



BIOLOGY

BOOKS - PRADEEP BIOLOGY (HINGLISH)

RESPIRATION IN PLANTS

NCERT Exercises with Answers

1. Differentiate between

(a) Respiration and Combustion.



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2. Differentiate between

(b) Glycolysis and Krebs cycle (or Citric acid cycle)

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3. Differentiate between

(c) Aerobic respiration and Fermentation.

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4. What are respiratory substrates ? Name the most common respiratory substrates.

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5. Give the schematic representation of glycolysis.

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6. What are the main steps in aerobic respiration ?

Where does it take place ?

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7. Give the schematic representation of an overall view of Krebs cycle ?

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8. ELECTRON TRANSPORT SYSTEM (ETS) AND OXIDATIVE PHOSPHORYLATION



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9. Distinguish between the following :

(a) Aerobic respiration and anaerobic respiration.



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10. Distinguish between the following :

(b) Glycolysis and fermentation. .



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11. Distinguish between the following :

(c) Glycolysis and Citric acid cycle.



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12. What are the assumptions made during the calculation of net gain of ATP?



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13. Discuss “The respiratory pathway is an amphibolic pathway.”

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

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15. What is oxidative phosphorylation ?

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16. What is the significance of step-wise release of energy in respiration?



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Additional Questions (Very Short Answer Questions)

1. Where do most of the Krebs cycle enzymes occur in mitochondria ?



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2. Where are ETS coenzymes located in mitochondria ?



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3. What are the alternative names for TCA cycle ?



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4. What does ETS stand for ? Where is it found ?



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5. What do ATP and ADP stand for ?



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6. How many high-energy phosphate molecules are formed from one glucose molecule ?

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7. Name the enzyme oxysomes represent.

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8. Which is the raw material in cell respiration.

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9. What kind of enzymes are present in mitochondria ?



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10. Give the role of ATPase.



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11. How many high-energy phosphate molecules are formed in each, glycolysis and Krebs cycle ? Give their names too.



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12. Why is no distinction made between ATP and GTP in calculating energy yield in cell respiration ?

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13. What is zymosis ?

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14. Which is the link reaction (gateway step) between glycolysis and citric acid cycle ?

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15. Which type of respiration produces water as one of the products ?

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16. Explain the term "Energy Currency". Which substance acts as energy currency in plants and animals.

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17. $F_0 - F_1$ particles participate in the synthesis of



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18. The product of aerobic glycolysis in skeletal muscle and anaerobic fermentation in yeast are respectively and



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19. Which of the following will release more energy on oxidation ? Arrange them in ascending order.

- (a) 1 gm of fat (b) 1 gm of protein (c) 1 gm of glucose
(d) 0.25 gm of glucose + 0.5 g glucose.



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Additional Questions (Short Answer Questions)

1. Name the entrant and receptor molecules in TCA cycle. How many high-energy phosphates this cycle yields ?



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2. What is substrate-level phosphorylation ?



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3. What are redox reactions ?



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4. Distinguish between floating and protoplasmic respiration.



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5. What is zymosis ?



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6. Define respiratory quotient. Give the RQ for carbohydrates, fats and proteins.

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7. How is proton gradient established ?

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8. Give resemblances between cellular respiration and burning.

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9. what is the primary role of cellular respiration ?



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10. Why is glycolysis called an ancient pathway ?



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11. What role can you assign to the intermembrane space of mitochondria in energesis ?



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12. For what purpose is the energy from electron transfers used ?

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13. Name the energy carrier produced by TCA cycle in plants and animals. Who suggested the sign \sim for high energy bonds.

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14. What is meant by the statement 'aerobic' respiration is more efficient?



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15. Write two energy yielding reactions of glycolysis.



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16. A. What is the value of RQ in germinating wheat grains ?

B. What is zymase ?

C. Name the kind of respiration which uses proteins as respiratory substrate.

D. Name the chief polysaccharide reserve food in plant cells.

E. Name the end products of anaerobic breakdown of pyruvic acid in muscle cells of animals.

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17. Sucrose is converted into glucose and..... by the enzyme....., and these two hexoses then enter thepathway .

