namibia university
OF SCIENCE AND TECHNOLOGY

Faculty of Health 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: NOVEMBER 2019	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 100

FIRST OPPORTUNITY EXAMINATION QUESTION PAPER	
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MODERATOR:	PROF HABAUKA KWAAMBWA

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

Question 1: Multiple Choice   **[20]**

1.1   Which of the following is/are characteristic of living organisms?   (1)

      a. Organised structure and Responsiveness to stimuli

      b. Responsiveness to stimuli

      c. Organised structure + Responsiveness to stimuli + Maintenance of homeostasis

      d. Maintenance of homeostasis

1.2   Which one of the following is a conjugate acid–base pair?   (1)

      a. NH_2^- and NH_4^+

      b. NH_3 and NH_4^+

      c. NaF and F^-

      d. H_3O+ and OH^-

1.3   Ammonia (NH_3) acts as a weak base in aqueous solution. What is the   (1)
acid that reacts with this base when ammonia is dissolved in water?

      a. None, there are no acids in pure water

      b. H_2O

      c. Oxygen that is always dissolved in water

      d. NH_4^+

1.4 Which of the following substances will dissolve in water to produce an acidic   (1)
solution?

      a. $FeCl_3$

      b. NH_3

      c. $NaC_2H_3O_2$

      d. $C_6H_{12}O_6$

1.5   Which of the following sentences is not true with respect to proteins?   (1)

      a. There are 20 amino acids in the protein we require everyday

      b. There is a limiting amino acid content in maximum quantity of protein

      c. Lysine is an essential amino acid.

      d. The requirement of essential amino acids per kg of protein is called 'reference pattern of amino acids'

1.6   Which of the following is the name given to molecular chaperones?   (1)

    a. Denaturation protein

    b. Allosteric protein

    c. Ribonuclease

    d. Heat shock protein

1.7   An inorganic ion required for the activity of an enzyme is known as   (1)

    a. Activator

    b. Coenzyme

    c. Cofactor

    d. Holoenzyme

1.8   What is an apoenzyme?   (1)

    a. It is a non-protein group

    b. It is a complete, biologically active conjugated enzyme

    c. It is a protein portion of an enzyme

    d. It is a prosthetic group

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

    a. Fungal

    b. Prokaryotic

    c. Eukaryotic

    d. Plant

1. 10   Compensatory response for respiratory alkalosis involves   (1)

    a. Increase in bicarbonate levels

    b. Decrease in pCO_2

    c. Decrease in bicarbonate levels

    d. Increase in pCO_2

1.11   A peptide which acts as potent smooth muscle hypotensive agent is   (1)

    a. Bradykinin

    b. Gramicidins

    c. Tryocidine

    d. Glutathione

1.12   Enzymes accelerate the rate of reactions by   (1)

     a. Increasing the equilibrium constant of reactions

     b. Decreasing the free energy change of the reaction

     c. Increasing the energy of activation

     d. Decreasing the energy of activation

1.13   A fatty acid which is not synthesized in the body and has to be supplied   (1)
in the diet is

     a. Linolenic acid

     b. Palmitic acid

     c. Lauric acid

     d. Palmitoleic acid

1.14   Propionyl CoA is formed on oxidation of   (1)

     a. Monounsaturated fatty acids

     b. Only unsaturated fatty acids

     c. Fatty acids with odd number of carbon atoms

     d. None of these

1.15   Lipids are stored in the body mainly in the form of   (1)

     a. Triglycerides

     b. Phospholipids

     c. Fatty acids

     d. Glycolipids

1.16   Deterioration of food (rancidity) is due to   (1)

     a. Peroxidation of lipids

     b. Cholesterol

     c. Vitamin E

     d. Phenolic compounds

1.17   Sorbitol is a   (1)

     a. Reducing sugar

     b. Sugar ester

     c. Sugar alcohol

     d. Glycoside

1.18   Each of the following vitamins is required for reactions in the oxidation   (1)

of pyruvate to CO_2 and H_2O EXCEPT

a. Niacin

b. Thiamine

c. Biotin

d. Riboflavin

1.19   Tetracycline, streptomycin and erythromycin are effective antibiotics   (1)

because they inhibit:

a. RNA synthesis in prokaryotes

b. RNA synthesis in eukaryotes

c. Protein synthesis in prokaryotes

d. Protein synthesis on cytoplasmic ribosomes of eukaryotes

1.20   In humans, the following statements about uric acid are true EXCEPT: (1)

a. It is the main product of purine metabolism

b. It is present in excessive amounts in gout

c. It is converted to urea in the liver

d. Xanthine dehydrogenase is one of the enzymes involved in its

formation

SECTION B   [80]

Question 2: Fill the blank spaces only by writing down the number and the   [20]
correct missing expression

2.1   To form_____ and proteins, amino acids are joined together   (1)

by peptide bonds.

