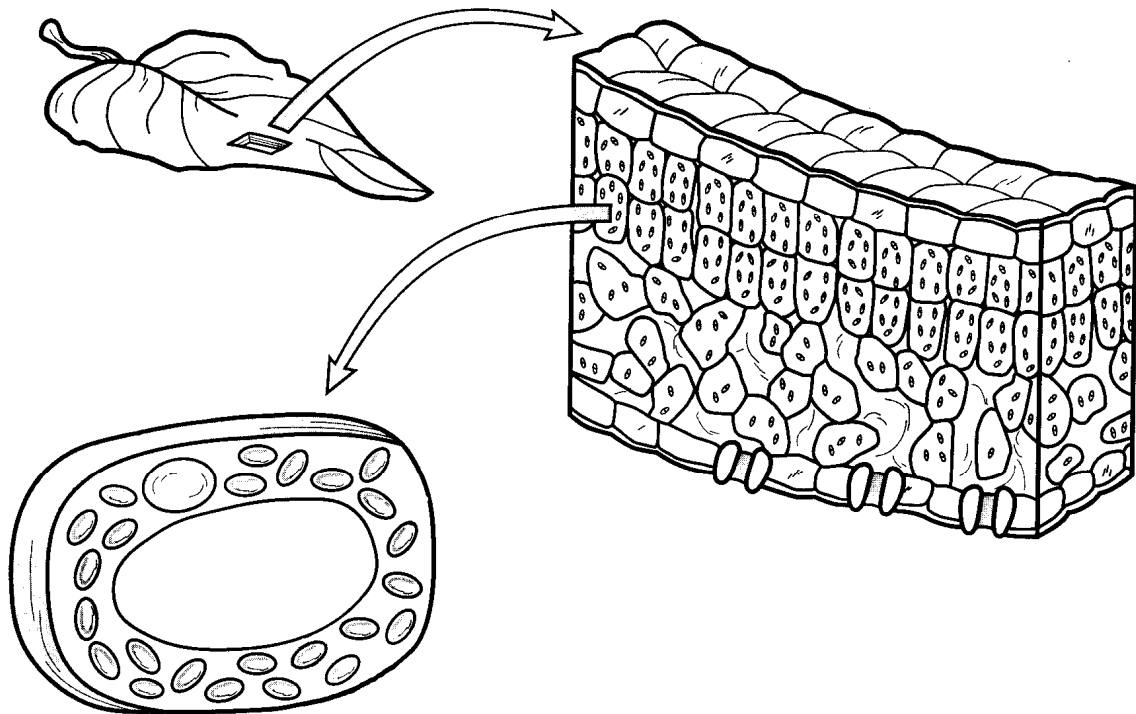


PHOTOSYNTHESIS

SUMMARY EQUATION

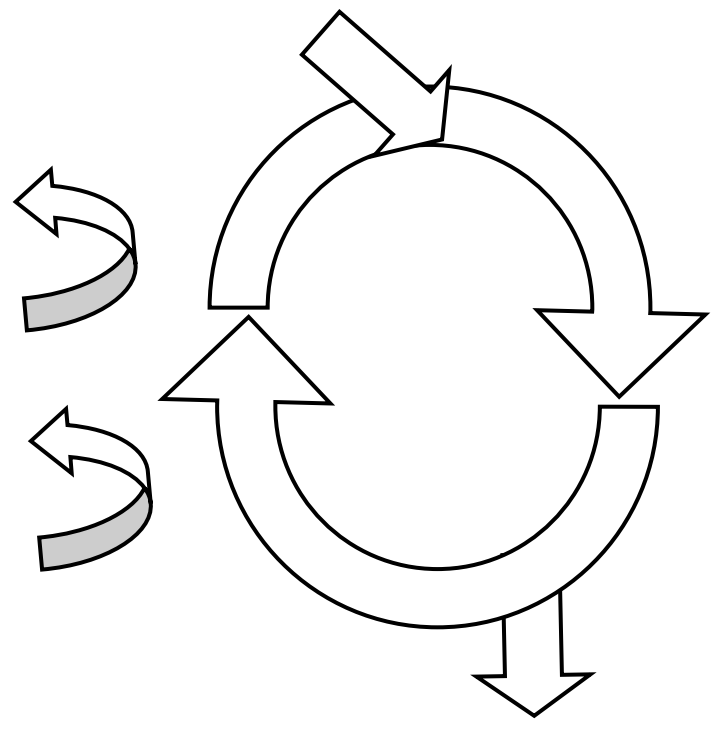
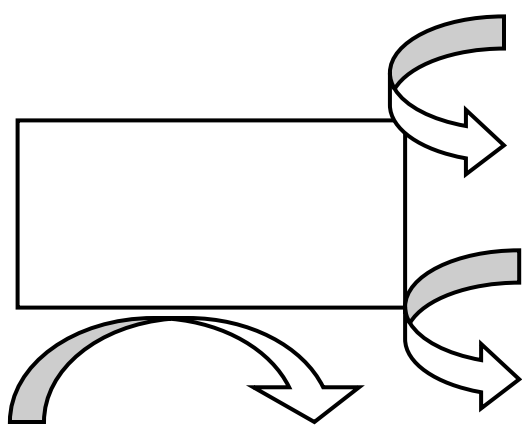
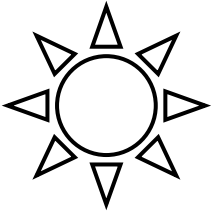
SITE OF PHOTOSYNTHESIS -- PLANTS



