



**NAMIBIA UNIVERSITY  
OF SCIENCE AND TECHNOLOGY**

**FACULTY OF HEALTH, APPLIED SCIENCES AND NATURAL RESOURCES**

**SCHOOL OF NATURAL AND APPLIED SCIENCES**

**DEPARTMENT OF BIOLOGY, CHEMISTRY AND PHYSICS**

<b>QUALIFICATION : BACHELOR OF SCIENCE (MAJOR AND MINOR)</b>	
<b>QUALIFICATION CODE: 07BOSC</b>	<b>LEVEL: 6</b>
<b>COURSE CODE: CEB601S</b>	<b>COURSE NAME: CELL BIOLOGY</b>
<b>SESSION: JUNE 2023</b>	<b>PAPER: THEORY</b>
<b>DURATION: 3 HOURS</b>	<b>MARKS: 100</b>

<b>FIRST OPPORTUNITY QUESTION PAPER</b>	
<b>EXAMINER</b>	DR LAMECH MWAPAGHA
<b>MODERATOR</b>	DR JEYA KENNEDY

<b>INSTRUCTIONS</b>
<ol style="list-style-type: none"><li>1. Answer ALL the questions.</li><li>2. Write clearly and neatly.</li><li>3. Number the answers clearly.</li><li>4. All written work <b>MUST</b> be done in <b>BLUE</b> or <b>BLACK</b> ink.</li></ol>

**PERMISSIBLE MATERIAL**

Scientific Calculator

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

## **SECTION A: MULTIPLE CHOICE QUESTIONS**

**[20]**

- There are 20 multiple choice questions in this section. Each question carries 1 mark.
- Answer **ALL** questions by selecting the **LETTER** with the correct answer.

1. Which of the following statements about the reactions of glycolysis is correct?
  - A. In glycolysis glucose-6-phosphate is split into glyceraldehyde-3-phosphate and dihydroxyacetone phosphate.
  - B. In glycolysis fructose-6-phosphate is split into glyceraldehyde-3-phosphate and dihydroxyacetone phosphate.
  - C. In glycolysis glucose-6-phosphate is isomerized to fructose-1:6-bisphosphate.
  - D. In glycolysis fructose-1:6-bisphosphate is split into glyceraldehyde-3-phosphate and dihydroxyacetone phosphate.
  
2. Which of the following types of molecules are the major structural components of the cell membrane?
  - A. Phospholipids and proteins
  - B. Phospholipids and cellulose
  - C. Nucleic acids and proteins
  - D. Proteins and cellulose
  
3. Cancer is caused by;
  - A. Uncontrolled meiosis
  - B. Rupturing of cells
  - C. Uncontrolled mitosis
  - D. Loss of immunity of the cells
  
4. Fat is hydrolysed by the enzyme known as;
  - A. Lipase
  - B. Pepsin
  - C. Trypsin
  - D. Amylase

5. Which of the following microscopy techniques, relies on the specimen interfering with the wavelength of light to produce a high contrast image, without the need for dyes or any damage to the sample?
- A. Conventional bright field light microscopy
  - B. Phase contrast microscopy
  - C. Electron microscopy
  - D. Fluorescence microscopy
6. Acts as the digestive system inside a cell. It helps to break down old or unneeded parts of the cell, and substances that have been brought into the cell from the outside.
- A. Endoplasmic reticulum
  - B. Ribosome
  - C. Lysosome
  - D. Mitochondria
7. The volume enclosed by the plasma membrane of plant cells is often much larger than the corresponding volume in animal cells. The most reasonable explanation for this observation is that;
- A. Plant cells are capable of having a much higher surface-to-volume ratio than animal cells.
  - B. Plant cells have a much more highly convoluted (folded) plasma membrane than animal cells.
  - C. Plant cells contain a large vacuole that reduces the volume of the cytoplasm.
  - D. Plant cells can have lower surface-to-volume ratios than animal cells because plant cells synthesize their own nutrients.
8. Which of the following deoxyoligonucleotides will hybridize with a DNA containing the sequence (5')AGACTGGTC(3')?
- A. (5')CTCATTGAG(3')
  - B. (5')GAGTCAACT(3')
  - C. (5')TCTGACCAG(3')
  - D. (5')GACCAGTCT(3')

