Q1. Which of the following is the correct sequence of steps in aerobic respiration?

A. Glycolysis → Krebs cycle → Link reaction → ETC
B. Glycolysis → Link reaction → Krebs cycle → ETC
C. Krebs cycle → Glycolysis → ETC → Link reaction
D. ETC → Krebs cycle → Glycolysis → Link reaction

Answer: B
Explanation:
In aerobic respiration:

1. Glycolysis occurs in cytoplasm

2. Link reaction (oxidative decarboxylation) converts pyruvate to Acetyl-CoA

3. Krebs cycle in mitochondrial matrix

4. Electron Transport Chain (ETC) in inner mitochondrial membrane

Q2. Which of the following compounds has the highest RQ (Respiratory Quotient)?

A. Glucose
B. Fats
C. Proteins
D. Organic acids

Answer: D
Explanation:
RQ = CO_2 evolved / O_2 consumed
For organic acids like malic acid, RQ > 1 (sometimes even > 1.0)

Q3. In which part of the mitochondrion does the electron transport chain (ETC) occur?

A. Outer membrane
B. Inner membrane
C. Matrix

D. Cristae

Answer: B
Explanation:
ETC enzymes and carriers are embedded in the inner mitochondrial membrane.

Q4. The end product of glycolysis is:

A. Acetyl-CoA
B. Lactic acid
C. Pyruvic acid
D. Citric acid

Answer: C
Explanation:
Glycolysis breaks glucose into 2 molecules of pyruvate (pyruvic acid).

Q5. Which enzyme catalyzes the first step of glycolysis?

A. Hexokinase
B. Pyruvate kinase
C. Aldolase
D. Enolase

Answer: A
Explanation:
Hexokinase phosphorylates glucose to form glucose-6-phosphate in the first step.

Q6. How many ATP molecules are produced from one molecule of glucose in aerobic respiration (net gain)?

A. 36
B. 38
C. 32
D. 30

Answer: B
Explanation:

Aerobic respiration yields 38 ATP molecules from one glucose molecule (2 from glycolysis, 2 from Krebs, and ~34 from ETC).

Q7. During lactic acid fermentation in muscles:

A. Oxygen is required
B. CO_2 is released
C. Pyruvate is reduced
D. ATP is not formed

Answer: C
Explanation:
Under anaerobic conditions in muscles, pyruvate is reduced to lactic acid, regenerating NAD^+ for glycolysis.

Q8. Which intermediate of Krebs cycle is a five-carbon compound?

A. Succinic acid
B. Alpha-ketoglutaric acid
C. Fumaric acid
D. Citric acid

Answer: B
Explanation:
Alpha-ketoglutaric acid is a 5-carbon compound in the Krebs cycle.

Q9. Which of the following steps is common to both aerobic and anaerobic respiration?

A. Glycolysis
B. Krebs cycle
C. ETC
D. Link reaction

Answer: A
Explanation:
Glycolysis occurs in the cytoplasm and is common to both aerobic and anaerobic pathways.

Q10. Which statement is incorrect regarding oxidative phosphorylation?

A. Occurs in mitochondria
B. Involves ATP synthase
C. Direct transfer of phosphate from a substrate
D. Involves electron transport chain

Answer: C
Explanation:
Direct transfer of phosphate from a substrate is substrate-level phosphorylation, not oxidative phosphorylation.

Q11. The number of ATP molecules formed by oxidative phosphorylation from one molecule of NADH is

A. 2
B. 3
C. 1
D. 4

Answer: B
Explanation:
Each NADH donates electrons to the ETC, resulting in the synthesis of approximately 3 ATP molecules via oxidative phosphorylation.

Q12. In which cellular compartment does glycolysis occur?

A. Mitochondrial matrix
B. Inner mitochondrial membrane
C. Cytoplasm
D. Nucleus

Answer: C
Explanation:
Glycolysis takes place in the cytoplasm, independent of mitochondria or oxygen.

Q13. The final electron acceptor in the electron transport chain is

A. NAD^+
B. Cytochrome
C. O_2

D. FAD

Answer: C
Explanation:
Oxygen (O_2) acts as the final electron acceptor in the ETC, combining with electrons and protons to form water.

Q14. The step of aerobic respiration that directly uses oxygen is

A. Glycolysis
B. Link reaction
C. Krebs cycle
D. Electron transport chain

Answer: D
Explanation:
Only the Electron Transport Chain (ETC) directly involves oxygen as the terminal electron acceptor.

Q15. Which of the following is a three-carbon compound formed in glycolysis?

A. Acetyl-CoA
B. Pyruvic acid
C. Citric acid
D. Oxaloacetic acid

Answer: B
Explanation:
Pyruvic acid is a 3-carbon compound formed at the end of glycolysis.

