

Name: _____ Period: _____ Date: _____

Open peebedu.com and navigate to **Light Reactions Simulator**. Click the **Watch the Sunrise** button to begin. Read the introduction popup, which describes the inputs (light energy, H₂O, ADP, Pi, NADP⁺), outputs (ATP, NADPH, O₂), and the Z-scheme electron flow from Photosystem II through Photosystem I.

Free Response Questions

Question 1 – Conceptual Analysis

Simulation Task: *In the Light Reactions Simulator, set the scenario to "Normal" and the light intensity to 50%. Click Play and observe for 30 seconds, recording the ATP Produced, NADPH Formed, and O₂ Released values. Then switch the scenario to "No Water" and observe for another 30 seconds, noting any changes in the production counters and the lumen/stroma pH values.*

(A) (1 pt) **Describe** the inputs and outputs of the light-dependent reactions that occur in the thylakoid membranes of chloroplasts.

(B) (1 pt) **Explain** why the production of ATP, NADPH, and O₂ all stop when water is no longer available to the chloroplast.

(C) (1 pt) **Predict** what would happen to the biomass of primary consumers in an aquatic ecosystem if increased cloud cover significantly reduced the light energy reaching the photosynthetic organisms at the base of the food web.

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

Question 2 — Analyze Model / Visual Representation

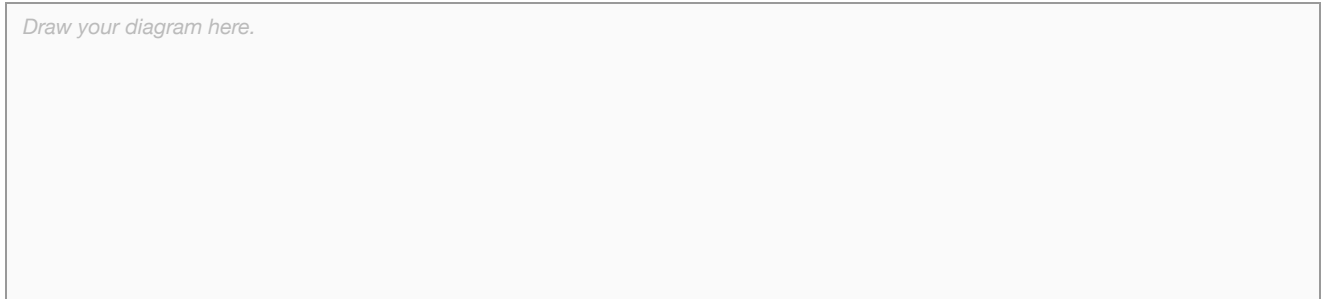
Simulation Task: *In the Light Reactions Simulator, set the scenario to "Normal" and click "Toggle Labels" to display the names of each protein complex in the thylakoid membrane. Click Play, then Pause after a few seconds. Observe the positions of PSII, cytochrome b6f, PSI, NADP+ reductase, and ATP synthase. Note the lumen pH and stroma pH values displayed on the H+ gradient panel.*

(A) (1 pt) **Describe** what happens to electrons in Photosystem II and Photosystem I when each absorbs light energy.

(B) (1 pt) **Explain** why the pH inside the thylakoid lumen decreases while the pH of the stroma increases during the light-dependent reactions.

(C) (1 pt) **Represent** the light-dependent reactions by drawing a labeled cross-section of the thylakoid membrane showing PSII, the cytochrome b6f complex, PSI, NADP+ reductase, and ATP synthase, with arrows indicating the direction of electron flow and H+ movement.

Draw your diagram here.



(D) (1 pt) **Explain** why removing all photosynthetic organisms from an aquatic ecosystem would eventually halt aerobic cellular respiration in the consumer organisms that remain.

3.4.A.2, EK 3.4.A.3, EK 3.4.B.4, EK 3.4.B.6