Contents

TEACHER GUIDE

STUDENT HANDOUTS

NAME: _____

Before You Read

Greenhouse Gases: Carbon Dioxide

1. **Most cars, trucks, and buses run on gasoline. Where do you think gasoline comes from? Write your ideas on the lines below.**

_____

_____

2. **Match each word to its definition. You may use a dictionary to help you.**

1	**released**	A substance formed from two or more other substances.	A
2	**compound**	The act of making a substance.	B
3	**food chain**	The force on a material. Often due to the weight of another material pressing down on it.	C
4	**pressure**	Let go.	D
5	**volcano**	The order in which living things eat other living things.	E
6	**formation**	Parts of a once-living thing.	F
7	**remains**	A mountain through which lava erupts.	G

Reading Passage

NAME: _____

Greenhouse Gases: Carbon Dioxide

In the last few years, people have been thinking of ways to put fewer greenhouse gases into the atmosphere. The greenhouse gas that usually gets the most attention is **carbon dioxide**. Carbon dioxide is an important greenhouse gas. People have been putting a lot of it into the atmosphere! Every time people burn wood, coal, oil, or gas, carbon dioxide is released into the atmosphere.

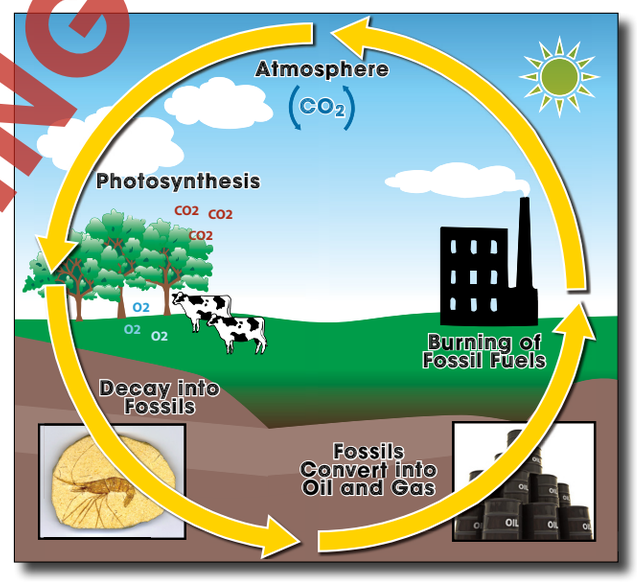
STOP

What activities release carbon dioxide into the atmosphere?

_____

_____

Carbon dioxide in the atmosphere is one stage in the global **carbon cycle**. Carbon is found in many materials on Earth. In fact, carbon is very important for living things. The bodies of all living things on Earth are made of carbon compounds. Living things need carbohydrates, a compound made of carbon and **hydrogen**. Carbon enters the food chain when plants take in carbon dioxide from the atmosphere and turn it into carbohydrates during **photosynthesis**. Living things break down carbohydrates for energy during **respiration**. Respiration releases carbon dioxide back into the atmosphere. The breakdown of once-living things, or **decay**, also releases carbon dioxide back into the atmosphere. Photosynthesis, respiration, and decay move carbon into and out of the atmosphere fairly quickly.



After You Read

NAME: _____

Greenhouse Gases: Carbon Dioxide

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

   a) Photosynthesis takes carbon out of the atmosphere.
   TRUE **FALSE**

   b) Carbohydrates are compounds made of carbon and nitrogen.
   TRUE **FALSE**

   c) Decay is the breakdown of once-living things.
   TRUE **FALSE**

   d) Limestone is a carbon-rich rock made of the shells of tiny ocean animals.
   TRUE **FALSE**

   e) Volcanoes take carbon out of the atmosphere.
   TRUE **FALSE**

2. **Number the events from 1 to 5 in the order they occur in the use of fossil fuels.**

   ☐ **a)** Over millions of years, heat and pressure change the remains into fossil fuels.

   ☐ **b)** Living things die and their remains become buried under ground.

   ☐ **c)** People pump fossil fuels from deep beneath Earth's surface.

   ☐ **d)** More layers of soil and rock form over the buried remains.

   ☐ **e)** Oil, coal, and natural gas are burned to power automobiles and factories.

3. **Circle the processes that add carbon to the atmosphere. Underline the processes that take carbon out of the atmosphere.**

photosynthesis respiration ocean animals forming shells

driving a car that runs on gasoline decay volcanic eruption

breathing burning coal in a power plant growth of trees

NAME: _____

After You Read

Greenhouse Gases: Carbon Dioxide

4. **Answer each question with a complete sentence.**

   a) Describe **two** ways that cutting down a forest adds carbon dioxide to the atmosphere.

