

Name: _____ Period: _____ Date: _____

Open **peebedu.com** and navigate to **Epic Genetics**. Click the **Let's Start!** button to begin. Read the introduction popup, which describes how genetic information flows from DNA to RNA to protein through the central dogma. Use the **Generate DNA** button to create a new DNA sequence, then explore the **Molecular Tools** panel on the left side of the screen.

Free Response Questions

Question 1 – Conceptual Analysis

Simulation Task: *In the Epic Genetics simulator, click **Generate DNA** to create a new sequence. First, select **RNA Polymerase** and click **Execute Actions** without adding a Promoter - observe what happens. Then add the **Promoter** and the **Transcription Factor**, select **RNA Polymerase**, and click **Execute Actions** again. Compare the Sim Status panel before and after adding the Transcription Factor, noting the change in transcript count.*

(A) (1 pt) **Describe** the relationship between regulatory DNA sequences and regulatory proteins in controlling whether a gene is transcribed.

(B) (1 pt) **Explain** why transcription cannot begin until a promoter is present in the simulated gene.

(C) (1 pt) **Predict** how the amount of a tissue-specific protein made in muscle cells would be affected if a mutation prevented the transcription factor that activates its gene from binding to the promoter.

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

Question 2 — Analyze Model / Visual Representation

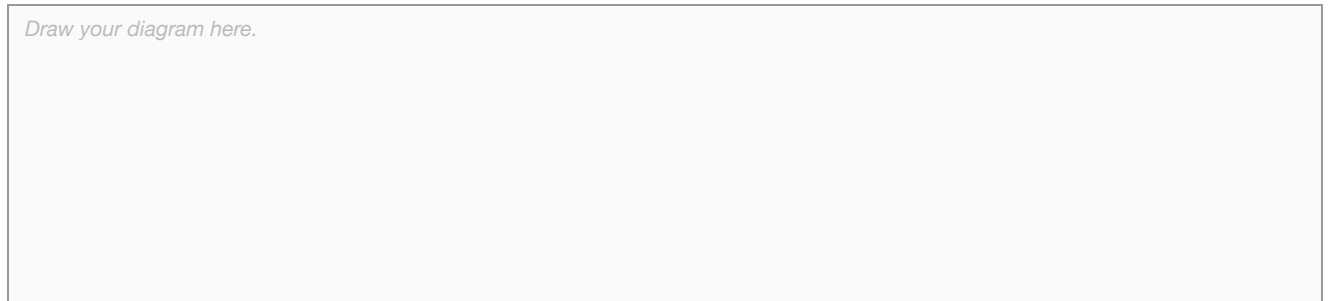
Simulation Task: In the Epic Genetics simulator, generate a new DNA sequence. Complete the full central dogma pathway: add the Promoter, select RNA Polymerase and click **Execute Actions**, then use the **Spliceosome** to process the pre-mRNA. Note the mature mRNA sequence. Now click **Reset**, generate the same or new DNA, and this time use the **Alt Spliceosome** instead. Compare the two mature mRNA sequences and the resulting polypeptide chains.

(A) (1 pt) **Describe** how the same DNA sequence in a single gene can give rise to more than one version of a mature mRNA molecule.

(B) (1 pt) **Explain** why a neuron and a liver cell in the same organism contain identical DNA yet produce different sets of proteins.

(C) (1 pt) **Represent** In the box below, draw a labeled diagram showing how one gene can produce two different proteins through alternative splicing. Your diagram should include: a DNA sequence with at least three exons and two introns, two different splicing patterns, and the two resulting mRNA and protein products. Label all components clearly.

Draw your diagram here.



(D) (1 pt) **Explain** how two individuals that have the same genotype can develop different phenotypes when they grow up in different environments.

6.3.A.4, 6.6.B.1