NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH, NATURAL RESOURCES AND APPLIED SCIENCES

DEPARTMENT OF HEALTH SCIENCES

QUALIFICATION: BACHELOR OF MEDICAL LABORATORY SCIENCES/BACHELOR OF HUMAN NUTRITION	
QUALIFICATION CODE: 08BMLS/08BOHN	**LEVEL**: 5
COURSE: BIOCHEMISTRY/INTRODUCTION TO BIOCHEMISTRY	**COURSE CODE**: BIO521S/IBC521S
SESSION: JANUARY 2023	**PAPER**: THEORY
DURATION: 3 HOURS	**MARKS**: 120

SUPPLEMENTARY/ SECOND OPPORTUNITY EXAMINATION QUESTION PAPAER	
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INSTRUCTIONS
1. Answer all questions. 2. Please write neatly and legibly. 3. Do not use the left side margin of the exam answer book. 4. No books, notes or other additional aids are allowed. 5. Mark all answers clearly with their respective question numbers.

Non-programmable calculator is allowed.

THIS QUESTION PAPER CONSISTS OF 8 PAGES (Including this front page)

SECTION A **[20]**

Question 1: Multiple Choice

1.1 Which organisms obtain their food by absorption through filaments called hyphae? (1)

a. Protista
b. Plantae
c. Archaea
d. Fungi

1.2 Which of the following kingdoms contains multicellular organisms that ingest their food? (1)

a. Protista
b. Animalia
c. Plantae
d. Archaea

1.3 From the biological viewpoint, solutions can be grouped into (1)

a. Isotonic solution
b. Hypotonic solutions
c. Hypertonic solution
d. All of these

1.4 _____ cells are cells that lack a membrane-bound nucleus. (1)

a. Animal
b. Prokaryotic
c. Fungal
d. Eukaryotic

1.5 The kidneys contribute to acid–base balance by (1)

a. Secretion of ammonia
b. Decreased carbon dioxide uptake
c. Regulating the pCO_2
d. Increased ketogenesis

1.6 pKa

a. Indicates the strength of an acid (1)
b. Reflects the pH of the solution
c. Is a measure of the buffer capacity
d. Is high when the acid is weak

1.7 The normal pH of human blood is (1)

a. 7.0–7.1
b. 7.25–7.3
c. 7.35–7.4
d. 7.5–7.55

1.8 Compensatory response for respiratory alkalosis involves (1)

a. Decrease in bicarbonate levels
b. Increase in bicarbonate levels
c. Decrease in pCO_2
d. Increase in pCO_2

1.9 Which of these amino acids does not have optical isomer(s) (1)

a. Alanine
b. Histidine
c. Threonine
d. Glycine

1.10 The following forces may play a role in the formation of quaternary structure EXCEPT (1)

a. Hydrogen bonds
b. Disulphide bridges
c. Electrostatic interactions
d. Peptide bonds

1.11 Insulin (1)

a. is made up of two polypeptide chains
b. has four disulphide linkages
c. contains 55 amino acids
d. is a glycoprotein

1.12 The physiological pH amino acid solutions (1)

a. contain both positive and negative charges
b. contain positively charged side chains
c. contain only positive charge
d. contain negatively charged side chains

1.13 In phenylketonuria (PKU), the compound accumulated in the urine is (1)

a. Homocysteine
b. Tryptophan
c. α-keto acid
d. Phenylpyruvate

1.14 Thyroxine is derived from (1)

a. Thiamine
b. Threonine
c. Tyrosine
d. Tryptophan

1.15 The reactions of the urea cycle occur in (1)
a. Cytosol
b. Mitochondrial matrix
c. Lysosome
d. Mitochondrial matrix and the cytosol

1.16 The major source of ammonia in the kidneys is (1)
a. Glutamine
b. Alanine
c. Creatinine
d. Leucine

1.17 Denaturation of proteins results in (1)
a. Disruption of primary structure
b. Breakdown of peptide bonds
c. Destruction of hydrogen bonds
d. Irreversible changes in the molecule

1.18 Which of these serum enzyme activities rises 4–8 hours after acute myocardial infarction (AMI)? (1)
a. AST
b. ALT
c. CKMB
d. LDH

1.19 Enzymes increase reaction rates by (1)
a. Altering the change in free energy of the reaction
b. Inhibiting the backward reaction
c. Enhancing the forward reaction
d. Decreasing the energy of activation

1.20 Enzyme activity regulation include the following except (1)
a. Allosteric activation
b. Competitive inhibition
c. Suicide inhibition
d. Covalent modification

SECTION B **[100]**

Question 2: Fill the blank spaces only by writing down the number and the correct missing expression (1 mark per correct answer). **(20)**

2.1 _____ acid is the study that explains how different sequences of biochemical reactions interact with each other for survival of cell (organism) under various conditions.

2.2 In Induced Fit Model, the enzyme molecule of amino acid residues that make up the _____are not oriented properly in the absence of substrate.

2.3 In spermatozoa, _____ accounts for 90% of cell whereas in other cells, it accounts for less than 10% of the cell.

2.4 _____amino acids are amino acids that can be converted to glucose

2.5 When the CO_2 level in the blood rises (as it does when you hold your breath), the excess CO_2 reacts with water to form additional carbonic acid and _____ blood pH.

2.6 Lactic acid enhances tissue oxyhaemoglobin dissociation and expansion of the coronary vessels, therefore compensates _____ phenomena.

2.7 Amino acids are _____for proteins.

2.8 Deamination of an amino acid is coupled with amination of _____acid.

2.9 To form polypeptides and proteins, amino acids are joined together by _____bonds.

2.10 _____are long, rod-shaped molecules that are insoluble in water and physically tough.

