Piling up!

Reduce the refuse!

Examples of Possible Academic Science Standards to Incorporate:

1st Grade:

- HLE 14.1 describe different types of pollution and their environmental affects;
- HLE 14.2 identify the importance of "reduce, reuse, recycle" practices,
- HLE 14.3 identify ways the environment affects a person's emotional, social and physical health;
- 7.7.2 Sample areas of the school grounds to identify where different materials are found.
- 7.4.1 Observe, describe, and record the life cycle of a particular animal.
- 7.3.2 Describe what plants and animals need in order to grow and remain healthy.

2nd Grade:

- SPI 7.7.3 Identify and categorize items in the classroom made from renewable or nonrenewable resources.
- SPI 7.7.4 Identify simple methods for reusing the earth's resources.
- 7.2.2 Investigate ways that plants and animals depend on each other.
- 1.5.1 Distinguish between fact and opinion.
- HLE 14.1 describe different types of pollution and their environmental affects;
- HLE 14.2 identify the importance of "reduce, reuse, recycle" practices,
- HLE 14.3 identify ways the environment affects a person's emotional, social and physical health;
- 2.3.02 Recognize the interaction between human and physical systems around the world.
    - a. Analyze how individuals and populations depend upon land resources.
    - d. Understand the rudimentary elements to the hydrologic cycle.
    - e. List earth's natural resources such as minerals, air, water, and land.

3rd Grade:

- SPI 7.7.4 Determine methods for conserving natural resources.
- 7.T/E.1 Explain how different inventions and technologies impact people and other living organisms.
- 1.5.2 Distinguish between fact and opinion.
- 1.5.3 Compare and contrast two ideas.
- HLE 14.1 identify the causes and effects of different types of pollution on health;
- HLE 14.2 apply the practices of "reduce, reuse, and recycle";

- HLE 14.3 evaluate and select environmentally safe products;
- CU 7.7.4 Design and evaluate a method for reusing or recycling classroom materials.
- CU 7.5.4 Determine how changes in an environmental variable can affect plants and animals of an area.
- 3.3.02 Recognize the interaction between human and physical systems around the world.
    - a. List the similarities and differences of local places and regions with other places and regions.
    - c. Understand the concept of an ecosystem.
    - e. Understand how technology allows people to adapt the environment to meet their needs.
- 3.6.01 Recognize the impact of individual and group decisions on citizens and communities.
    - a. Give examples of conflict, cooperation and interdependence among individuals, groups, and nations.
    - b. Examine the relationships and conflict between personal wants and needs and various global concerns, such as use of imported oil, land use, and environmental protection.
    - c. Give examples of economic, social, or political changes that result from individual or group decisions.

4th Grade:

- 7.T/E.1 Explain how different inventions and technologies impact people and other living organisms.
- SPI 7.7.2 Analyze how different earth materials are utilized to solve human problems or improve the quality of life.
- CU 7.7.4 Use data from a variety of informational texts to analyze and evaluate man's impact on non-renewable resources.
- CU 1.5.1 Distinguish between fact/opinion and cause/effect.
- SPI 1.5.1 Locate information to support opinions, predictions, and conclusions.
- 4.3.02 Recognize the interaction between human and physical systems around the world.
- HLE 14.1 identify the causes and effects of different types of pollution on health;
- HLE 14.2 apply the practices of "reduce, reuse, and recycle";
- HLE 14.3 evaluate and select environmentally safe products;
- 4.2.03 Understand fundamental economic concepts.
    - a. Explain and demonstrate the role of money in daily life.
    - b. Describe the relationship of price to supply and demand.
    - c. Use economic concepts such as supply, demand, and price to help explain events.

5th Grade:

- 7.T/E.1 Explain how different inventions and technologies impact people and other living organisms.
- SPI 7.2.3 Use information about the impact of human actions or natural disasters on the environment to support a simple hypothesis, make a prediction, or draw a conclusion.
- 1.5.1 Locate information to support opinions, predictions, and conclusions.
- SPI 1.5.3 Distinguish between fact/opinion and reality/fantasy.
- 1.5.6 Make inferences and draw appropriate conclusions from text.
- HLE 14.1 identify the causes and effects of different types of pollution on health;
- HLE 14.2 apply the practices of "reduce, reuse, and recycle";
- HLE 14.3 evaluate and select environmentally safe products;
- 5.2.03 Understand fundamental economic concepts.
    - a. Explain how supply and demand affects production and consumption
- 5.3.02 Recognize the interaction between human and physical systems around the world.

    - b. Explain human modifications of the physical environment.

6th Grade:

- HLE 14.1 identify major environmental health concerns that impact human health (e.g. air, water and noise pollution; negative social-emotional environment);
- HLE 14.2 demonstrate ways to reduce, reuse, and recycle solid waste;
- HLE 14.3 evaluate and critique products and their effects on the environment;
- HLE 14.4 demonstrate understanding of ways to promote a healthful environment;
- 6.2.02 Discuss economic connections, conflicts, and interdependence.
    - d. Appraise the relationship among scarcity of resources, economic development, and international conflict.

7th Grade:

- T/E.1 Explore how technology responds to social, political, and economic needs.
- CU 7.7.8 Determine the impact of man's use of renewable and nonrenewable resources on future supplies.
- CU 7.7.9 Evaluate how human activities affect the condition of the earth's land, water, and atmosphere.
- SPI 7.7.7 Analyze and evaluate the impact of man's use of earth's land, water, and atmospheric resources.
- Inq.3 Synthesize information to determine cause and effect relationships between evidence and explanations.
- 7.2.01 Understand fundamental economic concepts and their application to a variety of economic systems.
- 7.2.02 Understand global economic connections, conflicts, and interdependence.
    - a. Recognize that resources, goods, and services are exchanged worldwide.
    - b. Explain the interactions between domestic and global economic systems.
    - c. Explain the economic impact of improved communication and transportation.
    - d. Appraise the relationship among scarcity of resources, economic development, and international conflict.
    - f. Apply economic concepts to evaluate contemporary [and future] developments.
- 7.3.08 Understand how human activities impact and modify the physical environment.
    - a. Describe effects of human modification on the physical environment including global warming, deforestation, desertification, and urbanization.
    - b. Explain the ways in which human induced changes in the physical environment in one place can cause changes in other places.
    - c. Analyze the environmental consequences of humans changing the physical environment.
- 7.3.09 Understand the nature, distribution and migration of human populations on Earth's surfaces.
    - d. Analyze contemporary population issues.
    - e. Predict the consequences of population changes on the Earth's physical and cultural environments.
- 7.4.02 Understand how cooperation and conflict among people influence the division and control of resources, rights, and privileges.
    - a. Identify international and multinational organizations of cooperation.
    - b. Describe the current struggles over energy resources and how different governments resolve these problems.
    - c. Describe conditions and motivations that contribute to conflict, cooperation, and interdependence among groups, societies, and nations.

- e. Describe ideas and mechanisms governments develop to meet needs and wants of citizens, regulate territory, manage conflict, and establish order and security.

8th Grade +:

- SPI 0.2.2 Interpret the relationship between environmental factors and fluctuations in population size.
- SPI 0.2.4 Predict how various types of human activities affect the environment.
- SPI 0.4.3 Investigate the impact of the green revolution on world food production and on the environment.
- CU 0.4.1 Differentiate between renewable and nonrenewable resources.
- CU 0.3.5 Use the concept of the ecological footprint to predict the ecological consequences of human population growth.
- CU 0.3.4 Understand the search for a balance between effective usage of land and other natural resources and environment concerns.
- 8.2.02 Understand global economic connections, conflicts, and interdependence.
  - b. Apply economic concepts to evaluate historic, contemporary, and future developments.
  - c. Explain the economic impact of improved communication and transportation on the world economy.
  - d. Analyze the impact of national and international markets and events on the production of goods and services.

Examples of Possible Academic Vocabulary to Incorporate:

For the Academic Vocabulary we encourage you to use as many of these words as possible, not simply pick one or two. The following are a sampling of ones that may apply. The more words we can introduce in a setting that makes sense to our students, the better.

1st Grade:

- Balance
- Classify
- Environment
- Equality
- Future
- History
- Information
- Invent
- Investigate
- Living/Non-Living
- Life cycle
- Location
- Matter
- Mixed
- Past
- Planet
- Prediction
- Present
- Property
- Property
- Responsibilities
- Rights
- Technology

2nd Grade:

- Compare/Contrast
- Conflict
- Consumer
- Decision
- Depend
- Discussion
- Distance
- Duty
- Earth Resource
- Economy
- Edit
- Energy
- Equivalent
- Events
- Goods
- Government
- Growth
- Habitat
- History
- Infer
- Investigate
- Natural Resources
- Observation
- Producer
- Reasoning
- Renewable/Non-Renewable
- Rural
- Scientific Inquiry
- Scientist
- Similarities/Differences
- Symbol
- Type

3rd Grade:

- Borders
- Cause
- Conservation
- Cross Section
- Distribution
- Economy
- Effect
- Exports
- Summarize
- Tools
- Force
- Geography
- Global
- Imports
- Industry
- Landforms
- Manufacturing
- Natural Resources
- Opinion
- Population
- Primary Source
- Product
- Rural
- Scarcity

4th Grade:

- Compare
- Contrast
- Ecosystem
- Expansion
- Exploration
- Mass
- Political
- Population
- Range
- Supply and Demand
- Weathering

5th Grade:

- Credit
- Debt
- Gravity
- Implied
- Main Ideas
- Bias
- Historian
- Surface Area

6th Grade:

- Middle Ages
- Bias
- Cause And Effect
- Control
- Criteria
- Globalization
- Interdependence (economic)
- Plague
- Scavengers
- Relevant
- Relevancy
- Sample
- Simulation
- Technological
- Variable

7th Grade:

- Acceleration
- Function
- Impact
- Minerals
- Phenomenon
- Physical Processes

8th Grade:

- Bias
- Commerce
- Consumption
- Contract
- Debate
- Density
- Element
- Exchange
- Human Impact
- Interdependence
- International
- Jargon
- Product
- Variation
- Vernacular

Piling up!

Reduce the refuse!

Image Credit: http://jadielisicous.blogspot.com/2011/01/mountain-of-trash.html

How do we fix the problem of too much pollution?

Launching the Learning: "what comes before, matters in the end"

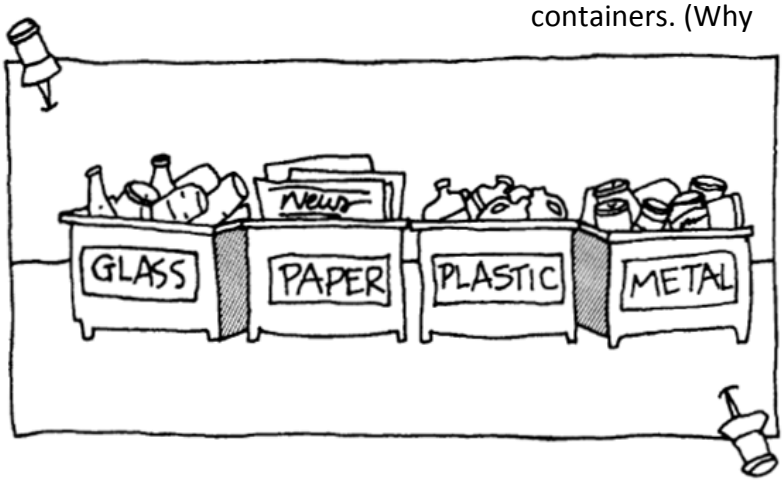
Take the time to slow down, ask the kids what they already know about the subject, make important connections to what is to come, and use the schemata of students to genuinely shape and guide the learning, throughout the following unit.

First, write a word or phrase in a circle (whiteboard, poster paper), ex. "*garbage*", and have students write as many words connected to it that they can think of around it, ex., *bags, cans, too much, landfills, recycle, stinks*, etc. Use a timer with this activity to create a sense of urgency (which adds to the fun). Keep the web visible throughout upcoming lessons and refer to it as you explore garbage in-depth, even asking them to add words and facts to it.

Get students thinking about the importance of a healthy Earth by reading books about trash, like *Here Comes the Garbage Barge* by Jonah Winter [a mostly true and completely stinky story that is sure to make you say, "Pee-yew!"], or *Tracking Trash: Flotsam, Jetsam, and the Science of Ocean Motion*, or *The Garbage Monster* by Joni Sensel and Chris Bivins. Place the book you have selected for read aloud on the ledge of the chalkboard or in front of the students and have the students look at the picture and title on the cover and use their schema to make predictions about the story [model this procedure for your students]. They can write a word or a complete thought. After they have settled in for read aloud discuss what is written and make predictions as a group about the story.

After reading, put the ball in their court by asking them what they would have done with the trash, what do they know about environmental problems, and how would they help solve the problem? With mountains of trash piling up across the world and running out of valleys to fill, and space to dig holes, we have to learn to reduce the amount of waste we throw away. What are students' ideas on how we can reduce the refuse?

- For example, buy items at the store that aren't wrapped in extra packaging, so there will be less to throw away.
- Buy products in larger containers. (Why do students think this would help?)
  - Learn to reuse other things—like washing out empty containers to store food in instead of throwing them away.
  - Learn to recycle.



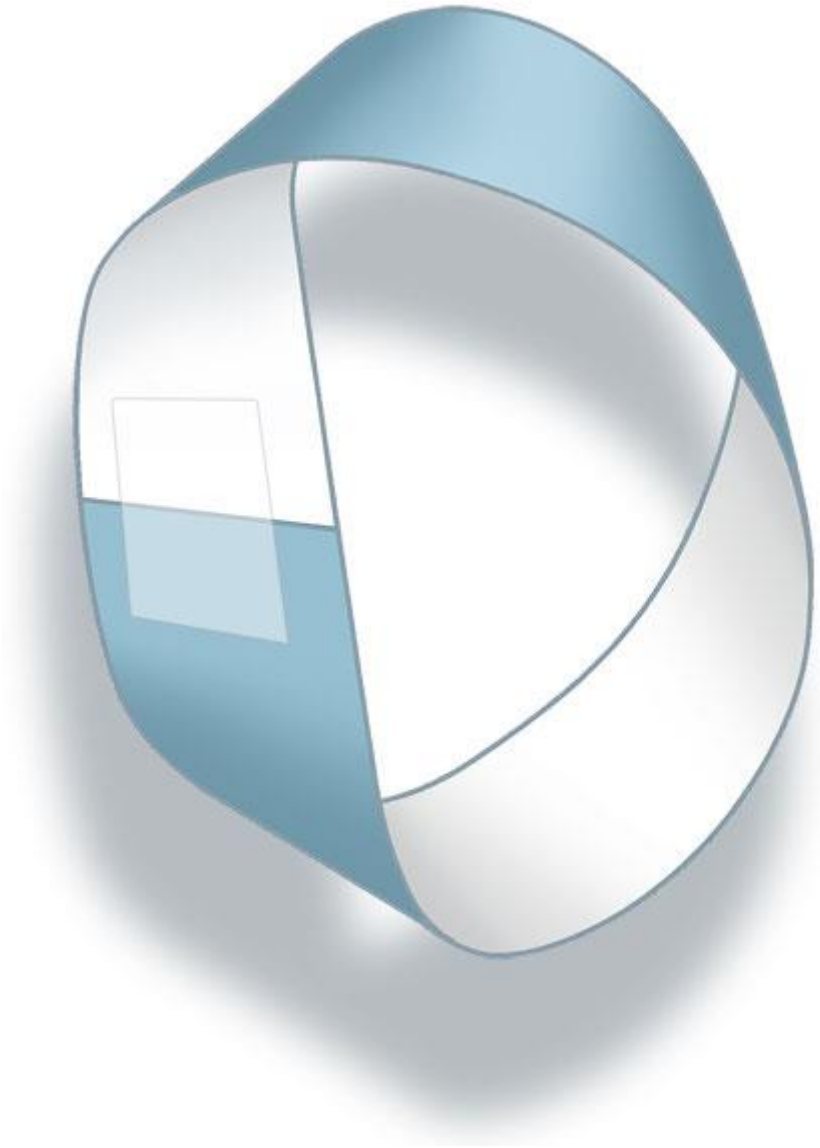
What is Recycling?