9. Which of the following statements about the electron transport chain is correct?
- A. The electron transport chain is made up of a chain of electron carriers with decreasing electron affinity.
  - B. The electron transport chain is made up of a chain of electron carriers with decreasing oxidising power.
  - C. The electrons transferred from carrier to carrier in the electron transport chain gain energy.
  - D. The electron transport chain is made up of a chain of electron carriers with increasing redox potential.
10. Which of the following statements is true of Na<sup>+</sup>/K<sup>+</sup>-adenosine triphosphatases?
- A. Their actions maintain a membrane potential with a value often of approximately -60 mV; the interior of the cell being positive with respect to the exterior
  - B. They use the free energy from the hydrolysis of ATP to transport K<sup>+</sup> out the cell and Na<sup>+</sup> into the cell
  - C. They are tetramers, consisting of four equally sized polypeptide chains
  - D. They indirectly control the volume of the cell
11. The chemical equation for photosynthesis;
- A.  $6\text{CO}_2 + \text{C}_6\text{H}_{12}\text{O}_6 \text{ --->using sunlight ---> } 6\text{H}_2\text{O} + 6\text{O}_2$
  - B.  $6\text{CO}_2 + 6\text{O}_2 \text{ --->using sunlight ---> } \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{H}_2\text{O}$
  - C.  $6\text{CO}_2 + 6\text{H}_2\text{O} \text{ --->using sunlight ---> } \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
  - D.  $6\text{O}_2 + 6\text{H}_2\text{O} \text{ --->using sunlight ---> } \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{CO}_2$
12. Photograph which is taken from a microscope is known as;
- A. Macrograph
  - B. Monograph
  - C. Micrograph
  - D. Pictograph

13. Calculate the field of view ( $\emptyset$ FOV) in  $\mu\text{m}$  of a microscope with a field of view index (FVI) 18 and an objective magnification of X20.
- A. 1900  $\mu\text{m}$
  - B. 890  $\mu\text{m}$
  - C. 900  $\mu\text{m}$
  - D. 90  $\mu\text{m}$
14. Which of the following statements is true?
- A. When signal molecules first bind to receptor tyrosine kinases, the receptors phosphorylate a number of nearby molecules.
  - B. In response to some G-protein-mediated signals, a special type of lipid molecule associated with the plasma membrane is cleaved to form IP3 and calcium.
  - C. Toxins such as those that cause botulism and cholera interfere with the ability of activated G proteins to hydrolyze GTP to GDP, resulting in phosphodiesterase activity in the absence of an appropriate signal molecule.
  - D. Protein kinase A activation is one possible result of signal molecules binding to G protein-linked receptors.
15. From the following list select the elements that are metals:
- I. Fe, II. S, III. Si, IV. Na, V. U, VI. Hg
- A. II, III
  - B. I, III, IV, V
  - C. I, IV, V, VI
  - D. III, IV, V
16. Arrange the following atoms in order of increasing electronegativity: **Sb, I, Sn, Te**
- A. I, Te, Sb, Sn
  - B. Sb, I, Sn, Te
  - C. Sn, Sb, Te, I
  - D. Sn, Te, Sb, I
17. Which two reactions occur during photophosphorylation?
- A. ATP is hydrolysed and NADP is reduced.
  - B. ATP is hydrolysed and NADPH is oxidised.
  - C. ATP is synthesised and NADP is reduced.
  - D. ATP is synthesised and NADPH is oxidised.

