CBSE Class 11 Biology

Important Questions

Chapter 14

Respiration in Plants

1 Marks Questions

1.Define fermentation and aerobic respiration.

Ans. Fermentation is partial breakdown of glucose.

Aerobic respiration glucose is completely degraded into CO_2 and H_2O.

2.What are the different types of respiration occurs in plants?

Ans. Aerobic respiration and Anaerobic respiration.

3.Name the energy currency of the cells.

Ans. ATP.

4.What are the other two names for kreb's cycle?

Ans. Citric acid cycle (CAC), Tricarboxylic acid cycle (TCA)

5.In which organelle does kreb's cycle occur in living cells?

Ans. Mitochondria.

6.Mention the conditions under which

(i) RQ is 1 (ii) R.Q is less than 1

Ans. (i) If carbohydrates are used as substrate and are fully oxidized the R.Q will be 1.

(ii) If fats are used in respiration, the R.Q well be less than 1.

7.What is respiration?

Ans. A process of physiochemical change by which environmental oxygen is taken into, to oxidize the stored food, for release of CO_2, water and energy. The energy released is used for doing various life activities, whereas CO_2 is used by the plants.

8.Give two types of cellular respiration.

Ans. (a) Aerobic **(b)** Anaerobic

9.How many carbon atoms are present in the molecule of each of :

Ans. (i) 6 carbon in glucose **(ii)** 3 carbon in pyruvate.

(i) Glucose and **(ii)** Pyruvate?

10.Nain the molecule which is terminal acceptor of electron.

Ans. Oxygen.

11.How many ATP mo1ecuIe am produced from a molecule of glucose on i complete oxidation in eukaryotes.

Ans. 36 ATP.

12.Where does ETC found in eukaryotic cell?

Ans. Mitochondrial membrane.

13.Name the enzyme which convert sugar into glucose and fructose.

Ans. Invertase.

14.How many molecules of ATP are produced by the oxidation of one molecule of

$FADH_2$?

Ans. 2 ATP molecules.

15.Why do the person with sufficient while fibres get fatigued ma short period ?

Ans. due to formation of Lactic acid.

16.Write the name of end product of glycolysis.

Ans. Pyruvic acid

17.Name the first product formed in Kerb's cycle.

Ans. Citric acid.

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2 Marks Questions

1.Define RQ. What is its value for fats?

Ans. Respiratory Quotient (RQ) : The ratio of the volume of CO_2 evolved to the volume of O_2 consumed in respiration is termed as the respiratory quotient or respiratory ratio.

$$R.Q = \frac{\text{Volume of } CO_2 \text{ evolved}}{\text{Volume of } O_2 \text{ consumed}}$$

Its value for fats is less than one.

2.What is the importance of F_0-F_1 particles in ATP production during aerobic Respiration?

Ans. F_1 head piece contains the site for ATP synthesis from ADP and phosphate.

F_0 forms the channel through which protons cross the inner membrane.

3.What is oxidative decarboxylation? What happens to pyruvate immediately after this reaction?

Ans. Oxidative decarboxylation – It is the process in which carbon is removed from a compound as carbon-dioxide and the compound is oxidized.

Pyruvate is oxidatively decarboxylated into 2C acetate unit, which joins coenzyme A (COA) to form acetyl CO – A.

4.What is respiration?

Ans. A process of physicochemical change by which environmental oxygen is taken into, to oxidize the stored food, for release of CO_2, water and energy. The energy released is used for doing various life activities, where as CO_2 is used by the plaints.

5.Why less energy is produced during anaerobic respiration?

Ans. i) Incomplete breakdown of respiratory substrate takes place.

ii) Some of the products of anaerobic respiration can be oxidized further to release energy which shows that anaerobic respiration does not liberate the whole of energy contained on the respiratory substrate.

iii) O_2 is not utilized for securing electrons & protons.

iv) $NADH_2$ does not produce ATP as electron transport is absent.

6. What is the function of phosphofructokinase in glycolysis?

Ans. It catalyses the formation of fructose -1, 6- biphosphate from fructose-6- phosphate and adenosine –tri- phosphate (ATP) Fructose -1,6- biophosphate is splited into 2 molecules of triose phosphate – 3 phosphoglyceraldhyde and dihydroxyacetone phosphate.

