



Composting In the Classroom

By Sarice Greenstein

INTRODUCTION:

In this lesson students will be able to understand what composting is, why it is important, and how to begin composting themselves. They will apply these concepts by designing and proposing a composting program at school.

Grade Level & Subject: Grades 9-12: Environmental Science, Health Science, Social Studies,

Length: One class period (about 45 minutes)

Objectives:

After completing this lesson, students will be able to:

- Understand cycles and why they are sustainable.
- Understand the process of composting and identify why composting is beneficial to the environment.
- Identify the necessary ingredients to a compost pile.
- Write a policy proposal for starting a composting program at their school

National Standards Addressed¹

This lesson addresses the following National Education Standards:

- **Content Standard:** [NS.9-12.3 Life Sciences](#)
As a result of their activities in grades 9-12, all students should develop understanding of
 - The cell
 - Molecular basis of heredity
 - Biological evolution
 - Interdependence of organisms
 - Matter, energy, and organization in living systems
 - Behavior of organisms
- **Content Standard:** [NS.9-12.6 Personal and Social Perspectives](#)
As a result of activities in grades 9-12, all students should develop understanding of
 - Personal and community health
 - Population growth
 - Natural resources
 - Environmental quality

¹ Education World (2008) *U.S. National Education Standards*. Retrieved June 19, 2008, from <http://www.education-world.com/standards/national/index.shtml>.

- Natural and human-induced hazards
- Science and technology in local, national, and global challenges
- **Content Standard:** [NSS-G.K-12.5 Environment and Society](#)
As a result of activities in grades K-12, all students should
 - Understand how human actions modify the physical environment.
 - Understand how physical systems affect human systems.
 - Understand the changes that occur in the meaning, use, distribution, and importance of resources.

Materials Needed:

- Copies (or transparency) of Reproducible #1 – **The Ecosystem**
- Copies (or transparency) of Reproducible #2 – **The Nitrogen Cycle**
- Computers (and/or projector) with internet access
- Copies of Reproducible #3 – **Composting Statistics** Worksheet (2 pages)

Assessment: Students will be assessed through the following activities:

- Participation in activities and discussion.
- Completion of Reproducible – **Composting Statistics** Worksheet.

LESSON BACKGROUND

Relevant Vocabulary:

- **Compost:** the transformation of raw organic material into its simplest form, so that it is suitable for a variety of soil and plant uses.
- **Organic material:** material that comes from a living organism and is capable of decay.
- **Humus:** the final product of decayed organic material that cannot be broken down any further; what compost is made of.
- **Nitrogen-rich matter:** “greens” of a compost pile - fruits, vegetables, grains, grass clippings, urine, animal hair.
- **Carbon-rich matter:** “browns” of a compost pile - leaves, woodchips, hay, etc
- **Compost Pile:** a combination of nitrogen-rich material from the kitchen and carbon-rich material from the yard which decomposes to form rich, organic fertilizer
- **Decomposition:** to separate into components or basic elements; to cause to rot.
- **Vermicomposting:** using earthworms to decompose organic matter into humus, water, and heat.

Information:

Food scraps and yard waste are major contributors to American landfills, with environmental consequences such as increased waste and the release of a major greenhouse gases called Methane. Fortunately, these wastes do not need to end up in the landfill but instead can be composted to create healthy soils that give nutrients to growing plants.

Composting is the most efficient type of recycling. Unlike recycling plastics and other materials,

composting does not involve chemicals, huge amounts of energy, or transportation to bring materials to recycling plants and then back to product shelves. Composting organic matter continues the natural life cycle of organic matter by returning nutrients into the Earth's soil to grow healthy plants and trees. Through decomposition, organic material is broken down through a series of processes into carbon dioxide, water, heat and humus, decayed organic material that makes the richest soil and is important in plant and tree growth. Understanding composting is a great way to understand the Earth and recycle natural resources.

