S.5 EOT1 P.1 BIOLOGY
MODULATED M. GUIDE

NAME.....STREAM.....

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$\frac{X}{50} \times 100$ %

MENGO SENIOR SCHOOL

UGANDA ADVANCED CERTIFICATE OF EDUCATION

END OF TERM I EXAMINATION 2026

BIOLOGY (THEORY)

Paper 1

Duration: 2 hours 30 minutes

Approved
Mupabi
HOD

INSTRUCTIONS TO CANDIDATES:

- *Answer all questions in this paper.*
- *Write answers to this section in the spaces provided.*
- *No additional sheets of paper should be inserted in this booklet.*

Item	Score	Initial
One	12	
Two	12	
Three	12	
Four	14	
Total	50	

Item One.

S.5 Biology students went to Ziika forest for their filed study. When they entered into inside, observed that there was little light inside due to canopy formed by tall trees. Plants which were completely under shade had yellowish leaves, elongated stems (etiolation) and broad leaves while those receiving adequate sunlight remained green and healthy. The forest manager explained that insufficient light affects chloroplast function, limiting the plant's ability to manufacture food. One student wanted to know how this tiny green organelle is responsible for the making food in plants.

a). Name the pigment found in chloroplasts and state its role in the plant cell. (2scores)

Chlorophyll pigment. ✓ 01

To trap or absorb light energy from the sun that drives photosynthetic reactions. ✓ 01

02 scores

Dan of accept function if pigment is wrong.

b). Describe how the chloroplast is suited for photosynthesis. (6scores)

- Biconcave disc shape to be set for light absorption; ✓ adaptation
- Contains many flattened stacked grana i.e thylakoids which provide a large surface area for maximum light energy absorption; ✓
- Thylakoid membrane is embedded with efficient chlorophyll pigments; ✓ for efficient capture of light energy; ✓
- The stroma contains all required enzymes; for the light independent stage to synthesise enough glucose; ✓
- Double membrane; ✓
- Own DNA, and ribosomes
- Starch grains for temporary store of products of photosynthesis.

06

Consider the first 3 points. (2scores each)

c). Explain why the leaves turned yellow in plants grown under shade. (3scores)

Under shade, with inadequate light, the plant does not produce enough chlorophyll ✓ 01 and the existing chlorophyll breaks down faster than it can be replaced ✓ 01

The plant etiolates; focuses its energy on stem elongation rather than leaf development and pigment production. ✓ 01

02

d). explain why the plants under complete canopy had elongated stems and broad leaves. (3scores)

• Elongation of stems is a survival mechanism that enables plants to reach at the top max. and trap light energy; required for photosynthesis.

• Broad leaves maximise surface area; to allow the plant to intercept and capture as much light energy as possible; 01

02

Total = 12 max

Item two

S.5 Biology students watched a documentary about desert birds that could survive for several days without drinking water. The narrator explained that these birds rely heavily on stored fats for both energy and water. This caught the students' interest, and their teacher further explained that lipids such as triglycerides are not only efficient energy reserves but also provide metabolic water upon oxidation. In their revision, they also discovered that lipids are hydrophobic, form important structures like cell membranes, and occur in different forms such as phospholipids, waxes, and steroids. The students were amazed at how such simple organic compounds could have so many critical roles.

a). Describe the structure of a triglyceride and explain how it is formed from its components. (4scores)

