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**M.Sc. (Third Semester)**  
**EXAMINATION, Dec. - Jan., 2021-22**  
**CHEMISTRY**  
**Paper Second**  
**(Chemistry of Biomolecules)**

*[ Time : Three Hours ]**[ Maximum Marks : 80 ]**[ Minimum Pass marks : 16 ]***Note : Attempt all questions as directed.****Section - A****(Objective/Multiple Choice Questions)****( 1 mark each )****Note : Attempt all questions.**

1. Select the correct statement of the following :

- (a) Fe (III) will not reduce easily in presence of  $\text{CN}^-$ .
- (b)  $\Delta G$  will negative in exergonic reaction.
- (c)  $\Delta G$  will positive in endergonic reaction.
- (d) Oxy-haemocyanin is paramagnetic and colourless.

- (A) a, b and c
- (B) b and c
- (C) b, c and d
- (D) All a, b, c and d

2. Select the correct statement of the following:

- (a) The biological function of cytochrome P - 450 is epoxidation of olifins.
- (b) In the catalytic cycle the oxidation of Fe are II, III, IV and V.
- (c) The colour of haemoglobin is due to  $\pi$  to  $\pi^*$ .
- (d) Raman frequency of  $\text{O}_2$  in oxy-haemoglobin is  $1100 \text{ cm}^{-1}$ .

- (A) a and d
- (B) a, b and d
- (C) a, c and d
- (D) All a, b, c and d

3. Select the correct statement of the following:

- (a) Hemoglobin Contain four-six member ring and four- five memberrng.
- (b) If  $\text{CN}^-$  bind with cobalt the Co (II) has magnetic moment of 4 and paramagnetic.
- (c) If  $\text{CN}^-$  bind with cobalt the Co(II) has magnetic

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moment of 2 and paramagnetic.

(d) The active site of oxy-hemoglobin will show Jahn-Teller distortion.

(A) a, c and d

(B) a, b and d

(C) a and b

(D) a and c

4. Select the correct statement of the following:

(a) Production of ATP during aerobic respiration is an example of endergonic reaction.

(b) In the cytochrome P-450 catalytic cycle, at the first step Fe has microstate of  $252$ .

(c)  $\text{Fe}^{2+}$  has term symbol of  ${}^5D_4$ .

(d) Myoglobin can transport 4  $\text{O}_2$  molecules.

(A) a, and c

(B) a, b and c

(C) a, c and d

(D) All a, b, c and d

5. Select the correct statement of superoxide dismutase:

(a) Serve as antioxidant defensive enzyme against oxidative stress.

(b) The active site of isoform of SOD-2 is Mn.

(c) The  $\text{Cu}^{2+}$  has microstate of 10 and  ${}^2D$  term

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symbol.

(d) Reaction of superoxide and superoxide dismutase is first order kinetic.

(A) a and d

(B) a, c and d

(C) a and b

(D) All a, b, c and d

6. Choose the correct statement of the following:

(a) Cytochrome c is a redox protein and electron carrier.

(b) Graphene oxide can behave as exo-receptor.

(c) Crown ether can behave as endo-receptor.

(d) Diastereomers will obtain if already a chiral centre exist in prochiral molecule.

(A) a, c and d

(B) a, b and c

(C) a and c

(D) All a, b, c and d

7. Choose the correct statement of the following:

(a)  $\text{CN}^-$  bind more stronger than CO with Fe.

(b) CO bind more stronger than  $\text{CN}^-$  with Fe.

(c) Calixarine is made by phenol monomer unit.

(d) Beta cyclodextrin is made by beta 1-4 linkage.

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(e) In enzyme the zinc activates  $H_2O$  and provide zinc bound hydroxide.

(A) a, b and c

(B) a, c and e

(C) b, c and e

(D) a, c, d and e

8. Choose the correct statement -

(a) Cytochrome P-450 act as monooxygenases and catalase the insertion of O into a C-H bond.

(b) The magnetic moment is 6 before losing of  $H_2O$  molecule in Cytochrome P-450.

(c) The term symbol of active site in Cytochrome P- 450 before losing of  $H_2O$  molecule is  $^2G$ .

(d) The term symbol of active site in Cytochrome P-450 before losing of  $H_2O$  molecule is  $^6S$ .

