

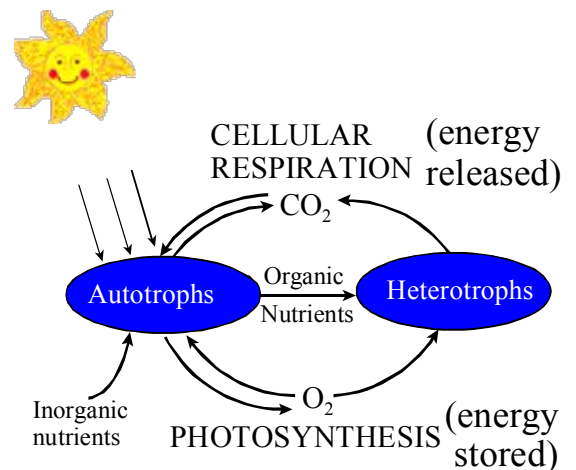
Ch 4: Worksheet

1. All organisms require **Energy** to carry out their life functions.
2. **Light (the sun)** is the ultimate source of energy for all life on earth.
3. During photosynthesis, the energy from the sun is stored within **Organic** compounds, mainly the sugar **Glucose**.
4. What classification of organisms can carry on photosynthesis? **Autotrophs**
5. Name several autotrophic organisms. **All Plants, Some Protists (algae), Some Monera (cyanobacteria)**
6. What is a biochemical pathway and give an example? **A series of chemical reactions controlled in steps by enzymes. Photosynthesis and Respiration are both biochemical “pathways.”**
7. What gas is used by photoautotrophs & what gas is produced?

Carbon Dioxide & Oxygen

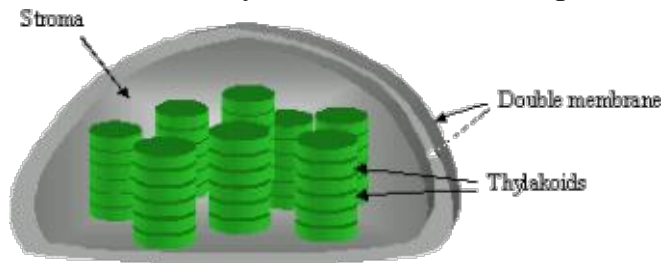
8. What organisms release stored energy from organic compounds through cellular respiration? **All**
9. Draw the diagram showing energy storage & transfer between autotrophs & heterotrophs. (Page 55)

10. What are the light reactions of plants and in what organelle do they occur? **The Light reactions of photosynthesis depend on light to energize chlorophyll molecules embedded in the thylakoid membranes of chloroplasts. Water molecules are split, NADP is reduced to NADPH, and phosphorylation of ADP occurs. The Calvin Cycle depends on the products of the light reactions.**



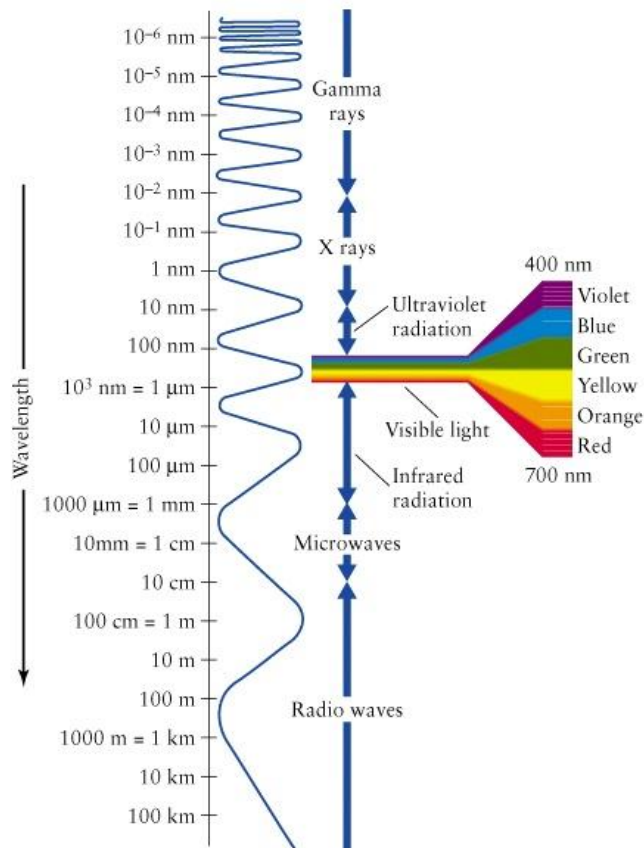
11. Flattened sacs in chloroplasts are known as **Thylakoids** and are **connected** to each other.

