Name KEY _____

8.3 The Process of Photosynthesis

The Light-Dependent Reactions: Generating ATP and NADPH

For Questions 1–5, write True if the statement is true. If the statement is false, change the underlined word or words to make the statement true.

TRUE **1.** Photosystems are clusters of chlorophyll and proteins.

PHOTOSYSTEM II **2.** The light-dependent reactions begin when photosystem I absorbs light.

TRUE **3.** Electrons from water molecules replace the ones lost by photosystem II.

NADPH **4.** ATP is the product of photosystem I.

ENERGY **5.** ATP and NADPH are two types of protein carriers.

6. How does ATP synthase produce ATP? _____

ROTATION OF ATP SYNTHASE PROVIDES ENERGY NEEDED TO BIND A PHOSPHATE GROUP TO ADP, CREATING ATP ☺

7. When sunlight excites electrons in chlorophyll, how do the electrons change?

THEY MOVE TO A HIGHER ENERGY STATE, OR MOVE FARTHER AWAY FROM THE NUCLEUS

8. Where do the light-dependent reactions take place? **THYLAKOID MEMBRANES**

_____

9. Complete the table by summarizing what happens in each phase of the light-dependent reactions of photosynthesis.

Light-Dependent Reactions	Summary
Photosystem II	**Photosystem II absorbs light and increases the electrons' energy level. The electrons are passed to the electron transport chain. Enzymes in the thylakoid break up water molecules into 2 electrons, 2 H+ ions, and 1 oxygen atom. The 2 electrons replace the high-energy electrons that have been lost to the electron transport chain.**
Electron Transport Chain	**Energy from the electrons is used by the proteins in the chain to pump H+ ions from the stroma into the thylakoid space. At the end of the electron transport chain, the electrons themselves pass to photosystem I.**
Photosystem I	**The electrons do not contain as much energy as they used to. Pigments use energy from light to reenergize the electrons. At the end of a short second electron transport chain, NADP + molecules in the stroma pick up the high-energy electrons, along with H+ ions, at the outer surface of the thylakoid membrane, to become NADPH.**
Hydrogen Ion Movement and ATP Formation	**Hydrogen ions began to accumulate within the thylakoid space. The buildup of hydrogen ions makes the stroma negatively charged relative to the space within the thy- lakoids. This gradient, the difference in both charge and H+ ion concentration**

	across the membrane, provides the energy to make ATP.

The Light-Independent Reactions: Producing Sugars

10. What does the Calvin cycle use to produce high-energy sugars?

The Calvin cycle uses carbon dioxide molecules as well as ATP and NADPH from the light-dependent reactions to make sugars.

11. Why are the reactions of the Calvin cycle called light-independent reactions?

The reactions of the Calvin cycle use ATP and NADPH as energy sources. They do not directly require light.

12. What makes the Calvin cycle a cycle?

The compound (RUBP) with which CO2 from the air combines is a product of the cycle, which enables the series of reactions to occur over and over.

13. Complete the diagram of the Calvin cycle by filling in the missing labels.