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18. The actual Krebs cycle begins when.....enters into a reaction to form citric acid.

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19. When organic acids serve as respiratory substrates, then RQ is.....than one.

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20., generated in the glycolysis enters into the mitochondrial matrix undergoes.....decarboxylation to form....Coenzyme.

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21. In.....plants, the CO_2 compensation point is usually much higher than in.....plants.



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22. Define the following :

(a) Respiration (b) Respiratory substrate

(c) Respiratory quotient (d) Anaerobic respiration

(e) Fermentation



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23. Write the significance of citric acid cycle (or TCA cycle).

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24. What are the advantages of anaerobic respiration in living beings ?

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25. Tabulate differences between the two types of fermentation.

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26. Explain CO_2 compensation point.



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27. oxygen is critical for aerobic respiration. Explain its role with respect to ETS.

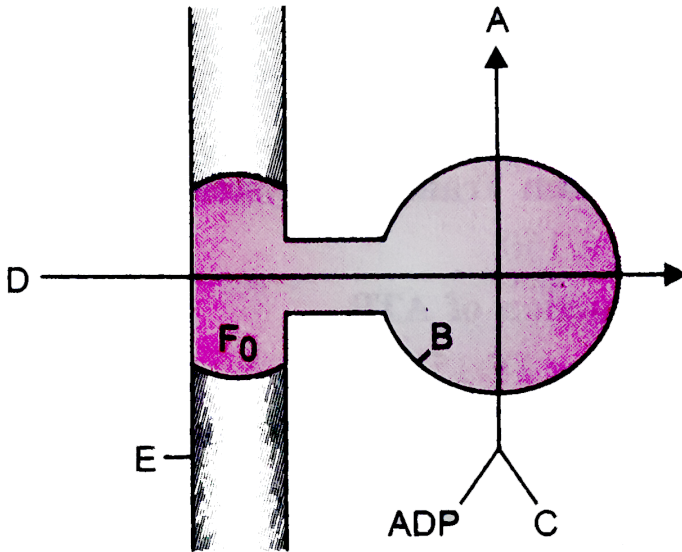


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28. Given below is a diagram showing ATP synthesis during aerobic respiration. Replace symbols ABCD and E by appropriate terms given in the box.

F₁, Particle Pi, $2H^+$, Inner mitochondrial membrane,

ATP, F_0 Particle, ADP



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29. Make corrections wherever you find mistake in spellings/words in the following paragraphs :-

A. When fats are used in respiration, the RQ is more

than unity because fats contain more O_2 and require relatively less amount of O_2 for oxidation.

B. The most important energy carrier is ATP. This energy rich compound is mobile and can pass from one cell into another.

C. Before pyruvic acid enters Krebs cycle, one of the two carbon atoms of pyruvic acid is reduced to carbon dioxide in the reaction called reductive carboxylation.

The remaining two carbon pyruvate unit is accepted by coenzyme A to form acetyl coenzyme A.



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30. A. Name the breakdown product of glucose which enters into the mitochondria during aerobic respiration.

B. What is the meaning of glycolysis ?

C. Name the enzyme responsible for phosphorylation of glucose and fructose into glucose-6-phosphate and fructose-6-phosphate.

D. Write the chemical reaction of citric acid cycle in which the FAD is reduced to $FADH_2$.

E. How many ATP molecules are generated during the complete breakdown of pyruvic acid molecule in aerobic respiration ?



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Additional Questions (Long Answer Questions)

1. Explain the major steps of glycolysis. Where does this process occur in a cell ?



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2. Explain the major steps of glycolysis. Where does this process occur in a cell ?



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3. What is phosphorylation ? Describe oxidative phosphorylation in plants .

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4. Describe the chemiosmotic production of ATP.

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5. Give a diagram showing the summary of cell respiration involving the use of carbohydrates, fats and proteins as respiratory substrates.

