Contents

TEACHER GUIDE

STUDENT HANDOUTS

EASY MARKING™ ANSWER KEY

MINI POSTERS

NAME: _____

Before You Read

Greenhouse Gases: Nitrous Oxide

1. Write each word beside its meaning.

absorb	**bacteria**	**source**
fertilizer	**industrial**	**nylon**

_____ **a)** To take in.

_____ **b)** A fake fabric.

_____ **c)** A substance that helps plants grow.

_____ **d)** The place or process that a substance comes from.

_____ **e)** A group of living things whose bodies have only one cell.

_____ **f)** A way of making a lot of products with a machine.

2. Carbon dioxide has a long residence time in the atmosphere—over 100 years. Methane has a short residence time in the atmosphere—only a few years. What would happen to the amount of carbon dioxide and methane in the atmosphere if people stopped releasing these gases right now?

_____

_____

_____

_____

Reading Passage

NAME: _____

Greenhouse Gases: Nitrous Oxide

Compared to carbon dioxide, the amount of nitrous oxide in the atmosphere is tiny. However, **nitrous oxide** absorbs much more radiation than carbon dioxide. One molecule of nitrous oxide is 298 times more harmful than one molecule of carbon dioxide. This makes nitrous oxide an important greenhouse gas that adds to climate change.

Nitrous oxide is made up of both **nitrogen** and **oxygen**. It is found naturally in the environment in tiny amounts. It is made by tiny organisms—or **microbes**—like bacteria. As with many of the other greenhouse gases, human activities have added a lot of extra nitrous oxide into the atmosphere.

What is the natural source of nitrous oxide in the atmosphere?

_____

_____

The main source of nitrous oxide from human activities is from fertilizers. A **fertilizer** is used to help plants grow. Plants need nitrogen to grow. Fertilizers that people make have a lot of nitrogen in it. Some of this nitrogen escapes into the atmosphere as nitrous oxide. Other sources of nitrous oxide include burning fossil fuels, and factories that make nylon. Nitrous oxide has a long residence time in the atmosphere—over a hundred years. We could cut down on the amount of nitrous oxide we put into the atmosphere. However, it will still take a long time for all the extra nitrous oxide that is already added to be removed naturally.

NAME: _____

After You Read

Greenhouse Gases: Nitrous Oxide

1. Fill in each blank with the correct word from the reading.

a) Nitrous oxide is made up of both _____ and _____.

b) Nitrous oxide absorbs much more radiation than _____.

c) A natural source of nitrous oxide in the atmosphere is from _____.

d) The main source of nitrous oxide from human activity is from certain types of _____ used in farming.

e) Another human source of nitrous oxide in the atmosphere is from burning _____.

f) Factories that make _____ also release nitrous oxide into the atmosphere.

2. Which word or phrase best describes:

a) The amount of nitrous oxide in the atmosphere?		**b) The residence time of nitrous oxide in the atmosphere?**	
____	**A** tiny	____	**A** short
____	**B** large	____	**B** long

3. Circle the greenhouse gases that are released when fossil fuels are burned.

carbon dioxide methane synthetic gases nitrous oxide

After You Read

NAME: _____

Greenhouse Gases: Nitrous Oxide

4. Answer each question with a complete sentence.

a) Describe **two** reasons why nitrous oxide plays an important role in climate change.

_____

_____

_____

_____

b) Explain the link between farming and nitrous oxide in the atmosphere.

_____

_____

Research

5. How do humans change the natural nitrogen cycle? Use the library or Internet resources. Research how Earth's nitrogen cycle works. Ask the following questions:

- In what parts of Earth can nitrogen be found?
- What form does nitrogen take in each part of the nitrogen cycle?
- How do natural processes move nitrogen from one part of the cycle to another?
- How do human activities move nitrogen from one part of the cycle to another?
- What is the residence time of nitrogen in each part of the cycle?

Use a big piece of paper or poster board. Draw a diagram showing all of the processes of the nitrogen cycle. Show where human activities change parts of the nitrogen cycle.

Hands-On Activity # 3

Nitrogen-Fixing Bacteria

HANDS-ON ACTIVITIES

You will need:

- seeds of one or more of the following legumes:
  - peas
  - beans
  - soybeans
  - peanuts
  - clover
  - alfalfa
- potting soil
- seed trays
- water
- a sunny window or warm, protected outdoor location
- a hand lens

You learned that plants need nitrogen to grow. You also learned that people affect the nitrogen cycle. They add nitrous oxide to the atmosphere by making and using nitrogen fertilizers. However, a group of plants called legumes has its own source of nitrogen. Certain bacteria change nitrogen gas from the atmosphere into a form of nitrogen that plants can use. Scientists call these nitrogen-fixing bacteria. These bacteria live right in the roots of legumes, in little bumps, or nodules.

