

PEEBEDU Virtual Restriction Digest

Unit 6: Gene Expression and Regulation

Name: _____ Period: _____ Date: _____

Open **peebedu.com** and navigate to **Virtual Restriction Digest**. When the mode selection dialog appears, choose **Case 3: Sickle Cell Screening**. Read the case introduction, which explains how the MstII restriction enzyme is used to screen patients for sickle cell genotypes by cutting the HBB (beta-globin) gene at specific recognition sites.

Free Response Questions

Question 1 — Conceptual Analysis

Simulation Task: *In the simulation, select **Case 3: Sickle Cell Screening**. Use the MstII restriction enzyme to digest HBB Gene samples from three patients. After the digestion is complete, click **View Results** to observe the gel electrophoresis banding patterns. Compare the fragment patterns for a normal (AA) individual, a carrier (AS), and an affected (SS) individual.*

(A) (1 pt) **Describe** what a difference in the number of fragments between two patients' samples indicates about the DNA sequences of those two patients.

(B) (1 pt) **Explain** why a DNA molecule in which one recognition sequence has been altered produces fewer fragments than an unaltered DNA molecule when both are digested with the same enzyme.

(C) (1 pt) **Predict** how many bands would appear on the gel if a DNA sample were digested with an enzyme whose recognition sequence does not occur anywhere in that sample.

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

Question 2 — Analyze Model / Visual Representation

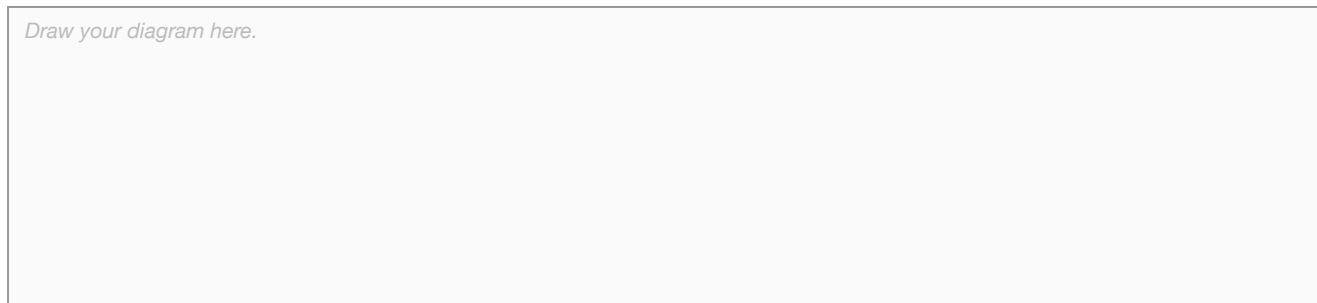
Simulation Task: *In the simulation, select **Standard Lab Mode**. Drag the **Lambda DNA** sample and the **EcoRI** restriction enzyme into the workspace. Click **Perform Digestion** and then **View Results** to observe the gel electrophoresis pattern. Next, repeat the experiment using **HindIII** on the same Lambda DNA. Compare the two gel patterns.*

(A) (1 pt) **Describe** how the gel pattern produced by digesting Lambda DNA with EcoRI differs from the pattern produced by digesting the same Lambda DNA with HindIII.

(B) (1 pt) **Explain** why the bands closest to the wells on a completed gel represent the largest DNA fragments while the bands farthest from the wells represent the smallest fragments.

(C) (1 pt) **Represent** In the box below, draw a labeled diagram showing how a restriction enzyme recognizes and cleaves a double-stranded DNA molecule at a palindromic recognition site. Your diagram should include: the double-stranded DNA with complementary base pairs at the recognition site, the enzyme bound to the DNA, and the resulting fragments with their sticky ends after cleavage.

Draw your diagram here.



(D) (1 pt) **Explain** how the specific pairing of bases between the two antiparallel strands of a DNA molecule allows a recognition sequence to read the same on both strands in the 5' to 3' direction.

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