag containing 90 brown kidney beans (representing non-renewable energy resources) and 10 white beans (representing renewable energy resources).
* Calculator
* Pencil

**Procedure**:

1. One person from each group will pick out 10 “energy beans” from the bag, without looking. These 10 beans represent the energy that is used in one year.
2. Count the brown and white beans and record the number on the attached data collection sheet for Year 1.
3. The brown beans represent energy from non-renewable energy sources, so when a brown bean is picked it cannot be returned to the bag, so set it aside. The white beans are renewable energy beans, so they should be put back into the bag each turn after counting them.
4. A second group member will pick 10 beans to represent energy use in Year 2.
5. Fill in the number of brown and white beans on the chart, and return the white beans back into the bag.
6. Repeat the process, returning all white beans to the bag after each person’s turn, until 20 years have passed or until all the brown energy beans are gone.
7. Answer the concluding questions.

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| **Year** | **Total Beans Removed** | **Number of Brown Beans**  **(Non-Renewable Energy)** | **Number of White Beans**  **(Renewable Energy)** | **Percent of Beans that are Renewable (white beans)** | **Number of Beans that are Remaining in the Bag.** |
| 1 |  |  |  |  |  |
| 2 |  |  |  |  |  |
| 3 |  |  |  |  |  |
| 4 |  |  |  |  |  |
| 5 |  |  |  |  |  |
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Using the data that you collected, determine the range, median, and mode

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| --- | --- | --- |
| **Function** | **White Beans (Renewable Energy)** | **Brown Beans (Non-Renewable Energy)** |
| Range of Energy Consumption |  |  |
| Median of Energy Consumption |  |  |
| Mode of Energy Consumption |  |  |

Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_

**“Renew A Bean” Concluding Questions**

1. How many years did it take for the non-renewable energy sources to run out when you used 10 energy beans per year?

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1. What are some examples of renewable and non-renewable energy sources?

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1. What does this activity demonstrate about our consumption of resources? What will happen if we keep using non-renewable resources?

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1. Describe what happens to the proportion of renewable vs. non-renewable energy sources that remain available, as energy is used over time.

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| **Lesson Plan 5—Connecting Energy to Trash** | | | | | | | | | | | | | | | |
| **SMART Objective:** By the end of this lesson, students will be able to understand that some waste material can be burned to generate electricity.  Students will be able to discuss the advantages and disadvantages of a waste to energy facility in Maryland. | | | | | | | | | | | | | | | |
| **Timeframe:** 1 hour/ 1 day | | | | | | | | | | | | | | | |
| **Standard:**  NGSS Construct explanations for how uneven distribution of Earth’s mineral and energy resources, which are limited and non-renewable, are a result of past and current geologic processes, including plate motions. | | | | | | | | | | | | | | | |
| **Lesson Components** | | | | | | | | | | | | | | | |
| [**21st Century Themes**](http://www.ecu.edu/cs-educ/account/upload/21st-Century-Skills-Definitions.pdf) | | | | | | | | | | | | | | | |
|  | Global Awareness | |  | Financial, Economic, Business, and Entrepreneurial Literacy | | |  | Civic Literacy | | |  | Health Literacy |  | Environmental Literacy  x | |
| [**21st Century Skills**](http://www.21stcenturyskills.org/index.php?option=com_content&task=view&id=254&Itemid=120) | | | | | | | | | | | | | | | |
|  | | Creativity and Innovation | | |  | Critical Thinking and Problem Solving x | | |  | Communication | | | |  | Collaboration  x |
| |  | | --- | |  | | **Unit Essential Question:** What are the advantages and disadvantages of waste to energy*?* | | **Teacher Background:**  Demand for energy has increased considerably in the past hundred years. Energy is used to power our electrical devices, to heat our homes and businesses and to fuel most forms of transportation. In using energy we consume valuable natural resources and create waste products that have an affect on the environment. Since it is highly unlikely the need for energy will decrease in the future, it is vitally important that we learn to use energy wisely, reducing not only the amount we consume, but also the amount of solid waste we create from its consumption.  There is a type of solid waste management that uses household waste to create energy. This process not only provides the benefit of eliminating waste, but also uses the heat generated in the process to produce steam, which in turn generates electrical power. This process is known as Waste-to-Energy (WtE). The WtE facilities produce electricity through combustion, incinerating the trash. Modern incinerators can reduce the amount of the waste by as much as 95%, varying somewhat depending upon the composition of the trash and how much material, such as metal, is recovered from the ash for recycling purposes. Currently, there are more than fifty WtE facilities operating in the New England and Middle Atlantic states, processing approximately 70 US tons of trash per day.  There is however controversy surrounding this issue. Many people are still concerned about burning trash to generate energy. Burning certain types of materials can cause toxins, such as dioxin, to escape into the atmosphere. Therefore, strict guidelines and standards have been put into place to monitor the types of trash that are incinerated in the US, and researchers continue to study the issue of converting waste to energy.  **Kid’s Speak**: We use more and more energy each and every day. We use it to make electricity, heat and fuel. It powers our laptops and TVs, gives us hot water and warm, comfy spaces, and helps transport us from place to place. It is very important that we learn not to waste the energy we use in our everyday lives, and to use it in an efficient manner.    **Eco-Fact**: There is modern Waste to Energy facilities today that can reduce the amount of waste going to landfills by 80- 95%, depending on the composition of the waste.  Source: ©2010 Green Education Foundation (GEF) Eco-Educational Series Fostering the next generation of environmental stewards. All Rights Reserved. | | **Materials:**   * Science Journals * Waste to Energy: An Overview video <http://www.youtube.com/watch?v=iioOVevReOs> * Graphic Organizer: Pros and Cons * Student handout: Waste-to-Energy Facility sketch handout * News article: <http://biomassmagazine.com/articles/5527/maryland-governor-to-sign-bill-making-msw-renewable-source/> * Extension/Homework: Major Users of WtE in the US data table provided below (Waste to Energy Chart) | | **5 E Lesson Plan** | | **Engagement (10Minutes):**  Quick Write in Science Journal: What do “waste- to-energy” mean to you? Explain  Students share their responses.  Show students the video Waste to Energy: An Overview video <http://www.youtube.com/watch?v=iioOVevReOs>  After video discuss with students different ways waste can be used to create energy. Provide students with background information on waste to energy. | | **Exploration : (15 Minutes)**  Introduce the Waste-to-Energy (WtE) process using incinerators to reduce waste and generate electricity.  Discuss the pros and cons of WtE and list on board.  Display the sketch of the WtE facility provided, below and use this sketch to explain the process of how trash is converted into energy:  **Garbage trucks bring trash to the WtE facility. No liquids, tires, or waste from hospitals are allowed. The trash is dropped into the receiving area. A crane picks it up and drops the trash into a hopper and the trash is pushed into the fire. A metal grate moves the trash back and forth slowly so that it burns completely. All that is left after the trash has been burned is ash and metal. The metal is removed using a magnet. It is sent to a recycling center to be reused. The ash is treated and sent to landfills to be used as cover material. At the same time the trash is burning, heat is being produced. This heat is used warm the water in the boilers. This heat changes the water from a liquid to steam. The steam is used to turn a turbine that produces electricity, which is later transferred to homes and businesses in the area.**  **Explain to students that states, which have large communities built on sandy type soils, often choose to use WtE management, because using landfills potentially risks the waters around them. These states have found that WtE is a better option for protecting the environment**. | | **Explanation: 30-40 minutes**  Distribute article and graphic organizer to groups of 2-3 students.  Within groups students read aloud article “Maryland governor to sign bill making MSW renewable source”  Students discuss article, complete the pros and cons handout and write a persuasive paragraph as to whether or not a Waste-to-Energy facility is needed in Maryland.  **Explain that solid waste management addresses the question, “What do we do with our trash?” There are five primary management options. Depending on the particular waste item, it can be reused, recycled, composted, burned, or landfilled. Burning solid waste, called waste-to-energy, reduces its volume and creates energy in the process.**  **Energy has many forms, such as heat, light, and movement. Energy can be stored, and it can change from one form to another. In this demonstration, heat energy will be converted into energy which creates motion.**  **Most of the electricity we use is produced by burning fossil fuels, natural gas, or heat produced in nuclear reactions. The heat produced in electric power plants is used to heat water and create steam. The steam then causes a turbine to turn, which generates electricity. In waste-to-energy facilities, waste material is burned instead of fossil fuels to produce electricity**. | | **Evaluation: 5 Minutes**  **Persuasion Writings Rubric:**  Students are able to define waste-to-energy and explain the process being used in their community and/or state. | | **Extension**  Homework Handout: Provide students the data table provided. This table indicates which US states are major users of WtE technology for solid waste management.  Ask students to:  o Find the total number of WtE facilities for the states listed on the data table.  o Find the average number of WtE facilities per state.  o Find the total number of tons of trash processed in these states using WtE technology.  o Find the average amount of tonnage processed in these states using WtE technology.  Students will research to determine if waste-to-energy Bill was passed in Maryland and list the pros and cons for the Bill.  Students can create a simple flow chart to show how trash moves through a WtE facility to reduce the trash and produce electricity. | |  | | | | | | | | | | | | | | | | |

