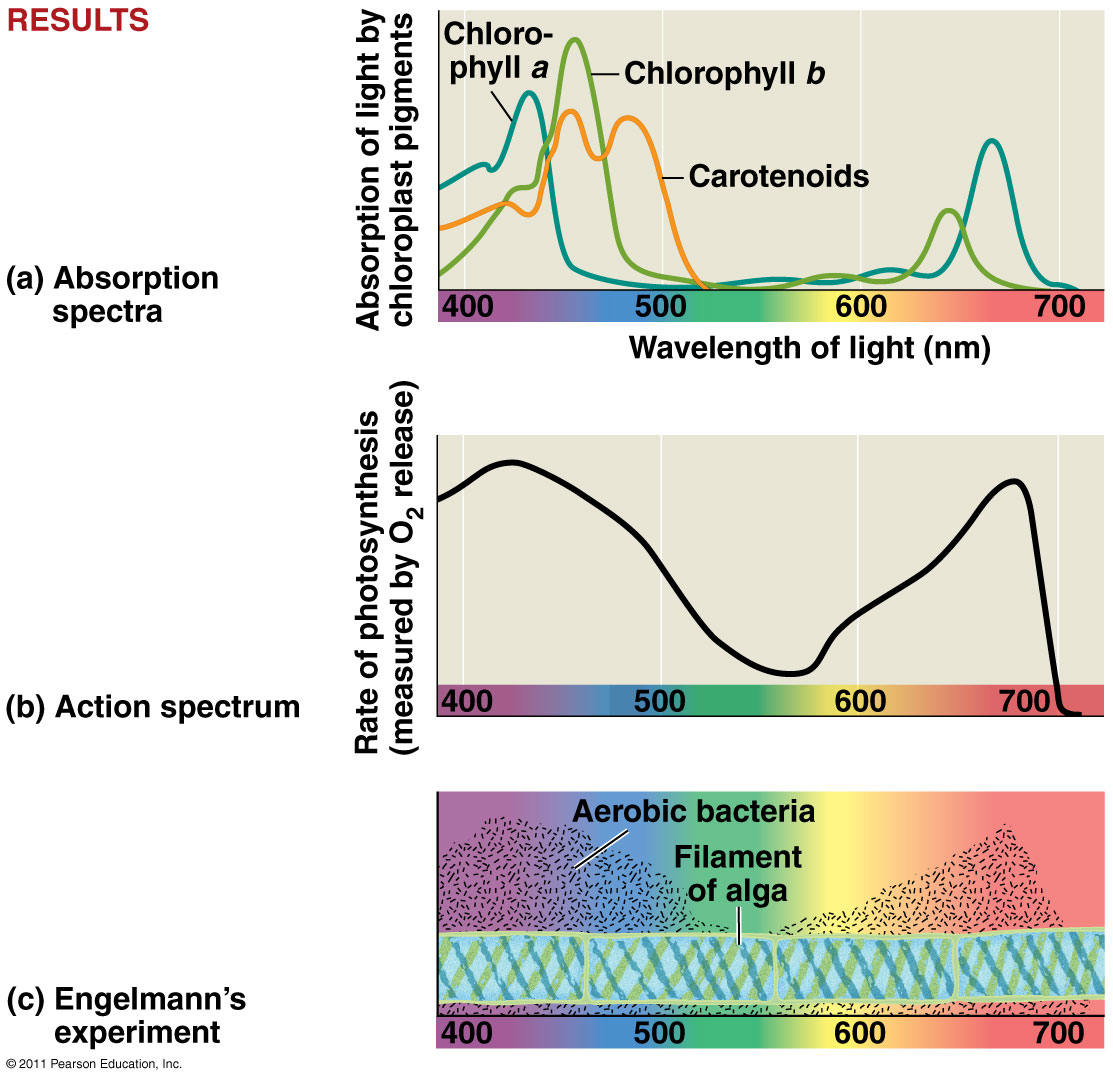
**PHOTOSYNTHESIS (CH. 10)**

|  |  |
| --- | --- |
| **LEARNING OBJECTIVE(S):** | 1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ how photosynthesis allows organisms to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. 2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ how cells capture energy from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ it to biological molecules for \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_. |
| 1. Write the balanced **equation** for photosynthesis. |  |
| 1. What type of organisms perform photosynthesis? | * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and other \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are producers * PHOTOautotrophs: * CHEMOautotrophs: * Heterotrophs: |
| 1. **Where** in the cell does photosynthesis occur? | * **mesophyll**: * **stomata**: * **chlorophyll**: |
| 1. What happens to **water** during photosynthesis? |  |
| 1. What are the 2 parts of photosynthesis?  * Where do they occur? * What are the input molecules? * What are the ouptuts? |  |
| 1. Summarize the **Light Reactions**  * How does light behave? | **Light Reactions**: Convert \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy to chemical energy of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Nature of sunlight   * Light = Energy = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ radiation * \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ wavelength (λ): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ E * Visible light - detected by human eye * Light can be: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| 1. How do different **pigments** respond to different wavelengths of light? | Pigments absorb different \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(λ) of light  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ – absorb violet-blue/red light, reflect \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   * **chlorophyll a** (reflects blue-green): light reaction, converts solar to chemical E * **chlorophyll b** (reflects yellow-green): conveys E to chlorophyll a * **carotenoids** (reflects yellow, orange): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, broaden color spectrum for photosynthesis   + Types: **xanthophyll** (reflect \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)   + **carotenes** (reflect \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_)   + **anthocyanin** (reflect red, purple, blue)   **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Spectrum**: determines effectiveness of different wavelengths for photosynthesis |