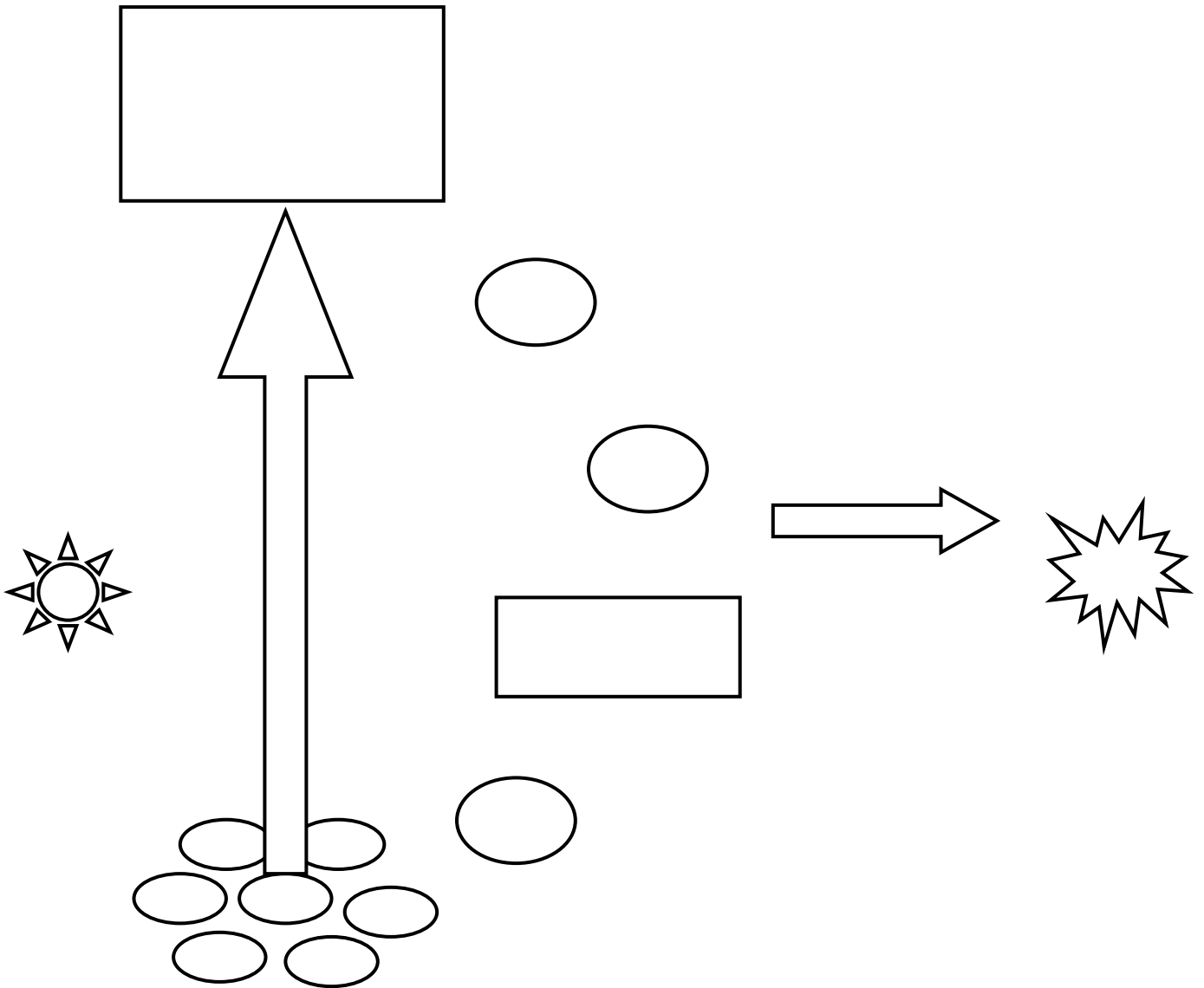
SITE OF PHOTOSYNTHESIS – PROKARYOTES