Recycling is a series of activities that includes the collection of used, reused, or unused items that would otherwise be considered waste, sorting and processing the recyclable products into raw materials, and remanufacturing the recycled raw materials into new products. Consumers

provide the last link in recycling by purchasing products made from recycled content. Recycling also can include composting of food scraps, yard trimmings, and other organic materials.

Möbius Motivates: The Recycling Loop

Making a Möbius strip is easy and a fascinating look at the world of topology (that's the science of the surface of a 3D shape), decomposition, and recycling.



Materials:

1 Sheet of paper per student
Scissors
Pencils or markers
Clear tape

1. Have students fold the paper into three **equal** parts, or use the included sheet, folding it on the lines and cutting it out.
2. On the first strip have them write "collect", write "Process & Manufacture on the second, and write "Buy & Use" on the third.
3. Have them, one at a time turn each strip over from **top to bottom**. Then, print the same word written on the front of the strip, on the back. For example, when you finish, the word "collect" will be written on both sides of the same strip, but one word is upside down compared to the other.

4. Have students tape the strips together, as shown. Be sure each seam is taped smoothly, on both sides.

Collect	Process & Manufacture	Buy & Use

5. Have students lay the long strip out smoothly in front of them on their desks and draw an arrow at the "Collect" end as shown.

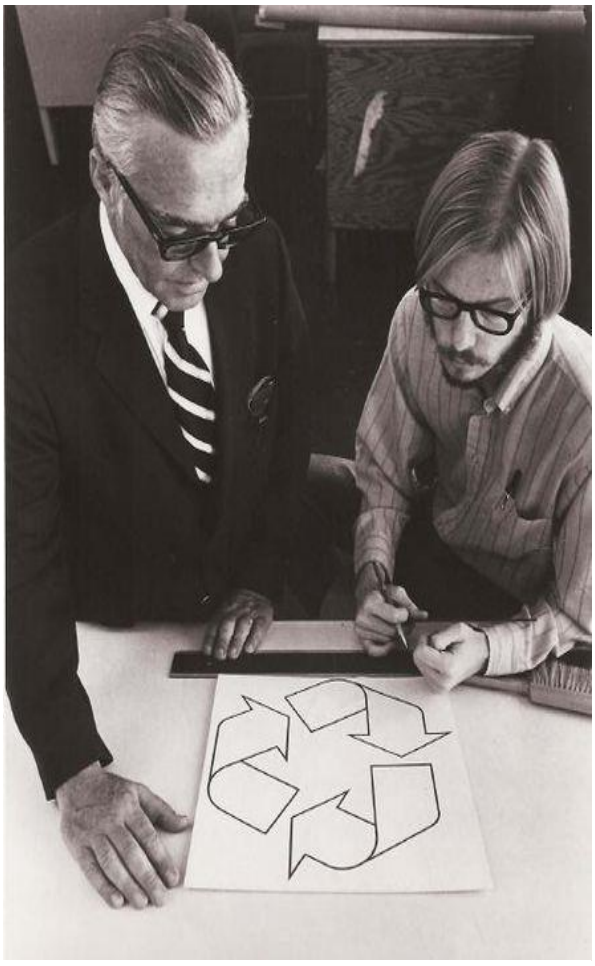
← Collect	Process & Manufacture	Buy & Use

6. Have them turn the strip over, **top to bottom**, and add an arrow to the "Buy and Use" side as shown. Have them check their strips, the arrows should **NOT** be on the same side of the strip.

Collect	Process & Manufacture	Buy & Use →

7. Have students put 1 twist in it before taping the ends with the arrows together to make a loop. They will put a twist in it by turning over only 1 end of the strip before they attach the ends at the arrows. Make sure they tape both sides of the seam.

Their symbol of recycling is a Möbius strip. A Möbius strip is a one sided, one edged loop, discovered by Agustus Möbius, If they don't believe their loop only has one edge and one side have them try the following:
To reinforce the idea of a continuous cycle, or if students seem confused about why this strip is unique, compare it to a simple loop of paper. Using a sample loop, demonstrate that when tracing your finger around the inside of the loop, it never touches the outside of the loop.



Gary Anderson [right] and his original design of the recycling logo.
http://en.wikipedia.org/wiki/Recycling_symb

Compare that again to tracing your finger on the Mobius strip, which shows the continuous use of all sides of the paper.

Have them try it:

1. Can they color each side a different color?
2. Without lifting their marker once they start have them draw a continuous line under all the words on their loop. The line will start where it began.
3. Use a marker to color the top edge of their loop, continue coloring the edge of their loop, the line will end where it began.
4. Have them try cutting it in half long ways, something very strange happens.

Where can they see a Möbius Strip?

Do students have any ideas? Did they know that the world-wide symbol for recycling is in fact a Möbius Strip? Why do they think this shape was chosen to represent recycling? It is composed of three mutually chasing arrows that form a Möbius strip (an unending single-sided looped surface). In 1969 and early 1970, worldwide attention to environmental issues culminated in the first Earth Day. In response, then Chicago-based Container Corporation of America, a large producer of recycled paperboard, sponsored a contest for art and design students at high schools and colleges across the country to raise awareness of environmental issues. It was won by Gary Anderson, a 23-year-old college student at the University of Southern California, whose entry was the image now known as the universal recycling symbol.

FYI Real World Applications

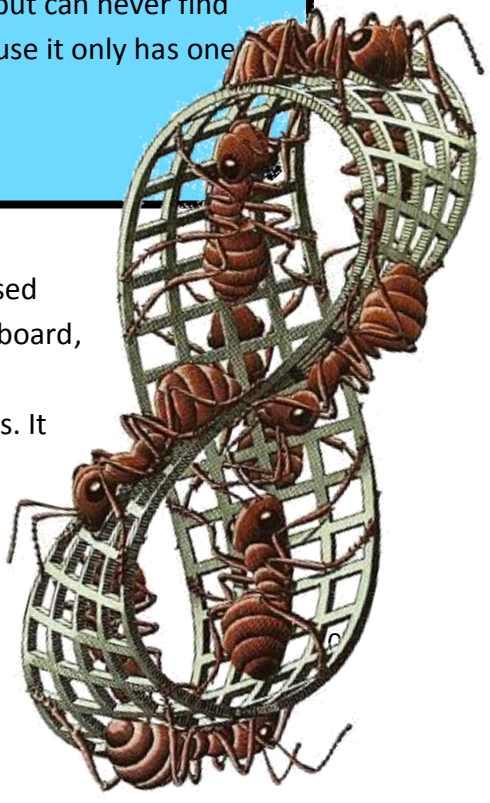
Scientists, mathematicians, engineers and even artists have all been interested in this weird form.

How is the Möbius Strip used in industry?

Conveyor belts use the concept to double their life as the belt gets worn over its whole area and not just one side, because of course the strip only has one side.

In art?

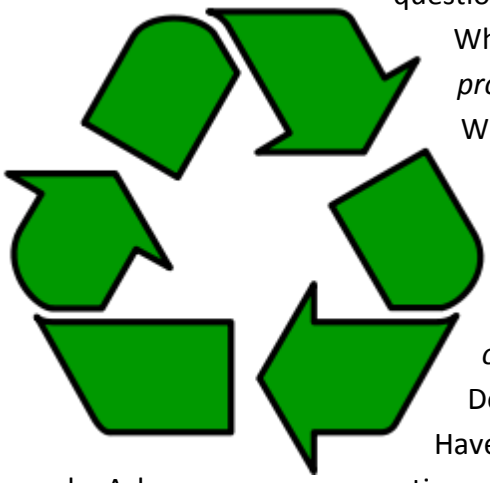
The artist M.C Escher lived in modern times he was born in 1898 and only died in 1972. He loved the idea of the Möbius Strip and used it as the basis for his drawing: Möbius Strip II (Red Ants) which he completed in 1963. In the picture the red ants keep walking round the strip but can never find the other side of it because it only has one side.



When we see the recycling symbol we can remember the unusual aspects of the Möbius strip and think of the actions we need to do for recycling to continue. With our help, recycling should have no end.

Extending the Cycle:

Have students use their geometry skills to put together additional Möbius strips for nature's recycling cycle that model how nutrients are passed from one living thing to the next. Use questions such as the following to spark ideas:



What could they draw on the Mobius strip? (*Pictures of producers, consumers, and decomposers.*)

What is happening to the nutrients in the cycle? (*They are getting passed from one living organism to the next.*)

How do producers, consumers, and decomposers work together to recycle nutrients in nature? (*Each one makes nutrients available, in one form or another, for other organisms.*)

Does the recycling ever end? (*No*)

Have the students refer to their Möbius strips of the nutrient cycle. Ask questions such as the following to help them synthesize what they've learned:

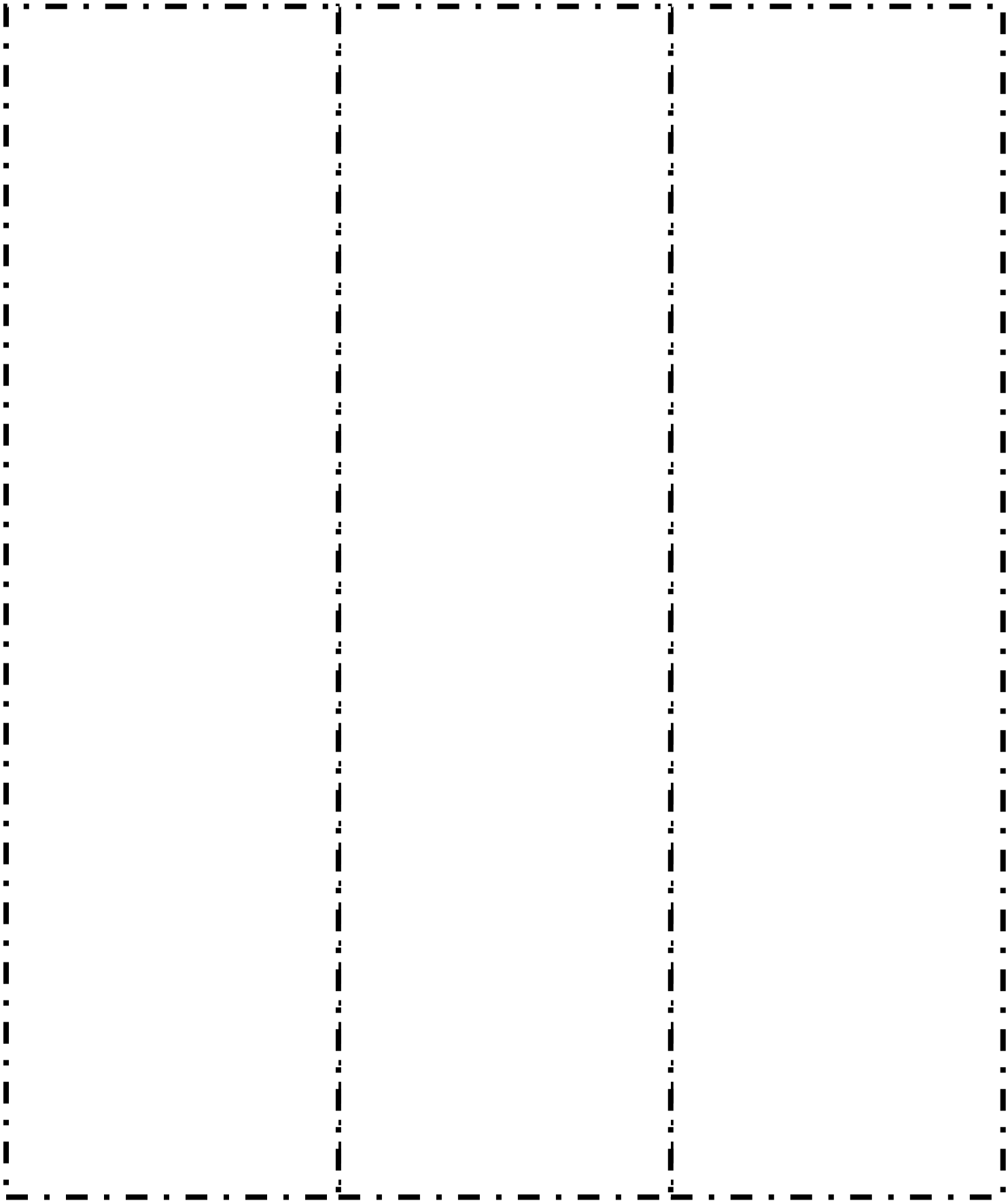
Are nutrients ever wasted in nature? (No, nutrients are passed on from one living organism to the next. They are recycled all the time.)

Are things wasted by humans?

How do producers, consumers, and decomposers depend on one another in the nutrient cycle? (They make nutrients available for each other.)

Does this type of model help them understand the nutrient and recycling cycle? Why or why not?

Students' experience with the Möbius strip, along with the discussions in the lesson, solidifies their understanding of how producers, consumers, and decomposers all work together to ensure that nutrients are continually recycled in nature.



Collect

Process & Manufacture

Buy & Use

What is an “environmental cycle?”

An environmental cycle is a continuous chain of natural events that happens all around us every day. For example, a new tree sprouts from the ground in your back yard. Over the years, its roots draw water and minerals from the soil and make food using sunlight. This process is called photosynthesis. While it grows, the tree’s leaves help purify the air we breathe. Each year it drops seeds to the ground that sprout into seedlings. When it is old, the tree dies, falls down, and decays. Nutrients from its wood enrich the soil so the saplings can grow into healthy new trees. Over the years, the young trees that grew from your tree’s seeds become mature trees, and the cycle begins all over again.

What does the environmental cycle have to do with recycling?

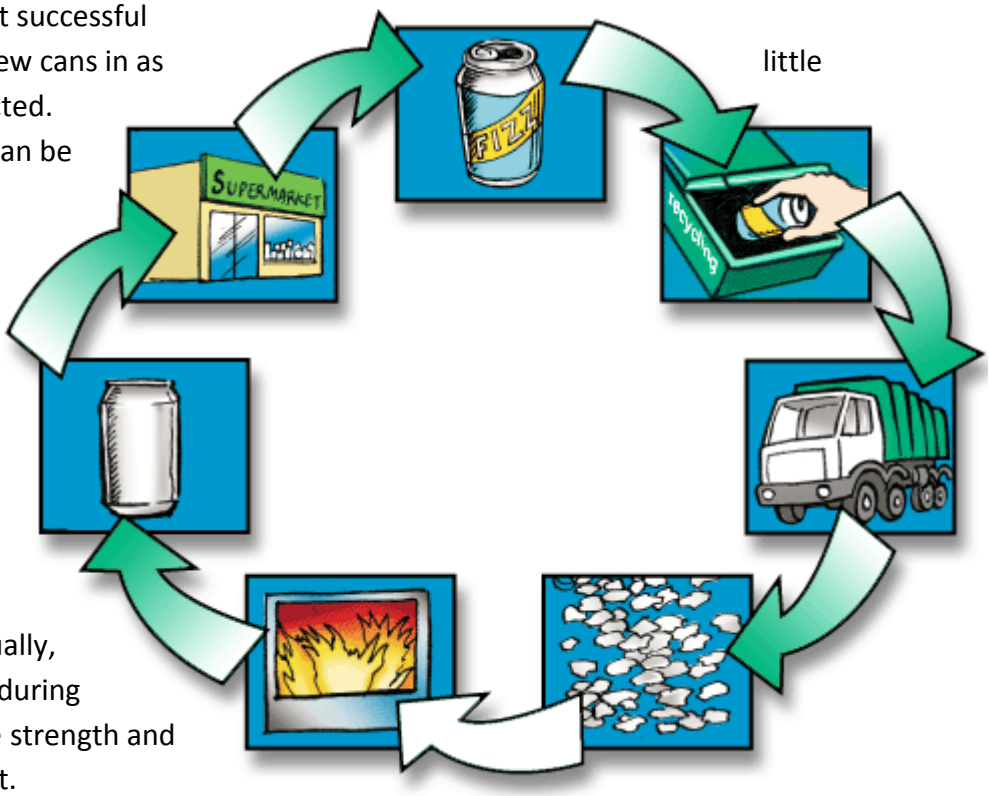
Answer: Just as nature has its environmental cycle, and we had our Möbius strip, when we recycle we create the recycle cycle. Instead of using virgin raw materials that come from nature to make new products, the recycle cycle enables us to use the materials in used products to make new ones. For example, recycled bottles may become jars, drinking glasses or new bottles, recycled aluminum beverage cans may become aluminum foil and so on. By recycling, we are helping to preserve our natural resources and reducing the amount of waste that is discarded. By recycling just one aluminum can, we save enough energy to run a tv for six hours!