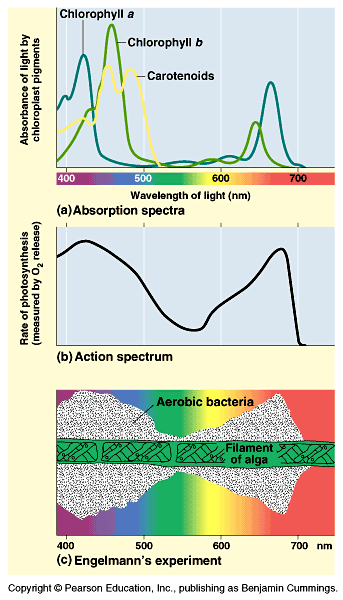
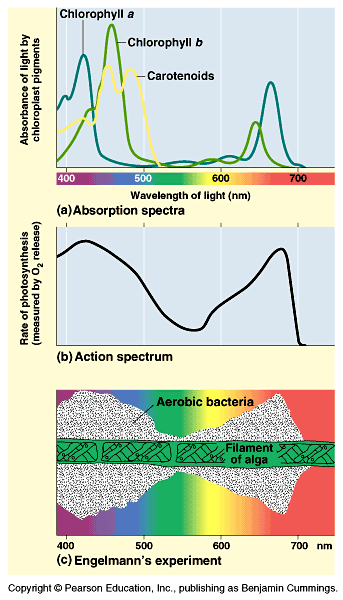
**Practice Analysis of an Absorption Spectrum**

1. Which color/wavelength of light provides the MOST energy to plants?
2. Why do most pigments have greater absorbance of shorter wavelengths of light vs. longer wavelengths?
3. Why would a plant not have pigments to capture ALL wavelengths of light?
4. Why do most plants appear green?
5. If a plant contained mostly carotenoids, what color would you expect them to appear?

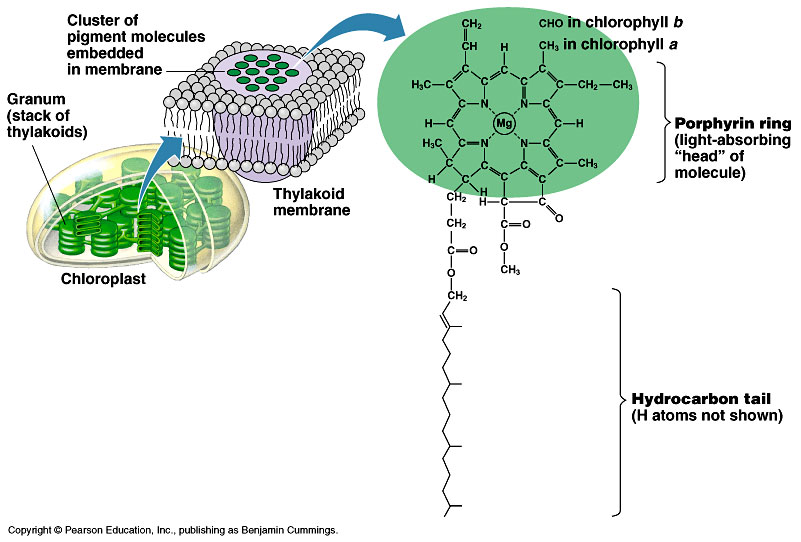
**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Spectrum**: plots rate of photosynthesis vs. wavelength

*(absorption of chlorophylls a, b, & carotenoids combined)*

1. Which wavelengths of light are most effective in driving photosynthesis?

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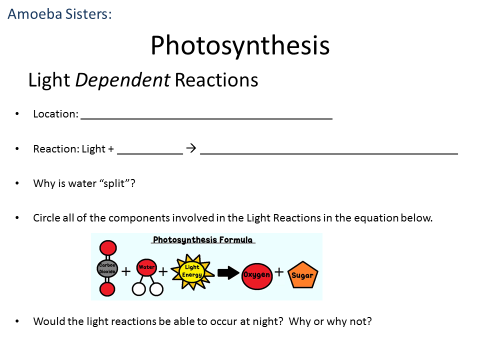
Chlorophylls & other pigments