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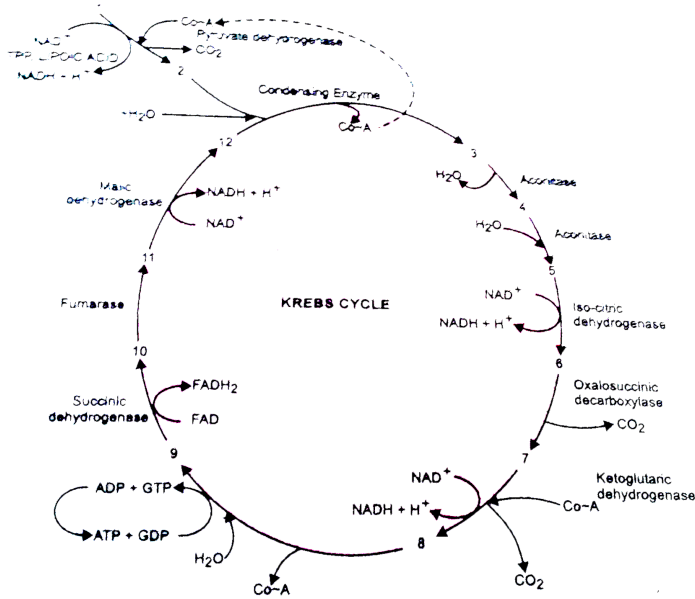
6. Given an account of Glycolysis. Where does it occur ? What are the end products ? Trace the fate of these products in both aerobic and anaerobic respiration .



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7. An outline diagram of Krebs cycle is given below. Label 1-12 and also mention the number of carbon

atoms in each molecule .



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Analytical Questions with Answers

1. Which enzymes of the citric acid cycle occur in the inner mitochondrial membrane ?



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2. How many ATP molecules come from TCA cycle ?



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3. Name the 10-step pathway which occurs in all living organisms (aerobes and anaerobes) without without the help of oxygen. In which part of the cell does it occur ?



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4. In which two steps of glycolysis ATP molecules are formed and in which two steps ATP molecules are consumed ?

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5. What is fermentation ? How is it different from aerobic respiration ?

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6. Name atleast two categories of products which are commercially produced by fermentation.



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7. What is meant by Respiratory Quotient (RQ) ? When will the value of RQ be 1 and when it less than 1 ?



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8. If a person is feeling dizzy, glucose or fruit juice is given immediately but not cheese sandwich, which might have more energy. Explain.



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9. How does a tree trunk exchange gases with the environment although it lacks stomata?

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10. What is fermentation ? Why anaerobic respiration should not be used as synonym of fermentation ?

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11. What is the shuttle system ? Give its role also.

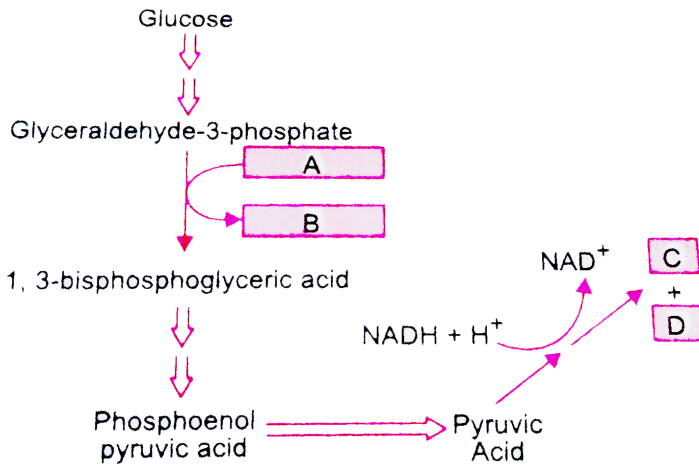
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12. Give any three correct options if R.A. is less than unity in a respiratory metabolism.