Resource:

- Composting Background Plan, Earth Day Network, 2009.
- Composting Student Action Plan, Earth Day Network, 2009.
- EPA Composting Info <http://www.epa.gov/epaoswer/non-hw/organics/fd-basic.htm>
- Sierra Club video <http://www.youtube.com/watch?v=9PALk7Nux9Y>
- Kitchen Gardeners International video <http://www.youtube.com/watch?v=aKlauRA7ugI>

LESSON STEPS:

Warm-up: *Waste - Organic or Inorganic?*

Begin this lesson by discussing with your class the importance of composting, and the difference between organic and inorganic waste. Consider the following questions and statements:

1. Americans throw away more than 25 percent of prepared food, creating nearly 12 percent of the total municipal solid waste generated by American households.² This significantly contributes to global warming as additional fossil fuels are needed to transport the extra food scraps to the dump, and without the aid of oxygen to help the food decompose properly, methane gas is released into the atmosphere further warming the earth. Think about your meals at home, school and other places.
 - a. How much do you and your family usually throw away?
 - b. What are some ways you could reduce this amount? *Eating leftovers, reducing meal-size and portions, packing lunch foods that I like, buying fewer groceries*
 - c. Another great way to avoid putting food and yard waste into landfills is by composting. Does anyone know what composting is? *Composting is how the Earth recycles nutrients, by turning dead and decomposing organic matter into nutrients for plants and trees.*
 - d. Does anyone compost in their home?
2. Organic matter is material that was recently alive. This includes most things we eat: vegetables, meats, grains, etc. Fortunately, all of these items are biodegradable, or break down naturally.
 - a. Can anyone think of other types of organic materials? *Trees, animals, people, leaves, grass, soil, etc.*

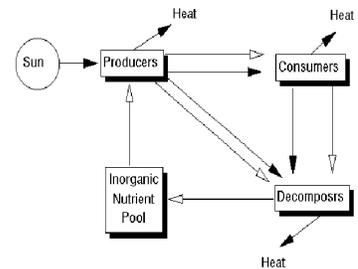
² <http://www.epa.gov/epaoswer/non-hw/organics/fd-basic.htm> Retrieved June 17 2008

3. Inorganic materials are usually synthesized by humans including Styrofoam cups, tin foil, and plastic silverware. These materials do not break down like organic matter, and should never go into a compost pile.
 - a. Can anyone think of other types of organic materials? *Products made from metal, plastic, electronics, etc.*

Activity One: Components of a Healthy Cycle

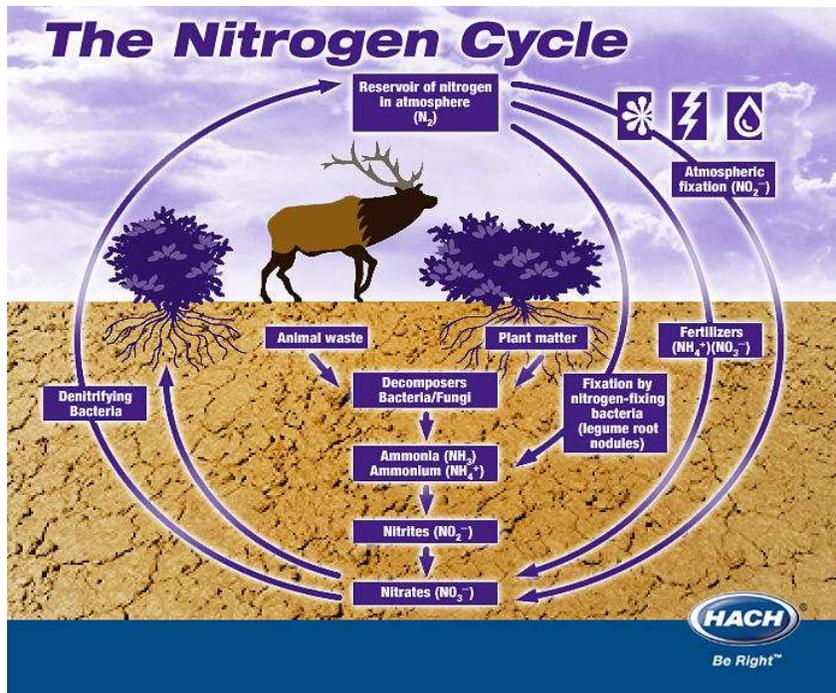
1. Begin the lesson by discussing cycles with your students.
 - a. A cycle is a process that returns to its beginning and then repeats itself in the same sequence. Cycles are sustainable because they reuse their products by turning them into something useful. *Ex. plants grow, become food and/or waste, decompose to become compost to produce nutrient-rich soil which helps more plants grow, etc...*
 - b. Nature sustains itself through a series of continuous cycles. Can anyone name examples? *The carbon cycle, the phosphorus cycle, the water cycle, the nitrogen cycle.*
 - c. All of these cycles make up a system we call the **Ecosystem**: the biggest cycle that drives everything around us and allows life to exist as we know it. Within our ecosystem is the flow of energy through the universe.
2. Direct your students to Reproducible #1 – **The Ecosystem** to begin to understand how energy moves through our ecosystem. Print, or show as transparency so students can copy into notebooks - have students fill in definitions and examples.

