**NCERT Solutions for Class 11 Biology Chapter 12 Science:** Chapter 12 of Class 11 Biology, "Respiration in Plants," focuses on the biochemical process by which plants break down glucose to release energy. It explains key concepts such as glycolysis, the Krebs cycle, and oxidative phosphorylation, along with the role of ATP in energy transfer.

The chapter also distinguishes between aerobic and anaerobic respiration, emphasizing their significance in energy production. Factors affecting the rate of respiration, such as temperature and oxygen levels, are discussed. NCERT Solutions for this chapter provide clear and concise explanations to help students grasp complex processes, reinforce understanding, and excel in exams through step-by-step answers.

# NCERT Solutions for Class 11 Biology Chapter 12 Overview

Chapter 12 of Class 11 Biology, "Respiration in Plants," explores how plants derive energy through the breakdown of glucose in processes like glycolysis, the Krebs cycle, and oxidative phosphorylation. It highlights the significance of ATP as the energy currency and distinguishes between aerobic and anaerobic respiration.

Understanding these processes is essential for comprehending plant metabolism and energy flow. NCERT Solutions for this chapter are crucial as they provide detailed, step-by-step answers to textbook questions, helping students build a solid foundation, clarify doubts, and prepare effectively for exams with an in-depth understanding of these vital biochemical pathways.

# NCERT Solutions for Class 11 Biology Chapter 12 Respiration in Plants

Below is the NCERT Solutions for Class 11 Biology Chapter 12 Respiration in Plants -

**Question 1: Differentiate between**

**a) Respiration and Combustion**

**b) Glycolysis and Krebs' cycle**

**c) Aerobic respiration and Fermentation**

Ans:

**a) Differences between respiration and combustion are as follows:**

A. Respiration and combustion are processes that release energy, but they differ significantly. **Respiration** is a biochemical process occurring in living cells, where glucose is oxidized to produce energy (ATP), carbon dioxide, and water. It is a controlled, enzyme-mediated process occurring at body temperature.

In contrast, **combustion** is a rapid chemical process involving the burning of a substance, usually in the presence of oxygen, to release energy as heat and light. It is non-cellular and occurs at high temperatures. Respiration is sustainable and occurs in steps, while combustion is immediate and energy-intensive. Respiration supports life, whereas combustion is primarily a physical process.

B. Glycolysis and the Krebs cycle are key stages in cellular respiration but differ in process and location. **Glycolysis** occurs in the cytoplasm and involves the breakdown of one glucose molecule into two molecules of pyruvate, producing ATP and NADH. It is anaerobic, not requiring oxygen.

In contrast, the **Krebs cycle** occurs in the mitochondrial matrix and is aerobic, requiring oxygen indirectly. It oxidizes acetyl-CoA (derived from pyruvate) to produce ATP, NADH, $FADH_2$, and $CO_2$. While glycolysis is the first step in glucose metabolism, the Krebs cycle follows and generates more high-energy electron carriers for oxidative phosphorylation.

C. **Aerobic respiration** and **fermentation** are processes for energy production but differ in oxygen requirements and efficiency. Aerobic respiration occurs in the presence of oxygen, breaking down glucose completely into carbon dioxide and water, and producing a high yield of ATP (around 36-38 ATP per glucose molecule).

It involves glycolysis, the Krebs cycle, and oxidative phosphorylation. In contrast, **fermentation** occurs anaerobically (without oxygen) and partially breaks down glucose to produce ATP, yielding less energy (only 2 ATP per glucose molecule). It results in end products like ethanol or lactic acid, depending on the organism. Aerobic respiration is more efficient, while fermentation supports survival in low-oxygen environments.