(A) a, b and d

(B) a, b and c

(C) a and c

(D) a and d

9. Choose the correct statement of the following :

(a) Carbonic anhydrase is an example of hydrolysis enzyme.

(b) The reaction of carbonic anhydrase and  $CO_2$  is

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example of electrophilic addition reaction.

(c) Fe-O binding is shorter than Co-O in FeMb or CoMb.

(d) CO has bond order of 3.

(A) a and b

(B) a, b and d

(C) a, b and c

(D) All a, b, c and d

10. Choose the correct statement :

(a) The oxidation of Mo is +VI and diamagnetic in xanthine oxidase enzyme.

(b) P-450 is named in cytochrome due to LMCT.

(c) Cyclodextrin behave as inclusion complex.

(d)  $C_{20}$  is known as smallest fullerene.

(A) a, b and d

(B) b, c and d

(C) a, c and d

(D) All a, b, c and d

11. Choose the correct statement -

(a) The activation energy of reaction is lowered so that a fewer substrate molecule can overcome it.

(b) A competitive inhibitor of enzyme of an enzyme is

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usually a metal ion usually  $\text{Hg}^{2+}$  or  $\text{Pb}^{2+}$ .

- (c) An enzyme lowers the free energy difference between substrate (s) and product (s) but it cannot change the equilibrium position of the reaction it catalyses.
  - (d) An enzyme cannot change the equilibrium position of the reaction it catalyses but it lowers the energy of activation of that reaction.
- (A) a, b and c  
(B) b and c  
(C) b and d  
(D) b, c and d

12. Choose the incorrect statement :

- (a)  $\text{NAD}^+$  is the initial electron acceptor in many metabolic oxidation reactions.
  - (b) The separation of proteins by isoelectric focusing is only based on charge.
  - (c) Mass spectrometry involves the separation of ionic fragments on a gel.
  - (d) Cathepsin D is not cysteine active site of protease
- (A) a, and b  
(B) b and c  
(C) b, c and d  
(D) All a, b, c and d

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13. Choose the correct option :

- (a) A proton moves from the serine to the histidine side chain in the catalytic triad of chymotrypsin.
  - (b) Gel-filtration chromatography separates proteins on their ability to bind to specific groups on the column matrix.
  - (c) Modern hypothesis about enzyme action is called induced-fit hypothesis.
  - (d) Proteins separated by isoelectric focusing can be tested for biological activity.
- (A) a, and c  
(B) a, b and d  
(C) a, c and d  
(D) All a, b, c and d

14. Restriction enzyme are also called-

- (a)  $K_m$ , the Michaelis constant, is expressed in terms of the reaction velocity.
- (b)  $K_m$ , the Michaelis constant, is a measure of the affinity the enzyme has for its substrate Molecular scissors.
- (c) The  $V_{\max}$  for a reaction remains unchanged in the presence of a competitive inhibitor.
- (d) The  $V_{\max}$  and  $K_m$  (Michaelis constant) for a reaction are unchanged in the presence of a

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competitive inhibitor.

- (A) a and b
- (B) b and c
- (C) b, c and d
- (D) All a, b, c and d

15. Choose the correct option -

- (a) Enzyme do not alter the over all change in free energy for a reaction.
- (b) Enzyme enhance the rate of reaction by lowering the activation energy.
- (c) The nucleophile in serine proteases is serine and water.
- (d) Holoenzyme produced with the combination of apoenzyme and coenzyme.

- (A) a and b
- (B) a, b and d
- (C) b and d
- (D) All a, b, c and d

16. Choose the correct statement :

- (a) In vitamin B<sub>12</sub>, one-five membered ring and three six membered.
- (b) Ca<sup>2+</sup> released into a myofibril by the action of a nerve

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impulse binds to a site on troponin to initiate contraction.

- (c) Na and K pump are example of active transport.
- (d) Digestion of starch by  $\alpha$  - amylase is an endergonic process.

- (A) a, b and c
- (B) b, c and d
- (C) b and c
- (D) All a, b, c and d

17. Which of the following statements about the mechanism of the Na<sup>+</sup>/K<sup>+</sup> pump are not correct?

- (a) The Na<sup>+</sup>/K<sup>+</sup>ATPase uses energy to pump Na<sup>+</sup> outside the cell and K<sup>+</sup> inside.
- (b) The Na<sup>+</sup>/K<sup>+</sup> ATPase use energy to pump Na<sup>+</sup> inside the cell and K<sup>+</sup> outside.
- (c) The Na<sup>+</sup>/K<sup>+</sup> ATPase use energy to bind both Na<sup>+</sup> and K<sup>+</sup> in turn.
- (d) The phosphorylation of the Na<sup>+</sup>/K<sup>+</sup> ATPase does not change its conformation.

