

**BIOC 0113: BIOCHEMISTRY**

**INSTRUCTIONS:**

**This exam comprises of two Papers (1 &2)**

*Paper 1 has two sections (A & B);*

*Answer all questions in section A and ant two in section B*

**Paper 2; Answer all questions in this paper**

**PAPPER 1**

**SECTION A: SHORT ESSAY QUESTIONS**

**(60 MARKS)**

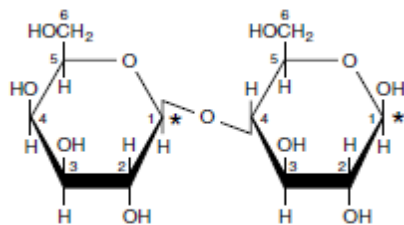
**Answer all questions in this section**

1. Define the following terms as used in Biochemistry

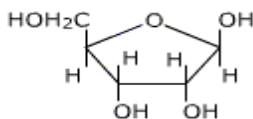
- i. Zwitterion (2 marks)
- ii. Amphibolic (2 marks)
- iii. Holoenzyme (2 marks)
- iv. Nucleotide (2 marks)
- v. Reduction (2 marks)

2. Identify the following structures

a



b



(5 marks)

Draw the following structures

- i.  $18:1\Delta^9$  (2 marks)
- ii. Peptide bond formation (3 marks)

3.

- a. Living organisms are said to be unique. Justify (3 mark)
- b. What are the properties of non-competitive inhibitors (4 marks)
- c.  $pK_a$  is the  $-\log$  of  $K_a$ . What information can one deduce from  $pK_a$  of a given weak acid? (3 marks)

4. Briefly explain the following observations

- a. Radiations are used in cancer treatment (3 marks)
- b. An athlete sweats profusely during and immediately after a race (2 marks)
- c. Excessive consumption of alcohol can lead to blindness (3 marks)
- d. A footballer experiences muscle pull during a football match

(2marks)

5.

- i. Glycogen is an important animal polysaccharide. Identify the monomers that make up glycogen (2 marks)
- ii. Highlight the significance of primary level of protein structure organization (5 marks)
- iii. List three enzymes that are exclusively found on the gluconeogenic pathway and not in the glycolytic pathway (3 marks)

6. Bicarbonate buffer system is buffer system that is quantitatively the most important in the extracellular fluid.

- a. What is a buffer (1 marks)
- b. What are the components making up buffer system? (2 marks)
- c. Describe how bicarbonate buffer system works (7 marks)

**SECTION B: ESSAY QUESTIONS****40 MARKS****Answer any two questions only**

- 7.
- a. In details, discuss levels of protein structure organization (15 marks)
  - b. Kidwathne, a Clinical medicine student, was given a picture illustrating a DNA molecules and RNA molecule and told to pinpoint the difference between the two biomolecules. What differences did he ought to pinpoint? (5 marks)
- 8.
- a. Describe the features of glycolysis (10 marks)
  - b. High concentrations of ammonia deplete ATP in cells, explain (5 marks)
  - c. Write brief notes on the importance of water in biological systems (5 marks)
- 9.
- a. Discuss the significance of gluconeogenesis (5 marks)
  - b. Illustrate how ammonia formed from oxidative deamination of amino acid is eliminated from the body (5 marks)
  - c. Discuss the molecular pathology of sickle cell anemia (10 marks)

**PAPER II:****MULTIPLE CHOICE & T/F**

**This section comprises of sixty questions, each question having four options;  
MARK the correct one**

- 1. Hydrolysis of lactose yields**
- a. Galactose and fructose
  - b. Galactose and glucose
  - c. Glucose and fructose
  - d. Fructose and galacose
- 2. Storage of polysaccharide made by animals is by**
- a. Amylopectin
  - b. Glycogen
  - c. Cellulose
  - d. Collagen

- 3. Which of the following would be considered a part of metabolism?**
- a. Biosynthetic pathway that's builds DNA
  - b. Catabolic pathways that break down complex carbohydrates
  - c. The capture of light energy for use in making glucose
  - d. All of the above
- 4. Milk is deficient in which vitamins?**
- a) Vitamin C
  - b) Vitamin A
  - c) Vitamin B
  - d) Vitamin K
- 5. The degradative Processes are categorized under the heading of**
- a) Anabolism
  - b) Catabolism
  - c) Metabolism
  - d) None of the above
- 6. The Golgi complex**
- a) Synthesizes proteins
  - b) Produces ATP
  - c) Provides a pathway for transporting chemicals
  - d) Forms glycoproteins
- 7. The following substances are cell inclusions except**
- a) Melanin
  - b) Glycogen
  - c) Lipids
  - d) Centrosome
- 8. Genetic information of nuclear DNA is transmitted to the site of protein synthesis by**
- a) rRNA
  - b) mRNA
  - c) tRNA
  - d) Polysome
- 9. The monosaccharide units are linked by 1 →4 glycosidic linkage in**

