



**NAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY**

FACULTY OF HEALTH, APPLIED SCIENCES AND NATURAL RESOURCES

DEPARTMENT OF NATURAL AND APPLIED SCIENCES

QUALIFICATION: BACHELOR OF SCIENCE (MAJOR AND MINOR)	
QUALIFICATION CODE: 07BOSC	LEVEL: 6
COURSE CODE: CEB601S	COURSE NAME: CELL BIOLOGY
SESSION: JUNE 2022	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 100

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

PERMISSIBLE MATERIAL

Scientific Calculator

THIS QUESTION PAPER CONSISTS OF NINE (9) 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 is a function of the Golgi apparatus?

- A. To aid endocytosis
- B. To make proteins from amino acids
- C. To synthesize ATP
- D. To make secretory products

2. Which type of microscope uses electrons to provide a three-dimensional view of the surface of the object?

- A. Light microscope
- B. Transmission electron microscope
- C. Scanning electron microscope
- D. Scanning-probe microscope

3. Amino acids are_____.

- A. building blocks of lipids
- B. building blocks of proteins
- C. building blocks of carbohydrates
- D. building blocks of nucleic acids

4. Apoptosis is classified as;

- A. Programmed cell death
- B. Non-programmed cell death
- C. Accidental cell death
- D. Mitotic cell death

5. In which phase of the cell cycle is DNA replicated?
- A. G1 phase
 - B. S phase
 - C. G2 phase
 - D. M phase
6. Which of the following is **NOT** evidence of the endosymbiotic theory?
- A. Mitochondria are similar to bacteria in size and structure
 - B. Mitochondria and chloroplasts have a double membrane: the outer membrane may be derived from the engulfing vesicle, and the inner one may be derived from the plasma membrane of the original prokaryote
 - C. Mitochondria and chloroplasts contain a limited amount of their own DNA and divide by splitting
 - D. The cristae in mitochondria resemble those found in bacteria
7. One molecule of acetyl-coenzyme A yields what energy rich molecules when metabolized via the citric acid cycle?
- A. 6 NADH + 2 FADH₂ + 2 GTP
 - B. 3 NADH + 1 FADH₂ + 1 GTP
 - C. 4 NADH + 1FADH₂ + 1 GTP
 - D. 3 NADH + 2 FADH₂ + 1 GTP
8. Which term describes centrioles beginning to move apart in animal cells?
- A. Telophase
 - B. Anaphase
 - C. Prometaphase
 - D. Prophase

9. The ribonucleotide polymer (5')GTGATCAAGC(3') could only form a double-stranded structure with;
- A. (5')CACTAGTTCG(3')
 - B. (5')CACUAGUUCG(3')
 - C. (5')CACUTTCGCCC(3')
 - D. (5')GCTTGATCAC(3')
10. Which of the following statements about the generation of ATP in the electron transport chain is correct?
- A. The generation of ATP from ADP coupled to electron transfer occurs by substrate level phosphorylation as in glycolysis
 - B. ATP synthase generation of ATP involves a rotating structure inside the inner mitochondrial membrane
 - C. Electron transport generates a proton gradient across the outer mitochondrial membrane
 - D. ATP synthase generation of ATP involves a rotating structure outside the inner mitochondrial membrane
11. Cells in culture will absorb amino acids from the surrounding culture medium. If radioactively labelled glycine is provided in the culture medium, in which organelle will radioactivity be found first?
- A. ribosomes
 - B. nucleus
 - C. lysosomes
 - D. Golgi apparatus
12. The movement of water molecules from an area of high concentration to an area of low concentration through a semipermeable membrane is known as;
- A. Active Transport
 - B. Diffusion
 - C. Phagocytosis
 - D. Osmosis

