From Oil to Plastic

OBJECTIVES:

Students will:
1. identify the natural resources used to make plastic products.
2. compare and contrast different types of life cycles (both natural and human-made).
3. sequence and describe the steps of a plastic product life cycle.

STANDARDS: Science

SKILLS: Analysis, description, critical thinking

SETTING: Classroom

TIME: 50 minutes

VOCABULARY:
Landfill
Life cycle
Natural resources
Nonrenewable resources
Oil
Petroleum
Plastic
Raw material
Recycle

Introduction

Overview:
In this lesson, students will learn about the life cycle of a plastic product and the nonrenewable resource used to make it, by watching a video showing how plastic is produced from raw material to final product. They will create posters showing the chronological steps to making a plastic product and discuss how recycling completes a product life cycle.

Teacher Background:

All of the products we use are made from natural resources. Some of these are made from renewable resources like wood and others from nonrenewable resources such as oil. Renewable resources can be replaced over a human's lifetime whereas nonrenewable resources are finite and cannot be replaced once they are used up.

All products have a life cycle, meaning there are a series of stages that a product goes through from extraction of raw materials to production and final product. A life cycle becomes incomplete when any stage of the cycle is disrupted or removed. If a product is not recycled after use, it will most likely end up in the landfill, which ends the life of the product and the natural resources used to make it. If the product is recycled, the natural resources and energy used to make the product will continue to be used in making a new product from the recycled material.

Plastic is made from fossil fuels (oil and natural gas), which are nonrenewable resources. Recycling saves these resources, which cannot be replaced over a short period of time.

Materials:

Students:
- ❑ Markers
- ❑ Glue (one bottle per group)
- ❑ Scissors (one per student)
- ❑ Poster paper (one piece per group)
- ❑ "Plastic Life Cycle Cards" (one set per group)
- ❑ "Plastic Life Cycle" worksheet

Teacher:
- ❑ "Life Cycle of a Tree" overhead
- ❑ "Life Cycle of a Plastic Product" overhead
- ❑ *From Oil to Plastic* DVD
- ❑ Rubric overhead
- ❑ Rubrics (one per student)

Preparation:

Be prepared to organize the students into groups of four.

ACTIVITY

Discussion

1 . Ask students what natural resource is used to make plastic and whether this is a nonrenewable or renewable resource.

2. Explain that both nonrenewable and renewable resources are used to make products. The products we use have a life cycle, meaning that all products originate from somewhere and often, after use, have an end of life. Recycling extends the life of a product by keeping recycled materials available to make a new product.

3. Tell the students that they will be learning about the plastic life cycle.

4. Ask students to describe a cycle and share some examples.

5. Show the overhead "Life Cycle of a Tree" and discuss the stages. Ask the students to vote whether this is an example of a renewable or nonrenewable resource cycle (renewable).

6. Explain that the products we use also have a life cycle. Put up the overhead "Life Cycle of a Plastic Product" and ask whether this is an example of a renewable or nonrenewable resource cycle (nonrenewable).

7. Explain that a cycle can be disrupted if any step in the process is disturbed or removed.

8. Cover the left side of the overhead and show the students how the plastic cycle can be incomplete or disrupted when a plastic product ends up in the landfill. Ask the students if there are any other choices besides putting it in the garbage that will help to continue the cycle.

9. Uncover the left side of the overhead and point out that recycling completes the cycle because a new plastic product can be made from the recycled material.

10. Tell the students that they will be learning about the life cycle of a plastic product by watching a video of how a plastic is made.

11. Show an overhead of the lesson rubric and review the expectations for this lesson.

Procedure

1. Before showing the video, ask the students to suggest some ideas for how plastic is made. While watching the video, students should write down the steps required to make a plastic product.

2. Show the DVD *From Oil to Plastic*.

3. Put the students into groups of four.

4. Tell the students that each group will receive a set of "Plastic Life Cycle Cards." Their job is to put the cards in chronological order on a poster representing how a plastic product is made. Each step should be numbered. They should also write a brief description of what happens at each stage of the life cycle based on what they saw in the video.

5. Pass out one set of "Plastic Life Cycle Cards," a piece of poster paper, markers, glue and scissors to each group.

6. As groups finish their posters, hand out the student worksheet "Plastic Life Cycle Cards" to each student and have them answer the questions.