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13. Study the following figure and label A, B, C and D

Pathway of Anaerobic respiration in yeast



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14. Which pathway of respiration is common in all living organisms ? Where does it occur inside the cell and what are its products ?

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15. Complete the following equation usually given for aerobic respiration :



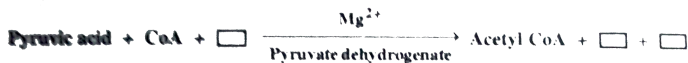
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16. Give three reasons why plants can get along without respiratory organs.



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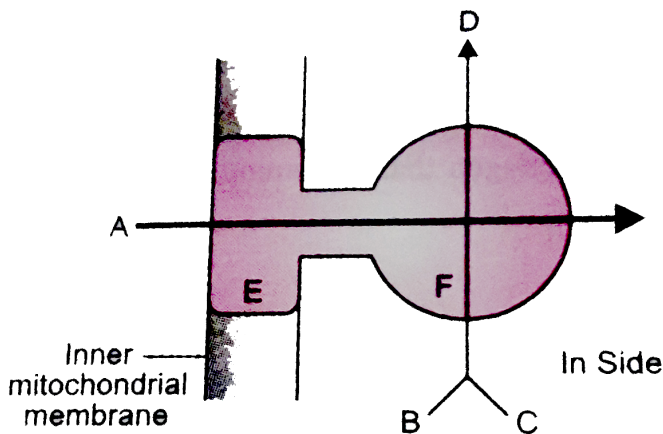
17. Complete the following equation of conversion of pyruvic acid into acetyl coenzyme A. Where does this process occur inside the cell ?



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18. What do you understand by oxidative phosphorylation ? Where does it occur in side the mitochondria ?

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19.

Observe the above figure and answer the following

questions

(i) What does the figure represent ?

(ii) Label A, B, C, D, E and F



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Practice Questions (I. Multiple Choice Questions)

1. The number of glucose molecules required to produce 38 ATP molecules under anaerobic condition by a yeast cell is

A. 2

B. 4

C. 19

D. 24

Answer: C



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2. Which of the following does not function as an electron carrier ?

A. Coenzyme-Q

B. Cytochrome-C

C. Cytochrome-a

D. H_2O

Answer: D



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3. The process used in conversion of pyruvate to acetyl CoA is

- A. Oxidative dehydration
- B. Oxidative decarboxylation
- C. Oxidative phosphorylation
- D. Oxidative dehydrogenation

Answer: B



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4. Which of the following plant parts can respire even in the absence of oxygen ?

A. Seeds

B. Roots

C. Stems

D. Leaves

Answer: A



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5. How many ATP molecules could maximally be generated from one molecule of glucose, if the complete oxidation of one mole of glucose to CO_2 and H_2O yields 686 kcal and the useful chemical energy available in the high energy phosphate bond of one mole of ATP is 12 kcal

A. One

B. Two

C. Thirty

D. Fifty seven

Answer: C



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6. All enzymes of TCA cycle are located in the mitochondrial matrix except one which is located in the inner mitochondrial membrane in eukaryotes and in cytosol in prokaryotes. This enzyme is

- A. Isocitrate dehydrogenase
- B. Malate dehydrogenase
- C. succinic dehydrogenase
- D. Lactate dehydrogenase

Answer: C

7. The overall goal of glycolysis, Krebs cycle and electron transport system is the formation of

A. ATP in one large oxidation reaction

B. Sugars

C. Nucleic acids

D. ATP in small stepwise units

Answer: D



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8. Which one is not correct about Krebs cycle ?

A. It is also called citric acid cycle

B. The intermediate compound which links glycolysis with Krebs cycle is malic acid

C. It occurs in mitochondria

D. It starts with six carbon compound

Answer: B



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9. The net gain of ATP during glycolysis is

A. Six

B. Eight

C. Two

D. Four

Answer: C



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10. In which of the following enzymes is not used in Krebs cycle ?