- (A) Only a
- (B) a and b
- (C) b, c and d
- (D) a,c and d

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18. Which of the following statements are not correct?

- (a) Cell theory is not applicable to virus.
  - (b) Cell membranes retain the contents of cells.
  - (c) Symport movement is bidirectional.
  - (d) Cell membranes are permeable to most inorganic ions.
- (A) a and d  
(B) b and c  
(C) b, c and d  
(D) c and d

19. Choose the incorrect statement :

- (a) 3 Na<sup>+</sup> and 2K<sup>+</sup> are involved in sodium potassium pump.
  - (b) 2 Na<sup>+</sup> and 3K<sup>+</sup> are involved in sodium potassium pump.
  - (c) K<sup>+</sup> can be trap by [18] crown-6.
  - (d) Na<sup>+</sup> cannot be trap by [15] crown -5.
- (A) a and c  
(B) a and d  
(C) b and d  
(D) a, c and d

20. Choose the correct statement :

- (a) Calcium can make complex with EDTA due to hard-hard interaction.
- (b) Thin filaments of skeletal muscle have plus and

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minus ends.

- (c) Fatty acid activation requires energy in the form of ATP.
  - (d) Calcium can make complex with EDTA due to hardsoft interaction.
- (A) b and c  
(B) a, b and c  
(C) b, c and d  
(D) a, b and d

### Section - B

#### ( Very Short Answer Type Questions )

( 2 marks each )

**Note : Attempt all questions.**

1. How will you define any reaction is exergonic?
2. Explain how cytochrome act as redox protein?
3. What do you mean by exoreceptor? Explain with suitable example.
4. How will you prepare calixarene? Write a reaction.
5. Define competitive inhibition with suitable example.
6. How many stereoisomers is possible in riboflavin?
7. Define the hydrophobic force in biopolymers.
8. What do you mean by reverse osmosis? Explain with suitable example.

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**Section - C**

**(Short Answer Type Questions)**

**( 3 marks each)**

**Note : Attempt all questions.**

1. If both hemoglobin and myoglobin bind oxygen reversibly why are their binding curves qualitatively different?
2. How do you explain the magnetic behaviour in iron-sulphur protein [Fe<sub>4</sub>S<sub>4</sub>].
3. Why Zinc is so valuable in biology relative to other metals?
4. What do you mean by partial asymmetric synthesis? Explain with suitable reactions.
5. What kind of reaction take place during induced-fit mechanism? Explain with suitable example.
6. Discuss the importance of Michaelis-Menten equation in enzyme chemistry.
7. Explain the ion binding mechanism in valinomycin.
8. What will happen when concentration of Na ion disbalance in body?

**Section - D**

**(Long Answer Type Questions)**

**( 5 marks each )**

**Note : Attempt all questions.**

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1. Explain the following:

- (a) The electron transfer reaction in Co substituted cytochrome-c in place of Fe. Explain the rate different.
- (b) Discuss the chemistry of O<sub>2</sub> binding in copper-enzyme.

**OR**

Discuss the following:

- (a) Why IR/Raman spectroscopy is best suited method for the verification of oxidation state of O<sub>2</sub> ligand?
  - (b) Explain the binding mechanism of CO in biological system.
2. Which metalloenzymes are responsible for the removal of hydrogen peroxides? Discuss their active site structure and function.

**OR**

Discuss the following:

- (a) How do you classify superoxide dismutase?
  - (b) How could you decide any molecule as endo-receptor? Give suitable example.
3. Discuss the four principal components of vitamin B12 complex.

**OR**

Discuss the following:

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- (a) How do you prepare aldehyde from alcohol using enzyme?
  - (b) Explain the biological function of non-aromatic co-enzyme A.
4. Explain molecular mechanism of ion transport across membrane.

**OR**

Discuss the following:

- (a) Gibbs Donnan effect
- (b) Explain the irreversible thermodynamic treatment of membrane transport.