_____

_____

   b) Think about the chart on page 23 that shows the steady rise of Carbon Dioxide in the atmosphere. This chart shows an overall trend covering hundreds of years. Each summer in the Northern Hemisphere, the amount of carbon dioxide in the atmosphere falls. Each winter, the amount of carbon dioxide rises. Using what you know about photosynthesis and respiration, explain the reason for this seasonal cycle.

_____

_____

_____

_____

Research

5. **How much carbon do you put into the atmosphere in your daily life?**

   First, list all the activities you do that releases CO2. Don't forget about the different ways we burn fossil fuels.

   Now, look at each activity on your list. Write down one change you could make to each activity. You want each activity to result in less carbon released into the atmosphere.

Hands-On Activity # 4

How does carbon move from rocks into the atmosphere?

You will need:

- samples of limestone
- chalk ("dustless" chalk will not work)
- shallow tray
- vinegar
- 50 mL beaker or small glass jar
- an eyedropper

In the carbon cycle, carbon moves between solid rocks, living things, and the atmosphere. In this investigation, you will see how carbon that is in solid rocks can change to carbon dioxide gas that is released into the atmosphere.

During part of the carbon cycle, tiny animals living at the surface of the oceans take in carbon dioxide gas. Reactions inside their bodies change the carbon dioxide gas to calcium carbonate. This is a compound that makes up shells. A reaction is a process that changes one compound to another. The shells fall to the ocean floor when the animals die. Thick layers of the shells form deposits that are used to make chalk. Over millions of years, the thick layers of shells are changed by Earth processes into limestone rock. Both chalk and limestone contain solid carbon in the form of calcium carbonate. Vinegar contains a substance that reacts with carbonate to make carbon dioxide gas. Because carbon dioxide is a gas, it forms gas bubbles during the reaction.

Follow the steps below to change solid carbonate into carbon dioxide.
Safety Note: Do NOT put the vinegar into your mouth or eyes. Wash your hands after you finish the experiment.

1. Place a sample of limestone and a sample of chalk into the tray.
2. Pour a small amount of vinegar into the beaker or jar.
3. Draw an eyedropper full of the vinegar.
4. Place a few drops of the vinegar onto the limestone.
5. See what happens. Write your observations in your science notebook.
6. Place a few drops of the vinegar onto the chalk.
7. See what happens. Write your observations in your science notebook.

NAME: _____

After You Read

Word Search

Find all of the words in the Word Search. Words are written horizontally, vertically, diagonally, and some are even written backwards.

absorb	coal	gaseous	plants	stratosphere
air	cycle	liquid	poles	sun
albedo	factories	matter	radiation	temperature
biogeochemical	feedback	nitrogen	residence time	troposphere
carbon	fossil fuel	oil	respiration	water vapor
chlorofluorocarbon	gas	photosynthesis	smog	

A	I	R	P	C	R	F	A	P	D	E	M	Z	Y	W	R	Q	T
H	N	A	I	L	Z	L	Y	A	O	D	E	B	L	A	E	G	A
B	Y	D	Z	O	A	G	P	C	A	L	A	G	A	T	C	A	N
I	M	I	L	F	R	N	T	C	O	B	E	A	V	E	A	S	D
O	C	A	B	I	V	A	T	X	C	A	C	S	Y	R	Z	E	W
G	B	T	T	E	Q	S	D	S	Z	Y	L	M	N	V	H	O	E
E	F	I	N	T	H	U	V	I	L	C	W	R	G	A	C	U	A
O	T	O	A	G	E	T	I	Y	A	Z	Y	I	O	P	A	S	O
C	E	N	S	A	W	R	L	D	C	T	A	N	B	O	I	L	M
H	M	K	A	S	M	N	B	O	S	Y	I	Z	T	R	A	T	N
E	P	J	B	D	I	O	K	P	Y	T	N	O	C	Y	C	L	E
M	E	A	S	B	N	L	R	D	R	S	C	I	N	T	L	O	S
I	R	D	O	K	L	B	F	O	M	K	C	A	B	D	E	E	F
C	A	B	R	F	N	F	G	U	F	A	C	T	O	R	I	E	S
A	T	W	B	L	G	E	K	J	E	V	X	N	Q	Z	T	F	A
L	U	T	A	O	N	M	C	F	H	L	R	U	I	B	X	B	D
W	R	Y	M	V	E	M	I	T	E	C	N	E	D	I	S	E	R
Q	E	S	T	R	A	T	O	S	P	H	E	R	E	G	T	H	W
Y	M	U	Y	R	O	U	M	V	W	J	L	K	R	Y	S	A	Q
M	F	N	R	Y	U	W	E	R	E	H	P	S	O	P	O	R	T
A	P	H	O	T	O	S	Y	N	T	H	E	S	I	S	Z	S	A
C	H	L	O	R	O	F	L	U	O	R	O	C	A	R	B	O	N
D	W	H	I	W	N	O	I	T	A	R	I	P	S	E	R	W	T

NAME: _____

After You Read

Comprehension Quiz

Part C

Answer the questions in complete sentences.