A. Isocitric acid \rightarrow Oxalosuccinic acid

B. Oxalosuccinic acid \rightarrow α -Ketoglutaric acid

C. Succinic acid → Fumaric acid

D. Malic acid → Oxaloacetic acid

Answer: B



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11. Which of the following enzymes is not used in Krebs cycle ?

A. Aconitase

B. Decarboxylase

C. Aldolase

D. Fumarase

Answer: C



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12. End products of fermentation are

A. ATP

B. Ethanol + CO_2 + ATP

C. Ethyl alcohol + CO_2 + H_2O + ATP

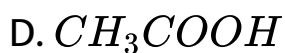
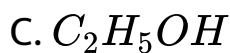
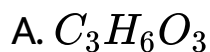
D. Pyruvic acid + CO_2

Answer: B



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13. Anaerobic respiration in muscles gives rise to the following



Answer: B



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14. Most enzymes that take part in 'Krebs cycle' are located in

- A. Mitochondrial matrix
- B. Cytoplasm
- C. Inner mitochondrial membrane
- D. Plasma membrane

Answer: A



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15. Intermediate stage between aerobic and anaerobic cycles is

- A. Glyoxylate cycle
- B. Glycolysis
- C. Krebs cycle
- D. None of these

Answer: B



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16. The energy-releasing process in which the substrate is oxidised without an external electron acceptor is called

A. Aerobic respiration

B. Glycolysis

C. Fermentation

D. Photorespiration

Answer: B



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17. The chemiosmotic coupling hypothesis of oxidative phosphorylation proposes that adenosine triphosphate (ATP) is formed because

A. A proton gradient forms across the inner membrane

B. There is a change in the permeability of the inner mitochondrial membrane towards adenosine diphosphate (ADP).

C. High energy bonds are formed in mitochondrial proteins

D. ADP is pumped out of the matrix into the inter membrane space.

Answer: A



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18. The ultimate electron acceptor of respiration in an aerobic organisms is:

A. Cytochrome

B. Oxygen

C. Hydrogen

D. Glucose

Answer: B



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19. Phosphorylation of glucose during glycolysis is catalysed by

- A. Phosphoglucomutase
- B. Phosphoglucoisomerase
- C. Hexokinase
- D. Phosphorylase

Answer: C



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20. Pyruvic acid, the key product of glycolysis can have many metabolic fates. Under aerobic condition it forms

A. Lactic acid

B. $CO_2 + H_2O$

C. Acetyl CoA + CO_2

D. Ethanol + CO_2

Answer: C



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21. Electron Transport System (ETS) is located in mitochondrial

- A. Outer membrane
- B. Inter membrane space
- C. Inner membrane
- D. Matrix

Answer: C



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22. Which of the following exhibits the highest rate of respiration?

A. Growing shoot apex

B. Germinating seed

C. Root tip

D. Leaf bud

Answer: B



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23. Choose the correct statement :

- A. Pyruvate is formed in the mitochondrial matrix.
- B. During the conversion of succinyl Co-A to succinic acid a molecule of ATP is synthesized.
- C. Oxygen is vital in respiration for removal of hydrogen .
- D. There is complete breakdown of glucose in fermentation .

Answer: C



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24. Mitochondria are called powerhouses of the cell.

Which of the following observations support this statement ?

A. Mitochondria synthesise ATP

B. Mitochondria have a double membrane

C. The enzymes of the Krebs cycle and the cytochromes are found in mitochondria.

D. Mitochondria are found in almost all plants and animal cells.

Answer: A



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25. The end product of oxidative phosphorylation is

A. NADH

B. Oxygen

C. ADP

D. ATP + H_2O

Answer: D



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26. Match the following and choose the correct option from those given below.

Column A

(A) Molecular oxygen

(B) Electron acceptor

(C) Pyruvate dehydrogenase

(D) Decarboxylation

Column B

(i) α - Ketoglutaric acid

(ii) hydrogen acceptor

(iii) cytochrome C

(iv) acetyl Co A

A. (A)-(ii), (B)-(iii), (C)-(iv), (D)-(i)

B. (A)-(iii), (B)-(iv), (C)-(ii), (D)-(i)

C. (A)-(ii), (B)-(i), (C)-(iii), (D)-(iv)

D. (A)-(iv), (B)-(iii), (C)-(i), (D)-(ii)

Answer: A



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27. The energy releasing metabolic process in which substrate is oxidised without an external electron acceptor is called.