How Does Recycling Work?

Many people already recycle items like paper, glass, and aluminum. While these efforts are a vital part of the process, the true recycling path continues long after recyclables are collected from household bins or community drop-off centers. Collecting, processing, manufacturing, and purchasing recycled products creates this closed circle, cycle, or loop that ensures the overall success and value of recycling.

Let’s Follow a Plastic Bottle Beyond the Bin...

After a plastic soda bottle is collected in a recycling bin, it is sorted and transported to a materials recovery facility. There it is cleaned and fed into a granulator that chops it into uniform-sized pieces, called “flakes.” A manufacturer then purchases the flakes and melts them, squeezing the plastic into thin spaghetti-like strands and chopping those strands into small pieces called “pellets.” These plastic pellets are further stretched and squeezed into thin fibers that can be remanufactured into items like clothing, bags, bins, carpet, plastic lumber, hospital supplies, house wares, packaging, shipping supplies, toys, and more. Consumers then complete the recycling loop by purchasing and using these new recycled content products. Recycled glass is used again and again in new glass containers as well as in glasphalt (the roadway asphalt that shimmers in sunlight), road filler, and fiberglass. Recycled aluminum beverage cans, one of the most successful recyclables, are remade into new cans in as little as 90 days after they are collected. Recycled aluminum cans also can be used in aluminum building materials.



However, like paper and glass, aluminum cans can’t be recycled forever. Just as your pants wear out at the knees or your sneakers get holes in the bottoms, recyclable products wear out, too. But they can last much longer than they do today. Usually, some new aluminum is added during remanufacture to preserve the strength and lengthen the life of the product.

So, what if we don’t? Does it really matter that much?

Read a book like *All the Way to the Ocean* by Joel Harper

Have students watch “The Plastic Perils of the Pacific” and/or “Dissolving Destinies” Video by Brandon and Carlene Strathmann

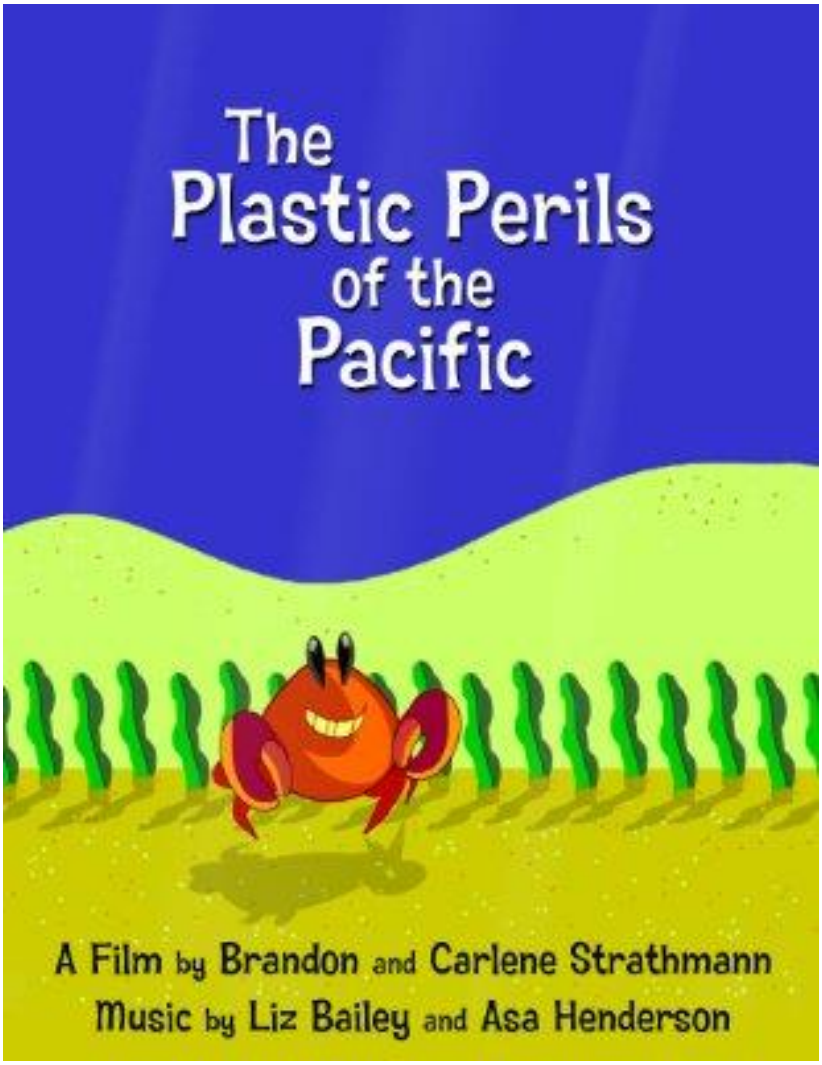
Plastic Perils: This award winning video tackles the dangers posed by plastic garbage in the open sea with humor. Our hero, a neurotic little red crab, finds his paradise under assault by the intrusion of a water bottle. He undertakes a fantastic journey through the beautiful realm of a coral reef, meeting and helping other sea life along the way. The crab was designed by a four year old girl, the filmmakers daughter, and the film has a charming children's book quality.

As a class watch the video at: http://www.imdb.com/video/wab/vi2269250329/

Dissolving Destinies: This film highlights an important but widely unknown issue, Ocean Acidification. Following our little crab through the coral reef, we see the effects of ocean acidification and learn that what we do on land affects what happens to the oceans.

Discuss the video and have students retell what happened in their own words. You may want to prompt them with the following questions:

- What other sea life was affected by plastic (turtle, birds, etc)?
- What plastic things were in the ocean? (bottle, bag, plastic soda holders)
- How did the crab help them?
- What would have happened without the crabs help?
- What can we do to help?



Not all garbage ends up at the dump. A river, sewer or beach can't catch everything the rain washes away, either. In fact, Earth's largest landfill isn't on land at all.

The Great Pacific Garbage Patch stretches for hundreds of miles across the North Pacific Ocean, forming a nebulous, floating junk yard on the high seas. It's the poster child for a worldwide problem: plastic that begins in human hands yet ends up in the ocean, often inside animals' stomachs or around

their necks. Before plastic, the trash the ocean collected would just break down, but not anymore.

Ocean researcher Charles Moore was taking part in a race across the Pacific in the late 90s and decided to take the route-less-traveled on his way home — and wound up engulfed in a mass of garbage as far as the eye could see.

This new continent is called the Great Pacific Garbage Patch, the Eastern Garbage Patch or the Pacific Trash Vortex, this non-biodegrading trash continent. In 2001, it was estimated to be the size of Texas. Now it may be as large as the continental United States! And it weighs over 3 million tons. It's floating out there between Japan and San Francisco, the biggest garbage heap in the world, and it's getting bigger. According to the UN Environment Program, the world produces 225 million tons of plastic every year and now another patch has been found, this time in the Atlantic Ocean.

Unlike most other trash, plastic isn't biodegradable — i.e., the microbes that break down other substances don't recognize plastic as food, leaving it to float there forever. What people don't understand is that it's not really a patch and it's not really an island, both of which you might be able to contain and clean up. No, it is much worse. It's like a gigantic toxic soup that continues to grow, destroying sea life as the plastic slowly breaks apart filling the ocean with poisonous bits of plastic debris that is eaten by birds, fish and, ultimately, by humans.

"Here Today, Still Here Tomorrow"

About 80 percent of debris in the Great Pacific Garbage Patch comes from land, much of which is plastic bags, bottles and various other consumer products. Free-floating fishing nets make up

another 10 percent of all marine litter, or about 705,000 tons, according to U.N. estimates. The rest comes largely from recreational boaters, offshore oil rigs and large cargo ships, which drop about 10,000 steel shipping containers into the sea each year, full of things like hockey gloves, computer monitors, resin pellets and LEGOs. But despite such diversity — and plenty of metal, glass and rubber in the garbage patch — the majority of material is still plastic, since most everything else sinks or biodegrades before it gets there.

The Plastic on the right is everything that was found in the bird's stomach. It died of starvation. Image found at http://earthfirst.com/wp-content/uploads/2008/02/bird-and-plastic1.jpg

It may take several years for debris to reach this area, depending on its origin. Plastic can be washed from the interiors of continents to the sea via sewers, streams and rivers, or it might simply wash away from the coast. Either way, it can be a six- or seven-year journey before it's spinning around in the garbage patch. On the other hand, fishing nets and shipping containers often fall right in with the rest of the trash. One of the most famous such debris spills came in 1992, when 28,000 rubber ducks fell overboard in the Pacific Ocean. The ducks continue to turn up on beaches

around the world to this day.

Tiny nurdles, in my sea

Sunlight does eventually "photodegrade" the bonds in plastic polymers, reducing it to smaller and smaller pieces, but that just makes matters worse. As sunlight breaks down floating debris, the surface water thickens with suspended plastic bits that still never go away; it just becomes microscopic and may be eaten by tiny marine organisms, entering the food chain. Instead of biodegrading (being broken down by organisms and eventually going away completely) the plastic is breaking up into tinier and tinier bits (many about the size of your pencil eraser) which are then eaten by jellyfish, turtles, and other sea creatures and marine birds. And now it's the food chain and eventually humans eat it. The small bits are called "mermaid tears" and "nurdles," which make them sound much cuter, friendlier, and much more beautiful than they are. Nurdles actually soak up chemicals so when they get eaten they're like poison pellets. The rest of it just breaks down into pollutants, making a giant thick poison soup of the sea.

New research shows that plastic has collected in a region of the Atlantic as well, held hostage by converging currents, called gyres, to form a swirling "plastic soup." And those fragments of plastic could also be present at the other three large gyres in the world's oceans.

Plastic Peril Journal

As a follow up have students keep a plastics journal of everything plastic that they throw away during the next two days. Plastic bags from stores? Drink bottles? Sandwich bags and/or wrappers around their food? When they bring their journals back total up how much plastic they use as a class. How much plastic would that be for the whole school?

Have students interview the janitor at your program. How many plastic bags of garbage does the janitor throw away every day, just for your school? What kind of garbage does he see the most? (Paper, plastic, food) What kind of litter does the janitor find most? How many bags is that a school year? How big of a pile would your school's garbage make? Have students discuss how they could reduce the numbers of bags of garbage made by their school.

Extension: Have students make posters showing their fellow students how much garbage is made by their school and have them give tips how to reduce that amount.

Discuss with students, what more can be done? Lead the discussion so that the students are the ones coming up with the ideas, if at all possible, the following are a few suggestions to get the ball rolling.

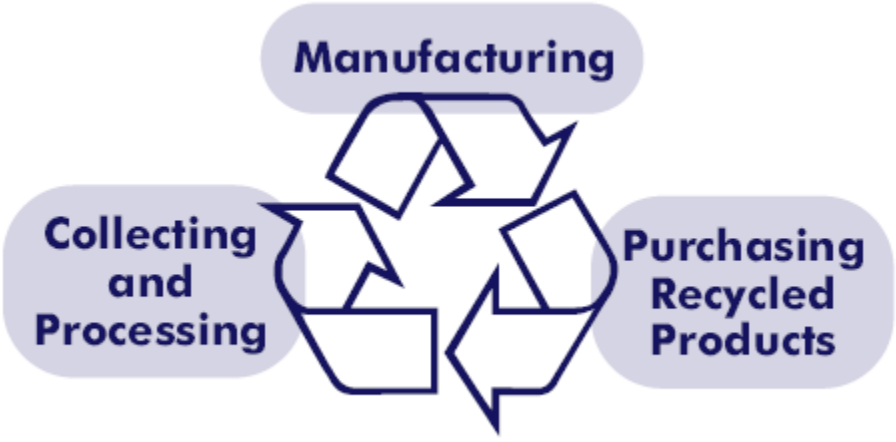
- Turn off the water while showering and brushing teeth. It saves water AND time because you end up focusing on getting clean and getting out of there!
- Start an itty bitty or large organic garden at school or home and create compost for it. It's a large undertaking, but if you can get your science teacher (or parent) behind you, it's very likely that your principal will allow you to start an organic garden

of some kind and a compost heap to fertilize it.

- Turn off lights and appliances/electronics when not in use. Although cleaner energy is becoming more common, no energy should be wasted.
- Hand-wash dishes or only run the dishwasher for full loads. Most people don't realize it, but dishwashers use considerably more water to wash a load of dishes than the traditional sink method does. A LOT MORE. So, to conserve water, it's best not to use the dishwasher at all. If you do, use eco-friendly dishwashing detergent and only run the washer when it is completely full. If it's not full or if you can, choose to wash dishes in the sink instead, of course, with eco-friendly dishwashing liquid.
- Set up bins to collect glass, paper, plastics, and aluminum that can be converted back into raw materials, then made into new products.
- Reduce waste by curbing use of disposables. It's easy to use throwaway cups, plates, wrappers, and utensils, but it only creates more waste for landfills. Also, disposable paper products like facial and bathroom tissue and paper towels and napkins also end up in the trash. We can save more trees by using less paper products, and we can keep more plastics and styrofoam out of the landfills by using less throwaway utensils and containers. Also, eating less often at fast-food restaurants cuts down on your usage of these items, too. When you have to use them, use less. When you don't have to use them, DON'T.
- Pay special attention to reducing the toxic materials that are bought, such as trying safer pest control products or household cleaners.
- Ease up on the video games. Playing video games on both computers and systems uses a LOT of energy! That's why your system or computer feels hot afterwards! You can save on energy by simply doing homework or going outside to play instead of posting up in front of the TV or computer screen. This activity uses more electricity than regular TV or computer usage, so it should be kept to a minimum.

What Are the Benefits of Recycling?

When each part of the recycling loop is completed, the process helps both the



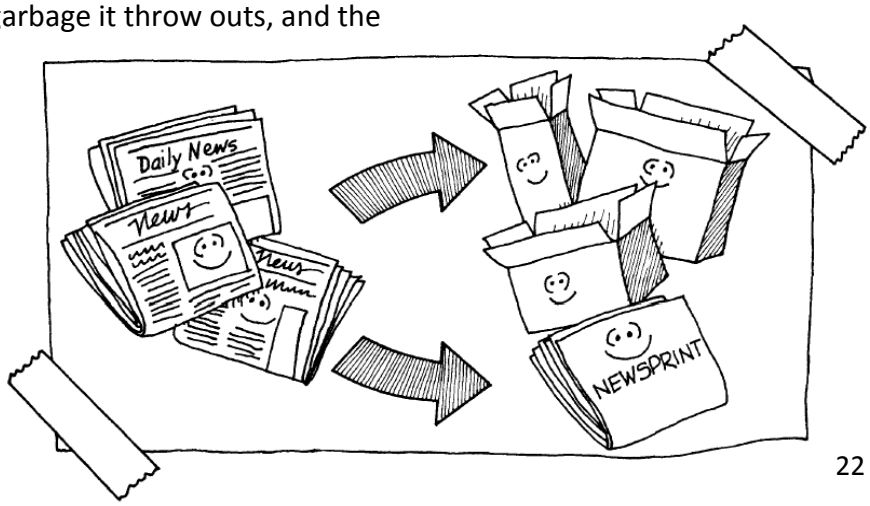
environment and the economy. Recycling prevents materials from being thrown away, reducing the need for landfilling and incineration. In addition, the use of recycled materials to manufacture new products prevents pollution caused by the manufacturing of produces from virgin materials. Also, using recycled materials for manufacturing decreases emissions of greenhouse gases that contribute to global climate change. Since the use of recycled materials reduces the need for raw material extraction and processing, energy is saved and the Earth's dwindling resources are conserved.

Recent studies indicate that recycling and remanufacturing account for about 1 million manufacturing jobs throughout the country and generate more than $100 billion in revenue. Many of the employment opportunities created by recycling are in areas of the country where jobs are most needed. Jobs include materials sorters, dispatchers, truck drivers, brokers, sales representatives, process engineers, and chemists.

