

A-LEVEL

Multiple-choice questions on respiration

1. Which of the following is the primary source of energy for cellular respiration?

- A) Glucose
- B) Oxygen
- C) Carbon dioxide
- D) Water

Answer: A) Glucose

Explanation: Glucose is the primary substrate for cellular respiration, where it undergoes a series of metabolic reactions to release energy.

2. In cellular respiration, where does glycolysis occur?

- A) Cytoplasm
- B) Mitochondria
- C) Nucleus
- D) Endoplasmic reticulum

Answer: A) Cytoplasm

Explanation: Glycolysis takes place in the cytoplasm of the cell.

3. Which molecule is produced during the Krebs cycle in cellular respiration?

- A) NADH
- B) ATP
- C) FADH₂
- D) All of the above

Answer: D) All of the above

Explanation: NADH, ATP, and FADH₂ are all produced during the Krebs cycle.

4. What is the final electron acceptor in the electron transport chain of cellular respiration?

- A) Oxygen

B) Carbon dioxide

C) NAD⁺

D) FAD

Answer: A) Oxygen

Explanation: Oxygen is the final electron acceptor, forming water when it accepts electrons and protons.

5. During anaerobic respiration, which of the following is produced in animal cells?

A) Lactic acid

B) Ethanol

C) Carbon dioxide

D) Oxygen

Answer: A) Lactic acid

Explanation: In the absence of oxygen, animal cells produce lactic acid through anaerobic respiration.

6. What is the net gain of ATP molecules produced in glycolysis?

A) 2 ATP

B) 4 ATP

C) 6 ATP

D) 8 ATP

Answer: A) 2 ATP

Explanation: Glycolysis produces a net gain of 2 ATP molecules.

7. Which enzyme is responsible for catalyzing the conversion of pyruvate to acetyl CoA in cellular respiration?

A) Pyruvate kinase

B) Pyruvate dehydrogenase

C) Citrate synthase

D) Isocitrate dehydrogenase

Answer: B) Pyruvate dehydrogenase

Explanation: Pyruvate dehydrogenase catalyzes the conversion of pyruvate to acetyl CoA.

8. Where does the electron transport chain occur in eukaryotic cells?

A) Cytoplasm

B) Mitochondrial matrix

C) Inner mitochondrial membrane

D) Outer mitochondrial membrane

Answer: C) Inner mitochondrial membrane

Explanation: The electron transport chain takes place in the inner mitochondrial membrane.

9. Which molecule carries high-energy electrons from glycolysis and the Krebs cycle to the electron transport chain?

- A) NAD^+
- B) FAD
- C) ATP
- D) Coenzyme A

Answer: A) NAD^+

Explanation: NAD^+ carries high-energy electrons to the electron transport chain.

10. In aerobic respiration, how many molecules of ATP are produced per molecule of glucose in total?

- A) 2 ATP
- B) 4 ATP
- C) 36-38 ATP
- D) 72 ATP

Answer: C) 36-38 ATP

Explanation: Aerobic respiration produces a maximum of 36-38 ATP molecules per molecule of glucose.

11. Which process involves the direct transfer of phosphate groups and substrate-level phosphorylation in cellular respiration?

- A) Glycolysis
- B) Electron transport chain
- C) Krebs cycle
- D) Chemiosmosis

Answer: A) Glycolysis

Explanation: Glycolysis involves substrate-level phosphorylation where ATP is formed by the direct transfer of a phosphate group.

12. What is the primary function of the citric acid (Krebs) cycle in cellular respiration?

- A) Production of ATP
- B) Generation of CO₂
- C) Oxidation of acetyl CoA
- D) Formation of NADH and FADH₂

Answer: D) Formation of NADH and FADH₂

Explanation: The Krebs cycle generates NADH and FADH_2 , which carry high-energy electrons to the electron transport chain.

13. Which complex in the electron transport chain pumps protons across the inner mitochondrial membrane?

- A) Complex I
- B) Complex II
- C) Complex III
- D) Complex IV

Answer: A) Complex I

Explanation: Complex I pumps protons from the mitochondrial matrix into the intermembrane space.

14. During anaerobic respiration in yeast, what is the byproduct of fermentation?

- A) Lactic acid
- B) Pyruvate
- C) Ethanol
- D) Acetyl CoA

Answer: C) Ethanol

Explanation: Yeast undergo alcoholic fermentation, producing ethanol as a byproduct.