- A. photorespiration
- B. glycolysis
- C. Fermentation
- D. aerobic respiration

Answer: C



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28. Pyruvate dehydrogenase complex, needed for the conversion of Pyruvic acid to Acetyl. CO-A is located in

A. grana of chloroplast

B. cytoplasm

C. matrix of mitochondria

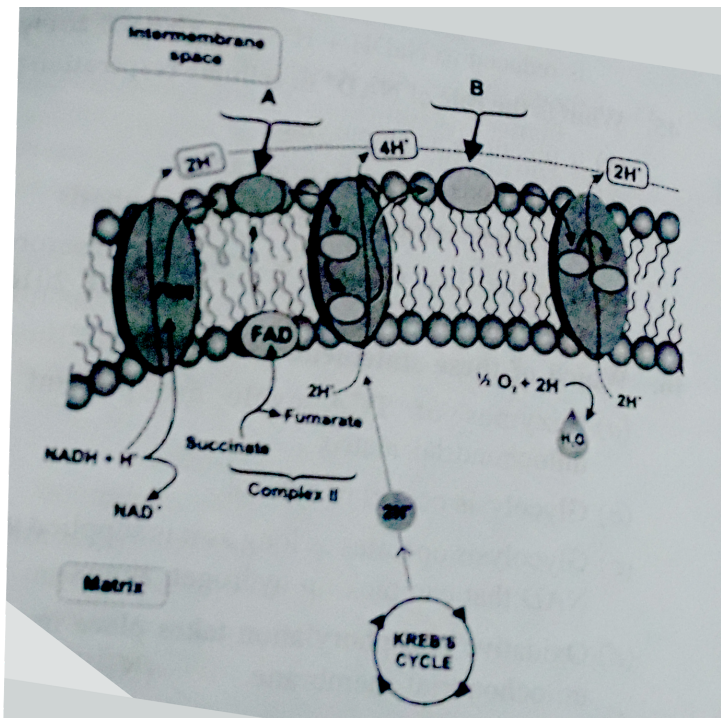
D. intermembranal space of mitochondria

Answer: C



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29. The following is a scheme showing the electron transport system. Identify the electron carrier molecules indicated as A and B. Choose the correct option.



A. A = Fe-S protein , B = FMN

B. A = FMN, B = Fe-S protein

C. A = coenzyme Q, B = cytochrome C

D. A = cytochrome C, B = coenzyme Q

Answer: C



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30. Mitochondria are semiautonomous as they possess

A. DNA

B. DNA + RNA

C. DNA + RNA ribosomes

D. protein

Answer: C



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31. Which one is true for ATP

- A. ATP is prosthetic part of an enzyme
- B. ATP is an enzyme
- C. ATP is organic ion of enzyme
- D. ATP is a co-enzyme.

Answer: D



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32. The size of mitochondria in plant cell is

- A. 0.1 - 1.0 μ m long
- B. 1.0 - 4.0 μ m long
- C. 2.0 - 4.0 μ m long
- D. 3.0 - 4.0 μ m long

Answer: B

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33. In which type of reactions related to plant photosynthesis peroxisomes are involved

- A. Glycolate cycle
- B. Calvin cycle
- C. Bacterial photosynthesis
- D. Glyoxylate cycle

Answer: D



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34. In citric acid cycle decarboxylation occurs when

- A. Citric acid converts to α -ketoglutaric acid
- B. Succinic acid converts to malic acid

C. Malic acid converts to oxaloacetic acid

D. Oxaloacetic acid converts to citric acid

Answer: A



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35. FAD acts as an e-acceptor in between

A. fumaric acid and malic acid

B. succinic and fumaric acid

C. malic acid and oxaloacetic acid

D. citric and isocitric acid

Answer: B



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36. Which is key intermediate compound linking glycolysis to Krebs cycle ?

