Respiration in Plants

CHAPTER 14

TRY YOURSELF ANSWERS

1. Photosynthesis and cellular respiration are complementary biochemical reactions. Photosynthesis requires the products of respiration, while respiration requires the products of photosynthesis. Water is broken down to form oxygen during photosynthesis, while in cellular respiration oxygen is combined with hydrogen to form water. Photosynthesis requires carbon dioxide and releases oxygen, cellular respiration requires oxygen and releases carbon dioxide. It is the released oxygen that is used by us and most other organisms for cellular respiration. Together these reactions allow plant cells to make and store energy and help to regulate atmospheric concentrations of carbon dioxide and oxygen.

2. Based on the availability of oxygen respiration is of two types- aerobic (in presence of oxygen) and anaerobic (in absence of oxygen).

3. The overall reaction of glycolysis which occurs in the cytoplasm is represented simply as :

$$C_6H_{12}O_6 + 2NAD^+ + 2ADP + 2H_3PO_4 \longrightarrow 2 \text{ Pyruvic acid} + 2ATP + 2NADH + 2H^+$$

4. Glycolysis involves the breaking down of glucose into some more simple compounds in order to produce energy. The end products of glycolysis are two molecules of pyruvate, two NADH and two ATP.

5. Enzymes used in preparatory or energy spending phase of glycolysis are hexokinase, phosphohexose isomerase, phosphofructokinase, aldolase and triose phosphate isomerase.

6. The acceptor molecule of Krebs' cycle is a 4-carbon compound called oxaloacetate. It accepts acetyl CoA (2-carbon compound) in the presence of enzyme citrate synthase and produce a 6-carbon compound called citric acid.

7. Krebs' cycle is named after Hans Krebs, discoverer of these cyclical reactions of cellular respiration. Its other names are the citric acid cycle and tricarboxylic acid cycle (TCA cycle). Krebs cycle is stepwise oxidative and cyclic degradation of activated acetate derived from pyruvate.

8. Krebs cycle directly generates two molecules of ATP. It also produces reduced coenzymes, NADH and $FADH_2$. These reduced coenzymes enter into electron transport chain and release more of the ATP molecules.

9. The high external acid concentration causes an increase in H^+ in the inner membrane space leading to increased ATP production by ATP synthetase. Therefore, low pH indicates the increase in acid concentration in the mitochondrial matrix, a condition that normally causes ATP production.

10. The proton motive force comprises of the electrical potential energy imparted when protons build up on one side of the membrane and the chemical potential energy due to the difference in concentration of protons on either side of the membrane.

11. The electron transport chain is located on the mitochondrial inner membrane and contains several different kinds of electron carriers.

12. Factors affecting fermentation include pH, temperature and nutrient availability.

13. Alcoholic fermentation converts one mole of glucose into two moles of ethanol and two moles of carbon dioxide and also produces two moles of ATP in the process. The overall chemical formula for alcoholic fermentation is :

$$C_6H_{12}O_6 \longrightarrow 2C_2H_5OH + 2CO_2$$

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