UNIT 2

1. Glycolysis occurs in the:

a) Nucleus

b) Cytoplasm

c) Mitochondria

d) Endoplasmic reticulum

2. The net gain of ATP molecules from one glucose molecule during glycolysis is:

a) 0

b) 2

c) 4

d) 6

3. What is the primary function of glycolysis?

a) Breakdown of glucose into pyruvate

b) Synthesis of fatty acids

c) Production of large amounts of ATP

d) All of the above (depending on oxygen availability)

4. Which molecule acts as the final electron acceptor in anaerobic glycolysis?

a) Oxygen (O2)

b) Pyruvate

c) NAD+

d) Carbon dioxide (CO2)

5. Which statement about glycolysis is FALSE?

a) It is the first step of cellular respiration.

b) It can occur with or without oxygen.

c) It produces a small amount of ATP directly.

d) It prepares pyruvate for further breakdown in the citric acid cycle (aerobic respiration).

6. The citric acid cycle takes place in the:

a) Cytoplasm

b) Nucleus

c) Mitochondria

d) Golgi apparatus

7. The citric acid cycle produces more ATP than glycolysis. True or False?

* True

* False

8. What is the primary function of the citric acid cycle?

a) Complete breakdown of glucose to CO_2 and H_2O

b) Generation of a significant amount of ATP through oxidative phosphorylation

c) Production of pyruvate from glucose

d) Synthesis of new carbohydrates

9. What are the main products of the citric acid cycle?

a) ATP, NADH, $FADH_2$, CO_2, and H_2O

b) Pyruvate, NAD+, FAD, and lactate

c) Glucose-6-phosphate, ATP, and water

d) Amino acids, glycerol, and fatty acids

10. Electrons from NADH and FADH2 are transferred to the electron transport chain in the mitochondria for further ATP production. True or False?

* True

* False

11. The pentose phosphate pathway (HMP shunt) is an alternative pathway to glycolysis located in the:

a) Nucleus

b) Cytoplasm

c) Mitochondria

d) Endoplasmic reticulum

12. The primary function of the HMP shunt is to produce:

a) Large amounts of ATP

b) Ribose-5-phosphate for nucleotide synthesis

c) Pyruvate for the citric acid cycle

d) Glucose for cellular needs

13. NADPH, a reducing agent important for biosynthesis, is generated in the:

a) Glycolytic pathway

b) Citric acid cycle

c) HMP shunt

d) All of the above

14. Deficiency in the enzyme glucose-6-phosphate dehydrogenase (G6PD) can lead to:

a) Increased ATP production

b) Hemolytic anemia due to damage to red blood cells

c) Enhanced protein synthesis

d) None of the above

15. Individuals with G6PD deficiency may experience problems with certain medications because G6PD helps protect red blood cells from oxidative stress. True or False?

* True

* False

16. Which organ is primarily responsible for glycogen storage?

a) Muscles only

b) Liver only

c) Both muscles and liver

d) Neither muscles nor liver

17. Glycogen storage diseases (GSDs) are caused by deficiencies in enzymes involved in:

a) Protein synthesis

b) DNA replication

c) Glycogen breakdown or synthesis

d) Lipid metabolism

18. Gluconeogenesis is the process of synthesizing glucose from:

a) Glycogen

b) Fatty acids

c) Amino acids

d) All of the above (depending on the metabolic state)

19. What is the primary significance of gluconeogenesis?

a) Breakdown of glucose for energy

b) Synthesis of glycogen for storage

c) Maintaining blood glucose levels during fasting

d) Production of energy for muscle contraction

20. Insulin is a hormone secreted by the pancreas that promotes:

a) Breakdown of glycogen and release of glucose into the blood

b) Uptake of glucose by cells and storage as glycogen

c) Glucagon secretion and gluconeogenesis

d) Release of fatty acids from adipose tissue

21. Glucagon is a hormone secreted by the pancreas that has the opposite effect of insulin and stimulates:

a) Glycogen synthesis and glucose storage

b) Breakdown of glycogen and release of glucose into the blood

c) Uptake of glucose by cells

d) Conversion of amino acids into glucose

22. Diabetes mellitus is a chronic condition characterized by:

a) High blood sugar levels due to insulin deficiency or resistance

b) Low blood sugar levels

c) Excessive breakdown of glycogen

d) Inability to absorb carbohydrates from the gut

23. There are two main types of diabetes mellitus. Type 1 diabetes is caused by:

a) Normal insulin production but impaired insulin action in cells

b) Insufficient insulin production due to destruction of pancreatic beta cells

c) Excessive glucagon secretion

d) Genetic predisposition and environmental factors (Type 2)