12. Stacks of Thylakoid sacs in chloroplasts are called **Grana**.



13. What gel-like solution surrounds the thylakoids inside the chloroplast? **Stroma**

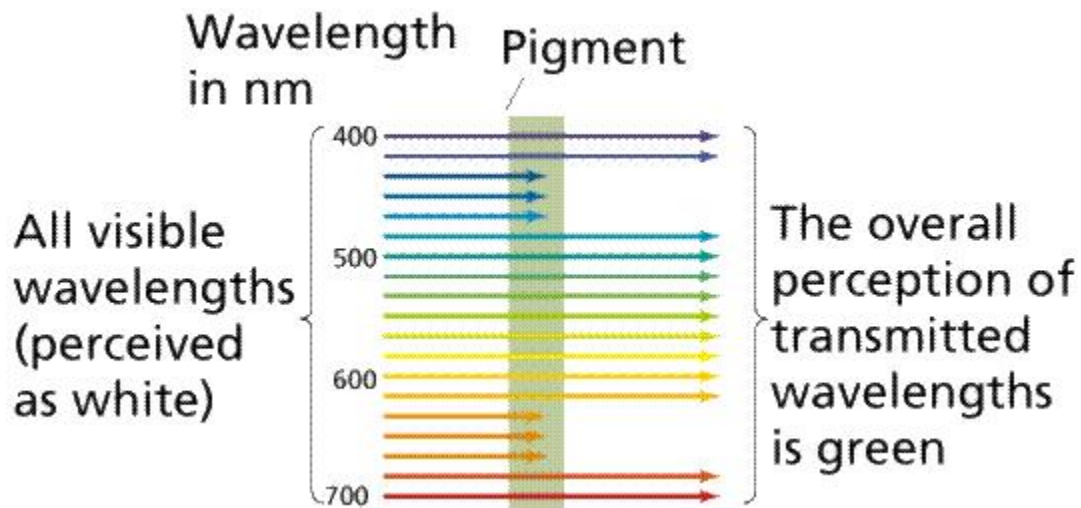
14. Name the 7 colors that make up the visible spectrum. **From highest energy to lowest (shorter wave-length to longer) Violet-Blue-Green-Yellow-Orange-Red**



15. What 3 things can happen to light that strikes an object? **Reflected** or **Transmitted** or **Absorbed**

16. What are pigments & what is their function in plants? **Chemicals that reflect only certain wave-lengths of visible light giving them color. More important than their reflection of light is the ability of pigments to absorb certain wave-lengths of light.**

