Name: _____ **Period:** _____ **Date:** _____

Open **peebedu.com** and navigate to **Pocket Mice Natural Selection**. Click the **Start Exploring** button to begin. Read the introduction popup, which describes how the MC1R gene controls coat color in pocket mice and how owl predation drives changes in allele frequencies across generations.

Part 1 — Model Evaluation (MAPP Framework)

Scientific models are simplified representations of complex biological phenomena. Use the MAPP framework below to evaluate the Pocket Mice Natural Selection simulation as a scientific model.

M — Mode

What type of model is the Pocket Mice Natural Selection simulation? Describe how this computational simulation represents the process of natural selection in pocket mouse populations. In your answer, identify at least three specific simulation elements and explain what each one is designed to show about natural selection and evolution.

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A — Accuracy

(a) Identify two things this simulation represents **accurately** about natural selection. For each, name the specific simulation feature and explain what aspect of natural selection it demonstrates.

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(b) Identify two things this simulation **oversimplifies or leaves out** about natural selection in real populations. Consider what you cannot observe in the simulation that would be important for a complete understanding of how natural selection operates in the wild.

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P — Purpose

What is the learning goal of this simulation? Explain how the Pocket Mice Natural Selection simulation is designed to help you understand how environmental change and predation drive shifts in allele frequencies over generations. In your answer, connect at least one specific simulation feature to a real-world biological scenario where natural selection has shaped a population.

P — Permanency

Could this model change with new scientific evidence? Describe one way that new discoveries about the MC1R gene or natural selection might change or improve a simulation like this. Explain why scientific models, including computational simulations, are revised as new evidence becomes available.

Small-Group Discussion

With your group, discuss the following:

- What are the strengths of this simulation as a model for natural selection?
- What are its limitations?
- If you could add one feature to improve this simulation, what would it be and why?
- How does the simulation help you connect changes in allele frequency to the concept of evolution by natural selection?

Part 2 — Free Response Questions

Conceptual Analysis

Question 1 — Natural Selection on the Sandy Desert

Simulation Task: Reset the simulation and set the Starting R Allele Frequency to 5%. Keep the environment as Sandy Desert with 2 owls. Click Skip to advance through at least 5 generations. Observe the allele frequencies, genotype counts, and the number of mice captured by owls each generation.

(A) (1 pt) **Describe** how natural selection acts on the phenotypic variation in coat color within the pocket mouse population on the sandy desert.

(B) (1 pt) **Explain** why the frequency of the R allele decreases over multiple generations in the sandy desert environment.

(C) (1 pt) **Predict** what would happen to the frequency of the R allele if the number of hunting owls were increased from 2 to 5 while the environment remains sandy desert.

(D) (1 pt) **Justify** your prediction by explaining how the intensity of selection pressure from predation affects the rate at which natural selection drives changes in allele frequency across generations.

EK 7.1.A.1, 7.1.A.2, 7.1.B.1

Analyze Model / Visual Representation

**Question 2 — Environmental Change and Directional Selection**

Simulation Task: Reset the simulation and set the Starting R Allele Frequency to 50%. Run the simulation in the sandy desert for 3 generations. Then click Trigger Volcanic Eruption to change the environment to dark lava rock and continue running the simulation for at least 5 more generations. Observe how the allele frequencies and phenotype counts change before and after the eruption.

(A) (1 pt) **Describe** how the volcanic eruption changes which phenotypic variation is favored by natural selection in the pocket mouse population.

(B) (1 pt) **Explain** how the shift from sandy desert to lava rock demonstrates that biotic and abiotic environmental factors can change the direction of natural selection.

(C) (1 pt) **Represent** the change in R allele frequency over time.

Draw your graph here.
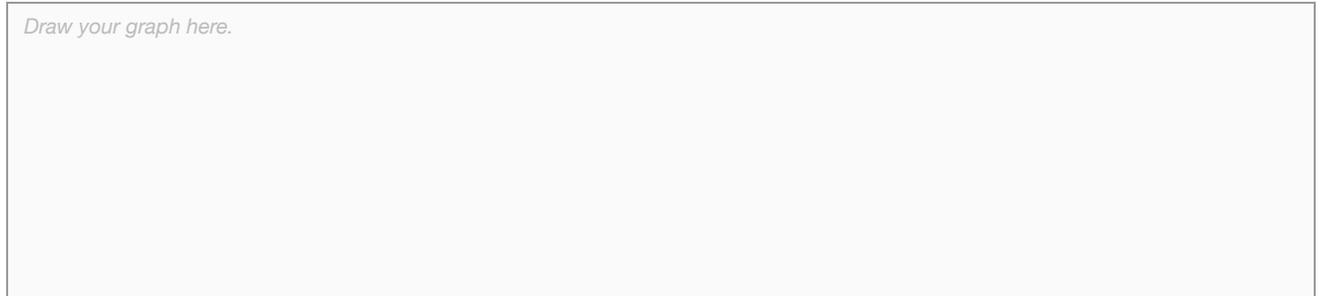
(D) (1 pt) **Connect** the predator-prey relationship between owls and pocket mice to how biotic interactions within a community can act as a selective pressure that drives evolutionary change.

EK 7.1.B.2, 7.2.A.1, 7.2.A.3