What Are the Challenges of Recycling?

Despite its success, the potential of recycling in this country, or most countries, is not yet fully realized. Some plastics, for example, such as bottles and containers, are recyclable in almost any community, but others, such as plastic "peanuts" used in packaging, usually cannot be included in curbside or drop-off recycling programs. These items still end up in the trash because it is not profitable (money making) to collect the tons needed for remanufacture into new products. In addition, the costs of collecting, transporting, and processing recyclables can sometimes be higher than the cost of disposing of these materials as waste. The average cost to process a ton of recyclables is $50, while the average value of those recyclables on the market is only $30. Processors often compensate for this discrepancy by charging a set fee for each ton of material they receive or by establishing ongoing contracts with communities or haulers.

Efforts to better manage waste and recycling programs are under development. Many communities across the country give financial incentives to encourage people to recycle. Residents are charged a fee based on the amount of solid waste they throw away. The more a household recycles, the less garbage it throw outs, and the lower the collection fee it pays.



Finally, recycling facilities are not always a welcome addition to a community. As with other waste management operations, recycling facilities are often accompanied by increased

traffic, noise, and even pollution.

One of these things is not like the others. Which of these items does not belong?

Divide your group into teams and compete in lines, or groups. List two items from one group and one item from another. Ex. Coffee Grounds, Banana Peels, Window Glass. Have teams say which one does not belong and which group the other two items belong in. If one team gets it incorrect, the other team gets a chance.

Variations:

- Have students sort different materials (or pictures of materials) into recycling, composting and trash categories (with re-use as a bonus point category) as part of a relay race/team competition and try to earn as many points as they can.
- Say the name of each item and/or show a picture and ask the competing team or team member which category the item would go in. Discuss any options for the item and have the class/team vote on where they would place the item. For example: an envelope can be recycled or reused. 2 bonus points per item go to those students/teams who can figure out a re-use option for any item.

Compostable

- ☐ grass clippings
- ☐ leaves
- ☐ wood ashes
- ☐ banana peels
- ☐ dryer lint
- ☐ oatmeal
- ☐ chipped twigs
- ☐ tofu
- ☐ coffee grounds
- ☐ 100% cotton balls
- ☐ Contents of your vacuum cleaner
- ☐ pencil shavings
- ☐ flowers from a flower arrangement
- ☐ human hair
- ☐ corn stalks
- ☐ burned toast
- ☐ pie crust
- ☐ dead plants
- ☐ receipts from the store
- ☐ old spices from your kitchen
- ☐ Post-it notes
- ☐ feathers
- ☐ old wool sweater
- ☐ apple peels
- ☐ leather
- ☐ watermelon rind
- ☐ used matches
- ☐ jack o' lanterns
- ☐ stale bread
- ☐ toothpicks
- ☐ cat hair
- ☐ egg shells

Recyclable

- ☐ Office paper
- ☐ Magazines
- ☐ shredded paper
- ☐ car tires
- ☐ telephone book
- ☐ glass jar
- ☐ metal lids from jars
- ☐ junk mail
- ☐ envelopes
- ☐ shampoo bottle
- ☐ books
- ☐ cereal boxes
- ☐ boxes to hold soda
- ☐ newspaper
- ☐ aluminum cans
- ☐ colored paper
- ☐ paper towel rolls
- ☐ paper bags
- ☐ glass bottle
- ☐ glass jar
- ☐ milk jugs

Trash

- ☐ window glass or mirrors
- ☐ incandescent or fluorescent light bulbs
- ☐ dishes
- ☐ rubber bands
- ☐ plastic wrap from newspapers
- ☐ photos
- ☐ wet cardboard
- ☐ bar soap
- ☐ plastic wrap
- ☐ plastic bottle tops
- ☐ plastic or Styrofoam cups
- ☐ packing peanuts
- ☐ motor oil
- ☐ Styrofoam
- ☐ clear food containers
- ☐ plastic egg boxes
- ☐ photos or film
- ☐ plastic toys
- ☐ garden plastics and flower pots
- ☐ aluminum foil
- ☐ pie pans
- ☐ scrap metal
- ☐ foil juice bags
- ☐ coat hangers
- ☐ propane tanks
- ☐ diapers

Recycling cuts back on negative environmental effects

Climate is the average pattern of weather over the long term. The earth's climate has warmed and cooled for millions of years, since long before we appeared on the scene.

There's no doubt that right now we're in one of the warming periods; indications of that change are all around us. It's warmer today around the world than at any time during the past 1000 years, and the warmest years of the previous century have occurred within the past decade.

We know that the earth has become warmer over the last century, the average surface temperature of the earth has increased during the twentieth century by about 0.6° ± 0.2°C. (The ± 0.2°C means that the increase might be as small as 0.4°C or as great as 0.8°C.) This may seem like a very small shift, but although regional and short-term temperatures do fluctuate over a wide range, temperatures planet-wide are generally quite steady. In fact, the difference between today's average global temperature and the average global temperature during the last Ice Age is only about 5 degrees C.

Though climate change isn't new, the study of how human activity affects the earth's climate is. The exploration of climate change encompasses many fields, including physics, chemistry, biology, geology, meteorology, oceanography, and even sociology.

Interpreting past and present climate data is difficult, but predicting future climate change—and its possible effects—is even more challenging.

Warming up isn't always a bad thing…

The earth receives a tremendous amount of energy from the sun. The land, sea, and air absorb some of this energy and reflect some of it back into space. The overall description of this process is called the earth's energy budget, like the amount of money you have to spend. The "greenhouse effect" is one aspect of this energy budget.

The greenhouse effect is actually essential to our existence: In the greenhouse effect, the sun warms the earth, and certain gases called greenhouse gases (including carbon dioxide and water vapor) acting just like the glass walls of a greenhouse keep the interior temperature higher than that outside. So inside our atmosphere it's much warmer than it is out there in space, which is a very good thing! The earth's atmosphere traps some of the energy radiated from the earth near the planet's surface, trapping heat and keeping the planet's surface warm enough to support life, at a hospitable 15°C. (With no greenhouse effect, the earth's average temperature would stabilize at about -18°C, or -0.39 F). The atmosphere isn't made up entirely of these greenhouse gases, however; in fact, oxygen and nitrogen, which together make up more than 95% of our atmosphere, are not greenhouse gases. So a little bit of greenhouses gasses, 5% goes a long way.

But it could be.

Industry and other human activity add carbon dioxide, a greenhouse gas, to the atmosphere. Because there are more greenhouse gasses, some scientists believe this strengthens the greenhouse effect and think it may help cause a significant warming trend. Other scientists believe humans don't have that much of an effect and that we are simply in the midst of a natural cycle of warming.

The possible implications of continued global climate change, regardless of the cause, don't mean that every day will be a day at the beach, or at least, not a day you'd want to spend there. What people and scientists aren't sure about are the precise effects of a strengthened greenhouse effect on global temperatures. Researchers are studying a variety of areas, from variations in the frequency and intensity of storms to changes in the incidence of mosquito-borne diseases. Rising sea levels can flood coastal areas, and habitat changes can cause the extinction of some species of plants and animals.

The effects of climate change on plants and animals are difficult to measure, but potentially dramatic, which has some people worried, regardless of the exact cause. Many species inhabit precise areas, and even small changes in climate may cause harmful disruptions in habitat or the availability of food. In the past, animals could respond to these pressures by moving from one place to another. Today, however, human land development has limited and shrunk ranges and travel routes, making species migration in response to climate change much more difficult. Moreover, loss of key predator or prey species may affect the life cycles of other organisms in the food chain.

Organic processes, like plants converting carbon dioxide into oxygen, can also play an important role in regulating the earth's climate. Changes in the extent of snow, ice, or vegetation covering the planet's surface can alter key climatic processes with unforeseeable effects (changing the amount of carbon dioxide consumed by plants, for example, or the proportion of the sun's heat absorbed by the earth).

Increases in precipitation can cause floods and landslides, while decreases may lead to droughts and wildfires. This range of possible effects is one reason why many types of scientists are keenly interested in studying the earth's changing climate. Sometimes, people keep records that offer clues to climate patterns—the changing dates of bird migrations, for instance, or the onset of spring. Other records that come from nature—such as tree rings, preserved bones, and fish scales in ocean sediments—go back farther than more direct measures of climate, making them valuable indicators of climate change.

Mapping our Thoughts: Global Climate Change

Work with students to create a visual web, or mind map, of the possible impacts of global warming, regardless of cause, or global climate change. One has been included to help give inspiration on mind map construction.

Debate it! Global Hoax or Global Warning?

Global warming - is it our fault? Is it real, or just another kind of Rubbish?

Activity modified from one found at: http://www.ithaca.edu/looksharp/Books_Global%20Warming/Lesson%201/Lesson%201%20Teacher%20Guide.pdf.

Students [and teachers] will explore their preconceptions of the question, "Is global warming really happening?" and any bias. Ask students to think without talking about the following questions. Give them a piece of paper and ask, ""Does global warming exist?" Explain why you think this. What is your evidence?" and then give them a minute to formulate their ideas and then have them write down their answers. Have students share their answers with the class.

Ask students: Which of the following statements do you most agree with?

A. Global warming is definitely happening.

B. Global warming is probably happening

C. Global warming is not happening.

Tally the results and write the number for each answer on the board.

Ask: Where does your information about global warming come from? Write responses on the board. Divide media sources from other responses (i.e., parents).

These sources (point to media sources on the board) are from the media. Media refers to any communication that is mediated by a form of technology where the person delivering the message is not in the same location as the person receiving the message. This includes messages from the Internet, books, magazines, newspapers, documentary films, TV shows, video games, advertisements, songs, and even T-shirts.

Materials:

- Student Worksheet for decoding two video clips
- Two video clips on DVD or YouTube Channel: http://www.youtube.com/projectlooksharp
- Global Warning (The 11th Hour), 4 min & Exposed: The Climate of Fear, 2 min
- Teacher Sample Answer sheets

Discussion: Check students for prior understanding of fact vs. opinion, viewpoint, possible motivations for bias or perspective, fact vs. opinion, and emotional vs. logical arguments. Depending on your class this can be done different ways - one would be to start a group t-chart on chart paper about the different types - facts and opinions, logical vs emotional, etc.

Terms:

- Bias: Prejudice in favor of or against one thing, person, or group compared with another, usually in a way considered to be unfair.

- Viewpoint: the mental attitude that determines a person's opinions or judgments; point of view.
- Fact: Something believed to be true or real
- Opinion: a belief, a view, judgment, or assessment formed by a person about a particular matter
- Preconception/Preconceived Notion: An opinion or conception formed in advance of adequate knowledge or experience, especially a prejudice or bias.
- Emotional argument: one that appeals to your feelings, to your "heart." An appeal to emotion is a type of argument which attempts to arouse the emotions of its audience in order to gain acceptance of its conclusion. May or may not be true.
- Logical Argument: Logic requires decisive statements, valid [and accepted] premises, tested within a logical sequence with enough information to allow a verifiable conclusion. The most famous logical sequence, called the syllogism, was developed by the Greek philosopher Aristotle. His most famous syllogism is:
    - Premise 1: All men are mortal.
    - Premise 2: Socrates is a man.
    - Conclusion: Therefore, Socrates is mortal.

  In this sequence, premise 2 is tested against premise 1 to reach the logical conclusion. Within this system, if both premises are considered valid by the audience, there is no other logical conclusion than determining that Socrates is a mortal. Different premises could lead to very different conclusions about the same subject. For instance, these two syllogisms about the platypus reveal the limits of logic for handling ambiguous [unclear] cases:
    - Premise 1: All birds lay eggs.
      Premise 2: Platypuses lay eggs.
      Conclusion: Platypuses are birds.
    - Premise 1: All mammals have fur.
      Premise 2: Platypuses have fur.
      Conclusion: Platypuses are mammals.

  Though logic is a very powerful argumentative tool and is far preferable to a disorganized

Image Credit: http://www.phac-aspc.gc.ca/ncfv-cnivf/publications/images/Gr000001.jpg

argument, logic does have limitations. Logic is a very effective tool for persuading an audience about the accuracy of an argument. However, people are not always persuaded by logic. Sometimes audiences are not persuaded because they have used values or emotions instead of logic to reach conclusions. But just as often, audiences have reached a different logical conclusion by using different premises. Therefore, arguments must often spend as much time convincing audiences of the legitimacy of the premises as the legitimacy of the conclusions.

You May Know Best but, I Know Better

We are constantly being influenced by media messages, some about controversial topics. We will now take a look at two opposing media messages about global warming. Both of these video clips come from longer documentary films.

Image Credit: http://3.bp.blogspot.com/_BwO2ehR9QnA/TLb8gmnsW1I/AAAAAAAAAnk/iE3ix34Vi94/s1600/media+2.jpg.

Ensure that you have the media equipment available to play the video clips. Show students the following two clips, having them answer the same questions for each segment using the student sheet, after going through the question's to be sure that students understand their meaning:

- *The 11th Hour (Global Warning)* Trailer for Leonardo DiCaprio's documentary 4 min
- *Exposed: The Climate of Fear* Glenn Beck's TV special 2 min

Class discussion:

Now, garner a few opinions. Start by having the kids tell you how they feel about the video clips - invariably someone will say "he's wrong," and someone else will say "they're right", which may spark an entire classroom debate. During the discussion have students explain their own viewpoints and give reasons, and, if applicable, support judgments through references to a text, prior knowledge, or other sources of evidence.

- Of the two video clips presented, did you trust one source more than the other? Why?
- Were any opinions offered as facts? How might students be able to tell?
- Why might you be more easily swayed by one bias over another?
- Which media sources, in your opinion, offer the most accurate and credible information about global warming?
- Have students rank the reliability of their sources [ex. Uncle Gustavo, 30 year oil well driller vs. Ms. Jane, the 1st year science teacher]

Discuss their answers on their sheets, including some of the answers from the teacher sheets.

Media both affect and reflect the societies in which we live. Like fish in water, we are often oblivious to the culture in which we swim.

Although still a controversial subject, there is a growing consensus that global climate changes are being caused by environmental pollution, especially by greenhouse gases. Do we need to take more urgent action to halt this trend or is such thinking a myth brought about by flawed or incomplete science? Global warming is a particularly difficult issue as it demands a world-wide response. Many developing nations are understandably angered that a problem that seems to have been created by the rich, developed nations will have most impact on them, this has turned global warming into a highly politicized and contentious issue. A global consensus remains far off.

Until about 1960, most scientists thought it implausible that humans could actually affect average global temperatures, some scientists still don't, ex. the Oregon Petition; a document which has been signed by thousands of scientists, and which declares that humanity's CO2 emissions will not cause the "disruption of the Earth's climate".

Is human activity bringing about alarming global warming scenarios and related catastrophes or not? Have students find the answers to these questions. and be prepared to debate in a variety of ways, such as supporting their own argument; negating the argument of the opposing side; presenting challenges to the opposing side; and raising new scientific questions.

Students should be familiar with the terms, "global warming," the "greenhouse effect," and "greenhouse gases." Also, they should be aware that the U.S. is a leading producer of

greenhouse gas emissions that some scientists believe may contribute to global warming. Would that fact affect the US opinion on global warming?

Sample Discussion Statements:

"The price of ignoring global warming is huge. The price of thinking it exists when if it doesn't is that we develop sustainable resources: we are running out of fossil fuels whether global warming exists or not."
"The popularity of an appeal doesn't make the argument valid."
"If those theories are correct, is that an excuse to use up all the world's oil reserves, or to carry on polluting the world?"
"Global warming does exist, but we're not the cause."

For a sample of a debate on the topic go to:

http://www.idebate.org/debatabase/topic_details.php?topicID=13

1. Who produced and who sponsored [paid for] this message?

2. Who do you think is the target audience?

3. What is your evidence?

4. What is this video's purpose?

5. What messages does it give about global warming?

6. What techniques does it use to give you those messages?

7. Are the messages accurate and believable? Why do you think that?

8. What is left out of this message that might be important to know?

9. Who might benefit from this message?

10. Who might be harmed from this message?

The 11th Hour (Global Warning)
Trailer for Leonardo DiCaprio's Documentary
4 min

Film 1 Introduction

This clip is the trailer for the film *Global Warning*. The film was written and produced by the actor Leonardo DiCaprio. The film was distributed in 2007 under the title *The 11th Hour*.

