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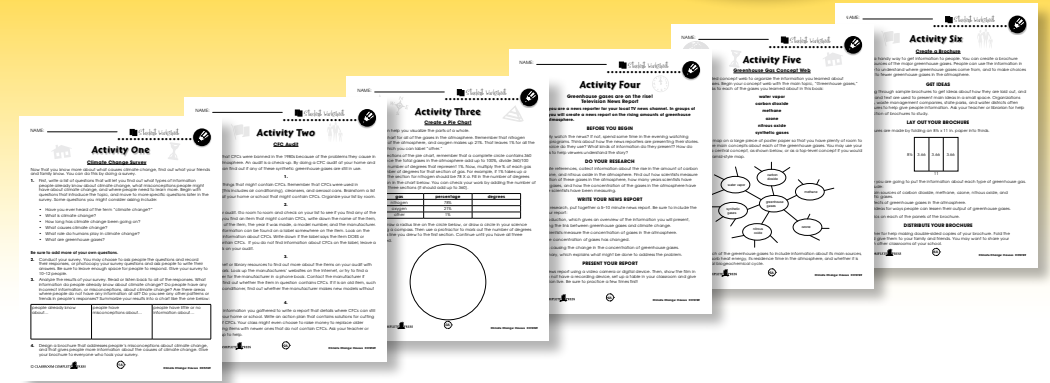
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Greenhouse Gases: Water Vapor

1. Write each word beside its meaning.

vapor	process	evaporate	ice caps
poles	shrink	albedo effect	cycle

- a) A series of events that happens over and over again.
- b) The solid sheets of ice covering the North and South poles of Earth.
- c) An activity in nature that is always going on.
- d) The land at the top and bottom of Earth's axis.
- e) The effect of reflecting radiation from the Sun on the average temperature of Earth.
- f) A material in the gaseous state.
- g) To change from a liquid to a gas.
- h) To lose material and become smaller.

2. Fill in the chart below with examples of water in each of its states.

State of Water	Examples
liquid	
solid	
gas	



Greenhouse Gases: Water Vapor

There is more water vapor in the atmosphere than any of the other greenhouse gases. More water vapor in the atmosphere leads to warmer temperatures. This then causes more water vapor to be absorbed into the atmosphere. This process that leads to more and more change is called a **positive feedback**. As Earth warms up, the polar ice caps start to melt and shrink. The water from the ice caps evaporate into the atmosphere. This creates a lower albedo effect and leads to more warming.



What happens to the size of Earth's ice caps when global temperature rises?



Water is always moving between the atmosphere and Earth's surface in a process called the **water cycle**. Water can exist on Earth in three states: solid, liquid or gas. Water is always changing from one state to another. With more water vapor in the atmosphere, more will condense into clouds. The clouds reflect the Sun's radiation from reaching Earth's surface. The greater albedo effect of the clouds could cool Earth. This kind of change that brings back balance is called a **negative feedback**.

Keep in mind that the more water vapor you have in the atmosphere, the more radiation it absorbs from Earth. This causes the atmosphere to heat up. In order for this water vapor to condense into clouds, the air needs to cool. As air cools, clouds are formed. Water falls back to the Earth as rain or snow. You can see how as a greenhouse gas, water vapor is difficult to narrow down how it affects climate change.



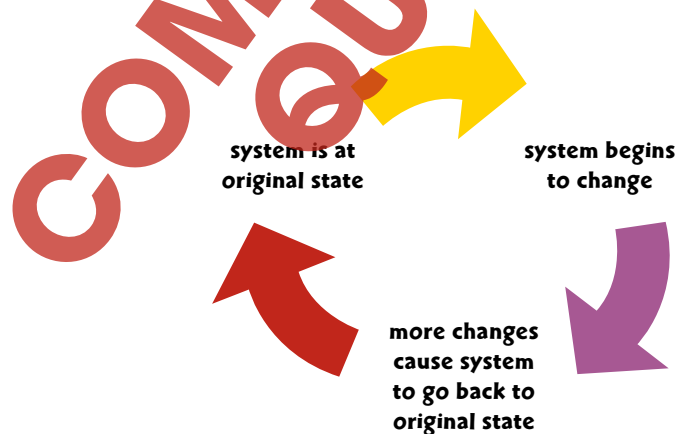
Greenhouse Gases: Water Vapor

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

- a) Greater cloud cover would lead to a higher albedo effect.
TRUE FALSE
- b) The kind of changes that bring back balance are called positive feedback.
TRUE FALSE
- c) In nature, water is always changing state.
TRUE FALSE
- d) Water vapor is the most common greenhouse gas in the atmosphere.
TRUE FALSE
- e) Melting ice caps create a higher albedo effect.
TRUE FALSE
- f) Climate change has already begun to melt the polar ice caps.
TRUE FALSE

2. Study the diagram below. Circle the phrase that tells what the diagram represents.

positive feedback negative feedback water cycle



Greenhouse Gases: Water Vapor

3. Answer each question with a complete sentence.

- a) Explain how water vapor as a greenhouse gas results in a positive feedback.