- a) Maltose
- b) Sucrose
- c) Cellulose
- d) Lactose

**10. The number of stereo-isomers of glucose is**

- a) 2
- b) 4
- c) 8
- d) 16

**11. Cori's cycle transfers**

- a) Glucose from muscles to liver
- b) Lactate from muscles to liver
- c) Lactate from liver to muscles
- d) Pyruvate from liver to muscle

**12. An amino acid not found in proteins is**

- a)  $\beta$ -Alanine
- b) Proline
- c) Lysine
- d) Histidine

**13. A ketogenic amino acid is**

- a) Valine
- b) Cysteine
- c) Leucine
- d) Threonine

**14. Denaturation of proteins results in**

- a) Disruption of primary structure
- b) Breakdown of peptide bonds
- c) Destruction of hydrogen bonds
- d) Irreversible changes in the molecule

**15. Control of urea cycle involves the enzyme:**

- a) Carbamoyl phosphate synthetase

- b) Ornithine transcarbamoylase
- c) Argininosuccinase
- d) Arginase

**16. If the fatty acid is esterified with an alcohol of high molecular weight instead of glycerol, the resulting compound is**

- a) glycolipid
- b) cerebrosides
- c) Wax
- d) Gangliosides

**17.  $\beta$ -Oxidation of fatty acids requires all the following coenzymes except**

- a) CoA
- b) FAD
- c) NAD
- d) NADP

**18. The most active form of Vitamin D is**

- a) 25-Hydroxycholecalciferol
- b) 1, 25-dihydroxycholecalciferol
- c) 25-dihydroxyergocalciferol
- d) None of these

**19. The kinetic effect of purely competitive inhibitor of an enzyme**

- a) Increases  $K_m$  without affecting  $V_{max}$
- b) Decreases  $K_m$  without affecting  $V_{max}$
- c) Increases  $V_{max}$  without affecting  $K_m$
- d) Decreases  $V_{max}$  without affecting  $K_m$
- e) None of the above

**20. In uncompetitive enzyme activity inhibition**

- a) The structure of inhibitor generally resembles that of the substrate
- b) Inhibitor increases apparent  $V_{max}$
- c)  $K_m$  remains unaffected
- d) Inhibitor decreases both  $V_{max}$  and  $K_m$
- e) Inhibitor increases  $V_{max}$  without affecting  $K_m$

**21. Enzymes activity is NOT controlled by**

- a) pH of the solution
- b) Temperature
- c) Concentration of the enzyme
- d) Concentration of the substrate
- e) None of the above

**22. Ribozymes are**

- a) Enzymes present in ribosomes
- b) Enzymes which combine the ribosomal subunits
- c) Enzymes which dissociate
- d) Enzymes made up of RNA
- e) All of these

**23. Allopurinol**

- a. It is a structural analogue of uric acid
- b. It can prevent uric acid stones in the kidneys
- c. It increases the urinary excretion of xanthine and hypoxanthine
- d. It is a competitive inhibitor of xanthine oxidase

e. All of these

**24. When NH<sub>3</sub> is perfused through a dog's liver \_\_\_\_\_ is formed, while \_\_\_\_\_ is formed in the bird's liver.**

- a. Urea, Uric acid
- b. Urea, allantoin
- c. Uric acid, creatinine
- d. Uric acid, Urea
- e. Urine, urea

**25. The following are not monosaccharides**

- a. Glucose
- b. Galactose
- c. Fructose
- d. Mannose
- e. lactose

**26. Nucleosides refers to;**

- a) Allosteric control of enzyme activities
- b) Combination of a phosphate and a base
- c) Combination of sugar, base and a phosphate
- d) Combination of sugar and a base
- e) Combination of sugar and a phosphate

**27. Which one of the following amino acid is a heterocyclic amino acid;**

- a) Cystine
  - b) Glycine
  - c) Aspartate
  - d) Glutamate
  - e) phenylalanine
- a) RNA polymerase

**28. In cellular respiration, energy-depleted electrons are donated to an inorganic molecule. In fermentation, the following molecules accepts these electrons**

- a. Oxygen
- b. Hydrogen



- c. Sulfur
- d. NADH
- e. None of the above

**29. In alkaline medium, aldehyde or ketone group can reduce each of the following to metallic hydroxide or oxide,**

- a. Silver salts
- b. Mercuric salts
- c. cupric salts
- d. ferric salts
- e. none of the above

**30. Mannose is a**

- a) Furanose
- b) Mosaccharide
- c) Disaccharide
- d) Polysaccharide
- e) Pyran

**31. The graph on which the plot of 1/velocity versus 1/substrate concentration is made is referred to as the \_\_\_\_\_ plot**

- a. Michaelis-Menten
- b. Vmax
- c. Linear Weaver- Burk
- d. Rate

**32. In glucose the orientation of the —H and —OH groups around the carbon atom 5 adjacent to the terminal primary alcohol carbon determines**

- a. D or L series
- b. Dextro or levorotatory
- c.  $\alpha$  and  $\beta$  anomers
- d. Epimers