Media Sample Questions & Answers

1) Who produced and who sponsored this message?	**Possible Answer:** This is a trailer for a movie written and produced by Leonard DiCaprio. It was sponsored by Global Green, Tree Media Group, and the Leonardo DiCaprio Foundation.
2) Who do you think is the target audience? What is your evidence?	**Possible Answer:** There are many possible answers to this question, including young people, people who like Leonardo DiCaprio, and so forth. Make sure that students back up answers with evidence.
3) What is its purpose?	**Possible Answer:** To promote the movie and to increase box office sales. To educate viewers about global warming. To promote attitudes and actions that address the threat of global warming. To scare viewers so that they will combat global warming.
4) What messages does it give about global warming?	**Possible Answer:** Earth's "perfect balance" is "breaking down" due to human civilization's "relentless consumption" and our "destructive addiction" to oil. Fossil fuel pollution is causing global warming. Scientists agree that global warming is one of the greatest challenges facing all of humanity. Weather- and climate-related catastrophes (storms, droughts, floods, etc.) are caused by global warming. Corporations and politicians are addicted to oil and are "resistant to change." We must support renewable energy and green technologies and elect politicians who support these views. We must learn more about global warming in order to save our planet. Probe for evidence for answers that are not clearly reflected in the text.

Media Sample Questions & Answers

5) What techniques does it use to communicate those messages?	**Possible Answer:** The narration by a celebrity adds credibility and interest. Scary words and text about human's impact on the environment with collages of dark and red images segmented into fast-moving boxes are reinforced by dramatic techno music. Hopeful narration and text about what we can do to combat global warming with brighter, airy, and mostly blue images are reinforced by positive stringed music.
6) Are the messages accurate and credible? Why do you think that?	**Possible Answer:** Answers will vary. Some students may find the source, imagery, and content credible, while others see a lack of credibility. It is important to probe for reasoning and to let students debate each other about degrees of credibility.
7) What is left out of this message that might be important to know?	**Possible Answer:** There is still significant scientific debate about the causes of global warming. Not all scientists see the causes as anthropogenic; some believe the current warming trend is due to natural fluctuations in climate. It is not possible to prove that weather-related catastrophes such as droughts, floods, and hurricanes are definitively caused by global warming. There is likely to be a devastating economic impact if society abandons fossil fuel use. Even an immediate and dramatic shift from a fossil fuel economy may not be enough to stop the effects of global warming.
8) Who might benefit from this message?	**Possible Answer:** Those who support the message, including environmental groups and some politicians. Companies and individuals whose livelihood is tied to the existence of and fear about global warming. DiCaprio and the producers of the film. All living things (if the message is accurate).
9) Who might be harmed by this message?	**Possible Answer:** Those who oppose the message, including some corporate interests and politicians. Companies and individuals whose livelihood is tied to continued unregulated use of cheap fossil fuel energy. All people (if the message is wrong and the global economy suffers from unneeded regulation).

Exposed: The Climate of Fear
Glenn Beck's TV special
2 min

Film 2 Introduction

We will now watch and analyze a second video about global warming that takes a different perspective. You will view two minutes from *Exposed: Climate of Fear*. The two hour special was produced by TV and radio commentator Glenn Beck, former host of *CNN Headline News*. It was aired May 2, 2007, on CNN. You will answer the same questions for this segment.

Media Sample Questions & Answers

1) Who produced and who sponsored this message?	**Possible Answer:** This was produced by TV commentator Glenn Beck and CNN. It was sponsored by CNN and its advertisers.
2) Who do you think is the target audience? What is your evidence?	**Possible Answer:** There are many possible answers to this question, including CNN viewers, people who like Glenn Beck, and so forth. Make sure that students back up answers with evidence.
3) What is its purpose?	**Possible Answer:** To increase ratings and bring advertising revenue for *CNN News*. To educate viewers about the media hype that may perpetuate myths about global warming. To promote attitudes and actions that question the reality of global warming. To promote Glenn Beck and *CNN News*, particularly with conservative viewers.
4) What messages does it give about global warming?	**Possible Answer:** The media generates irrational fear about global warming. Claims that severe weather are caused by global warming are false. Humans are not the sole cause of global warming. Scientists have been wrong about the climate in the past ("in the 1970s global cooling was the consensus").

Media Sample Questions & Answers

5) What techniques does it use to communicate those messages?	**Possible Answer:** Emotional narration by a celebrity news broadcaster. Use of dramatic images from movies and TV news and intense music that stirs outrage at media manipulation. Juxtaposing alarmist TV news reports with commentary by experts (male authors with PhDs) suggesting that global warming is a product of media hype not backed by accurate science.
6) Are the messages accurate and credible? Why do you think that?	**Possible Answer:** Answers will vary. Some students may find the source, imagery, and content credible, while others see a lack of credibility. It is important to probe for reasoning and to let students debate each other about degrees of credibility.
7) What is left out of this message that might be important to know?	**Possible Answer:** A great majority of leading climate scientists, including over 2,500 who participated in the United Nations Intergovernmental Panel on Climate Change (the IPCC) are in agreement that the Earth's climate is warming due to a mixture of human and natural factors. Although it is not possible to prove that global warming causes certain weather events (storms, drought, etc.), the IPCC has identified evidence of increased tropical storm activity in the North Atlantic since 1970 due to warmer tropical ocean temperatures. In the 1970s, some scientists suggested the planet was cooling (not a consensus as stated in the film). Their projections were based on relatively primitive climate modeling. Today's models are far more precise and accurate in predicting climate change.
8) Who might benefit from this message?	**Possible Answer:** Those who support the message, including some industry groups and politicians. Companies and individuals whose livelihood is tied to unregulated fossil fuel use. Beck and the producers of the film. All people (if the message is accurate).
9) Who might be harmed by this message?	**Possible Answer:** Those who are attacked by Beck's message, including environmental groups, some politicians, and perhaps the media (though media typically like controversy and hype, even if it is about the media). Companies (solar energy, green technologies, etc.), environmental groups, individuals, and politicians whose livelihood benefits from fear about global warming and the call for more regulation of the energy industry. All living things (if the message is wrong and global warming is a reality).

Fix It!

Regardless of the cause, or causes, we need to do whatever we can to lessen the impact and keep our planet healthy. Production of certain materials from scratch can release significant amounts of CO2 into the atmosphere. Aluminum production is a prime example—producing new aluminum creates 95% more CO2 than recycling old aluminum cans. In addition, recycling paper saves trees—for each ton of paper recycled, 17 trees are saved. Each of these trees can extract around 250 pounds of carbon dioxide from the air in a year.

Climate change is a complicated problem, but one of the most effective solutions is very simple: reduce the use of fossil fuels. Unlike many other environmental problems where there are just a few main sources of emissions (such as factories or power plants), everyone contributes to greenhouse gas emissions through daily activities that require energy. Electricity use, heating, transportation, and waste are the main sources of greenhouse gas emissions from individuals.

I've Got a Feeling

Materials: None

Explanation: To introduce the topic or provide concrete examples of discussion points have students see how feelings and emotions can spread have them participate in the following activity.

How to Play: One person begins, as the host, with a neutral emotion. The first guest knocks or rings the bell (saying "knock-knock" or "ding-dong"), and enters in

Recycling Facts

- By recycling 1 ton of paper, we save: 17 trees, 7,000 gallons of water, 463 gallons of oil, 3 cubic yards of landfill space, and enough energy to heat an average home for 6 months.
- Manufacturers can make one extra-large Tshirt out of only five recycled plastic soda bottles.
- Americans throw away enough aluminum every 3 months to rebuild our entire commercial air fleet.
- When one ton of steel is recycled, 2,500 pounds of iron ore, 1,400 pounds of coal, and 120 pounds of limestone are conserved.
- Recycling aluminum cans saves 95 percent of the energy required to make aluminum cans from scratch.
- The amount of aluminum recycled in 1995 could have built 14 aircraft carriers.
- Did you know that you can run a TV for 6 hours on the same amount of electricity that is saved by you taking and recycling just one aluminum can?
- Also, just by recycling one glass bottle, you can save enough electricity to light up a 100watt bulb for 4 hours

highly charged emotional state. Emotions that work well with this exercise include, excitement, fear, anger, jealousy, joy, sadness, etc. As soon as the host picks up on the emotion, she "catches" it, and interacts with the guest. The next guest enters with a different emotion, and the host and guest "catch" it. Things get more chaotic as more guests enter, as each new guest causes a different emotion to permeate the party. Once the first guest has entered, the participants can interact with different people until they notice a change in the emotion, and then they must adapt that emotion. The participants should not watch the new guests for the emotional state, rather, they should let the emotion "travel" to them as it will. To make things really tricky, two guests could enter at the same time with different emotions. The participants will be really energetic after this game, so plan accordingly to use that energy.

Have students relate this to how emotions and movements related to recycling, living green, and the Earth can grow, change, and/or spread. According to surveys 9 out of 10 people would recycle more if it were made easier. How could we make it easier? How does a movement spread?

Mapping our Minds: Creating Change

Work with students to create a MindMap, using the one included for inspiration, of what strategies might work and what strategies don't in getting people to change. What helps them want to change or not change? Do they believe their attitudes shape their behaviors more or do their behaviors shape their attitudes more? Can we reasonably expect to have "good" behavior from people unless we create "good" feelings in them? Feelings play a crucial role in determining human behavior. What if they feel powerless or not listened to? Does the situation seem too big and out of their control? Discuss with students the included facts and discuss how because we are all part of the problem, we can all be part of the solution. One individual's contribution may not seem to make a big difference, but a lot of people acting together can make a huge difference.

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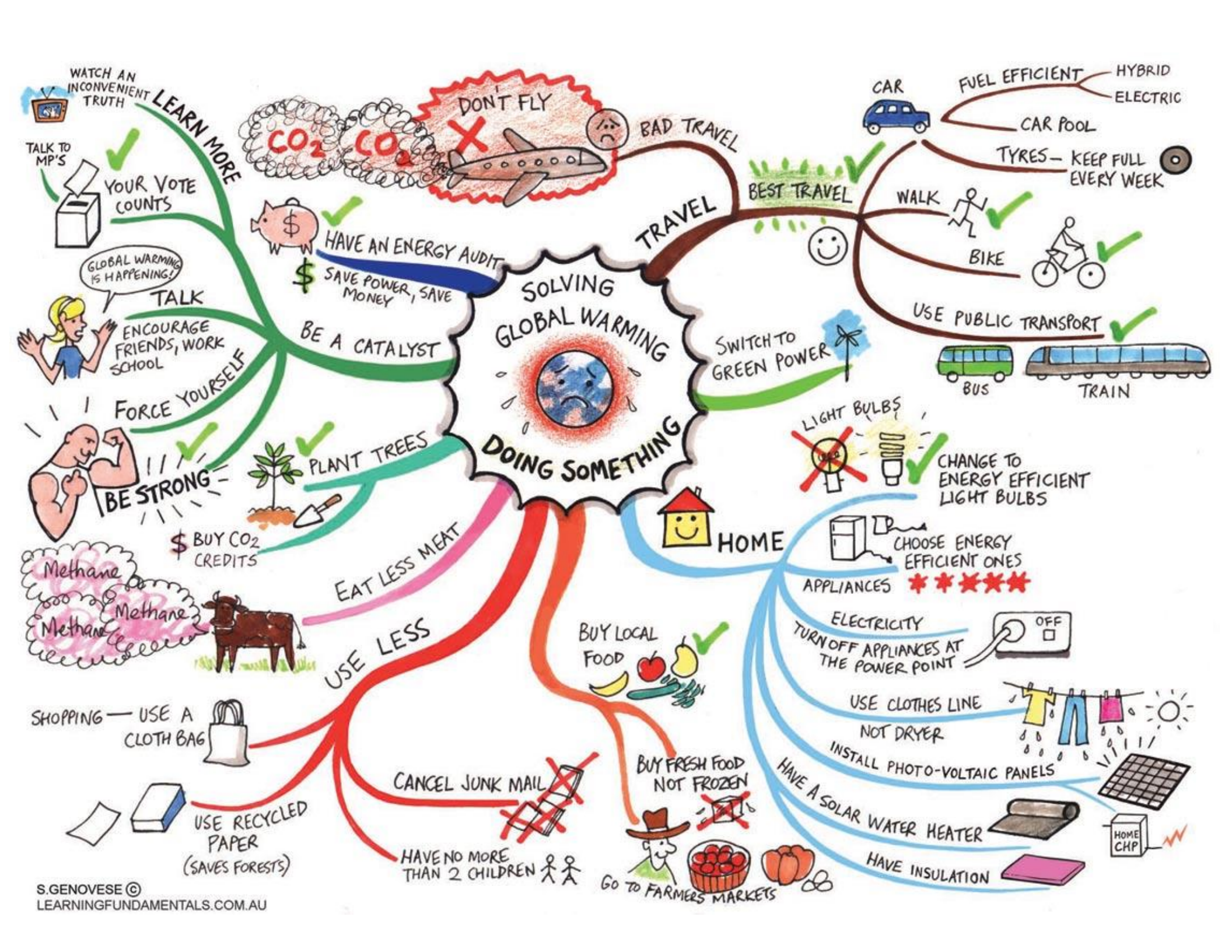
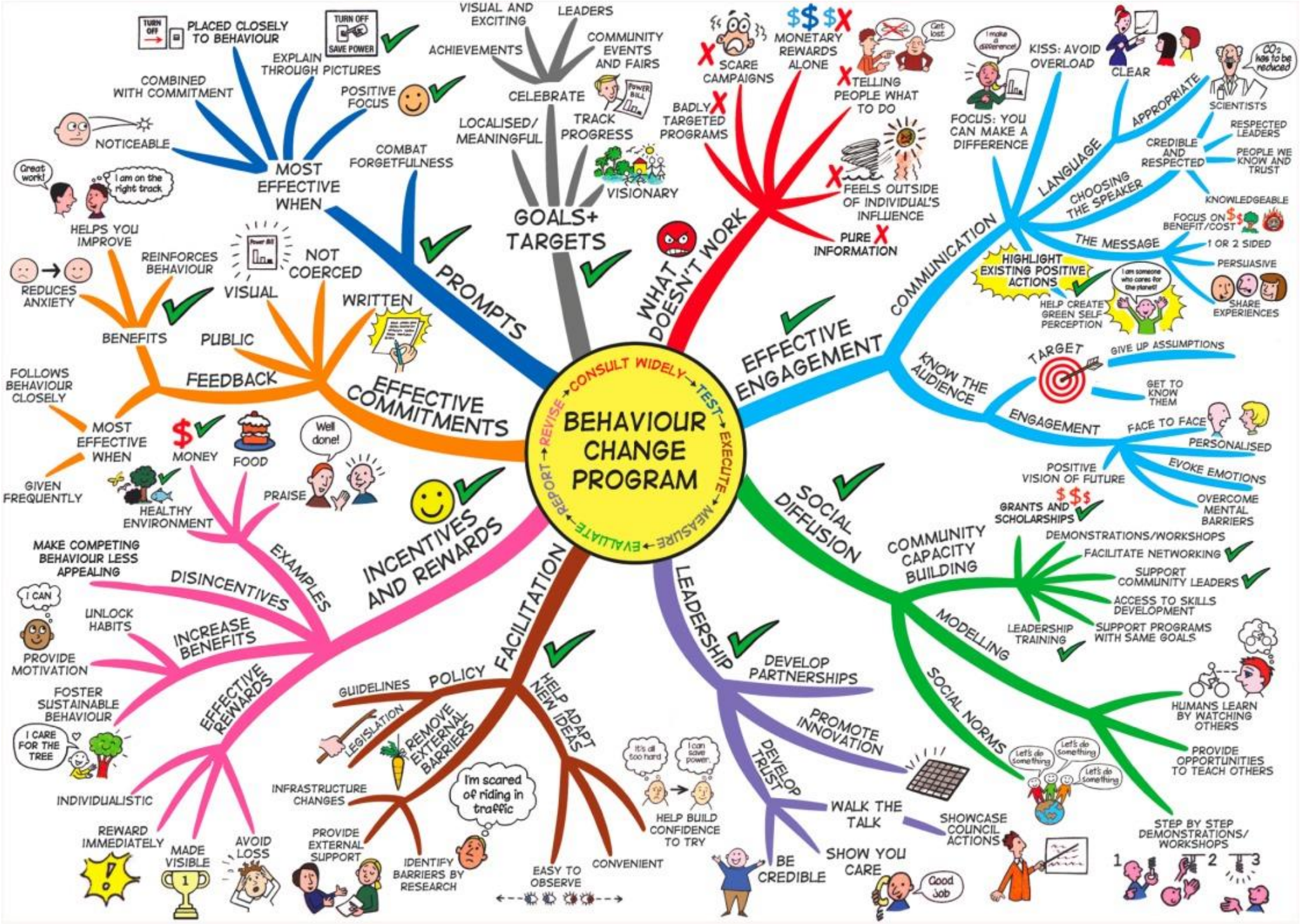



