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Mock Test - 3 280

**1. BIOCHEMISTRY-
NUMBER OF QUESTION ASKED IN NE-SLET (2018-2025)**

Topics		2025	2024	2023	2022	2021	2019	2018
1	Structure of atoms, molecules and chemical bonds	1	-	1	1	-		
2	Biomolecules	3	1	1	-	-	1	1
3	Stabilization Interaction	-	-	-	1	-	-	-
4	Biophysical Chemistry	-	-	-	-	-	2	2
5	Bienergetics	3	2	-	-	8	-	4
6	Principles of Catalysis	3	3	1	3	2		2
7	Conformation of proteins	-	-	-	-	1	-	-
8	Conformation of nucleic acids	-	-	-	-	-	-	-
9	Stability of Protein and Nucleic acids	-	-	1	-	-	-	-
10	Metabolism of carbohydrates, lipids, amino acids nucleotides and vitamins	2	5	4	2	-	5	3

Unit-1.1: Structure of Atoms, Molecules & Chemical Bonds

Previous Year Questions

(NE- SLET 2022)

1. Two statements are given below, one is Assertion (Ass) and the other is Reason (R). Select the correct statement from the codes given below:

Assertion (Ass): Certain radio- active elements present in food or drink, tend to replace other substances isoelectronic' to them.

Reason (R): Such radioactive elements replace other elements that are present in the same family in the periodic table.

- (A) Both (Ass) and (R) are true and (R) is the correct explanation of (Ass)
(B) Both (Ass) and (R) are true, but (R) is not the correct explanation of (Ass)
(C) (Ass) is true, but (R) is false
(D) Both (Ass) and (R) are false

(NE-SLET 2023)

2. Two statements are given below, one is Assertion (Ass) and the other is Reason (R). Select the correct answer from the codes given below:

Assertion (Ass): The association constant in water for G-C base pair is three times lower than that for the A-T base pair.

Reason (R): There are three hydrogen bonds in G-C base pair and two in A-T base pair.

- (A) Both (Ass) and (R) are true and (R) is the correct explanation of (Ass)
(B) Both (Ass) and (R) are true but (R) is not the correct explanation of (Ass)
(C) (Ass) is false but (R) is true
(D) Both (Ass) and (R) are false

(NE-SLET 2025)

3. Match the items of Column-I with those of Column-II and select the correct match from the codes given below:

Column-I	Column-II
(a) Amphipathic compounds	1. Attraction between non-polar regions
(b) Hydrophobic interactions	2. Equilibrium constant
(c) Van-der Waal's forces	3. Weak interatomic interactions

(d) Position of equilibrium of a chemical reaction	4. Polar and non-polar regions
--	--------------------------------

Codes:

(a)	(b)	(c)	(d)
(A) 3	2	4	1
(B) 4	1	3	2
(C) 1	4	2	3
(D) 4	1	2	3

Answer Key

1	2	3
(A)	(C)	(D)

EXPLANATIONS

Previous Year Questions

1. **Correct Answer is (A):-** Radioactive elements can replace similar elements in biological systems because they share key properties, like electronic configurations and chemical behavior, based on their position in the periodic table. This similarity enables them to mimic and substitute for essential elements, affecting biological functions.

2. **Correct Answer is (C):-** The assertion that the association constant for the G-C base pair in water is three times lower than that for the A-T base pair is incorrect. In reality, G-C base pairs, which form three hydrogen bonds, are more stable than A-T base pairs, which form two hydrogen bonds. This increased stability would imply a higher, not lower, association constant for G-C base pairs compared to A-T base pairs. The reason provided, stating that there are three hydrogen bonds in a G-C base pair and two in an A-T base pair, is accurate. This difference in the number of hydrogen bonds directly contributes to the comparative stability of these base pairs, with G-C being more stable than A-T.

3. **Correct Answer is (D):**

- (a) **Amphipathic compounds:** These compounds have both polar (hydrophilic) and non-polar

(hydrophobic) regions, which is why they are described as having **polar and non-polar regions** (4).

