MLB 111
KONTROLEBLAD / *CONTROL PAGE*

VAN & VOORLETTERS *SURNAME & INITIALS*		SIGNATURE *HANDTEKENING*	

STUDENTENOMMER *STUDENT NUMBER*								-		1 - 8	TOETSNOMMER *TEST NUMBER*	0	1	9 - 10

VRAAG *QUESTION*	PUNTE *MARKS*					
1				•		11 - 14
2				•		15 - 18
3				•		19 - 22
4				•		23 - 26
5				•		27 - 30
6				•		31 - 34
7				•		35 - 38
8				•		39 - 42
9				•		43 - 46
10				•		47 - 50
11				•		51 - 54
12				•		55 - 58
13				•		59 - 62
14				•		63 - 66
15				•		67 - 70
16				•		71 - 74
17				•		75 - 78
18				•		79 - 82
19				•		83 - 86
Totaal / *Total*				•		87 - 91

UNIVERSITY OF PRETORIA
UNIVERSITEIT VAN PRETORIA

MOLECULAR AND CELL BIOLOGY 111
MOLEKULÊRE EN SELBIOLOGIE 111

FIRST SEMESTER TEST : 15 APRIL 2008
EERSTE SEMESTERTOETS : 15 APRIL 2008

MARKS AWARDED *PUNTE TOEGEKEN*	

SURNAME AND INITIALS
VAN EN VOORLETTERS..... SIGNATURE
HANDTEKENING .....

STUDENT REGISTRATION NUMBER
STUDENT REGISTRASIENOMMER... .....

DEGREE (e.g. BSc 1)
GRAAD (bv. BSc 1).....

DATE OF TEST
DATUM VAN TOETS.....

NAME OF TEST VENUE
NAAM VAN TOETSLOKAAL. .....

QUESTION *VRAAG*	**MARKS AWARDED** *PUNTE TOEGEKEN*	**MAX MARKS** *MAKS PUNTE*
1		**9**
2		**14**
3		**14**
4		**10**
5		**8**
6		**8**
7		**6**
8		**7**
9		**8**
10		**6**
11		**10**
TOTAL *TOTAAL*		**100**

MOLECULAR AND CELL BIOLOGY 111 (MLB 111)
MOLEKULÊRE EN SELBIOLOGIE 111 (MLB 111)

FIRST SEMESTER TEST / *EERSTE SEMESTERTOETS*

2008-04-15

MARKS / *PUNTE* : 100
TIME / *TYD* : 100 MIN

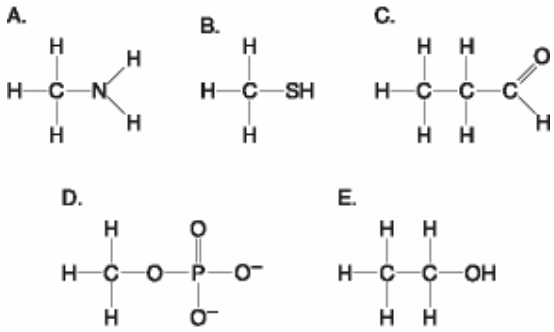
EXAMINERS / *EKSAMINATORE*:

Dr A Gaspar Dr Q Kritzinger

The test paper consists of 11 questions and 20 pages. **VERIFY IT !!**
Die toetsvraestel bestaan uit 11 vrae en 20 bladsye. ***KONTROLEER DIT !!***

QUESTION / *VRAAG* 1: [9]

1.1 Consider the structures below and answer the questions that follow: /
Beskou die onderstaande strukture en beantwoord die vrae wat volg:



1.1.1 Identify the functional groups. /
Identifiseer die funksionele groepe. (2½)

A: .....

B: .....

C: .....

D: .....

E: .....

1.1.2 Why is structure A classified as a base? /
Waarom word struktuur A geklassifiseer as 'n basis? (1)

.....

.....

1.1.3 Explain why structure E is soluble in water. /
Verduidelik waarom struktuur E oplosbaar in water is. (1)

.....

.....

1.1.4 Explain why a C – H bond is a <u>non-polar</u> covalent bond. /
Verduidelik waarom 'n *C – H binding 'n <u>nie-polêre</u> kovalente binding is.* (1)

.....

.....

