KATHMANDU UNIVERSITY
End Semester Examination
June/July, 2023

Marks Scored:

Level : B.Tech.
Year : II

Course : BIOT 203
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date 04 JUL 2023

SECTION "A"
[20 Q. × 1 = 20 marks]

Encircle the most appropriate option.

1. As the nonpolar hydrocarbon chain length of fatty acids increases, their solubility and melting point will:
   a. increase simultaneously.
   b. decrease simultaneously.
   b. increase and decrease, respectively.
   d. decrease and increase, respectively.

2. Which of the following statements is **NOT TRUE**?
   a. The active site of an enzyme is the region that binds the substrates and the cofactor, if any.
   b. Binding energy is a major source of free energy used by enzymes to lower the activation energies of reactions.
   c. In an enzyme-catalyzed reaction, the activation energy ($\Delta G^{\ddagger}$) is directly proportional to the free energy change ($\Delta G$).
   d. A higher activation energy corresponds to a slower reaction.

3. The number of _____ defines the identity of an element.
   a. electrons b. protons c. neutrons d. positrons

4. Which of the following statements is **NOT TRUE**?
   a. Weak interactions between enzyme and substrate are optimized in the transition state.
   b. The tertiary structure of a globular protein is determined by its amino acid sequence.
   c. The occurrence of glycolysis and the TCA cycle in mitochondria facilitates electron flow to the respiratory chain.
   d. Coenzyme A acts as an acetyl group carrier.

5. When you run very fast for a few minutes, your thigh muscles become sore and painful because of:
   a. excess accumulation of pyruvic acid due to anaerobic glycolysis.
   b. excess accumulation of lactic acid due to anaerobic glycolysis.
   c. excess accumulation of citric acid due to a downregulated TCA cycle.
   d. excess accumulation of oxaloacetic acid due to a downregulated TCA cycle.

6. One effect of glucose phosphorylation within cells is to _____ glucose inside the cell.
   a. dissolve b. trap c. release d. import

7. Which of the following statements is **NOT TRUE**?
   a. Free fatty acids obtained in the diet or released from adipose tissue cannot pass directly through the mitochondrial membranes.
   b. In the oxidation of odd-number fatty acids, propionyl-CoA is converted to succinyl-CoA.
   c. The formation of malonyl-CoA from acetyl-CoA is an irreversible process catalyzed by malonyl-CoA decarboxylase (MCD).
   d. The brain, which preferentially uses glucose as fuel, can adapt to the use of ketone bodies under starvation conditions.

8. Mitochondrial DNA and chloroplast DNA:
   a. are always circular.
   b. are always linear.
   c. can be circular or linear.
   d. do not have genes.

9. Which of the following processes does gluconeogenesis **NOT** involve?
   a. Conversion of amino acids to glucose.
   b. Conversion of lactate to glucose.
   c. Conversion of glycerol to glucose.
   d. Conversion of glycogen to glucose.

10. Glycosaminoglycans are a family of linear _____ polymers composed of repeating disaccharide units.
   a. branched  b. anionic  c. cationic  d. chargeless

11. Enzymes enhance reaction rates by:
   a. stabilizing activation energies.
   b. destabilizing activation energies.
   c. increasing activation energies.
   d. decreasing activation energies.

12. Which of the following statements is **NOT TRUE**?
   a. Most vertebrate animals cannot use cellulose as a fuel source because they lack an enzyme to hydrolyze the $\alpha 1 \Rightarrow 4$ linkages.
   b. Hemoglobin has four polypeptide subunits, all of which are held together by noncovalent interactions.
   c. Virtually all the mass of an atom is concentrated in the nucleus.
   d. Proteins are polymers of amino acids, with each amino acid residue joined to its neighbor by a specific type of covalent bond.

13. The immediate donor of glucose residues in the reaction catalyzed by glycogen synthase is
   a. ADP-glucose  b. UDP-glucose  c. GDP-glucose  d. CDP-glucose

14. The catabolism of one molecule of a C-16 saturated fatty acid by beta oxidation leads to the formation of:
   a. 8 $FADH_2$, 8 NADH, and 8 acetyl CoA molecules.
   b. 8 $FADH_2$, 7 NADH, and 8 acetyl CoA molecules.
   c. 7 $FADH_2$, 8 NADH, and 8 acetyl CoA molecules.
   d. 7 $FADH_2$, 7 NADH, and 8 acetyl CoA molecules.