(b) **Hydrophobic interactions:** This refers to the **attraction between non-polar regions**, where non-polar molecules tend to group together in water to minimize their exposure to the polar solvent (1).

(c) **Van-der Waals forces:** These are **weak interatomic interactions** that arise due to temporary dipoles between atoms or molecules, contributing to molecular attraction at short distances (2).

(d) **Position of equilibrium of a chemical reaction:** This is related to the **equilibrium constant**, which is a measure of the position of equilibrium in a reversible chemical reaction (3).

Unit-1.4:- Principles of Biophysical Chemistry

Previous Year Questions

(NE-SLET-2018-II)

1. Select the correct match from the following by using the codes:

a. Tris-HCl (PH 7.0)	1. ΔH
b. Free energy change	2. pK_a
c. Enthalpy change	3. ΔG
d. Negative logarithm of an equilibrium constant	4. Buffer

Codes:

	a	b	c	d
(A)	1	2	4	3
(B)	4	3	1	2
(C)	2	4	3	1
(D)	3	1	2	4

(NE- SLET-2018 – III)

2. Examine the following statements and select the correct answer from the codes given below:

- (a) A proton donor and its corresponding proton acceptor make up a conjugate acid-base pair.
 (b) Phenylalanine has hydrophilic R group.
 (c) Ampholytes are substances that can act as an acid or a base.
 (d) Isoelectric point is a pH at which net electric charge of a molecule is zero.

	(a)	(b)	(c)	(d)
(A)	True	True	True	True
(B)	True	False	True	True
(C)	True	False	False	True
(D)	False	True	True	False

(NE-SLET-2019)

3. Following statements are either True or False. Select the correct answer from the codes given below:

- a. The ΔG of a reaction can be calculated from its K_{eq}
 b. The rate of reaction depends on the activation energy.
 c. The change in free energy determines the direction of a chemical reaction.
 d. In biological system cells can transform one type of energy into another.

	a	b	c	d
(A)	False	True	True	False
(B)	True	True	True	True
(C)	True	False	False	False
(D)	False	False	False	True

(NE-SLET-2019)

4. Which of the following statements regarding enzyme inhibition is correct?

- (A) Non-competitive inhibition of an enzyme can overcome by adding large amount of substrate
 (B) Competitive inhibition is seen when the substrate and the inhibitor compete for the active site on the enzyme
 (C) Non-competitive inhibitors often bind to the enzyme irreversibly
 (D) Competitive inhibition is seen when a substrate competes with an enzyme for binding to as inhibitor protein

Answer Key			
1	2	3	4
(B)	(B)	(B)	(B)

EXPLANATION

Previous Year Questions

1. Correct Answer is (B):

- **Tris-HCl (PH 7.0):** A Buffer solution made with Tris (tris(hydroxymethyl)aminomethane) and hydrochloric acid (HCl)
- **Free energy change:** The Gibbs free energy change (ΔG) indicates whether a chemical reaction will proceed spontaneously.
- **Enthalpy change:** The enthalpy change (ΔH) refers to the heat absorbed or released during a chemical reaction.
- **Negative logarithm of an equilibrium constant:** The pK_a value indicates the acidity of a substance. It's the negative logarithm of the acid dissociation constant (K_a).

2. Correct Answer is (B):

False statement explanation:

- Phenylalanine is an amino acid with a benzyl side chain (R group), which is hydrophobic, not hydrophilic. Its aromatic side chain tends to avoid water, preferring to be in nonpolar environments.

3. Correct Answer is (B):

- a. The ΔG (Gibbs free energy change) of a reaction can be calculated from its K_{eq} (equilibrium constant).

- b. The rate of a reaction depends on the activation energy (E_a).
 - c. The change in free energy (ΔG) determines the direction of a spontaneous chemical reaction.
 - d. In biological systems, cells can transform one type of energy into another.
4. **Correct Answer is (B):** In competitive inhibition, both the substrate and inhibitor molecules compete for the same active site on the enzyme. This type of inhibition can often be overcome by increasing the concentration of the substrate, thereby out competing the inhibitor for binding to the enzyme's active site.