A. NADH

B. ATP

C. Acetyl CoA

D. malic acid

Answer: C



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37. Which of the metabolites is common to respiration mediated breakdown of fats, carbohydrates and proteins ?

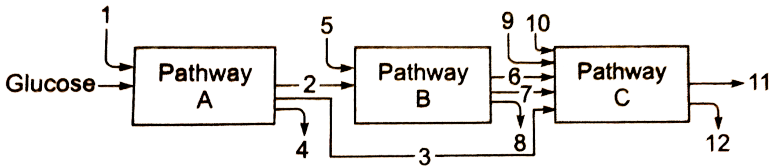
- A. Fructose-1, 6-bisphosphate
- B. Pyruvic acid
- C. Acetyl CoA
- D. Glucose-6-phosphate

Answer: C



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38. The three boxes in this diagram represent the three major biosynthetic pathways in aerobic respiration. Arrows represent net reactants or products.



Arrows numbered 4,8 and 12 can all be

- A. ATP
- B. H_2O
- C. FAD^+ or $FADH_2$
- D. NADH

Answer: A



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39. In which one of the following processes CO_2 is not released

- A. Aerobic respiration in plants.
- B. Aerobic respiration in animals
- C. Alcoholic fermentation
- D. Lactate fermentation

Answer: D



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40. RQ (Respiratory Quotient) is defined as

A. volume of CO_2 evolved = volume of O_2 consumed

B. $\frac{\text{volume of } O_2 \text{ consumed}}{\text{volume of } CO_2 \text{ evolved}}$

C. $\frac{\text{volume of } CO_2 \text{ evolved}}{\text{volume of } O_2 \text{ consumed}}$

D. $\frac{\text{volume of } O_2 \text{ evolved}}{\text{volume of } CO_2 \text{ consumed}}$

Answer: C



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41. Refrigerated fruits maintain their flavour and taste for longer period due to

- A. non-availability of O_2
- B. presence of excess of CO_2
- C. presence of excess humidity
- D. slower rate of respiration

Answer: D



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42. Which of the following biomolecules is common to respiration-mediated breakdown of fats, carbohydrates and proteins ?

- A. Glucose-6-phosphate
- B. Fructose 1, 6-bisphosphate
- C. Pyruvic acid
- D. Acetyl CoA

Answer: C



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43. Oxidative phosphorylation is

A. formation of ATP by transfer of phosphate group

from a substrate to ADP

B. oxidation of phosphate group in ATP

C. addition of phosphate group to ATP

D. formation of ATP by energy released from

electrons removed during substrate oxidation

Answer: D



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44. Which statement is wrong for Krebs' cycle ?

- A. There is one point in the cycle where FAD^+ is reduced to $FADH_2$.
- B. During conversion of succinyl CoA to succinic acid, a molecule of GTP is synthesised.
- C. The cycle starts with condensation of acetyl group (acetyl CoA) with pyruvic acid to yield citric acid
- D. There are three points in the cycle where NAD^+ is reduced to $NADH + H^+$

Answer: C



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45. What is the role of NAD^+ in cellular respiration

- A. It functions as an enzyme
- B. It functions as an electron carrier
- C. It is a nucleotide source for ATP synthesis
- D. It is the final electron acceptor for anaerobic respiration

Answer: B::C



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46. Which of these statements is incorrect.

- A. Enzymes of TCA cycle are present in mitochondrial matrix
- B. glycolysis occurs in cytosol
- C. Glycolysis operates as long as it is supplied with NAD that can pick up hydrogen atoms
- D. Oxidative phosphorylation taken place in outer mitochondrial membrane

Answer: D





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Practice Questions (II. Assertion-Reason Type Questions)

1. Assertion. All the enzymes participating in the Krebs cycle reactions occur in the matrix of mitochondria.

Reason. Krebs cycle generates GTP in animal as well as plant cells.