Decision Matrix

Waste to Energy Facilities

in Maryland

**CONS**

**Pros**

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| **Lesson Plan 6—Waste and the Environment** | | | | | | | | | | | | | | | |
| **SMART Objective:** By the end of this lesson,students increase awareness about the human and environmental consequences of too much waste and identify potential solutions to the problem. | | | | | | | | | | | | | | | |
| **Timeframe:** 1-2 hours/ 1-2 days | | | | | | | | | | | | | | | |
| **Standards:** NGSS Construct explanations for how uneven distribution of Earth’s mineral and energy resources, which are limited and non-renewable, are a result of past and current geologic processes, including plate motions. | | | | | | | | | | | | | | | |
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| [**21st Century Themes**](http://www.ecu.edu/cs-educ/account/upload/21st-Century-Skills-Definitions.pdf) | | | | | | | | | | | | | | | |
|  | Global Awareness | |  | Financial, Economic, Business, and Entrepreneurial Literacy | | |  | Civic Literacy | | |  | Health Literacy |  | Environmental Literacy  x | |
| [**21st Century Skills**](http://www.21stcenturyskills.org/index.php?option=com_content&task=view&id=254&Itemid=120) | | | | | | | | | | | | | | | |
|  | | Creativity and Innovation | | |  | Critical Thinking and Problem Solving | | |  | Communication | | | |  | Collaboration  x |
| |  | | --- | |  | | **Unit Essential Question:**   * What is waste and where does it come from? | | **Vocabulary:** waste, garbage, landfill, combustor  **Teacher Background:**   * Waste, also called trash or garbage, is anything that is discarded, rejected, surplused, abandoned, or otherwise released into the environment in a manner (or quantity) that could have an impact on that environment. Most students don’t really think about what happens to waste once it is thrown away or placed in a recycling bin. The paths of waste are important for our environment and new waste-related technologies can lead to far-reaching environmental solutions. * The United States leads the world in waste production. In 2007, Americans generated about 254 million tons of trash. (This was nearly triple the waste production in 1960.) * The average person throws away 4.5 pounds of trash per day. * Too much waste has serious human and environmental consequences including pollution, depletion of natural resources, lack of landfill space, unclean water, financial burden, and increased greenhouse emissions. * Waste can take many different paths. The majority of waste is sent to landfills. Landfills are carefully designed structures in the ground that collect trash and safely isolate it from the rest of the environment. Some items decompose in landfills but others remain there in the same state indefinitely. * New technologies use landfill gas as a renewable energy source, generating power for nearby homes. * In addition to being sent to landfills, trash can also be recycled and recovered into material and energy resources.   Source:thinkgreen.com | | Misconceptions about our Current Waste Management System There are many misconceptions about waste, the use and disposal of toxic chemicals, and the relationship between environmental health and economic vitality. When these are re-examined, we can see why we need to move Beyond Waste. These misconceptions, and the dangers they pose, were the impetus for the Beyond Waste Plan.  Misconception 1: If a product is on the shelf, it is safe. Fact: The use of chemicals is proliferating and there is no systematic assessment of their impact on human health or the environment. We might assume products have been tested and declared safe for the intended purpose. What we may not know is that:   * Many chemicals in products have not been tested or approved by any regulatory authority for their impacts on human health. * We are exposed to chemicals through product use and disposal. * Children and infants are at greater risk of harm from exposure because of their low body weight, high metabolic rates, and the tendency to put things in their mouths.   Misconception 2: Existing laws and regulations provide adequate protection from toxic chemicals Fact: Many toxic chemicals are released into the environment through:   * Permitted discharges * Exclusions to regulations * Non-point sources * Hazardous waste management related problems   The total amount of toxins entering the environment through these channels is significant. Un-regulated, un-tracked emissions far outweigh permitted sources. Cumulative effects of these hazardous wastes contribute to an increasing toxic burden in our environment and our bodies.   Misconception 3: Landfills solve the waste problem Fact: Waste is inefficient. Landfills ignore the true cost of waste and the missed opportunities to conserve resources and foster new business markets. As long as there is waste, landfills will continue to provide an important service. However, reliance on landfills does not provide an adequate solution to our future resource and waste management problems because:   * Permanent disposal of potentially useful materials means our economy must rely on extracting increasing amounts of diminishing natural resources. * Hazardous substances are present in many wastes being disposed. * Subsidies and hidden impacts distort the complete costs of land filling, perpetuating the belief that it is more economic to dispose of, rather than reclaim, material.   Misconception 4: Recycling solves the waste problem Fact: Recycling is a necessary component of diverting material from disposal facilities and reducing virgin material demand, but the current system is not wholly effective. Recycling does not successfully address long range problems of waste accumulation and resource depletion because:   * Most products are not designed for recycling so it can be difficult and expensive to recover and reprocess materials. * Virgin material subsidies and the external costs not accounted for in our disposal practices place recyclable materials at an economic disadvantage compared to virgin materials. * Some companies that call themselves recyclers are actually waste-trading - exporting the materials to other venues where they are subsequently land filled, or recycled under hazardous environmental and working conditions.   **Misconception 5: Eliminating waste and toxics will be bad for the economy Fact:** Waste is a result of poor product design, failure to efficiently use resources, and subsidized markets that encourage waste. Many leading businesses understand that waste is lost profit and eliminating waste can benefit their bottom line. Eliminating waste and toxins will benefit the Washington economy because:   * Existing businesses can save money * There will be new job creation (reuse, remanufacturing, efficiency, and recycling industries) * Businesses will be able to compete more effectively in the global economy.   **Service-Learning Connection**  **Preparation.** After the students examine the litter in different areas around the school, they write a report describing their findings and explaining their ideas about how to address the litter problem at their school. They request a meeting with the principal to discuss their ideas in greater detail.  **Service.** After receiving the support of the principal, students implement a plan for controlling the litter problem at their school. They make suggestions such as establishing a school wide litter patrol team, organizing cleanup days several times a month, and implementing an incentive program for students who commit to picking up one piece of litter every day.  **Reflection.** The students divide into groups to discuss and evaluate the success of  their project.  **Celebration.** The students share their success by giving a report on their project to the PTO/PTA during a school wide open house event. | | **Materials:**   * Science Notebook * DE Streaming: Real World Science- Trash and the Environment (15:00) [http://player.discoveryeducation.com/index.cfm?guidAssetId=77B98334-881C-4593-B352-E15D3645E6DC&blnFromSearch=1&productcode=US](http://player.discoveryeducation.com/index.cfm?guidAssetId=77B98334-881C-4593-B352-E15D3645E6DC&blnFromSearch=1&productcode=US" \t "_blank) * Student handout for video: “Trash and the Environment” questions * <http://www.sprep.org/att/publication/Retro/Factsheets/Where-does-waste.pdf> * Student activity handout: “Waste Watcher” * Large trash bags & gloves * Extension/Homework Trash Tracker handout: <http://www-tc.pbs.org/america-revealed/static/media/downloads/2012-02-25/TrashTracker.pdf> | | * **5 E Lesson Plan** | | **Engagement (5 Minutes)**  **Quick write: Students respond to the questions in their science notebook.**  What is waste?  What are some other names we have for waste?  Where does the waste come from? | | **Exploration (20 min):**  After discussing journal entries, show students the following video:  DE Streaming: Real World Science- Trash and the Environment [http://player.discoveryeducation.com/index.cfm?guidAssetId=77B98334-881C-4593-B352-E15D3645E6DC&blnFromSearch=1&productcode=US](http://player.discoveryeducation.com/index.cfm?guidAssetId=77B98334-881C-4593-B352-E15D3645E6DC&blnFromSearch=1&productcode=US" \t "_blank)    Handout questions for students to take notes and answer during video.    After video:  Discuss trash and the effect on the environment. Ask students to think about the different kinds of products and materials that they use and dispose of every day. | | **Explanation( 20 minutes)**  **Rational:** One of the most important parts of maintaining a planet that is healthy for all life forms is reducing the amount of waste that is created by humans. This waste has a huge negative impact on the natural environment. Recycling waste and reducing the waste produced is important for conserving raw materials, reducing pollution, conserving energy, and preserving natural resources.     1. Students will group together into teams of 4 or 5, and receive the “Waste Watcher” activity sheet. 2. Take students out of the classroom to collect waste in and around the school grounds. 3. Return back to the classroom and students complete activity sheet. 4. Record class findings on chalkboard/chart paper and discuss.   Share with students that, unless reused or recycle, each item likely will end up in a landfill. Review the definition of a landfill from the background information above. | |  | | **Extension/Homework:**  Write the following words on the board:   * Plastics * Electronics * Food and Liquids * Paper   Invite students to select a specific type of waste that they will track over a given time period (one day, one week, etc.) through photography or video recordings in a specific place (eg: home, school, local trash can on a specific street corner, etc.). They can use the reproducible “[Trash Tracker](http://www-tc.pbs.org/america-revealed/static/media/downloads/2012-02-25/TrashTracker.pdf)” to take notes of the locations they were photographing, at which times or what days, and their observations about the waste—for example, what is its weight or volume or going even further, where might it end up (landfills, incinerators, recycling). | |  | | | | | | | | | | | | | | | | |



Trash and the Environment

Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Class\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What was the greatest percent of our waste?

2. Explain "Nature's Recycling System.

3. Define decompose.

4. Define raw materials.

5. Do we waste more plastic or food waste?

6. What item will never decompose?

7. What happens to trash in a landfill?

8. Explain why Waste to Energy Facility Plants are a more environmentally sound way to dispose of trash.

9. What is the best thing you can do to help the environment?

10. Think about your day. How much trash do you create?

“Waste Watchers”

Students walk around the school grounds to see what kinds of trash they find. One student in the group is the record keeper and records the findings; the other members of the group collects the (clean) trash and places the trash in the trash bag.

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| Waste type | Tally |
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Questions:

1. Was there any waste found that was unexpected?
2. What kinds of trash were most prevalent?
3. Why do you suppose that these items are the most frequently discarded?

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| **Lesson 7—Landfills and the Environment** | | | | | | | |
| **SMART Objective:**  By the end of this lesson students will:   * Create awareness for the types of waste we create and the options for its disposal. * Stimulate critical thinking about choices we make for consumer products and support of our overall lifestyle. * Be challenged to be mindful of the short and long term effects of the waste stream generated by the human race. | | | | | | | |
| **Timeframe:** 1-2 hours/1-2 days | | | | | | | |
| **Standard:**  NGSS Construct explanations for how uneven distribution of Earth’s mineral and energy resources, which are limited and non-renewable, are a result of past and current geologic processes, including plate motions. | | | | | | | |
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| **Lesson Components** | | | | | | | |
| [**21st Century Themes**](http://www.ecu.edu/cs-educ/account/upload/21st-Century-Skills-Definitions.pdf) | | | | | | | |
| Global Awareness | Financial, Economic, Business, and Entrepreneurial Literacy | | Civic Literacy | | Health Literacy | Environmental Literacy  x | |
| [**21st Century Skills**](http://www.21stcenturyskills.org/index.php?option=com_content&task=view&id=254&Itemid=120) | | | | | | | |
| Creativity and Innovation | | Critical Thinking and Problem Solving | | Communication | | | Collaboration |
| |  | | --- | |  | | **Unit Essential Question**: What is a landfill and how does it work? | | **Teacher Background:**  **All About Landfills**  **1. What exactly is a landfill?**  A landfill is a specially designed facility for the burial of municipal solid waste. In the past, landfills were  poorly designed, poorly managed garbage dumps that created ongoing environmental problems as  chemicals leached into the soil and air. Today’s landfills are designed in such a way that leachates cannot  leak down through the soil into the water table. This is accomplished by a layer of clay-like soil at the bottom of the landfill.  The next layer up is a synthetic lining, usually made of plastic. All remaining layers alternate between soil and garbage.  **2. How much of our trash is disposed of in landfills?**  As of 1996, approximately 55% of all the United States’ garbage resides in landfills, while 17% is incinerated, and 28%  is recycled. The 28% that is recycled is greater than the EPA’s initial goal of 25% recycling.(Source: US EPA, Office of Solid  Waste)  **3. How does the trash in a landfill decompose?**  There are three classes of bacteria and fungi that work to degrade garbage. Cellulolytic microbes initiate the process by breaking  down the cellulose in paper, wood, and other plant wastes. Then acidogens ferment these sugars into acids, which methanogens  then convert into methane gas and carbon dioxide.  **4. What types of materials are put in landfills?**  Municipal solid waste landfills are filled with everything we throw away, from glass bottles to  grass clippings and other yard wastes. The latter constitutes nearly 20% of all garbage landfilled.  Disposable and non-durable products are major culprits in the growth of waste. In just one day, Americans throw away 150,000  tons of packaging material. This would fill 10,000 tractor trailer trucks, which would stretch 120 miles end to end.  (Source: Garbage magazine)  **5. What are the three main problems or environmental concerns associated with landfills?**  **Methane Gas**, **leachate**, and **loose waste** are the three main challenges for landfills today.   * **Methane gas** is produced in a landfill by anaerobic decomposition. It can be collected using current technology and   then used to generate electricity, or it can be purified and used as a power generating fuel.   * **Leachate** is a thick liquid that forms when garbage decomposes. At its best, it is similar to very strong sewage water;   at its worst, it carries hazardous materials with it that were dissolved from the waste. Newer landfills have synthetic  liners above a clay-like soil that help to prevent the leachate from leaking into the groundwater, causing contamination.  Older landfills do not utilize this type of liner, and are therefore a threat to our groundwater—especially to nearby neighborhoods.   * **Loose waste** is another problem. It attracts disease carrying vermin of all types, and it can fly away in the breeze. At   the end of every working day, a "daily cover" must be applied to minimize these problems. Once the landfill stops  accepting waste, a final multi-layer cover must be applied to keep liquids away from the waste. Vegetation is then  planted to reduce the effects of erosion.  **6. Are there products in my house that should not be sent to a landfill?**  Many of the products we use in our homes are considered hazardous materials. A hazardous material is one that is toxic or will  corrode metal, burn, or explode. Materials like oven cleaner, batteries, motor oil, paints, varnishes, thinners, fluorescent bulbs,  mercury switches, etc., should not be sent to landfills because they are considered hazardous. These materials should be taken  to a hazardous waste drop-off site. If every citizen convinces him or herself that "my hazardous materials are so small they  won’t matter," the total problem remains enormous.  • Compost yard and organic wastes. Use them as nutrients for other plants.  • Mulch leaves and grass clippings.  • Buy recycled paper products and products with less packaging.  • Buy durable products rather than disposable ones.  • Reuse jars and containers.  • Recycle oil and old tires.  Some of this lesson information is adapted from various web sites, including: http://www.awma.org/education,  <http://www.plantea.com/>, compost-materials.htm <http://www.learnnc.org/lessons/Dawngilbert5232002144>,  <http://www.howstuffworks.com/landfill.htm>  , <http://en.wikipedia.org/wiki/Landfill> | | Materials:   * Science Journal * Items from school or home trash can with the following cleaned items in it: banana peel, candy wrapper, plastic bag,   tuna fish tin can, aluminum can, glass bottle and Polystyrene foam   * Video: <http://www.thinkgreen.com/secret-life-of-landfills> * Student Handouts- “All About Landfills” and “Waste Not” * Student Handout(optional)- Typical Anatomy of a Landfill <http://www.wm.com/about/community/pdfs/Anatomy_of_a_Landfill.pdf> * Student Handout(optional)- The Science of Managing Waste (<http://www.wm.com/wm/environmental/documents/WMscien_mnging_waste.pdf> | | 5 E Lesson Plan | | **Engagement (15 min)**  **Quick Write in Science Journal:** Define and Illustrate a landfill?    Review the definition of a landfill from the background information above.  Then have students watch, Talking Trash: The Secret Life of Landfills at <http://www.thinkgreen.com/secret-life-of-landfills> for  a quick inside look at a landfill.  If time permits, this is also a good time to distribute and review the two student handouts, Typical Anatomy of a Landfill and  The Science of Managing Waste. | | **Exploration**   1. Place the class trash (trash collected from waste activity) in front of the room and pull out (or have students look at) 5-10 random items made of different materials. Ask students to examine each item and to try to identify what it is made of, where it   originally came from, where it likely will go once it leaves the trashcan, and whether there might be other uses or paths  for this item to take.   1. Distribute student handouts: “All About Landfills” and “Waste Not” 2. Within a group of 4 or 5, students read “All About Landfills”, answer comprehension questions and complete and   discuss “Waste Not” activity. | | **Explanation**   * The average person throws away 4.5 pounds of trash per day. * Too much waste has serious human and environmental consequences including pollution, depletion of natural resources,   lack of landfill space, unclean water, financial burden, and increased greenhouse emissions.   * Waste can take many different paths. The majority of waste is sent to landfills. Landfills are carefully designed structures   in the ground that collect trash and safely isolate it from the rest of the environment. Some items decompose in landfills  but others remain there in the same state indefinitely. | | Evaluation  **Ask:** Why do students think that waste production has increased so much? How might the categories of waste have changed over  the years? How will the categories likely change in the future? If this trend continues, how much waste production might there  be 30 years from now?  You can evaluate your students using the following three-point rubric:   * **Three points:** Students generate logical reasons for the waste problem in the US; identify risks of this problem; work   well in their teams to investigate one risk; and generate creative ideas for new technologies.   * **Two points:** Students generate fairly logical reasons for the waste problem in the US; identify some risks of this   problem; work fairly well in their teams to investigate one risk; and generate ideas for new technologies.   * **One point:** Students unable to generate reasons for the waste problem in the US; unable to identify risks of this   problem; difficulty working in teams to investigate one risk; and unable to generate ideas for new technologies. | | **Extension**   1. Have students generate a list of the risks associated with too much waste production in the United States.   Examples of risks include pollution, depletion of natural resources, lack of landfill space, unclean water,  financial burden and increased greenhouse emissions.   1. Each student selects one of the risks from their list to investigate further. Challenge them to find out at least   five facts about how too much waste relates to their risk; whether their risk is environmental, human or  both; and what the local and national implications are. | | **Service-Learning Connection**  **Preparation.** Students complete research on air, water, and soil pollution in our state and the various ways  that we can address these problems. They then design age-appropriate oral presentations, with visuals such  as posters and charts, to give to lower grade classes.  **Service.** The students make their presentations at an assembly.  **Reflection.** After making their presentations, the students discuss and contemplate the impact of what  they learned from the experience. | | | | | | | | |