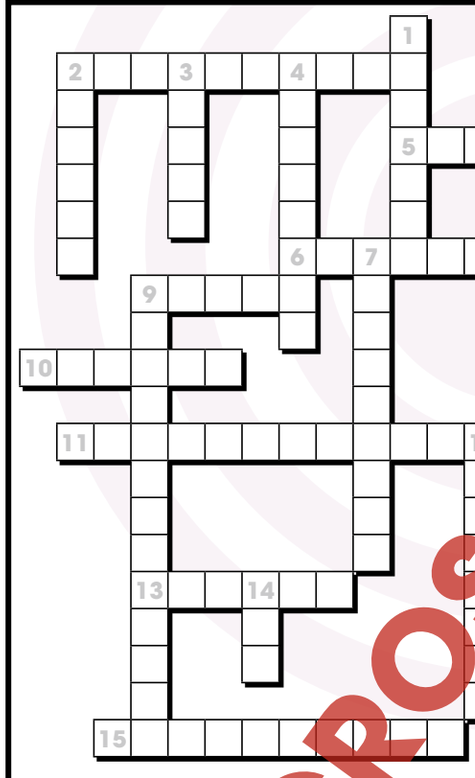
Grow one or more types of legumes. Observe and investigate these nodules. Place the potting mix in the seed trays. Plant the seeds according to the directions on the packet. Place your seed tray in a sunny location. Make sure to water each day. When your plants are about 4 weeks old, take a few of them out of the soil. Rinse the roots. Look at the nodules using a hand lens.

Use the library or Internet resources. Find out more about how organic farmers use legumes to replace the use of human-made nitrogen fertilizer.

NAME: _____ After You Read

Crossword Puzzle!

CROSSWORD



WORD LIST

albedo
atmosphere
carbon dioxide
cycle
energy
evaporate
fertilizer
gas
global
warming
greenhouse
heat
hydrogen
methane
nitrogen
oxygen
ozone
synthetic

Across

2. The thin layer of air that surrounds Earth.
5. Temperature is a measure of this.
6. ___ gases absorb radiation from Earth's surface.
9. A series of events that happen over and over again.
10. Radiation is a form of this.
11. The rise in the average temperature at Earth's surface (two words).
13. The second most common gas in the atmosphere.
15. A substance that helps plants grow.

Down

1. A greenhouse gas released by termites.
2. Effect caused by reflection of Sun's radiation.
3. A main ingredient in smog.
4. One of the elements in both methane and water.
7. Liquid water changes to gas.
8. A substance made only by humans.
9. A gas released by burning fossil fuels (two words).
12. The most common gas in the atmosphere.
14. State of matter that has no definite shape or volume.

NAME: _____ After You Read

Comprehension Quiz

ASSESSMENT

30

Part A

8

Circle the word **TRUE** if the statement is TRUE or **Circle** the word **FALSE** if it is FALSE.

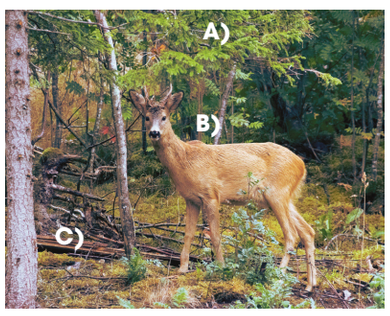
1. Nitrogen and oxygen are the most common gases in the atmosphere.
   TRUE **FALSE**
2. In a gas, the particles of matter are close together.
   TRUE **FALSE**
3. Without the atmosphere, the average temperatures on Earth's surface would be much colder.
   TRUE **FALSE**
4. Heat energy travels from the Sun to the Earth in the form of radiation.
   TRUE **FALSE**
5. The kind of change that brings back balance in a system is called positive feedback.
   TRUE **FALSE**
6. Fossil fuels are formed from the remains of plant and animals that lived millions of years ago.
   TRUE **FALSE**
7. Residence time describes the amount of time it takes to complete a biogeochemical cycle.
   TRUE **FALSE**
8. Farms are a source of the greenhouse gas methane.
   TRUE **FALSE**

Part B

6

Label the diagram by doing the following:

