KATHMANDU UNIVERSITY
End Semester Examination [C]
April/May, 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 : 27 APR 2023

SECTION "A"
[20Q. × 1 = 20 Marks]

Encircle the most appropriate option.

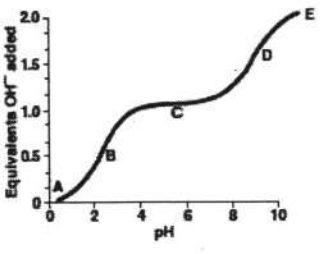
1. Cytoskeleton is found
   a. In both plant and animal cells
   b. In plant cells but not animal cells
   c. In animal cells but not in plant cells
   d. Neither in plant cell nor in animal cells

2. Which of the following is **NOT** a trait of living organisms?
   a. Ability to sense and to environmental changes
   b. Ability to move around
   c. Ability to self-replicate and self-assemble
   d. Ability to gradually evolve over time

3. In the history of the earth, which of the events likely came first
   a. Diversification of multicellular eukaryotes
   b. Appearance of photosynthetic sulfur bacteria
   c. Appearance of aerobic bacteria
   d. Appearance of endosymbionts

4. What was the conclusion of Anfinsen's experiment?
   a. Secondary structure of the protein determines tertiary structure
   b. Primary structure of protein determines tertiary structure
   c. Primary structure of the protein determines secondary structure
   d. Tertiary structure of the protein determines primary structure

5. The letters A through E designate certain regions on the titration curve for glycine (shown below). Which one of the following statements concerning this curve is correct?
   a. Point A represents the region where glycine is deprotonated.
   b. Point C represents the region where the net charge on glycine is 0.
   c. Point D represents the pKa of glycine's carboxyl group.
   d. Point E represents the pI for glycine.



6. Which of the following statements concerning the peptide shown below is correct?
Gly-Cys-Glu-Ser-Asp-Arg-Cys

a. The peptide contains glutamine.
b. The peptide contains a side chain with a secondary amino group.
c. The peptide contains a majority of amino acids with side chains that would be positively charged at pH 7.
d. The peptide is able to form an internal disulphide bond.

7. ADH requires NAD+ for catalytic activity. In the reaction catalyzed by ADH, an alcohol is oxidized to an aldehyde as NAD+ is reduced to NADH and dissociates from the enzyme. The NAD+ is functioning as a (an):

a. apoenzyme
b. coenzyme-cosubstrate
c. coenzyme-prosthetic group
d. cofactor

8. Which of the following statements about Michaelis-Menten kinetics is correct?

a. The Michaelis constant is defined as the concentration of the substrate required for the reaction to reach maximum velocity
b. Michaelis constant is defined as the dissociation constant of the enzyme-substrate complex
c. Michaelis constant is expressed in terms of reaction velocity
d. Michaelis constant is the measure of the affinity the enzyme has for its substrate

9. Which of the following processes does gluconeogenesis **NOT** entail?

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. What is one of the two activities of debranching enzymes during glycogenolysis?

a. Formation of alpha 1→ 6glycosidic bond
b. Formation of beta 1→4 glycosidic bond
c. Hydrolysis of alpha 1→6 glycosidic bond
d. Hydrolysis of beta 1→6 bond

11. The breakdown of one molecule of a C16 fully saturated fatty acid by beta oxidation leads to the formation of

a. 8 $FADH_2$, 8 NADH and 8 acetyl CoA molecules
b. 7 $FADH_2$, 7 NADH and 7 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

12. What does beta-oxidation involve?

a. Conversion of fatty acids to 2 carbon acetyl CoAs
b. Conversion of fatty acids to glycerol
c. Conversion of fatty acids to malanoyl CoA
d. Conversion of glucose to fatty acids

13. The following is the sum of three steps in the citric acid cycle.
$A + B + FAD + H_2O \rightarrow C + FADH_2 + NADH$
Choose the lettered answer that corresponds to the missing "A", "B", and "C".