* Please attach Landfill activity in dropbox (did not know how to attach)

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| **Lesson Plan 8–Calculating Your Carbon Footprint** | | | | | | | | | | | | | | | |
| **SMART Objective:** By the end of this lesson, students will understand that individual choices contribute to climate change.  Students will learn the role that carbon-containing greenhouse gases play in the changing climate and calculate their own carbon footprints. | | | | | | | | | | | | | | | |
| **Timeframe:** 1 day | | | | | | | | | | | | | | | |
| **Standards:** NGSS Construct explanations for how uneven distribution of Earth’s mineral and energy resources, which are limited and non-renewable, are a result of past and current geologic processes, including plate motions. | | | | | | | | | | | | | | | |
| **Lesson Components** | | | | | | | | | | | | | | | |
| [**21st Century Themes**](http://www.ecu.edu/cs-educ/account/upload/21st-Century-Skills-Definitions.pdf) | | | | | | | | | | | | | | | |
|  | Global Awareness | |  | Financial, Economic, Business, and Entrepreneurial Literacy | | |  | Civic Literacy | | |  | Health Literacy |  | Environmental Literacy  x | |
| [**21st Century Skills**](http://www.21stcenturyskills.org/index.php?option=com_content&task=view&id=254&Itemid=120) | | | | | | | | | | | | | | | |
|  | | Creativity and Innovation | | |  | Critical Thinking and Problem Solving | | |  | Communication | | | |  | Collaboration  x |
| |  | | --- | |  | | **Unit Essential Questions: “**What is a Carbon Footprint”? | | **Teacher Background:**  **Vocabulary:**  CARBON FOOTPRINT-The total amount of greenhouse gas emissions caused by a person, household, event, or organization. GREENHOUSE GAS EMISSIONS-Gases such as CO2 and methane discharged into the air from sources such as internal combustion engines and livestock. GLOBAL WARMING: An increase in the Earth's average air and ocean temperatures due to heat from the sun being trapped by excess greenhouse gasses accumulating in the Earth's atmosphere  Source: Source.com | | **Materials:**   * Student laptops/Computer * **["Carbon Footprints"](http://www.scholastic.com/thelorax/pdf/lorax_68_carbonfootprints.pdf" \t "_blank)** student worksheet, * **["Energy Hide and Seek"](http://www.scholastic.com/thelorax/pdf/lorax_68_energyhideandseek.pdf" \t "_blank)** family worksheet, * Pencils and paper * Internet access: **[www.myfootprint.org](http://www.myfootprint.org/" \t "links)** * **Video:** [**http://abcnews.go.com/Technology/video/reduce-carbon-footprint-9280533**](http://abcnews.go.com/Technology/video/reduce-carbon-footprint-9280533) | | **5 E Lesson Plan** | | **Engagement :**  **Quick write in Science Journal:** How much energy do you think you consume each day, compared to people in other parts of the world?  Generate a list and tally of all the energy you use in a day, starting with the moment you wake up.  **Encourage students to consider every detail, including the electricity that powers their alarm clocks and lights; the heat used to warm their showers; the energy used to manufacture their clothes and grow and prepare their breakfasts; the gas that fuels the school bus, etc.**  ***Explain:*** *Carbon dioxide and methane are the greenhouse gases most responsible for global climate change. Many natural processes release carbon-containing gases. But by burning fossil fuels for energy, humans are adding much more of these gases to the atmosphere than the planet can absorb. Each time we use energy-by growing and cooking food, using electronics, heating and lighting our homes, making and recycling products, traveling by car, etc.-we add more greenhouse gases to the atmosphere. As a result, our planet's temperature is rising, affecting the health and well-being of many plants and animals, including humans.*  ***Elaborate****: Worldwide, the average two-person household has a carbon footprint of about 11 tons of carbon every year. Compare that to the United States where the average household emits about 59 tons of carbon dioxide each year. This is six times higher than the average emissions for the remainder of the world.*  ***Discuss*** *how countries with fast-growing economies such as China and India are increasing their use of fossil fuels as they grow.*  ***Ask:*** *Does this make it even more important to countries like the United States to reduce their carbon footprints?* | | **Exploration :**   1. Students calculate their household’s carbon footprint by visiting the online carbon calculator: **[www.myfootprint.org](http://www.myfootprint.org/" \t "links)** and recording results. 2. Watch video: <http://abcnews.go.com/Technology/video/reduce-carbon-footprint-928053> 3. Distribute the “Carbon Footprints” student worksheet. 4. After completing handout, students pair with a partner and discuss ways that students, families, and schools can reduce their carbon footprints.   **Make sure teams discuss home energy usage, transportation, food production, recycling, and waste.**   1. With a partner, students make a plan to reduce their carbon footprints.   **Encourage student teams to brainstorm big ideas and innovative ways to take action and reduce the carbon footprints of your school, your community, and your town or city.** | | **Explanation:**  Homework: Copy and distribute the "Energy Hide and Seek" family worksheet.  Encourage students to complete these activity pages as homework assignments and show their family what they have discovered. | | **Evaluation:** Students complete student survey and be able to list ways to reduce the carbon footprint. | |  | | | | | | | | | | | | | | | | |

**[](http://www.google.com/imgres?imgurl=http://media.treehugger.com/assets/images/2011/10/carbon-footprint-green.jpg&imgrefurl=http://www.treehugger.com/clean-technology/how-to-reduce-your-carbon-footprint-by-one-ton-a-year.html&h=310&w=468&sz=14&tbnid=lN_bizjVLstYSM:&tbnh=80&tbnw=121&prev=/search?q=carbon+footprint+pictures+images&tbm=isch&tbo=u&zoom=1&q=carbon+footprint+pictures+images&usg=__legSvZMzWXrM6Vbu6IzVPcYh6pk=&sa=X&ei=DgIaUOGANMSV6wHBuYGADA&ved=0CBEQ9QEwAA)How big is your footprint? Here’s a hint: It has nothing to do with your shoe size. The total set of greenhouse gases given off by a person (or a household) is known as a carbon footprint.**

**When it comes to carbon emissions, bigger is definitely not better. Now for the good news: There are steps you can take to shrink your carbon footprint, both at home and at school. Use this worksheet to help you develop a carbon-cutting action plan!**

1. In your writing notebook, brainstorm ways that you can reduce your carbon footprint at home, focusing on the following key areas:
   1. Energy Use b. transportation c. Growing and Cooking Food d. Recycling and Waste
2. Talk with your family about putting your ideas into practice.
3. Working in teams, list all the ideas you can think of to reduce your school’s carbon footprint.
4. Take a vote to select one area of focus for your class. Write your focus here:
5. Together, make a plan to take action! In your writing notebook, answer the following questions: Which school administrator or faculty member can we talk to in order to learn more about how the school currently handles this issue?
6. What changes can individual students and/or classrooms undertake to lower their carbon footprint?
7. What school-wide changes can be made to lower our carbon footprint?
8. How can we put our ideas into practice?
9. How can we educate others to help reduce the school’s carbon footprint?
10. **Writing Contest!**

Starting March 2, tell

a true story from

Your[](http://www.google.com/imgres?imgurl=http://4.bp.blogspot.com/_U4cm19Pr9jE/SnZvBWg6lhI/AAAAAAAAAQQ/O4j2urB9hUU/s320/Carbon-Footprint-8-18-7.gif&imgrefurl=http://servalsgroup.blogspot.com/2009/08/reducing-carbon-footprint-while-cooking.html&usg=__n12e_OG4BCFIW6iwSgceInflGpo=&h=307&w=311&sz=38&hl=en&start=10&sig2=5cJCiyd4iojPPX2pBQ0VMA&zoom=1&tbnid=7_Iu_Q9IqoplzM:&tbnh=115&tbnw=117&ei=0gIaULrsEaWg6QGh-oDgAw&prev=/images?q=carbon+footprint+pictures+images&hl=en&sa=X&rlz=1T4ADSA_enUS415US415&tbm=isch&itbs=1)Energy Hide-and-Seek[](http://www.google.com/imgres?imgurl=http://www.dalbeattiematters.co.uk/userfiles/image/carbonfootprint.jpg&imgrefurl=http://www.dalbeattiematters.co.uk/features.asp?ID=353&h=1123&w=816&sz=386&tbnid=ZVFZofrcr4JorM:&tbnh=88&tbnw=64&prev=/search?q=carbon+footprint+pictures+images&tbm=isch&tbo=u&zoom=1&q=carbon+footprint+pictures+images&usg=__jOzBlZ_qawhyWlK4av9BXSI9dEw=&sa=X&ei=DgIaUOGANMSV6wHBuYGADA&ved=0CBUQ9QEwAg)

The clues to saving energy are hidden right before your eyes! Find the hidden words in the puzzle below to fill in the blanks. After decoding these energy fun facts, talk about how to save energy in your own home!

**Family Activity Page**

1. Solar and wind power are examples of\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy sources.

2. Electricity produced by the energy in water is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

3. Oil, coal, and natural gas are types of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

4. Compact \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ lights, or CFLs, use 75 percent less energy than traditional \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ bulbs.

