PEEBEDU

Blood Sugar Regulation App

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

> Open **peebedu.com** and navigate to **Blood Sugar Regulation App**. Click the **Start Regulating** button to begin. Read the introduction popup, which describes the four stages of blood sugar regulation: Glucose Rise, Insulin Response, Glucose Drop, and Glucagon Response.

Free Response Questions

Question 1 — Conceptual Analysis

> **Simulation Task:** *Set the simulation to* **Normal Regulation** *mode. Click* **Eat Food** *twice and observe the glucose meter and trend chart as blood sugar rises. Watch for the pancreas to release insulin and for glucose to return toward the set point. Then click* **Exercise** *and observe how the system responds when glucose drops below the set point.*

(A) (1 pt) **Describe** the roles of the signaling molecules and target organs involved in returning blood glucose to its set point after a meal.

(B) (1 pt) **Explain** why blood glucose concentration rises sharply after eating but then returns to approximately the same baseline level, rather than continuing to rise or falling to zero.

(C) (1 pt) **Predict** how blood glucose levels over a 24-hour period in an individual whose beta cells have been destroyed by an autoimmune response would differ from those in a healthy individual consuming the same meals.

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

Question 2 — Analyze Model / Visual Representation

> **Simulation Task:** *First run the* **Normal Regulation** *scenario: click* **Eat Food** *and observe the full cycle of glucose rise, insulin release, and return to normal. Then switch to the* **Type 1 Diabetes** *scenario and click* **Eat Food** *again. Compare the glucose trend lines and meter readings between the two scenarios.*

(A) (1 pt) **Describe** the relationship between a change in blood glucose concentration and the cellular responses that return glucose to its set point, identifying the levels of biological organization at which this process operates.

(B) (1 pt) **Explain** why an individual with reduced cellular sensitivity to insulin maintains a higher average blood glucose concentration after meals than a healthy individual, even though both individuals produce insulin from the pancreas.

(C) (1 pt) **Represent** the feedback loop for blood glucose regulation by drawing a labeled diagram that includes the stimulus, the pancreas, the signaling molecules, the target organs, and arrows showing how the response opposes the original stimulus.

Draw your diagram here.

(D) (1 pt) **Explain** how an organism with a dysfunctional glucose regulation feedback loop would be affected during periods of food scarcity compared to organisms with normal regulation.

4.4.A.1