24. Which of the following is NOT a potential complication of chronic hyperglycemia (high blood sugar) in diabetes?

a) Nerve damage (neuropathy)

b) Kidney damage (nephropathy)

c) Eye damage (retinopathy)

d) Improved wound healing

25. Management of diabetes mellitus may include lifestyle changes, medications, and in some cases, insulin therapy to:

a) Increase blood sugar levels

b) Reduce blood sugar levels and maintain good glycemic control

c) Stimulate glucagon secretion

d) Promote glycogen breakdown

26. The electron transport chain (ETC) is located in the:

a) Cytoplasm

b) Nucleus

c) Inner mitochondrial membrane

d) Endoplasmic reticulum

27. Electrons from NADH and FADH2 are passed through a series of protein complexes in the ETC, ultimately leading to the:

a) Production of ATP directly

b) Reduction of oxygen to water

c) Breakdown of glucose

d) Synthesis of new carbohydrates

28. Each transfer of electrons in the ETC releases energy used to pump protons across the inner mitochondrial membrane, creating a:

a) Concentration gradient of glucose

b) Proton gradient (electrochemical gradient)

c) Gradient of oxygen molecules

d) Gradient of carbon dioxide

29. The chemiosmotic theory explains how the proton gradient established by the ETC drives the synthesis of ATP by:

a) Directly transferring electrons to ATP synthase

b) Using the proton gradient to power ATP synthase

c) Increasing the concentration of ATP in the mitochondria

d) Stimulating the breakdown of glucose

30. Inhibitors that target specific protein complexes in the ETC can disrupt the flow of electrons and prevent ATP production. True or False?

* True

* False

31. Oxidative phosphorylation refers to the coupled processes of the electron transport chain and:

a) Glycolysis

b) Citric acid cycle

c) Substrate-level phosphorylation

d) Gluconeogenesis

32. The enzyme ATP synthase in the inner mitochondrial membrane utilizes the proton gradient to:

a) Generate a voltage gradient

b) Directly phosphorylate glucose

c) Transport electrons across the membrane

d) Phosphorylate ADP to form ATP

33. Chemiosmosis is the mechanism by which the energy stored in the proton gradient is used for ATP synthesis in oxidative phosphorylation. True or False?

* True

* False

34. Compared to substrate-level phosphorylation (in glycolysis and the citric acid cycle), oxidative phosphorylation generates a significantly:

a) Lower amount of ATP

b) Higher amount of ATP

c) Identical amount of ATP

d) Variable amount of ATP depending on the cell type

35. Uncouplers are molecules that disrupt the proton gradient in the mitochondria, leading to:

a) Increased ATP production

b) Decreased ATP production and heat generation

c) Enhanced electron transport

d) Inhibition of oxidative phosphorylation

36. Substrate-level phosphorylation refers to the direct transfer of a phosphate group from a high-energy molecule to ADP, resulting in ATP production. This occurs in:

a) The electron transport chain only

b) Glycolysis and the citric acid cycle

c) Oxidative phosphorylation only

d) All of the above (depending on the metabolic pathway)

37. Rotenone is an inhibitor that specifically blocks electron transfer at Complex I of the ETC. True or False?

* True

* False

38. Antimycin A inhibits electron transfer at Complex III of the ETC, preventing further ATP production. True or False?

* True
* False

39. Cyanide is a potent inhibitor of cellular respiration that disrupts electron transfer at Complex IV (cytochrome c oxidase). True or False?

* True
* False

40. 2,4-Dinitrophenol (DNP) is an example of an uncoupler that disrupts the proton gradient, leading to decreased ATP production and increased heat generation. True or False?

* True
* False