- b) How does climate change alter the size of Earth's polar ice caps? How does this cause a change in the albedo effect?

Research

4. How does Earth's water cycle respond to changes in Earth's temperature?

Working in a small group, create a model of Earth's water cycle. Get a container to represent each part of the water cycle, such as the atmosphere, the oceans, fresh water, ice caps, etc. Be sure the sizes of the containers show the relative sizes of the parts of the water cycle. Fill each container with small objects, such as dried beans or marbles. The objects represent water. First, move your objects between containers to show how the water cycle would change if Earth's temperature rose. For example, if more water would move from the ice caps to the oceans, move some of your objects from the ice cap container to the ocean container. Then, move objects to show how the water cycle would change if Earth's temperature cooled.

Nitrogen-Fixing Bacteria

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.

Crossword Puzzle!

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.

Comprehension Quiz

Part A

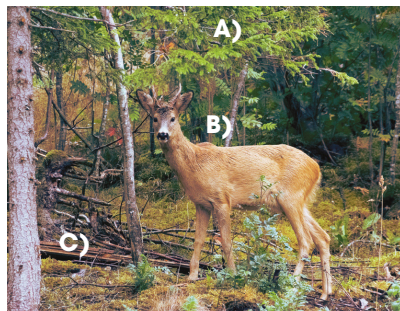
Circle the word **TRUE** if the statement is TRUE or **Circle** the word **FALSE** if it is FALSE.

