



MAASAI MARA UNIVERSITY

**REGULAR UNIVERSITY EXAMINATIONS
2018/2019 ACADEMIC YEAR
END OF FIRST TRIMESTER EXAMS**

**SCHOOL OF HEALTH SCIENCES
BACHELOR OF SCIENCE NURSING (BSc.N)**

COURSE CODE: NUR 1105

COURSE TITLE: MEDICAL BIOCHEMISTRY I

DATE: 21ST AUGUST, 2019

TIME: 0830 - 1130 HRS

INSTRUCTIONS TO CANDIDATES

This paper has THREE sections. Answer ALL questions in sections A and B. Answer only TWO questions in section C.

This paper consists of six printed pages. Please turn over.

SECTION A: Answer ALL questions in this section

1. Certain nucleic acids harbour significant free energy that can be released and coupled to the synthesis of biological molecules. Which of the following represents a nucleic acid form containing the greatest amount of free energy?
 - A. Adenosine triphosphate
 - B. Adenosine
 - C. Adenosine monophosphate
 - D. Adenosine diphosphate
2. Which two polysaccharides share all of their glycosidic linkage types in common?
 - A. Cellulose and amylopectin
 - B. Amylose and glycogen
 - C. Amylose and cellulose
 - D. Glycogen and amylopectin
3. Which of the following statements regarding differences between DNA and RNA is **FALSE**?
 - A. DNA is double-stranded, whereas RNA is single-stranded.
 - B. DNA uses the nitrogenous base thymine; RNA uses uracil.
 - C. The sugar in DNA is deoxyribose; the sugar in RNA is ribose.
 - D. DNA strands replicate in a 5' to 3' direction, whereas RNA is synthesized in a 3' to 5' direction.
4. Water is the universal solvent for biological systems. Compared to ethanol, for example, water has a relatively high boiling point and high freezing point. This is due primarily to which one of the following properties of water?
 - A. Its hydrophobic effect
 - B. Ionic interactions between water molecules
 - C. Hydrogen bonds between water molecules
 - D. Van der Waals interactions
5. The release of insulin from the β -cells of the pancreas requires Ca^{2+} influx through a channel that is activated by a change in the membrane potential across the plasma membrane. The movement of calcium across the membrane is an example of which one of the following?
 - A. Voltage-gated channel
 - B. Passive diffusion
 - C. Active transport
 - D. Ligand-gated channel
6. Enzymes increase the rate of a reaction by:
 - A. Decreasing the activation energy.
 - B. Increasing the overall free energy change of the reaction.
 - C. Increasing the activation energy.
 - D. Decreasing the overall free energy change of the reaction.
7. Which of the following statements below is **NOT** a physical property of alkanes?
 - A. The boiling points increases with the number of carbons

- B. Those with more than fifteen carbons exist as solid at room temperature
- C. Those with more than four but less than twenty carbons are liquid at room temperature.
- D. Those with less than 4 carbons are gaseous at room temperature
8. Select **ONE** that best defines the cyclic forms of monosaccharides.
- Hemiacetals.
 - Hemiketals.
 - Acetals.
- A. i and iii only
- B. i and ii only
- C. ii and iii only
- D. i, ii, and iii
9. Gangliosides have considerable physiological and medical significance. Which among the ones given below **DOES NOT** confirm this statement?
- A. Act as specific receptors for certain pituitary glycoprotein hormones
- B. Act in cell-cell recognition
- C. Receptor for cholera toxin
- D. Give integrity to the plasma membrane
10. Below are some evidences that illustrate the change of replicating systems to protobionts. Select one that **DOES NOT** show this change.
- A. Natural selection would have acted to biochemical sophistication of protobionts.
- B. Heating and cooling mixtures of amino acids can form spherical proteinoids.
- C. Mixtures of lipids and proteins can form liposomes.
- D. Liposomes can “reproduce” by budding off smaller units.
11. The quaternary structure of a given protein is defined by which of the following?
- A. Linear order of the amino acids
- B. Ordered organization of secondary structures within the protein
- C. Structure resulting from the interactions between multiple polypeptide chains
- D. Overall structure resulting from association of domains within the protein
12. In a single strand of a nucleic acid, nucleotides are linked by:
- A. Hydrogen bonds.
- B. Phosphodiester bonds.
- C. Ionic bonds.
- D. Van der Waals forces.
13. Which of the statements below **BEST** explains the functions of oxidoreductases?
- A. Act on many chemical groupings to add or remove hydrogen atoms.
- B. Regulate metabolism by transferring phosphate from ATP to other molecules.
- C. Add water across a bond
- D. Cleave various bonds by means other than hydrolysis and oxidation
14. Below are points to be taken into account when reference is made to pH and its scale. Which one is **ODD**?

