Name: _____   Date: _____

                                          Section: _____

Enzyme Environment Activity

Investigating Environmental Effects on Enzyme Function

Phase 1: ENGAGE (5 minutes)

Getting Started: Open peebedu.com and navigate to Enzyme Environmental Impact Explorer

Read the introduction popup to understand enzyme structure, temperature, and pH effects.

Essential Questions: How do environmental conditions affect enzyme structure and function? _____ Why do different digestive enzymes have different optimal conditions? _____ What molecular mechanisms underlie enzyme denaturation? _____

Pre-Activity Predictions:

Based on your knowledge of protein structure:

- How should temperature affect enzyme activity? _____

- Which digestive enzyme would work best in the stomach? _____

Phase 2: EXPLORE (20 minutes)

Systematic Investigation of Enzyme Conditions

Part A: Enzyme Selection and Initial Observations

Select **Pepsin** first

- Observe enzyme structure at 25°C, pH 7.0

- Enzyme movement: _____

- Structural state: Folded / Unfolded

Part B: Temperature Investigation

Keep pH at 7.0, vary temperature systematically:

Temperature	Enzyme Activity	Ion Behavior
0°C	_____	_____
20°C	_____	_____
40°C	_____	_____
60°C	_____	_____
80°C	_____	What happens to ion behavior at 80°C? _____

Phase 3: EXPLAIN (10 minutes)

Molecular Mechanisms Analysis

Temperature Effects - Identify Patterns:

- Pattern 1: Increased temperature → increased _____ energy

- Pattern 3: Denaturation is _____ (reversible/irreversible) in most cases

pH Effects - Cause and Effect:

Complete the molecular explanations:

- Low pH → excess H+ → protonation of _____ groups → charge _____

- Charge repulsion → protein _____ → loss of _____

Structure-Function Relationship: Explain how the simulation demonstrates:

- Primary structure: _____

- Active site integrity: _____

Digestive System Adaptation: Match enzyme to digestive location based on optimal pH:

- Mouth (pH ˜6.8): _____

- Small intestine (pH ˜8): _____

Phase 4: ELABORATE (10 minutes)

Real-World Applications

Scenario Analysis:

Fever Response: Normal body temp: 37°C, Fever: 40°C

- Which enzymes remain functional? _____

- Evolutionary advantage of fever? _____

Antacid Effects: Patient takes antacids, raising stomach pH from 2 to 5:

- Effect on pepsin activity: _____

- Alternative solutions: _____

Lactose Intolerance: Based on lactase properties:

- Optimal conditions: _____

- Effect of consuming hot beverages with dairy: _____

Phase 5: EVALUATE (5 minutes)

Assessment Questions

Data Analysis: Plot enzyme activity curves for one enzyme showing:

- Temperature vs. activity (bell curve)

- pH vs. activity (bell curve)

Explain the molecular basis for each curve shape. (3 pts)

Pattern Application: You discover a new enzyme from thermophilic bacteria with optimal temperature of 75°C. Predict:

- Likely structural adaptations: _____

- Industrial applications: _____

(3 pts)

Systems Integration: Explain how the simulation's visual elements (movement, charge interactions, unfolding) accurately represent:

- Kinetic energy changes: _____

- Hydrophobic collapse: _____

(4 pts)

Model Evaluation:

- Most accurate representation: _____

- Missing element: _____

Research Challenge: Investigate one enzyme adaptation:

- Psychrophilic enzymes (cold-adapted)

- Thermophilic enzymes (heat-adapted)

- Acidophilic enzymes (acid-adapted)

Compare structural features to mesophilic enzymes: _____