**33. Which of the following is an epimeric pair?**

- a. Glucose and fructose
- b. Glucose and galactose

- c. Galactose and mannose
- d. Lactose and maltose

**34. An essential amino acid in man is**

- a. Aspartate
- b. Tyrosine
- c. Methionine
- d. Serine

**35. Which one of the following is semi-essential amino acid for humans?**

- a. Valine
- b. Arginine
- c. Lysine
- d. Tyrosine

**36. In proteins the  $\alpha$ -helix and  $\beta$ -pleated sheet are examples of**

- a. Primary structure
- b. Secondary structure
- c. Tertiary structure
- d. Quaternary structure

**37. Zymogen is**

- a. An intracellular enzyme
- b. Serum enzyme
- c. A complete extracellular enzyme
- d. An inactivated enzyme

**38. Isoelectric pH of an amino acid is that pH at which it has a**

- a. Positive charge
- b. Negative charge
- c. No charge
- d. None of these

**39. RNA does not contain**

- a. Uracil
- b. Adenine
- c. Hydroxy methyl cytosine

d. Phosphate

**40. A polymeric unit of starch which has a branched structure is**

- a. Glucose
- b. Amylopectin
- c. Isomaltose
- d. Amylose

**41. Which of the following statements about enzymes or their function is true?**

- a. Enzymes do not alter the overall change in free energy for a reaction
- b. Enzyme are proteins whose three-dimensional structure is key to their function
- c. Enzymes speed up reactions by lowering activation energy
- d. All of the above

**42. Before they can react, many molecules need to be destabilized. This state is typically achieved through**

- a. Changing the three-dimensional structure of molecules
- b. Oxidizing the molecules by removing electrons
- c. Changing the reaction from biosynthetic to catabolic pathway
- d. The input of small amount of activation energy

**43. Phospholipid contains**

- a. Hydrophilic heads and hydrophobic tails
- b. Long water soluble carbon chains
- c. Positive charged functional groups
- d. Both (b) and (c)

**44. Micelles of fatty acids in water are organized such that the .....faces the solvent and the .....are directed toward the interior**

- a. Carboxylic acid groups, hydrocarbon chains heads
- b. Hydrophilic heads, hydrophobic tails
- c. Hydrocarbon chains, carboxylic acid groups
- d. Both (a) and (b)

**45. Cholesterol is the precursor of**

- a. Steroid hormones
- b. Vitamin A

- c. Bile salts
- d. Both (a) and (c)

**46. The glycoside bonds in DNA and RNA**

- a. Connect the sugar to the base
- b. Can be hydrolyzed by OH-ion
- c. Stabilize Watson-Crick H-bonds
- d. Are free to rotate over about  $180^{\circ}$

**47. Which of the following is found on RNA but not DNA?**

- a. Uracil
- b. Deoxyribose
- c. Phosphate
- d. Adenine

**48. Glycolytic pathway regulation involves**

- a. Allosteric stimulation by ADP
- b. Allosteric inhibition by ATP
- c. Feedback, or product, inhibition by ATP
- d. All of the above

**49. A deficiency of thiamin produces the disease known as**

- a. Beri-beri
- b. Scurvy
- c. Cataract
- d. Anemia

**50. A glucogenic amino acid is one which is degraded to**

- a. Keto-sugars
- b. Either acetyl CoA or acetoacetyl CoA
- c. Pyruvate or citric acid cycle intermediates
- d. None of the above

**51. A ketogenic amino acid is one which degrades to**

- a. Keto-sugars
- b. Either acetyl CoA or acetoacetyl CoA
- c. Pyruvate or citric acid cycle intermediates

- d. Multiple intermediates including pyruvate or citric acid cycle intermediates and acetyl CoA or acetoacetyl CoA

**52. Transamination is the transfer of an amino**

- a. Acid to a carboxylic acid plus ammonia
- b. Group from an amino acid to a keto acid
- c. Acid to a keto acid plus ammonia
- d. Group from an amino acid to a carboxylic acid

**53. Which of the following is incorrect**

- a. In DNA double helix, two strands of DNA are bound with each with the bases
- b. Adenine always pairs with thymine
- c. Guanine always pairs with the cytosine
- d. None of the above

**54. Glycerophosphatids are**

- a. Complex lipids
- b. Simple lipids
- c. Derived lipids
- d. None of the above

**55. Sterols such as cholesterol and bile are classified as**

- a. Derived lipids
- b. Simple lipids
- c. Complex lipids
- d. Phosphatides

**56. Lipid catabolism occurs in**

- a. Nuclei
- b. Cytoplasm
- c. Mitochondrion
- d. Golgi apparatus<sup>57</sup>.

**57. The following statements are correct concerning role of co-factor to an enzyme except**

- a. Help in maintaining and producing active structural conformation of the enzyme.
- b. Formation of E-S complex.
- c. Are organic in nature

d. Accept or donate electrons.

**58. In DNA, guanine pairs with**

- a. Adenine
- b. Cytosine
- c. Thymine
- d. uracil

**59. In RNA, uracil pairs with**

- a. Adenine
- b. Cytosine
- c. Thymine
- d. Uracil

**60. During glycolysis, electrons removed from glucose are passed to**

- a. FAD
- b. NAD<sup>+</sup>
- c. Acetyl CoA
- d. Pyruvic acid