5. Appliances with the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ rating are more efficient.

6. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the conversion of waste, such as plastic, glass, or aluminum, into new materials.

7. Energy “vampires,” like computers and TVs, use \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ even when they’re turned off. So unplug!

8. Devices used to harness energy from moving air are called wind \_\_\_\_\_\_\_.

9. Twenty-eight percent of energy consumed in the United States is used for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, or moving things and people from place to place.

10. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is biodegradable fuel made from natural sources such as soybeans.

11. The sun is the source of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ power.

12. Gasoline for cars is made from oil, also known as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

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| **Lesson 9—3Rs and the Environment** | | | | | | | |
| **SMART Objective**  By the end of this lessonthe students will be able to:   * Define and describe the importance of: reduce, reuse and recycle. * Understand the different methods of waste disposal. | | | | | | | |
| **Timeframe:** 1-hour/1 day | | | | | | | |
| **Lesson Components** | | | | | | | |
| [**21st Century Themes**](http://www.ecu.edu/cs-educ/account/upload/21st-Century-Skills-Definitions.pdf) | | | | | | | |
| Global Awareness | Financial, Economic, Business, and Entrepreneurial Literacy | | Civic Literacy | | Health Literacy | Environmental Literacy  x | |
| [**21st Century Skills**](http://www.21stcenturyskills.org/index.php?option=com_content&task=view&id=254&Itemid=120) | | | | | | | |
| Creativity and Innovation | | Critical Thinking and Problem Solving | | Communication | | | Collaboration  x |
| |  | | --- | |  | | Unit Essential Question: What are the different methods of waste management and how do they help the environment? | | Teacher Background:  Decompose means to rot or to break down. When a piece of trash decomposes, it becomes nonexistent in the environment. Different types of items take longer to decompose. For example, a banana peel takes three or four weeks to decompose, while a cigarette butt takes two to five years.  What does it mean to *reduce* waste?  *Reduce:* use fewer resources (which, in turn, reduces trash)  - Methods of reducing use of resources and trash  - buy used products  - select products that are energy-efficient  - avoid overly packaged goods because packaging is  all throw away  What does it mean to *reuse?*  *Reuse:* taking an item that might be thrown out and  using it again for a purpose other than its original use (or  allowing someone else to use it instead of throwing it out)  - Items that can be reused  - An old shirt can become a rag used for cleaning  - An old envelope can become a shopping list or a note  - Magazines, CDs, and DVDs can be shared or traded  What does it mean to *recycle?*  *Recycle*: process old, used items in order that the material  can be used to make new products  - Items that can be recycled  - Paper  - Metal  - Glass  Why is it important to *reduce*, *reuse*, and *recycle?*  - conserve natural resources  - save energy  - decrease pollution  - protects the environment  Web site: <http://www.recycling-guide.org.uk/rrr.html> | | **Service-Learning Connection**  **Preparation.** Students clean up and maintain their assigned areas for two weeks. They also conduct a school wide litter survey, implement a tracking system, and complete graphs showing the amounts of litter they collect during the two-week period. Students then plan a drop-in and issue invitations to school administrators and local school board representatives to hear the results of their project.  **Service.** Students share results of the cleanup project with school administrators and local school board representatives at a drop-in or evening gathering. After sharing their results and ideas, the students brainstorm with the school administrators and local school board representatives to come up with ideas for implementing a long-term plan for keeping the school clean and litter free.  **Reflection.** The students discuss the issues surrounding the idea that a lack of pride is related to the litter problem and that increasing pride is a good way to address that problem.  **Celebration.** “Before” and “after” photos of the assigned areas are posted on a bulletin board outside the classroom or are published in the school newspaper. The PTO/PTA acknowledges and pledges to support the students’ efforts. | |  | | Materials:  Science Journal  3Rs video by Jack Johnson <http://www.youtube.com/watch?v=eEREvkflsgU>  Student Handout-3Rs graphic organizer  3 Sheets of Poster Board (one labeled-Recycle,1 labeled -Reduce, 1 labeled- Reuse)—*which will later be used as posters to hang around school for service learning project*  Scissors  Glue stick  Old magazines (1 per pair of students) | | 5 E Lesson Plan | | Engagement: List the following trash items on the chalkboard: paper bag, wool sock, leather shoe, tin can, disposable diaper, an aluminum can, a plastic jug, and a Styrofoam container.  Quick Write (allot 5 minutes): Make predictions about the decomposition time of the various items. Students share with a partner.  Before revealing the decomposition time of each item, have students think about how often these items are placed into trash and the impact this has on our environment.  Paper bag – 1 month  Wool sock – 1 year  Leather shoe – 45 years  Tin can – 90 years  Disposable diaper – 550 years  Aluminum can – 200-500 years  Plastic jug – 1 million years  Styrofoam container – more than 1 million years  Retrieved from: No More Trash Web — site: <http://mdc.mo.gov/nomoretrash/facts/>  Share with students: It takes a lot of time for trash to decompose. As we continue through the lesson, we will learn about different ways we can *reduce* the amount of trash that enters our environment because it is everyone’s responsibility to lower the trash output, since we are all contributors to the problem. | | Exploration:   1. Show 3Rs song video <http://www.youtube.com/watch?v=eEREvkflsgU>. 2. Distribute student handout. Explain: On the sheet, there are three bubbles that each contain a word – *reduce*, *reuse*, or *recycle*. Write the definition in the corresponding bubble and list ways you can reduce, reuse, or recycle. 3. Ask students: Why is it important to *reduce*, *reuse*, and *recycle*? (Conserve natural resources, save energy, decrease pollution and protects the environment) 4. Ask students: What are other waste management methods that you know? (incineration and landfill)   Explain to students that today we will be reviewing the concept 3Rs by creating posters that will be displayed in the hallways to inform others about our Recycling Service Learning Project.  Tell students: You will be given magazines, scissors, and glue. When I say *REDUCE*, *REUSE*, *RECYCLE*, flip through the magazines and find a picture of one item that could be *recycled*, *reused*, or the usage could be *reduced*. When you have found a picture, cut it out of the magazine. After one picture has been cut for each category, glue the picture under the appropriate heading *reduce*, *reuse*, or *recycle*.(Allot 5-10 minutes for this activity.) | | Explanation  Today, we learned about the concepts of *reduce*, *reuse*, and *recycle*. Making these concepts a habit in our daily lives will help protect the environment by reducing pollution, saving energy, and conserving natural resources. We all enjoy living in a clean environment and future generations will want to enjoy the same thing, so we should help protect it now. | | Evaluation:   * Observe the class for comprehension while completing 3Rs graphic organizer. * Review the items glued under each heading. If any items do not belong, point this out. * Observe comprehension with student individual work and student working with partner. | | Extension   * Students create a poster/draw a picture that illustrates the importance of *reduce*, *reuse*, and *recycle*. * Prepare a paper identifying what happens to a piece of paper (plastic, glass, metal, etc.) from the time it is placed in your recycling bin until it gets *recycled*.   Initiate recycling project at school by creating different collection bins for different recyclable items (paper, plastic, bottles).   * Plan field trip to a recycling center and interview the manager of the center. * Invite waste management personnel to school to speak with students. * Have students to contact a recycling center to Volunteer for a day to assist at a town recycling center   or conduct a survey at the center by watching and analyzing what people are bringing. | |  | | | | | | | | |

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Reduce

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Recycle

**Recycle**

**1.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_2.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_3.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_4.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_5.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

[](http://www.bing.com/images/search?q=reduce+reuse+recycle+logo&view=detail&id=08591392F7A98729A873EAB0493B36F4CE1A1EA6&first=1)

Reduce

**Reuse**

**1.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_2.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_3.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_4.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_5.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Reuse

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| **Lesson Plan 10—Ready, Set, Recycle** | | | | | | | | | | | | | | | |
| **SMART Objective:**  By the end of this unit, students understand the meaning and significance of recycling by organizing a classroom/school recycling program. | | | | | | | | | | | | | | | |
| **Timeframe:** 1-2 days | | | | | | | | | | | | | | | |
| **Standards:**  Science  NS.K-4.1 Science as inquiry Abilities necessary to do scientific inquiry, Understanding about scientific inquiry  NS.K-4.2 Properties of objects and materials  NS.K-4.3 Life Sciences Characteristics of organisms, organisms and environments  NS.K-4.5 Science and Technology: Abilities to distinguish between natural objects and objects made by humans  NS.K-4.6 Personal and Social Perspectives: Characteristics and changes in populations , types of resources , changes in environments  NS.K-4.7 History of Nature and Science: Science as a human endeavor | | | | | | | | | | | | | | | |
| **Lesson Components** | | | | | | | | | | | | | | | |
| [**21st Century Themes**](http://www.ecu.edu/cs-educ/account/upload/21st-Century-Skills-Definitions.pdf) | | | | | | | | | | | | | | | |
|  | Global Awareness | |  | Financial, Economic, Business, and Entrepreneurial Literacy | | |  | Civic Literacy | | |  | Health Literacy |  | Environmental Literacy  x | |
| [**21st Century Skills**](http://www.21stcenturyskills.org/index.php?option=com_content&task=view&id=254&Itemid=120) | | | | | | | | | | | | | | | |
|  | | Creativity and Innovation x | | |  | Critical Thinking and Problem Solving x | | |  | Communication  x | | | |  | Collaboration  x |
| |  | | --- | |  | | **Unit Essential Question:** What is needed to start a classroom/school recycling program? How will a recycling program provide student learning services? | | **Teacher Background:**  **Steps to setting up a recycle center and recycling process for your classroom/school:**  • Use a master recycling planning guide to consolidate the final recycling plan and post near the recycling area. The charts are a guide to be used by your students. You might have students work in groups or pairs, and then share ideas with the entire class to consolidate and create a plan for the entire class.  • Students have school or teachers purchase recycling bins or use cardboard boxes to make collection bins (making recycling bins lesson to follow) for reusable and recyclable materials.  • Students use arts and crafts products to make posters to hang in the classroom and school to promote the classroom recycling program.  • Students brainstorm other ways to communicate their recycling plan- through letters home, announcements, etc.  • Assign class jobs to assist in the classroom recycling center.  • Implement the plan.  Source: [www.elmersgluecrew.com](http://www.elmersgluecrew.com) | | Misconceptions: | | **Materials:**   * Science Journals * Index cards * Student Handout—Our Recycling Plan sample sheet | | **5 E Lesson Plan Template** | | **Engagement: Pass out index cards to each student.**  Have students write down or draw on an index card one idea they have learned about the environment or had confirmed by reading thus far. Collect cards and randomly share some ideas from the cards. Keep cards for later use. | | **Exploration :**   1. As a class or in small groups, have students brainstorm ways to implement a classroom/school recycling program. 2. Handout student planning guide. 3. Students can work in pairs, or small groups to fill out recycling guides. 4. Allow students some time to work. | | **Explanation:**  After students have had time to collaborate within their groups, start class discussion about recycling and the specific plan for your classroom.  **Guided Questions:**  • What do we regularly throw away that can be reused?  • What do we regularly throw away that can be recycled?  • How can we organize our recycling system in our classroom?  • Who will be involved (class, whole school, community)?  • How will we communicate our ideas with others (letter, posters, morning announcements, etc.)?  • How will it be collected?  • Where will the bins be kept?  • When will they be taken to recycling facility?  • Who will help us (other classes, parents)?  • How will we keep track of how much we have recycled (charts, graphs)? | | **Evaluation:** Ask students to turn the index card over that they used in the beginning of the lesson and write another new thought or idea that they have learned from this lesson. | | **Extension:**   * Have students look through information about recycling facilities in their area. Share with the class what you have learned about each recycling facility and the types of materials they will accept for recycling. * Contact local organizations such as Lion's Club, Kiwanis, etc. to see if your class can get   involved in assisting in their recycling efforts with such items as used eye glasses, books,  toys or clothing.   * Plan a visit to a recycling facility or invite a guest speaker to come to your class. | |  | | | | | | | | | | | | | | | | |

**Our Classroom’s Recycling Guide and Plan**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| What will we recycle? | Who will help us? | How will we communicate our plans? | What is  our goal? | How often  will the recycling center pickup? |
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**Weekly Schedule:**

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| --- | --- | --- | --- |
| Classroom Task | How Perform | Who? | Completed by: |
|  |  |  |  |
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**WHAT:**

* What is the need for the service project?
* How does your understanding of Clean & Green help in your choice of service project?
* Who or what will you help?