7. Ask each group to present their plastic life cycle poster to the rest of the class.

Wrap-Up

1. Ask the class how the cycle would change if someone chose to throw away a plastic product instead of recycling it.

2. Ask the students whether they think that product life cycles using nonrenewable resources like oil can continue forever. Why or why not?

Final Assessment Idea

Have students write a narrative (as if they were a plastic bottle) of a plastic product's life from production to final product. They should write it as an autobiography so the reader can imagine what it is like to be a plastic product.

Extensions:

Assign groups of students to research other product life cycles stating what natural resources are lost if the products end up in the landfill. Have them present their findings.

Teacher Materials:

California State Content Standards

The standards below represent broad academic concepts. This lesson provides connections to these academic concepts through hands-on activities and exploration. This lesson is not designed for a student to master the concepts presented in the standards. Additional lessons in the classroom that build on this lesson or the standard(s) ensure that students will have the opportunity to master these concepts.

SCIENCE	CONTENT STANDARDS
Grade 4	**Physical Science** 6.g. Students know electrical energy can be converted to heat, light and motion. **Investigation and Experimentation** 6.c. Students will formulate and justify predictions based on cause-and-effect relationships.
Grade 5	**Physical Science** 1.f. Students know differences in chemical and physical properties of substances are used to separate mixtures and identify compounds. 1.h. Students know living organisms and most materials are composed of just a few elements.
Language Arts	**Content Standards**
Grade 4	**Reading Comprehension** 2.1. Students identify structural pattern found in informational text (e.g., compare and contrast, cause and effect, sequential or chronological order, proposition and support) to strengthe comprehension.
Grade 5	**Reading Comprehension** 2.1. Students understand how text features (e.g., format, graphics, sequence, diagrams, illustrations, charts, maps) make information accessible and usable.

