

## **Chapter 11: Bioenergetic (Short Questions Answers)**

How thylakoids and chemiosmosis are linked?

Thylakoid membranes are involved in ATP synthesis by chemiosmosis.

Name the phases of Calvin-Benson cycle?

The Calvin-Benson cycle or Calvin cycle can be divided into three phases:

- Carbon fixation
- Reduction
- Regeneration of CO<sub>2</sub> acceptor (RuBP)

### **Define redox potential.**

Redox potential (also called oxidation-reduction potential or ORP) is an integrated measure of the balance between total oxidants and total reductants in a biological system, such as the human body.

### **What is fermentation and its two types? or What is anaerobic respiration?**

Respiration that occurs in the absence of oxygen is called anaerobic respiration or fermentation. There are two types of fermentation i.e., alcoholic fermentation and lactic acid fermentation.

### **Differentiate between photolysis and glycolysis.**

The water-splitting step of photosynthesis that releases oxygen is called photolysis. While during respiration splitting of a glucose molecule into two pyruvic acids is called glycolysis.

### **What is payoff stage of glycolysis?**

The oxidative phase is also called payoff stage because in this stage high energy phosphate bonds are formed and energy is stored.

### **How many phases Calvin cycle can be divided into?**

Calvin cycle can be divided into three phases Carbon fixation. Reduction and Regeneration of CO<sub>2</sub> acceptor (RuBP).

### **Rup and RuBP stands for what?**

Rup stands for ribulose phosphate and RuBP stands for ribulose biphosphate.

### **What is respiration?**

Respiration is the universal process by which organisms breakdown complex compounds containing carbon in a way that allows the cells to harvest a maximum of usable energy.

### **Define cellular respiration.**

Cellular respiration is the process by which energy is made available to cells in a step by step breakdown of C-chain molecules in the cells.

**Name the most common fuel used by the cell to provide energy by cellular respiration.**

The most common fuel used by the cell to provide energy by cellular respiration is glucose.

**What is respiratory chain?**

In respiratory chain (also called electron transport system) electrons are transported in a series of oxidation-reduction steps to react, ultimately with molecular oxygen.

**Which oxidation reduction substances take part in respiratory chain.**

The oxidation reduction substances which take part in respiratory chain are:

- a coenzyme called coenzyme Q
- a series of cytochrome enzymes
- molecular oxygen ( $O_2$ )

**Define oxidative phosphorylation.**

Synthesis of ATP in the presence of oxygen is called oxidative phosphorylation.

**Define Chemiosmosis Or what is chemiosmosis.**

Chemiosmosis is the process that used membranes to couple redox reactions to ATP production. Electron transport chain pumps protons across the membrane of thylakoids in case of photosynthesis into the thylakoids space. The energy use for this pumping comes from the electron, moving through to electron transport chain.

**What are the products of light reaction.**

NADPH<sub>2</sub>, and ATP

**Name the process which acts as energy capturing and energy releasing.**

The photosynthesis acts as an energy capturing while respiration as an energy releasing process.

**What are the major ways by which cell processes pyruvic acid?**

Cell processes pyruvic acid in three major ways, alcoholic fermentation, lactic acid fermentation and aerobic respiration.

### **What is the difference between aerobic and anaerobic respiration?**

The respiration that occurs in the absence of oxygen is referred to as anaerobic (without oxygen). The respiration that occurs only in the presence of oxygen is called aerobic respiration. During aerobic respiration glucose is completely oxidized to CO<sub>2</sub> and water and energy is released.

### **Where and when anaerobic respiration occurs in man and other animals?**

This form of anaerobic respiration occurs in muscle cells of humans and other animals during extreme physical activities, such as sprinting (running), when oxygen cannot be transported to the cells as rapidly as it is needed.

### **How much energy is released by anaerobic respiration (or alcoholic and lactic acid fermentation)?**

Both alcoholic and lactic acid fermentation yield relatively small amount of energy from glucose molecule. Only about 2% of the energy present within the chemical bonds of glucose is converted into adenosine triphosphate (ATP).

### **Where oxygen is involved in aerobic respiration?**

Oxygen is involved in the last step when it accepts H to form water molecule.

### **What is ATP? or Give importance of ATP.**

Adenosine triphosphate, generally abbreviated ATP is a compound found in every living cell. It plays the key role in most biological transformations for example, synthesis of more complex compounds, active transport across the cell membrane, muscular contraction, and nerve conduction etc.

### **What is the composition of ATP?**

The ATP molecule is composed of a purine base (adenine), a 5-carbon sugar (ribose) and three phosphate groups at position 5 (carbon 5 in the ribose ring) of ribose molecule.

### **What is biological oxidation?**

The maintenance of living system requires a continual supply of free energy which is ultimately derived from various oxidation reduction reactions like photosynthesis, respiration etc.

### **What are the major stages of cellular respiration?**

Cellular respiration may be sub-divided into 4 stages.

- Glycolysis
- Pyruvic acid oxidation
- Krebs cycle or citric acid cycle
- Respiratory chain (Electron Transport Chain)

### **Where cellular respiration is carried out within the cell?**

The first stage i.e., glycolysis is carried out in cytosol while other stages i.e., pyruvic acid oxidation, krebs cycle and respiratory chain (electron transport chain) occur within mitochondria.

### **What are the major phases of glycolysis? Or What is meant by preparatory and oxidative phases of glycolysis.**

Glycolysis can be divided into two phases, a preparatory phase and an oxidative phase. In the preparatory phase breakdown of glucose occurs and energy is expended. In the oxidative phase high energy phosphate bonds are formed and energy is stored.

### **How glucose is activated in glycolysis?**

The first step in glycolysis is the transfer of a phosphate group from ATP to glucose so that it is activated and a molecule of glucose-6-phosphate is formed.

### **How it was proved that source of O<sub>2</sub> in photosynthesis is water.**

In 1930s, Van Niel hypothesized that plants split water as a source of hydrogen, releasing oxygen as a by-product. Water and carbon dioxide containing heavy-oxygen isotope <sup>18</sup>O were prepared in the laboratory. Experimental green plants in one group were supplied with H<sub>2</sub>O containing <sup>18</sup>O and with CO<sub>2</sub> containing only common oxygen <sup>16</sup>O. Plants in the second group were supplied with H<sub>2</sub>O containing common oxygen <sup>16</sup>O but with CO<sub>2</sub> containing <sup>18</sup>O. It was found that plants of first group produced <sup>18</sup>O but the plant of second group did not.

**Differentiate between photosynthetic and accessory pigments.**

Carotenoids and chlorophyll b are called accessory pigments because they absorb light and transfer the energy to chlorophyll a which is main photosynthetic pigment and then initiates the light reactions.

**Compare non-cyclic electron flow with cyclic electron flow.**

In predominant type of electron transport called non-cyclic electron flow the electrons pass through the two photosystems. In less common type of path called cyclic electron flow only photosystem I is involved.

**What is photophosphorylation?**

Synthesis of ATP in the presence of light is called photophosphorylation.

**What is rubisco?**

The Rubisco (ribulose biphosphate carboxylase), is an enzyme. It is the most abundant protein in chloroplasts, and probably the most abundant protein on Earth. The rubisco catalyzes the a reaction in Calvin cycle when a molecule of CO<sub>2</sub> reacts with a highly reactive phosphorylated five carbon sugar named ribulose biphosphate (RuBP).

**How NADH & ATP can inhibit cellular respiration.**

NADH inhibits pyruvate decarboxylase and ATP inhibits phosphofructokinase.