**SO WHAT:**

* What expectations do you have about your service project experience?
* As we talked about ‘how the project will proceed’...Is there anything that makes you feel uncomfortable, unprepared, or ready to get started?
* Does your service project make maximum use of the team players? Does everyone have full participation?

**NOW WHAT:**

* Do we have agreement with the plan?
* If not full agreement, are there questions to answer first?
* If you do not fully agree, do you have an alternative to offer the group?

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| **Lesson Plan 11—Persuading Others** | | | | | | | | | | | | | | | |
| **SMART Objective:** By the end of this lesson,students will apply environmental principles learned in previous lessons and will demonstrate these principals as they make choices to protect the environment. | | | | | | | | | | | | | | | |
| **Timeframe:** 1 day | | | | | | | | | | | | | | | |
| **Standards:** MS S3d: the student produces evidence that demonstrates understanding of natural resource management and MS S4a big ideas and unifying concepts, such as  order and organization; models, form, and function;  change and constancy; and cause and effect and MS S4d  impact of technology, such as constraints and trade-offs;  benefits and risks; and problems and solutions; and MS  S4e impact of science, such as historical and contemporary  contributions; and interactions between science and  society and MS S5f works individually and in teams to  collect and share information and ideas. | | | | | | | | | | | | | | | |
| **Lesson Components** | | | | | | | | | | | | | | | |
| [**21st Century Themes**](http://www.ecu.edu/cs-educ/account/upload/21st-Century-Skills-Definitions.pdf) | | | | | | | | | | | | | | | |
|  | Global Awareness | |  | Financial, Economic, Business, and Entrepreneurial Literacy | | |  | Civic Literacy | | |  | Health Literacy |  | Environmental Literacy  x | |
| [**21st Century Skills**](http://www.21stcenturyskills.org/index.php?option=com_content&task=view&id=254&Itemid=120) | | | | | | | | | | | | | | | |
|  | | Creativity and Innovation | | |  | Critical Thinking and Problem Solving | | |  | Communication | | | |  | Collaboration  x |
| |  | | --- | |  | | **Unit Essential Questions: “**What Can We Do to Persuade Others to be Environmentally Responsible?” | | **Materials:**   * Science Journal * Changing Behaviors handout * Changing Behaviors survey form | | **5 E Lesson Plan** | | **Engagement :**  **Quick write in Science Journal:** How can you help others to change their consumer behaviors? | | **Exploration/Evaluation :**  1.) Pass out the Changing Behaviors worksheet.  2.) Divide the class into small groups.  3.) Explain to the class that they are to choose three of the eight scenarios (you may add to those on the handout) to examine. In their small groups, they are to respond to the chosen scenarios, creating a brief paragraph for each.  4.) Engage students in a class discussion of the responses. | | **Explanation:**  1.) Pass out the Changing Behaviors survey form.  2.) Divide the class into small groups or retain the original groups.  3.) Explain to the class that they are to create a list of 10-20 questions that they will ask other students, parents and friends about their consumer habits. Questions should cover the topics of reuse and recycling in the home and school, and buying recycled goods.  4.) Explain to students that each person should copy the list of consumer habit questions. Each student is to ask fellow students, friends and/or parents to respond to the questions. Each student should ask three people to respond.  5.) Explain to students that responses should be recorded on the Changing Behaviors survey form.  6.) Engage the class in a discussion about the survey responses and about behaviors that responders would be willing to change. | | **Extension:** Students will create surveys and collect responses.  The discussion about the surveys should have students identify consumer habits that they have changed for themselves and should also have students ask themselves how they can help others to change their consumer behaviors. **Students may have difficulty in creating the required list of consumer questions. The teacher can lead students to questions by mentioning reuse, recycle and recycled products as well as mentioning questions such as:**   * Do you recycle used plastic shopping bags? * Do you use a thermos to carry drinks to school? * Do you use a refillable coffee cup for school/work? * Do you donate used clothing and shoes? * Do you reuse seal-able plastic bags? * Do you save and reuse paper that has blank space? * Do you use cloth instead of paper towels? * Do you use cloth instead of paper napkins? * Do you choose goods that contain recycled materials? * Do you recycle cardboard? * Do you reuse plastic containers such as butter tubs? * Do you reuse glass jars? * Do you reuse aluminum foil? * Do you place grass, branches, and leaves in a home compost pile? | | **Service-Learning Connection**  **Preparation.** Students prepare pamphlets and posters demonstrating the need to change the habit of littering in the school. The pamphlets and posters focus on the impact of litter on health and contain facts that students learned as a result of their study of litter and potential diseases. Students design and distribute a form to survey student and community attitudes. The survey form contains such statements as "Littering can cause health problems within our school and community” and asking respondents to indicate that they “strongly agree,” “agree,” “don't know,” “disagree,” or “strongly disagree."  **Service.** Students conduct their survey of their school and community prior to distributing their pamphlets and posters. Two or three weeks after their pamphlets and posters were distributed, students conduct a second survey to determine if attitudes have changed.  **Reflection.** Upon completing the project, students analyze the results of the surveys they conduct before and after their pamphlet and poster campaign. They also discuss how the campaign progressed and how to improve their project as a whole.  **Celebration.** Students write articles for the school newspaper about their project and its results. | | | | | | | | | | | | | | | | |

Changing Behaviors Scenarios

A. Your family discards a great deal of paper such as computer paper, paper napkins,

and paper towels. How can you convince family members to change their behaviors?

B. Friends and family say that recycling takes too much time and effort. How can you help

to convince them to recycle?

C. Most students throw all of their lunch packaging away. How can you change your lunch

packaging to create less waste?

D. Many grocery items are packaged in plastic that cannot be recycled because the number

in the recycling symbol is 3 or higher. Your family doesn’t examine the symbols. How can you

change their behaviors?

E. Buying laundry detergent in very large containers saves money and reduces plastic waste.

Your family buys in small or medium containers. How can you convince them to buy in bulk?

F. A huge amount of paper is discarded in school every day. Your school doesn’t have a paper

recycling program. How can you convince the school to begin one? Where can you go to get

assistance? Who in the school can help you?

G. Your family uses a lot of plastic wrap to protect leftovers, wrap sandwiches and cover food

in the refrigerator. What can your family do to eliminate plastic wrap?

H. Wrapping paper, white and colored tissue, and cards are thrown away after presents are

opened. How can these materials be recycled in your school’s art program? Who can you

ask about recycling these materials in art classes?

Step 5 Advocacy

Changing Behaviors

Handout

**1.3**

Rhode Island Resource Recovery Corporation P r o j e c t W A S T E **C u r r i c u l u m G u i de**

Changing Behaviors

Survey Sheet

**You and your group are going to create a list of ten to twenty questions (your teacher will tell you how many) that you will ask other students, parents, relatives and friends.**

**The questions will deal with consumer habits and should involve the concepts of reuse, recycling and waste reduction.**

**You should record your questions on this sheet. To help you with ideas, a sample question is listed below.**

**When your sheet is complete and you are asking the questions, record the answers in a special notebook or section of a notebook so that responses will be easy to locate when you are done.**

Example: **Do you recycle newspapers? If not, would you be willing to change your behavior?**

**1.**

**2.**

**3.**

**4.**

**5.**

**6.**

**7.**

**8.**

**9.**

**10.**

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| **Lesson Plan 12 Proposal** | | | | | | | | | | | | | | | |
| **SMART Objective:** By the end of the students will be able to plan a proposal for a school-wide recycling program. | | | | | | | | | | | | | | | |
| **Timeframe:** 1 hour/ 2 days | | | | | | | | | | | | | | | |
| **Standard:** NGSS Design engineering solutions for stabilizing changes to communities by: (1) using water efficiently, (2) minimizing human impacts on environments and local landscapes by reducing pollution, and (3) reducing the release of greenhouse gases. | | | | | | | | | | | | | | | |
| **Lesson Components** | | | | | | | | | | | | | | | |
| [**21st Century Themes**](http://www.ecu.edu/cs-educ/account/upload/21st-Century-Skills-Definitions.pdf) | | | | | | | | | | | | | | | |
|  | Global Awareness | |  | Financial, Economic, Business, and Entrepreneurial Literacy | | |  | Civic Literacy | | |  | Health Literacy |  | Environmental Literacy  x | |
| [**21st Century Skills**](http://www.21stcenturyskills.org/index.php?option=com_content&task=view&id=254&Itemid=120) | | | | | | | | | | | | | | | |
|  | | Creativity and Innovation | | |  | Critical Thinking and Problem Solving | | |  | Communication  x | | | |  | Collaboration  x |
| |  | | --- | |  | | **Unit Essential Question:** How can we create a recycling program in our school? | | **Teacher Background:**  As human populations and per-capita consumption of natural resources increase, so do the impacts on Earth’s systems unless the activities and technologies involved are engineered otherwise.  Continued monitoring of the changes to Earth’s surface provides a deeper understanding of the way in which human activities are impacting Earth’s systems, providing the basis for social policies | | **Misconceptions:**  Recycling turns materials that would otherwise become waste into valuable resources. Collecting used bottles, cans, and newspapers and taking them to the curb or to a collection facility is just the first in a [**series of steps**](http://www.epa.gov/osw/conserve/rrr/recycle.htm#steps) that generates a host of financial, environmental, and social returns. Some of these benefits accrue locally as well as globally.  Source: <http://www.epa.gov/osw/conserve/rrr/recycle.htm> | | **Materials:**   * Science Journals * Graph paper * Internet access * Note taking sheet | | **5 E Lesson Plan Template** | | **Engagement :**  Ask students to answer the following prompt in their journal:  How can we develop a recycling program in our school? | | **Exploration :**  Ask students to research recycling programs that different schools have implemented. Students should also complete the graphic organizer.  This research can be done in a computer lab or by printing out a variety of articles.  Some websites that discuss school-wide recycling programs are:  <http://infohouse.p2ric.org/ref/41/40956.pdf>  <http://www.scdhec.gov/environment/lwm/recycle/pubs/recycling_guide.pdf>  <http://pvh.mcpsweb.org/school-wide-recycling-program-started-pv-high-school>  <http://dphds.org/blog/?p=7491>  <http://www.wvrecycles.org/KidsPage/NevadaRecyclingCurriculum.pdf>  <http://www.daggerpress.com/2012/03/27/emmorton-elementary-school-students-go-green-with-school-wide-composting-and-recycling-projects-recycling-program-earns-cash-for-school/> | | **Explanation:**  After groups have research different recycling programs, ask students to develop a recycling proposal.   * The first step of the proposal requires students to draw a map of the school and decide how many recycling bins are needed. This map should be drawn on graph or chart paper and include all components of a map. * The second step of the proposal is for students to research different the prices of different recycling bins. Students should include the total cost of recycling bins on the chart. * Students should research the recycling days for your school at Baltimore City’s website: <http://publicworks.baltimorecity.gov/Recycling.aspx> * Students should then develop a calendar of school-wide recycling pick up by members of the class. Blank calendars can be found: <http://www.wincalendar.com/word-calendar-templates.htm> | | **Evaluation:**  Finally, students should create a power point proposal to the school community about the recycling program at your school. Include the information that was researched such as price of containers, pick up days, and frequency of school-wide recycling collection. Students should also consider suggesting ways that money can be raised for the price of the recycling containers or partnerships your school can develop. | | **Extension**  To extend the lesson, the students can also plan a fundraising campaign to raise money for the cost of the recycling bins. Some ideas for fundraising include a bake sale, garage sale, car wash, as well as other ideas. | | **Service-Learning Connection**  **Preparation.** The students complete the trash collection and weighing activity and learn the amount of trash that is generated at their school on a daily and weekly basis.  **Service.** Through their infomercial “broadcasts,” the students help their classmates and the school staff realize how much trash is generated on a daily and weekly basis. The students challenge other classes to reduce the amount of trash they create.  **Reflection.** The students gather in small groups to discuss why it is important to  reduce the amount of trash that we produce. | | | | | | | | | | | | | | | | |

Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Date:\_\_\_\_\_\_\_\_\_\_\_\_\_

Researching a Recycling Program

*Search for recycling programs that different schools has implemented. Record your findings in the chart below.*

|  |  |  |  |
| --- | --- | --- | --- |
| **School/ Website** | **Summary of Program** | **Pros of Program** | **Cons of Program** |
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Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Date:\_\_\_\_\_\_\_\_\_\_

**Recycling Proposal**

**Step #1**: Develop a map of your school on graph paper. Include on your map a title, key, and compass. From your map, determine the total number of recycling bins needed.