18. Which of the following describes cell communication systems?
- A. Cell signaling evolved more recently than systems such as the immune system of vertebrates.
  - B. Communicating cells are usually close together.
  - C. Most signal receptors are bound to the outer membrane of the nuclear envelope.
  - D. In response to a signal, the cell may alter activities by changes in cytosol activity or in transcription of RNA.
19. The volume enclosed by the plasma membrane of plant cells is often much larger than the corresponding volume in animal cells. The most reasonable explanation for this observation is that;
- A. Plant cells are capable of having a much higher surface-to-volume ratio than animal cells.
  - B. Plant cells have a much more highly convoluted (folded) plasma membrane than animal cells.
  - C. Plant cells contain a large vacuole that reduces the volume of the cytoplasm.
  - D. Plant cells can have lower surface-to-volume ratios than animal cells because plant cells synthesize their own nutrients.
20. A sample of blood, added to a saline solution with a less negative water potential than the cell contents, results in a uniform red colour in the solution which is unaffected by centrifugation. Which one of the following explains this result?
- A. Haemoglobin has diffused through the erythrocyte membrane into the solution.
  - B. Water has entered the erythrocytes by osmosis, causing them to swell and burst and the haemoglobin is released into the solution.
  - C. Water has entered erythrocytes by osmosis. As the cells are now less dense than the solution, they will not sediment on centrifugation.
  - D. Water has left the cells by osmosis, causing them to shrink and become too small to sediment on centrifugation.

**END OF SECTION A**

## **SECTION B**

**[80]**

- There are **FIVE (5)** questions in this section. Answer all Questions.

### **Question 1**

**[18]**

a) Describe the following terminologies as used in microscopy;

(4)

- I. Photobleaching:
- II. Resolution:
- III. Phototoxicity:
- IV. Fluorescent in situ hybridization (FISH):

b) State **FOUR (4)** applications of the fluorescence microscope.

(4)

c) Briefly, discuss **FIVE (5)** factors that affect enzyme action.

(10)

### **Question 2**

**[16]**

a) The glycolysis pathway is regulated by **THREE (3)** enzymes namely;

(3)

b) Distinguish between carrier proteins and channel proteins.

(4)

c) Describe the G-protein coupled receptors in cell signalling.

(9)

### **Question 3**

**[16]**

a) Briefly describe the **THREE (3)** cell signalling stages.

(6)

b) Explain **FIVE (5)** functions of membrane proteins .

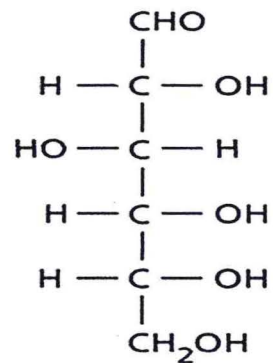
(10)

**Question 4**

[14]

a) Draw the Haworth projection of the monosaccharide below in the  $\alpha$  and  $\beta$  forms.

(8)



b) Briefly describe how the movement of sodium and potassium ions takes place across the cell membrane.

(6)

**Question 5**

[16]

a) Describe the **THREE (3)** main steps in Polymerase Chain Reaction.

(6)

b) Briefly discuss what happens during each phase of the eukaryotic cell cycle.

(10)