1. Describe the main characteristics of the **troposphere** and the **stratosphere**. (3)

2. Explain how **greenhouse gases** affect the temperatures on Earth's surface. (3)

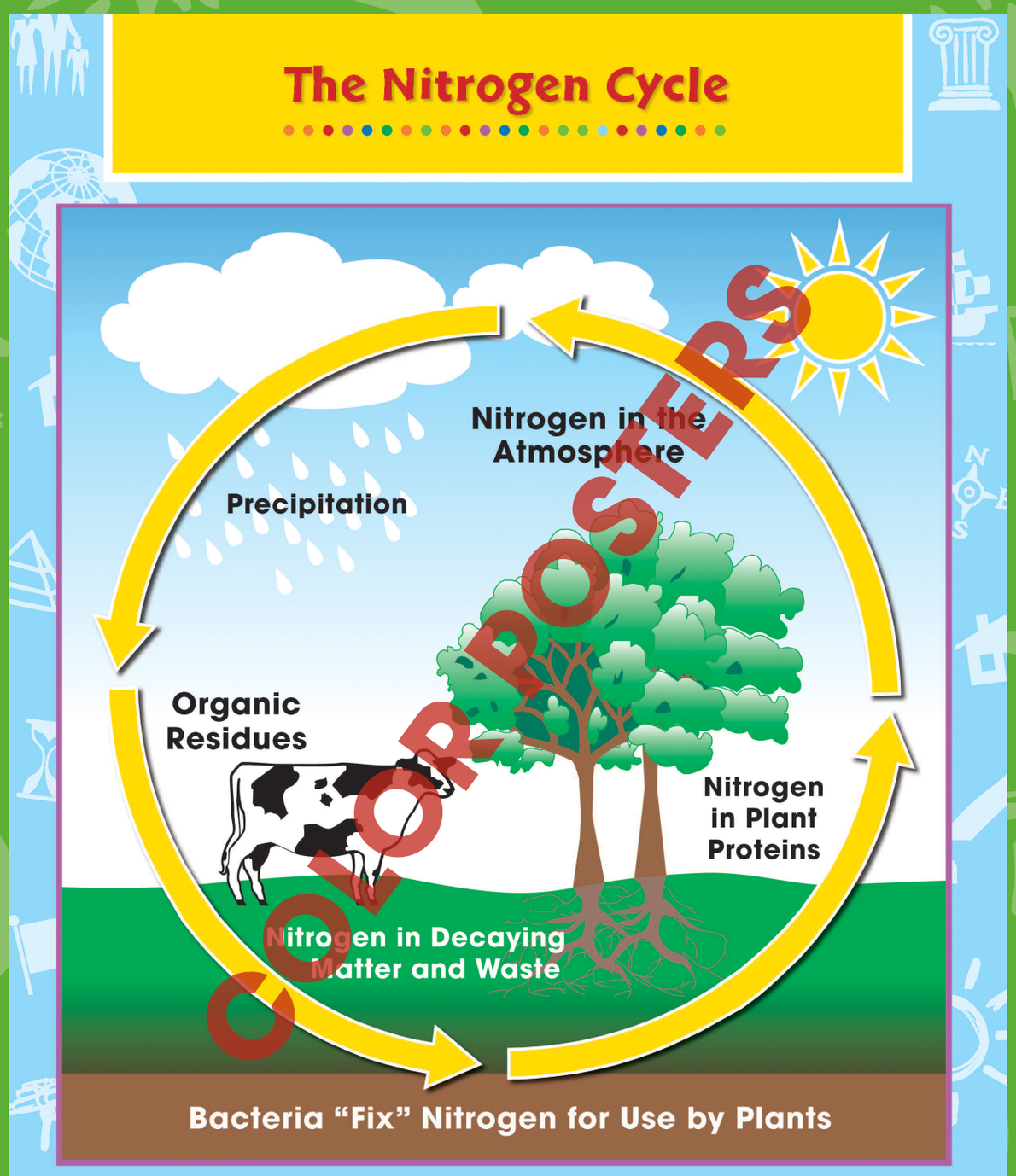
3. What is the **albedo effect**? Give an example of how the albedo effect could cause a positive feedback cycle that would speed up climate change. (4)

4. How does the **residence time** of a greenhouse gas relate to its role in causing climate change? (3)

5. Why has the amount of carbon dioxide in the atmosphere been increasing for the past 100 years or so? (3)

SUBTOTAL: /16

The Nitrogen Cycle



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photosynthesis respiration ocean animals forming shells
driving a car that runs on gasoline decay volcanic eruption
breathing burning coal in a power plant growth of trees

EASY MARKING ANSWER KEY

EZ

1.

a) TRUE

b) FALSE

c) TRUE

d) TRUE

e) FALSE

2.

a) 3

b) 1

c) 4

d) 2

e) 5

3.