Q16. During alcoholic fermentation, which gas is released?

A. Oxygen
B. Carbon dioxide
C. Nitrogen
D. Methane

Answer: B
Explanation:
Alcoholic fermentation by yeast releases CO_2 as glucose is converted to ethanol.

Q17. In which stage of respiration is $FADH_2$ produced?

A. Glycolysis
B. Link reaction
C. Krebs cycle
D. ETC

Answer: C
Explanation:
$FADH_2$ is generated during Krebs cycle, particularly in the conversion of succinate to fumarate.

Q18. Which of the following statements is true regarding Respiratory Quotient (RQ)?

A. RQ of fats is more than 1
B. RQ of carbohydrates is less than 1
C. RQ of proteins is equal to 1
D. RQ of organic acids is more than 1

Answer: D
Explanation:
Organic acids have high oxygen content, so their RQ > 1.

Q19. The main function of ATP synthase is to:

A. Break down glucose
B. Carry electrons
C. Synthesize ATP from ADP and Pi
D. Release carbon dioxide

Answer: C
Explanation:
ATP synthase uses proton gradient across inner mitochondrial membrane to synthesize ATP from ADP + Pi.

Q20. Which compound links glycolysis to the Krebs cycle?

A. Oxaloacetate

B. Acetyl-CoA
C. Citrate
D. Glucose-6-phosphate

Answer: B
Explanation:
Pyruvate from glycolysis is converted to Acetyl-CoA, which enters the Krebs cycle.

Q21. The enzyme involved in conversion of glucose to glucose-6-phosphate is

A. Hexokinase
B. Phosphofructokinase
C. Aldolase
D. Pyruvate dehydrogenase

Answer: A
Explanation:
Hexokinase catalyzes the first step of glycolysis by phosphorylating glucose to form glucose-6-phosphate using ATP.

Q22. In aerobic respiration, oxidative decarboxylation of pyruvate takes place in

A. Cytoplasm
B. Mitochondrial matrix
C. Inner mitochondrial membrane
D. Outer mitochondrial membrane

Answer: B
Explanation:
Pyruvate enters the mitochondrial matrix, where it undergoes oxidative decarboxylation to form Acetyl-CoA.

Q23. The number of NADH molecules produced in one turn of the Krebs cycle is

A. 1
B. 2
C. 3
D. 4

Answer: C
Explanation:
One turn of the Krebs cycle produces 3 NADH, 1 $FADH_2$, and 1 GTP/ATP.

Q24. Which of the following statements about anaerobic respiration is correct?

A. Oxygen is essential
B. It yields more ATP than aerobic respiration
C. It leads to complete oxidation of glucose
D. It involves partial breakdown of glucose

Answer: D
Explanation:
In anaerobic respiration, glucose is partially broken down into compounds like lactic acid or ethanol, and less ATP is formed.

Q25. The first stable compound formed in the Krebs cycle is

A. Acetyl-CoA
B. Oxaloacetate
C. Citric acid
D. Succinic acid

Answer: C
Explanation:
Citric acid is formed when Acetyl-CoA combines with oxaloacetic acid — it is the first stable product of the Krebs cycle.

Q26. How many ATP molecules are generated from one $FADH_2$ during oxidative phosphorylation?

A. 1
B. 2
C. 3
D. 4

Answer: B
Explanation:
One $FADH_2$ entering the ETC results in the synthesis of approximately 2 ATP molecules.

Q27. The process by which ATP is formed in mitochondria using energy from proton gradient is called

A. Substrate-level phosphorylation
B. Photophosphorylation
C. Oxidative phosphorylation
D. Hydrolysis

Answer: C
Explanation:
Oxidative phosphorylation uses energy from the proton motive force across the inner mitochondrial membrane to synthesize ATP via ATP synthase.

Q28. During glycolysis, which step results in substrate-level phosphorylation?

A. Conversion of glucose to glucose-6-phosphate
B. Conversion of 1,3-bisphosphoglycerate to 3-phosphoglycerate
C. Conversion of pyruvate to Acetyl-CoA
D. Conversion of fructose-6-phosphate to fructose-1,6-bisphosphate

Answer: B
Explanation:
Conversion of 1,3-bisphosphoglycerate to 3-phosphoglycerate produces ATP directly, which is an example of substrate-level phosphorylation.

Q29. In alcoholic fermentation, pyruvate is first converted into

A. Acetaldehyde
B. Acetyl-CoA
C. Lactic acid
D. Ethanol

Answer: A
Explanation:
In alcoholic fermentation, pyruvate is first converted to acetaldehyde, which is then reduced to ethanol.