- a. **Producers** absorb the sun's energy to create food for themselves through the process of photosynthesis.
 - i. Can anyone name some producers? *Plants, trees, grasses, etc.*
- b. **Consumers** are all organisms that do not obtain their energy from the sun. Consumers may obtain energy by eating plants or animals or both.
 - i. Can anyone name some consumers? *Humans, animals, some rare plants, etc.*
 - ii. Consumers can consume producers, or other consumers lower on the food chain, or both.
- c. **Decomposers** are the last link in the chain. They consume dead organisms and convert them into carbon dioxide and nutrients, which are then reused.
 - i. Name some consumers. *Bacteria and fungi.*



Source: <http://www.marietta.edu/~biol/102/ecosystem.html>

3. Direct your students to Reproducible #2 – **The Nitrogen Cycle** to begin to understand how nitrogen moves through our ecosystem.



Source: <http://www.h2ou.com/h2images/NitrogenCycle-lgr-F.jpg>

- a. This cycle is especially reliant on decomposers such as bacteria and fungi.
- b. Although there are many ways that we have upset the balance of nitrogen in the environment, focus on how food disposal is a part of this process.
- c. Notice how plant matter needs to go into the ground in order to create nitrates that will help nurture new plants. Explain that most of American's food ends up in landfills, which does not enable nitrogen to return to the soil. Obviously, landfills are not a part of this ageless cycle. Instead of decomposing and then feeding back into the soil to fertilize more plants, nitrogen-rich matter (from foods) in landfills is converted to nitrous oxide and methane, which is then released into the atmosphere.
- d. With the nitrogen cycle upset, there are numerous affects on the environment.
 - i. Explain to your students that nitrous oxide is a greenhouse gas, and a major contributor to global climate change. Your students should be familiar with how and why global climate change is affecting humans.
 - ii. Explain that the depleted nitrogen in the soil must be replaced for some crops to grow, involving expensive and polluting synthetic fertilizers.

Activity Two: *Continue the Cycle—Compost!*

1. Introduce the concept of composting to students. Start by reviewing the vocabulary below.
 - **Compost:** the transformation of raw organic material into its simplest form, so that it is suitable for a variety of soil and plant uses.
 - **Organic material:** material that comes from a living organism and is capable of decay.
 - **Humus:** the final product of decayed organic material that cannot be broken down any further; what compost is made of.

- **Nitrogen-rich matter:** “greens” of a compost pile - fruits, vegetables, grains, grass clippings, urine, animal hair.
 - **Carbon-rich matter:** “browns” of a compost pile - leaves, woodchips, hay, etc
 - **Compost Pile:** a combination of nitrogen-rich material from the kitchen and carbon-rich material from the yard which decomposes to form rich, organic fertilizer
 - **Decomposition:** to separate into components or basic elements; to cause to rot.
 - **Vermicomposting:** using earthworms to decompose organic matter into humus, water, and heat.
2. Show the following short YouTube videos, or have students watch in small groups:
 - a. Sierra Club Video <http://www.youtube.com/watch?v=9PALk7Nux9Y>
 - b. Kitchen Gardeners International <http://www.youtube.com/watch?v=aKlaurA7ugI>
 3. Expand on the concepts of these discussions and videos - explain the benefits of composting:
 - a. Composting organic matter continues the natural life cycle of organic matter by returning the nutrients into the Earth’s soil.
 - b. Composting helps keep the nitrogen cycle in balance.
 - c. Compost provides chemical-free fertilizer that helps plants and trees grow naturally and healthily.
 - d. Composting saves money on fertilizers for gardens and on waste disposal costs.
 - e. Composting reduces the amount of waste entering landfills and cuts down on landfill space.
 - f. Composting food and garden waste helps prevents climate change by reducing methane emissions produced in landfills, and by cutting down on CO₂ emitted from transporting food waste to the landfill.
 4. Explain that the best compost has a healthy balance of nutrients. Demonstrate healthy compost by writing the recipe for compost on the board:

