LEC 1 Metabolism Q:

1. **What is the primary purpose of metabolism in living organisms?**

   A) Breakdown of waste products

   B) Energy generation

   C) Photosynthesis

   D) Digestion of food
   Answer: B

2. **Which type of energy is associated with motion?**

   A) Potential Energy

   B) Thermal Energy

   C) Kinetic Energy

   D) Chemical Energy
   Answer: C

3. **In a reversible reaction, what is required for both directions of the reaction?**

   A) Different enzymes

   B) Same enzyme

   C) Higher temperatures

   D) Lower concentrations
   Answer: B

4. **What does a negative ΔG indicate about a reaction?**

   A) The reaction is not spontaneous

   B) The reaction is at equilibrium

   C) The reaction is spontaneous

   D) The reaction requires additional energy
   Answer: C

5. **What is the equation for calculating free energy change (ΔG)?**

   A) $\Delta G = \Delta G^\circ + RT \ln([\text{Reactants}]/[\text{Products}])$

B) $\Delta G = \Delta G^\circ + RT \ln([Products]/[Reactants])$

C) $\Delta G = \Delta G^\circ - RT \ln([Products]/[Reactants])$

D) $\Delta G = \Delta G^\circ - RT \ln([Reactants]/[Products])$
Answer: B

6. **What does ΔG° represent?**

A) Free energy change under physiological conditions

B) Free energy change under standard conditions

C) Activation energy of a reaction

D) The energy of the transition state
Answer: B

7. **Which of the following is true about the relationship between ΔG and the reaction mechanism?**

A) ΔG is affected by the mechanism of the reaction

B) ΔG depends only on the initial and final states

C) ΔG cannot be calculated without knowing the mechanism

D) ΔG is constant regardless of concentration
Answer: B

8. **What happens at equilibrium in a chemical reaction?**

A) Concentrations of reactants and products are equal

B) The rate of the forward reaction equals the rate of the reverse reaction

C) The reaction stops completely

D) ΔG becomes positive
Answer: B

9. **Which of the following statements best describes the concept of activation energy?**

A) It is the energy required to initiate a reaction.

B) It determines the overall ΔG of a reaction.

C) It is constant for all reactions.

D) It is the energy released during a spontaneous reaction.
Answer: A

10.**Which of the following factors can shift the equilibrium of a reversible reaction?**

A) Temperature changes

B) Changes in concentration of reactants or products

C) Addition of a catalyst

D) Both A and B
Answer: D

11. **If the standard free energy change (ΔG°) of a reaction is +5 kcal/mol, which of the following is true under standard conditions?**

A) The reaction will proceed spontaneously in the forward direction.

B) The reaction is at equilibrium.

C) The reaction is not spontaneous and will favor reactants.

D) The products will be formed in greater concentrations.
Answer: C

12. **In biochemical pathways, which of the following conditions can lead to a change in ΔG during a reaction?**

A) Change in temperature

B) Alteration of concentrations of substrates or products

C) Both A and B

D) None of the above
Answer: C

13. **How does an enzyme affect the Gibbs free energy (ΔG) of a reaction?**

A) It lowers the ΔG of the products.

B) It increases the ΔG of the reactants.

C) It lowers the activation energy but does not affect ΔG.

D) It raises the ΔG of the transition state.
Answer: C

14. **At equilibrium, which of the following is true regarding the Gibbs free energy (ΔG)?**

A) ΔG = 0, and the reaction ceases to occur.

B) ΔG is negative, indicating the reaction is favorable.

C) ΔG is positive, indicating the reaction will proceed.

D) ΔG can be calculated using the equilibrium constant (K_eq).
Answer: A

15. **What effect does increasing the concentration of products have on the Gibbs free energy change (ΔG) of a reversible reaction?**

A) It decreases ΔG, favoring the reverse reaction.

B) It increases ΔG, favoring the forward reaction.

C) It has no effect on ΔG.

D) It shifts the equilibrium to favor reactants.
Answer: A

16. **Which of the following correctly describes the relationship between enthalpy (ΔH) and free energy (ΔG) in a biochemical reaction?**

A) $\Delta G = \Delta H + T\Delta S$

B) $\Delta G = \Delta H - T\Delta S$

C) $\Delta G = \Delta H + \Delta S$

D) $\Delta G = \Delta H - \Delta S$
Answer: B

17. **In the context of metabolic pathways, what role does feedback inhibition play?**

A) It enhances the activity of enzymes in a pathway.

B) It prevents the accumulation of intermediate products.

C) It increases the rate of product formation.

D) It stabilizes the equilibrium state of the reaction.
Answer: B

18. **What is the significance of the standard free energy change (ΔG°) being positive for a reaction?**

A) The reaction is spontaneous under standard conditions.

B) The reaction will favor the formation of products.

C) The reaction requires energy input to proceed.

D) The reaction is at equilibrium.
Answer: C

19. **If the concentration of reactants is decreased while keeping the concentration of products constant, what effect does this have on ΔG?**

A) ΔG becomes more negative, favoring the forward reaction.

B) ΔG becomes less negative, favoring the reverse reaction.

C) ΔG remains constant.

D) ΔG becomes zero.
Answer: B

20. **Which statement best describes the role of ATP in metabolic processes?**

A) ATP is a product of all metabolic reactions.

B) ATP provides a source of potential energy for cellular work.

C) ATP is a waste product of energy metabolism.

D) ATP inhibits metabolic pathways.
Answer: B

21. **What is the primary reason why enzymes are necessary for biochemical reactions in cells?**

A) They change the equilibrium constant of the reaction.

B) They increase the temperature of the reaction.

C) They lower the activation energy required for the reaction.

D) They change the free energy of the products.
Answer: C

22. **Which of the following best explains why metabolic pathways are often compartmentalized within cells?**

A) It allows for faster reactions.

B) It prevents substrate competition.

C) It allows for regulation and localization of metabolic processes.

D) It reduces the need for enzymes.
Answer: C

23. **If the equilibrium constant (K_eq) for a reaction is 10, what can be inferred about the standard free energy change (ΔG°) for that reaction?**

A) ΔG° is positive and indicates the reaction is not favorable.

B) ΔG° is negative and indicates the reaction is favorable.

C) ΔG° is zero and indicates the reaction is at equilibrium.

D) ΔG° cannot be determined without more information.
Answer: B

Done By: Khaled Ghanayem