

What is the Nitrogen Cycle?

Worksheet

The nitrogen cycle is the natural process by which nitrogen is converted between atmospheric N_2 gas and usable compounds like ammonia, nitrite, and nitrate through fixation, nitrification, assimilation, ammonification, and denitrification.

Questions

1. Which process converts atmospheric N_2 gas into ammonia?

- A) Nitrification
- B) Nitrogen fixation
- C) Denitrification
- D) Assimilation

2. Which bacteria convert ammonia into nitrite and nitrate?

- A) Denitrifying bacteria
- B) Nitrogen-fixing bacteria
- C) Nitrifying bacteria
- D) Decomposers

3. What happens during denitrification?

- A) N_2 gas is converted to ammonia
- B) Nitrate is converted back into N_2 gas
- C) Plants absorb nitrate
- D) Dead matter is decomposed

4. Why is nitrogen fixation necessary for life?

- A) Because plants can absorb N_2 gas directly
- B) Because most organisms cannot use N_2 gas directly and need it converted to ammonia or nitrate first
- C) Because nitrogen gas is toxic to soil bacteria
- D) Because N_2 gas doesn't exist in the atmosphere

5. A legume crop fixes about 150 kg of nitrogen per hectare per year via root-nodule bacteria. If a farm has 8 hectares of soybeans, how much nitrogen is fixed annually?

6. Air is about 78% nitrogen gas (N_2) by volume. In 100 L of air, how many liters are N_2 ?

7. A wetland's denitrifying bacteria convert 40 kg of nitrate-nitrogen back to N_2 gas each month. How much is converted in a year?

8. Define: What is nitrogen fixation?

9. Define: What is nitrification?

10. Define: What is assimilation in the nitrogen cycle?

Answer Key

1. B) Nitrogen fixation - Nitrogen fixation, done by bacteria like Rhizobium or by lightning, converts N_2 into usable ammonia.
2. C) Nitrifying bacteria - Nitrifying bacteria carry out nitrification, converting NH_3 to NO_2 and then NO_3 .
3. B) Nitrate is converted back into N_2 gas - Denitrifying bacteria convert nitrate back into nitrogen gas, completing the cycle back to the atmosphere.
4. B) Because most organisms cannot use N_2 gas directly and need it converted to ammonia or nitrate first - N_2 's triple bond is too strong for most organisms to break, so bacteria must convert it into usable forms first.
5. Nitrogen fixed = $150 \text{ kg/ha} \times 8 \text{ ha} = 1,200 \text{ kg}$ of nitrogen fixed per year
6. Volume of $N_2 = 78\% \times 100 \text{ L} = 0.78 \times 100 = 78 \text{ L}$ of N_2
7. Annual denitrification = $40 \text{ kg/month} \times 12 \text{ months} = 480 \text{ kg}$ of nitrogen returned to the atmosphere per year
8. The conversion of atmospheric N_2 gas into ammonia (NH_3), done mainly by bacteria like Rhizobium or by lightning.
9. The conversion of ammonia into nitrite and then nitrate by nitrifying bacteria in the soil.
10. The uptake of nitrate or ammonium by plants to build proteins and nucleic acids, which then passes to animals that eat them.

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