

LUSAKA APEX
MEDICAL UNIVERSITY



FACULTY OF PRE-MEDICAL SCIENCES

UNIVERSITY EXAMINATIONS JULY 2020

BS 1001

CELLS AND BIOMOLECULES

FRIDAY 31st JULY 2020

DURATION: Four Hours

TOTAL MARKS: 100

Examiners: Ms. K. Malisa, Mr M. Mudenda & Ms. L. Chanda

INSTRUCTIONS FOR THE WHOLE PAPER

1. Write your Student Identity Number on ALL pages of the answer booklet(s).
2. Follow the instructions outlined in each section on the number of questions to answer.
3. Present your work in a clear and logical and legible manner.
4. Any disregard for examinations rules and regulations will result in you being disqualified from this examination.
5. Ensure that you upload your answer scripts in PDF format to the Moodle platform before the end of the exam duration.
6. Answer scripts with identical entries will automatically be disqualified.

SECTION A [40 Marks]

Answer All the questions in this section.

A1. The Scientific Method.

Dr. Moono, a Lecturer and Researcher at one of the local universities in Lusaka City is concerned about the effects of alcohol intake on the academic performance of students at her university. What steps can Dr. Moono take to best study these effects? [10 Marks]

A2. The Origin of Life

- a) In 1859 a scientist proposed the theory spontaneous generation. What was the name of the scientist? [1 Mark]
- b) Briefly state the theory of spontaneous generation. [2 marks]
- c) In a quest to disprove the theory of spontaneous generation, several scientists conducted experiment to argue for or against spontaneous generation. John Needham. Argued for spontaneous generation. Which scientist disproved John Needham's experiment to prove the theory of spontaneous generation? [1 mark]
- d) Briefly explain the experiment that conclusively disproved the idea of spontaneous generation? [2 marks]
- e) What does the term abiogenesis mean? [1 mark]
- f) "Individuals with characteristics best suited to their environment are more likely to survive, reproduce successfully and pass their genes on to their children. Individuals that are poorly adapted to their environment are less likely to survive, reproduce and pass their genes to the next generation." Which scientist suggested this theory?[1 mark]
- g) The scientist in (f) largely based his theory on what organism found where? [2 marks]

A3. Classification of Organisms

- a) What Language is used in the naming of organisms scientifically? [1 Mark]
- b) What is the two-word system of naming organisms called? [1 Mark]
- c) Which Scientist was responsible for developing the two-word system of naming organisms as stated in (b) above? [1 Mark]
- d) Classify a human being up to species level. Ensure that you use the scientific rules of naming and writing. [7 Marks]

A4. Early Developments and Discoveries in Biology

Complete the following table on early developments and discoveries in biology by filling in the year of the event. [10 Marks]

DEVELOPMENT/DISCOVERY	YEAR
German Botanist Matthias Schleiden concluded that all plants are made up of cells	
German Physician Rudolf Virchow concluded that all cells arise from pre-existing cells	
Robert Hooke first used the word cell to describe the basic unit of organisms as observed in a thin slice of cork.	
German Zoologist Theodore Schwann concluded that all animals are made up of cells	
Anton van Leeuwenhoek, used a microscope with one lens to observe insects and other specimen.	

SECTION B [20 Marks]

Instruction: Question B1 is compulsory. Answer question B1 and any other (one) question.

B1. Mitosis and Meiosis

- a) What are the similarities and differences between meiosis 1 and mitosis?
- b) What are the differences between binary fusion and mitosis?
- c) Mention the differences between Prophase in Mitosis and Prophase in Meiosis 1. [10 Marks]

B2. Prokaryotic and Eukaryotic Cells

- a) An organism consists of ribosome, cytoplasm, cell wall, cell membrane and a nucleoid.
What type of cell is it? [1 mark]
- b) Name one feature Prokaryotic and Eukaryotic cells have in common? [1 mark]
- c) What component or molecule do bacterial cell walls contain that differs from all other cells? [1 mark]
- d) What is the composition of the fluid found in the vacuole? [1 mark]
- e) Which organism among plants, bacteria, fungi and protozoa do not contain cells with cell wall? [1 mark]
- f) State which component in the cell is known as the? [5 marks]
 - i. Powerhouse of the cell
 - ii. Storage organelle for genetic material
 - iii. Site for metabolic reactions
 - iv. Control center of the cell
 - v. Site for protein synthesis

