

Name: _____ Period: _____ Date: _____

Open **peebedu.com** and navigate to **Alcohol Metabolism Explorer**. Read the three-slide introduction, which explains the ethanol metabolism pathway: Ethanol → (ADH1B enzyme) → Acetaldehyde (toxic) → (ALDH2 enzyme) → Acetate (harmless). Click **Begin** to start exploring.

Free Response Questions

Question 1 — Conceptual Analysis

Simulation Task: In the ADH1B panel, set Allele 1 to Wildtype (A) and Allele 2 to Variant (G). Compare the DNA sequences, RNA sequences, and resulting amino acids for each allele. Note how the single-base change propagates through transcription and translation.

(A) (1 pt) **Describe** how the single-nucleotide difference between the two ADH1B alleles shown in the simulation changes the codon read during translation.

(B) (1 pt) **Explain** why an altered codon can cause a cell to produce an enzyme with reduced activity.

(C) (1 pt) **Predict** the activity of the enzyme produced by an individual who carries two variant ADH1B alleles.

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

Question 2 — Analyze Model / Visual Representation

Simulation Task: *In the ALDH2 panel, try all three genotype combinations: Wildtype/Wildtype, Wildtype/Variant, and Variant/Variant. For each combination, observe the protein structure visualization and the phenotype display (face icon and flush label). Then select the case study “Sakura” and read the family description.*

(A) (1 pt) **Describe** the relationship between the number of variant alleles and the severity of the flush phenotype in the ALDH2 gene, as shown in the simulation.

(B) (1 pt) **Explain** why an individual carrying one wild-type and one variant ALDH2 allele produces an intermediate amount of functional enzyme.

(C) (1 pt) **Represent** the ALDH2 genotypes expected among the offspring of Sakura (Wildtype/Variant) and Kenji (Wildtype/Wildtype) by drawing a completed Punnett square for the cross described in the case study.

Draw your diagram here.

(D) (1 pt) **Explain** why the sequence of amino acids in a polypeptide determines the overall shape of the finished protein.

6.5.A.3