BEHAVIOUR CHANGE PROGRAM
CONSULT WIDELY
TEST
EXECUTE
MEASURE
EVALUATE
REPORT
REVISE
PROMPTS
PLACED CLOSELY TO BEHAVIOUR
EXPLAIN THROUGH PICTURES
COMBINED WITH COMMITMENT
POSITIVE FOCUS
NOTICEABLE
MOST EFFECTIVE WHEN
COMBAT FORGETFULNESS
GOALS+ TARGETS
VISUAL AND EXCITING
LEADERS
ACHIEVEMENTS
COMMUNITY EVENTS AND FAIRS
CELEBRATE
TRACK PROGRESS
LOCALISED/ MEANINGFUL
VISIONARY
WHAT DOESN'T WORK
SCARE CAMPAIGNS
MONETARY REWARDS ALONE
BADLY TARGETED PROGRAMS
TELLING PEOPLE WHAT TO DO
FEELS OUTSIDE OF INDIVIDUAL'S INFLUENCE
PURE INFORMATION
EFFECTIVE ENGAGEMENT
COMMUNICATION
FOCUS: YOU CAN MAKE A DIFFERENCE
KISS: AVOID OVERLOAD
CLEAR
APPROPRIATE
SCIENTISTS
LANGUAGE
CHOOSING THE SPEAKER
CREDIBLE AND RESPECTED
RESPECTED LEADERS
PEOPLE WE KNOW AND TRUST
KNOWLEDGEABLE
THE MESSAGE
FOCUS ON BENEFIT/COST
1 OR 2 SIDED
PERSUASIVE
SHARE EXPERIENCES
HIGHLIGHT EXISTING POSITIVE ACTIONS
HELP CREATE GREEN SELF PERCEPTION
KNOW THE AUDIENCE
TARGET
GIVE UP ASSUMPTIONS
GET TO KNOW THEM
ENGAGEMENT
FACE TO FACE
PERSONALISED
EVOKE EMOTIONS
OVERCOME MENTAL BARRIERS
POSITIVE VISION OF FUTURE
GRANTS AND SCHOLARSHIPS
EFFECTIVE COMMITMENTS
PUBLIC
WRITTEN
VISUAL
NOT COERCED
REINFORCES BEHAVIOUR
HELPS YOU IMPROVE
REDUCES ANXIETY
BENEFITS
FEEDBACK
FOLLOWS BEHAVIOUR CLOSELY
MOST EFFECTIVE WHEN
GIVEN FREQUENTLY
INCENTIVES AND REWARDS
MONEY
FOOD
PRAISE
HEALTHY ENVIRONMENT
EXAMPLES
DISINCENTIVES
MAKE COMPETING BEHAVIOUR LESS APPEALING
INCREASE BENEFITS
UNLOCK HABITS
PROVIDE MOTIVATION
EFFECTIVE REWARDS
FOSTER SUSTAINABLE BEHAVIOUR
INDIVIDUALISTIC
REWARD IMMEDIATELY
MADE VISIBLE
AVOID LOSS
FACILITATION
POLICY
GUIDELINES
LEGISLATION
REMOVE EXTERNAL BARRIERS
INFRASTRUCTURE CHANGES
HELP ADAPT NEW IDEAS
PROVIDE EXTERNAL SUPPORT
IDENTIFY BARRIERS BY RESEARCH
EASY TO OBSERVE
CONVENIENT
LEADERSHIP
DEVELOP PARTNERSHIPS
PROMOTE INNOVATION
DEVELOP TRUST
HELP BUILD CONFIDENCE TO TRY
BE CREDIBLE
WALK THE TALK
SHOW YOU CARE
SHOWCASE COUNCIL ACTIONS
STEP BY STEP DEMONSTRATIONS/ WORKSHOPS
SOCIAL DIFFUSION
COMMUNITY CAPACITY BUILDING
DEMONSTRATIONS/WORKSHOPS
FACILITATE NETWORKING
SUPPORT COMMUNITY LEADERS
ACCESS TO SKILLS DEVELOPMENT
LEADERSHIP TRAINING
SUPPORT PROGRAMS WITH SAME GOALS
MODELLING
SOCIAL NORMS
HUMANS LEARN BY WATCHING OTHERS
PROVIDE OPPORTUNITIES TO TEACH OTHERS

When the garbage truck comes and takes away our garbage, where does it go?

Read and discuss the poem, "Sarah Cynthia Sylvia Stout Would Not Take the Garbage Out" by Shel Silverstein with the students. Have students identify the kind of text it is, ex .a poem, a play, a story, fiction, non-fiction? Can a poem also be a story? What was the author's purpose? (e.g., to entertain, to inform, to describe, to persuade, to share feelings, to share experiences) Might he have had more than one? Shel Silverstein once said, "I have never written anything without a purpose. Everything I write is to say something." When they asked him about "Sarah Cynthia Sylvia Stout" he said, "Now that one has a definite meaning we should all pay attention to, since we all live in this house together." (A boy named shell, 1988) What house is Shell talking about? The Earth? This poem is a very strong didactic [designed to teach] poem that fits wonderfully for our era and situation right now. What or who could Sarah represent? Ex. We are the little girl. What could be the point of the poem? We need to take care of the earth. We, everyone in the country, are the little girl who doesn't want to take out the trash. Have the students determine the problem in the poem, recognize its solution & decide what Sarah could have done with her garbage. What could have been recycled? What could be put in the compost pile? Poor Sarah met an awful fate for not taking the garbage out. In students' opinion, will we end up like Sarah if we don't care for our environment? Ask the students if they know what happens to garbage after they put it in the garbage can. Write their thoughts on the board. Ask the students to predict what it would be like and what would happen if their community ran out of room for garbage.

When people participate in a neighborhood curbside recycling program, items such as glass jars, newspaper, aluminum beverage cans, steel cans, plastic milk jugs, and soft drink bottles are picked up and taken to a recycling center. In some communities, where there is no curbside recycling program, people can collect their recyclables and take them to a collection or recycling center. There, the materials are sorted by grade, baled, crushed, or otherwise processed for transport, and sold to companies that will make new products out of them. Materials such as paper and plastic are manufactured in different grades. Newsprint, for instance, is a different grade of paper than computer print-out paper. Each grade is recycled separately.

Recycling makes us more energy-efficient.

You may want to introduce this topic with a book on energy such as *My Light* by Molly Bang. Energy is one of the most important parts of our world—it makes things happen. Energy means the "ability to do work." Every time you flip a light switch on; use hot water; or ride in a car, bus, train, or plane, you are using energy. Each time you watch TV or use a computer, you are using energy. All of the clothes that you wear, toys you play with, and food you eat are products made from processes that require energy.

It often takes a great deal more energy to create something from scratch than to recycle it. For example, it takes twice as much energy to burn plastic as to recycle it; it takes 64% more energy to make paper than to recycle it; and recycling just one pound of steel can save enough energy to run a 60-watt bulb for one day.

Waste-full Energy

While Earth's sources of energy (oil, natural gas, coal) continue to serve us well, they are known as nonrenewable resources, that means they will eventually be used up and we can't get any more of them. Once we use all of our supplies, we will have to depend on new sources of energy. We're already looking for new energy sources so that we can conserve (save) what is left of those that come from within the Earth. That's where garbage, among other things like wind, water, and solar energy, comes in. Did students know that you can get energy from garbage? There are two ways that we can use our trash to make energy.

Some communities and waste disposal companies burn part of the garbage in waste-to-energy plants. These facilities burn garbage and the burning garbage produces steam which can be used to make electricity. This process creates heat that can be changed into to fuel and electricity. Waste-to-energy facilities take a large amount of trash and make it smaller by burning it. This reduces the amount of trash that piles up in our landfills, which is better for the environment, but they still create a lot of smoke which goes up into the atmosphere and ash [which has to be buried], which aren't.

Most often, garbage is taken to a landfill where it is covered with dirt and that is where the second way for us to use trash for energy comes in. It involves the garbage that we dispose of in landfills. As this trash decomposes, it produces methane gas (also created by cows when they burp, but they burp less, and make more milk, if they eat herbal oregano supplements). Too often, this valuable stinky source of energy is not used. Now, however, over 150 landfills in the United States are using the gas, captured by a special pipe system [a waste to energy system] set up in the landfill, to generate electricity; provide fuel for factories, schools, and other facilities; and to produce natural gas for general distribution.

Have students use the following graphic organizer to help them understand how our trash can help us generate power and electricity.

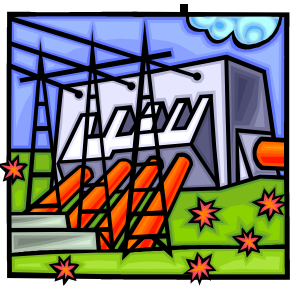
Trash's Path to Becoming Energy

Your House

Produces

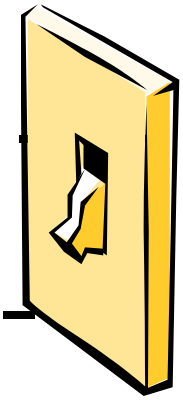
That goes to

That produces: _____



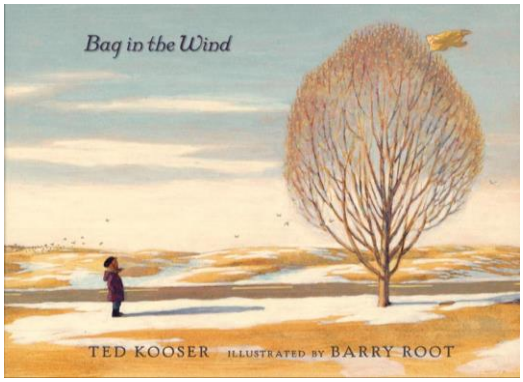
Burns methane

Delivered on wires



What is a Landfill?

Launching the Learning:



Introduce this topic by reading a book about landfills such as *Bag in the Wind* by Ted Kooser. [The life of a plastic bag in a landfill is extraordinarily uneventful and long—15,000 years, give or take a few millennia—but in a singular first children's book, Pulitzer Prize-winning poet Ted Kooser follows a plastic bag on its capricious journey from a landfill into a series of townspeople's lives.] Place the book you have selected for read aloud on the ledge of the chalkboard or in front of the students and have the students look at the picture and title on the cover and use their schema to make predictions about the story [model this procedure for your students]. They can write a word or a complete thought. After they have settled in for read aloud discuss what is written and make predictions as a group about the story. Were they right?

Note: It always helps to look over a book before you read it aloud. If the prose in a book is too long for younger students, shorten or skip overly descriptive passages. Model interactive techniques and encourage your students to get into the act. Invite them to describe pictures, read bits of text, or guess what will happen next. Dramatize roles in the story with them. Expect lots of questions, especially from young children. Take time to answer these as you go along.

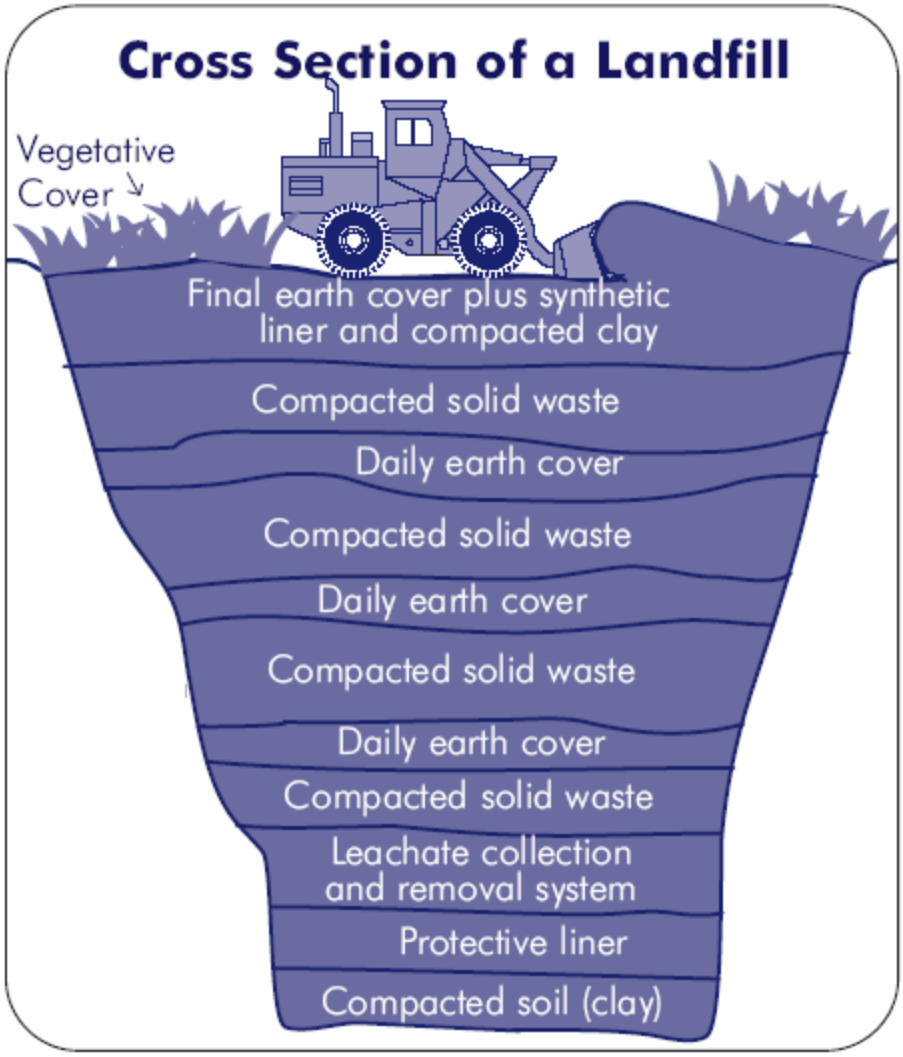


Image Brainstorm

Project an image of a landfill on the computer, projector, or smart board, or have several printed images of landfills and ask students to tell you everything they can about the picture. Choose images that make sense to them and also allow you to connect to the new content and/or concepts students will be learning.

Landfills are the most common form of waste disposal and are an important component of an integrated waste management system. A landfill is a large area of land or an excavated site that is specifically designed and built to receive wastes. Today, about 56 percent of our country's trash is disposed of in landfills.

In the past, garbage was collected in open dumps. These uncovered and unlined sites allowed leachate, a disgusting and smelly liquid formed by decomposing waste, to soak into the soil and ground water. Open dumps also attracted rodents and insects, emitted odors, and created fire hazards. Most of these small and unsanitary dumps have been replaced by large, modern facilities that are designed, operated, and monitored according to strict federal and state regulations. Today's landfills try to eliminate the harmful and undesirable characteristics of dumps to help protect public health and the environment. They are filled by trucks hauling garbage to the site. A fee is paid to the landfill operator based on how much garbage the truck carries. This fee is called a tipping fee because the trucks lift their loads to 'tip' them on the face of the landfill. where the garbage is spread out, then crushed and compacted with heavy equipment and covered daily with soil or a special fabric cover. Rainwater and liquids from the decomposing waste still combine to create disgusting and smelly leachate, which collects at the bottom of the landfill. In a landfill, leachate is pumped out and treated in a leachate or sewage treatment facility. Gas is also created as the organic material decomposes. Half of this gas is methane, which is combustible (flammable) and can be used as fuel. It is collected so that the landfill doesn't explode from the buildup. Almost all of the rest of the gas is primarily carbon dioxide; it, too, can be recovered and used for industrial purposes.

