Pond Under Pressure

Use pond data to trace feedback and changing conditions.

HS-ENV1-4 "Analyze data regarding differences between systems in equilibrium and systems in disequilibrium. Use corresponding data to support how steady state is achieved through negative and positive feedback loops."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Circle the table values that show the largest change from before the storm, underline the processes that oppose and reinforce oxygen loss, and number the steps in the chain that reinforces oxygen loss.

After the Storm at Pine Pond

(1) Pine Pond is monitored at dawn, when dissolved oxygen is often lowest. Before a storm, oxygen and phosphorus change little from day to day, although both keep moving through the pond. A storm washes fertilizer into the water. The table records a single dawn measurement on each listed day. Similar readings on two dates alone cannot prove long-term stability.

PINE POND DAWN MEASUREMENTS

Time	Oxygen (mg/L)	Phosphorus (mg/L)
Before storm	8	0.03
Day 2	4	0.10
Day 4	2	0.18
Day 12	6	0.07
Day 24	8	0.03

(2) Extra phosphorus fuels algae. When algae die, bacteria break them down and use oxygen. If oxygen falls very low, the pond bottom can release phosphorus that had been held in sediment. That added phosphorus can support more algae, whose later decay uses still more oxygen. This chain reinforces the first oxygen drop.

(3) Oxygen also moves from air into water. The lower the water's oxygen, the faster this transfer tends to occur under otherwise similar conditions. This process opposes oxygen loss. Once the storm input ends, algae can take up phosphorus, and some phosphorus settles into sediment. Together, these processes can help readings return near their earlier levels.

2 ANSWER WITH EVIDENCE

Use the passage

1. Compare the before-storm and Day 4 readings. Which set better represents Pine Pond's usual steady conditions, and what data show a disturbance?

2. From Day 2 to Day 4, how did both measurements change? Use the passage to explain why sediment release could create a positive feedback loop.

3. From Day 4 to Day 12, how did the oxygen reading change? Explain why oxygen moving in from the air is a negative feedback on oxygen loss.

4. Does the Day 24 reading prove that Pine Pond has reached a steady state again? Support your answer with the table and explain one limit of the data.

3 YOUR TURN

Your own words

Imagine a different pond has three dawn readings in order: oxygen 7, 5, and 3 mg/L, and phosphorus 0.05, 0.09, and 0.14 mg/L. In 4 to 5 sentences, compare what could happen next if sediment release dominates versus if oxygen transfer from air dominates, name each feedback type, and explain what repeated readings would show about steady state.

Pond Under Pressure

PART 1 · READ AND MARK

Circle the table values that show the largest change from before the storm, underline the processes that oppose and reinforce oxygen loss, and number the steps in the chain that reinforces oxygen loss. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Compare the before-storm and Day 4 readings. Which set better represents Pine Pond's usual steady conditions, and what data show a disturbance?	**The before-storm readings better represent its usual steady conditions. By Day 4, oxygen fell from 8 to 2 mg/L and phosphorus rose from 0.03 to 0.18 mg/L.**
2	From Day 2 to Day 4, how did both measurements change? Use the passage to explain why sediment release could create a positive feedback loop.	**Oxygen fell from 4 to 2 mg/L, while phosphorus rose from 0.10 to 0.18 mg/L. Low oxygen can release phosphorus from sediment, fueling algae whose later decay uses more oxygen.**
3	From Day 4 to Day 12, how did the oxygen reading change? Explain why oxygen moving in from the air is a negative feedback on oxygen loss.	**Oxygen rose from 2 to 6 mg/L. Lower oxygen can speed its transfer from air to water, opposing the drop. The readings are consistent with this process but do not prove its cause.**
4	Does the Day 24 reading prove that Pine Pond has reached a steady state again? Support your answer with the table and explain one limit of the data.	**No. Day 24 matches the before-storm readings of 8 mg/L oxygen and 0.03 mg/L phosphorus, but a single matching measurement cannot show that conditions will remain steady.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

If sediment release dominates, phosphorus could rise above 0.14 mg/L while oxygen drops below 3 mg/L. This is positive feedback because more phosphorus can fuel algae whose later decay uses oxygen. If transfer from air dominates, oxygen could rise above 3 mg/L, a negative feedback because the transfer opposes oxygen loss. Repeated similar readings for both oxygen and phosphorus over many days would support a steady state.

Accept other predictions that correctly connect each feedback mechanism to a direction of change. Measurements can support an explanation, but they do not prove which process caused a change.