7.Give difference between Breathing and Respiration?

Ans.

	Breathing	**Respiration**
a.	It is a biophysical process.	It is a biochemical process
b.	Oxygen is taken in and CO_2 is given out.	Water, carbon dioxide and energy is released by the oxidation of carbohydrates.

8.Define aerobic respiration?

Ans. The process of release of energy through intake of molecular oxygen and release of CO_2

is known as aerobic respiration.

9.What is compensation point?

Ans. At low concentration of CO_2 and non-limiting light intensity, photosynthetic rate of a given plant will be equal to the total amount of respiration. Atmospheric concentration of CO_2 at which photosynthesis just compensates for respiration is referred to as the CO_2 compensation point.

10. Mention two steps of glycol sis in which ATP is utilized.

Ans. (i) ATP molecules are formed by direct transfer of Pi to ADP.

(ii) By oxidation of NADH.

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3 Marks Questions

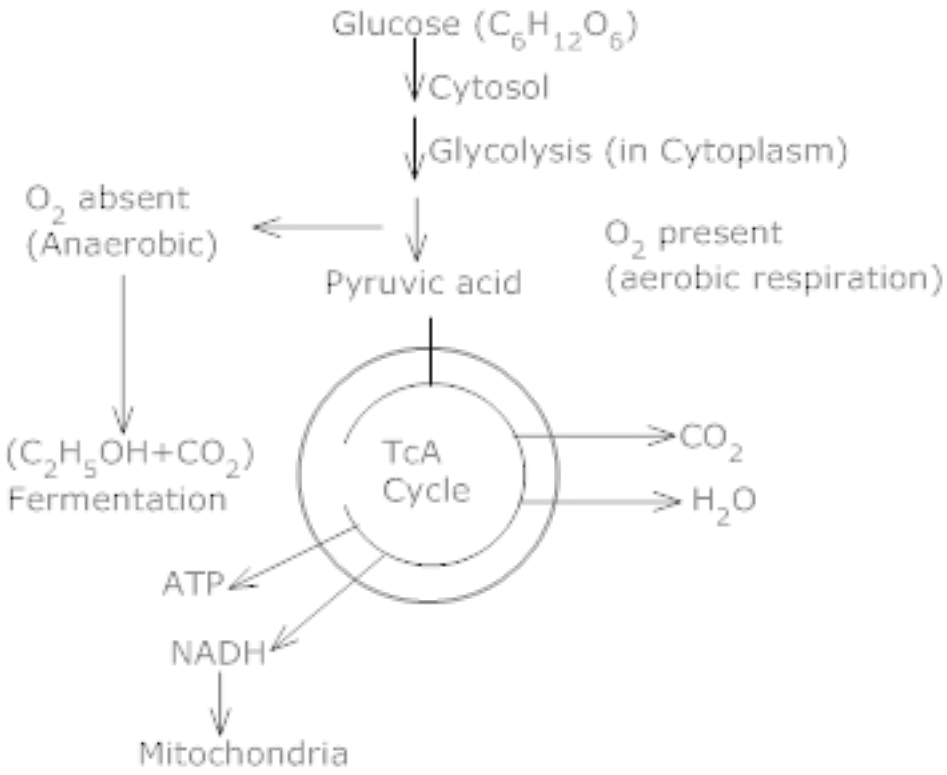
1.Describe the mechanism of Respiration.

Ans. Mechanism of respiration – Glucose molecule is broken down into an intermediate molecule, Pyruvic acid.

a) Breakdown of pyruvic acid in anaerobic respiration – In this process in absence of oxygen the pyruvic acid is incompletely reduced to ethyl alcohol.