In addition to being safer for the environment and neighboring communities, these larger landfills hold more trash than the dumps of the past. In 2001, about 1,850 municipal solid waste landfills were operating in the United States (EPA, 2003). While this number is significantly smaller than the number of landfills 25 years ago, new landfills—often called megafills due to their size—can accommodate significantly more garbage. This greater capacity is necessary to keep up with the steady growth of garbage.

Landfills that handle hazardous wastes are specially designed with two sets of liners and two leachate detection (remember, leachate is a liquid formed by decomposing waste), to soak into the soil and ground water. After a landfill is capped, filled up, and covered in grass. For decades to come, even while the land may be used for recreation sites such as parks, golf courses, and ski slopes, landfill companies must monitor their old landfill sites to make sure the land is safe, there aren't any leaks or potential problems.

Even with the new methods, we're fast running out of space for landfills—especially near cities. Seaside cities have been dumping trash into their oceans for decades to get around the problem, but even the ocean can only do so much, and now, with widespread marine ecological collapse, this is no longer a good or safe option. Worse yet, it's difficult to find land in suburban and rural areas whose residents will allow landfills to come into their areas without a fight. And the methods don't always work perfectly.

Landfills can pose other problems if not properly designed or managed. If a liner leaks, for example, the underlying soil and ground water can become contaminated. Additionally, since landfills are often located in remote areas, waste must be hauled long distances, which might result in environmental impacts from increased truck traffic (e.g., air pollution) and noise from truck traffic and the use of equipment onsite. Additionally, landfills often compete for local garbage within a given municipality. Competition can lead to reduced support for recycling and other waste reduction programs. The squeeze for landfill land is only going to get worse in the future.

Landfill Facts

- The first garbage dump was created in 500 BC by the ancient Greeks in Athens. Residents were required to take their trash at least 1 mile away from the city walls to dump.
- Paper takes up as much as 50 percent of all landfill space. Recycling 1 ton of newspapers would save 3 cubic feet of that space.
- It used to be believed that all garbage decomposed in a landfill, but in a study of waste buried for more than 15 years, Professor William Rathje of the University of Arizona found perfectly readable newspapers and chicken bones with meat still on them, proving that waste does not decompose completely in a landfill.

For example, electronics are made from many different resources, including plastic (made from petroleum) and various metals (mined from the earth). That's why recycling electronics is so important to recover these materials to use again. Recycling electronics requires de-manufacturing, or dismantling, them, which is labor-intensive, but it yields valuable resources that can be used to make new electronics or other products. In 1998, more than 112 million pounds of materials were recovered from electronics including steel, glass, plastic, and precious metals.

Electronics (especially computers) become outdated very quickly and need to be replaced often. In fact, nearly 250 million computers will become obsolete in the next 5 years. When no

longer used, electronics are often thrown away, ending up in landfills and incinerators. Electronics can contain substances that can contaminate the soil and ground water. In fact, TVs and computers can contain an average of 4 pounds of lead (depending on their size, make, and vintage) as well as other potential toxics like cadmium, mercury, beryllium, nickel, zinc, and brominated flame retardants.

The Landfill Harmonic

"The world sends us garbage, we send back music." Favio Chavez-Recycled Orchestra Director

Before the following discussion have students watch the three minute Landfill Harmonic movie trailer found at: http://www.landfillharmonicmovie.com/#prettyPhoto[3425-Movie Teaser]/0/

The story develops in one of the poorest slums in Latin America. Just outside Asuncion, Paraguayans capital; Cateura is the city's trash dump. It is built on a landfill. Here, people live in a sea of garbage. And they live *from* garbage. Every day, tons of rotting detritus spill from trucks and people swarm over it to pick the pieces of trash that are their livelihood.

The people of Cateura may be the poorest of the poor but they are proud and the life of their slum is vibrant. Family bonds, rivalries and friendships are intense.

Surrounded by stories of drug-violence, alcoholism and destitution, they make herculean efforts to reaffirm their life and dignity.

A few years ago, one of the garbage pickers, "Cola", an untutored genius of the slum, got together with local musician Favio Chávez to make instruments for the children of the slum. There was no money for real instruments so together they started to make instruments from trash – violins and cellos from oil drums, flutes from water pipes and spoons, guitars from packing crates.

With children like Ada and Tania and with the support of many in the slum, Favio slowly put together one of the world's most unlikely orchestras. It is entirely made of garbage. They call it "**The Recycled Orchestra**".

Chávez got to know these kids and their families over 5 years ago while working on a waste recycling project at the landfill of Cateura. In this area more than 40% of children don't finish school because their parents need them to work. Being an environmental engineer but with a musical background, one day he decided to help the children by teaching them music lessons. The idea was simply to keep the kids from playing in the landfill.

"At first it was very difficult because we had no place to rehearse and we had to teach in the same place where the parents were working in the trash," said Chávez. "The children knew nothing about music and it was very difficult to contact parents because many of them do not live with their children."

Eventually, parents began to see that playing music was keeping their kids out of trouble, some even reclaiming children they had previously abandoned.

Soon there were more children wanting lessons than there were instruments, so Chávez and Nicolas "Cola" one of the garbage pickers experimented with making some out of recycled materials from the landfill. String and wind instruments are made with oil tin cans, forks, bottle caps, and whatever is around. "Eventually the recycled instruments were improved, and in many cases, they now sound better than the wooden Made In China instruments the more able children play on."

The recycled instruments serve another, more practical purpose: The kids can safely carry them. "For many children, it was impossible to give them a violin to take home because they had nowhere to keep it and their parents were afraid they would be robbed or the instrument would be sold to buy drugs."

The Orchestra had remained unheard of for many years. The launching of the Landfill harmonic short teaser on the Internet triggered a social media events that changed this. "More things have happened in the last 7 months, than in the last 7 years on our lives". Since then, the Orchestra has traveled to many places and soon, as we are getting close to finishing our movie, the plans are to align the release, festival and premieres of the film with a tour of the Orchestra in the U.S., Europe and other countries as well.

The Orchestra has grown from just a few musicians to over 35. Their recent fame have peak the interest of the families and children of the community in such way, that many children are now

enrolling for music classes. The music school of Cateura, does not have their own building yet, but teaches music and how to build recycled instruments to more than 200 kids of the landfill.

Explore the website with students to see and learn more about the kids of Cateura, the landfill, the community, the story, and the music.

http://www.landfillharmonicmovie.com/#prettyPhoto[3425-The Landfill]/11/

Sarah Cynthia Sylvia Stout
Would not take the garbage out!
She'd scour the pots and scrape the pans,
Candy the yams and spice the hams,
And though her daddy would scream and shout,
She simply would not take the garbage out.
And so it piled up to the ceilings:
Coffee grounds, potato peelings,
Brown bananas, rotten peas,
Chunks of sour cottage cheese.
It filled the can, it covered the floor,
It cracked the window and blocked the door
With bacon rinds and chicken bones,
Drippy ends of ice cream cones,
Prune pits, peach pits, orange peel,
Gloppy glumps of cold oatmeal,
Pizza crusts and withered greens,
Soggy beans and tangerines,
Crusts of black burned buttered toast,
Gristly bits of beefy roasts. . .
The garbage rolled on down the hall,
It raised the roof, it broke the wall. . .
Greasy napkins, cookie crumbs,
Globs of gooey bubble gum,
Cellophane from green baloney,
Rubbery blubbery macaroni,
Peanut butter, caked and dry,
Curdled milk and crusts of pie,
Moldy melons, dried-up mustard,
Eggshells mixed with lemon custard,
Cold french fried and rancid meat,
Yellow lumps of Cream of Wheat.
At last the garbage reached so high
That it finally touched the sky.
And all the neighbors moved away,
And none of her friends would come to play.
And finally Sarah Cynthia Stout said,
"OK, I'll take the garbage out!"

But then, of course, it was too late. . .
The garbage reached across the state,
From New York to the Golden Gate.
And there, in the garbage she did hate,
Poor Sarah met an awful fate,
That I cannot now relate
Because the hour is much too late.
But children, remember Sarah Stout
And always take the garbage out!
Shel Silverstein, 1974

Luscious Layered Landfill

To teach students how a modern landfill functions (that is, how its many layers contain garbage and prevent leakage into soil or ground water). Students will construct edible models of a landfill to learn about its different layers and their functions.

Key Terms:

- Landfill
- Clay liner
- Plastic liner
- Leachate
- Leachate collection pipes
- Methane
- Decompose
- Rodent

Materials:

- One 8-ounce pliable clear plastic cup per student
- Five chocolate sandwich cookies per student
- One 8-ounce box of raisins
- One fruit rollup/fruit leather per student
- Two graham crackers per student
- Two pretzel or cracker sticks per student
- One package of birthday candles
- One set of matches
- One scoop of chocolate yogurt (or pudding) per student
- Two tablespoons of whipped cream per student
- One plastic knife per student
- One plastic fork per student
- One handful (per student) of a variety of small chewable fruit snacks
- One copy of Anatomy of a Landfill handout per student

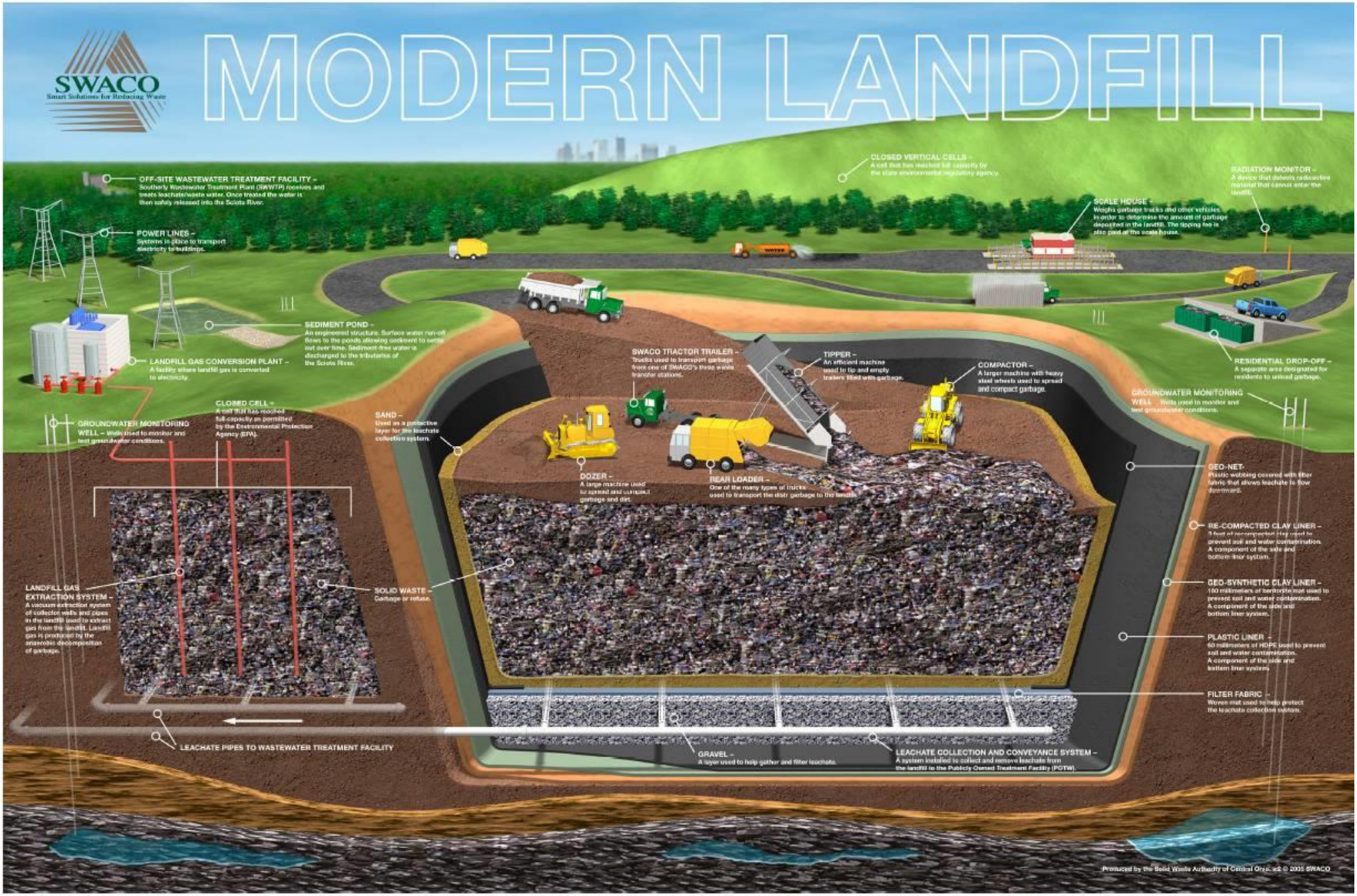
Explain the purpose of a landfill to students and explain that they will construct their own model landfills in class. Copy and distribute the Anatomy of a Landfill handout. Using the handout, go over each layer's name and function with students.

1. Distribute a cup and five chocolate sandwich cookies to each student. Explain that the cup represents an excavated hole in the ground.
2. Have students carefully "unscrew" two of their cookies so that one half has white cream and the other is bare. Students should have two cookie halves with white cream and

two cookie halves without cream. Crush the bare cookie halves into small pieces and put them into the cup. Explain that the crushed cookies represent a layer of soil that is placed in the bottom of real landfills.

3. Next, have the students take the cookie halves with white cream and break them up into two or three pieces. Direct students to place the pieces in the cup with the white cream face up. These pieces represent a layer of clay that is put on top of the soil in real landfills
4. Have students use the plastic knife or scissors to cut their fruit rollups to roughly fit the size of the top of cup and slide them into place (will push up on sides) on top of the cookies to represent a plastic liner. Plastic liners prevent leachate from escaping from a landfill into the ground. Leachate is liquid created when trash decomposes.
5. Have students crush and add their graham crackers to represent a sand layer. This layer is used to prevent liquids in landfills from seeping out.
6. Have students place raisins on top to represent a layer of pebbles. Like the sand layer, pebbles provide further protection against leachate leaks.
7. Have students rip the pretzel/cracker sticks in half and bite off both ends to represent leachate pipes. Stick pipes into pebble layer. These pipes collect any leachate that collects on top of the liners.
8. Ask students to sprinkle the fruit snacks on top of the raisins. The fruit snacks represent pieces of garbage. Ask students to think about what happens when a landfill or "cup" is filled up with trash? How can they reduce the amount of trash that they send to the landfill?
9. Give each student a scoop of yogurt/pudding on top of the candies. Then, have the students add one more layer of fruit snacks on top of the yogurt/pudding. The yogurt layer represents the seepage created from rain seeping through the garbage. Explain that in a real landfill, more layers of garbage or "fruit snacks" are placed on the landfill each day, so that liquid from the decomposition of the trash is continually created.
10. Direct students to "unscrew" their two remaining cookies and crush another layer of the bare cookie halves, without the cream, on top of the fruit snacks and yogurt/pudding to represent soil again. This layer reduces the amount of rain water that reaches the garbage.
11. Each student should use a layer of whipped cream to "cap" the landfill or cover it (as would a plastic cap) in order to prevent odor, insect, and rodent problems.
12. In front of the class, stick a candle deep into your own edible "landfill" and light it. Explain that the candle represents the methane gas recovery system, which draws methane gas from the decomposing garbage. The flame represents energy that can be generated by burning the captured methane gas.
13. Have students eat their landfills as a snack. When they get to the bottom of their cup, ask students to notice whether their cookie or "soil" layer is dry, or whether the ice cream or "leachate" leaked past the many layers and the fruit roll-up liner to soak the cookies. Remind students that if they built their landfill correctly, their cookies will be dry, just as in a real landfill the soil remains protected from leachate.

14. After enjoying the luscious layered landfill as a snack, ask the students if they remember the purpose of all the different parts, such as the fruit roll-up, the licorice, the cookies, and the candle.