17. Is red light reflected or absorbed by an object if the object appears red to your eyes? **Reflected**



18. What is the most important chloroplast pigment? **Chlorophyll a**

19. Chlorophyll b and carotenoids are examples of **accessory** pigments in plants.

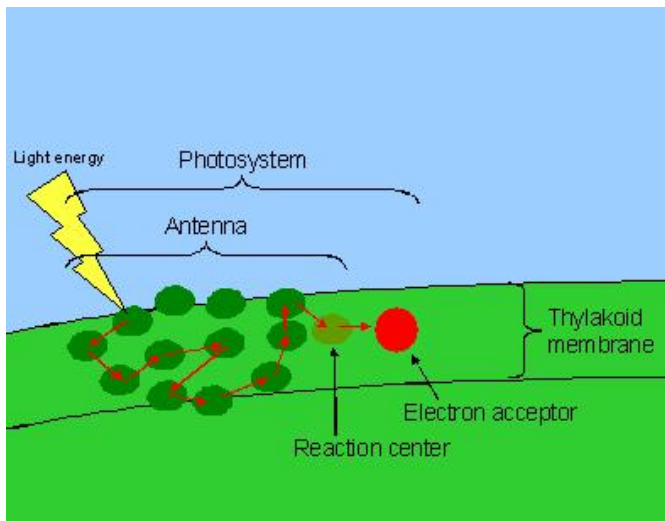
20. Name another accessory pigment & tell what colors they include. When could you see these colors? **Accessory pigments include chlorophyll b (also c, d, and e in algae and protists), xanthophylls, and carotenoids (such as beta-carotene). In the fall when chlorophyll a begins to breakdown and the reds, yellows, and oranges show through.**

21. Chlorophyll is most abundant in the **leaves/chloroplasts** of a plant, while accessory pigments appear more in the **vegetables, flowers** and fruits.

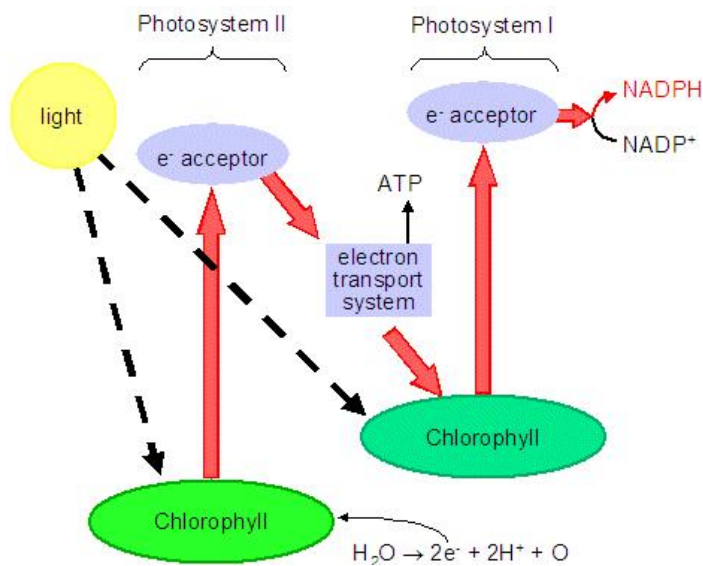
22. Pigments are grouped into clusters and together act as a(n) **antennae** system.

23. What is a photosystem? **Photons of light that are picked up by any of the pigment molecules in the antenna pass their energy to nearby pigment molecules until it is eventually passed to a special molecule of chlorophyll a called the *reaction center*.**

The reaction center molecule becomes ionized and it loses its electron to an electron acceptor. This electron will need to be replaced. The antenna, the reaction center, and the electron transport molecules make up a photosystem. There are two kinds of photosystems in eucaryotes. The reaction center chlorophyll molecule of photosystem I absorbs 700 nm light best and is therefore called P₇₀₀. The reaction center of photosystem II absorbs 680 nm light best and is called P₆₈₀.



24. Name the 2 types of photosystems. **Photosystem I & Photosystem II**



25. The light reactions start when **antennae** pigments absorb **light**.

26. When light energy is absorbed by chlorophyll a molecules, what happens to its electrons? **They become “excited” and move to a higher energy level.**

27. Once these electrons become "excited", they have enough energy to do what? **Leave the chlorophyll**

28. What are the chemicals called that pick up these freed electrons & where are they located? **electron acceptors** in the **thylakoid membrane.**

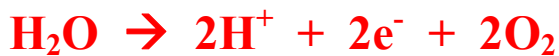
29. These electrons lose **energy** as they are passed through a series of molecules called the **electron transport chain.**

30. Photosystem I chlorophyll molecules also absorb **light**, and its electrons eventually combine with **NADP** to form NADPH.