STRUCTURE OF CHLOROPLASTS

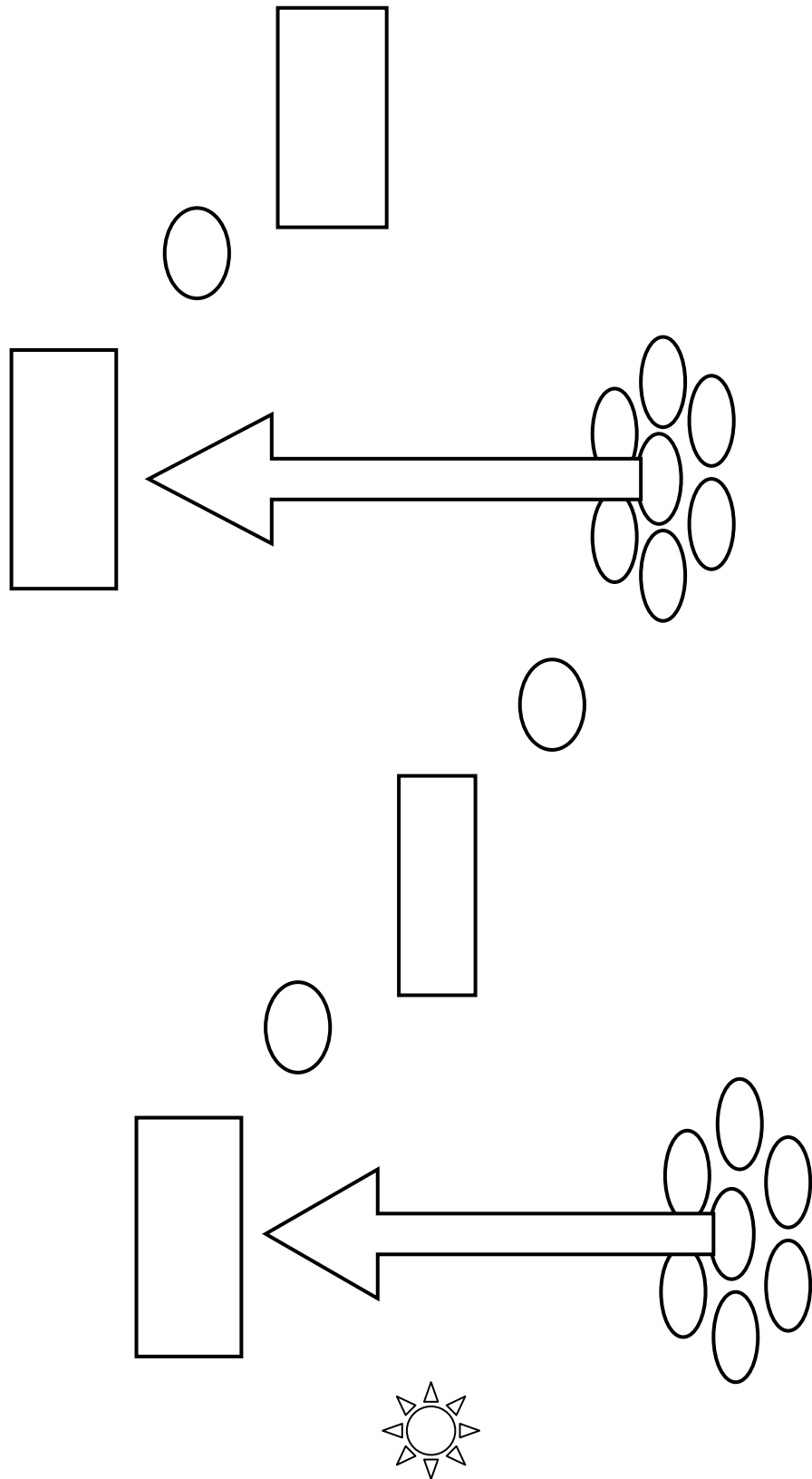
OVERVIEW OF PHOTOSYNTHESIS



