Photosynthesis Study Guide (Chapter 8)

- **Photosynthesis** – an organism’s ability to convert light energy into chemical energy
  - occurs within photoautotrophs (make own food with sunlight)
  - occurs in plant’s chloroplasts
    - **chlorophyll** – green pigment required for photosynthesis
- **Chloroplast** – plant cell structure bounded by inner and outer membranes
  - **stroma** – fluid-filled region containing enzymes required to make carbohydrates
  - **thylakoids** – sacs where the chlorophyll is located
    - **lumen** – fluid-filled region that facilitates photosynthesis
  - **granum** – a stack of thylakoids

- **Chlorophyll** – pigment that has the ability to absorb many wavelengths of light
  - **Chlorophyll A** – most dominant, bright green, absorbs almost every wavelength
  - **Chlorophyll B** – yellowish-green, accessory
  - **absorption spectrum** – pigment’s ability to absorb light
- **Photosynthesis Equation:**
  - \[6\, \text{CO}_2 + 12\, \text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\, \text{O}_2 + 6\, \text{H}_2\text{O}\]
- **Photosynthesis Phases:**
  - **Light-dependent** – light is captured by chlorophyll, water molecules split creating high-energy molecules ATP and NADPH\(^+\) (use energy for next phase)
    - **Photo system** – unit of proteins, chlorophyll that has the ability to capture light energy and transfer electrons inside thylakoids
    - **Electron transport chain** – movement of electrons from one membrane potential to the next, causes photolysis
    - **Photolysis** – use of light to split water molecule
    - **(Photo)phosphorylation** – addition of phosphate group to a molecule
  - **Non-cyclic**
Cyclic

- Chemiosmosis – mechanism by which the phosphorylation of ADP is coupled to diffusion down a proton gradient
  - Light-independent/Carbon Fixation – high-energy molecules ATP and NADPH⁺ help to fix carbon from CO₂ to produce glucose, takes place in stroma with aid of enzymes to finalize photosynthesis
- Calvin Cycle:
  1. CO₂ uptake phase – CO₂ captured by ribulose biphosphate (RuBP) to be brought into plant, producing PGA
  2. Carbon reduction phase – PGA rearranged by ATP and NADPH⁺ to form G3P molecule, G3Ps rearranged to form glucose molecule
  3. RuBP regeneration phase – ATP takes leftover G3Ps and converts them into RuBP
- Factors affecting photosynthesis:
  - Amount of sunlight available
  - Surface area of given plant
  - CO₂ concentration in air
  - Soil content and pH
  - Temperature