04 JUL 2023

15. Which of the following is the most polar amino acid?
a. Glycine b. Asparagine c. Serine d. Glutamate

16. The coenzyme required to convert dUMP to dTMP is:
a. S-adenosylmethionine. b. Coenzyme A.
c. Tetrahydrofolate. d. Pyridoxal phosphate.

17. Which one of the following steps happens during oxidative phosphorylation?
a. Electrons pass sequentially through the electron transport chain located in the outer and inner membranes of the mitochondria.
b. As electrons flow through the electron transport chain, protons are pumped into the mitochondrial matrix.
c. The entry of protons into the matrix of mitochondria is coupled with the production of ATP.
d. The streaming of protons through the $F_1$ subunit causes the $\alpha_3\beta_3$ spheroid to rotate.

18. The de novo biosynthesis of purine requires:
a. Fumarate, glycine, and aspartate b. Formate, glycine, and aspartate
c. Glycine, asparagine, and fumarate d. Glycine, asparagine, and formate

19. Epinephrine
a. decreases insulin secretion.
b. decreases oxygen delivery to tissues.
c. decreases glycogen breakdown in the liver and muscles.
d. decreases the mobilization of fatty acids from adipose tissue.

20. Which of the following statements is **NOT TRUE**?
a. 3-Phosphoglycerate is the precursor for serine, glycine, and cysteine.
b. In the urea cycle, carbamoyl phosphate synthetase I is allosterically activated by a metabolite synthesized from acetyl-CoA and glutamate.
c. Hypermethylation of guanine in CpG islands of the gene promoter is associated with gene silencing.
d. Pyruvate is an entry point into catabolism for amino acids like cysteine and threonine.

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SECTION "B"
[5Q × 3 = 15 marks]

Attempt *ANY FIVE* questions.

1. "You are what you eat", said Prof. Dr. Lynn Harrison to her Ph.D. student. What components should you ideally include in your diet for a healthy lifestyle? Focus on what is essential to your body.

2. Discuss the biological roles of miRNA, snRNA, and snoRNA.

3. How is glycogen phosphorylase regulated allosterically and hormonally? Write down the biological functions of muscle and liver glycogen.

4. Explain the repayment of the oxygen debt after vigorous activities.

5. What is gout, and how can it be treated? Explain the mechanism.

6. Jacques Monod, in 1954, said: "What is true of *E. coli* is true of the elephant." Elaborate on this quote.

7. Discuss the roles of the major types of lipoproteins found in your body.

SECTION "C"
[5Q × 5 = 25 marks]

Attempt *ANY FIVE* questions.

8. Explain in detail the pathway of beta oxidation of fatty acids. Write about the physiological significance of the pathway. [4+1]

9. With suitable figures, elaborate on the different forces stabilizing the three-dimensional structure of proteins.

10. Describe the pentose phosphate pathway. What are the consequences of a deficient pentose phosphate pathway?

11. Define vitamins and mention their types. Describe the mechanism of action and functions of vitamin D. What could be the consequences of folic acid deficiency in pregnant women and normal humans? [1+2+2]

12. Explain the urea cycle and write about its significance. What is the "Krebs bicycle"? [3+1+1]

13. With appropriate illustrations, describe how different hormones regulate fat metabolism.

14. Draw the structure of cytidine triphosphate. Describe the pyrimidine biosynthetic pathway. How do cells generate the precise amounts of pyrimidine they need? [1+3+1]

## SECTION "D"

[2 Q × 7.5 = 15 marks]

Attempt *ANY TWO* questions.

15. Discuss the three-dimensional structure of the B-form of DNA with appropriate illustrations. Write about the contributions of Erwin Chargaff and Rosalind Franklin to elucidating the structure. [4+1.5+2]

16. Discuss the complete catabolism of a molecule of glucose under aerobic conditions.

17. With suitable figures and examples, explain in detail the four levels of protein structure.