



KPK Class 11 Biology Conceptual Questions – Chapter 4

Bioenergetics

Q1: Define Glycolysis?

- Glycolysis is a fundamental metabolic pathway that breaks down **glucose** by enzymes, releasing energy and **pyruvic acid**¹. It occurs in the **cytoplasm** of cells and is an **anaerobic** process (meaning it doesn't require oxygen). During glycolysis, one molecule of glucose is converted into two molecules of **pyruvate**, resulting in a net gain of **two ATP** (adenosine triphosphate) and two **NADH** molecules, which are involved in other metabolic processes².

Q2: What is Photorespiration?

- Photorespiration is a process in plant metabolism where the enzyme **RuBisCO** oxygenates **RuBP** (ribulose-1,5-bisphosphate), wasting some of the energy produced by photosynthesis. Instead of the desired reaction (addition of carbon dioxide to RuBP), approximately **25%** of reactions by RuBisCO add oxygen to RuBP, creating a product that cannot be used within the **Calvin–Benson cycle**. This process lowers the efficiency of photosynthesis and potentially reduces photosynthetic output by **25%** in **C3 plants**⁸.

Q3: What do you mean by Chemiosmosis?

- Chemiosmosis is a biological process wherein ions (usually **protons**, H⁺) move across a semi-permeable membrane, such as the membrane inside **mitochondria**. This movement generates an **electrochemical gradient** that can be used to drive **ATP synthesis**. In eukaryotes, ATP is produced through the process of **cellular respiration** in the mitochondria. It involves the flow of protons down the gradient via chemiosmosis, providing energy for the enzyme **ATP synthase** to make ATP¹⁹.

Q4: State the Role of Carbon Dioxide as one of the raw materials in Photosynthesis.

- During photosynthesis, plants take in **carbon dioxide (CO₂)** from the air. Within the plant cell, carbon dioxide is **reduced**, meaning it gains electrons. This transformation results in the production of **glucose** (a simple sugar) and **oxygen**. The oxygen is released into the surrounding air, while glucose is used by the plant for energy and stored as excess

food. Without this process, life on Earth would be unsustainable in the long term, as most living things require oxygen to survive¹¹.

Q6: What is the main difference Between Cyclic and Non-cyclic Photophosphorylation?

○ **Cyclic Photophosphorylation:**

- Occurs in **anaerobic** conditions.
- Involves **photosystem I (PS-I)**.
- Found in **photosynthetic bacteria** and **isolated chloroplasts**.
- **Does not produce oxygen**.
- **ATP synthesis** only.
- **Electron donor:** P700.
- **Electron movement:** Cyclic. ○

Non-cyclic Photophosphorylation:

- Occurs in **aerobic** conditions.
- Involves both **photosystem I (PS-I)** and **photosystem II (PS-II)**.
- Found in **algae, cyanobacteria, and plants**.
- **Produces oxygen** (oxygenic photosynthesis).
- Produces both **ATP** and **NADPH**.
- Facilitates the synthesis of **organic molecules** and long-term energy storage.