13. Which of the following statements about the TCA cycle is correct?
- A. Oxygen is used to oxidise the acetyl group carbons of acetyl-CoA in the TCA cycle
 - B. Oxygen is not used in the TCA cycle, so the cycle can occur in anaerobic conditions
 - C. The TCA cycle produces the water that is formed during the complete oxidation of glucose
 - D. Three molecules of NADH and one molecule of FADH₂ are produced in one turn of the TCA cycle
14. 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
15. Which of the following apply to intercellular junctions?
- A. The three major adhesive junctions of animal cells are adherens junctions, desmosomes and hemidesmosomes
 - B. The junctional complexes of gastrointestinal enterocytes ensure that nutrients are only absorbed through the spaces between the cells, which prevents them absorbing potentially harmful substances
 - C. Desmosomes and hemidesmosomes connect epithelial cells to their basement membrane and adjacent cells respectively
 - D. Gap junctions and plasmodesmata are homologous structures
16. Holes in plant leaves that allow carbon dioxide to enter and oxygen to leave.
- A. Stomata
 - B. Roots
 - C. Chlorophyll
 - D. Chloroplast

17. Which of the following statements is true of Na⁺/K⁺-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⁺ out the cell and Na⁺ into the cell
 - C. They are tetramers, consisting of four equally sized polypeptide chains
 - D. They indirectly control the volume of the cell
18. Which statement correctly outlines some of the main events in photosynthesis?
- A. A 5C carbohydrate accepts carbon dioxide and is then reduced by NADPH derived from photophosphorylation.
 - B. A 3C carbohydrate is regenerated and reduced by hydrogen molecules derived from photophosphorylation.
 - C. Photolysis uses light to produce reduced NADP and oxygen which are used to reduce a 3C carbohydrate.
 - D. Photolysis produces NADPH and ATP which are used to reduce a 5C carbohydrate.
19. What is the overall net equation of the citric acid cycle?
- A. $\text{Acetyl-coA} + 3\text{NAD}^+ + \text{FAD} + \text{ADP} + \text{P}_i + 2\text{H}_2\text{O} = \text{CoA} + 2\text{CO}_2 + 3\text{NADH} + \text{FADH}_2 + \text{ATP} + 2\text{H}^+$
 - B. $\text{Glucose} + 2\text{NAD}^+ + 2\text{ADP} + 2\text{P}_i = 2\text{Pyruvate} + 2\text{ATP} + 2\text{NADH} + 2\text{H}_2\text{O} + 2\text{H}^+$
 - C. $\text{CoA} + \text{NAD}^+ + 3\text{FAD} + \text{ADP} + \text{P}_i + 2\text{H}_2\text{O} = \text{Acetyl-coA} + 2\text{CO}_2 + \text{NADH} + 3\text{FADH}_2 + \text{ATP} + 2\text{H}^+$
 - D. $\text{Glucose} + 2\text{H}_2\text{O} + 10\text{NAD}^+ + 2\text{FAD} + 4\text{ADP} + 4\text{P}_i = 6\text{CO}_2 + 10\text{NADH} + 2\text{FADH}_2 + 4\text{ATP} + 10\text{H}^+$
20. Which reaction is catalysed by the enzyme RuBisCO?
- A. Carboxylation of ribulose bisphosphate (RuBP)
 - B. Conversion of triose phosphate (TP) to ribulose phosphate (RuP)
 - C. Oxidation of glycerate-3-phosphate (GP)
 - D. Reduction of glycerate-3-phosphate (GP)

END OF SECTION A

SECTION B

[80]

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

Question 1

[12]

- a) Describe the **THREE (3)** main steps in Polymerase Chain Reaction. (3)
- b) Explain the role of each of the following enzymes involved in DNA replication (4)
- c) As a research scientist you have been tasked to generate Ideal PCR primers for gene amplification. Briefly state **FIVE (5)** factors you would consider when designing primers. (5)

Question 2

[17]

- a) Briefly describe the structure and functions of the extracellular matrix. (3)
- b) State **FOUR (4)** applications of the confocal microscope. (4)
- c) Fluorescence in situ hybridization (FISH) is a laboratory technique for detecting and locating a specific DNA sequence on a chromosome. The technique relies on exposing chromosomes to a small DNA sequence called a probe that has a fluorescent molecule attached to it. State **TEN (10)** applications of FISH. (10)

