

Name: _____ Period: _____ Date: _____

Open **peebedu.com** and navigate to **Sickle Cell Simulation**. Read through the **Introduction** slides, which cover red blood cells and hemoglobin, the sickle cell mutation, genotypes and their effects, and the connection between sickle cell trait and malaria resistance. Click **Get Started** to begin.

Free Response Questions

Question 1 — Conceptual Analysis

Simulation Task: Set both Chromosome 11 copies to HbA Normal. Observe the DNA template strand, mRNA codons, and amino acid sequence for codon 6 on both panels. Note the blood vessel animation on the right. Then switch Copy 2 to HbS Sickle and compare the sequences. Finally, set both copies to HbS Sickle and observe the red blood cell shapes and blood flow.

(A) (1 pt) **Describe** the process by which a change in a DNA nucleotide sequence results in a different amino acid in the polypeptide chain.

(B) (1 pt) **Explain** why a point mutation in the HBB gene can change the phenotype of a red blood cell.

(C) (1 pt) **Predict** the rate of blood flow through the vessel shown in the simulation for an individual whose two HBB alleles are both HbS.

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

Question 2 — Analyze Model / Visual Representation

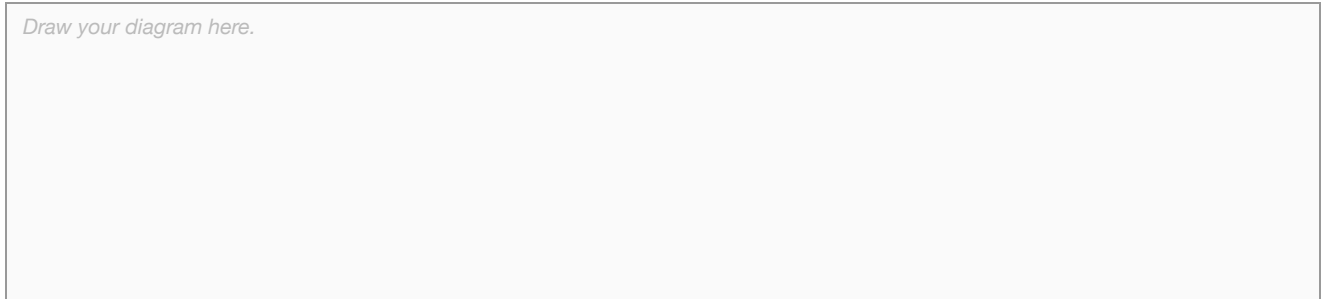
Simulation Task: Set one chromosome copy to HbA Normal and the other to HbS Sickle (heterozygous, HbA/HbS). Observe the blood flow and person status display. Then toggle the Malaria Exposure switch ON and observe how the simulation represents the interaction between sickle cell trait and the malaria parasite. Compare the stats displayed for all three genotypes with malaria active.

(A) (1 pt) **Describe** the difference in the person status display shown in the simulation for the three HBB genotypes when malaria exposure is switched on.

(B) (1 pt) **Explain** why the HbS allele affects survival differently depending on whether malaria is present in the environment.

(C) (1 pt) **Represent** the difference between a normal red blood cell and a sickled red blood cell by drawing a labeled diagram that shows how the arrangement of hemoglobin molecules differs inside each cell.

Draw your diagram here.



(D) (1 pt) **Explain** why interactions among amino acid R groups determine the three-dimensional shape of a protein.

6.7.C.1