31. What would happen if the electrons lost from photosystem II weren't replaced? **Photosynthesis would stop**

32. **Water** provides the replacement electrons for photosystem II when water is **split.**

33. Write the equation for the splitting of a water molecule.



34. What important gas is released when water is split? **O₂**

35. **ATP** or energy for a cell is synthesized during the light reactions in a process called **Photophosphorylation.**

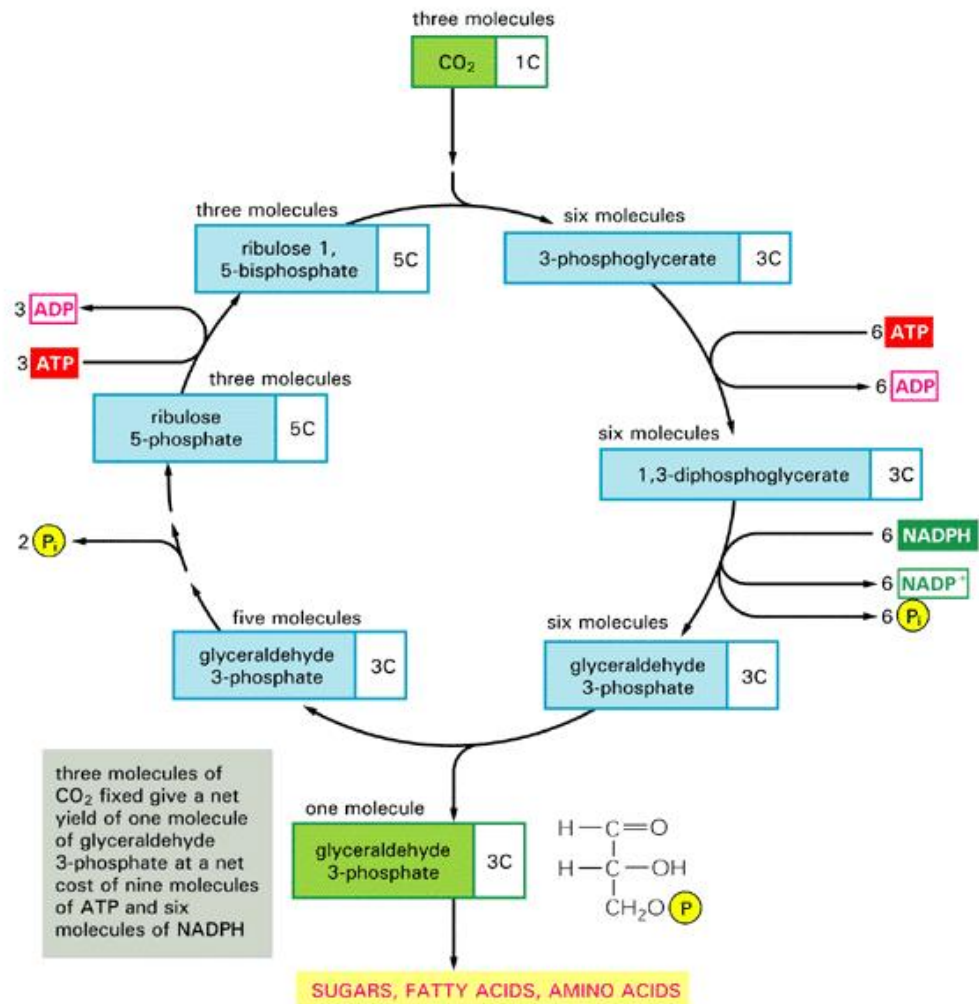
36. The **Calvin** cycle is the second set of photosynthetic reactions that uses energy stored in **ATP** and **NADPH** to make **organic** compounds.