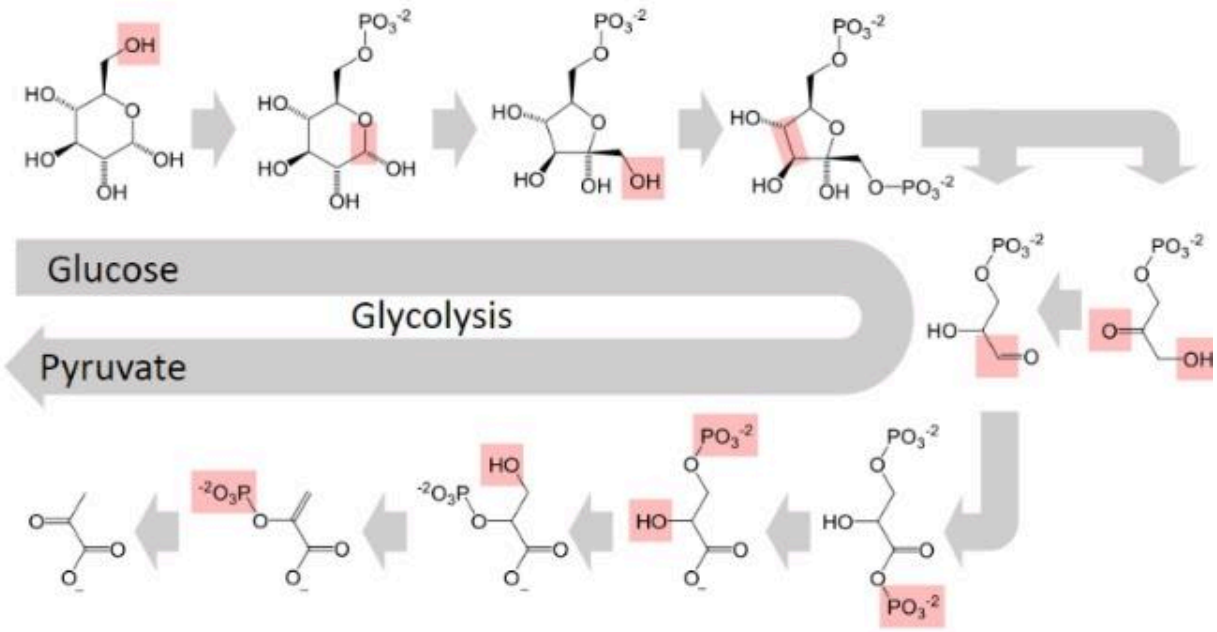
**Question 2: What are respiratory substrates? Name the most common respiratory substrate.**

**Ans:**

Respiratory substrates are organic substances. They are oxidized during respiration to release energy within living cells. Carbohydrates, proteins, fats, and organic acids are common respiratory substrates. The most common respiratory substrates are glucose (carbohydrates). It is a type of hexose monosaccharide.

**Question 3: Give the schematic representation of glycolysis.**

**Ans:**



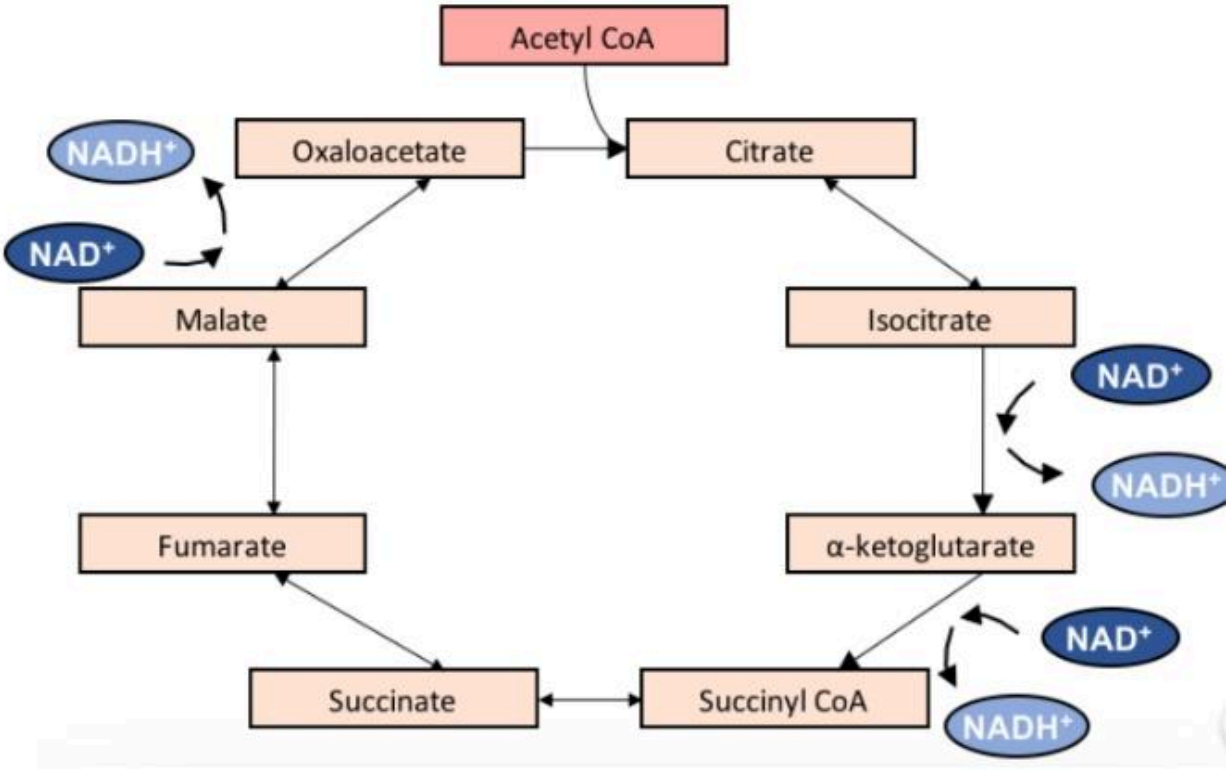

**Question 4: What are the main steps in aerobic respiration? Where does it take place?**

**Ans.** The main steps in aerobic respiration are **glycolysis**, **Krebs cycle**, and **oxidative phosphorylation**. Glycolysis occurs in the cytoplasm, breaking glucose into pyruvate and producing ATP and NADH.

