BIO 303 Current Final Term Spring 2021

Q1. Define pH and write its equation and what is the pH of water at 25°C? 2 Marks

The pH of a solution is defined as the logarithm to the base 10 of the reciprocal of the [H+], i. e, the negative logarithm of the [H+]

• pH = log 1/[H+]

• = -log[H+]

The pH of water at 25°C, in which H+ and OH– ions are present in equal numbers, is 7.0

• pH = -log[1 x 10-7]= 7

Q2. Competitive Inhibition? 2 Marks

This type of inhibition occurs when the inhibitor binds reversibly to the same site that the substrate would normally occupy i.e. active site and, therefore, competes with the substrate for that site.

Q3. 5 types of chemical reactions in biological system. 3 Marks

The reactions going on in biological systems can be categorized into 5 types:

1. Reactions that make-or-break carbon-carbon bonds

2. Internal rearrangements, isomerizations, and eliminations

3. Free-radical reactions

4. Group transfer

5. Oxidation-reduction reactions

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Q4. Difference between Oxidation and Reduction? 2 Marks

Oxidation

• Addition of oxygen

• loss of electrons

• Loss of hydrogen

Reduction

• Removal of oxygen

• Gain of electrons

• Gain of hydrogen

Q5. Enone. 2 Marks

An enone, also called an α, β-unsaturated carbonyl, is a type of organic compound consisting of an alkene conjugated to a ketone. The simplest enone is methyl vinyl ketone or CH_2=$CHCOCH_3$.

Q6. Competitive Inhibition and Noncompetitive Inhibition. 3 Marks

Competitive Inhibition

This type of inhibition occurs when the inhibitor binds reversibly to the same site that the substrate would normally occupy i.e. active site and, therefore, competes with the substrate for that site. Reversible inhibitors bind to enzymes through non covalent bonds.

Noncompetitive Inhibition

Inhibitors bind enzymes at sites distinct from the substrate binding site and generally bear little or no structural resemblance to the substrate. Noncompetitive inhibition cannot be overcome by increasing the concentration of substrate.

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Q7. What is Equilibrium constant (K)? 3 Marks

The composition of a reacting system tends to continue changing until equilibrium is reached. At the equilibrium concentration of reactants and products, the rates of the forward and reverse reactions are exactly equal and no further net change occurs in the system.

Q8. Why pure water passes electric current? 2 Marks

Pure water carries electrical current as H3O+ migrates toward the cathode and OH- toward the anode.

Q9. What is competitive inhibitor Effect of Competitive Inhibition on Vmax? 5 Marks

Competitive inhibitors resemble the substrate and compete for binding to the active site of the enzyme.

1. Effect on Vmax

• The effect of a competitive inhibitor is reversed by increasing [S].

• At a sufficiently high substrate concentration, the reaction velocity reaches the Vmax as observed in the absence of inhibitor.

• When [S] far exceeds [I], the probability that an inhibitor molecule will bind to the enzyme is minimized and the reaction exhibits a normal Vmax.

• Therefore, a competitive inhibitor does not decrease Vmax

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Q10. What is entropy? 2 Marks

Entropy is a quantitative expression for the randomness or disorder in a system. When the products of a reaction are less complex and more disordered than the reactants, the reaction is

said to proceed with a gain in entropy. It is denoted by **S**.

Q11. Rate of Reaction? 2 Marks

The rate of any reaction is determined by the concentration of the reactant (or reactants) and by a rate constant, usually denoted by k.

Q12. What is activation energy reflecting the rate of the reaction? 2 Marks

The rate of a reaction reflects this activation energy: a higher activation energy corresponds to a slower reaction.

Q13. Which ions are formed by the ionization of water and what happened to H+ ion? 2 Marks

Water molecules have a slight tendency to undergo reversible ionization to yield a hydrogen ion (a proton) and a hydroxide ion. Hydrogen ions formed in water are immediately hydrated to hydronium ions (H_3O^+).

Q14. Origin of Phytanic Acid? 2 Marks

Origin of Phytanic Acid

Phytol is the alcohol moiety of the chlorophyll molecule and, as an integral part of chlorophyll, it is abundantly present in plants and even in the marine environment. Phytol can be released from chlorophyll by the action of bacteria present in the rumen of ruminant animals. The resulting free phytol can be converted to phytanic acid in the rumen of animals.

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Q15. What do you mean by Energy hill and Transition state? 2 Marks

But there is an energy barrier between S and P: The energy required for

• alignment of reacting groups

• formation of transient unstable charges

• bond rearrangements

• and other transformations Enzymes

• This is illustrated by the energy

"hill"

To undergo reaction, the molecules must overcome this barrier and therefore must be raised to a higher energy level. This is called the transition state.

Q16. First Law of Thermodynamics? 2 Marks

The first law is the principle of the conservation of energy: it states that "for any physical or chemical change, the total amount of energy in the universe remains constant; energy may change form or it may be transported from one region to another, but it cannot be created or destroyed."

