

THE NITROGEN CYCLE

Name: _____

(1) The nitrogen cycle is a crucial process that plays a vital role in maintaining the balance of nitrogen in the environment. Nitrogen is an essential element for all living organisms as it is a building block of proteins, nucleic acids, and other important biomolecules. However, atmospheric nitrogen, which makes up about 78% of the Earth's atmosphere, is not directly usable by most organisms. This is where the nitrogen cycle comes into play. The **nitrogen cycle** is a vital process that occurs in nature, ensuring the availability of nitrogen, an essential element for living organisms. This cycle describes the movement and transformations of nitrogen in various forms throughout the environment.

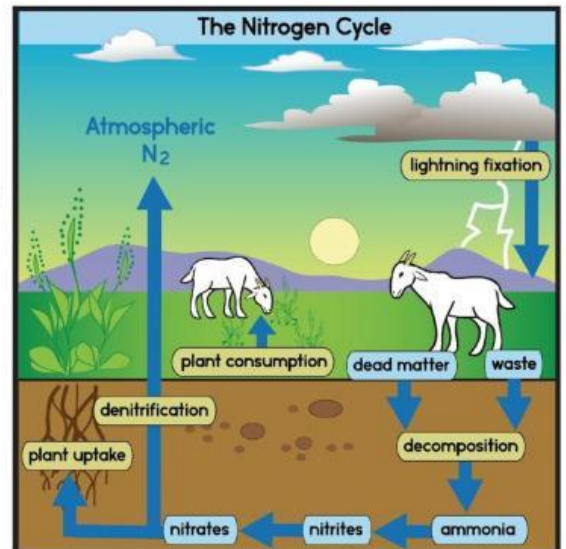
(2) The nitrogen cycle consists of several key processes, including ammonification, nitrification, nitrogen fixation, and denitrification. **Ammonification** is the first step in the nitrogen cycle. It is the process by which organic nitrogen compounds, such as proteins and nucleic acids, are decomposed into simpler forms by decomposers like bacteria and fungi. These decomposers break down the organic matter and convert it into ammonium (NH_4^+).

(3) **Nitrification** is the next step. In this process, specialized bacteria called **nitrifying bacteria** convert ammonium (NH_4^+) into nitrite (NO_2^-) and then into nitrate (NO_3^-). Nitrite and nitrate are forms of nitrogen that plants can readily absorb and use for growth. **Assimilation** occurs when plants take in these nitrogen compounds from the soil through their roots. The plants then use this nitrogen to produce proteins, nucleic acids, and other essential compounds necessary for their growth and development.

(4) **Nitrogen fixation** is another crucial process in the nitrogen cycle. It is the conversion of **atmospheric nitrogen gas** (N_2) into a usable form by certain bacteria. This process can occur through biological nitrogen fixation, where **nitrogen-fixing bacteria** in the soil or root nodules of legumes (a type of plant) convert nitrogen gas into ammonium or other organic nitrogen compounds. Nitrogen can also be fixed during a process called **lightning fixation**. During a lightning strike, the intense causes the nitrogen gas molecules in the air to break apart. The broken nitrogen molecules then react with oxygen to form nitrogen oxides. These nitrogen oxides are soluble in water and get dissolved in rain, forming nitric acid. This nitric acid is then carried to the soil by rainwater.

(5) **Denitrification** is the final step in the nitrogen cycle. It is the process by which certain bacteria, known as **denitrifying bacteria**, convert nitrate (NO_3^-) back into atmospheric nitrogen gas (N_2). Denitrification primarily occurs in oxygen-depleted environments like wetlands and soil with poor drainage. This step helps maintain the balance of nitrogen in the atmosphere.

(6) Human activities, such as the excessive use of fertilizers and the combustion of fossil fuels, have significantly disrupted the natural nitrogen cycle. Nitrogen-based fertilizers, when applied in large quantities, can lead to nitrogen runoff into rivers and oceans. This excess nitrogen can cause water pollution and harm aquatic life. Additionally, the combustion, or burning, of fossil fuels releases nitrogen oxides into the atmosphere, contributing to air pollution and the formation of smog. These nitrogen compounds can then be deposited onto land or water bodies through precipitation, further disrupting the nitrogen cycle. It is important for humans to adopt sustainable agricultural practices and reduce the emissions of nitrogen compounds to mitigate these negative effects on the nitrogen cycle and maintain the balance of ecosystems.