	Reactant A	Reactant B	Reactant C
a.	Succinyl CoA	GDP	Succinate
b.	Succinate	NAD+	Oxaloacetate
c.	Fumarate	NAD+	Oxaloacetate
d.	Succinyl CoA	NAD+	Oxaloacetate

14. Which one of the following steps happens during oxidative phosphorylation?
a. Electrons pass through the electron transport chain in the outer membrane of the mitochondria
b. Protons are pumped out to the matrix of mitochondria
c. Proton's entry into the matrix of mitochondria is coupled with production of ATP
d. Proton's exit from the outer membrane of mitochondria is coupled to ATP production

15. A nucleoside contains
a. A 6 carbon sugar and phosphate group(s)
b. A 5 carbon sugar and a nitrogenous base
c. A nitrogenous base and a phosphate group(s)
d. A 5 carbon sugar and a phosphate group(s)

16. De novo purine biosynthesis requires
a. Fumarate, glycine and aspartate
b. Glycine, asparagine and fumarate
c. Formate, glycine and aspartate
d. Glycine, asparagine and formate

17. Which of the following compound is shared by the citric acid cycle and urea cycle?
a. Alpha-ketoglutarate
b. Oxaloacetate
c. Succinyl CoA
d. Fumarate

18. From the muscles to the liver, NH_4^+ is carried as
a. Glutamine
b. Glutamate
c. Arginine
d. Alanine

19. Retinol
a. can be enzymatically formed from retinoic acid
b. has alcohol functional group
c. is the light absorbing portion of rhodopsin
d. is phosphorylated and dephosphorylated during visual cycle

20. Which vitamin can be synthesized from precursors in the human body?
a. Vitamin B1
b. Vitamin B3
c. Vitamin B2
d. Vitamin B12

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SECTION "B"
[5Q. × 3 = 15 marks]

Attempt *ANY FIVE* questions.

1. Describe alpha-keratin?

2. What are six classifications of enzymes? Draw their general equation.

3. Draw two anomeric forms of glucose. How are they formed?

4. Draw a general structure of a lipoyl group. How is this structure related to the function of the molecule?

5. Draw full structures of CTP and dATP and AMP-CMP connected by phosphodiester bond.

6. Draw the structure of proline and tryptophan. Describe the synthesis and breakdown of these amino acids.

7. Write a short note on nitric oxide and its signaling pathway

SECTION "C"
[5Q. × 5 = 25 marks]

Attempt *ANY FIVE* questions.

8. What is the difference between chemoheterotrophs and photoautotrophs? Illustrate with examples.

9. Describe the functions of chylomicron, VLDL, LDL and HDL, and relate their composition to their function.

10. Fill in the table below:

Complex	First electron donor	Last electron acceptor	Number of protons pumped out	Overall equation
1				
2				
3				
4				

Write down the overall equation of electron transfers from 1 molecule of NADH and $FADH_2$ to oxygen.

11. Carbonic anhydrase of erythrocytes (Mr 30,000) has one of the highest turnover numbers known. It catalyzes the reversible hydration of CO_2:
$H_2O + CO_2 \rightarrow H_2CO_3$
This is an important process in the transport of CO_2 from the tissues to the lungs. If 10.0 microgram of pure carbonic anhydrase catalyzes the hydration of 0.30 g of CO_2 in 1 min at 37 degree Celsius at V_{max}, what is the turnover number (k_{cat}) of carbonic anhydrase (in units of min^{-1})?

12. With diagrams describe the 10 steps of glycolysis. Describe how many ATPs and NADHs are generated.

13. Describe how atmospheric N_2 is converted to NH_4^+.

14. Write a short note on Vitamin D. Describe its biosynthesis and function. What does happen during vitamin D deficiency?

SECTION "D"

[2Q. × 7.5 = 15 marks]

Attempt *ANY TWO* questions.

15. How are peptides synthesized in vitro? Briefly mention how overall yield varies with percentage efficiency of each step. [5 + 2.5]

16. Draw the structure of a triacylglycerol. Label the functional groups. Draw the structure of different phospholipids. Label the functional groups.

17. Describe the process of conversion of ribonucleotides to deoxyribonucleotides. How is this process regulated? Describe.