Glucose → Ethyl alcohol + CO_2 + 2ATP

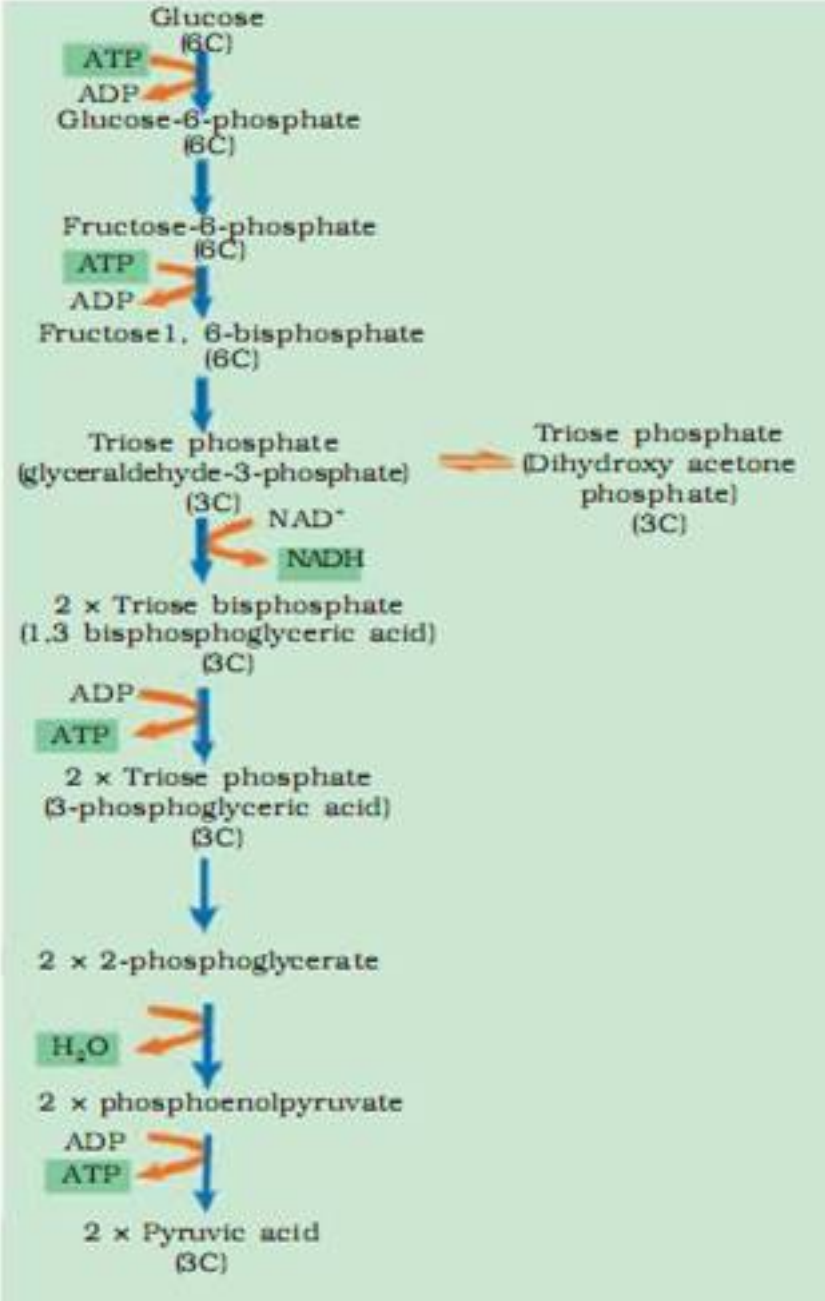
b) Breakdown of pyruvic acid in aerobic respiration – In this process the pyruvic acid is completely oxidized into CO2 and H2O is the presence of oxygen. This process occurs in the mitochondria of the cell and is khown as kreb's cycle.



The broad schene of respiration.

2.What are the various steps involved in glycolysis?

Ans. Steps of Glycolysis –



3.Explain Respiratory Balance sheet.

Ans. a) As equetial, orderly pathway functioning, with one substrate forming next one with glycolysis, TCA cycle and ETS pathway following one after another.

b) NADH synthesized in glycolysis. It is transferred into mitochondria and undergoes oxidative phosphorylation.

c) None of intermediates in pathway are used to form any other compound.

d) Only glucose is being respired; no other alternative substrates enter in pathway at any of intermediary stages.

4.What is the significance of stepwise release of energy in respiration?