B3. Cell Membrane and Cell Transport

- a) What kind of solution should a cell be placed in for it to become lysed? [1 mark]
- b) Give an example of a transmembrane protein. [1 mark]
- c) Which form of membrane transport does NOT require the expenditure of energy by the cell?
[1 Mark]
- d) Given a cell with concentration of solutes in the environment lesser than the concentration of solutes in the surrounding fluid.....
- i. the extracellular fluid is said to be? [1 Mark]
 - ii. the intracellular fluid is said to be? [1 Mark]
- e) Given the following molecules carbon dioxide, nitrogen, oxygen, potassium ion, water...
- i. Which is least likely to cross a cellular membrane by simple diffusion? [1 Mark]
 - ii. Which will cross the membrane with the least speed? [1 Mark]
 - iii. Which will cross the membrane with the fastest speed? [1 Mark]
 - iv. Why is the molecule on iii able to cross faster than the molecule in ii? [1 Mark]
- f) A bacterium containing sodium ions at a concentration of 0.1 mM lives in a pond that contains sodium ions at 0.005 mM. What specific mode of transport are the sodium ions entering the cell by? [1 Mark]

SECTION C [40 Marks]

Instruction: Answer any four (4) questions in this section.

C1. Water

Water has a number of unique properties that are essential for life. Most of these properties are as a result of the polar nature of water and its ability to form hydrogen bonds. Using your knowledge on the properties of water, answer the questions below.

- a) Why is it important for water to be a liquid over a broad range of temperatures? [2 Marks]
- b) Why is water referred to as polar and why does its polarity affect its solvent properties? [2 Marks]
- c) What two processes are involved in the transport of water from the roots to the leaves of a plant? [2 Marks]
- d) What is the biological importance of solid water being able to float on liquid water? [2 Marks]
- e) Why is water's high latent heat of vaporization biologically significant? Give two reasons. [2 Marks]

C2. Carbohydrates

- a) D-Glucose alpha-D-Glucose -Amylopectin Glycogen Sucrose.

Using each carbohydrate only once from the list above, state which carbohydrate is:

- i. A non-reducing sugar? [1 Mark]
- ii. A carbohydrate containing both a beta 1-4 glycosidic bond and beta 1-6 glycosidic bond in its structure [1 Mark]
- iii. A cyclic monosaccharide [1 Mark]
- iv. A reducing sugar [1 Mark]

b) Give the uses of the each of the polysaccharides below: [4 marks]

- i. Amylose
- ii. Cellulose
- iii. Glycogen
- iv. Peptidoglycan

c) In a lab experiment, Ngosa and Melinda synthesized an artificial polysaccharide containing four glucose units, one galactose unit and one fructose unit. Upon acid hydrolysis of the polysaccharide with three water molecules, they obtained two disaccharides and two monosaccharide units. If the monosaccharide units obtained were a glucose unit and galactose unit, what were the two other molecules obtained? [2 marks]

C3. Lipids

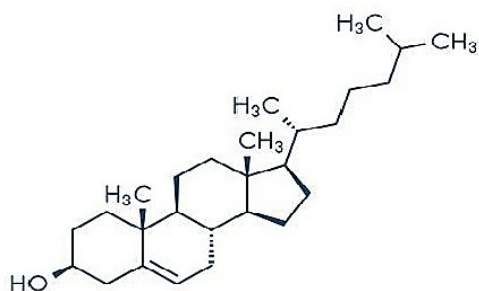


Figure 1.1

- a) Name the molecule shown in Figure 1.1 above. [1 Mark]
- b) List four functions of the molecule named in (a) above in the human body. [4 Marks]
- c) Name two functions of this molecule in the cell plasma membrane. [2 Marks]
- d) Excess of this molecule in your blood stream can lead to health problems. List any two of these health problems. [2 Marks]
- e) State one way of preventing accumulation of high levels of this molecule in your body. [1 Mark]

C4. Amino Acids and Proteins

Amino acids are organic compounds that contain amine and carboxyl functional groups, along with a side chain specific to each amino acid. Clearly and concisely explain the process of dipeptide formation. [10 Marks]

C5. Nucleic Acids

Humans have two types of nucleic acids in their bodies: DNA and RNA. These molecules contain the set of instructions for our cells: they determine who and what we are. Compare and contrast DNA and RNA. [10 Marks]

C6. Enzymes

- a) What do you understand by the term enzyme? [1 Mark]
- b) Define the term Energy of Activation. [1 Mark]
- c) What type of proteins are enzymes? [1 Mark]
- d) What are enzyme co-factors? [1 Mark]
- e) What is an enzyme without a co-factor called? [1 Mark]
- f) Explain how an enzyme controlled reaction is affected by changes in potential hydrogen. [3 Marks]
- g) Explain how a non-competitive enzyme inhibitor affects enzyme activity. [2 Marks]

C7. Vitamins and Minerals

Vitamins and minerals are required by the body for optimal health. List 5 fat soluble vitamins and for each mention the disease caused by its deficiency. [10 Marks]

-The End-