The Krebs cycle takes place in the mitochondrial matrix, oxidizing pyruvate into $CO_2$, NADH, and $FADH_2$. Oxidative phosphorylation occurs in the inner mitochondrial membrane, where electron carriers generate ATP through the electron transport chain and chemiosmosis. This process efficiently produces energy using oxygen.

**Question 5: Give the schematic representation of an overall view of Krebs' cycle.**

**Ans:** The schematic representation of an overall view of krebs' cycle (Citric acid cycle):

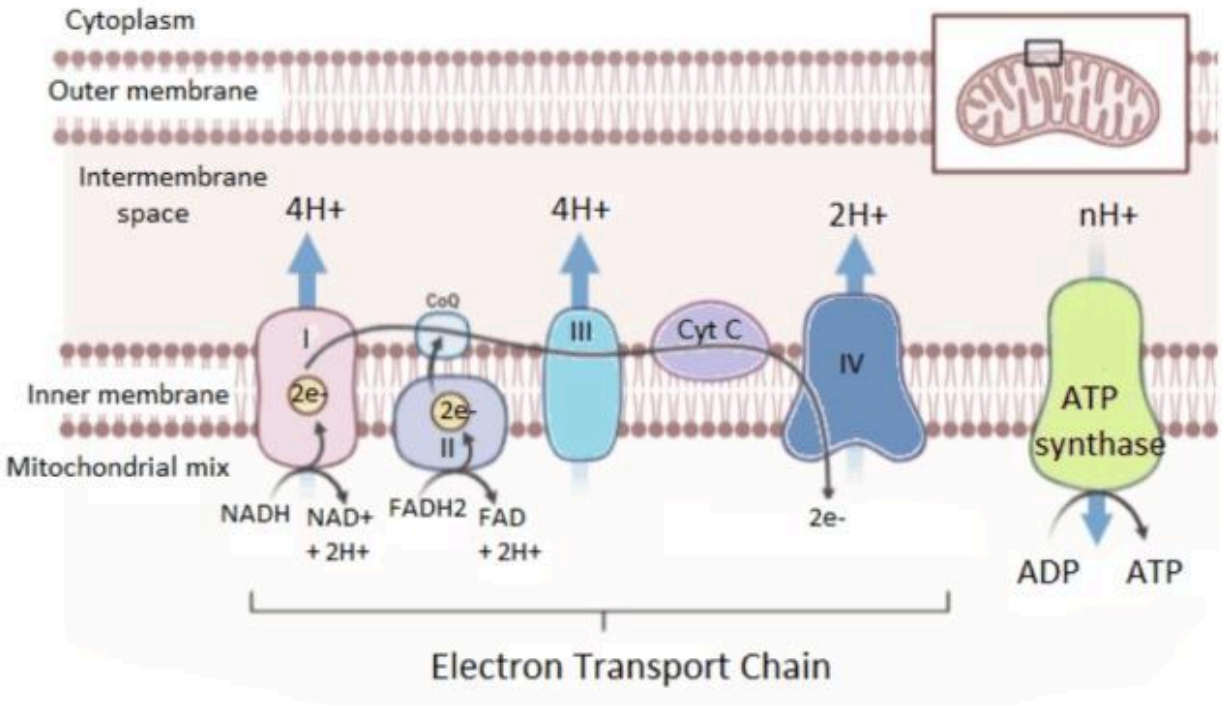



**Question 6: Explain ETS.**

**Ans.**

The **Electron Transport System (ETS)** is the final stage of aerobic respiration, occurring in the inner mitochondrial membrane. It involves a series of protein complexes (I-IV) and mobile electron carriers. NADH and $FADH_2$, produced in earlier stages, donate high-energy electrons to the ETS.

These electrons pass through complexes, releasing energy used to pump protons into the intermembrane space, creating a proton gradient. ATP synthase utilizes this gradient to produce ATP in a process called chemiosmosis. Oxygen acts as the final electron acceptor, combining with electrons and protons to form water. ETS is crucial for generating the majority of ATP in respiration.