Ans. Advantages of step wise oxidation during respirations-

a) It facilitates the utilization of a relatively higher proportion of that energy in ATP synthesis.

b) Activities of enzymes for the different steps may be enhanced or inhibited by specific compounds. This provides a means of controlling the rate of the pathway and the energy output according to the need of the cell.

c) The same pathway may be utilized for forming intermediates used in the synthesis of other bimolecular like amino acids.

5.Write the significance of citric acid cycle.

Ans. **i)** It explains the process of breaking of pyruvate into CO_2 and water.

It is major pathway of generation of ATP.

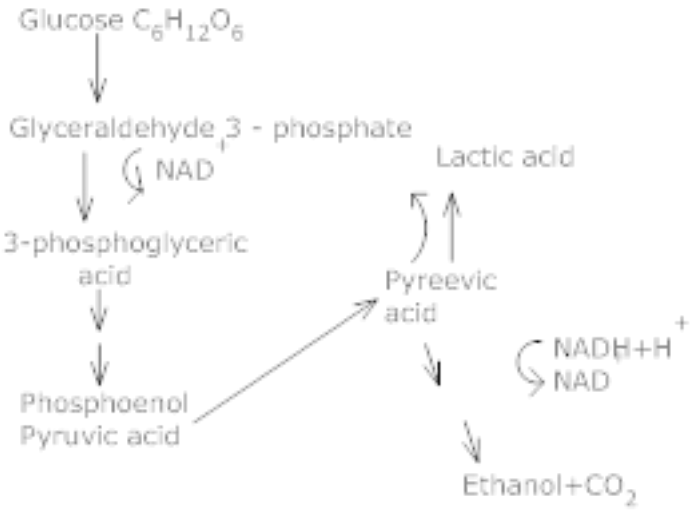
(ii) More energy is released (30 ATP) in this process as compared to glycolysis.

(iii) Many intermediates compounds are formed. They are used in the synthesis of other bimolecules like amino-acids, nucleotides, Chlorophyll, cytochromes and fats.

6.Explain fermentation.

Ans. It occurs in some organisms like some bacteria that produce lactic acid from pyruvic acid.

In animal cells, such as muscles during exercise, when O_2 is inadequate for cellular exercise, the pyruvic acid is reduced to lactic acid by lactate dehydrogrogenase. Reducing agent is $NADH + H^+$ that is reoxidised to NAD^+ in both processes.



Major pathway of anaerobic respiration

In both lactic acid and alcohol fermentation not much energy is relased; less than seven per cent of the energy in glucose is released and not all it is trapped as high energy bonds of ATP. The processes are hazardous either the acid or alcohol is produced. Yeasts poison themselves to death when the concentration of alcohol reaches approximately 13%.

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5 Marks Questions

1.Describe the process and role of citric acid cycle in living organisms.

Ans. It is called “tricarboxylic acid cycle”. Following steps are present for completing this cycle-

(i) In this step, CO^2 is removed from pyruvic acid and resulting 2- carbon unit with the sulphur containing compound coenzyme A forming Acetyl CoA. During this process the hydrogen released is accepted by NAD and $NADH_2$ is produced.

Pyruvic acid _ CoA + NAD → Acetyl CoA + NADH2 + CO_2

(ii) Acetyl coenzyme A reacts with a 4 – carbon compound oxaloacetic acid to form citric acid.

(iii) The citrate remains in equilibrium with cisaconitic acid and isocitric acid in the presence of the enzyme aconitase.

Citric acid → Isocitric acid.

(iv) Isocitrate is dehydrogenated in the presence of isocitrate dehydrogenase enzyme to form oxalosuccinate. The hydrogen released is accepted by NAD to form $NADH_2$.

Isocitric acid + NAD → Oxalosuccinate + $NADH_2$.

(v) A molecule of CO_2 is lost from oxalosuccinate and a 5 – carbon compound α – ketoglutaric acid is formed in the presence of decarboxylate enzyme.

(vi) α – ketoglutarate loses a molecule of CO_2 and 4 – carbon compound succinyl CoA is formed.