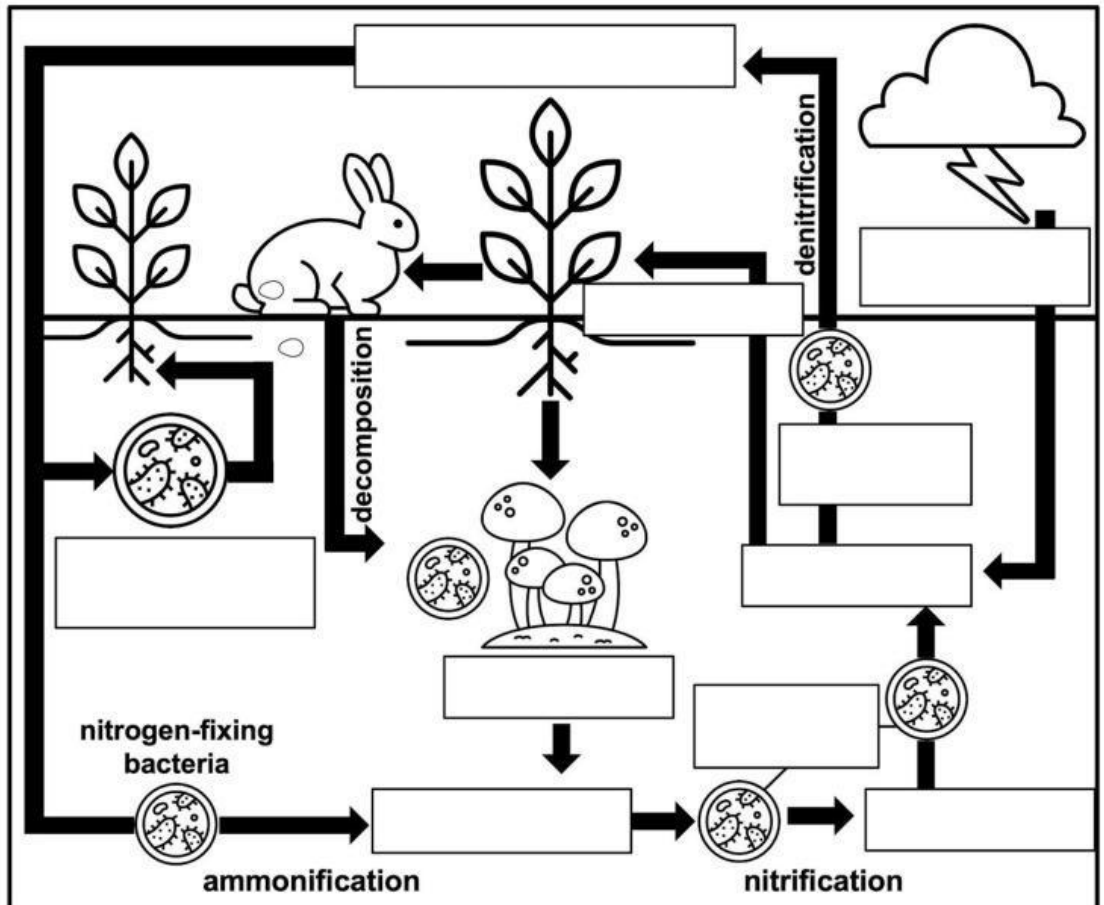
THE NITROGEN CYCLE DIAGRAM

Name: _____

Directions: Color in the features in the nitrogen cycle diagram. Use the word bank to label the diagram.

WORD BANK

ammonium (NH_4^+)
 assimilation
 atmospheric nitrogen (N_2)
 decomposers
 denitrifying bacteria
 lightning fixation
 nitrates (NO_3^-)
 nitrifying bacteria
 nitrites (NO_2^-)
 nitrogen-fixing bacteria
 nitrogen-fixing bacteria



Directions: Define the terms in the table below.

TERM	DEFINITION
1. ammonification	
2. nitrification	
3. denitrification	
4. assimilation	
5. nitrogen fixation	
6. lightning fixation	

NITROGEN CYCLE ARTICLE QUESTIONS

Name: _____

Multiple Choice

1. Why is nitrogen essential for living organisms?
☐ a. It is a building block of proteins and nucleic acids.
☐ b. It is a building block of carbohydrates and lipids.
☐ c. It is a building block of vitamins and minerals.
2. How do nitrifying bacteria contribute to the nitrogen cycle?
☐ a. They convert atmospheric nitrogen into organic nitrogen compounds.
☐ b. They convert organic nitrogen compounds into ammonium.
☐ c. They convert ammonium into nitrite and nitrate.
3. What is nitrogen fixation?
☐ a. the conversion of ammonium into nitrate and nitrate
☐ b. the conversion of atmospheric nitrogen into ammonium and other organic nitrogen molecules
☐ c. the conversion of atmospheric nitrogen into organic nitric acid
4. How does lightning fixation occur?
☐ a. Lightning causes nitrogen gas molecules to break apart and react with oxygen.
☐ b. Lightning causes nitrogen gas molecules to break apart and react with carbon dioxide.
☐ c. Lightning causes nitrogen gas molecules to break apart and react with water.
5. What is denitrification?
☐ a. the conversion of nitrite into atmospheric nitrogen
☐ b. the conversion of nitrate into atmospheric nitrogen
☐ c. the conversion of nitrite into nitrate
6. What human activities disrupt the natural nitrogen cycle?
☐ a. overfishing and overharvesting crops
☐ b. combustion of fossil fuels and excessive fertilizer use
☐ c. driving electric cars and excessive overharvesting of crops
7. True or False: Decomposers break down the organic matter and convert it into nitrate.
☐ a. true
☐ b. false
8. What process occurs when plants take in these nitrogen compounds from the soil through their roots?
☐ a. assimilation
☐ b. denitrification
☐ c. nitrogen fixation
9. What type of bacteria converts nitrate into atmospheric nitrogen gas?
☐ a. nitrifying bacteria
☐ b. nitrogen-fixing bacteria
☐ c. denitrifying bacteria
10. Which of the following is the correct sequence of events in the nitrogen cycle?
☐ a. ammonium → nitrate → nitrite
☐ b. nitrate → nitrite → ammonium
☐ c. ammonium → nitrite → nitrate
11. What type of bacteria live in the soil or root nodules of legumes and convert nitrogen gas into ammonium or other organic nitrogen compounds?
☐ a. nitrifying bacteria
☐ b. nitrogen-fixing bacteria
☐ c. denitrifying bacteria
12. In what type of environment does denitrification typically take place?
☐ a. oxygen-depleted environments like wetlands and soil with poor drainage
☐ b. oxygen-rich environments like mountain tops and rainforest canopies
☐ c. carbon-dioxide rich environments like wetlands and deserts.

Short Answer

13. Describe the sequence of events that occurs when a nitrogen gas atom in an animal's DNA cycles through in the nitrogen cycle to eventually become an atom of atmospheric nitrogen.