A. If both A and R are true and R is the correct explanation of A.

B. If both A and R are true but R is not the correct explanation of A.

C. If A is true but R is false.

D. If both A and R are false.

Answer: D



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2. Assertion. Protoplasmic respiration can not be carried on for long.

Reason. It breaks down cell's own material (proteins) and produces toxic ammonia.

A. If both A and R are true and R is the correct explanation of A.

B. If both A and R are true but R is not the correct explanation of A.

C. If A is true but R is false.

D. If both A and R are false.

Answer: A



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3. Assertion. RQ indicates the type of substrate oxidized in cell respiration.

Reason. Floating respiration uses carbohydrates.

A. If both A and R are true and R is the correct explanation of A.

B. If both A and R are true but R is not the correct explanation of A.

C. If A is true but R is false.

D. If both A and R are false.

Answer: B



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4. [A]: Glucose oxidation is a slow process.

[R]: It consists of only two subprocesses.

A. If both A and R are true and R is the correct explanation of A.

B. If both A and R are true but R is not the correct explanation of A.

C. If A is true but R is false.

D. If both A and R are false.

Answer: C



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5. [A] : Fermentation is a wasteful process.

[R]: It yields only 5% of the energy provided by aerobic

respiration.

A. If both A and R are true and R is the correct explanation of A.

B. If both A and R are true but R is not the correct explanation of A.

C. If A is true but R is false.

D. If both A and R are false.

Answer: A



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6. Assertion. Anaerobic respiration causes fatigue in humans.

Reason. With rest, the fatigue disappears disappears.

A. If both A and R are true and R is the correct explanation of A.

B. If both A and R are true but R is not the correct explanation of A.

C. If A is true but R is false.

D. If both A and R are false.

Answer: B



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7. Assertion. Krebs cycle is regarded the amphibolic (central) pathway of the cell.

Reason. Catabolic pathways converge on it and anabolic pathways diverge from it.

A. If both A and R are true and R is the correct explanation of A.

B. If both A and R are true but R is not the correct explanation of A.

C. If A is true but R is false.

D. If both A and R are false.

Answer: A



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8. Assertion. There is no net exchange of gases at compensation point.

Reason. Photosynthesis and respiration stop at compensation point.

A. If both A and R are true and R is the correct explanation of A.

B. If both A and R are true but R is not the correct explanation of A.

C. If A is true but R is false.

D. If both A and R are false.

Answer: C

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9. Assertion. Cyanide promotes oxidative phosphorylation.

Reason. Cyanide is an important component of electron transport system.

A. If both A and R are true and R is the correct explanation of A.

B. If both A and R are true but R is not the correct explanation of A.

C. If A is true but R is false.

D. If both A and R are false.

Answer: D



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10. Assertion. The atmospheric concentration of CO_2 at which photosynthesis just compensates for respiration is referred to as CO_2 compensation point.

Reason. CO_2 -compensation point is reached when the amount of CO_2 uptake is less than that generated through respiration because the level of CO_2 is more than that required for achieving CO_2 -compensation point.

- A. If both A and R are true and R is the correct explanation of A.
- B. If both A and R are true but R is not the correct explanation of A.
- C. If A is true but R is false.
- D. If both A and R are false.

Answer: C



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11. Assertion: Cytochrome oxidase enzyme contains copper.

Cyanide combines with copper of cytochrome oxidase and prevents oxygen combining with it

A. If both A and R are true and R is the correct explanation of A.

B. If both A and R are true but R is not the correct explanation of A.

C. If A is true but R is false.

D. If both A and R are false.

Answer: C



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12. Assertion. Presence of flavin nucleotide is essential for the activity of some enzymes.

Reason. Flavin nucleotide is an activator of these enzymes.

A. If both A and R are true and R is the correct explanation of A.

B. If both A and R are true but R is not the correct explanation of A.

C. If A is true but R is false.

D. If both A and R are false.

Answer: A



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