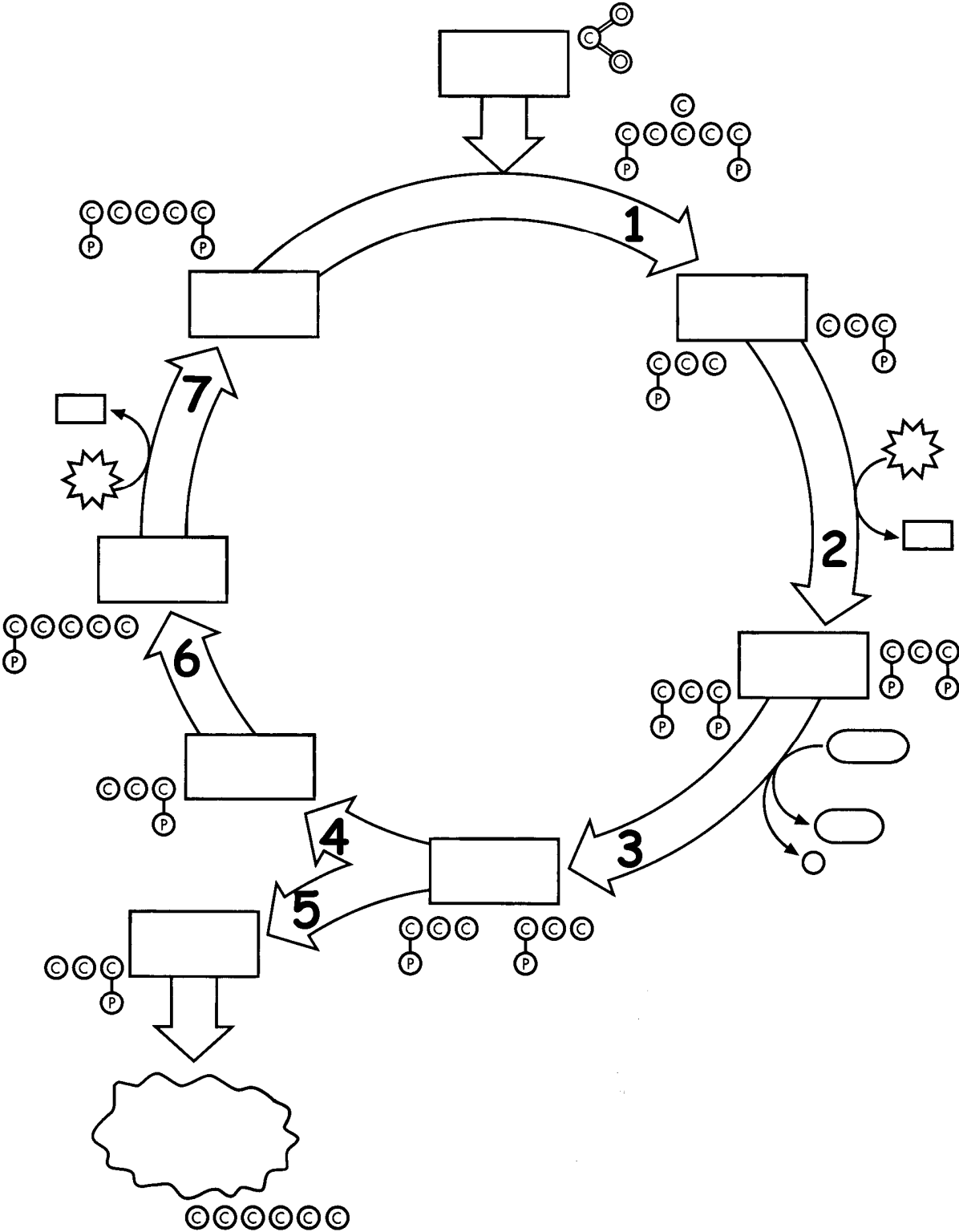
LIGHT REACTIONS – CYCLIC ELECTRON FLOW



