Name: **Date:** **Section:**

Enzyme Environment Activity: Environmental Effects on Enzyme Function

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

1. 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

1. **Temperature Test:**

Keep pH at 7.0, slowly increase temperature:

- ----------

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

1. **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

1. **Group by Location:**

- Stomach enzymes work best at pH: _____

Why the differences? _____

Phase 3: EXPLAIN (15 minutes)

Making Sense of Your Discoveries

1. **Temperature Patterns (Identify 3):**

- Pattern 2: Higher temp = _____ molecular movement

1. **pH Patterns (Identify 3):**

- Pattern 2: Each enzyme has a _____ pH for its location

1. **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

1. **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:

1. **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? _____

1. **Digestive Disorders:**

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

- Can pepsin work properly? Yes / No
- Suggest a treatment: _____

1. **Food Science:**

- 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

1. **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

1. **Graph Interpretation:**

[Temperature graph space] [pH graph space]

Label: optimal point, denaturation, low activity zones

1. **Problem Solving:**

You eat ice cream (cold) with hot coffee.

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

1. **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