**Step #2:** Research the prices of different recycling bins and include them in the chart below.

|  |  |  |  |
| --- | --- | --- | --- |
| **Source of Container** | **Price per Container** | **Total Containers Needed** | **Total Price** |
|  |  |  |  |
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**Step #3**

Research the days that recycling is picked up at your school and determine the days that recycling will need to be collected. Also consider if recycling needs to be collected weekly or less frequently. <http://publicworks.baltimorecity.gov/Recycling.aspx>

After you have researched the recycling days, include a schedule of how members of your class will collect the recycling. Use a blank calendar template to help.

**Step #4**

Write a powerpoint to your school community a recycling program at your school. Include the information that you researched such as price of containers, pick up days, and frequency of school-wide recycling collection. Also consider suggesting ways that money can be raised for the price of the recycling containers or partnerships your school can develop. Use friendly letter format.

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| **Lesson Plan 13 Writing to City Council** | | | | | | | | | | | | | | | |
| **SMART Objective:** By the end of today’s lesson students will be able to explain the organizational structure of Baltimore City’s government. | | | | | | | | | | | | | | | |
| **Timeframe:** 1 hour/ 2 days | | | | | | | | | | | | | | | |
| **Standard:** NGSS Design engineering solutions for stabilizing changes to communities by: (1) using water efficiently, (2) minimizing human impacts on environments and local landscapes by reducing pollution, and (3) reducing the release of greenhouse gases. | | | | | | | | | | | | | | | |
| **Lesson Components** | | | | | | | | | | | | | | | |
| [**21st Century Themes**](http://www.ecu.edu/cs-educ/account/upload/21st-Century-Skills-Definitions.pdf) | | | | | | | | | | | | | | | |
|  | Global Awareness | |  | Financial, Economic, Business, and Entrepreneurial Literacy | | |  | Civic Literacy  x | | |  | Health Literacy |  | Environmental Literacy  x | |
| [**21st Century Skills**](http://www.21stcenturyskills.org/index.php?option=com_content&task=view&id=254&Itemid=120) | | | | | | | | | | | | | | | |
|  | | Creativity and Innovation | | |  | Critical Thinking and Problem Solving | | |  | Communication  x | | | |  | Collaboration  x |
| |  | | --- | |  | | **Unit Essential Question:** How can Baltimore become better at recycling? | | **Teacher Background:**  As human populations and per-capita consumption of natural resources increase, so do the impacts on Earth’s systems unless the activities and technologies involved are engineered otherwise.  Continued monitoring of the changes to Earth’s surface provides a deeper understanding of the way in which human activities are impacting Earth’s systems, providing the basis for social policies | | **Misconceptions:**  Recycling turns materials that would otherwise become waste into valuable resources. Collecting used bottles, cans, and newspapers and taking them to the curb or to a collection facility is just the first in a [series of steps](http://www.epa.gov/osw/conserve/rrr/recycle.htm#steps) that generates a host of financial, environmental, and social returns. Some of these benefits accrue locally as well as globally.  <http://www.epa.gov/osw/conserve/rrr/recycle.htm> | | **Materials:**   * Baltimore city government organization chart * Friendly letter graphic organizer | | **5 E Lesson Plan Template** | | **Engagement :**  Ask students to answer the following prompt in their journal:  Why do you think people in Baltimore City do not recycle as much as they could?  What are some barriers to recycling that are experienced in Baltimore City?  Who is your City Council representative?  Who are your government representatives? | | **Exploration :**  After students have written in their science journals, ask students to think-pair-share the questions from the engagement. Ask students to list the three biggest barriers for recycling in Baltimore City.  After students have shared the barriers, ask students to develop suggestions for fixing these barriers. Would a new law need to be passed? Should more resources be provided by Baltimore City? | | **Explanation:**  After discussing some of the barriers and suggestions for recycling, explain to students that they have a voice. Explain to students that many laws were passed by people bringing their concerns to their government representatives.  Explain the organization of the Baltimore City government using this chart: <http://www.baltimorecity.gov/Government/ActsofStateLegislature/MunicipalOrganizationalChart.aspx>  Use the City Council website to look up the City Council representative for your school : <http://cityservices.baltimorecity.gov/citycouncil/>  Ask students to write a letter to the City Council representative for your school with ideas or suggestions on how to improve recycling in Baltimore. Students should use the writing process. More information on the writing process can be found at: <http://www.kimskorner4teachertalk.com/writing/writingprocess/menu.html>  Friendly letter graphic organizers can be found at:  <http://www.readwritethink.org/files/resources/interactives/letter_generator/> | | **Evaluation:**  Students should be evaluated using the attached rubric. | | **Extension**  Send the letters to the City Council representative and invite the representative to come to your school.  Additional lessons on government can be found at <http://www.civiced.org/index.php?page=middle_school> | | **Preparation.** Students gather information about the litter problems that exist in Maryland and its bordering states. The teacher locates contact information on legislators and environmental agencies in Delaware and Virginia.  **Service.** The students will write letters to the legislators and environmental agencies in Delaware, Virginia and District of Columbia asking that states become more “litter wise” and show respect for their surroundings and generally keep America clean. These letters are mailed, and copies are published in the school newspaper or a local newspaper.  **Reflection.** The students will write in their journals or participate in a class discussion on what  harm litter does and why Maryland and its bordering states must develop a plan for litter control. | | | | | | | | | | | | | | | | |

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| Friendly Letter Rubric   |  | | --- | | Student Name:     \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |

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| --- | --- | --- | --- | --- |
| CATEGORY | **4** | **3** | **2** | **1** |
| **Content Accuracy** | The letter contains at least 4 suggestions to improve recycling in Baltimore City. | The letter contains at least 3 suggestions to improve recycling in Baltimore City. | The letter contains at least 2 suggestions to improve recycling in Baltimore City. | The letter contains at least 1 suggestion to improve recycling in Baltimore City. |
| **Format** | Complies with all the requirements for a friendly letter. | Complies with almost all the requirements for a friendly letter. | Complies with several of the requirements for a friendly letter. | Complies with less than 75% of the requirements for a friendly letter. |
| **Grammar & spelling (conventions)** | Writer makes no errors in grammar or spelling. | Writer makes 1-2 errors in grammar and/or spelling. | Writer makes 3-4 errors in grammar and/or spelling | Writer makes more than 4 errors in grammar and/or spelling. |
| **Ideas** | Ideas were expressed in a clear and organized fashion. It was easy to figure out what the letter was about. | Ideas were expressed in a pretty clear manner, but the organization could have been better. | Ideas were somewhat organized, but were not very clear. It took more than one reading to figure out what the letter was about. | The letter seemed to be a collection of unrelated sentences. It was very difficult to figure out what the letter was about. |

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| **Lesson Plan 14 Recycling Bins** | | | | | | | | | | | | | | | |
| **SMART Objective:**  By the end of this lesson students will start to formulate a solution to how as a school, we can reduce our waste and disposals. | | | | | | | | | | | | | | | |
| **Timeframe:** 1-2 days | | | | | | | | | | | | | | | |
| **Standards:** NGSS Design engineering solutions for stabilizing changes to communities by: (1) using water efficiently, (2) minimizing human impacts on environments and local landscapes by reducing pollution, and (3) reducing the release of greenhouse gases. | | | | | | | | | | | | | | | |
| **Lesson Components** | | | | | | | | | | | | | | | |
| [**21st Century Themes**](http://www.ecu.edu/cs-educ/account/upload/21st-Century-Skills-Definitions.pdf) | | | | | | | | | | | | | | | |
|  | Global Awareness | |  | Financial, Economic, Business, and Entrepreneurial Literacy | | |  | Civic Literacy | | |  | Health Literacy |  | Environmental Literacy  x | |
| [**21st Century Skills**](http://www.21stcenturyskills.org/index.php?option=com_content&task=view&id=254&Itemid=120) | | | | | | | | | | | | | | | |
|  | | Creativity and Innovation | | |  | Critical Thinking and Problem Solving | | |  | Communication | | | |  | Collaboration  x |
| |  | | --- | |  | | **Unit Essential Question:** What can we do to be an environmentally responsible person? | | **Teacher Background:** Humans have varying degrees of impact on the Earth’s surface through their everyday activities. With careful planning, the impact on the land can be controlled. | | **Misconceptions:** | | **Materials:**   * Science Journals * Student Handout—Personal Survey on Recycling * Power point or art samples of Recycling Centers and Bins * Art supplies: 6-10 clean, medium-sized, cardboard boxes, paint, paper plates, paintbrushes, cups with water, paper towels, and lots of newspaper * Assignment Sheet & Rubric * HW reading --<http://www.epa.gov/osw/education/kids/gremlin/gremlin.pdf> | | **5 E Lesson Plan** | | **Engagement :**   * Distribute Student Survey. * Collect the surveys, tabulate the responses, and analyze data from the survey responses to determine next steps for launching the school-wide recycling program. * Show slide show or display pictures of recycling bins and centers in around Baltimore City and Maryland and discuss.   **Explain to students how big of a problem waste has become and our action is required to help the Earth.**  **Explain to the students that they will be conducting a service learning project as a group to promote recycling.** | | **Exploration :**   1. Divide the class into groups of four. 2. Hand out assignment sheet to each student along with rubrics for assessment. Review assignment sheet with the class. Make sure to read word for word so students can get a good understanding of what is expected of them. **The first project will be to design a paper recycling box for important places within the school (Library, office…).** 3. Allow time for questions. 4. Each student will be given a role within the group to make sure that everyone is actively participating. Roles will be as followed: Runner, Reporter, Illustrators. 5. Allow students a minute in their group to decide who will do what. If there is confusion, step in and assign the roles yourself. 6. Allow students about 5 minutes to brain storm and create a draft about how they will design their recycling bins. **They are able to work within their groups but each student needs to document their own thoughts and information.**   **Make sure to have all your supplies available for today (6-10 clean, medium-sized, cardboard boxes, paint, paper plates, paintbrushes, cups with water, paper towels, and lots of newspaper). Students will be working on art to compose paper recycle boxes to be placed throughout the school. To make it easier on yourself, place everything needed for each group in a box. This way, students can quickly get their supplies when it is time for the activity to take place.**  **Explain to them that they will be decorating and illustrating the cardboard boxes for paper recycling due to that fact that lots of paper is thrown away verses being recycled.**   1. Show the students a picture of or an example of what you expect for them. This should be a previous project or one composed by the teacher. 2. Advise the students that this project should be inspired by saving Earth. Their final projects should illustrate that. 3. Each completed box and poster should be placed in a designated area to dry. 4. Have students gather and put away all materials where they should be located. Paint brushes should be washed out, desks should be cleared, and all trash properly disposed of. | | **Explanation:**  **Ask Reporters:**  **Why did your group decide to design your recycling bin the way you did? Explain**  **Where would you put your bin within the school? Why?**    Have the students call out what they think of when they think about the Earth and saving the planet.  **Exit Ticket--Science Journal Entry( 5 minutes)**: Allow the students to write a mini reflection, approximately one paragraph, on what they think needs to be done to make a change. Draw an illustration of your recycling bin.  **Explain to them this is the importance of this project. Advise students upon completion of their box, they will have to complete a public service announcement and video for the recycling program**. | | **Evaluation:** Students will receive a final grade on the project from various activities from the service learning project. They will be expected to have followed the rubric and will be graded on how each component. Their writing journals will be reviewed for participation to make sure that all students were actively participating in the project. The final work of art will be graded for its creativity and collaboration.  Writing Journal: 20%  Participation: 10%  Paper Recycle Box: 10%  Feedback will be given throughout the whole project by the teacher. From observations teacher should be able to tell students what they are looking for and they are following directions properly. Upon completion of the whole service learning project, students will receive a rubric with a breakdown of how they received the grade they did. | | **Extension:**   * Homework Reading Assignment: Read and relate the comic Adventures of the Garbage Gremlin, <http://www.epa.gov/osw/education/kids/gremlin/gremlin.pdf> to the lesson. * Students compose a piece of art made of recycled goods.   . | | **Service-Learning Connection**  **Preparation.** After completing the activity using their at-home trash, the students organize and participate in a trash- and litter-collection effort at their school. They sort and classify what they find as “recyclable,” “reusable,” or “neither recyclable nor reusable,” and tally the results. They also research the most effective ways to dispose of trash and litter, and they investigate how their school disposes of its trash. Does the school recycle?  **Service.** The students create posters and write a letter to the principal detailing the kinds of trash that their school generates and giving information about how these particular items of waste are most effectively and efficiently handled.  **Reflection.** The students exchange thoughts about what they have accomplished with their school trash and litter collection and analysis and about what effect their pamphlets and their letter to the principal have had or will have in the future. | | | | | | | | | | | | | | | | |

