

LEC 2 Q – META:

1. Under which condition does a reaction have no favored direction?

- A) When $K_{eq} < 1$
- B) When $K_{eq} = 1$
- C) When $K_{eq} > 1$
- D) When $\Delta G^\circ > 0$

Answer: B

2. In which stage of energy production does Acetyl-CoA primarily participate?

- A) Glycolysis
- B) Citric Acid Cycle
- C) Electron Transport Chain
- D) Digestion

Answer: B

3. What is the primary function of mitochondria in cells?

- A) Protein synthesis
- B) Lipid storage
- C) ATP production
- D) Genetic material replication

Answer: C

4. Which of the following statements about ATP is correct?

- A) ATP is solely used for protein synthesis.
- B) ATP has a low energy value and cannot couple with reactions.
- C) ATP can be hydrolyzed to drive energetically unfavorable reactions.
- D) ATP is exclusively present in muscle cells.

Answer: C

5. What is a characteristic feature of allosteric enzymes?

- A) They can only activate metabolic pathways.
- B) They are primarily involved in irreversible reactions.
- C) They are regulated by multiple metabolites.
- D) They have a fixed catalytic activity regardless of conditions.

Answer: C

6. Which metabolic pathway type is described as having the same initial and final product?

- A) Linear
- B) Cyclic
- C) Spiral
- D) Catabolic

Answer: B

7. **How do cells manage to perform endergonic reactions?**
A) By using only high-energy substrates.
B) By coupling them with exergonic reactions like ATP hydrolysis.
C) By increasing the temperature of the reaction.
D) By altering the pH of the reaction environment.
Answer: B
8. **What role does Acetyl-CoA play in cellular metabolism?**
A) It serves as a high-energy phosphate donor.
B) It acts as a universal acyl group carrier for various pathways.
C) It functions solely in the electron transport chain.
D) It is exclusively involved in lipid synthesis.
Answer: B
9. **Which of the following is NOT a characteristic of the Krebs Cycle?**
A) It generates both ATP and electron carriers (NADH, FADH₂).
B) It occurs in the cytoplasm of prokaryotic cells.
C) It involves a cyclic pathway with a fixed starting and ending compound.
D) It requires Acetyl-CoA to initiate the cycle.
Answer: B
10. **What is the primary determinant of the spontaneity of a biochemical reaction at equilibrium?**
A) The concentration of substrates
B) The activation energy
C) The Gibbs Free Energy change (ΔG)
D) The presence of enzymes
Answer: C
11. **Which statement correctly describes the relationship between ΔG° and K_{eq} ?**
A) $\Delta G^\circ = 0$ when $K_{eq} > 1$
B) A positive ΔG° indicates a reaction that favors products at equilibrium.
C) $\Delta G^\circ = -RT \ln K_{eq}$
D) K_{eq} does not influence ΔG° .
Answer: C
12. **In the context of energy metabolism, what is the main role of Acetyl-CoA?**
A) It serves as a primary energy currency.
B) It enters the citric acid cycle for energy production.
C) It directly generates ATP.
D) It is the end product of glycolysis.
Answer: B
13. **Which organelle is primarily responsible for ATP production?**
A) Ribosome
B) Nucleus
C) Mitochondrion
D) Endoplasmic reticulum
Answer: C

14. **What mechanism allows endergonic reactions to proceed in the cell?**
- A) Increasing substrate concentration
 - B) Coupling with exergonic reactions
 - C) Reducing activation energy
 - D) Lowering the temperature
- Answer: B**
15. **Which of the following enzymes is most likely to be allosterically regulated?**
- A) Hexokinase
 - B) Phosphofructokinase
 - C) Pyruvate kinase
 - D) Lactate dehydrogenase
- Answer: B**
16. **The Krebs Cycle is important because it:**
- A) Directly synthesizes glucose from pyruvate.
 - B) Generates GTP as the primary energy currency.
 - C) Produces NADH and FADH₂ for the electron transport chain.
 - D) Is the only pathway for lipid metabolism.
- Answer: C**
17. **How is the majority of ATP generated during cellular respiration?**
- A) Substrate-level phosphorylation
 - B) Oxidative phosphorylation
 - C) Fermentation
 - D) Photophosphorylation
- Answer: B**
18. **Which type of metabolic pathway is characterized by breaking down complex molecules into simpler ones?**
- A) Anabolic
 - B) Catabolic
 - C) Amphibolic
 - D) Biosynthetic
- Answer: B**
19. **In what way does mitochondrial DNA differ from nuclear DNA?**
- A) It is inherited from both parents.
 - B) It is circular and has fewer genes.
 - C) It encodes for all mitochondrial proteins.
 - D) It is located in the nucleus.
- Answer: B**
20. **Which of the following statements best describes the role of ATP in cellular metabolism?**
- A) ATP serves as a long-term energy storage molecule.
 - B) ATP provides energy primarily through substrate-level phosphorylation.
 - C) ATP can couple exergonic and endergonic reactions.

D) ATP is synthesized only during glycolysis.

Answer: C

21. **What is the effect of increasing the concentration of substrates on the Gibbs Free Energy (ΔG) of a reaction?**

A) It always makes the reaction spontaneous.

B) It can make ΔG more negative, favoring product formation.

C) It has no effect on ΔG .

D) It makes ΔG more positive.

Answer: B

22. **Which process directly generates the most ATP during cellular respiration?**

A) Glycolysis

B) Krebs Cycle

C) Electron Transport Chain

D) Fermentation

Answer: C

23. **What is the primary function of coenzyme A in metabolism?**

A) It acts as an electron carrier.

B) It facilitates the transfer of acyl groups.

C) It serves as a substrate for glycolysis.

D) It is involved in protein synthesis.

Answer: B

24. **Which of the following correctly describes an allosteric enzyme?**

A) It binds substrates in a competitive manner.

B) It is subject to regulation by effectors at sites other than the active site.

C) It functions only at a fixed rate.

D) It is irreversible under physiological conditions.

Answer: B

25. **In the citric acid cycle, which molecule is regenerated to allow the cycle to continue?**

A) Acetyl-CoA

B) Oxaloacetate

C) Citrate

D) Alpha-ketoglutarate

Answer: B

26. **Which metabolic pathway is primarily responsible for the conversion of glucose into pyruvate?**

A) Gluconeogenesis

B) Krebs Cycle

C) Glycolysis

D) Beta-oxidation

Answer: C

27. **What is the main role of NADH and FADH₂ in cellular respiration?**

A) They are energy carriers that donate electrons to the electron transport

chain.

- B) They are substrates for the citric acid cycle.
- C) They directly produce ATP during glycolysis.
- D) They are used to synthesize glucose.

Answer: A

28. **Which of the following conditions would favor the forward direction of a reaction at equilibrium?**

- A) High product concentration
- B) Low reactant concentration
- C) High reactant concentration
- D) High temperature

Answer: C

29. **What distinguishes catabolic pathways from anabolic pathways?**

- A) Catabolic pathways require energy, while anabolic pathways release energy.
- B) Catabolic pathways involve the synthesis of macromolecules, while anabolic pathways involve their breakdown.
- C) Catabolic pathways generate ATP, while anabolic pathways consume ATP.
- D) Catabolic pathways are irreversible, while anabolic pathways are reversible.

Answer: C

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