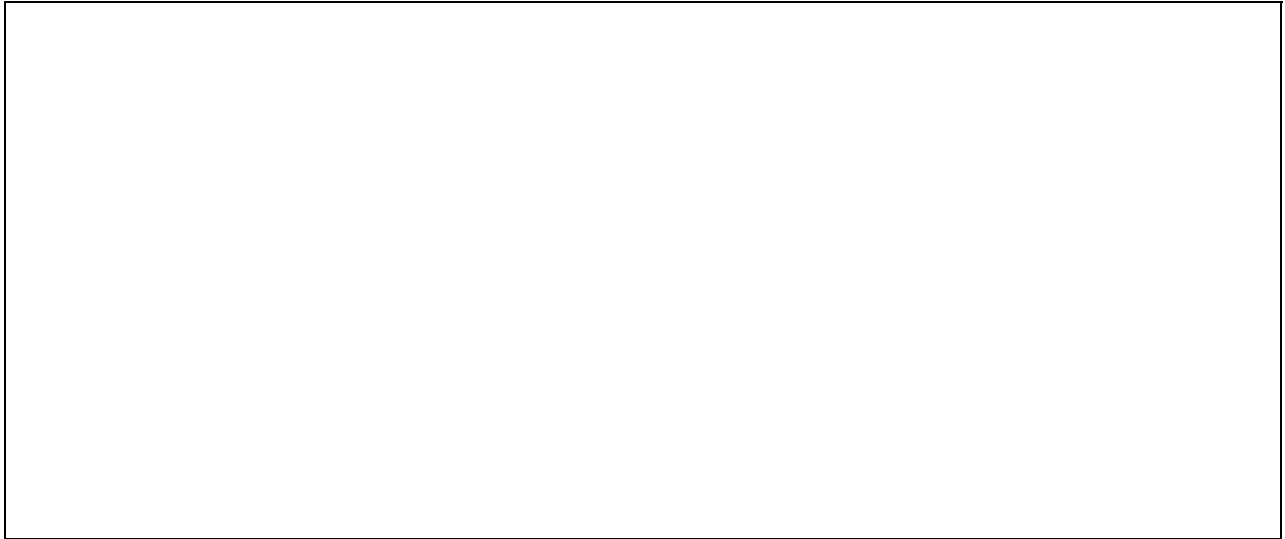
LIGHT REACTIONS – NONCYCLIC ELECTRON FLOW