accept formula

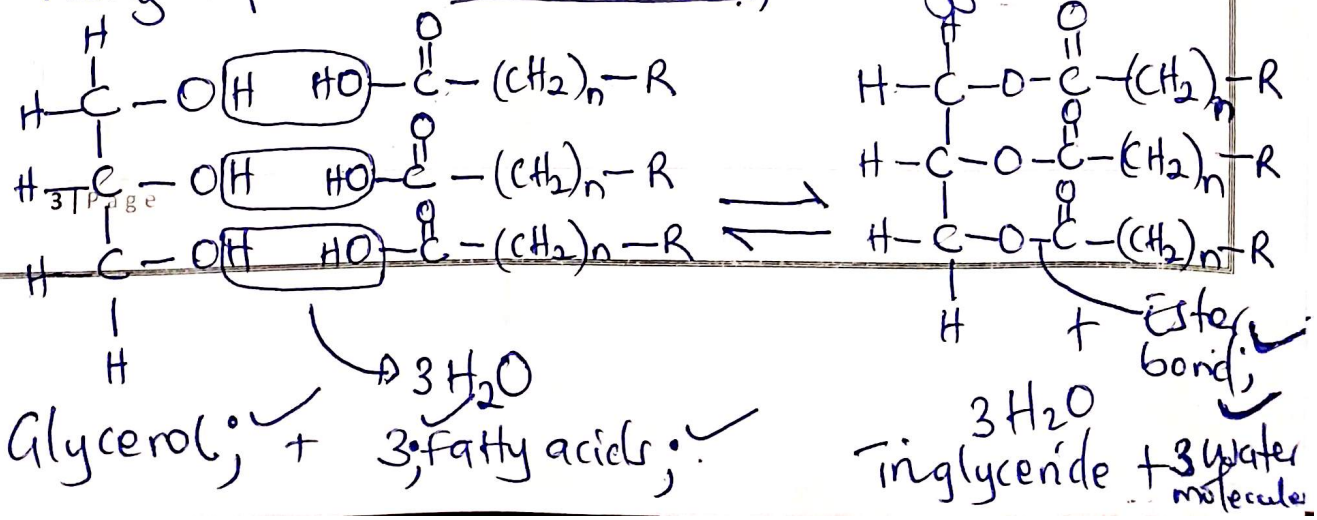
Structurally, a triglyceride is made up of one glycerol molecule 01 which is a three-Carbon alcohol with three hydroxyl groups and three fatty acid molecules which is long hydrocarbon chain 01

02

formation occurs through condensation; Each of the three fatty acids reacts with one of the three hydroxyl groups on the glycerol molecule; An ester bond forms between glycerol and each fatty acid.

03

For every ester bond created, one molecule of water is released making a production of three water molecules; for one triglyceride molecule formed.



@. Lipids are insoluble in water and so don't dissolve away hence storing energy for long period of time ✓

b). Explain reasons why lipids are suitable for long-term energy storage in desert birds. (6scores)

mark any 2

Consider the first 3 points given (2 scores each)

(b) Lipids have higher energy density providing much energy per gram; high proportion of hydrogen–carbon bonds for allowing birds to store a large amount of energy without significantly increasing their body weight 02

©Compact, Lipids take up minimal space by not binding to water molecules since they are hydrophobic ✓

c). Explain the difference between saturated and unsaturated fatty acids, giving one example of each. (3scores)

Saturated fatty acids are made up of a single bond between carbon atoms thus form straight chains that allow molecules to pack closely together. 01 01 03

Example; Stearic acid, palmitic acid, Lauric acid, Butyric acid ½ ½

- Diff ✓
- Example ✓

Unsaturated fatty acids are made up of one or more double bonds between carbon atoms forming kinks in their chains preventing molecules from packing together. 01

Example; Oleic acid, Linoleic acid, palmitoleic acid ½ ½

d). Explain the role of phospholipids in the structure and function of cell membranes. (2scores)

Structurally, phospholipids have hydrophilic head and two hydrophobic fatty acid tails that spontaneously form a bilayer in aqueous environment in a cell. 01 02

The phospholipid bilayer functions as selectively permeable barrier 01 regulating the entry and exit of substances in cell membrane.