Unit - 1.6: Principles of Catalysis, Enzymes and Enzyme Kinetics, Enzyme Regulation, Mechanism of Enzyme Catalysis, Isozymes

Previous Year Questions

(NE-SLET-2018- II)

1. Which of the following is not a general characteristic of enzymes?
- All enzymes show allosteric properties
 - Enzymes increase reaction rates by lowering the activation energy barrier
 - The catalytic activity of some enzymes can be regulated
 - Enzymes usually are substrate specific

(NE- SLET-2018 – III)

2. A competitive inhibitor of an enzyme is usually:

- a highly reactive compound
- a metal ion such as Zn^{2+} or Cu^{2+}
- Structurally similar to the substrate.
- Water insoluble

[AAS-2021]

3. Match the items of Column-I with those of Column-II and select the correct match by using the codes given below:

Column-I	Column-II
(a) Allosteric enzyme	1. PDC
(b) Isoenzyme	2. Acetyl-CoA
(c) Multienzyme complex	3. LDH
(d) Coenzyme	4. ATPase

Codes:

- | | |
|------------------------|------------------------|
| (A) a-1, b-4, c-3, d-2 | (B) a-4, b-3, c-1, d-2 |
| (C) a-3, b-1, c-4, d-2 | (D) a-2, b-4, c-3, d-1 |

[AAS-2021]

4. Two statements are given below, one is Assertion (Ass) and the other is Reason (R). Select the correct answer from the codes given below:

Assertion (Ass): Allosteric enzymes show feedback inhibition **Reason (R):** The inhibition is competitive.

- Both (Ass) and (R) are correct and (R) is the correct explanation of (Ass)
- Both (Ass) and (R) are correct, but (R) is not the correct explanation of (Ass)
- (Ass) is true but (R) is false
- Both (Ass) and (R) are false

(NE- SLET 2022)

5. The non-competitive inhibition of enzyme activity-

- decreases K_m value
- decreases V_{max}
- decreases both K_m value and V_{max}
- increases V_{max} and decreases K_m value

(NE- SLET 2022)

6. Two statements are given below, one is Assertion (Ass) and the other is Reason (R). Select the correct statement from the codes given below:

Assertion (Ass): Allosteric enzymes show feedback inhibition.

Reason (R): The inhibitor is competitive.

- Both (Ass) and (R) are true and (R) is the correct explanation of (Ass)
- Both (Ass) and (R) are true, but (R) is not the correct explanation of (Ass)
- (Ass) is true, but (R) is false
- Both (Ass) and (R) are false

(NE- SLET 2022)

7. Two statements are given below, one is Assertion (Ass) and the other is Reason (R). Select the correct statement from the codes given below:

Assertion (Ass): Coenzyme is a non-protein group without which enzymes are inactive or incomplete.

Reason (R): Coenzyme not only provide a point of attachment for the chemical group being transformed but also influence the properties of the group.

- Both (Ass) and (R) are true and (R) is the correct explanation of (Ass)
- Both (Ass) and (R) are true, but (R) is not the correct explanation of (Ass)
- (Ass) is true, but (R) is false
- Both (Ass) and (R) are false

(NE-SLET 2023)

8. With reference to enzymes, turn over number means

- the number of substrate molecules that a molecule of an enzyme converts into products per hour
- the number of substrate molecules that a molecule of an enzyme converts into products per second
- the number of substrate molecules that a molecule of an enzyme converts into products per day
- the number of substrate molecules that a molecule of an enzyme converts into products per minute

(NE-SLET-2024)

9. Match the items of Column-I with those of Column-II and select the correct match by using the codes given below:

Column-I	Column-II
(a) NADH	1. Nucleic acid
(b) Ribozyme	2. Enzyme precursor
(c) Cofactor	3. High energy electron carrier
(d) Zymosan	4. Prosthetic group

- (a) (b) (c) (d)
 (A) 3 1 4 2
 (B) 3 4 1 2
 (C) 4 1 2 3
 (D) 3 4 2 1

(NE-SLET-2024)

10. Two statements are given below, one is Assertion (Ass) and the other is Reason (R). Select the correct answer from the codes given below:

Assertion (Ass): The non-protein part of holoenzyme is a cofactor which together with coenzyme accelerate the rate of biochemical reactions.