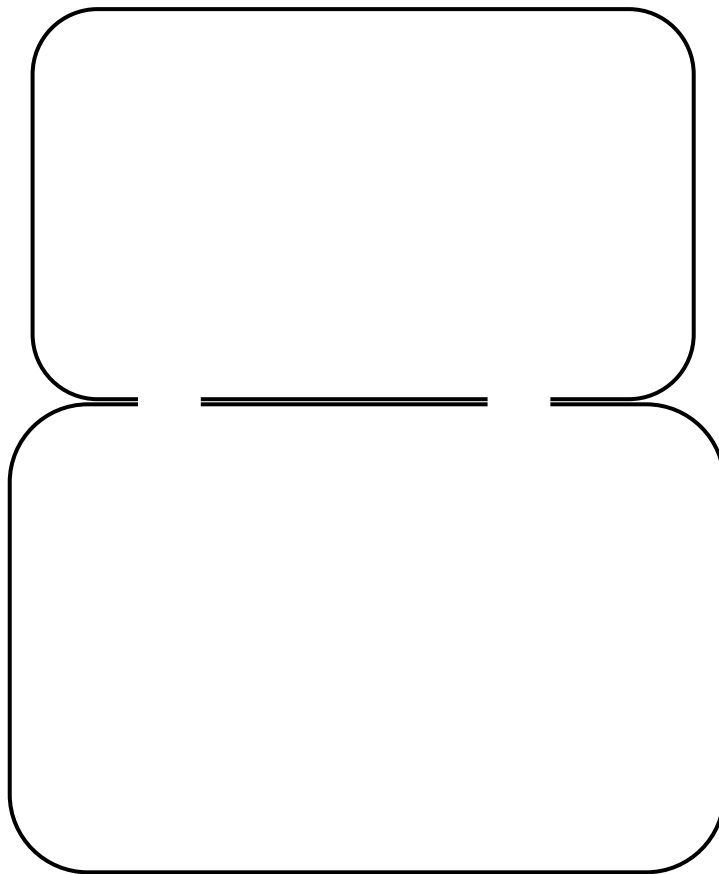
CALVIN CYCLE



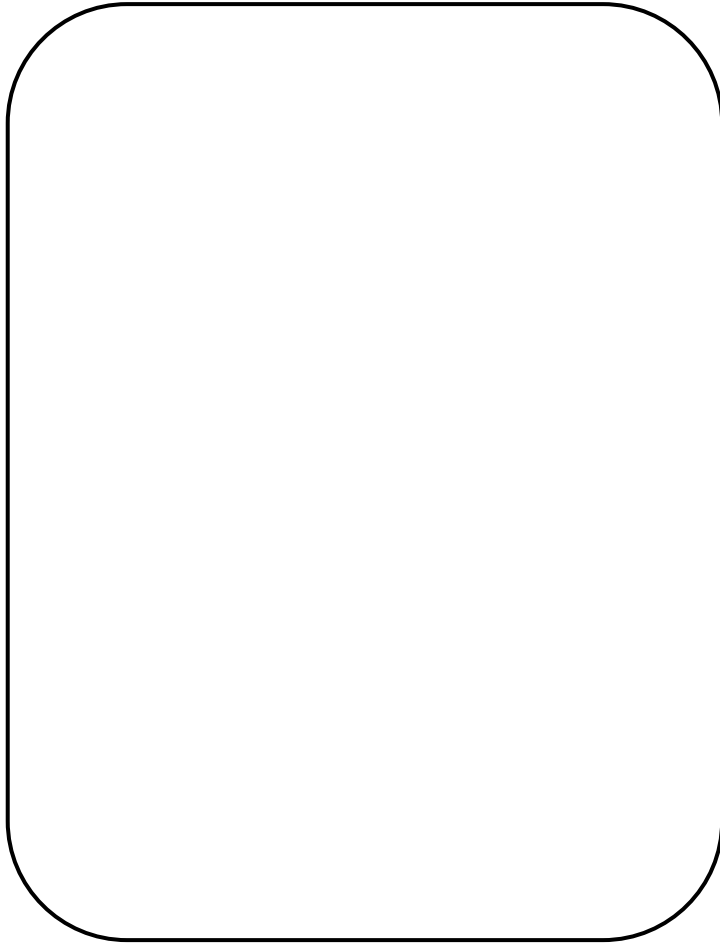
PROBLEM – PHOTORESPIRATION



C₄ PLANTS



CAM PLANTS



QUESTIONS

1. Define the following terms.

Term	Definition
Autotrophic Nutrition	
Heterotrophic Nutrition	

2. Complete the following chart comparing the two types of autotrophs.

Type of Autotroph	Energy Source	Example

3. Where does photosynthesis occur within plants?

4. Water and carbon dioxide are both required for photosynthesis.

- a. How does the water get to the site of photosynthesis?

- b. How does the carbon dioxide get to the site of photosynthesis?

5. Write the summary equation for photosynthesis.

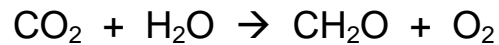
6. In one form of the summary equation, water is written on both sides of the equation.

a. Why? _____

b. During what stage of photosynthesis is water produced?

c. During what stage of photosynthesis is water consumed?

7. The simplest form of the summary equation for photosynthesis is:



What is the advantage of writing the equation in this form?

8. What is the source of the O₂ produced in photosynthesis?

Describe the experiments that provided proof of this.