∝ – keloglutarate + CoA + NAD → succinyl + CoA + $NADH_2$ + CO_2

(vii) Succinyl CoA forms succinate, and ATP is found by linking ADP and inorganic phosphate (Pi)

Succinate CoA + ADP + Pi → Succinylate + CoA + ATP

b Succinate is oxidized into fumarate in the presence of succinate dehydrogenase enzyme. The hydrogen liberated is accepted by FAD and $FADH_2$ is formed.

Succinate + FAD → Fumerate + $FADH_2$

(ix) In this step the fumarate is converted into malate in the presence of enzyme fumarate hydrase (fumarase)

Fumarate → Malate.

(x) Malate is changed into oxaloacetate in the presence of the enzyme malate denydrogenase. NAD is reduced to $NADH_2$ by the liberated hydrogen.

Thus oxaloacetic acid produced is ready to combine with the fresh acetyl CoA obtained from pyruvic acid for completing one cycle.

Net yield kreb's cycle :- 1 Pyruvic acid + 1ADP + 4NAD + 1FAD à$3CO_2$ + $1FADH_2$ + $4NADH_2$ + 1ATP

Thus total yield of energy

1ATP = 1 ATP

3×4NADH2 = 12ATP

2×1FADH2 = 2ATP

Total = 15 ATP

Thus 2 Pyruvic acid in ghycolysis yield, 15×2=30ATP.

2..Explain ETS.

Ans. Mechanism of Electron transport system – Glucose molecule is completely oxidized by the end of the citric acid cycle. The energy is not released unless NADH and FADH are oxidized through the ETS. The oxidation means 'removal of electrons from it'. Metabolic pathway through which the electron passes from one carrier to another is called "Electron transport system" It is operative in the inner mitochondria membrane. Electrons from NADH produced in mitochondrial matrix are oxidized by NADH dehydrogenase (complex I) and electrons are then transferred to ubiqinone located within the inner membrane also receives reducing equivalents via FADH; that is generated during oxidation of succinate, through activity of enzyme named succinate dehydrogenase (complex II). Reduced ubiquinone is then oxidized with the transfer of electrons to cytochrome complex (complex III). Cytothrome is small protein attached to outer surface of inner membrane and acts as a mobile carries for transfer of electrons between complex III and complex IV. (complex IV) is cytochromes 'c' oxidize complex having cytochromes 'a' and a_3.

When electron pass from one carries to another via complex I to IV in ETS, they are coupled to ATP synthase (complex V) for production ATP from ADP and inorganic phosphate. Oxidation of one molecule of NADH, gives rise to 3 molecules of ATP, while that of FADH, produces 2 molecules of ATP. Electrons are curried by cytochromes and recombine with their protons before the final stage when hydrogen atom is accepted by oxygen to form water. O_2 acts as final hydrogen acceptor. Whole process by which oxygen allows the production of ATP by phosphorylation of ADP is called 'oxidative phosphorylation'.

3.Give the various steps involved in Glycolysis.

Ans. The steps are as follows-

1) Glucose is phosphorylated in the presence of ATP, catalyzed by the enzyme hexokinase.

2) Glucose – 6 – phosphate is changed into its isomer fructose – 6 – phosphate catalyzed by phosphohexose isomers.

3) Fructose – 6 – phosphate is phosphorylated in the presence of ATP to form Fructose 1, 6 biphosphate.

4) Fructose 1, 6 biposphate is split into two molecules of triose phosphate one of 3 –

phosphoglyceral dehyde and one of dihydroxyacetose phosphate, which are interconvertible. This reaction is catalysed by phosphofructokinase.

5) 3 – phosphoglyceraldehyde is oxieised to 1,3 biphosphoglycerate, with the reduction of NAD to NADH.

6) Phosphoglycerate kinase catalyses the formation of 3-phosphoglycerate to 1,3 biposphoglycerate and 1 molecule of ATP is produced directly (substrate phosphation).

7) 3-phosphoglycerate is converted into 2-phosphoglycerate and then into phosphoenlpysuvate (PEP)

8) PEP is converted into pyrucate long with the formation of one molecule of ATP directly. The enzyme pyruvate kinase catalyses this step.

The end products of glycolysis are 2 molecules of pyruvc acid + 2 NADH + 2ATP.