Teacher

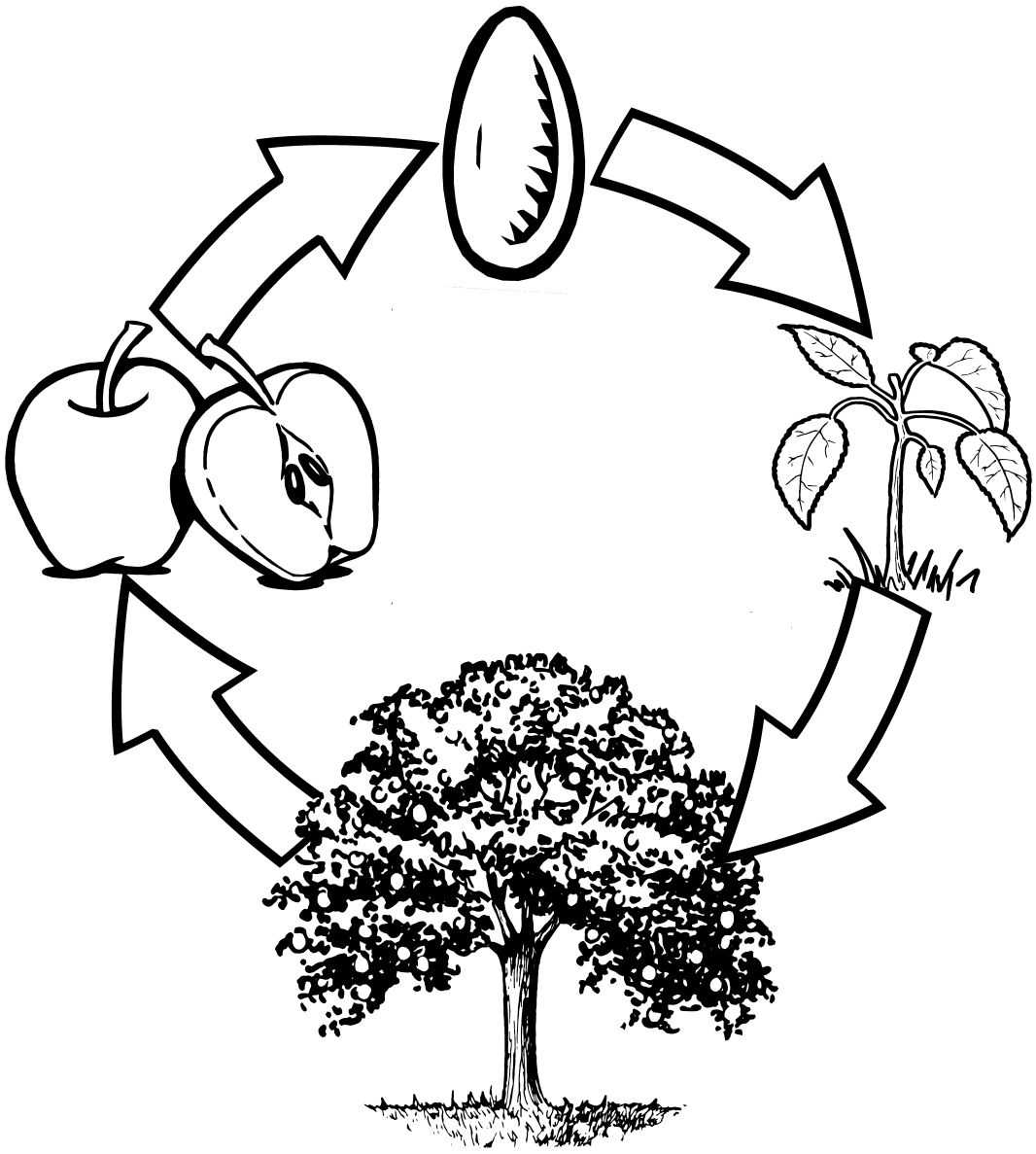
From Oil to Plastic Rubric

A rubric is a scoring tool that defines the criteria by which a student's work will be evaluated. This rubric is provided to assist you in setting expectations for students and assessing their performance and engagement during the lesson based on specific tasks. Ideally, a rubric is developed with the cooperation of the students. Two blank rows have been provided for you and your class to develop and add your own assessment criteria.

CATEGORY	4	3	2	1
Plastic Life Cycle poster	The group's poster includes all the steps for making plastic in order with a description of each step.	The group's poster includes all of the steps for making plastic although some are not in order or missing descriptions.	The group's poster includes all of the steps for making plastic although a few are not in order or missing descriptions.	The group's poster includes all the steps for making plastic but they are out of order and missing descriptions.
Listing non-renewable resources and products made from these resources	The group clearly identifies three nonrenewable resources and three products made from these resources.	The group identifies three nonrenewable resources and two products made from these resources.	The group identifies three nonrenewable resources but does not list products made from these resources.	The group does not attempt the assignment.

