A pond after a nutrient pulse

Ecosystem stability | constructed time series

Name _____ Date _____

A shallow pond receives a nutrient pulse on day 0. The table is a constructed teaching dataset. Dissolved oxygen is measured at dawn. Algae can photosynthesize in light; organisms also respire, and decomposers use oxygen when breaking down organic matter.

Day	Algae index	Dawn oxygen mg/L
0	10	8
4	80	3
8	25	4

1. Use the data to support a claim about ecosystem change.

2. Construct a causal explanation linking the bloom, decomposition and oxygen.

3. Identify one observation needed to test the explanation against an alternative.

Use evidence and show the relationships in your reasoning. Additional paper is permitted.

The resistant survivors

Natural selection | constructed population model

Name _____ Date _____

A population initially contains 90 susceptible insects and 10 resistant insects. After one application, 9 susceptible and 8 resistant insects survive. Resistance is inherited. Survivors reproduce. The treatment does not create the resistance allele in this model.

1. Calculate the resistant fraction before and immediately after treatment.

2. Explain how repeated selection could change a later generation.

3. Distinguish selection from a claim that individual insects changed because they needed resistance.

Use evidence and show the relationships in your reasoning. Additional paper is permitted.

Where does the dry mass come from?

Matter and energy | constructed growth investigation

Name _____ Date _____

Two similar seedlings receive equal minerals and water for a week. One grows in light with access to carbon dioxide; one remains dark. The light-grown plant gains dry mass. Students are told dry mass is measured after water is removed.

1. Develop a model for carbon entering the light-grown plant.

2. Explain how light and carbon dioxide play different roles in photosynthesis.

3. Identify a control or measurement that would strengthen the investigation.

Use evidence and show the relationships in your reasoning. Additional paper is permitted.

A response that reverses a change

Homeostasis | constructed feedback data

Name _____ Date _____

A simulation tracks a body regulation variable with a target of 5 units. A disturbance raises it to 8. A response activates, and readings return through 7 and 6 to 5. When the response is blocked under otherwise similar conditions, readings stay near 8.

1. Explain why this pattern supports negative feedback.

2. Design a repeated comparison to test whether the response contributes to recovery.

3. State a limitation of the simulation for explaining a real body system.

Use evidence and show the relationships in your reasoning. Additional paper is permitted.

A mutation and a chain of effects

Information and protein | constructed molecular model

Name _____ Date _____

A model gene encodes a protein that transports a nutrient into a cell. A mutation changes the protein's shape. In a controlled model system, altered proteins bind less nutrient; the cells grow more slowly. No DNA sequence or complete folding mechanism is supplied.

1. Construct an explanation linking DNA information, protein and cell function.

2. Identify evidence supporting the proposed pathway.

3. Identify a claim about the exact molecular change that the supplied model cannot establish.

Use evidence and show the relationships in your reasoning. Additional paper is permitted.

Restoring a migration route

Human impacts and solutions | constructed design decision

Name _____ Date _____

A stream barrier limits fish migration. A team compares two proposed designs using constructed pilot estimates. Budget ceiling is $60,000. A third option, removing the barrier, has not been evaluated.

Design	Cost $	Estimated passage
A	40000	55%
B	75000	80%

1. Evaluate both designs against ecological and budget criteria.

2. Recommend a plan or revision with a stated trade-off.

3. Design one post-installation measure to evaluate the ecological outcome.

Use evidence and show the relationships in your reasoning. Additional paper is permitted.