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**

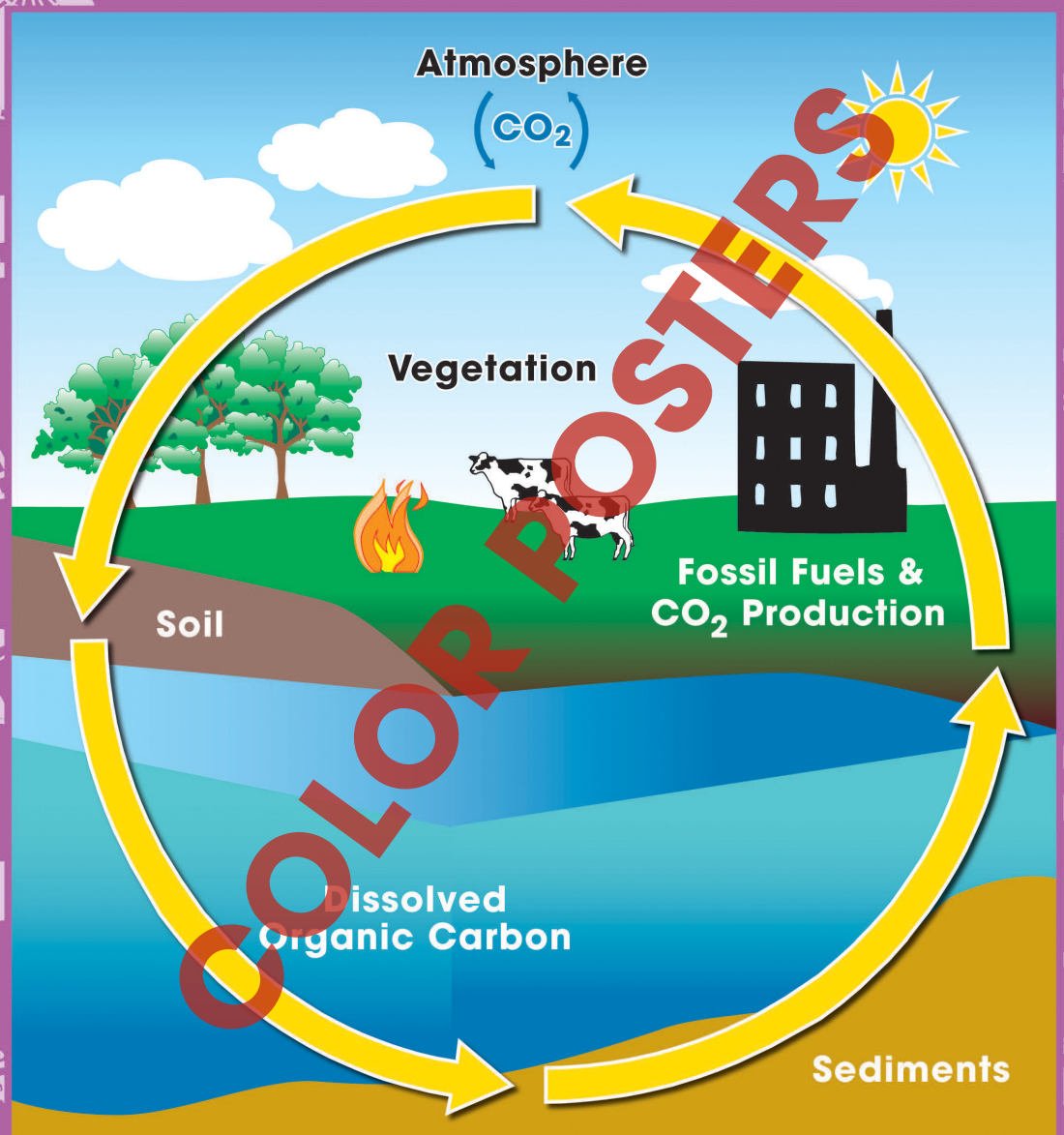
Part B

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?



The Carbon Cycle

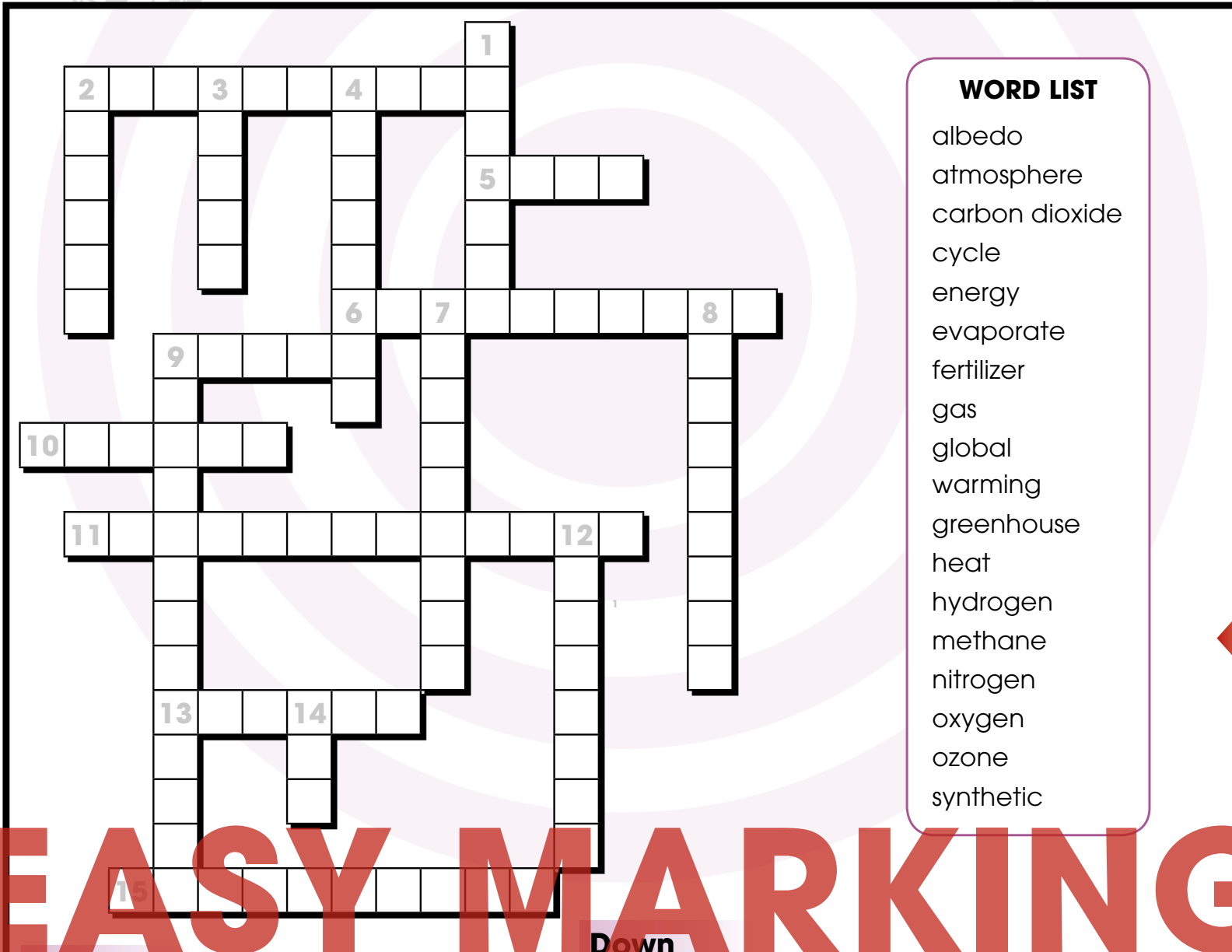


NAME: _____

After You Read 



Crossword Puzzle!



WORD LIST

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

Across:

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

Down:

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

EASY MARKING ANSWER KEY

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.
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The Carbon Cycle