**END OF SECTION B**



## PERIODIC TABLE OF THE ELEMENTS

1																	18
1 <b>H</b> 1.00794																	2 <b>He</b> 4.00260
3 <b>Li</b> 6.941	4 <b>Be</b> 9.01218											5 <b>B</b> 10.81	6 <b>C</b> 12.011	7 <b>N</b> 14.0067	8 <b>O</b> 15.9994	9 <b>F</b> 18.9984	10 <b>Ne</b> 20.179
11 <b>Na</b> 22.9898	12 <b>Mg</b> 24.305											13 <b>Al</b> 26.9815	14 <b>Si</b> 28.0855	15 <b>P</b> 30.9738	16 <b>S</b> 32.06	17 <b>Cl</b> 35.453	18 <b>Ar</b> 39.948
19 <b>K</b> 39.0983	20 <b>Ca</b> 40.08	21 <b>Sc</b> 44.9559	22 <b>Ti</b> 47.88	23 <b>V</b> 50.9415	24 <b>Cr</b> 51.996	25 <b>Mn</b> 54.9380	26 <b>Fe</b> 55.847	27 <b>Co</b> 58.9332	28 <b>Ni</b> 58.69	29 <b>Cu</b> 63.546	30 <b>Zn</b> 65.38	31 <b>Ga</b> 69.72	32 <b>Ge</b> 72.59	33 <b>As</b> 74.9216	34 <b>Se</b> 78.96	35 <b>Br</b> 79.904	36 <b>Kr</b> 83.8
37 <b>Rb</b> 85.4678	38 <b>Sr</b> 87.62	39 <b>Y</b> 88.9059	40 <b>Zr</b> 91.22	41 <b>Nb</b> 92.9064	42 <b>Mo</b> 95.94	43 <b>Tc</b> (98)	44 <b>Ru</b> 101.07	45 <b>Rh</b> 102.906	46 <b>Pd</b> 106.42	47 <b>Ag</b> 107.868	48 <b>Cd</b> 112.41	49 <b>In</b> 114.82	50 <b>Sn</b> 118.69	51 <b>Sb</b> 121.75	52 <b>Te</b> 127.6	53 <b>I</b> 126.9	54 <b>Xe</b> 131.29
55 <b>Cs</b> 132.905	56 <b>Ba</b> 137.33	71 <b>Lu</b> 174.967	72 <b>Hf</b> 178.49	73 <b>Ta</b> 180.948	74 <b>W</b> 183.85	75 <b>Re</b> 186.207	76 <b>Os</b> 190.2	77 <b>Ir</b> 192.22	78 <b>Pt</b> 195.08	79 <b>Au</b> 196.967	80 <b>Hg</b> 200.59	81 <b>Tl</b> 204.383	82 <b>Pb</b> 207.2	83 <b>Bi</b> 208.908	84 <b>Po</b> (209)	85 <b>At</b> (210)	86 <b>Rn</b> (222)
87 <b>Fr</b> (223)	88 <b>Ra</b> 226.025	103 <b>Lr</b> (260)	104 <b>Rf</b> (261)	105 <b>Db</b> (262)	106 <b>Sg</b> (263)	107 <b>Bh</b> (264)	108 <b>Hs</b> (265)	109 <b>Mt</b> (268)	110 <b>Uun</b> (269)	111 <b>Uuu</b> (272)	112 <b>Uub</b> (269)		114 <b>Uuq</b>		116 <b>Uuh</b>		118 <b>Uuo</b>

**Lanthanides:**

57 <b>La</b> 138.906	58 <b>Ce</b> 140.12	59 <b>Pr</b> 140.908	60 <b>Nd</b> 144.24	61 <b>Pm</b> (145)	62 <b>Sm</b> 150.36	63 <b>Eu</b> 151.96	64 <b>Gd</b> 157.25	65 <b>Tb</b> 158.925	66 <b>Dy</b> 162.50	67 <b>Ho</b> 161.930	68 <b>Er</b> 167.26	69 <b>Tm</b> 166.934	70 <b>Yb</b> 173.04
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**Actinides:**

89 <b>Ac</b> 227.028	90 <b>Th</b> 232.038	91 <b>Pa</b> 231.036	92 <b>U</b> 238.029	93 <b>Np</b> 237.048	94 <b>Pu</b> (244)	95 <b>Am</b> (243)	96 <b>Cm</b> (247)	97 <b>Bk</b> (247)	98 <b>Cf</b> (251)	99 <b>Es</b> (252)	100 <b>Fm</b> (257)	101 <b>Md</b> (258)	102 <b>No</b> (259)
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