PEEBEDU

Virtual Gel Electrophoresis

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

> Open **peebedu.com** and navigate to **Virtual Gel Electrophoresis**. Read the introduction popup, which explains that gel electrophoresis separates DNA fragments by size using an electric field. Select the **Sickle Cell** scenario to begin, then explore other scenarios as directed.

Free Response Questions

Question 1 — Conceptual Analysis

> **Simulation Task:** *Select the* **Sickle Cell** *scenario from the mission menu. Load all samples into the lanes and run the gel at the default voltage (100V). Observe the band patterns that appear in each lane and note which lanes show different banding patterns from one another.*

(A) (1 pt) **Describe** the properties of DNA fragments that determine how far each fragment migrates through a gel during electrophoresis.

(B) (1 pt) **Explain** why a single nucleotide change in the beta-globin gene can cause an individual's DNA to produce a different banding pattern on a gel than DNA from an individual without that change, after both samples are cut with the same restriction enzyme.

(C) (1 pt) **Predict** how the banding pattern of an individual who carries one copy of the normal beta-globin allele and one copy of the sickle cell allele would compare to the patterns of individuals who are homozygous for each allele.

(D) (1 pt) **Justify** your prediction.

Question 2 — Analyze Model / Visual Representation

> **Simulation Task:** *Select the* **Cystic Fibrosis** *scenario from the mission menu. Load all samples and run the gel. Then switch to the* **Custom Scenario***, load a DNA Ladder in Lane 1 and any other sample in Lane 2, adjust the voltage slider to 50V, run the gel, reset, then re-run at 150V. Compare how the band positions change.*

(A) (1 pt) **Describe** how gel electrophoresis banding patterns can be used to determine whether an individual carries a specific mutation in a gene.

(B) (1 pt) **Explain** why DNA fragments of different sizes end up at different positions in the gel after electrophoresis is complete.

(C) (1 pt) **Draw** In the box below, draw a labeled diagram of a gel electrophoresis result that shows the following: a DNA ladder (molecular weight marker) in Lane 1, a normal individual in Lane 2, a carrier (heterozygous) in Lane 3, and an affected individual in Lane 4. Label the wells, the direction of DNA migration, the positive and negative electrodes, and indicate relative fragment sizes.

Draw your diagram here.

(D) (1 pt) **Explain** how an allele that produces an altered protein detectable by gel electrophoresis could be maintained in a population despite being harmful to homozygous individuals.

6.8.A.1