Name: _____ **Date:** _____

Section: _____

Reproductive Isolation Activity

Modeling Speciation Through Reproductive Isolation

Background: _____

Speciation occurs when populations become reproductively isolated and diverge genetically. This simulation allows you to explore how different factors contribute to reproductive isolation and eventual speciation.

Phase 1: ENGAGE (10 minutes)

Getting Started: Open peebedu.com and navigate to Natural Selection and Speciation Simulation

Initial Exploration: Identify the variables you can control

Note the two traits: color (continuous) and shape (discrete) Observe the different graphs available Understand population splitting mechanism

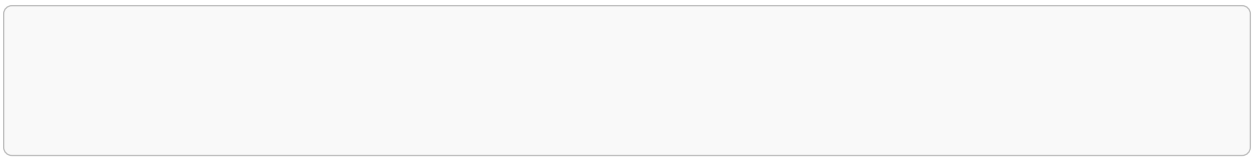
Pre-Assessment Questions: List three prezygotic barriers that prevent interbreeding:

- _____

- _____

How does allopatric speciation differ from sympatric speciation? _____

What role does gene flow play in preventing speciation? _____



Phase 2: EXPLORE (30 minutes)

Investigation 1: Baseline Evolution Without Barriers

Set initial parameters:

- Population: 200
- Mean trait: 128
- SD: 30
- Shape: 50% circles
- Mating preference: None
- Max color difference: 100

Run 50 generations and record:

Data Collection - No Barriers:

- ———-

Investigation 2: Behavioral Isolation (Assortative Mating)

Reset simulation. Change mating preference to '`Like Shapes Prefer`'

Shape-Based Mating Data:

- ————

%circles - %squares	25 (split)

Divergence =	Pop1 mean - Pop2 mean

Investigation 4: Reproductive Compatibility

After 100 generations of isolation, test reproductive compatibility:

- Change max color difference to 30
- Note if populations can still interbreed

Compatibility Test:

- Color difference between populations: _____
- Speciation occurred? (Yes/No): _____

Phase 3: EXPLAIN (25 minutes)

Speciation Mechanisms Analysis

Natural Selection's Role:

Explain how predation pressure drove divergence:

Reproductive Barriers Evolution:

Complete the flowchart: _____

“‘ Initial Population → [Your barrier] → Reduced Gene Flow →

→ [Result] → Reproductive Isolation → [Final outcome] “‘

Calculate selection coefficient (s) for dark creatures in light environment:

If 80% of dark creatures are eaten per generation:

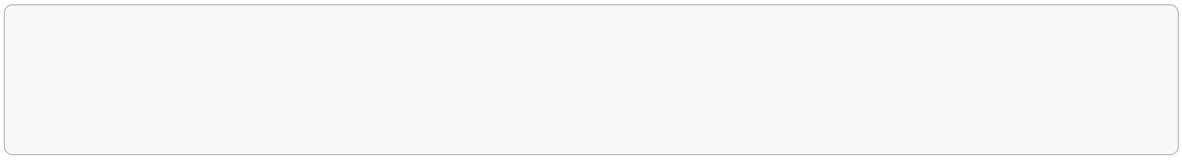
- Fitness of dark (wd) = _____
- Fitness of light (wl) = 1.0

Hybrid Zone Dynamics:

If populations meet again, predict hybrid fitness:

- Parent 1 traits: _____

- Hybrid traits: _____



Phase 4: ELABORATE (20 minutes)

Advanced Analysis

Speciation Rate Factors:

Design experiment to test effect of population size on speciation rate:

- Independent variable: _____

- Controls: _____

Real-World Applications:

Match the simulation parameters to real examples: _____ "' Color difference barrier → _____ Shape preference → _____ Geographic split → _____ Predation pressure → _____ "'

Options: Darwin's finches, Cichlid fish coloration, Island colonization, Sexual selection

Sympatric Speciation Modeling:

Design settings to model sympatric speciation:

- Mating preference: _____

- Predation: _____

Data Analysis:

Calculate reproductive isolation using FST analog:

FST = (HT - HS) / HT

Where:

- HT = total color variance

- HS = average within-population variance

Your calculation: _____

Phase 5: EVALUATE (15 minutes)

Assessment Questions

Experimental Design:

A researcher claims shape preference alone can cause speciation. Design test:

- Null hypothesis: _____

- Required controls: _____

Data Interpretation:

Given: Pop 1 evolved mean color 45, Pop 2 evolved mean color 210 Original max color difference for mating: 30

Calculate:

- Current reproductive barrier strength: _____

Critical Analysis:

Evaluate this claim: ‘`Speciation requires geographic isolation`‘

- Evidence for: _____

- Your conclusion: _____

Concept Application:

How would you modify the simulation to model:

- Polyploid speciation: _____

- Adaptive radiation: _____

Synthesis:

Create a speciation timeline showing:

- Initial variation
- Barrier establishment
- Trait divergence
- Reproductive isolation

Reflection Essay:

- Investigate Galápagos finch speciation
- Study cichlid species flocks
- Analyze polyploid speciation in plants

Advanced Modeling:

- Add habitat preference as third trait

- Model hybrid zones
- Simulate reinforcement

Literature Connection:

- Read Mayr's biological species concept
- Compare with other species concepts
- Evaluate concept limitations
- Hybrid zone case studies
- Mathematical models of speciation
- Current speciation research