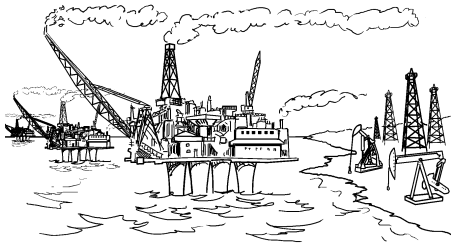
Name:_____ Date:_____

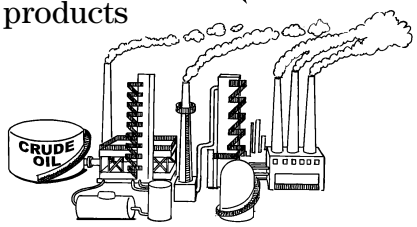
Life Cycle of a Tree

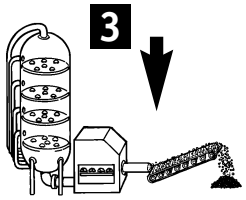


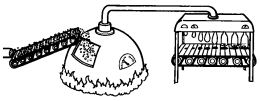
Teacher

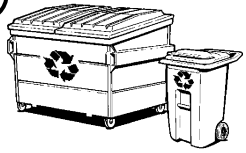
Life Cycle of a Plastic Product

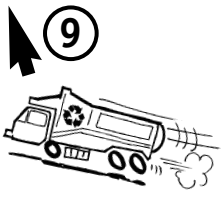


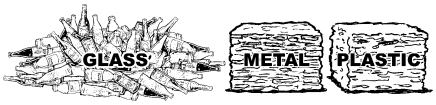


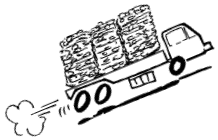


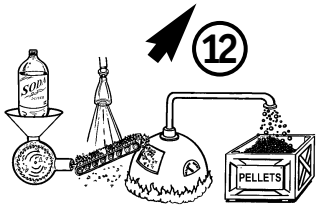


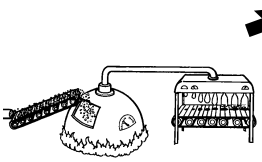












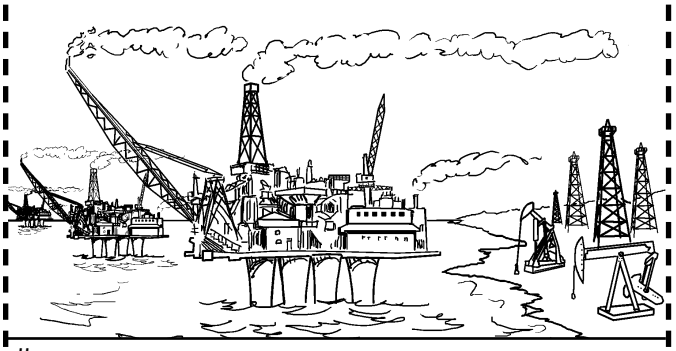
1. Wells pump crude oil
2. Oil is shipped and transported to refineries
3. Oil is refined
4. Plastic pellets are made
5. The pellets are melted to make plastic products
6. Plastic products are used
7. There is a choice; if plastic is thrown away, it ends up in a landfill

Or

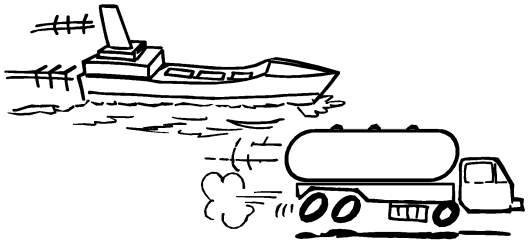
8. If plastic is recycled, the resources can be used again
9. Recyclables get picked up by a recycling truck
10. Recyclables are sorted by type at a recycling facility
11. Bales of plastic are sold and transported to a remanufacturer
12. Bales of plastic are shredded; plastic flakes are washed and melted to form recycled plastic pellets
13. Recycled plastic pellets are melted to make plastic products
14. Plastic products are used

Plastic Life Cycle Cards

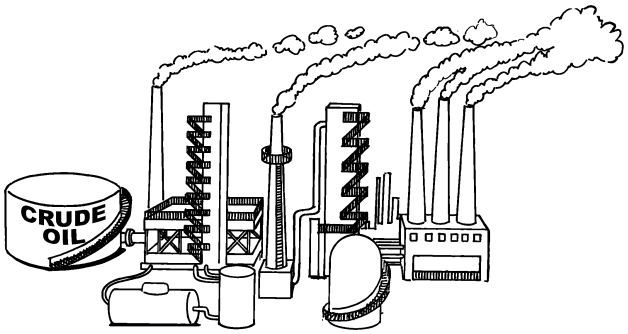
Directions: Cut out each card and glue the cards in chronological order to show how a plastic bottle is made and how it can be used again to make a new product.
Arrange the cards on your poster to show a cycle (in a circle).



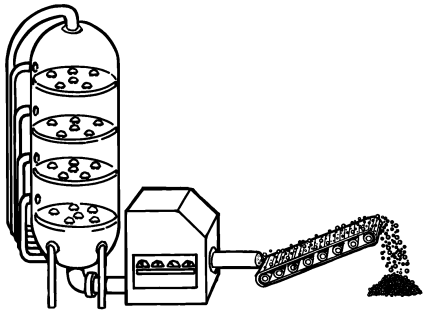
____ Wells pump crude oil.



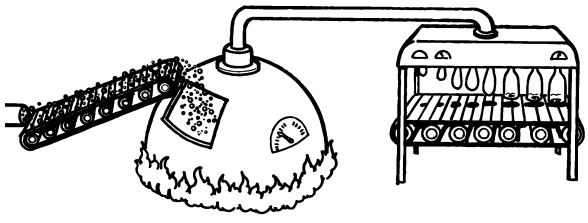
____ Oil is shipped and transported to refineries.



____ Oil is refined.



____ Plastic pellets are made.



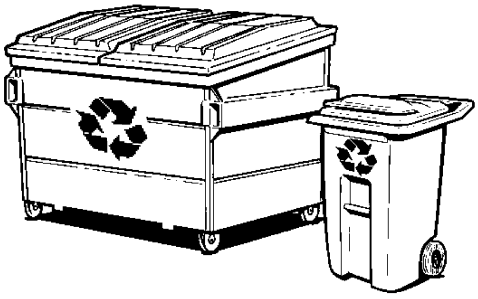
____ The pellets are melted to make plastic products.

