Protein Builder

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

Open **peebedu.com** and navigate to **Protein Builder**. Click the **Start Building!** button to begin. Read the introduction popup, which describes four levels of protein structure: Primary, Secondary, Tertiary, and Quaternary.

Free Response Questions

Question 1 — Conceptual Analysis

Simulation Task: *Build a chain of at least 12 amino acids that includes two cysteines (C), one positively charged amino acid (R, H, or K), one negatively charged amino acid (E or D), and at least three nonpolar amino acids. Apply the Alpha Helix secondary structure. Then switch to Tertiary Structure and use Drag mode to move R-group spheres until the folding score reaches at least 80%.*

(A) (1 pt) **Describe** the property of amino acids that determines how a protein folds into its three-dimensional shape.

(B) (1 pt) **Explain** why a polypeptide chain folds into a specific three-dimensional shape rather than remaining as a linear strand.

(C) (1 pt) **Predict** what would happen to an enzyme's ability to catalyze reactions if a mutation replaced a cysteine involved in a disulfide bridge with a nonpolar amino acid.

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

Question 2 — Analyze Model / Visual Representation

> **Simulation Task:** *Reset the simulation and build two different chains of 10 amino acids each. For the first chain, use mostly nonpolar amino acids. For the second chain, use a mix of polar, charged, and nonpolar amino acids. Apply the Beta Sheet secondary structure to each chain, then switch to Tertiary Structure and click Auto-Fold Protein for each chain. Compare the folding scores and the types of interactions that form.*

(A) (1 pt) **Describe** what determines the primary structure of a polypeptide.

(B) (1 pt) **Explain** why two polypeptide chains with the same secondary structure fold into different tertiary shapes when their amino acid sequences differ.

(C) (1 pt) **Represent** the tertiary structure of a protein showing at least two types of R-group interactions.

Draw your diagram here.

(D) (1 pt) **Explain** how a single amino acid substitution in a digestive enzyme could affect an organism's ability to compete for food in its environment.

1.7.A.3