

Cell Biology and Metabolism – 10th grade

1. Introduction to Advanced Cell Biology

- . Cell Theory Revisited: Modern discoveries in cell biology.**
- . Comparison of Prokaryotic vs. Eukaryotic Cells: Structural and genetic differences.**
- . Endosymbiotic Theory: Origin of mitochondria and chloroplasts.**

2. Detailed Cell Structure and Function

- . Organelles and Their Roles:**
Nucleus, mitochondria, ER, Golgi, lysosomes, peroxisomes.
- . Cytoskeleton and Cell Movement:**
Microtubules, microfilaments, and motor proteins.
- . Cell Membrane and Transport:**
Passive vs. active transport, endocytosis, exocytosis.

3. Photosynthesis and Energy Transformation

- . Light-Dependent Reactions:**
Photosystems, electron transport, ATP, and NADPH production.
- . Calvin Cycle: Carbon fixation, reduction, and regeneration of RuBP.**

- **C4 and CAM Pathways: Alternative photosynthetic strategies in different climates.**
- **Equation:**

$$6\text{CO}_2 + 6\text{H}_2\text{O} + \text{Light} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$$

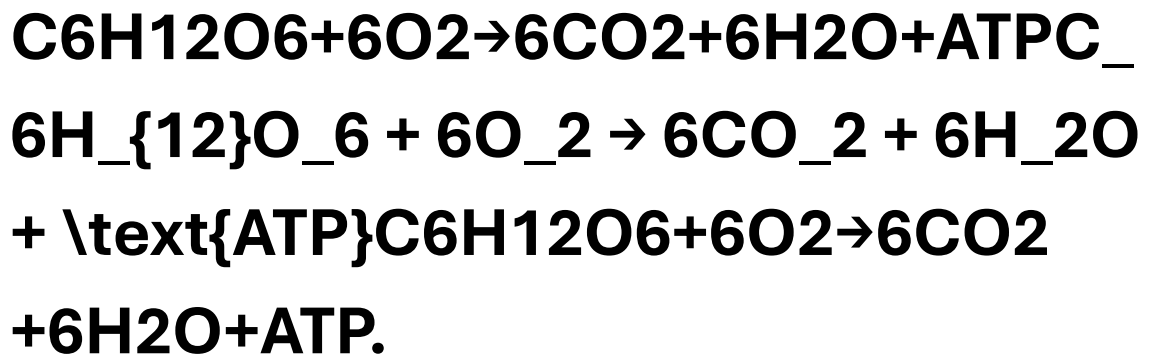
$$\text{CO}_2 + 6\text{H}_2\text{O} + \text{Light} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$$

4. Cellular Respiration and Energy Production

- **Glycolysis: Glucose breakdown, ATP and NADH production.**
- **Krebs Cycle: Production of electron carriers, CO₂ release.**

- . **Electron Transport Chain & Chemiosmosis: ATP synthesis through oxidative phosphorylation.**
- . **Aerobic vs. Anaerobic Respiration: Efficiency and applications.**

- . **Equation:**



5. Metabolic Pathways and Regulation

- . **ATP as the Universal Energy Molecule: How ATP drives cellular processes.**

- . Enzymes and Metabolic Regulation: Allosteric regulation, inhibitors, and cofactors.**
- . Cellular Homeostasis: Feedback inhibition in metabolic pathways.**
- . Fermentation in Detail: Lactic acid vs. alcoholic fermentation, industrial and biological importance.**

6. Cell Communication and Signaling

- . Types of Cell Signaling: Autocrine, paracrine, endocrine, and direct contact.**
- . Signal Transduction Pathways: Receptor-ligand interactions, secondary messengers.**

- . Cell Cycle Regulation: Role of cyclins and checkpoints in mitosis.**

7. Summary and Review

- . Key Concept Recap: Cellular structure, energy flow, and metabolic control.**
- . Q&A Session: Clarification of complex topics.**
- . Homework Assignment: Case studies on metabolic disorders and experimental analysis of enzyme activity.**

8. Assessment & Homework

- . In-Class Quiz: Covers organelle function, energy pathways, and signal transduction.**

- . Homework Assignment: Investigate real-world applications of cell metabolism (e.g., cancer metabolism, biofuels).**