9. Photosynthesis is described as an endergonic redox process.
- Why endergonic? _____
 - What substance is oxidized? _____
 - To what is it oxidized? _____
 - What substance is reduced? _____
 - To what is it reduced? _____

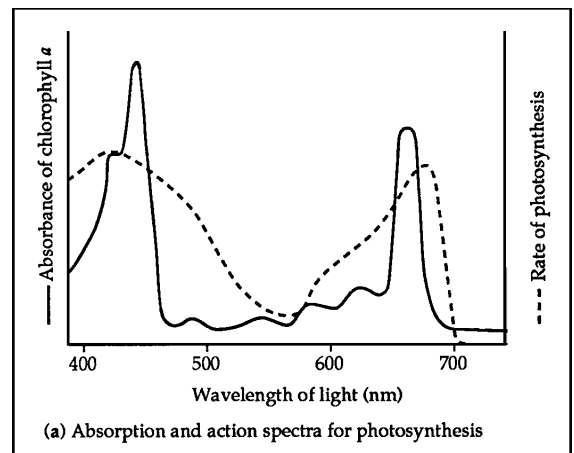
10. What are the two stages of photosynthesis and briefly describe what happens during each stage?

Stage	Events

11. What is the difference between an absorption spectrum and an action spectrum?

Absorption Spectrum	Action Spectrum

12. Describe the significance of the graph at the right.



13. What pigments are involved (directly and indirectly) in photosynthesis?

14. In general, describe the structure of a photosystem.

Where, within the chloroplast, are the photosystems located?

15. Compare and contrast the two photosystems in photosynthesis.

Photosystem I	Photosystem II

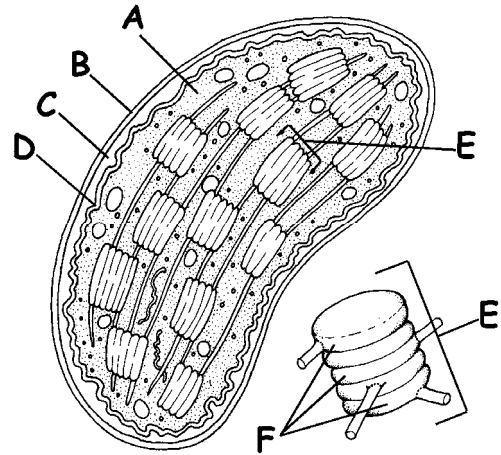
16. Compare and contrast cyclic and noncyclic electron flow.

Cyclic Electron Flow	Noncyclic Electron Flow

17. What is the role of water in noncyclic electron flow?

18. Match the structure or description with the correct letter on the diagram below.

- _____ Granum
- _____ Thylakoids
- _____ Stroma
- _____ Outer membrane
- _____ Inner membrane
- _____ Intermembrane space
- _____ Location of photosystems
- _____ Site of Calvin Cycle



19. The chemiosmotic synthesis of ATP occurs in both the mitochondria and chloroplasts. Complete the following chart providing the location of each component involved in the synthesis of ATP

Component	Location in Mitochondria	Location in Chloroplasts
High [H ⁺]		
Low [H ⁺]		
Electron Transport Chain		
ATP Synthase Complex		
ATP production		