- A. No direct relationship exists between the magnitudes of $[H^+]$ and pH.
B. A pH of 7 indicates neutrality only at 25°C.
C. The pH of a solution varies between 0 and 14.
D. There is no relationship between pH and the temperature change
15. The **MOST** abundant phospholipids in the membrane is:
A. Phosphatidyl Glycerol
B. Glycerophospholipids
C. Sphingolipids
D. Phosphotidyl Choline
16. In the β -sheet structure of proteins, the hydrogen bond on the peptide bond nitrogen of one of the peptides will most likely form a hydrogen bond with which of the following?
A. Hydrophilic side chains in the adjacent sheet segment
B. Hydrophobic side chains in the adjacent sheet segment
C. Peptide bond carbonyl in the adjacent sheet segment
D. Peptide bond carbonyl within 3 amino acids of the same segment
17. Which of the following **BEST** describes the characteristics of polar amino acids?
A. Ionizable in water
B. More likely to be exposed to water than to be found in the interior of a folded protein
C. Partially charged due to the oxygen atom in their carboxyl group
D. Partially charged due to fairly consistent sharing of electrons among atoms in their R group
18. The following are some structural properties of sphingolipids.
i. They are all phospholipids.
ii. They all contain a sphingosine backbone.
iii. They can have either phosphodiester or glycosidic linkages to their polar head groups.
- Which of the following is/are **TRUE** about sphingolipids?
A. i only
B. iii only
C. ii and iii only
D. i, ii, and iii
19. Choose the statement that **DOES NOT** relate to maltose.
A. Has an α , β -1,2-glycosidic bond
B. Is a reducing sugar
C. Has a α -1, 4-glycosidic bond
D. Is obtained from the breakdown of starches.
20. Biochemistry impacts on human beings in different ways. Which one among the ones given below **DOES NOT**?
A. Medicine
B. Industrial applications
C. Environmental applications
D. Sports

SECTION B: Answer ALL questions in this section (40 mrks)

- 1.
- Write the equation for the Gibb's Free Energy (1 mrks)
 - Differentiate between spontaneous and non-spontaneous reactions (3 mrks)
 - Use a diagram to show the difference between 'High' and 'Low' energy phosphate compounds (4 mrks)

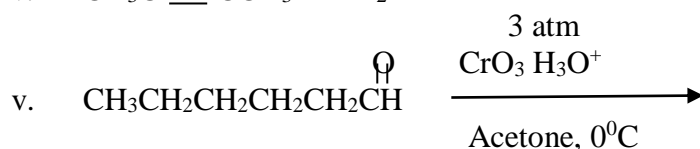
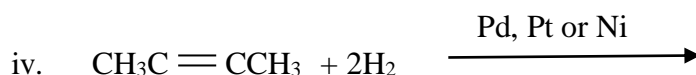
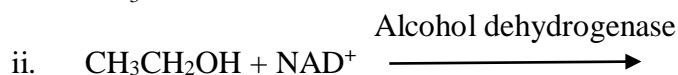
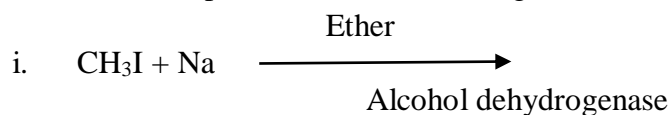
2.

Write the following biochemical equations

- Formation of Cystine (2 mrks)
- To show the ionic properties of amino acids at physiological pH (2 mrks)
- For some important amines produced from decarboxylation of amino acids (2 mrks)
- Amide formation (2 mrks)

3.

- Outline **THREE** physical properties of alkenes (3 mrks)
- Write the products of the following reactions (5 mrks)



4.

- State the principle areas of Biochemistry (4 mrks)
- Discuss the solubility of ionic compounds in water (4 mrks)

5.

- Define the following terms as applied in enzymology
 - Substrate (½ mrks)
 - Apoenzyme (½ mrks)
 - Holoenzyme (½ mrks)
- Outline factors that affect the rate of enzyme activity (2½ mrks)
- Draw a well labelled diagram of the structure of mRNA (4 mrks)

SECTION C: Answer only TWO questions of your choice (40 mrks)

1.
 - a. Organic compounds differ in terms of functional groups present. Draw the structures of the following organic compounds to illustrate different functional groups present in each (5 mrks)
 - i. 2,2-dimethylpropane
 - ii. 2-Bromo-5-methylhexane
 - iii. 2 methyl-1-propanol
 - iv. 3-methylpentanal
 - v. 4-hydroxy-3-methyl-2-butanone
 - b. Carboxylic acids are common compounds in the body of living organisms. Discuss the physical properties of both carboxylic acids and phenols (5 mrks)
 - c. Nucleic acids are one the biomolecules studied in Medical Biochemistry. Discuss both the physical and chemical properties of nucleic acids (10 mrks)
2.
 - a. Blood type is based on three or four monosaccharides attached to a membrane protein of red blood cells. Discuss the carbohydrates in different blood groups and where possible draw their structures (10 mrks)
 - b. Based on the chemical theory of evolution, discuss the conversion of biological polymers into replicating systems and the evidence thereof (10 mrks)
3.
 - a. Cross membrane movement of small molecules is one of the mechanism through which transportation occurs in biomembranes. Based on this fact explain the following terms in relation to biomembranes.
 - i. The transport systems (4 mrks)
 - ii. While citing examples the primary active transport (6 mrks)
 - b. Several forces govern the interactions of different domains that are fundamental functional units of tertiary structure of protein. Explain these forces in details. (10 mrks)
4.
 - a. Lipids are very crucial compounds that support the lives of living organism. Discuss their functions in the human body (10 mrks)
 - b. Enzymes can be used to diagnose different conditions in specific tissues. Discuss the Lactate dehydrogenase in this regard (10 mrks)

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