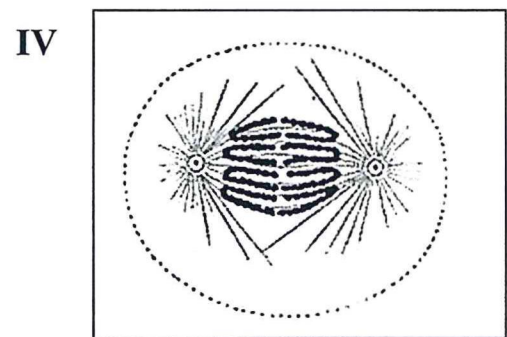
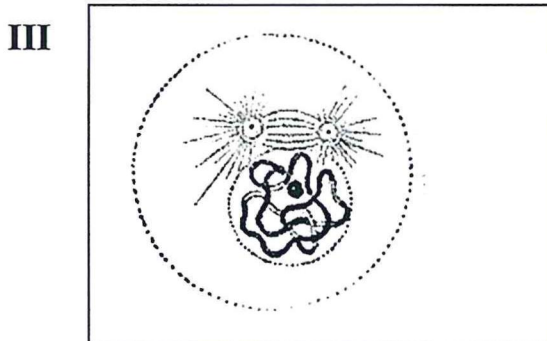
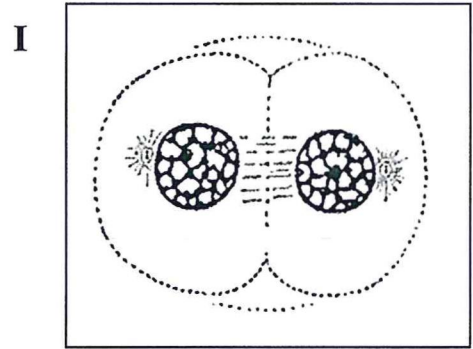
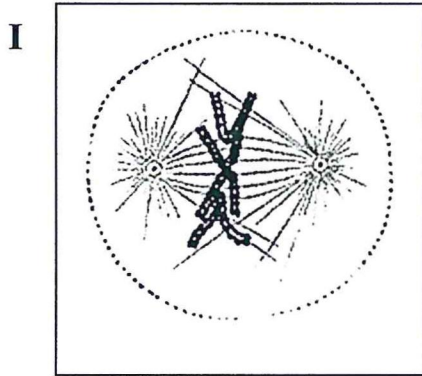
Question 3

[18]

- a) Briefly describe the functions of the following RNA's: (10)
 - I. Messenger RNA (mRNA):
 - II. Ribosomal RNA (rRNA):
 - III. Transfer RNA (tRNA):
 - IV. Small nuclear RNA (snRNA):
 - V. microRNA (miRNA):

b) Describe Protein scaffolds. (4)

c) Names the phases of mitosis shown in the images below: (4)



Question 4 [17]

a) Briefly describe the following chemical signals; (5)

- I. Pheromones Signals:
- II. Neuroendocrine Signals:
- III. Autocrine Signals:
- IV. Neural Signals:
- V. Paracrine Signals:

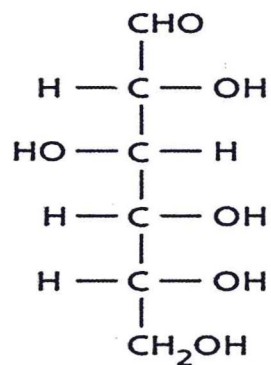
b) What is the fate of absorbed glucose by tissues in Eukaryotes? (6)

- c) Briefly describe how the movement of sodium and potassium ions takes place across the cell membrane. (6)

Question 5

[16]

- a) Distinguish between carrier proteins and channel proteins. (2)
- b) Briefly explain the Electron Transport Chain/Oxidative Phosphorylation process. (8)
- c) Draw the Haworth projection of the monosaccharide below in the α and β forms. (6)



END OF SECTION B