Reason (R): Coenzyme is a non-protein part of a holoenzyme that always remains associated with apoenzyme.

Codes:

- (A) Both (Ass) and (R) are true and (R) is the correct explanation of (Ass)
 (B) Both (Ass) and (R) are true but (R) is not the correct explanation of (Ass)
 (C) Both (Ass) and (R) are false
 (D) (Ass) is true but (R) is false

(NE-SLET-2024)

11. The enzymatic reaction for which thiamin pyrophosphate acts as a cofactor is

- (A) fixation of carbon dioxide
 (B) peptide bond formation
 (C) phosphate group transfer
 (D) decarboxylation of α -keto acid

(NE-SLET-2025)

12. Phenylketonuria is caused by an absence or deficiency of—

- (A) 4-Azido-L-phenylalanine
 (B) Phenylalanine
 (C) Carboxypeptidase A
 (D) Phenylalanine hydroxylase

(NE-SLET-2025)

13. Match the items of Column-I with those of Column-II and select the correct match from the codes given below:

Column-I	Column-II
a) Competitive inhibitors	1. Converting of activation energy
b) RNase activity	2. Glycogen synthase
c) Covalent modification	3. Acid-base catalysis
d) Catalytic enhancement	4. Increase of K_m

Codes:

- (a) (b) (c) (d)
 (A) 4 3 2 1
 (B) 4 2 1 3
 (C) 4 2 3 1
 (D) 1 3 2 4

(NE-SLET-2025)

14. Two statements are given below, one is Assertion (Ass) and the other is Reason (R). Select the correct answer from the codes given below:

Assertion (A): In competitive inhibition, the substrate and inhibitor cannot bind to the enzyme at the same time.

Reason (R): This type of inhibition can be overcome by the high concentration of substrate.

Codes:

- (A) Both (A) and (R) are true and (R) is the correct statement that explains the (A)
 (B) Both (A) and (R) are true, but (R) is not the correct statement that explains the (A)
 (C) (A) is true but (R) is false
 (D) Both (A) and (R) are false

Answer Key									
1	2	3	4	5	6	7	8	9	10
A	C	C	C	C	C	A	B	A	D
11	12	13	14						
D	D	C	A						

EXPLANATION

Previous Year Questions

1. **Correct Answer is (A):** Allosteric properties refers to enzymes that can be inhibited or activated by the binding of molecules other than the substrate at specific regulatory sites. While some enzymes do exhibit allosteric regulation, it's not a universal characteristic. Many enzymes function without this additional layer of control.

2. **Correct Answer is (C):** A competitive inhibitor typically shares structural similarities with the enzyme's natural substrate allowing it to compete for binding in the active site.
3. **Correct Answer is (c):** - a-3, b-1, c-4, d-2.
Here's why each option belongs to its corresponding term:
 - (a) Allosteric enzyme - 3. LDH (Lactate Dehydrogenase): Allosteric enzymes can change their activity based on the presence of other molecules. LDH is a well-known example of an allosteric enzyme.
 - (b) Isoenzyme - 1. PDC (Pyruvate Dehydrogenase Complex): Isoenzymes are enzymes with slight variations in structure and function depending on the tissue they are found in. PDC has different isoenzymes in different tissues.
 - (c) Multienzyme complex - 4. ATPase: Multienzyme complexes are groups of enzymes that work together in a specific order within a single unit.
 - (d) Coenzyme - 2. Acetyl-CoA: Coenzymes are small organic molecules that assist enzymes in their reactions. Acetyl-CoA acts as a coenzyme in some reactions.
4. **Correct Answer is (C):** - (Ass) is true but (R) is false. Allosteric enzymes can exhibit feedback inhibition, where the end product of a metabolic pathway binds to the allosteric site of the enzyme, leading to a decrease in enzyme activity. However, the inhibition in allosteric enzymes is non-competitive, not competitive.
5. **Correct Answer is (C):** Non-competitive inhibition occurs when an inhibitor binds to an enzyme at a site other than the active site, altering the enzyme's shape and reducing its activity. This type of inhibition decreases both the K_m value (the substrate concentration at which the enzyme reaches half of its maximum velocity) and V_{max} (the maximum velocity of the enzyme-catalyzed reaction).
6. **Correct Answer is (C):** Allosteric enzymes are regulated through feedback inhibition where the product of a pathway inhibits an earlier enzyme in the pathway, not through competitive inhibition. This regulation involves binding to a site other than the active site, altering enzyme activity without directly competing with the substrate (non-competitive).
7. **Correct Answer is (A):** Coenzymes are non-protein organic molecules that bind to enzymes and are necessary for the enzyme's activity. Without coenzymes, many enzymes cannot catalyze their reactions effectively. Coenzymes not only serve as carriers of specific functional groups during enzymatic reactions but also participate in the reaction by interacting with the substrate or modulating the enzyme's structure or activity.
8. **Correct Answer is (B):** The turnover number, or k_{cat} , is an important parameter used to characterize enzyme kinetics. It represents the efficiency of an enzyme in converting substrate molecules into product molecules per unit time.
9. **Correct Answer is (A):**