1.2 Calculate the pH of a 2×10^{-8} M NaOH solution. /
Bereken die pH van 'n 2 x 10^{-8} M NaOH oplossing. (2)
(Kw = 1 X 10^{-14})

1.3 Intracellular pH is maintained constant by means of phosphate buffer system. /
Intrasellulêre pH word konstant gehou dmv 'n fosfaat buffersisteem.

$$\mathbf{H_2PO_4^- \leftrightarrows H^+ + HPO_4^{2-}}$$

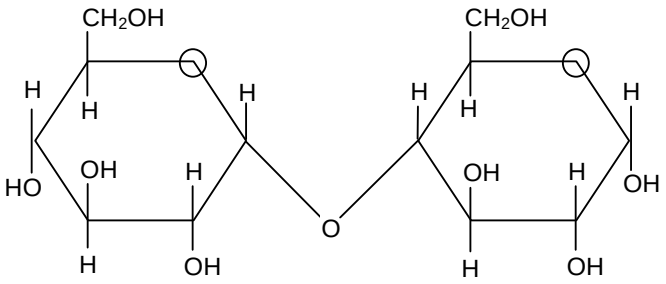
1.3.1 Identify the conjugate acid –base pair. /
Identifiseer die gekonjugeerde suur-basis paar. (1)

1.3.2 Indicate the shift in the reaction direction (left or right) when the intracellular pH drops. /
Dui die skuif in reaksierigting aan (links of regs) wanneer die intrasellulêre pH daal. (½)

.....

QUESTION / *VRAAG* 2: [14]

2.1



2.1.1 Give the general as well as the specific name for the structure above. /
Gee die algemene sowel as die spesifieke naam vir die bogenoemde struktuur.
(1)

.....

2.1.2 Identify the monomer in the structure above. /
Identifiseer die monomeer in die bogenoemde struktuur. (½)

.....

2.1.3 What is the name of the bond linking the monomers? /
Wat is die naam van die binding wat die monomere koppel? (½)

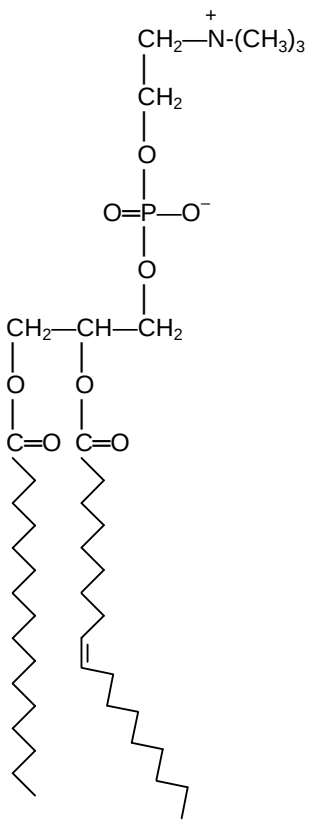
.....

2.1.4 Draw the structures of the products that form when the above structure is hydrolyzed. /
Teken die produkte wat vorm wanneer die bogenoemde struktuur gehidroliseer word. (1)

2.1.5 Which polymer consists of repeating units of the above structure? /
Watter polimeer bestaan uit herhalende eenhede van die bogenoemde struktuur?
(½)

.....

2.2 Study the structure below and answer the following questions: /
Bestudeer die struktuur gegee hieronder en beantwoord die vrae wat volg:



2.2.1 Identify the above biomolecule (general name). /
Identifiseer die biomolekule hierbo (algemene naam). (½)

.....

2.2.2 Circle the hydrophilic head on the above structure. /
Omsirkel op die bogenoemde struktuur die hidrofiliese kop. (½)

2.2.3 Indicate with an arrow on the above molecule the saturated fatty acid. /
Dui m.b.v. 'n pyltjie die versadigde vetsuur op die bogenoemde molekuul aan. (½)

2.2.4 How many C-atoms does the unsaturated fatty acid contain? /
Hoeveel C-atome bevat die onversadigde vetsuur? (½)

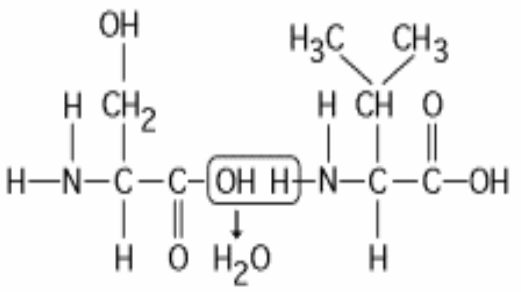
.....

