1. The diagram below shows a partial model of photosystems II and I in the light-dependent reactions of photosynthesis.

Which statement explains the process that occurs immediately after the electrons are excited in photosystem II?

(A) The excited electrons are replaced when an enzyme splits a water molecule into two electrons, an oxygen atom, and two hydrogen ions.

(B) The excited electrons release energy in the form of ATP and are then transported back to the reaction center through a series of redox reactions.

(C) The excited electrons are accepted by the terminal electron acceptor NADP⁺ and used to generate ATP.

(D) The excited electrons are added to ADP⁺ to produce ATP, which is used to drive the reactions needed to produce sugar from carbon dioxide in the Calvin cycle.
2. The chloroplasts in a plant cell have a mutation that causes hydrogen ions to diffuse directly through the phospholipid bilayer of the membranes identified in the diagram below.

Which statement explains how the mutation most directly affects the chloroplasts?

(A) Chlorophyll in the photosystems is not able to use free energy to excite electrons to higher energy levels.

(B) Enzymes in the stroma are not able to use ATP and NADPH to generate 3-carbon sugars in the Calvin cycle.

(C) The thylakoid membrane is not able to generate an electrochemical gradient needed for the production of ATP via chemiosmosis.

(D) Enzymes in the thylakoid membrane are not able to split water and generate oxygen through photolysis.
3. Noncyclic photophosphorylation and cyclic photophosphorylation are the two pathways that generate ATP in the light-dependent reactions. The diagrams below show the light-dependent reactions and the Calvin cycle.

Based on the diagrams, which statement best explains why there are two different pathways that generate ATP in the light-dependent reactions?

(A) Noncyclic photophosphorylation allows the chloroplast to undergo photosynthesis, even when no water is available.

(B) The Calvin cycle requires more ATP than NADPH, and the extra ATP is generated by cyclic photophosphorylation without generating an excess of NADPH.

(C) Cyclic photophosphorylation requires less energy from photons, which allows ATP to be produced more quickly than in noncyclic photophosphorylation.

(D) The Calvin cycle generates NADP⁺, which is converted into NADPH more quickly if two pathways are utilized rather than one.
4. The cells of a plant are exposed to a chemical that binds to and inactivates proteins that serve as proton pumps on cell membranes. Which statement explains how this chemical will most likely disrupt the process of photosynthesis?

(A) The plant cells will be unable to produce ATP because they will be unable to generate the electrochemical gradient across the thylakoid membrane.

(B) The plant cells will be unable to use active transport and will use simple diffusion to move hydrogen ions across the thylakoid membrane, which will reduce the rate at which sugars are produced.

(C) The plant cells will be unable to reduce NADP⁺ to NADPH because the necessary hydrogen ions will be unable to move across the thylakoid membrane.

(D) The plant cells will be unable to move carbon dioxide into the stroma, which will result in the inability to produce sugars in the Calvin cycle.
5. An absorption spectrum is a graph that plots a pigment’s degree of light absorption at different wavelengths of light. The graph below shows the relationship between the absorption spectrum for chlorophyll a (solid line) and the overall rate of photosynthesis (dotted line) in an alga exposed to different wavelengths of light.

Which statement best explains the data shown in the graph?

(A) Chlorophyll a must serve a minor role in the absorption of light during photosynthesis because the absorption spectrum of chlorophyll a does not match the rate of photosynthesis.

(B) Other pigments must absorb light in other wavelengths, which increases the range of visible light that can be utilized by the alga for photosynthesis.

(C) Photosynthesis will not occur if the alga is exposed to light that is in the green-yellow wavelength because chlorophyll a absorbs only the violet-blue and orange-red wavelengths of light.

(D) The alga is only able to use a small percentage of the total energy received from the sun for photosynthesis because chlorophyll a does not absorb light in the yellow wavelength and most of the light produced by the sun is in the yellow wavelength.