15. Which of the following is a respiratory substrate commonly used in cellular respiration?

- A) Proteins
- B) Nucleic acids
- C) Lipids
- D) All of the above

Answer: D) All of the above

Explanation: Proteins, nucleic acids, and lipids can serve as respiratory substrates in cellular respiration.

16. What is the purpose of oxygen in cellular respiration?

- A) To produce CO₂
- B) To accept electrons in the electron transport chain
- C) To form ATP
- D) To activate enzymes

Answer: B) To accept electrons in the electron transport chain

Explanation: Oxygen is the final electron acceptor in the electron transport chain, forming water.

17. Which step of cellular respiration produces the majority of ATP?

- A) Glycolysis
- B) Krebs cycle
- C) Electron transport chain
- D) Fermentation

Answer: C) Electron transport chain

Explanation: The majority of ATP is produced during the electron transport chain.

18. In which phase of cellular respiration is carbon dioxide released?

- A) Glycolysis
- B) Krebs cycle
- C) Electron transport chain
- D) Fermentation

Answer: B) Krebs cycle

Explanation: Carbon dioxide is released during the decarboxylation reactions of the Krebs cycle.

19. Which of the following is not a product of the Krebs cycle?

- A) ATP
- B) NADH
- C) FADH₂
- D) Pyruvate

Answer: D) Pyruvate

Explanation: Pyruvate is a substrate for the Krebs cycle, not a product.

20. What is the primary role of Coenzyme Q (ubiquinone) in the electron transport chain?

- A) Accept electrons from NADH
- B) Transport protons across the inner mitochondrial membrane
- C) Deliver electrons to Complex IV
- D) Oxidize FADH₂

Answer: C) Deliver electrons to Complex IV

Explanation: Coenzyme Q transfers electrons between Complexes I and III, ultimately delivering them to Complex IV.

21. During which phase of cellular respiration is water produced as a byproduct?

- A) Glycolysis
- B) Krebs cycle
- C) Electron transport chain
- D) Fermentation

Answer: C) Electron transport chain

Explanation: Water is formed when oxygen accepts electrons and protons in the electron transport chain.

22. Which molecule is regenerated at the end of the Krebs cycle for it to continue?

- A) Pyruvate
- B) Acetyl CoA
- C) Oxaloacetate
- D) Citrate

Answer: C) Oxaloacetate

Explanation: Oxaloacetate is regenerated at the end of the Krebs cycle to combine with acetyl CoA for the next cycle.

23. What is the function of ATP synthase in the electron transport chain?

- A) To transfer electrons
- B) To pump protons
- C) To synthesize ATP
- D) To produce NADH

Answer: C) To synthesize ATP

Explanation: ATP synthase utilizes the proton gradient to synthesize ATP from ADP and inorganic phosphate.

24. Which stage of cellular respiration is common to both aerobic and anaerobic pathways?

- A) Glycolysis
- B) Krebs cycle
- C) Electron transport chain
- D) Fermentation

Answer: A) Glycolysis

Explanation: Glycolysis occurs in both aerobic and anaerobic respiration pathways.

25. What is the fate of the carbon atoms in glucose during cellular respiration?

- A) Converted to water
- B) Released as carbon dioxide
- C) Incorporated into ATP
- D) Converted to lactic acid

Answer: B) Released as carbon dioxide

Explanation: Carbon atoms from glucose are released as carbon dioxide during cellular respiration.

26. Which of the following is a byproduct of the breakdown of fatty acids in beta-oxidation?

- A) NADH
- B) FADH₂
- C) Acetyl CoA
- D) Glycerol

Answer: C) Acetyl CoA

Explanation: Fatty acids are broken down into acetyl CoA through beta-oxidation.

27. What is the primary function of NADH and FADH₂ in cellular respiration?

- A) To transport electrons to the cytoplasm
- B) To store energy in the form of ATP

C) To carry high-energy electrons to the electron transport chain

D) To regulate glycolysis

Answer: C) To carry high-energy electrons to the electron transport chain

Explanation: NADH and FADH₂ carry high-energy electrons to the electron transport chain for ATP synthesis.

