

Photosynthesis

Name _____

Date _____

Period _____

Part 1 · Vocabulary

1. Write the letter of the matching description next to each term.

- | | |
|-----------------------|---|
| _____ Thylakoid | A Three-carbon product of the Calvin cycle; one leaves for every three CO ₂ fixed |
| _____ Granum | B Turning inorganic CO ₂ into organic molecules |
| _____ Stroma | C Protons flowing back through ATP synthase drive the formation of ATP |
| _____ Chlorophyll | D The enzyme that joins CO ₂ to RuBP |
| _____ Reaction center | E Pigment that absorbs blue and red light and reflects green |
| _____ NADPH | F A stack of thylakoids |
| _____ Chemiosmosis | G Energy carrier made when photosystem I reduces NADP ⁺ |
| _____ RuBisCO | H Disc-shaped membrane sac inside the chloroplast |
| _____ Carbon fixation | I The fluid around the grana, where the Calvin cycle happens |
| _____ G3P | J Where a special pair of chlorophyll a gives up an excited electron |

Part 2 · The big picture

2. Write the overall equation for photosynthesis. What supplies the energy?

3. Complete the table for the two stages of photosynthesis.

	Where in the chloroplast	Takes in	Gives out
Light-dependent reactions			
Calvin cycle			

Part 3 · The light-dependent reactions

4. Why do most leaves look green?

- | | |
|--|---|
| A Chlorophyll absorbs green light best | C Leaves are full of green carotenoids |
| B Chlorophyll absorbs blue and red light and reflects green | D Green light carries the most energy |

5. In a photosystem's antenna, what is passed from chlorophyll to chlorophyll after a photon is absorbed, and where does it end up?

6. P680 in photosystem II has just given away an excited electron. Where does the electron that replaces it come from?

- | | |
|---------------------|-------------------------|
| A Water | C Carbon dioxide |
| B Oxygen gas | D NADPH |

7. The O₂ that plants release — where do its oxygen atoms come from?

- | | |
|------------------------------|---|
| A From water | C From glucose |
| B From carbon dioxide | D They are created from light energy |

8. Put these in the order the electrons from water pass through them. Number them 1–6.

- _____ NADP⁺
- _____ Plastocyanin (Pc)
- _____ Photosystem I (P700)
- _____ Cytochrome b6f complex
- _____ Photosystem II (P680)
- _____ Plastoquinone (Pq)

9. Why do the electrons need a second photon at photosystem I?

10. Photosystem I energizes the electrons once more. Which molecule finally receives them?

- | | |
|--|--|
| A NADP ⁺ , which becomes NADPH | C ADP, which becomes ATP |
| B O ₂ , which becomes water | D CO ₂ , which becomes sugar |

Part 4 • Making ATP

11. During the light reactions, where is the pH lowest?

- | | |
|---------------------------------|------------------------------------|
| A In the thylakoid lumen | C In the cytoplasm |
| B In the stroma | D It is the same everywhere |

12. Explain how the light reactions make ATP.

13. The chloroplast ATP synthase has 14 c-subunits; one full turn moves 14 protons and makes 3 ATP. About how many protons does each ATP take? The human mitochondrial enzyme moves 8 protons per turn — how many per ATP there?

Part 5 · The Calvin cycle

14. Complete the table for three turns of the Calvin cycle (three CO₂ fixed).

	Molecules in	Molecules out	Energy used
1 · Fixation			
2 · Reduction			
3 · Regeneration			

15. One G3P (three carbons) leaves the Calvin cycle. How many CO₂ molecules had to be fixed to make it?

- A 1 C 6
B 3 D 18

16. Show that carbon atoms are conserved in the fixation stage of three turns.

17. How many turns of the Calvin cycle does one glucose take? Why?

18. Why is "dark reactions" a misleading name for the Calvin cycle?

Part 6 · Photosynthesis and cellular respiration

19. Compare photosynthesis and cellular respiration.

	Photosynthesis	Cellular respiration
Organelle (in eukaryotes)		
Takes in		
Gives out		
Electron transport chain in		
ATP made by		

20. Which statement is true?

- | | |
|--|--|
| A Plants photosynthesize instead of respiring | C Only animals carry out cellular respiration |
| B Plants carry out both photosynthesis and cellular respiration | D Only plants carry out photosynthesis |

21. Which organisms first carried out photosynthesis, and how did they change Earth?