SWACO
Smart Solutions for Reducing Waste
MODERN LANDFILL
OFF-SITE WASTEWATER TREATMENT FACILITY – Southerly Wastewater Treatment Plant (SWWTP) receives and treats leachate/waste water. Once treated the water is then safely released into the Scioto River.
POWER LINES – Systems in place to transport electricity to buildings.
SEDIMENT POND – An engineered structure. Surface water run-off flows to the ponds allowing sediment to settle out over time. Sediment-free water is discharged to the tributaries of the Scioto River.
LANDFILL GAS CONVERSION PLANT – A facility where landfill gas is converted to electricity.
GROUNDWATER MONITORING WELL – Wells used to monitor and test groundwater conditions.
CLOSED CELL – A cell that has reached full capacity as permitted by the Environmental Protection Agency (EPA).
LANDFILL GAS EXTRACTION SYSTEM – A vacuum extraction system of collector wells and pipes in the landfill used to extract gas from the landfill. Landfill gas is produced by the anaerobic decomposition of garbage.
LEACHATE PIPES TO WASTEWATER TREATMENT FACILITY
SOLID WASTE – Garbage or refuse.
SAND – Used as a protective layer for the leachate collection system.
CLOSED VERTICAL CELLS – A cell that has reached full capacity by the state environmental regulatory agency.
SCALE HOUSE – Weighs garbage trucks and other vehicles in order to determine the amount of garbage deposited in the landfill. The tipping fee is also paid at the scale house.
RADIATION MONITOR – A device that detects radioactive material that cannot enter the landfill.
RESIDENTIAL DROP-OFF – A separate area designated for residents to unload garbage.
GROUNDWATER MONITORING WELL – Wells used to monitor and test groundwater conditions.
SWACO TRACTOR TRAILER – Trucks used to transport garbage from one of SWACO's three waste transfer stations.
TIPPER – An efficient machine used to tip and empty trailers filled with garbage.
COMPACTOR – A larger machine with heavy steel wheels used to spread and compact garbage.
DOZER – A large machine used to spread and compact garbage and dirt.
REAR LOADER – One of the many types of trucks used to transport the distr garbage to the landfill.
GEO-NET – Plastic webbing covered with filter fabric that allows leachate to flow downward.
RE-COMPACTED CLAY LINER – 3 feet of recompacted clay used to prevent soil and water contamination. A component of the side and bottom liner system.
GEO-SYNTHETIC CLAY LINER – 180 millimeters of bentonite mat used to prevent soil and water contamination. A component of the side and bottom liner system.
PLASTIC LINER – 60 millimeters of HDPE used to prevent soil and water contamination. A component of the side and bottom liner system.
FILTER FABRIC – Woven mat used to help protect the leachate collection system.
GRAVEL – A layer used to help gather and filter leachate.
LEACHATE COLLECTION AND CONVEYANCE SYSTEM – A system installed to collect and remove leachate from the landfill to the Publicly Owned Treatment Facility (POTW).
Produced by the Solid Waste Authority of Central Ohio. v2 © 2005 SWACO

A Landfill Is No Dump!

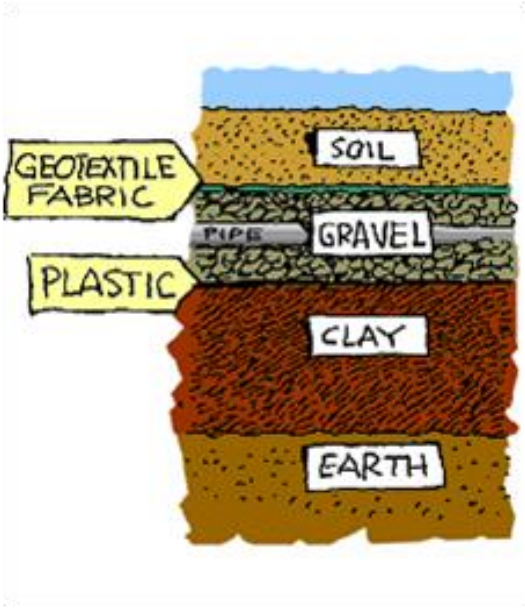
To teach students where garbage goes and explain the difference between unlined trash "dumps" of the past and today's specially designed landfills, Students will construct models of an old-fashioned "dump" and a modern landfill in class and observe their differences.
A landfill must not let the liquid contaminants seep into the ground water or soil. Therefore, all modern landfills must be lined with either plastic or clay to prevent leachate pollution. But which landfill liner is better? Which will successfully prevent leachate pollution? Clay, plastic, or neither?

Materials:

- transparent 2-liter soda bottles or water bottles cut in half with caps
- 1 bag each of sand, gravel, topsoil, clay dirt
- Materials for garbage to put between layers (optional)
- plastic wrap
- food coloring - red or blue or green
- cups of water
- Landfill Layers Cards (cut apart)

Have students:

1. Tap 3 holes in the bottle cap and replace the bottle cap on the bottle.
2. After cutting the bottle in half place the top half of the bottle, cap-side-down, inside of the bottom half of the bottle.
3. Place their liner at the bottom. If plastic - lay it on the bottom and press flat. If clay, pack it down with their fingers.
4. Have students randomly select any or all three of the soils - sand, gravel, topsoil and begin layering the soils, "garbage" in between if you decide, have students be sure to pack them with their fingers. Or use the materials recommended on the cards you pass to them.
5. Students can layer their soils as thick as they want and as few or many layers as they want, if they've chosen their own materials, when they're done constructing their land fill, add a few drops of food coloring to their cup/container of water. The colored water represents leacheate.
6. Have students pour the colored water into their landfill and time how fast the water drains and measure how much water leaks.
7. What happened? Did the leachate leak through?



Have students repeat the exercise and change their materials or do it with other groups, recording and graphing their results. What did others find? How do different landfills compare? Was using clay or a plastic liner the most effective way of preventing leachate

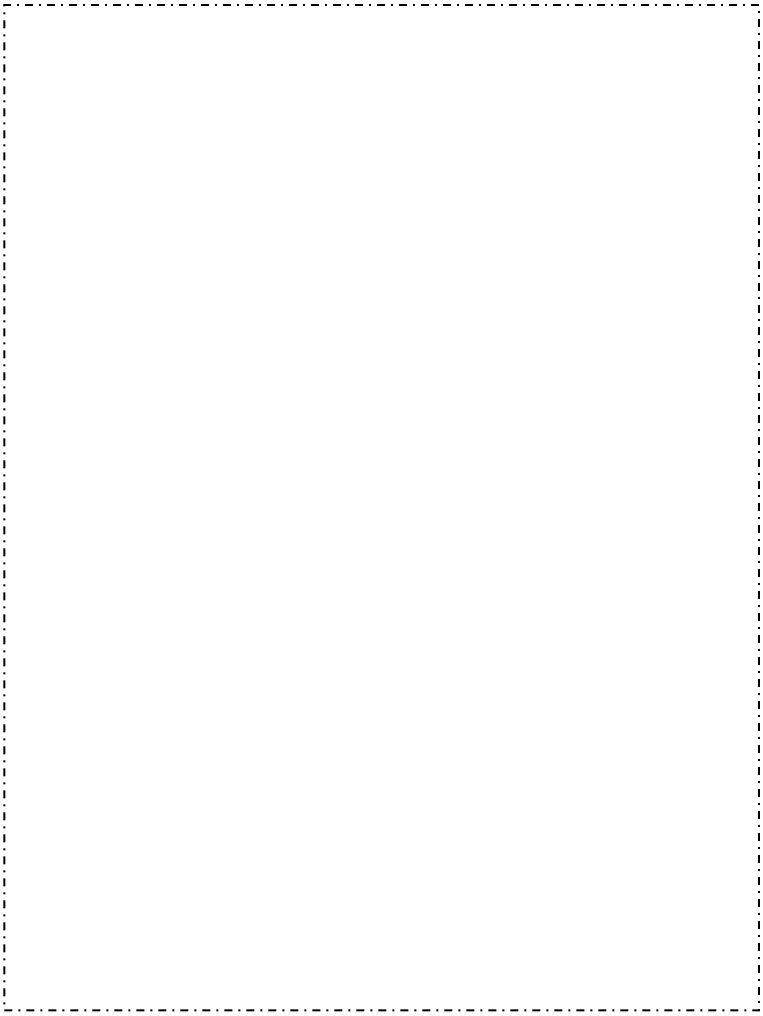
pollution?

Discussion Points:

1. Ask students to decide, based on the experiment results, which landfill is better for the environment and why. Which kind of disposal facility would they rather have in their neighborhood?
2. Have students determine how an unlined landfill or “dump” could pollute ground water and surrounding soil.

Potting Soil Sand Clay	Potting Soil Sand Plastic	Potting Soil Sand Clay Plastic
Potting Soil Gravel Clay	Potting Soil Gravel Plastic	Potting Soil Gravel Clay Plastic
Gravel Sand Clay	Gravel Sand Plastic	Gravel Sand Clay Plastic
Potting Soil Sand Gravel Clay	Potting Soil Sand Gravel Plastic	Potting Soil Sand Gravel Clay Plastic

Draw a diagram of your landfill in the space:



Measure the amount of leachate you are going to pour through your landfill:
_____ oz/cups

How quickly did leachate come through?
_____ seconds/minutes

How much leachate came through?
_____ oz/cups

Repeat the exercise and change the materials [use the back of the sheet for your diagram]

2nd Round

Materials (in order):

-
-
-
-

How quickly did leachate come through?
_____ seconds/minutes

How much leachate came through? _____ oz/cups

3rd Round

Materials (in order): _____

How quickly did leachate come through? _____ seconds/minutes

How much leachate came through? _____ oz/cups

Based on the experiment results, in your opinion, which landfill is better for the environment? Why?

Which kind of disposal facility would you rather have in your neighborhood?

It improves the quality of our groundwater.

The garbage in landfills is usually not treated in any way—it's simply thrown in a big hole and buried over with dirt, rocks, etc. Much of this garbage is not environmentally friendly or readily biodegradable—and it's no surprise that contaminants can get into our water. Rain and other runoff from landfills gets into our streams, rivers, lakes, and other waterways, damaging fragile ecosystems. It's also a major reason why it's not safe to drink from streams and rivers when you're hiking and camping—even when it looks like you're in a pristine (perfectly clean) environment. Recycling reduces the trash in landfills, and the more we recycle, the more our water systems can start becoming as pure as they look.

It reduces air pollution

Many factories that produce plastics, metals, and paper products release toxins into the air. Recycle these materials, and there will be less need for companies to manufacture new materials—saving on the amount of pollution dumped into our atmosphere. In addition, disposing of certain recyclable materials can also produce significant pollution. For example, plastics are often burned in incinerators. Plastics are made with oil, and that oil is released into the atmosphere when the plastic burns—creating serious greenhouse-gas emissions.

It creates jobs.

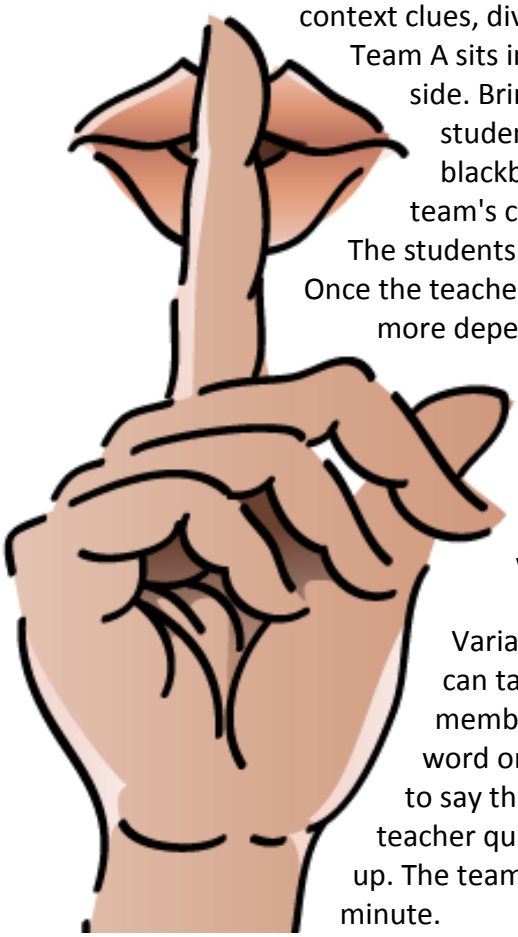
From manufacturing to processing, from collection to invention—it's no secret that recycling is a growth industry, earning billions of dollars annually. Our need to recycle is only going to grow more urgent as populations grow and as technology changes. Recycling creates far more jobs than landfills do—enough jobs to make a big difference in a small town.

It's good business.

Pitting business against the environment is a lose-lose situation: everybody suffers. And yet, that's how the debate has been framed in politics and the public sphere for years. This is a shame, because the truth is that recycling just makes good business sense. Industrial factories and processing plants save plenty of money on energy and extraction strategies when they use recycled materials instead of virgin resources. They also ensure that basic resources don't become a scarce commodity, keeping demand and prices down and ensuring that their business can continue for decades to come.

Taboo

To review what they've learned so far and help students determine word meaning through context clues, divide the class into Teams A and B.



Team A sits in a group on one side of the classroom, Team B sits on the other side. Bring two chairs to the front of the room so that when seated, a student is facing his or her respective team and their back is to the blackboard or white board. One member from each team sits in their team's chair. The teacher writes a word, phrase, or sentence on the board. The students in the chairs must not see what's written on the board.

Once the teacher says 'go', the teams have one minute, using only single word [or more depending on age and skill level of students] verbal clues, to get their seated teammate to say the item written on the board. The only rule (or taboo) is that they must NOT say the item written on the board, in full or part. The first student in the hot seat to utter the word scores a point for their team. When the round is over, two new team players are rotated into the hot seat and a new item is written up. The first team to score X number of points wins.

Variation: To ensure a slightly quieter and less chaotic game, the teams can take it in turns. Rather than two students in the hot seat, only one member from each team plays at a time. The teacher as usual scribbles a word on the board and gives the team one minute to get their teammate to say the item. If the hot-seated player manages to say the word, the teacher quickly writes another item on the board and so on until the minute is up. The team scores a point for every item they manage to say within one minute.

Recyclart: Any old thing will do?

Materials:

- Glue
- Scissors
- Tape
- Recyclables
- Paper

- Markers/Crayons/Colored Pencils
- Pen & Ink
- Imagination

Recycling and reusing objects normally destined for the landfill has always been a creative process, but in the hands of an imaginative artist, the practice can result in masterpieces superior to works crafted of more traditional mediums. The most unassuming trash-bin or cluttered drawer, with a little imagination, can be turned into an artist's palette. Art can be made using:

- buttons,
- toys,
- plastic forks,
- concentrated juice can tops,
- soda can tabs,
- plastic fruit baskets,
- 6 pack soda rings,
- beads
- magnets,
- old toys,
- tin cans,
- egg cartons,
- fabric
- newspapers,
- old lunch bags,
- paper plates or recycled card stock,
- cereal boxes
- toilet paper rolls,
- menus,
- junk mail,
- greetings cards,
- advertising brochures,
- twist ties,
- oatmeal containers
- Berry baskets
- Baby food jars
- Plastic soda bottles
- Tuna cans (no sharp edges)
- glossy junk mail,
- gum/candy wrappers
- calendars,

All American Girl
Main Recycled Materials: Tax Forms and Political Junk Mail
Artist: Sandhi Schimmel Gold

- old cassette tapes,
- fruit and vegetable net bags (great for creating texture),
- paper towel rolls
- and/or nearly anything else students can get their hands on, as long as it is something that was headed to the trash can or recycling bin.

[Make sure to check the items so that they are clean and safe for the children to use.]

If we all look closely enough at all the material clutter of our lives, who knows what sort of possibilities will emerge? Wild and wonderful project ideas jump out at students from deep within recycle bins and throwaway boxes, everything from murals to jewelry. We have to teach students to see things in a different way, and practice the art of “upcycling”, or literally turning everyday trash into creative treasures and the results are worth it!

Ideas & Inspiration:

From Roots to Wings & Leaves of Glass

Help kids create a tree made of recycled wire, paper, plastics and other recycled material, including birds and other creatures, out of all recycled

materials for display and to teach other students about recycling. For inspiration go to: http://vimeo.com/5956108 & http://www.youtube.com/watch?v=rJStBTEsCTI

Remember: With children who have allergies to all sorts of things including eggs or peanuts be careful of what kinds of materials you bring in.