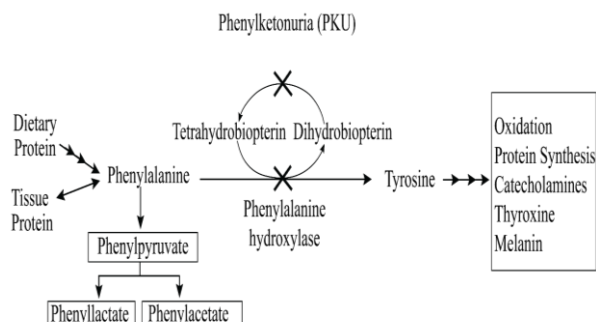
NADH: Nicotinamide adenine dinucleotide (reduced) is a high-energy electron carrier involved in cellular respiration.

Ribozyme: It is an RNA molecule that can catalyze specific biochemical reactions

Cofactor: Cofactor can tightly bound to the enzyme termed as Prosthetic group.

Zymosan: Zymosan is a precursor form of an enzyme.
10. **Correct Answer is (D):** A holoenzyme is an enzyme with a non-protein helper molecule (cofactor) that speeds up reactions. A coenzyme is indeed a non-protein part of a holoenzyme. Some coenzymes bind transiently to the enzyme during the reaction, accepting or donating functional groups and then dissociating. They are not permanently attached to the apoenzyme.
11. **Correct Answer is (D):** Thiamin pyrophosphate (TPP) plays a crucial role in decarboxylation reactions specifically those involving α -keto acids. These reactions remove a carboxyl group (CO_2) from the α -keto acid molecule
12. **Correct Answer is (D):** Phenylketonuria (PKU) is a genetic disorder caused by a deficiency or absence of the enzyme **phenylalanine hydroxylase**. This enzyme is responsible for converting the amino acid phenylalanine into tyrosine. Without functional

phenylalanine hydroxylase, phenylalanine accumulates in the body, leading to brain damage and intellectual disabilities if untreated. The condition is usually detected through newborn screening, and treatment involves a phenylalanine-restricted diet



13. Correct Answer is (C):

- **Competitive inhibitors** increase **K_m** because they compete with the substrate for the active site, requiring more substrate concentration to reach half-maximal velocity.
- **RNase activity** can be enhanced through **catalytic enhancement**, increasing its efficiency.
- **Glycogen synthase** is regulated by **covalent modification**, such as phosphorylation or dephosphorylation, which activates or inhibits its function.
- **Acid-base catalysis** lowers the **activation energy** of reactions by using proton donors or acceptors to facilitate the reaction, commonly seen in enzymes like RNase.

14. Correct Answer is (A):

Assertion (True): In competitive inhibition, the substrate and the inhibitor compete for the same active site of the enzyme. Therefore, they cannot bind simultaneously.

Reason (True and correctly explains the assertion): Because competitive inhibitors bind at the active site, increasing substrate concentration reduces the chances of inhibitor binding, thereby overcoming inhibition.