Recipe for Healthy Compost:

- Twice as many browns as greens
 - 50-60% humidity
 - 120-140 degrees Fahrenheit
 - Small particle size so air and moisture can travel through
 - Neutral pH
 - It must be turned regularly to ensure regular oxygen flow
5. Distribute Reproducible #3 – **Composting Statistics** Worksheet (2 pages). Lead your students to match statistics with the diagrams. *Solutions: 1. H, 2. B, 3. A, 4. D, 5. F, 6. E, 7. C, 8. I, 9. G*

Activity Three: *Getting the Compost Churning...*

1. Have students investigate and discuss the viability of a composting program at your school. Urge them to consider the following factors: volume, storage, maintenance, use, finances, community/student/staff support, and spreading the word.
2. If your students decide composting is a possibility at your school, have them pursue and start a composting program!

3. Encourage students to gather all their ideas and write up a proposal. Speak with local experts for ideas and support, including custodial staff, kitchen workers, the town recycling coordinator, local gardeners, and even parents.
4. Include plans for:
 - a. Who will need to approve and make final decisions and how they will be approached.
 - b. How will matter be collected? (*i.e. bins, buckets in cafeteria, etc.*) Will students and teachers be able to bring material from home?
 - c. How will matter be transported? (*i.e. carts, carried, etc.*)
 - d. Who will purchase necessary items and what is the cost? Where will the funds come from? (*i.e. donations, fundraisers, school budget, etc.*)
 - e. Where will compost be placed so it can be used by plants? Does your school have a garden? Could one be started?
 - f. What method of composting will be employed? (*i.e. vermicompost, decomposition, etc.*)
 - g. How will instructions and information be communicated?
 - h. Who will be responsible for overseeing program and carrying out tasks? How will this project be sustained after students graduate? Implement a system for electing new composters each year.
5. Distribute proposal to school environmental club and sponsors, teachers, staff and potentially interested community members. Give presentations to gain support for the project, whether it be to the school board, the principal, or the PTSA.

Extension Assignment: *Spread the word!*

1. In order to have a successful composting program, people need to be informed about what they can and cannot put into composting bins. For this reason, assign the students to design a poster that will demonstrate through pictures and/or words what is eligible for your compost bin.
2. Refer to the list below (and Reproducible #4 – **Composting Poster**) about what to include on your poster. Remember, what you can compost will depend on the type of composting program that is implemented. Relatively simple compost piles cannot handle any meat or greasy substances, but industrial composters can handle minimal amounts of grease, and compostable plastics.
3. Give the students at least a few days to work on this and hold a competition so that the best designs can be used for your already existing or incoming composting program. You can then place these posters at designated compost drop-off locations at the school to advertise composting.

COMPOSTABLE:

- Fruits and vegetables
- Grains
- Eggshells
- Coffee Grounds
- Organic matter only

