Name: ____________________ **Date:** ____________

Section: ________

Enzyme Environment Activity

How Environment Shapes Enzyme Function

Phase 1: ENGAGE (5 minutes)

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

Click through the introduction - pay attention to the digestive system pH values!

The Challenge: Your digestive system is like a chemical factory with different conditions in each section. How do enzymes work in such varied environments? _______

Quick Think:

- What happens to an egg white (protein) when you cook it? _______

- What might this tell us about enzymes and heat? _______

Your Mission: Discover the optimal working conditions for 9 different enzymes and understand why they're perfectly suited for their locations in the body!

Phase 2: EXPLORE (20 minutes)

Part A: Learning the Controls

Select **Amylase** (found in saliva)

Initial Observations at 25°C, pH 7:

- Enzyme shape: Compact / Spread out
- Movement speed: Fast / Medium / Slow
- Charged regions visible? Yes / No

Temperature Test: Keep pH at 7.0, slowly increase temperature:

- ———-

Discovery: At what temperature does amylase unfold? ___°C

pH Test: Reset to 37°C, adjust pH:

- ———-

Best pH ———

Pro Tip: Look for the green checkmarks when you're close!

Part C: Pattern Recognition

Group by Location:

- Mouth enzymes work best at pH: _______
- Intestinal enzymes work best at pH: _______

Why the differences? _______

Phase 3: EXPLAIN (15 minutes)

Making Sense of Your Discoveries

Temperature Patterns (Identify 3):

- Pattern 1: All human enzymes work best around ___°C (Hint: body temp!)

- Pattern 3: Too hot = enzyme _______ (unfolds permanently)

pH Patterns (Identify 3):

- Pattern 1: Extreme pH causes charged regions to _______

- Pattern 3: Wrong pH = wrong _______ = no function

The Denaturation Process: Number these events in order: ___ Enzyme loses function ___ Heat breaks weak bonds ___ Active site changes shape ___ Protein unfolds ___ Substrate can't bind

Location Matching: Explain why each enzyme's optimal pH matches its body location:

Example: Pepsin works at pH 2 because the stomach has hydrochloric acid

Your turn:

- Amylase at pH 6.8: _______

Phase 4: ELABORATE (12 minutes)

Real-World Applications

Medical Scenarios:

Fever Emergency: A child has a 104°F (40°C) fever.

- Which enzymes still work normally? _______

- Why do doctors worry about fevers above 105°F? _______

Digestive Disorders: A patient can't produce enough stomach acid (pH stays at 5):

- Can pepsin work properly? Yes / No

- Suggest a treatment: _______

Food Science: Why do we cook meat? _______

- What happens to bacterial enzymes? _______

- Why can't we eat raw chicken safely? _______

Design Challenge:

Create an enzyme for extreme conditions:

- Where it works: Deep sea volcanic vent (90°C, pH 3)

- How it differs from human enzymes: _______

Phase 5: EVALUATE (8 minutes)

Show What You Learned

Quick Check: Match the condition to its effect:

- High temperature • Enzyme moves slowly
- Low temperature • Enzyme unfolds
- Wrong pH • Enzyme shape distorts
- Optimal conditions • Maximum activity

Graph Interpretation: Sketch enzyme activity curves: _______ [Temperature graph space] [pH graph space]

Label: optimal point, denaturation, low activity zones

Problem Solving: You eat ice cream (cold) with hot coffee.

- What happens to lactase enzyme? _______
- Why might this cause discomfort? _______

Big Picture: Explain why having different enzymes with different optimal conditions is an advantage for digestion:

Model Evaluation:

- Coolest feature: _______
- One improvement suggestion: _______

Key Vocabulary:

- **Optimal Conditions:** Temperature and pH where enzyme works best
- **Denaturation:** Permanent unfolding of enzyme structure
- **Active Site:** Part of enzyme where reaction occurs

- **pH:** Measure of acidity (low) or basicity (high)
- **Catalase:** Enzyme that breaks down hydrogen peroxide