Q30. Which of the following coenzymes is required for oxidative decarboxylation of pyruvate?

A. NAD^+
B. Coenzyme A
C. TPP
D. All of these

Answer: D
Explanation:
NAD^+, Coenzyme A, and Thiamine pyrophosphate (TPP) are all involved in the oxidative decarboxylation of pyruvate to Acetyl-CoA.

Q31. The net gain of ATP molecules in glycolysis per molecule of glucose is

A. 2
B. 4
C. 6
D. 8

Answer: A
Explanation:
Though glycolysis produces 4 ATP, it uses 2 ATP in initial steps, giving a net gain of 2 ATP per glucose.

Q32. Respiratory quotient (RQ) for carbohydrate is

A. 0.7
B. 1
C. 0.9
D. Less than 1

Answer: B
Explanation:
For carbohydrates, the volume of CO_2 evolved equals O_2 consumed, so RQ = 1.

Q33. Which intermediate of the Krebs cycle is used for amino acid synthesis?

A. Fumarate
B. Succinic acid
C. Alpha-ketoglutarate

D. Oxaloacetate

Answer: C
Explanation:
α-ketoglutarate is used in glutamate synthesis, an amino acid.

Q34. Pasteur effect is related to

A. High rate of glycolysis under aerobic condition
B. Low oxygen availability leading to more fermentation
C. Inhibition of fermentation by oxygen
D. Enhancement of photosynthesis in presence of oxygen

Answer: C
Explanation:
The Pasteur effect is the inhibition of anaerobic fermentation by oxygen.

Q35. The link between glycolysis and Krebs cycle is

A. Oxaloacetic acid
B. Lactic acid
C. Pyruvate
D. Acetyl-CoA

Answer: D
Explanation:
Acetyl-CoA is formed from pyruvate and enters the Krebs cycle — it's the link between the two processes.

Q36. Which of the following yields maximum energy upon complete oxidation?

A. 1g glucose
B. 1g fat
C. 1g protein
D. 1g sucrose

Answer: B
Explanation:
Fats yield more ATP per gram (~9 kcal/g) compared to carbohydrates (~4 kcal/g).

Q37. The end product of glycolysis is

A. Acetyl-CoA
B. Ethanol
C. Pyruvate
D. Lactate

Answer: C
Explanation:
Under aerobic conditions, glycolysis ends with the formation of 2 pyruvate molecules from one glucose.

Q38. Which enzyme catalyzes the conversion of fructose-1,6-bisphosphate to two 3-carbon compounds?

A. Aldolase
B. Enolase
C. Isomerase
D. Hexokinase

Answer: A
Explanation:
Aldolase splits fructose-1,6-bisphosphate into glyceraldehyde-3-phosphate and dihydroxyacetone phosphate.

Q39. The site of Krebs cycle in eukaryotic cell is

A. Cytoplasm
B. Nucleus
C. Mitochondrial matrix
D. Inner mitochondrial membrane

Answer: C
Explanation:
The Krebs cycle takes place in the mitochondrial matrix of eukaryotic cells.

Q40. In oxidative phosphorylation, ATP is synthesized due to

A. Movement of protons through ATP synthase

B. Direct transfer of phosphate
C. Hydrolysis of ADP
D. Movement of oxygen

Answer: A
Explanation:
Proton gradient across the inner mitochondrial membrane drives ATP synthesis via ATP synthase.

Q41. In alcoholic fermentation, which of the following is released?

A. O_2
B. H_2
C. CO_2
D. H_2O

Answer: C
Explanation:
CO_2 is released during conversion of pyruvate to acetaldehyde in alcoholic fermentation.

Q42. Which of the following is not a product of Krebs cycle?

A. CO_2
B. NADH
C. ATP
D. Glucose

Answer: D
Explanation:
Glucose is broken down before the Krebs cycle begins. It is not a product of the cycle.

Q43. Anaerobic respiration in yeast leads to the formation of

A. Lactic acid
B. Acetic acid
C. Ethanol
D. Pyruvic acid

Answer: C

Explanation:
In yeast, anaerobic respiration results in ethanol and CO_2 formation.

Q44. Total number of ATP molecules produced from one molecule of glucose in aerobic respiration is approximately

A. 36
B. 38
C. 40
D. 34

Answer: B
Explanation:
Aerobic respiration of 1 glucose molecule yields approximately 38 ATP (including NADH and $FADH_2$).

Q45. Final hydrogen acceptor in aerobic respiration is

A. NAD^+
B. FAD
C. Oxygen
D. Water

Answer: C
Explanation:
In aerobic respiration, oxygen acts as the final electron (hydrogen) acceptor, forming water.