Important Questions on Biochemistry for CSIR NET Life Science

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1. The V_{max} of several enzymes from the pectoral muscles (chest muscles used for flying) of pigeon and pheasant are shown below. The indication of the importance of various ATP-producing pathways is the V_{max} of certain enzymes of this pathway.
What can be concluded from the data given below?
I. β-oxidation predominates in pigeons while in pheasants anaerobic glycolysis of glycogen predominates.
II. Pigeon muscle would consume more O_2.
III. Pigeon is a long-distance flyer as lactate building in pheasant limits long-distance flights
A. I only
B. II only
C. I and II
D. I, II, and III

2. Consider the following statements:
I. Each strand in a β sheet is a helix with 3.6 amino acids per turn.
II. Loops of a polypeptide that protrude from the surface of a protein often form the binding sites for other molecules.
III. An enzyme reaches a maximum rate at high substrate concentration because it has a fixed number of active sites where the substrate binds.
IV. Higher concentrations of enzymes give rise to a higher turnover number.
Which of the following statements is CORRECT?
A. I and IV
B. I and III
C. II and III
D. II and IV

3. Which one of the following statements is true regarding amino acids?
A. Proline has a high propensity to form a-helix in globular proteins.
B. Both isoleucine and threonine can exist as diastereomers.
C. Side chain pK_a of aspartic acid is more than the side chain pK_a of glutamic acid
D. The dihedral angle of the proline is more restricted than the F dihedral angle.

4. Dissimilatory sulfate-reducing bacteria utilizes:
A. Sulfate as a final electron acceptor.
B. Sulfur as a final electron donor.
C. H_2S as a final acceptor.
D. H_2S as a final donor.

5. The interaction energy between two opposite charges separated by 3A in a vacuum is -500 $kJmol^{-1}$. The interaction energy between these two charges in water will be closet to
A. - 1500 $kJmol^{-1}$
B. - 166 $kJmol^{-1}$
C. - 55 $kJmol^{-1}$
D. -6 $kJmol^{-1}$

6. Given below is the [P] vs time plot of an enzymatic reaction carried out by the enzyme 'X'. Which one of the following statements is the correct interpretation of the data?

A. The K_m and V_{max} of the enzyme 'X' are 15 and 60 units, respectively.

B. The V_{max} is 60 but the K_m cannot be determined.

C. The K_m is 15 but the V_{max} cannot be determined.

D. Neither the K_m nor the V_{max} of the enzyme 'X' can be determined from these data.

7. Given below are some physicochemical properties (column X) and their manifestations (column Y). Which one of the following is the most appropriate match?

Column X	**Column Y**
a. Pauling electronegativity	i. Charge separation
b. Isolated (π) orbital overlap	ii. Solvation of atoms
c. Aromaticity	iii. Restricted rotation
d. Dielectric constant	iv. Planarity of molecules

A. a = i, b = iv, c – ii, d – iii

B. a = iii, b – ii, c – iv, d – i

C. a = ii, b – iii, c – iv, d – i

D. a = iv, b – ii, c – i, d – iii

8. β-oxidation of a 16-carbon fatty acid and a 17 carbon fatty acid leads to the formation of:

A. (8 Acetyl CoA) and (8 Acetyl CoA + CO_2), respectively

B. (5 Propionyl CoA + 1 CO_2) and (5 Propionyl CoA +1 Acetyl CoA), respectively

C. (5 Propionyl CoA + 1 CO_2) and (5 Propionyl CoA + 2 CO_2), respectively

D. (8 Acetyl CoA) and (7 Acetyl CoA + 1 Propionyl CoA), respectively

9. You have sequenced a peptide from the amino terminus of a protein in order to construct an oligonucleotide probe to search for the mRNA encoding this protein. The peptide sequence is Met-Ala-Cys-His-Trp-Asn.

I. How many possible oligonucleotide probes would you have to synthesize?

II. How many probes would you have to synthesize if this peptide contained a leucine rather than a tryptophan residue at the position?

A. I - 32 oligonucleotide probes; II - 32 oligonucleotide probes

B. I - 16 oligonucleotide probes; II - 192 oligonucleotide probes

C. I - 32 oligonucleotide probes; II - 128 oligonucleotide probes

D. I - 32 oligonucleotide probes; II - 192 oligonucleotide probes

10. Competitive inhibitor of an enzyme will affect the double reciprocal plot by:

A. increasing the slope of the line

B. decreasing the slope of the line

C. not affecting the slope

D. increasing the slope first and then decreasing it

Solutions

1. Ans. D.

Solution. In the absence of oxygen, cells consume glucose at a high, steady rate. When oxygen is added, glucose consumption drops precipitously and is then maintained at a lower rate. All the above statements are correct.

2. Ans. C.

Solution. Each strand in an alpha-helix has 3.6 amino acids per turn. Turnover depends on individual enzyme (K_{cat}), not on the total enzyme

3. Ans. B.

Solution. Molecules of the residual amino acids, threonine and isoleucine, contain two asymmetric carbon atoms and thus, exist as four stereoisomers forming two enantiomer and four diastereomer pairs, respectively. Therefore, option B is the correct answer.

4. Ans. A.

Solution. They use sulfate as an electron acceptor which is converted into sulfite or H_2S. Dissimilatory sulfate-reducing prokaryotes are a heterogeneous group of bacteria and archaea consisting of diverse phyla such as *Archaeoglobi, Proteobacteria, Firmicutes, Nitrospirae* and others that can use sulfate as a terminal electron acceptor. During the process, sulfate is ultimately reduced to hydrogen sulfide through the intermediates adenosine 5'-phosphosulfate (APS) and sulfite. The reduction of sulfate to sulfite requires two electrons at a standard redox potential ($E^{0'}$) of -516 mV, which is too high for physiological electron carriers. This problem is solved by the formation of a mixed anhydride between the sulfate and phosphate, as in adenosine 5'-phosphosulfate (APS).

5. Ans. D.

Solution. The interaction energy between any two charged particles is derived from Coulomb's law using well-known procedures. The interaction energy between particles is negative if the particles are oppositely charged. However, the interaction energy between them is positive, if the particles are similarly charged.

6. Ans. D.

Solution: Neither the Km nor the Vmax of the enzyme can be determined from these data.

7. Ans. C.

Solution. Pauling electronegativity → solvation of atoms, isolated (π) orbital overlap → restricted rotation, aromaticity → planarity of molecules, dielectric constant → charge separation.

8. Ans. D.

Solution. 16 carbon fatty acid (8 Acetyl CoA) 8 X 2 =16 Carbon 17 carbon fatty acid (7 Acetyl CoA + 1 Propionyl CoA) 7 X 2=14 + 1 X 3 = 3 Total 14 +3 = 17

9. Ans. D.

Solution. I - 32 oligonucleotide probes single codon for met, 4 for ala, 2 for cys, 2 his, 1 trp, 2 asn = 1 x 4 X 2 X 1 X 2 X 1=32; II - 192 oligonucleotide probes leu has 6 codon instead of trp which has a single codon.

10. Ans. A.

Solution:. Slope is K_m/V_{max} since K_m increases in competitive inhibition so slope will increase.

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