____ Plastic products are used.

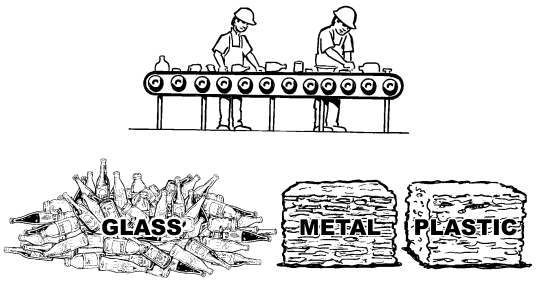
Student

Plastic Life Cycle Cards

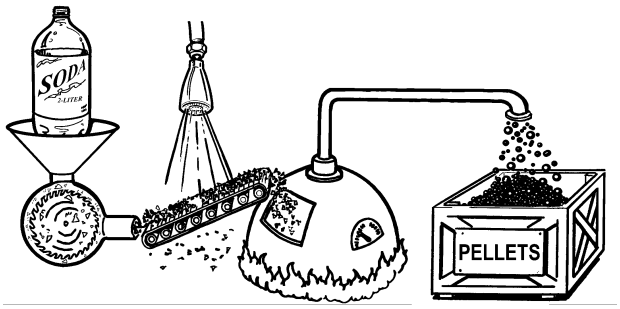
Directions: Cut out each card and glue the cards in chronological order to show how a plastic bottle is made and how it can be used again to make a new product. Arrange the cards on your poster to show a cycle (in a circle).



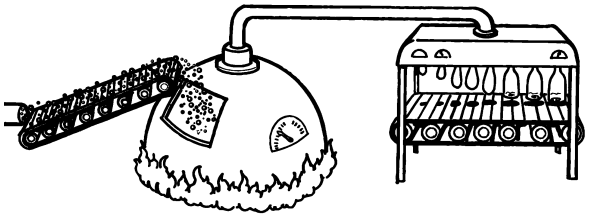
_____ If plastic is recycled, the resources can be used again.



_____ Recyclables are sorted by type at a recycling facility.



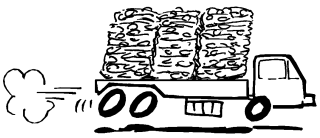
_____ Plastic is shredded, washed and melted into recycled plastic pellets.



_____ Recycled plastic pellets are melted to make plastic products.

_____ Plastic products are used.

_____ Recyclables get picked up by a recycling truck.



___ Bales of plastic are transported to a remanufacturer.

Student

Plastic Life Cycle

Directions: List three nonrenewable natural resources and one product made from this resource.

Nonrenewable Natural Resources	Product Made:
1.	
2.	
3.	

What natural resources are lost when a plastic product ends up in a landfill instead of being recycled?

Name:_____ Date:_____

DEFINITIONS

Vocabulary:

Landfill: an area of land designed to handle the disposal of solid waste. The garbage is usually spread out, compacted and covered with dirt or other material in order to protect the environment in and around the landfill.

Life cycle: a series of changes that an organism undergoes throughout its life. For example, a frog life cycle usually includes the following stages: egg, tadpole, immature frog and adult frog. A life cycle can also describe the steps to producing a product, which usually includes the following stages: extraction of raw materials, production, distribution and use of a product, and final disposal or recycling of remaining materials.

Natural resources: living or nonliving materials that come from the Earth such as fossil fuels, minerals, plants, animals, water, air, sunlight, and other forms of energy.

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

Oil: a liquid substance, usually black and sticky that is used to produce fuel and products such as plastic.

Petroleum: a substance occurring naturally in the Earth in solid, liquid or gaseous state that is composed of a complex mixture of hydrocarbons used to make products such as oil, natural gas, plastic and fuel.

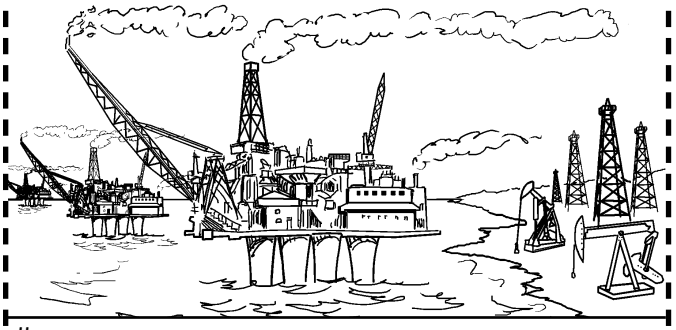
Plastic: a material made from petroleum. It can be molded, extruded or cast into a desired shape.