2.11 The_____concentration that produces half the maximal velocity (Vmax/2) is known as Michaelis constant.

2.12 Substances that decrease the catalytic activity of enzymes are called _____.

2.13 One difference between 'chemical catalysts and enzymes is that enzymes are _____ in the type of reaction to be catalysed and they function within a moderate range of hydrogen ion concentration and temperature along with certain other specified conditions.

2.14 Catalytic efficiency of enzymes can be regulated by _____or inhibition.

2.15 Enzymes may be termed as 'molecular switches', which regulate the catalytic activity and transfer of _____ in the biological system.

2.16 Obesity is accumulation of _____ in the body.

2.17 Insulin decreases _____in the liver.

3.18 Carbohydrates are defined as polyhydroxy derivatives of aldehydes or _____.

2.19 _____ are polymers of the same monosaccharide units, e.g. starch, glycogen, inulin, cellulose, dextrin, dextran.

2.20 _____are stereoisomers that are mirror images of each other.

Question 3: Match the correct expressions or definitions by writing down the number and the letter only (1 mark per correct answer). **(20)**

a. Essential amino acids
b. Mitochondria
c. Lectins
d. Glucogenic
e. Hydrolytic enzymes
f. Amino acids
g. Lectins
h. Catalytic
i. Axial
j. Glycoproteins
k. Golgi bodies
l. Amphoteric properties
m. A buffer
n. Albinism
o. Glycerophospholipids
p. Amphipathic
q. Phenylalanine hydroxylase
r. Michaelis–Menten constant
s. Dissociation constant
t. Cholesterol
u. Organic solvent
v. Prokaryotes
w. Amphipathic
x. pH
y. Isoenzymes

3.1 _____ are predominantly present in those subcellular organelles, which are bound by a membrane.
3.2 _____are called 'powerhouses' of the cell.
3.3 Proteins produced by the ribosomes are stored in the form of secretory granules in the _____.
3.4 _____are the monomeric units, which are joined together to form proteins.
3.5 _____need to be supplied in the form of dietary proteins.
3.6 _____amino acids yield pyruvate or any of the intermediates of the TCA cycle.
3.7 _____ proteins act as biocatalysts in various metabolic reactions, known as enzymes, e.g. hexokinase and lactate dehydrogenase.
3.8 Proteins exhibit _____. Each protein has an isoelectric pH at which there is no net charge on the protein.
3.9 phenylketonuria is an inborn error of amino acid metabolism. _____ is the deficient enzyme.

3.10 _____ occurs due to the deficiency of the enzyme tyrosinase.

3.11 Blood _____ plays a very important role in the maintenance of body homeostasis.

3.12 _____ is defined as a solution which resists a change in pH when an acid or a base is added.

3.13 pKa is the negative logarithm of the _____ of a weak acid.

3.14 _____ is the characteristic of an enzyme at any given pH and temperature. It helps to evaluate the affinity of the enzyme towards its substrate.

3.15 _____ are enzymes that catalyse the same chemical reaction, but differ from each other structurally, electrophoretically and immunologically (e.g LDH).

3.16 _____ These proteins bind to specific carbohydrate structures.

3.17 The storage form of fatty acids is _____

3.18 In addition to phospholipids and glycolipids, _____ is a major type of membrane lipid.

3.19 _____: A term applied to molecules that have both hydrophilic and hydrophobic moieties.

3.20 A lipid is defined as a compound soluble in _____.

Question 4: Short Answers **(40)**

4.1 The major carbohydrates present in our diet are starch, glycogen, sucrose, lactose, maltose and very little concentrations of fructose and pentose.

a. Describe the structures and functions of chitin and starch. (4)

b. State briefly four regulation processes of blood glucose. (4)

c. What are the structural differences between maltose, sucrose and lactose? (3)

d. Name the three enzymes involved in the process of gluconeogenesis. (3)

e. Why is a Citric Acid Cycle said to be an anaplerotic process? (2)

f. What is glycogenolysis? (2)

4.2 The animal sources of protein and lipids include milk, butter, ghee, meat, and fish.

a. Explain the difference between oil and fat. (2)

b. What are prostaglandins and what is its precursor? (3)

c. Name two polyunsaturated fatty acids (PUFAs) (2)

d. Name three constituents of cephalin and three constituents for lecithin (6)

e. Name three glucogenic amino acids. (3)

f. What is known as animal starch? What is it structural particularity? (2)

g. What is Cori cycle and explain the events that place in that cycle? (4)

[20]

Question 5: Calculation

5.1 A solution of a certain weakly acidic substance was prepared by dissolving and diluting 2.344 g to a final volume of 100 mL. In a titration, 42.6 mL of 0.250 M NaOH solution was required to reach a successful endpoint. The shape of the titration curve was used for the assumption that the acid was monoprotic. The pH at the endpoint was 9.4.

a. Calculate the apparent molecular weight of the unknown acid. (2)

b. Calculate the K_a for the acidic substance. (3)

c. Calculate the pH of the original 100 mL solution (prior to titration). (2)

d. Calculate the pH at the midpoint of the titration (after addition of 21.3 mL of the sodium hydroxide solution). (2)

3.2 A solution of 25.8 mL of 0.328 M sodium hydroxide is required to titrate 50.0 mL of sulfuric acid. Calculate the concentration of the acid (3)

5.3. A windscreen washing liquid contains 2.00 g/L ammonia. What is the pH of this liquid? The molecular weight of NH_3 =17 g/mol (3)

5.4. You need to prepare a buffer solution at pH = 7.00 with KH_2PO_4 and Na_2HPO_4. What would be the respective concentration of these substances if you wished to obtain a final phosphate concentration ($[HPO_4^{-2}] + [H_2PO_4^{-1}]$) of 0.3M? (5)

THE END