NOT COMPOSTABLE

- Meat



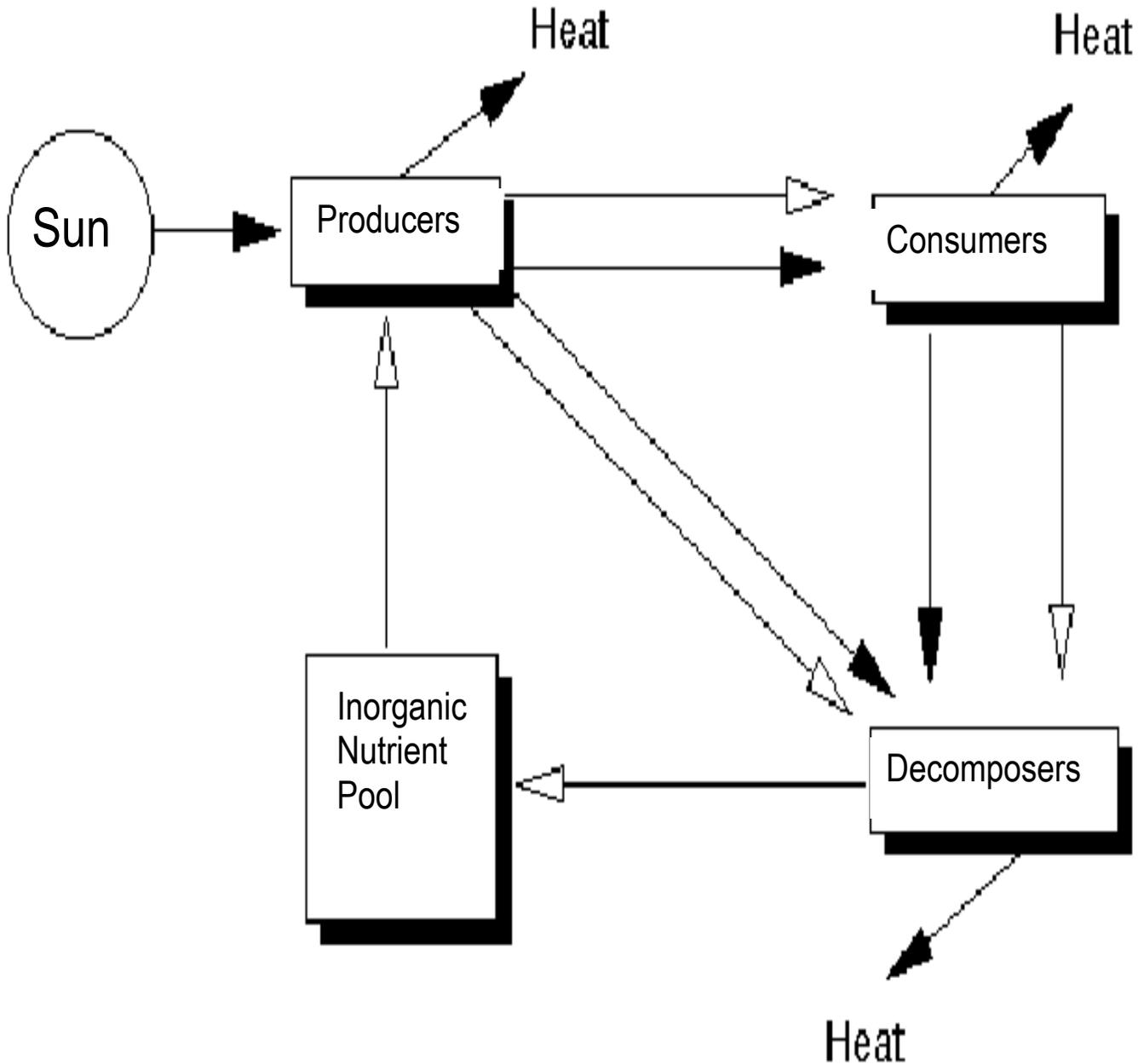
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- Greasy or oily foods
 - Fish
 - Plastic, cardboard or Paper*
 - Anything inorganic
- * Please recycle when possible