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| **Lesson Plan 15 Video** | | | | | | | | | | | | | | | |
| **SMART Objective:** By the end of today’s lesson students will be able to create a public service announcement about recycling. | | | | | | | | | | | | | | | |
| **Timeframe:** 1 hour/ 2 days | | | | | | | | | | | | | | | |
| **Standard:** NGSS Design engineering solutions for stabilizing changes to communities by: (1) using water efficiently, (2) minimizing human impacts on environments and local landscapes by reducing pollution, and (3) reducing the release of greenhouse gases. | | | | | | | | | | | | | | | |
| **Lesson Components** | | | | | | | | | | | | | | | |
| [**21st Century Themes**](http://www.ecu.edu/cs-educ/account/upload/21st-Century-Skills-Definitions.pdf) | | | | | | | | | | | | | | | |
|  | Global Awareness | |  | Financial, Economic, Business, and Entrepreneurial Literacy | | |  | Civic Literacy | | |  | Health Literacy |  | Environmental Literacy  x | |
| [**21st Century Skills**](http://www.21stcenturyskills.org/index.php?option=com_content&task=view&id=254&Itemid=120) | | | | | | | | | | | | | | | |
|  | | Creativity and Innovation | | |  | Critical Thinking and Problem Solving | | |  | Communication  x | | | |  | Collaboration  x |
| |  | | --- | |  | | **Unit Essential Question:** How can we spread the word about the school-wide recycling program? | | **Materials:**   * Science Journals * Video camera (Donors Choose would also be a good resource to obtain a video camera) * Internet access * Note taking sheet | | **5 E Lesson Plan** | | **Engagement :**  Ask students to answer the following prompt in their journal:  List the trash that you throw away each day. Consider what your dispose of at your house, in the classroom, and even in the cafeteria. | | **Exploration :**  Watch a few recycling videos on the internet. Some helpful sites include:  <http://web1.caryacademy.org/facultywebs/joselyn_todd/science7/unit105/psavideo.htm>  <http://www.youtube.com/watch?v=Yl2442sK3Kg>  <http://www.youtube.com/watch?v=ecqeAvZoXj0>  <http://www.epa.gov/region9/psa/psa-recycle.html> | | **Explanation:**  After watching samples of public service announcements, ask students to work in small groups to create their own public service announcement. Each announcement only be one to two minutes long, but should explain pertinent information about the school wide recycling program and what should recycled.  Students can review what can be recycled at Baltimore Department of Public Works’ website: <http://publicworks.baltimorecity.gov/Recycling/AcceptableUnacceptableRecycleMaterial.aspx>.  The following outline can be used to plan for the public service announcement: <http://www.readwritethink.org/files/resources/script_outline.pdf> | | **Evaluation:**  Students will be evaluated via the following rubric: <http://www.readwritethink.org/files/resources/lesson_images/lesson939/psa-rubric.pdf> | | **Extension**  Students can watch The Garbage Story: Dealing With Solid Waste Disposal on unitedstreaming.com. It can be found: <http://player.discoveryeducation.com/index.cfm?guidAssetId=13E647B8-0AD4-45AE-A3E0-7395EB81A80C&blnFromSearch=1&productcode=US> | |  | | | | | | | | | | | | | | | | |

Public Service Announcement Writing Guide

Adapted from: <http://www.storiestogrowby.com/sample.htm>

Title of Public Service Announcement

CONTRIBUTING WRITER(S):

CHARACTERS, in order of Appearance:  
Character #1  
Character #2  
Character #3  
Character #4  
Character #5  
Character #6  
Character #7  
Character #8

ACTS, SCENES & BRIEF DESCRIPTIONS:   
ACT I -Describe where Act I takes place.  
ACT II - Describe where Act II takes place.  
ACT III -Describe where Act III takes place. *(You may add other information, depending on the story, such as "the next day"; "after the storm"; "many years later".)*

ACT I - *[describe where Act I takes place]*

CHARACTER #1:  
Indicate here the opening words that Character #1 will say.

CHARACTER #2:  
*[you can use brackets to show how the line should be read - surprised? angry? sad?]* Indicate here the opening words that Character #2 will say.

CHARACTER #1:  
Again, indicate what words Character #1 should say. Notice that each character's name appears in capital letters, followed by a colon and a line space. This way, the actors will be easily able to find their lines on the page.

*A few thoughts:*

* Remember to start each new Act or Scene at the top of a page.
* Imagine your play as if it were acted out in your mind. Imagine you're in the audience watching the play. Think to yourself: What would make this public service announcement even more interesting?

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| **Lesson Plan 16** | | | | | | | | | | | | | | | |
| **SMART Objective:** By the end of today’s lesson students will be able to teach younger students about the importance of recycling. | | | | | | | | | | | | | | | |
| **Timeframe:** 1 hour/ 2 days | | | | | | | | | | | | | | | |
| **Standard:**  Design engineering solutions for stabilizing changes to communities by: (1) using water efficiently, (2) minimizing human impacts on environments and local landscapes by reducing pollution, and (3) reducing the release of greenhouse gases | | | | | | | | | | | | | | | |
| **Lesson Components** | | | | | | | | | | | | | | | |
| [**21st Century Themes**](http://www.ecu.edu/cs-educ/account/upload/21st-Century-Skills-Definitions.pdf) | | | | | | | | | | | | | | | |
|  | Global Awareness | |  | Financial, Economic, Business, and Entrepreneurial Literacy | | |  | Civic Literacy | | |  | Health Literacy |  | Environmental Literacy  x | |
| [**21st Century Skills**](http://www.21stcenturyskills.org/index.php?option=com_content&task=view&id=254&Itemid=120) | | | | | | | | | | | | | | | |
|  | | Creativity and Innovation  x | | |  | Critical Thinking and Problem Solving | | |  | Communication  x | | | |  | Collaboration  x |
| |  | | --- | |  | | **Unit Essential Question:** How can we teach younger students about the school-wide recycling program? | | **Teacher Background:**  As human populations and per-capita consumption of natural resources increase, so do the impacts on Earth’s systems unless the activities and technologies involved are engineered otherwise.  Continued monitoring of the changes to Earth’s surface provides a deeper understanding of the way in which human activities are impacting Earth’s systems, providing the basis for social policies | | **Materials:**   * Public Service Announcement Videos * 5E Lesson Template * 5E Lesson Rubric | | **5 E Lesson Plan** | | **Engagement :** Ask students to answer in their science journals:  How would you teach recycling?  What are some ways that you could make a recycling lesson engaging and interactive?  How would you teach about the importance of recycling to younger students? | | **Exploration :**  Show students the public service announcements that were created in the previous lesson. Ask students to incorporate these public service announcements in their lesson plans.  Also explain to students that their lesson plans should incorporate the following items:  Objective  5Es: engagement, exploration, explanation, evaluation, and extension.  (For more information on how to explain the 5Es, use <http://www.roundrockisd.org/index.aspx?page=3211>)  Spend some time explaining to students that their lesson should include something that can assess whether their students were able to understand the importance of recycling. | | **Explanation:**  After explaining the components of the 5E lesson, students should work in small groups to prepare their lessons. Students should also be shown the attached rubric. | | **Evaluation:**  Students will be evaluated via the lesson plan rubric. | | **Extension**  Students can implement lessons to other grades. In STEM schools, first grade is also learning about recycling, so first grade may be a good grade to collaborate with. | | **Service-Learning Connection**  **Preparation.** The students develop a survey form to assess their peers’ level of understanding with regard to the litter problem. The students then follow up by determining the best way to use the results of their survey.  **Service.** Recognizing that people cannot help to solve a problem if they are  unaware that there is indeed a problem, the students design and distribute a survey  form for their elementary school peers to complete regarding litter. The students collect  the surveys and evaluate the results.  **Reflection.** Upon completing the school survey, the students share their assessments of the results and discuss the effectiveness of the activity in determining the middle school students’ level of awareness. | | | | | | | | | | | | | | | | |

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**5 E Lesson Plan: The Importance of Recycling**

GroupMembers:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Objective:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **Engagement** |  |
| **Exploration** |  |
| **Explanation** |  |
| **Evaluation** |  |
| **Extension** |  |

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| |  | | --- | | Recycling Lesson Plan Using the 5E Format | |

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| CATEGORY | **4** | **3** | **2** | **1** |
| **Lesson Design** | The lesson plan includes and correctly identifies objectives, implementation, and assessment. | The lesson plan correctly identifies all but one of the following: objectives, implementation, and assessment. | The lesson plan correctly identifies all but two of the following: objectives, implementation, and assessment. | The lesson plan is missing three of the following: objectives, implementation, and assessment. |
| **Content**  **Knowledge** | The lesson plan thoroughly includes importance information about recycling and the school-wide recycling program. | The lesson includes much information about the importance of recycling and the school-wide recycling program. | The lesson includes some information about the importance of recycling and the school-wide recycling program. | The lesson includes little information about the importance of recycling and the school-wide recycling program. |
| **Mechanics** | Capitalization and punctuation are correct throughout the poster. | There is 1 error in capitalization or punctuation. | There are 2 errors in capitalization or punctuation. | There are more than 2 errors in capitalization or punctuation. |
| **Grammar** | There are no grammatical mistakes on the lesson plan. | There is 1 grammatical mistake on the lesson plan. | There are 2 grammatical mistakes on the lesson plan. | There are more than 2 grammatical mistakes on the lesson plan. |

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| **Lesson Plan 17 Field Trip** | | | | | | | | | | | | | | | |
| **SMART Objective:** By the end of the day, students will engage in field work about recycling and create a cartoon about what they have learned. | | | | | | | | | | | | | | | |
| **Timeframe:** 1 hour/ 1 days | | | | | | | | | | | | | | | |
| **Standard:**  Design engineering solutions for stabilizing changes to communities by: (1) using water efficiently, (2) minimizing human impacts on environments and local landscapes by reducing pollution, and (3) reducing the release of greenhouse gases. | | | | | | | | | | | | | | | |
| **Lesson Components** | | | | | | | | | | | | | | | |
| [**21st Century Themes**](http://www.ecu.edu/cs-educ/account/upload/21st-Century-Skills-Definitions.pdf) | | | | | | | | | | | | | | | |
|  | Global Awareness | |  | Financial, Economic, Business, and Entrepreneurial Literacy | | |  | Civic Literacy | | |  | Health Literacy |  | Environmental Literacy  x | |
| [**21st Century Skills**](http://www.21stcenturyskills.org/index.php?option=com_content&task=view&id=254&Itemid=120) | | | | | | | | | | | | | | | |
|  | | Creativity and Innovation | | |  | Critical Thinking and Problem Solving | | |  | Communication  x | | | |  | Collaboration |
| |  | | --- | |  | | **Unit Essential Question:** What happens to recycled materials? | | **Teacher Background:**  As human populations and per-capita consumption of natural resources increase, so do the impacts on Earth’s systems unless the activities and technologies involved are engineered otherwise.  Continued monitoring of the changes to Earth’s surface provides a deeper understanding of the way in which human activities are impacting Earth’s systems, providing the basis for social policies. | | **5 E Lesson Plan Template** | | **Engagement :**  Ask students to answer the following prompt in their journal:  Where does our recycling go after we set it out on the curb?  What would you expect to see at a recycling center?  How can we reuse items instead of throwing them away or recycling them? | | **Exploration :**  If possible plan and attend a field trip to one of the following locations:  Waste Management Recycle America (WMRA) 1000 Ritchie Road Capital Heights, MD 20743 Contact: Michael Caplan (301) 499-1707 ext. 201  Great Kids Farm  6601 Baltimore National Pike  Catonsville, MD  <http://www.baltimorecityschools.org/greatkidsfarm>  Contact: Beth Mathie 410-744-1096 and tell her that you are looking for a program tailored to the recycling unit.  Virtual Field Trips:  Montgomery County Facility Tour  <http://www6.montgomerycountymd.gov/swstmpl.asp?url=/content/dep/solidwaste/facilities/tours/mrf_tour1.asp> | | **Explanation:**  After students have attended the field trip, ask them to create a cartoon about the process that recyclable items take. This includes from pick up at their house or school to the recycling center and the process at the recycling center. Students should use one of the following cartoon templates or create their own:  <http://www.innovativeclassroom.com/Files/Reproducibles/CartoonTemplate.pdf>  <http://www.readwritethink.org/files/resources/interactives/comic/> | | **Evaluation:**  Students will be evaluated via the attached rubric. | | **Extension**  Students can recycling games at the following websites:  <http://www.pbs.org/independentlens/garbage-dreams/game.html>  <http://www.epa.gov/recyclecity/mainmap.htm>  <http://kids.nationalgeographic.com/kids/games/actiongames/recycle-roundup/> | |  | | | | | | | | | | | | | | | | |