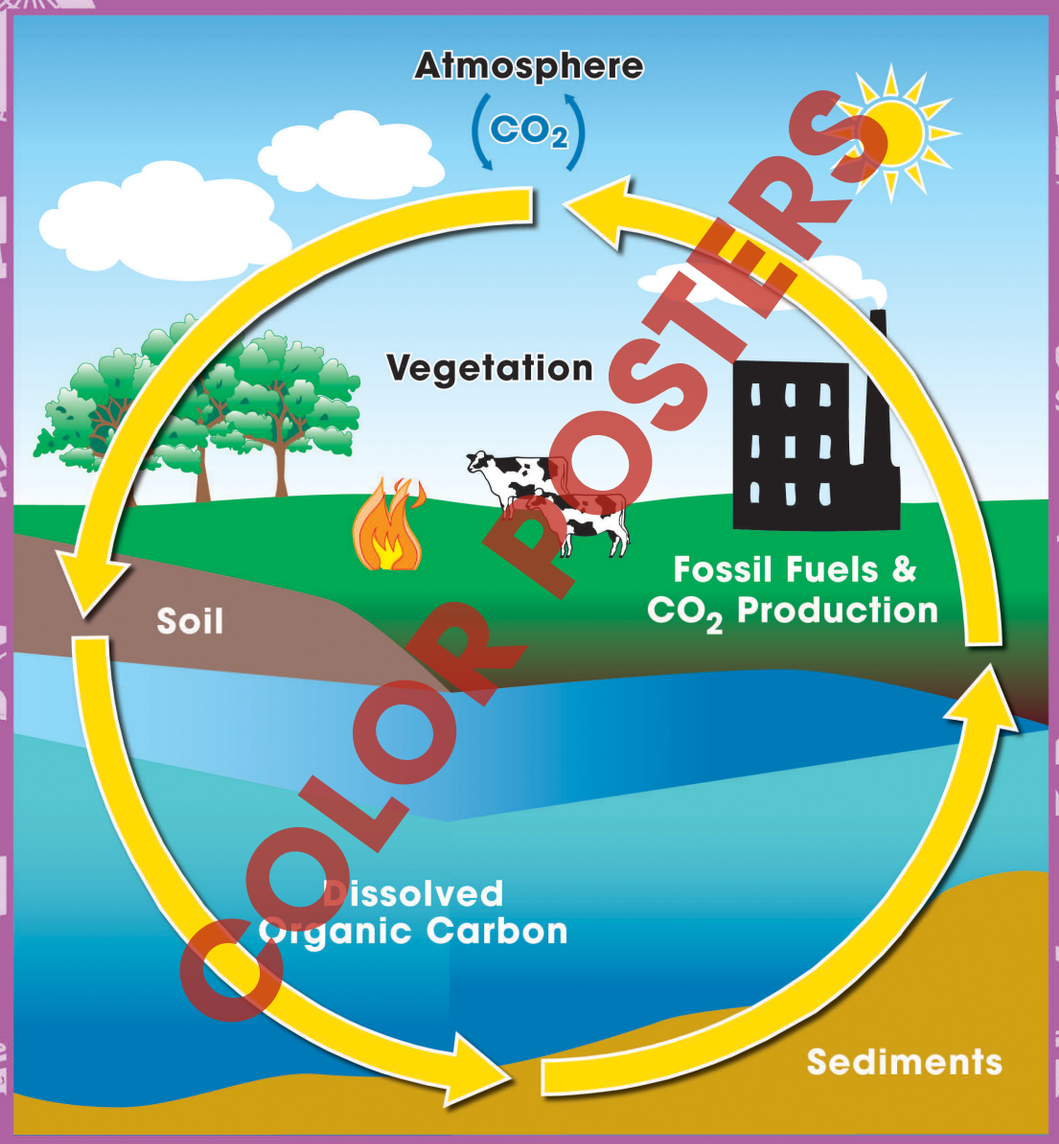
1. Label the diagram to show some of the processes in the **carbon cycle**.
   1 decay _____
   2 photosynthesis _____
   3 respiration _____
2. What is the main human source of carbon dioxide in the atmosphere?
   _____



SUBTOTAL: /14

The Carbon Cycle

COLOR POSTER



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Greenhouse Gases: Nitrous Oxide

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Use a big piece of paper or poster board. Draw a diagram showing all of the processes of the nitrogen cycle. Show where human activities change parts of the nitrogen cycle.

4.

a) Nitrous oxide absorbs a lot of radiation. Nitrous oxide stays in the atmosphere for a long time.

b) Fertilizers contain nitrogen, which releases into the atmosphere as nitrous oxide.

Across:

2. atmosphere
5. heat
6. greenhouse
9. cycle
10. energy
11. global warming
13. oxygen
15. fertilizer

Down:

1. methane
2. albedo
3. ozone
4. hydrogen
7. evaporate
8. synthetic
9. carbon dioxide
12. nitrogen
14. gas

10

15

EZ

NAME: _____

Greenhouse Gases: Nitrous Oxide

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The Carbon Cycle