37. Carbon atoms from **CO₂** are "fixed" into organic compounds in the Calvin cycle in a process called carbon **Fixation.**

38. In what part of the chloroplast does the Calvin cycle occur? **Stroma**

39. Carbon dioxide combines with **RuBP** to make two molecules of **PGA.**

40. PGA is converted into **PGAL**, ADP, **NADP**, and phosphate.

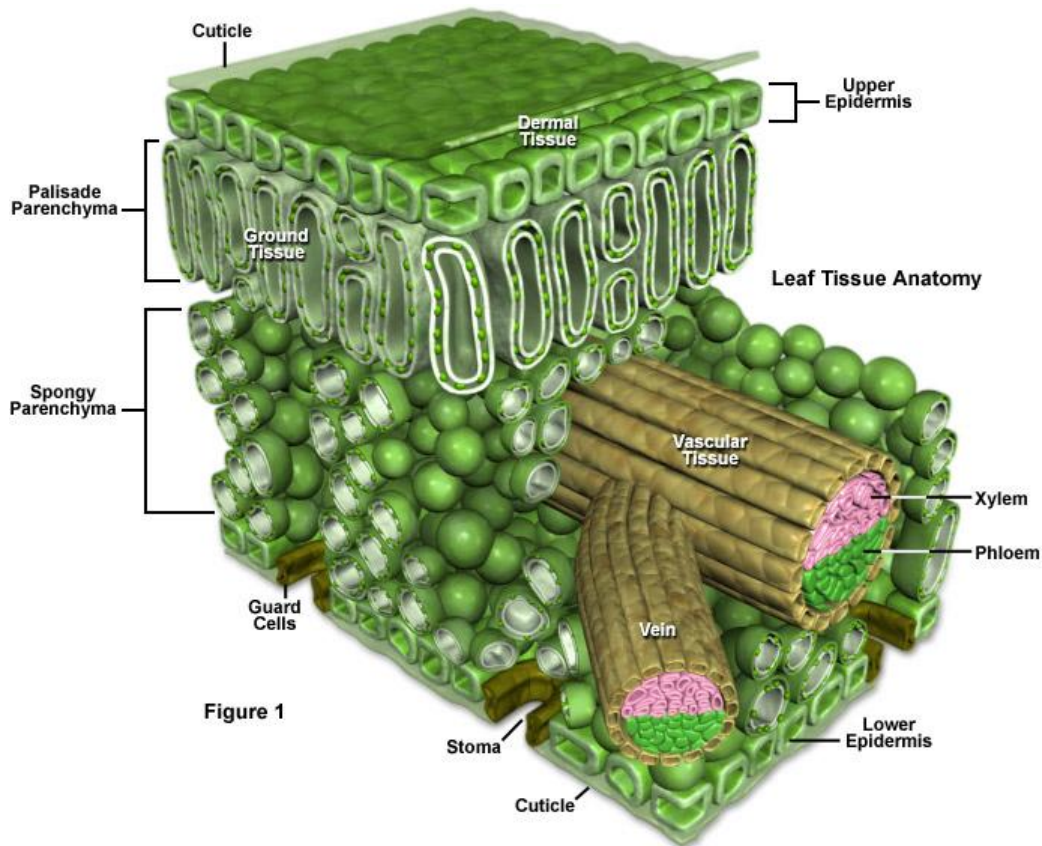


41. Carbohydrates made from PGAL in the Calvin cycle include the monosaccharides **Glucose** and **Fructose**, the disaccharide **Sucrose**, and polysaccharides such as **Starch**, **Cellulose**, and **Amylose**.

42. Write the balanced equation for photosynthesis.



43. What are stomata & where are they located? **Numerous small openings in the leaf's epidermis that allows carbon dioxide to enter and water vapor and oxygen to exit. Water loss through stomata is called transpiration.**



44. When would plant cells need to close or partially close their stomata? **When temperatures get too high and water conservation becomes important.**

45. Name 2 alternate carbon-fixing pathways used by plants in hot climates. **C4 and CAM**

46. Plants that close their stomata during the hottest part of the day thus fixing carbon into four carbon compounds are called **C4 plants**. Name three. **Corn, sugar cane, sorghum, many grasses**

47. CAM plants open stomata at **night** and close during the **day**.

48. Name 3 environmental factors that affect the rate of photosynthesis.

1) Temperature 2) light intensity 3) oxygen concentration

4) pH 5) availability of water and carbon dioxide