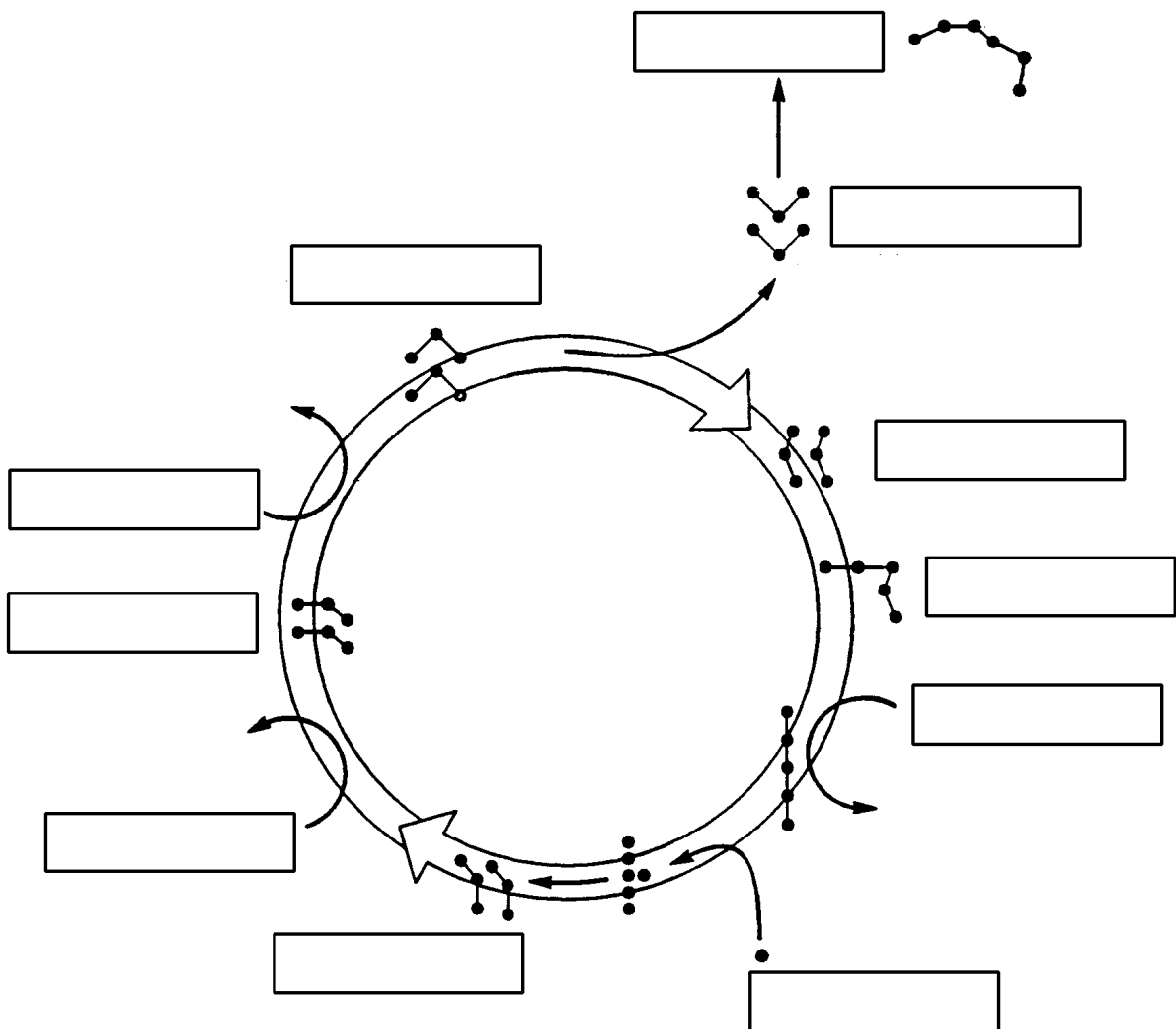
20. The synthesis of ATP in both the mitochondria and chloroplasts requires the input of energy. What is the source of the energy for ATP production in the:

- a. Mitochondria? _____
- b. Chloroplasts? _____

21. What are the reactants and products of the light reactions of photosynthesis?

Reactants	Products

22. Complete the following diagram by correctly identifying the molecules. Write in the name of the molecule in the blank provided.



23. What process is occurring in the diagram shown in question 24?

24. What is the role of rubisco in the Calvin cycle?

25. For each glyceraldehyde phosphate molecule that exits the Calvin cycle:

_____ molecules of CO₂ enter the cycle

_____ molecules of ATP are used

_____ molecules of NADPH are used

_____ turns of the Calvin cycle are required

26. For each glucose molecule produced by photosynthesis:

_____ molecules of CO₂ are used

_____ molecules of ATP are used

_____ molecules of NADPH are used

_____ turns of the Calvin cycle are required

27. Where does the Calvin cycle occur within the chloroplasts? _____

28. What are the reactants and products of the Calvin cycle?

Reactants	Products

29. Provide the following information about photorespiration.

What is photorespiration?	
Why does it occur?	
What effect does it have on photosynthetic output?	

30. What environmental conditions foster photorespiration?

31. How have each of the following reduced the effects of photorespiration?

C₄ Plants	
CAM Plants	

32. What is the fate of the products of photosynthesis?
