

Name: _____ Period: _____ Date: _____

Open **peebedu.com** and navigate to **Sugar Factory**. Click the **Let's Make Sugar!** button to begin. Read the introduction popup, which outlines six steps for producing glucose through light-dependent reactions, the Calvin cycle, and glucose synthesis.

Free Response Questions

Question 1 — Conceptual Analysis

Simulation Task: Click "Water the Plant" and "Provide Sunlight & CO₂" to generate molecules. Drag 2 H₂O into the Thylakoid Membrane slots and click it to run the light reactions. Then drag 3 CO₂, 3 ATP, and 2 NADPH into the Calvin Cycle slots, click the Calvin Cycle to produce G3P, drag 2 G3P into the Glucose Synthesis zone, and click it to produce glucose.

(A) (1 pt) **Describe** the molecules that photosynthesis uses as reactants.

(B) (1 pt) **Explain** why photosynthesis requires an input of light energy in addition to carbon dioxide and water.

(C) (1 pt) **Predict** what will happen to the number of glucose molecules produced in the Glucose Synthesis zone if carbon dioxide is withheld while sunlight is still supplied.

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

Question 2 — Analyze Model / Visual Representation

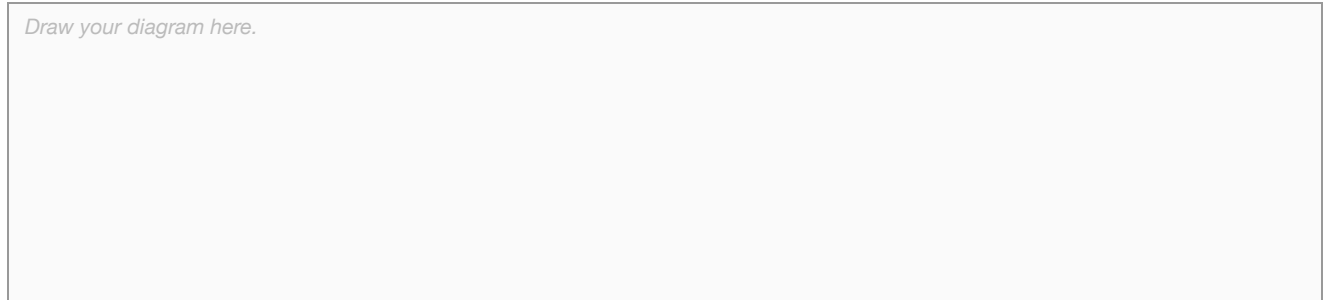
Simulation Task: Complete one full cycle of the Sugar Factory: drag 2 H₂O into the Thylakoid Membrane zone, click Provide Sunlight & CO₂, and trigger the thylakoid reaction. Note which molecules are produced there. Then move those molecules into the Calvin Cycle zone with CO₂ and trigger it, and finally combine 2 G3P in the Glucose Synthesis zone.

(A) (1 pt) **Describe** the region of the chloroplast in which the light reactions occur.

(B) (1 pt) **Explain** why the ATP and NADPH made in the thylakoid zone must move to the Calvin Cycle zone before glucose can be produced.

(C) (1 pt) **Represent** the chloroplast by drawing a labeled diagram that shows the thylakoid membrane, the stroma, and arrows for the movement of ATP and NADPH between them.

Draw your diagram here.



(D) (1 pt) **Explain** how the internal membranes of the chloroplast allow the light reactions and carbon fixation to proceed at the same time without interfering with each other.

3.4.A.2, 3.4.B.6