28. What is the role of oxygen in the final step of cellular respiration?

A) To release energy

B) To form water

C) To produce ATP

D) To convert glucose

Answer: B) To form water

Explanation: Oxygen acts as the final electron acceptor, combining with electrons and protons to form water.

29. What is the significance of the proton gradient across the inner mitochondrial membrane in cellular respiration?

A) It generates heat

- B) It drives ATP synthesis
- C) It activates enzymes
- D) It produces carbon dioxide

Answer: B) It drives ATP synthesis

Explanation: The proton gradient powers ATP synthesis as protons flow back into the mitochondrial matrix through ATP synthase.

30. Which of the following is NOT a part of the electron transport chain in cellular respiration?

- A) NADH dehydrogenase
- B) Cytochrome c
- C) Succinate dehydrogenase
- D) Pyruvate kinase

Answer: D) Pyruvate kinase

Explanation: Pyruvate kinase is an enzyme involved in glycolysis, not the electron transport chain.

31. What is the purpose of the oxygen consumed during aerobic respiration?

- A) To generate CO₂
- B) To produce water

- C) To form ATP
- D) To oxidize glucose

Answer: B) To produce water

Explanation: Oxygen combines with electrons and protons to form water during aerobic respiration.

32. Which molecule serves as a link between glycolysis and the Krebs cycle by transporting acetyl groups into the mitochondria?

- A) Pyruvate
- B) Coenzyme A
- C) NAD⁺
- D) FADH₂

Answer: B) Coenzyme A

Explanation: Coenzyme A transports acetyl groups from glycolysis to the Krebs cycle by forming acetyl CoA.

33. What is the primary purpose of fermentation in cellular respiration?

- A) To generate ATP
- B) To recycle NADH

- C) To produce oxygen
- D) To form carbon dioxide

Answer: B) To recycle NADH

Explanation: Fermentation regenerates NAD^+ by transferring electrons from NADH to pyruvate.

34. Which of the following statements about the Krebs cycle is correct?

- A) It occurs in the cytoplasm.
- B) It produces CO_2 and ATP.
- C) It directly generates NADH.
- D) It is also known as glycolysis.

Answer: C) It directly generates NADH.

Explanation: The Krebs cycle directly produces NADH and FADH_2 , which carry high-energy electrons to the electron transport chain.

35. What is the term for the metabolic pathway that regenerates NAD^+ from NADH during anaerobic respiration?

- A) Citric acid cycle
- B) Calvin cycle
- C) Cori cycle

D) Urea cycle

Answer: C) Cori cycle

Explanation: The Cori cycle involves the regeneration of NAD^+ from NADH during anaerobic respiration.

36. Which enzyme catalyzes the conversion of citrate to isocitrate in the Krebs cycle?

A) Citrate synthase

B) Aconitase

C) Isocitrate dehydrogenase

D) Succinyl-CoA synthetase

Answer: B) Aconitase

Explanation: Aconitase catalyzes the conversion of citrate to isocitrate in the Krebs cycle.

37. How many ATP molecules are generated from the complete oxidation of one molecule of acetyl CoA in the Krebs cycle?

A) 1

B) 2

C) 3

D) 12

Answer: B) 2

Explanation: One turn of the Krebs cycle produces three NADH, one FADH₂, and one GTP, equivalent to two ATP molecules.

38. Which molecule is regenerated during the conversion of oxaloacetate to citrate in the Krebs cycle?

- A) NAD⁺
- B) FAD⁺
- C) Coenzyme Q
- D) Oxaloacetate

Answer: D) Oxaloacetate

Explanation: Oxaloacetate is regenerated at the end of the Krebs cycle and can combine with a new acetyl CoA to restart the cycle.

39. In cellular respiration, what is the primary function of the electron carriers NADH and FADH₂?

- A) Accept protons
- B) Transfer electrons
- C) Synthesize ATP
- D) Transport oxygen

Answer: B) Transfer electrons

Explanation: NADH and FADH₂ transfer high-energy electrons to the electron transport chain.

40. During anaerobic respiration in bacteria, what is the common byproduct instead of lactic acid or ethanol?

- A) Methane
- B) Ammonia
- C) Hydrogen sulfide
- D) Nitrous oxide

Answer: A) Methane

- Explanation: Some bacteria produce methane as a byproduct during anaerobic respiration.