Item 2, total – 12

Item Three

During a lab session, senior biology students studied muscle tissues from two individuals—one a long-distance runner and the other a non-athlete. Under an electron microscope, they observed that the athlete's muscle cells contained a significantly higher number of mitochondria compared to those of the non-athlete. Their teacher explained that this difference had something to do with energy demands placed on the cells by the body's activity level.

a). What is the function of mitochondria in cells? (2scores)

(01)

- They are sites of ATP formation / aerobic respiration;

b). Explain why muscle cells of athletes have more mitochondria. (3scores)

(02)

- More mitochondria allows muscle cells to produce a greater amount of ATP quickly to meet the high energy demands during frequent and intense muscle contractions.
- More mitochondria increases efficiency in using oxygen to generate energy thus delaying the onset of muscle fatigue.

c). Describe two structural adaptations of mitochondria that suit them to their function. (5scores)

Do not accept physiological

(04)

any two adaptation

- The inner mitochondrial membrane is highly folded into cristae to increase surface area available for electron transport chain and enzymes involved in ATP synthesis thus allowing faster rate of respiration.
- The central fluid space (matrix) contains a high concentration of enzymes of Krebs cycle. It contains its own DNA; and ribosomes allowing Mitochondria to produce the specific proteins needed for respiration.
- Double membranes seperate mitochondrion from interference by processes in the cytoplasm.
- Inner membrane has cristae with Oxysomes; that contain ATP Synthetase (ATPase) on stalked particles that make ATP;
- Many ribosomes; for protein synthesis;

ii. d). Compare mitochondria to chloroplasts in terms of energy transformation. (5scores)

Similarities: - Both involve phosphorylation of ADP to ATP.
- Both mitochondria and chloroplasts are energy converting organelles. / involve chemiosmosis

Differences:

Chloroplast	Mitochondria
Converts light energy into chemical energy (Glucose) - Photophosphorylation	Converts chemical energy into a usable form of energy (ATP) - Oxidative phosp
Captures light energy to build organic molecules.	Breaks down organic molecules to release energy
Requires CO_2 and H_2O and light	Requires glucose and oxygen
Releases glucose and oxygen as products	Releases CO_2, water and ATP

05

Total item 3 = 12

Item four

Mr. Isaac a farmer in Luuka village sleeps a house without windows and ventilators where he cooks from at night when the door is closed. He recently developed difficulties in breathing while inside the room. During day while in his garden, he could supply his plants with a gas used during photosynthesis upon exhalation. He has reached out to you seeking for help on what causes difficulty in breathing (dyspnea).

a). Help Mr. Isaac identify the inhaled gas in the room and explain to him fully why the gas he inhaled caused him such a symptom. (06 Scores)

01

~~Carbon monoxide~~ Carbon monoxide gas

In presence of carbon monoxide and oxygen, haemoglobin combines readily with carbon monoxide to form a permanent compound known as carboxyhaemoglobin than combining with oxygen. Carboxyhaemoglobin compound formed is permanent and doesn't later dissociate to make haemoglobin molecule free again reducing no of free Hb to transport oxygen to respiring

because carbon monoxide oxidises iron II to iron III resulting into total lack of oxygen in the tissues; a condition known as anoxia.

05 max

b). Identify the gas he supplied to his crops and explain how it is transported from his body. (09 scores)

Carbon dioxide gas

CO_2 can be transported in solution form or as carbamino haemoglobin when it combines with the amino group of haemoglobin as well as bicarbonate ions to a large percentage as follows: When CO_2 is formed during respiration, it diffuses from the tissues into RBC via their thin and permeable membranes; In the RBC, CO_2 reacts with water in presence of carbonic anhydrase enzyme to form carbonic acid, $H_2O + CO_2 \xrightarrow{\text{carbonic anhydrase}} H_2CO_3$. The formed acid dissociates into hydrogen ions and bicarbonate ions: $H_2CO_3 \rightleftharpoons H^+ + HCO_3^-$

The bicarbonate ions diffuse out of RBC into plasma along CO_2 gradient, and chloride ions diffuse into RBC = chloride shift

Combine with sodium ion to form $NaHCO_3$ hydrogen carbonate which is taken to lungs.

When Bicarbonate ions in lungs react with H^+ to form carbonic acid which dissociates into CO_2 and H_2O, these are expelled out of lung capillaries by lungs during exhalation.

$H^+ + HCO_3^- \longrightarrow H_2CO_3$; $H_2CO_3 \longrightarrow H_2O + CO_2$

ENDS

09 max.

Ignore if the gas is not correct

Total item 4 = 14 max