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

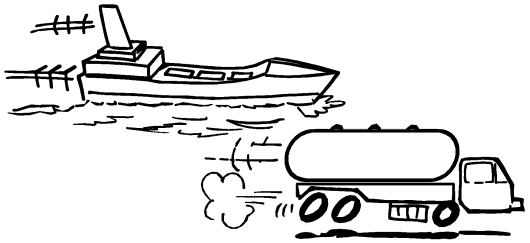
Recycle: the process of producing new products from used material or the process of remanufacturing used materials into new products. Some used materials can be made into new items of the same thing. Others are made into entirely new items.

Tarjetas del Ciclo Vital del Plástico

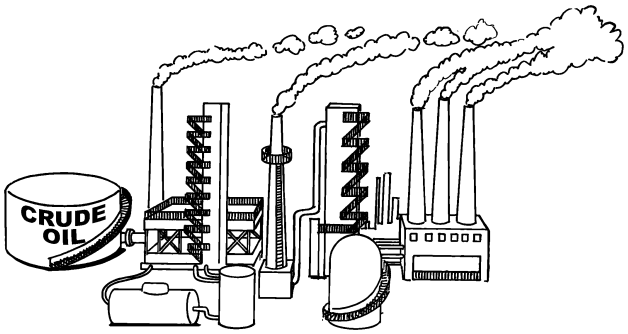
Instrucciones: Recorte cada tarjeta y pegue las tarjetas por orden cronológico para demostrar como se fabrica una botella plástica y como se puede reutilizar para fabricar un nuevo producto. Para demostrar un ciclo arregle las tarjetas en círculo.



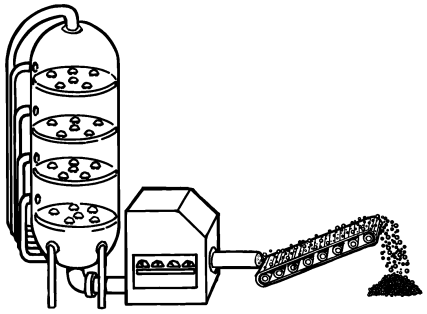
____ Los pozos bombean el petróleo crudo



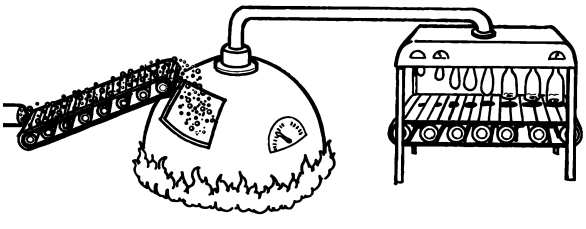
____ El petróleo es mandado via barco o transportado a la refinería.



____ El petróleo crudo es refinado.



____ Bolitas de plástico son fabricadas.



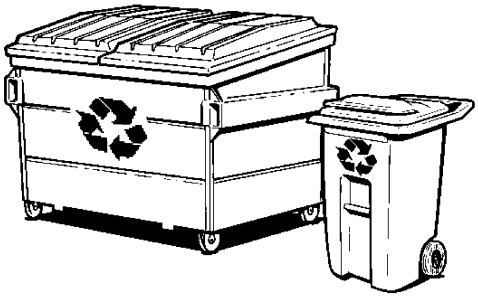
____ Las bolitas son derretidas para fabricar productos plásticos.