**Question 7: Distinguish between the following:**

**a) Aerobic respiration and Anaerobic respiration.**

**b) Glycolysis and Fermentation.**

**c) Glycolysis and Citric acid cycle.**

**Ans:**

**a) Aerobic respiration and Anaerobic respiration**

**A. Aerobic respiration** occurs in the presence of oxygen, completely breaking down glucose into carbon dioxide and water, yielding high energy (36-38 ATP per glucose). It includes glycolysis, the Krebs cycle, and oxidative phosphorylation, primarily occurring in the mitochondria.

**Anaerobic respiration** occurs without oxygen, partially breaking down glucose to produce energy (2 ATP per glucose) with byproducts like ethanol, lactic acid, or methane, depending on the organism. It mainly takes place in the cytoplasm and is less efficient than aerobic respiration.

**B. Glycolysis** is the first step of glucose metabolism, occurring in the cytoplasm, where one glucose molecule is broken into two pyruvate molecules, producing 2 ATP and 2 NADH. It is common to both aerobic and anaerobic pathways and does not require oxygen.

**Fermentation** is an anaerobic process that follows glycolysis when oxygen is unavailable. It converts pyruvate into end products like ethanol or lactic acid to regenerate $NAD^+$ for glycolysis. While glycolysis is a universal step, fermentation is specific to anaerobic conditions.

**C. Glycolysis** occurs in the cytoplasm, breaking one glucose molecule into two pyruvate molecules, producing 2 ATP and 2 NADH. It is an anaerobic process and the first step in cellular respiration. In contrast, the **Citric Acid Cycle (Krebs cycle)** occurs in the mitochondrial matrix and requires oxygen indirectly. It oxidizes acetyl-CoA (derived from pyruvate) into $CO_2$, generating NADH, $FADH_2$, and 2 ATP. Glycolysis is a preparatory phase, while the Citric Acid Cycle is a central stage of aerobic respiration.

**Question 8: What are the assumptions made during the calculation of net gain of ATP?**

**Ans:**

Although it is possible, calculating the net ATP gain for each glucose molecule oxidised may only be a theoretical exercise in practice. Only the following presumptions can be used to make these calculations:

One substrate forms the next, and the glycolysis, TCA cycle, and ETS route all happen one after the other in an orderly, sequential process.

Once in the mitochondria, the NADH generated during glycolysis is subjected to oxidative phosphorylation. The pathway doesn't use any of its intermediates to create another molecule.

All that is respired is glucose. At none of the intermediate steps does the route receive any more alternate substrates.

However, in a living system, such assumptions are invalid. Instead of happening one after the other, all paths happen at the same time. When necessary, substrates are removed from the routes after entering them. ATP is used only when necessary. Enzymatic rates are influenced by several things. Therefore, one glucose molecule can produce 36 ATP molecules through aerobic respiration.

**Question 9: Define RQ. What is its value for fats?**

**Ans:**

The ratio of the volume of $CO_2$ evolved to the volume of $O_2$ consumed in respiration over a given period is known as a respiratory quotient (RQ) or respiratory ratio. Its value can be equal to one, zero, more than one or less than one.

$$\text{RQ} = \frac{\text{Volume of } CO_2 \text{ evolved}}{\text{Volume of } O_2 \text{ consumed}}$$

When fat or protein is used as a respiratory substrate, the respiratory quotient (RQ) is less than one.

$$C_{57}H_{104}O_6 + 80O_2 \rightarrow 57CO_2 + 52H_2O$$

$$\text{RQ} = \frac{57CO_2}{80O_2}$$

$$= 0.71$$

The respiratory quotient (RQ) is about 0.7 for most of the common fats.

**Question 10: What is oxidative phosphorylation?**

**Ans. Oxidative phosphorylation** is the final stage of aerobic respiration, occurring in the inner mitochondrial membrane. It involves the **electron transport chain (ETS)** and **chemiosmosis**, where high-energy electrons from NADH and $FADH_2$ are transferred through protein complexes, creating a proton gradient. ATP synthase utilizes this gradient to generate ATP, with oxygen acting as the final electron acceptor to form water.

# Benefits of Using NCERT Solutions for Class 11 Biology Chapter 12

**Clear Understanding**: Solutions simplify complex topics like glycolysis, the Krebs cycle, and oxidative phosphorylation, making them easier to comprehend.

**Exam Readiness**: Well-structured answers align with the CBSE exam pattern, enhancing preparation and confidence.

**Concept Clarity**: Step-by-step explanations help in understanding aerobic and anaerobic respiration processes.

**Time-Saving**: Organized solutions save time with concise and accurate answers.

**Practice and Mastery**: Provides ample practice, reinforcing important concepts for better retention.

**Convenience**: Solutions are available in a downloadable PDF format for easy access and revision anytime.