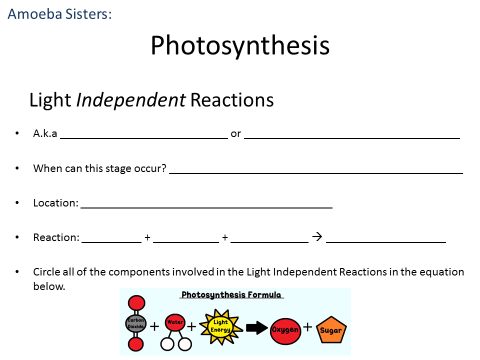
* 1. embedded in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
  2. arranged in a “\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_”
     1. collection of molecules
  3. structure-function relationship



QUESTIONS I STILL HAVE ARE…

SO FAR I UNDERSTAND…





SUMMARIZE PHOTOSYNTHESIS REACTIONS:

|  |  |
| --- | --- |
| 1. Overview of the **Light Reactions** | 1. Light energy \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_releasing \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 2. Movement of e- used to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 3. Electrons end up on NADP+, reducing it to **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| 1. What is a **photosystem**? | 10_13_HarvestLight-L.jpg   * Photosystems located in the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ act as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ molecules * **Photosystem II** – made mostly of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   + P680 = absorbs 680nm wavelength, red light * **Photosystem I** – made mostly of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_   + P700 = absorbs 700nm wavelength, red light     **What happens in a photosystem?**  10_12_ExcitChlorophyll-L.jpg  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in chlorophyll molecules are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ by absorption of light |
| 1. Describe the 2 **pathways for electron flow** during the light reactions. | 1. **Linear (non-cyclic) electron flow**    1. PS\_\_\_\_ 🡪 PS\_\_\_\_I 🡪 Calvin Cycle    2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is split; \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ released 2. **Cyclic (non-linear) electron flow**    1. PS\_\_\_\_ only 🡪 Calvin Cycle    2. No water splitting    3. No \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_ produced    4. Utilized when \_\_\_\_\_\_\_\_ supplies are low or when \_\_\_\_\_\_\_\_\_\_\_\_\_ is high |
| 1. Trace/outline the flow of electrons through the **linear pathway**. | https://legacy.owensboro.kctcs.edu/gcaplan/bio/Notes/07_08aPhotosElectronFlow_L.jpg   1. Photons of light are absorbed by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ which excites electrons (e-) 2. Excited \_\_\_\_\_\_ passed to the primary \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the reaction center of Photosystem \_\_\_\_\_. 3. Water is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (regenerates more e-) and\_\_\_\_\_\_\_ is released 4. e- are passed through an \_\_\_\_\_\_\_ 5. e- activate primary e- acceptor of Photosystem \_\_\_\_\_; PSI also captures more photons of light here 6. e- are passed through a second \_\_\_\_\_ and NADP is reduced to make \_\_\_\_\_\_      * During the e- transfers through the ETC, \_\_\_\_\_ are pumped across the thylakoid membrane to set up a proton-motive force (H+ gradient). * As protons flow through \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_by chemiosmosis, \_\_\_\_\_\_is produced. * These steps together are called \_\_\_\_\_\_\_\_\_phosphorylation   10_18ThylakoidMembrane-L.jpg  **Proton motive force generated by:**   1. H+ from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 2. H+ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ across by cytochrome protein 3. Removal of H+ from \_\_\_\_\_\_\_\_\_ when NADP+ is reduced |
| 1. What is the **main idea/ purpose of the light reactions**? |  |
| 1. How is the **cyclic (non-linear) flow of electrons** different? | 10_16CyclicElectronFlow-L.jpg  **Cyclic Electron Flow**:   * uses \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ * produces \_\_\_\_\_\_\_\_\_\_\_\_ for Calvin Cycle * does not produce \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
| 1. What similarities do we see in cellular respiration and photosynthesis? | 10_17ChemisomosisComp-L.jpgBoth |
| ***Summarize the Light Reactions:*** | |
| 1. What is the **Calvin Cycle**? | **Calvin Cycle:**  *Occurs in:*  *Uses:*  Image result for simple calvin cycle diagram*Produces:*  *3 Phases:*   1. ***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_:***The enzyme called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ catalyzes a reaction between \_\_\_\_\_\_\_\_ and a 5 carbon sugar. 2. ***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_:*** *Uses* 6 \_\_\_\_\_\_\_ and 6 \_\_\_\_\_\_\_\_\_\_\_ to produce 1 net \_\_\_\_\_\_\_\_\_ (3 carbon sugar) 3. ***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_:***uses 3 ATP to remake the 5 C sugar |
| ***Summarize the Calvin Cycle:*** | |