____ Productos plásticos son usados

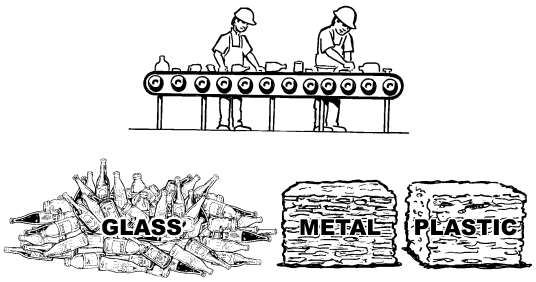
Estudiante

Tarjetas del Ciclo Vital del Plástico

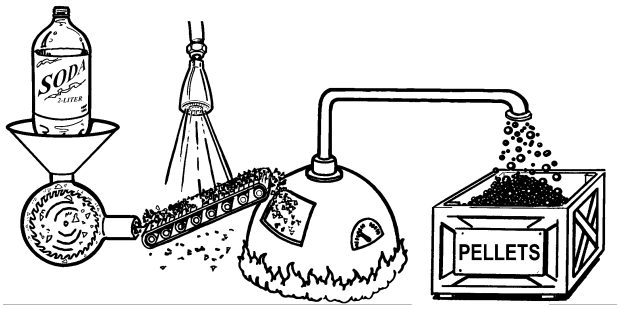
Instrucciones: Recorte cada tarjeta y pegue las tarjetas por orden cronológico para demostrar como se fabrica una botella plástica y como se puede reutilizar para fabricar un nuevo producto. Para demostrar un ciclo arregle las tarjetas en círculo.



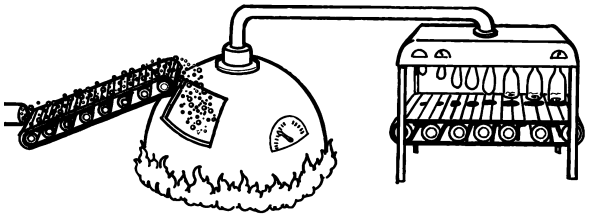
_____ Si el plástico es reciclado, Los recursos pueden ser utilizados otra vez



_____ Reciclables son ordenados en una instalación de reciclaje a de acuerdo a su categoría



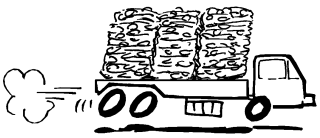
_____ El plástico es cortado en pedacitos, lavado y derretido para formar pequeñas bolitas plásticas recicladas.



_____ Bolitas plásticas recicladas son derretidas para fabricar productos plásticos

_____ Productos plásticos son usados

_____ Reciclables son recogidos por un camion de reciclaje



___ Balas de Plástico son transportadas para ser fabricadas otra vez

El Ciclo Vital del Plástico

Instrucciones: escriba en lista tres recursos naturales que no son renovables y un producto fabricado a base de estos recursos.

Recursos Naturales No Renovables	Producto Fabricado:
1.	
2.	
3.	

¿ Cuáles productos naturales son pérdidos cuando un producto plástico termina en un vertedero de basura en lugar de ser reciclado?

Nombre: _____ Fecha: _____

DEFINICIONES

Vocabulario:

Ciclo de vida: Una serie de cambios que experimenta un organismo durante su vida. Por ejemplo, el ciclo de vida de una rana usualmente incluye las siguientes etapas: huevo, renacuajo, rana inmadura y rana adulta. El ciclo de vida tambíen puede describir los pasos que se toman para producir un producto que usualmente incluye las siguientes etapas: extracción de los materiales crudos, producción, distribución y el uso del producto y la eliminación final ó reciclo de los materiales restantes.

Materia prima: Un material ó recurso natural que fue minado o cosechado para el uso de producir un producto como bauxite (aluminio) , mineral de hierro, silica, etc.

Petróleo: Una sustancia líquida, usualmente negra y pegajosa que es usada para producir combustibles y productos como el plástico.

Petróleo: Una sustancia que occurre naturalmente en la tierra en forma sólida, líquida o en estado gaseoso que es formada por una mezcla compleja de hidrocarbonos usados para producir productos como el aceite, gas natural, plástico, y combustible.

Plástico: Un material producido del petróleo. Puede ser moldeado, extrudido ó hecho en una forma deseada.

Recurso natural: Materiales vivos o que no viven que vienen de la tierra como combustibles fósiles, minerales, plantas, animales, agua, aire, luz de sol y otras formas de energía.

Recursos no renovables: Minerales o recursos de energía que pueden ser minados o extraídos de la tierra como el carbón, petróleo, mineral de hierro, cobre, etc. El proceso de como se forman estos minerales en la naturaleza es tan lento que una vez que se hayan acabado estos minerales son considerados perdidos para siempre

Reciclar: El proceso de producir nuevos productos derivados de materiales usados ó el proceso de fabricar cosas nuevas de materiales viejos. Algunos materiales viejos se pueden hacer de nuevo idénticos a su forma original.

Vertedero de basura: Un terreno diseñado para la eliminación de desechos sólidos. La basura es usualmente regada, comprimida y cubrida con tierra ó otro tipo de material con el motivo de proteger el ambiente adentro y alrededor del vertedero de basura.