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BOTANY HIGH-YIELD CHEAT SHEET

1. Plant Cell Structure & Tissues

Key Organelles:

- **Cell Wall:** Cellulose, hemicellulose, pectin Matrix.
- **Chloroplast:** Double membrane, thylakoids, stroma.
- **Central Vacuole:** Turgor pressure, storage (H_2O , ions).

Permanent Tissues:

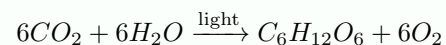
- **Parenchyma:** Living, thin-walled, photosynthesis/storage.
- **Collenchyma:** Living, uneven primary wall (1°), mechanical support.
- **Sclerenchyma:** Dead, secondary wall (2°) with lignin (fibers/sclereids).

Vascular System:

- **Xylem:** Unidirectional (H_2O + minerals). Tracheids & Vessel elements (Dead at maturity).
- **Phloem:** Bidirectional (Organic solutes). Sieve tube elements + Companion cells (Living).

2. Photosynthesis Mechanics

Overall Reaction:



Light Reactions (Thylakoid Membrane):

- **PS II (P_{680}):** Photolysis of $H_2O \rightarrow 2e^- + 2H^+ + \frac{1}{2}O_2$.
- **ETC:** e^- transfer builds proton gradient ΔpH .
- **PS I (P_{700}):** Produces $NADPH$.
- **ATP Synthase:** Photophosphorylation via Chemiosmosis.

Dark Reactions (Calvin Cycle / C_3):

1. **Carbon Fixation:** $RuBP(5C) + CO_2 \xrightarrow{RuBisCO} 2 \times 3\text{-PGA}$.
2. **Reduction:** $3\text{-PGA} + ATP \rightarrow G3P(3C) + NADP^+$.
3. **Regeneration:** $G3P \rightarrow RuBP$ (Requires ATP).

3. C_4 & CAM Adaptations

C_4 Pathway (Kranz Anatomy):

- **Mesophyll:** $PEP + CO_2 \xrightarrow{PEP-C} \text{Oxaloacetate (4C)}$.
- **Bundle Sheath:** Malate decarboxylated to release CO_2 to RuBisCO (suppresses photorespiration).

CAM Pathway (Temporal Separation):

- **Night:** Stomata open $\rightarrow CO_2$ fixed by PEP-C $\rightarrow$ Malic Acid stored in vacuole.
- **Day:** Stomata close $\rightarrow$ Malic Acid decarboxylated for Calvin Cycle.

5. Phytohormones Summary

- | | |
|-----------------------|--|
| Auxin (IAA): | Apical dominance, tropisms, rooting. |
| Gibberellins: | Stem elongation, seed germination. |
| Cytokinins: | Cell division, delay senescence. |
| Abscisic Acid: | Stomatal closure, stress response. |
| Ethylene: | Fruit ripening, triple response, abscission. |

6. Plant Transport Mechanics

Water Potential Equation:

$$\Psi = \Psi_s + \Psi_p + \Psi_g$$

- Ψ_s : Solute potential (always negative).
- Ψ_p : Pressure potential (turgor, usually positive).

Transpiration-Cohesion-Tension Theory:

1. Evaporation at stomata creates negative pressure tension.
2. Cohesion (H-bonding) keeps water column intact.
3. Adhesion binds H_2O molecules to xylem cell walls.

8. Plant Kingdom Classification

- **Bryophytes:** Non-vascular, gametophyte dominant (Mosses, Liverworts).
- **Pteridophytes:** Vascular, seedless, sporophyte dominant (Ferns, Horsetails).
- **Gymnosperms:** Vascular, naked seeds, cones (Conifers, Cycads).
- **Angiosperms:** Flowering plants, enclosed seeds (Monocots, Dicots).

7. Reproduction & Life Cycles

Alternation of Generations:

Sporophyte ($2n$) $\xrightarrow{\text{Meiosis}}$ Spores (n)

Spores (n) $\xrightarrow{\text{Mitosis}}$ Gametophyte (n)

Gametophyte (n) $\xrightarrow{\text{Gametes}}$ Zygote ($2n$)

Angiosperm Double Fertilization:

- 1st Sperm (n) + Egg (n) $\rightarrow$ Zygote ($2n$)
- 2nd Sperm (n) + 2 Polar Nuclei ($2n$) $\rightarrow$ Endosperm ($3n$)