

Name: _____ Period: _____ Date: _____

Open **peebedu.com** and navigate to **Aquarium Simulator**. Read the introduction popup, which describes the nitrogen cycle in an aquarium ecosystem: ammonia production by fish, conversion to nitrite and then nitrate by beneficial bacteria, and absorption of nitrate by aquatic plants. Click through the introduction, then explore the simulator controls.

Free Response Questions

Question 1 — Conceptual Analysis

Simulation Task: *In the Aquarium Simulator, start with an empty tank. Add two guppies and one Anubias plant, then add nitrifying bacteria. Click "Feed Fish" three times and observe the Nitrogen Cycle Monitor. Record the ammonia, nitrite, and nitrate levels. Then add four goldfish without adding additional plants or bacteria. Feed the fish again three times and observe how the nitrogen levels change.*

(A) (1 pt) **Describe** the processes that make up the nitrogen cycle.

(B) (1 pt) **Explain** how the nitrogen released in fish waste ends up in the tissues of the aquarium plants.

(C) (1 pt) **Predict** what will happen to the ammonia reading if you continue adding goldfish to this tank without adding any plants or bacteria.

(D) (1 pt) **Justify** your prediction.

Question 2 — Analyze Model / Visual Representation

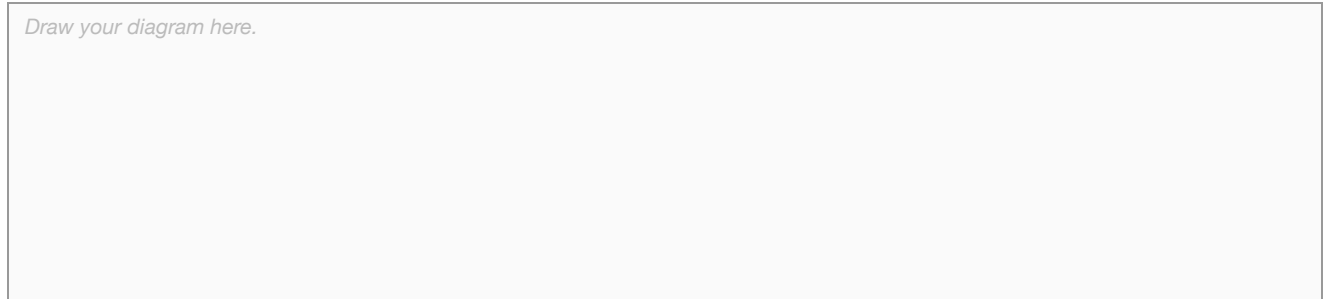
Simulation Task: Reset the aquarium using "Clear Aquarium." Build a balanced community: add two guppies, one goldfish, two Hornwort plants, and one Anubias plant. Add all three bacteria types (nitrifying, ammonifying, and denitrifying). Feed the fish twice and observe the Nitrogen Cycle Monitor stabilize. Then remove all plants and observe the changes in nitrogen compound levels over the next several feedings.

(A) (1 pt) **Describe** the relationship between the plant population in the tank and the nitrate concentration.

(B) (1 pt) **Explain** why removing the plant population has a negative effect on the fish population in this aquarium community.

(C) (1 pt) **Represent** the flow of nitrogen through the aquarium community. In the box below, draw a diagram of the fish, the three types of bacteria (nitrifying, ammonifying, denitrifying), and the plants, using labeled arrows that show the direction of nitrogen flow and the form of nitrogen (ammonia, nitrite, nitrate) at each step.

Draw your diagram here.



(D) (1 pt) **Explain** why living things need to take in nitrogen-containing compounds.

8.5.B.1, 8.5.B.3