Q17. What is Enzyme inhibitor and explain its classes? 5 Marks

Enzyme inhibitors are molecular agents that interfere with catalysis, slowing or halting enzymatic reactions. Any substance that can diminish the velocity of an enzyme catalyzed reaction is called an inhibitor.

For example, aspirin inhibits the enzyme (cyclooxygenase).

• Two broad classes of enzyme inhibitors:

• 1. Reversible

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• 2. Irreversible

• In general, irreversible inhibitors, bind to enzymes through covalent bonds.

• Reversible inhibitors typically bind to enzymes through noncovalent bonds.

• Competitive inhibitors resemble the substrate and compete for binding to the active site of the enzyme.

• Noncompetitive inhibitors do not bind at the active site. They bind either free enzyme at a site other than active site or the ES complex.

Q18. How phytanic acid is formed from Phytol? 2 Marks

Phytol can be released from chlorophyll by the action of bacteria present in the rumen of ruminant animals. The resulting free phytol can be converted to phytanic acid in the rumen of animals.

Q19. How delta G and G° is related to each other? 2 Marks

Thus, delta G'° is a constant; it has a characteristic, unchanging value for a given reaction. But the actual free-energy change, delta G, is a function of reactant and product concentrations and of the temperature prevailing during the reaction.

Q20. How activation energy affects the rate of the reaction? 2 Marks

The rate of a reaction reflects this activation energy: a higher activation energy corresponds to a slower reaction.

Q21. What is function of cofactor in dehydrogenase coenzyme A? 2 Marks

Accepts acetyl group from lipoamide.

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Q22. Source of Electron for Photosynthetic and Non-photosynthetic? 2 Marks

In non-photosynthetic organism, source of electron: food

In photosynthetic organism, source of electron: chemical compound excited by the absorption of light.

Q23. What is the effect of Concentration of Substrate on the rate of reaction? 3 Marks

The rate of an enzyme-catalyzed reaction increases with substrate concentration until a maximal velocity (Vmax) is reached reflecting the saturation with substrate of all available binding sites are occupied on the enzyme molecules present.

Q24. Explain Ligand? 5 Marks

Ligand

In biochemistry and pharmacology, a ligand (from the Latin ligandum, binding) is a substance (usually a small molecule), that forms a complex, with a biomolecule to serve a biological purpose. In a narrower sense, it is a signal triggering molecule, binding to a site on a target protein. A molecule bound reversibly by a protein is called a ligand. Ligands include substrates, inhibitors, activators, and neurotransmitters. A ligand may be any kind of molecule, including another protein. A ligand binds at a site on the protein called the binding site. Interactions between ligands and proteins may be regulated, through interactions with additional ligands. These other ligands may cause conformational changes in the protein that affect the binding of the first ligand.

Q25. Write down the characteristics of Binding site? 3 Marks

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binding site is complementary to the ligand in

• size,

• shape,

• charge, and

• hydrophobic or

• hydrophilic character.

Q26. Function of Phosphofructokinase-1? 3 Marks

Phosphofructokinase-1 (PFK-1) catalyzes the transfer of a phosphoryl group from ATP to fructose 6-phosphate to yield fructose 1,6-bisphosphate.

Glucose 6-phosphate and fructose 6-phosphate have other possible fates, but fructose 1,6-bisphosphate is targeted for glycolysis.

Q27. Define Pentose Phosphate Pathway and write the other name of this pathway? 3 Marks

Pentose Phosphate Pathway NADPH formed in the oxidative phase is used to reduce glutathione to GSSG (Glutathione disulfide) and to support reductive biosynthesis.

The oxidative pentose phosphate pathway

• Phosphogluconate pathway

• Hexose monophosphate pathway

Q28. Significance of GLUCONEOGENESIS? 5 Marks

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Biomedical importance of Gluconeogenesis

- To maintain the blood glucose concentration during prolonged fasting or starvation when sufficient carbohydrate is not available from the diet or glycogen reserves.
- It maintains the level of intermediates of the TCA cycle even when fatty acids are the main source of acetyl coA in the tissues.
- It clears the lactate produced by muscle and erythrocytes and glycerol produced by adipose tissue.

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Q29. Define Lyases enzyme? 2 Marks

• Theses enzymes catalyze the addition of

• NH_3,

• H_2O or

• CO_2 to double bonds or

• the removal of these groups leaving behind double bonds.

Q30. Define Coenzyme? 2 Marks

If it is a complex organic molecule or metallo-organic compound it is termed a coenzyme. Coenzymes serve as recyclable shuttles that transport many substrates from one point within the cell to another.

Q31. Explain Michaelis-Menten equation? 3 Marks

They postulated that the enzyme first combines reversibly with its substrate to form an enzyme substrate complex in a relatively fast reversible step:

k1

$E + S \leftrightarrow ES$

K-1

Michaelis-Menten equation, the rate equation

$V_0 = Vmax [S] / Km + [S]$

V_0 = initial reaction velocity

Vmax = maximal velocity

Km = Michaelis constant

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