Circled: respiration, driving a car, decay, volcanic eruption, breathing, burning coal in a power plant

Underlined: photosynthesis, ocean animals forming shells, growth of trees

4.

a) The cut trees will no longer take carbon out of the atmosphere by photosynthesis. The cuttings will decay to add more carbon to the atmosphere.

b) When plants grow in the warm months, they are photosynthesizing a lot and they take carbon out of the atmosphere. When leaves fall off in the winter, plants are not photosynthesizing, so they take less carbon out of the atmosphere.

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

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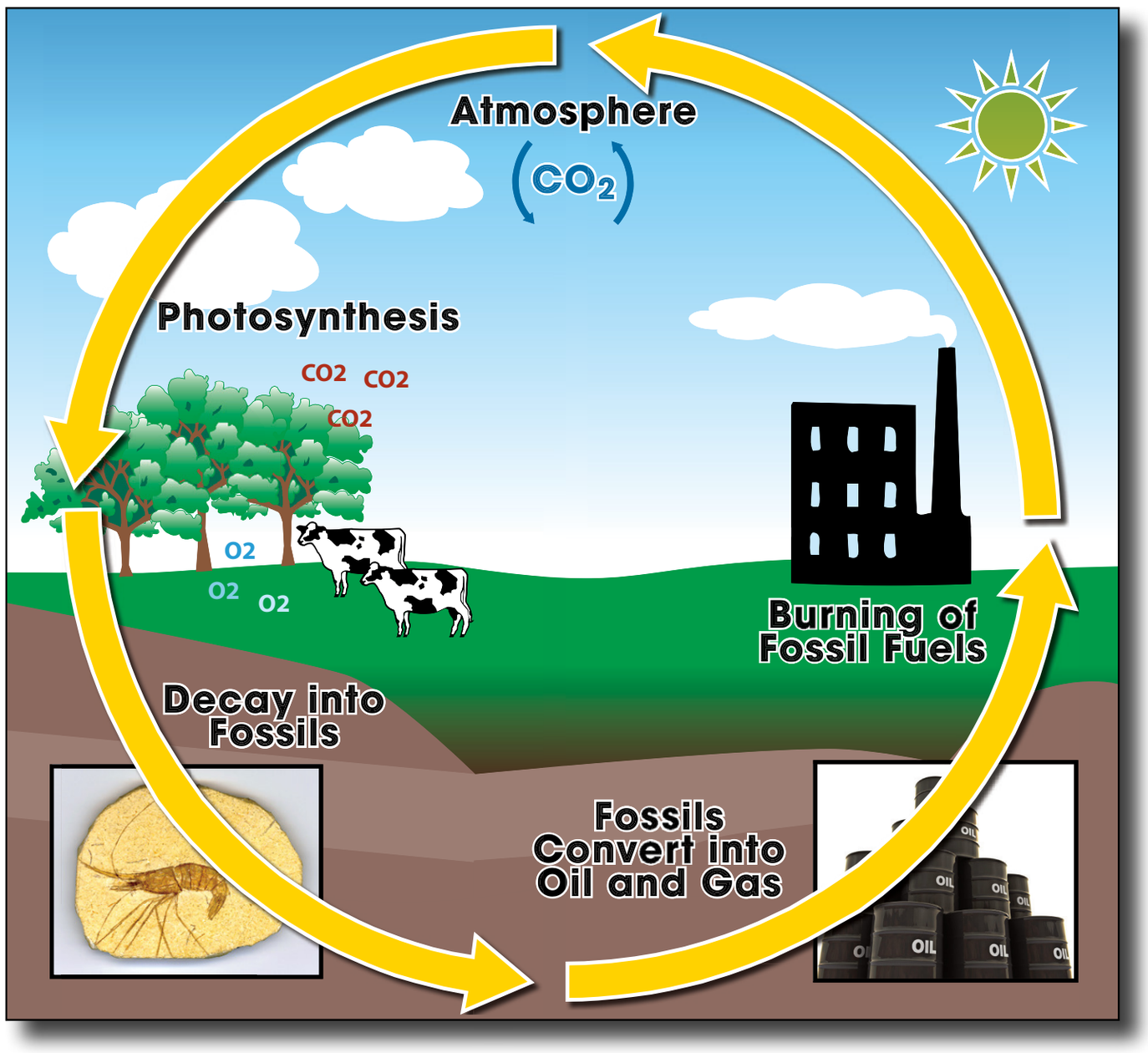

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