2.2   Human chromosomes are composed of _____ chromatin, which   (1)

consist of DNA and proteins histones

2.3   The actual order of the amino acids in the protein is called its _____   (1)

and is determined by DNA.

2.4 The respiratory system contributes to the balance of acids and bases in The body by regulating the blood levels of _____ formed by the equilibrium reaction of CO_2 water in in the blood. (1)

2.5 Obesity is accumulation of _____ in the body. (1)

2.6 pKa is the negative logarithm of the _____ constant for a weak acid. (1)

2.7 Insulin decreases _____ process in the liver. (1)

2.8 There are 20 different amino acids commonly found in _____. (1)

2.9 Transcription process is catalysed by the enzyme _____. (1)

2.10 Proteins can also be classified into families and super families, according to their sequence _____ as well as their shapes and composition. (1)

2.11 Genetic information is contained in _____, which in eukaryotes is located mainly in the nucleus (1)

2.12 Globular proteins (e.g., haemoglobin) are _____, spherical molecules that are usually soluble in water. (1)

2.13 Biosynthesis of cellular nucleic acids is largely dependent on the _____ synthesis of nitrogenous bases, namely purines and pyrimidines. (1)

2.14 Enzymes follow the basic physical and chemical_____of proteins. (1)

2.15 Carbohydrates are defined as polyhydroxy derivatives of aldehydes or _____. (1)

2.16 _____ are polymers of the same monosaccharide units, e.g. starch, glycogen, inulin, cellulose, dextrin, dextran. (1)

2.17 _____ are stereoisomers that are mirror images of each other. (1)

2.18 In _____, the conversion of pyruvate to lactate is the essential step. (1)

2.19 The formation of ketone bodies is called _____ and their utilisation is called ketolysis. (1)

2.20 Sphingolipids are involved in intracellular communication and as _____ determinants of the ABO blood groups. (1)

Question 3: Short Answers [40]

3.1 Name the four buffer systems in the body. (4)

3.2 What is the difference between holoenzyme, apoenzyme and abzyme? (3)

3.3 Name six functions of protein. (6)

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

3.5 Name three constituents of cephalin and three constituents for lecithin (6)

3.6 What are the roles of prostaglandins? (2)

3.7 What is respiratory acidosis? (2)

3.8 Describe briefly the principle of each of the following tests:

    a. Ninhydrin test (2)

    b. Xanthoproteic test (2)

    c. Sudan III dye (2)

3.9 After you have defined the principle of the Barfoed's test, explain why the Barfoed's test is said to be a quantitative determination test for sugars. (4)

3.10 After defining reducing sugar. Give an example of a reducing monosaccharide and an example of a reducing disaccharide sugar. (3)

3.11 Name an activator and an inhibitor of the Gluconeogenesis pathway (2)

Question 4: Calculation [20]

4.1 Calculate the fluoride ion concentration and pH of a solution that is 0.20 M in HF and 0.10 M in HCl. The equilibrium constant for the ionization of HF is 6.8×10^{-4}. (5)

4.2 What is the pH of the following solutions?

    a. 0.35 M hydrochloric acid (2)

    b. 0.35 M acetic acid (pKa = 4.76) (3)

4.3 A weak acid, HA, has a total concentration of 0.20 M and is ionized (dissociated) by 2%;

    a. What is the Ka for this acid? (3)

    b. Calculate the pH for this acidic solution. (2)

4.4 You have been given the kinetics data of the enzyme below.

     a. Calculate the Km and the Vmax of the enzyme   (2)

     b. Determine the velocity of the enzyme at 4×10^{-6} M   (3)

Peptide concentration M (10^{-4})	Velocity (Mμmol/min) 10^{-6}
2.5	2.2
5	5.8
10	5.9
15	7.1
20	7.1
25	7.1

$$v = \frac{[S]\,V_{max}}{[S] + K_m}$$

$$v[S] + vK_m = [S]V_{max}$$

$$vK_m = [S]V_{max} - v[S]$$

$$vK_m = [S]\,(V_{max} - v)$$

$$K_m = \frac{[S]\,(V_{max} - v)}{v}$$

END OF EXAM