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.

Part 1 — Model Evaluation (MAPP Framework)

Scientific models are simplified representations of complex biological phenomena. Use the MAPP framework below to evaluate the Blood Sugar Regulation App as a scientific model.

M — Mode

What type of model is the Blood Sugar Regulation App? Describe how this computational simulation represents the process of blood glucose regulation. In your answer, identify at least three specific simulation elements and explain what each one is designed to show about how the body maintains blood sugar levels.

_____

_____

_____

_____

A — Accuracy

(a) Identify two things this simulation represents **accurately** about blood sugar regulation. For each, name the specific simulation feature and explain what aspect of glucose homeostasis it demonstrates.

_____

_____

_____

(b) Identify two things this simulation **oversimplifies or leaves out** about blood sugar regulation. Consider what you cannot observe in the simulation that would be important for a complete understanding of hormonal signaling and cellular responses involved in glucose homeostasis.

_____

_____

_____

_____

P — Purpose

What is the learning goal of this simulation? Explain how the Blood Sugar Regulation App is designed to help you understand how negative feedback mechanisms maintain blood glucose homeostasis through the actions of insulin and glucagon. In your answer, connect at least one specific simulation feature to a biological consequence of disrupted glucose regulation.

P — Permanency

Could this model change with new scientific evidence? Describe one way that new discoveries might change or improve a simulation like the Blood Sugar Regulation App. Explain why scientific models, including computational simulations, are revised as new evidence becomes available.

Small-Group Discussion

With your group, discuss the following:

- What are the strengths of this simulation as a model for blood sugar regulation?
- What are its limitations?
- If you could add one feature to improve this simulation, what would it be and why?
- How does the simulation help you connect the organism-level observation of blood sugar changes to the cellular-level actions of insulin and glucagon?

Part 2 — NGSS Questions

1.

Describe how the pancreas detects a rise in blood sugar and responds by releasing insulin. Explain how insulin causes body cells and the liver to remove glucose from the bloodstream, bringing blood sugar back toward a normal level.

HS-LS1-3

2.

Describe how the pancreas responds when blood sugar drops below the normal range. Explain the role of glucagon in signaling the liver to release stored glucose and how this raises blood sugar back toward the set point.

HS-LS1-3

3.

*Simulation Task: In **Normal Regulation** mode, click **Eat Food** and then click **Exercise** after the glucose level begins to fall. Watch the full cycle on the glucose trend chart as the line rises, falls, and returns to the normal range.*

Explain how the insulin and glucagon responses you observed work together as a negative feedback system. Describe why the blood sugar level does not continue rising or falling indefinitely but instead returns toward a stable value.

HS-LS1-3

4.

*Simulation Task: Switch to the **Type 1 Diabetes** scenario and click **Eat Food** twice. Observe the glucose meter and trend chart. Notice whether the pancreas releases insulin. Then click the **Take Insulin** button and observe what happens to the glucose level.*

Explain why blood sugar rises without returning to normal in the Type 1 Diabetes scenario. Describe how injecting insulin externally restores the ability of the body to lower blood sugar, and explain what this tells you about the importance of the pancreas in the negative feedback loop.

HS-LS1-3

5.

Explain why blood sugar stays elevated in the Type 2 Diabetes scenario even though insulin is being released. Describe how reducing insulin sensitivity changes the way body cells respond to the insulin signal and disrupts the feedback loop.
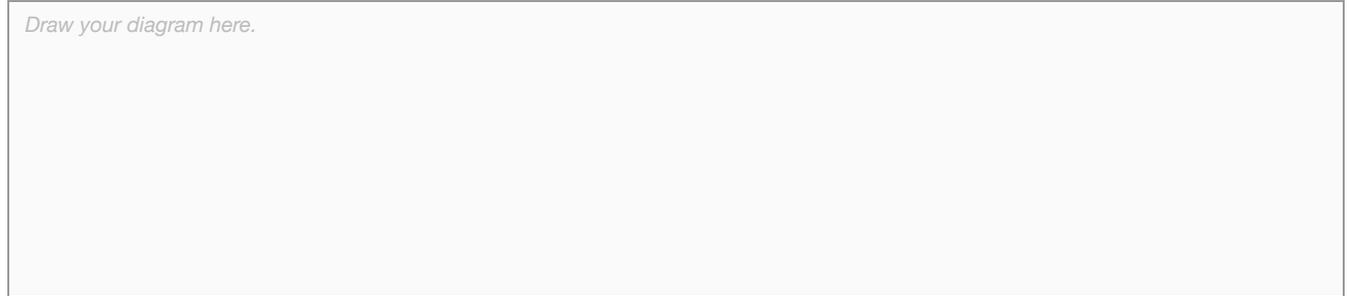
HS-LS1-3

6.

In the box below, draw a diagram of the negative feedback loop for blood sugar regulation. Include the pancreas, liver, body cells, insulin, and glucagon. Use arrows to show how a rise in blood sugar triggers insulin release and how a drop in blood sugar triggers glucagon release, with each response bringing blood sugar back toward the normal range.

Draw your diagram here.

HS-LS1-3

7.

When blood sugar regulation fails, many other organ systems are affected. Choose one other organ system (such as the circulatory system, nervous system, or urinary system) and explain how prolonged high blood sugar could disrupt its normal function. Describe why the failure of one feedback system can have consequences throughout the entire organism.

HS-LS1-2