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| |  | | --- | | Recycling Cartoon | |

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| CATEGORY | **4** | **3** | **2** | **1** |
| **Cartoon Choice** | Cartoon explains the full process of recycling. | Cartoon explains most of the recycling process. | Cartoon explains some of the recycling process, but leaves out many major parts. | Cartoon explains very little about the recycling process. |
| **Number of Frames** | 5 or more frames | 4 frames | 3 frames | 2 frames |
| **Organized and neat** | Product demonstrates that much time and effort went into its creation; very neat. | Obvious time and effort went into this project; mostly neat. | Some time and effort are reflected; slightly messy | Little effort went into project; very messy |

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| **Lesson Plan 18—Paper Making & Reflection** | | | | | | | | | | | | | | | |
| **SMART Objective:**  By the end of this lesson students will be able to name the benefits of paper recycling, summarize the paper recycling process and make recycled paper. | | | | | | | | | | | | | | | |
| **Timeframe:** 2-3 days | | | | | | | | | | | | | | | |
| **Standards:**. | | | | | | | | | | | | | | | |
| **Lesson Components** | | | | | | | | | | | | | | | |
| [**21st Century Themes**](http://www.ecu.edu/cs-educ/account/upload/21st-Century-Skills-Definitions.pdf) | | | | | | | | | | | | | | | |
|  | Global Awareness | |  | Financial, Economic, Business, and Entrepreneurial Literacy | | |  | Civic Literacy | | |  | Health Literacy |  | Environmental Literacy  x | |
| [**21st Century Skills**](http://www.21stcenturyskills.org/index.php?option=com_content&task=view&id=254&Itemid=120) | | | | | | | | | | | | | | | |
|  | | Creativity and Innovation | | |  | Critical Thinking and Problem Solving | | |  | Communication | | | |  | Collaboration  x |
| |  | | --- | |  | | **Unit Essential Question:** How do we make new paper from used paper? | | **Teacher Background:** Making paper using recycled paper saves resources, trees, of course, and reduces pollution to our air and water. Reducing the amount of material we throw into trash can and reusing items we have also reduces the amount of resources we consume.  The importance of conserving resources becomes more and more important with the increasing population growth throughout the world and the increasing drain on resources by Americans and as China is becoming a growing consumer of products and resources. Being good stewards of our air, water and resources will become more and more important as the strain on resources becomes more evident in the coming decades.  Service Learning Component  The Academic Service-Learning component for this unit consists of a hands-on activity where the learners will make paper out of scraps of used paper (i.e. recycling).  With this newly made 100% recycled paper, learners will make greeting cards and/or stationery for people in the community.  Learners will then reflect on the concepts that were covered in the unit through discussion and journal writing and share their experiences and feelings with their teacher and families. | | **Materials:**   * Teacher Transparency or Student handout—Making Recycled Paper * old paper (anything but newspaper) * blender and a wide container (pan-shaped)—at least 4 if possible * larger mixing spoons * cups to scoop pulp onto screens * blotters * dishwashing detergent * sponges or towels for soaking up water * warm water * a place to dry the paper * iron (to help dry paper) * scale * (Optional:) spices, dried flowers, herbs, vanilla, etc.; a * bathroom scale | | **5 E Lesson Plan Template** | | **Engagement : Show students all of the scrap paper that will be used for this activity.**  **Ask them to respond in their science journal to the following prompt:**  “What is the purpose for recycling paper?”  After journal entry, tell them that, believe it or not, they are going to create recycled paper from these old scraps! | | **Exploration :**   1. Explain to students that they will be acting as philanthropists by making cards with the recycled paper for others in their community to spread some cheer. 2. Start to make paper by collecting paper scraps from the classroom – either from the recycling box or scrap paper from student’s desks and tubs.  **Focus on the fact that these are scraps that would normally be thrown away but instead we are creating something new with it.** 3. Have learners begin tearing the paper into about one inch (3 cm) squares.  **A cupful of loosely packed paper scraps makes about one standard sheet of paper.  Use a variety of types of paper.  Note:  The more difficult the paper is to tear, the longer the fibers are in the paper.  Longer fibers make stronger paper.** 4. Display Making Recycled Paper procedures or distribute student handout for Making Recycled Paper. 5. Read aloud all steps and ask students if they have questions. 6. As a class, the teacher with the help of two or more students will use the written procedure s and diagrams to make recycled paper.   \*If more than one blender is available, other groups of students will then perform the same procedures.   1. After completing step 8 students will answer the following questions within their science journals.   **Day 2(After drying of paper)**  Use your recycled paper to make greeting cards for someone in your community (grandparents, sick or elderly person) you know that needs to start recycling.  **Discuss with learners why they should share these with the sick/elderly instead of just keeping them for themselves.**  Why would it benefit the person receiving the card?  How do you think they would feel?  How do you think you will feel by giving?  **Review what a philanthropist is and stress that students are acting as philanthropists by making the cards.**  **Day 3**  Have the learners reflect on their experience this past week learning about the four R’s and the service projects of: 1) cleaning up the school grounds, 2) teaching others about recycling and 3) creating greeting cards for others in their community.  **Briefly discuss these ideas as a class before they write in their journals. Listed below are some idea starters.**   1. What did you learn from doing this project? 2. How do you think the people felt when they read your card? 3. Do you think anyone noticed that we cleaned the grounds?   **\*\*Distribute End of the Unit Post Test** | | **Explanation:**   * Ask students after journal entries are complete: * What conclusions can you make about yield from the original paper? * What are the benefits of recycling paper? What are the drawbacks? * Can paper be recycled indefinitely? (No, eventually the fibers break down.) * What are the benefits of recycling paper rather than throwing it away?   *Write the students responses on the board and add the following: (We don’t have to cut down trees if we recycle, and there is less pollution created when we recycle paper. It leaves the forest so that wild animals have a place to live. We are conserving space in the landfill so that there will be a safe place to put our trash for as long as possible!)* | | **Evaluation:**  **The assessment for this lesson will be the reflection journals. Base the grade on a class rubric for journal writing.**  **Check for understanding regarding the sequence of paper making process. (example--student will proficiently unscramble the procedures of recycled paper making by placing the pre-written steps in numerical order).**  **Students are able to draw a step-by-step diagram of how the paper is made.**  **Differentiation: Students are able to make a poster that encourages people to recycle paper.**  ANSWERS TO END OF THE UNIT ASSESSMENT   1. a, c, d, e, f, h 2.)f 3.) C 4.) A, B, C, E 5.) D 6.) NO 7.) C   8.) B 9. ) ALUMINUM 10.) CONSERVE 11.) POLLUTING  12—13. ) ANSWERS VARY | | **Extension:** Deliver recycled cards personally to the person in the neighborhood and | |  | | | | | | | | | | | | | | | | |

Making Recycled Paper

Make recycled paper by using the following procedures:

**1**Tear sheets of used paper into small strips, about one-inch square. Loosely pack into blender until 1/3 to 1/2 full. Add warm water until blender is 2/3 full. It is also helpful to add a pinch or two of dryer lint, to improve the texture of the paper.

**2**Blend (with lid on) until the paper looks like oatmeal mush (5-10 seconds). If you are coloring the paper by using scraps of construction paper, add them now.(If you desire white paper, add a small amount of dish washing detergent to de-ink the paper.)

**3**Pour into a pan. When pulp is mush consistency, add about 1/2 inch of water for every blender-full of pulp, adding more or less, depending on the thickness of paper desired.

**4** Scoop the pulp mixture evenly onto the screen with a cup (hold the frame over ½ of the pan). If students want to add things individually to their pulp (colors, paper bits, glitter, spices) they add it to their cupful. Let the pulp drain.

**5**Place a piece of blotter over the wet sheet of paper on the screen, then flip then screen over the so the paper is between the blotter and the screen, with the screen on top.

**6** Soak up extra water with a sponge. This water can be squeezed out of the sponge back into the pulp mixture.

**7** Lift off the screen and place the new paper in a safe place to dry. Drying takes one or two days. Exchange blotter and dry paper towels every few hours, if you want the paper to dry more quickly. The paper should not be touched or unnecessarily disturbed while drying. You may iron the paper to speed up the drying process; place a sheet of paper between the new paper and the iron.

**8**For special effects, you may use cookie cutters to create unusual shapes for your paper, or you may add glitter or food coloring to the mixture. As a recycling experiment, you can weigh the paper before placing it in the blender, then weigh the recycled paper after it dries. What conclusions can you make about yield from the original paper? What are the benefits of recycling paper? What are the drawbacks? Can paper be recycle indefinitely? (No, eventually the fibers break down.)

Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date\_\_\_\_\_\_\_\_\_\_\_\_

Class\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Recycling Unit: Post Test**

* 1. **What is municipal solid waste? Circle the items that might be included.**
  2. Appliances and furniture
  3. Automobile bodies
  4. Boxes, bottles and cans
  5. Carpets and rugs (not from a demolition site)
  6. Construction debris
  7. Disposable diapers
  8. Leftover industrial chemicals
  9. Tires
  10. **You are in charge of building a new landfill. Which of these sites would you recommend to the local government?**

1. Marsh at the edge of town
2. Abandoned gravel quarry
3. Edge of the river
4. A spot in the county industrial area
5. They are all great ideas
6. You haven’t found a suitable site yet
   1. **What does the recycling symbol stand for?**
7. Reduce, Reuse, Recycle
8. Collect material, Process material, Buy material with recycled content
9. Anything with this symbol is recyclable
10. Anything with this symbol is illegal to dispose of
    1. **Compost can be a squirmy, hot mass of rotting garbage. Circle the organisms you might find that are turning this stuff into good soil.**
11. Bacteria
12. Earthworms
13. Fungi
14. Meadow mice
15. Mites
16. Snakes
    1. **Waste reduction refers to what?**
    2. Reducing the amount of trash created in the first place
    3. Squashing trash to make it smaller
    4. Burning trash to get rid of it
    5. Preventing material from needing to be disposed of
    6. **Is a landfill and dump the same thing?**

Yes

No

**7. Many of earth's resources are found under earth's surface. One way to get these resources is by**

A) clear-cutting  
B) farming  
C) mining  
D) using windmills

**8. Oil will someday be all used up. Oil is a \_\_\_\_\_\_\_\_\_\_\_\_\_ resource**

A) renewable  
B) nonrenewable  
C) exhausted  
D) inexhaustible

**10. Which resource can be recycled?**

A) coal  
B) natural gas  
C) wood  
D) aluminum

**11. Turning of lights when they are not needed is a way we can \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_our resource at home.**

A) reuse  
B) reserve  
C) recycle  
D) conserve

**12. We need clean air and water to live. If we make our air and water dirty we are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ our resources**

A) conserving  
B) polluting  
C) recycling  
D) reusing

**13. Explain the process of making paper.**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**14. What are landfills and what do they look like?**

15. Why is it important to recycle?

15. Why is it that some people do not recycle?