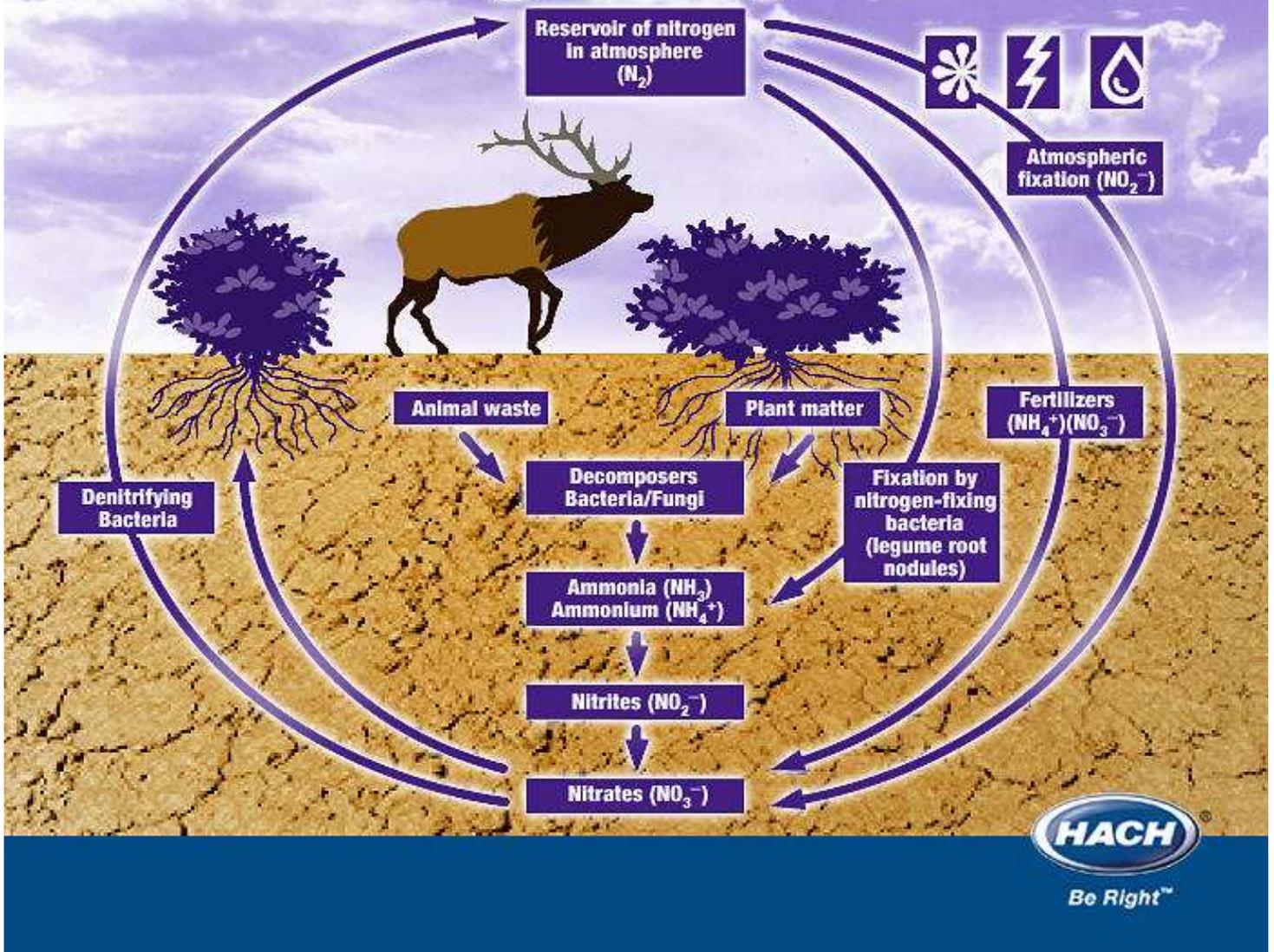
CONCLUSION:

At the end of this lesson, students should have a good idea of what composting is, why it is important, and how to think about running a composting program at the school. If students are interested in seeing composting at their school, they will write a detailed and professional proposal, and will work to implement a composting program at school.

The Ecosystem



The Nitrogen Cycle



Name:

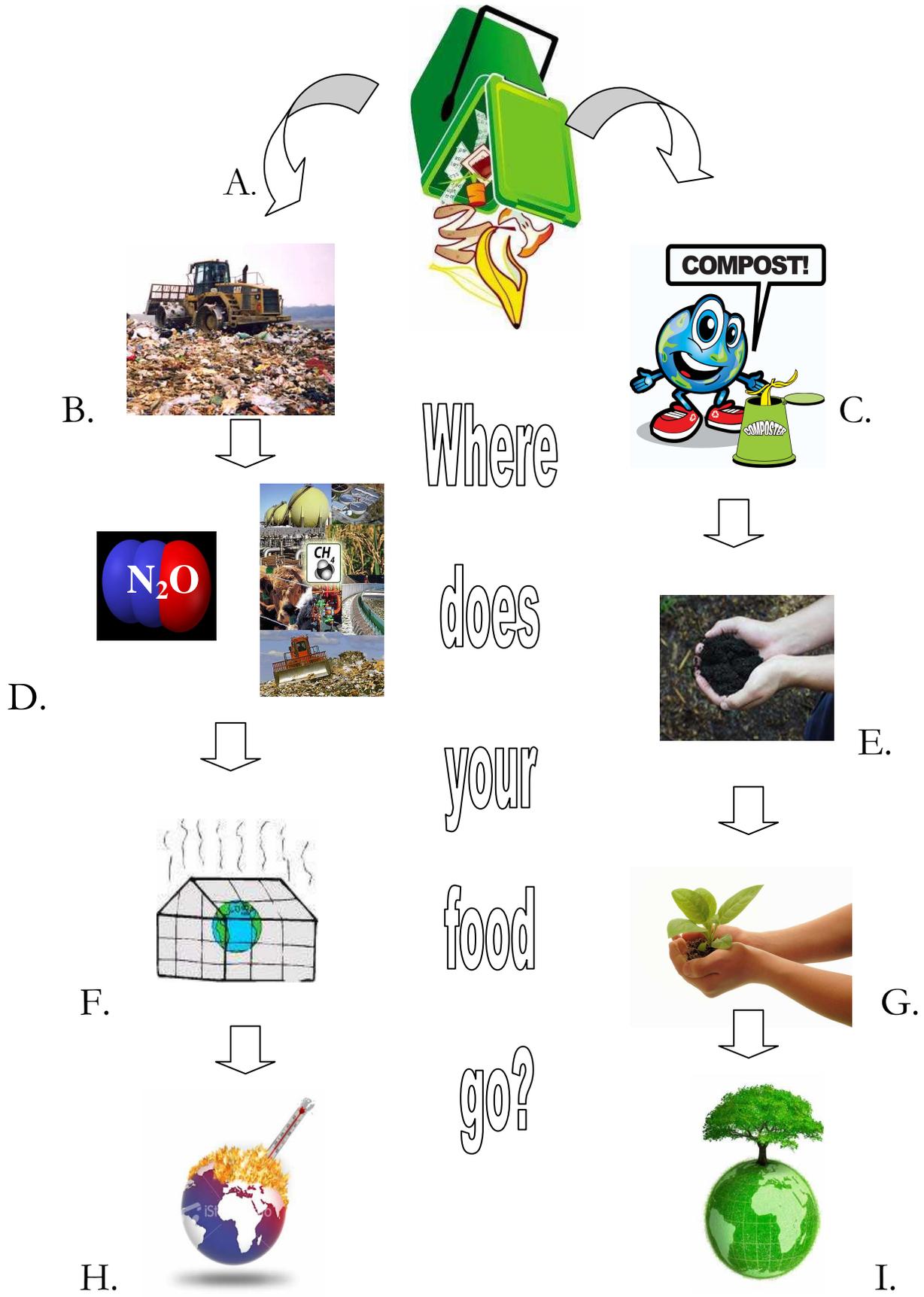
Date:

Composting Statistics

Write the letter of the diagram that matches each statistic on composting.

1. _____ Food sent to landfills contributes unnecessarily to **global warming**.
2. _____ There are 1,754 landfills in the United States that cause water, air and soil pollution, and disrupt local wildlife.
3. _____ Americans throw away more than one-quarter of our food waste each year, nearly 96 billion pounds of food.
4. _____ Landfills release landfill gas which includes methane and CO₂. 3.8% of U.S. global warming damage is from methane in landfill gas.³ Nitrous oxide (N₂O) is also released at landfills sights.
5. _____ Methane is a **greenhouse** gas that has 25 times the warming effect that carbon dioxide has. Nitrous oxide (N₂O) is the fourth largest contributor to global warming behind CO₂, NH₄ and water vapor.
6. _____ Composting food scraps creates rich **fertilizer** that is healthy for humans and plants.
7. _____ The amount of waste we send to landfills every year can be drastically reduced if we **compost** our organic waste.
8. _____ Composting is one way to make **Earth** greener.
9. _____ Compost helps grow **plants** that are free of harmful pesticides.

³ <http://www.energyjustice.net/lfg/#22>





http://www.waste-invaders.co.uk/actiontime/gunge_tank_k1.html

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