2.2.5 Which type of bonds link the fatty acids to the glycerol part? /
Watter soort bindings koppel die vetsure aan die gliserol deel? (½)

.....

2.2.6 Indicate on the above structure the part of the molecule that is replaced by a fatty acid in the case of a triacylglycerol. /
Dui op die bogenoemde struktuur aan die deel van die molekuul wat vervang word met 'n vetsuur in die geval van 'n triasielgliserol. (½)

2.3 Refer to the figure below to answer the following questions: /
Verwys na die figuur hieronder om die volgende vrae te beantwoord:



2.3.1 Classify the amino acid on the N-terminal of the product formed by the above reaction. /
Klassifiseer die aminosuur aan die N-terminaal van die produk gevorm deur die bogenoemde reaksie. (½)

.....

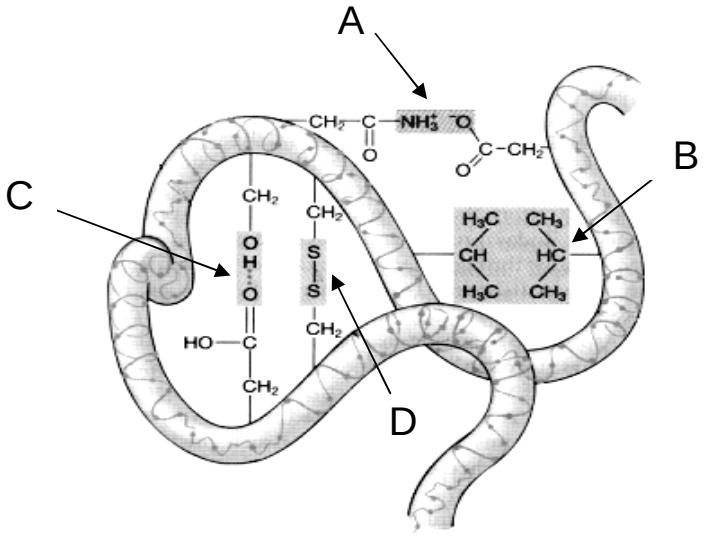
2.3.2 Which type of bond links the two amino acids in the above product? /
Watter tipe binding koppel die twee aminosure in die bogenoemde produk? (½)

.....

2.3.3 What charge does the functional group attached to the α-C on the C-terminal of the above product carry at pH 7? /
Watter lading dra die funksionelegroep gebind aan die α-C van die C-terminaal van die bogenoemde produk by 'n pH van 7? (½)

.....

2.4 Identify the interactions that stabilize the 3D-structure of proteins. /
Identifiseer die interaksies wat die 3D-struktuur van proteïene stabiliseer. (2)



A: .....

B: .....

C: .....

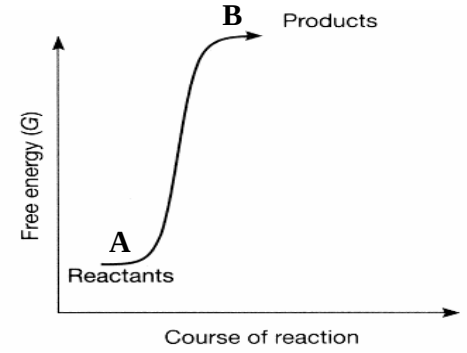
D: .....

2.5 Compare the structures of DNA and RNA by completing the following table: /
Vergelyk die strukture van RNA en DNA deur die volgende tabel te voltooi: (4)

Polynucleotide/ *Polinukleotied*	RNA	DNA
Sugar / *Suiker*		
N-bases (abbreviations) / *N-basisse (afkortings)*		
Complementary N-base pairing/ *Komplementêre N-basisparing*		

QUESTION / *VRAAG* 3: [14]

3.1 Use the following figure to answer the questions that follow: /
Gebruik die volgende figuur om die vrae wat volg te beantwoord:



3.1.1 Indicate △G on the above figure. /
Dui ⊿G op die bogenoemde figuur aan. (½)

3.1.2 Write down the general reaction (with its corresponding △G) that is represented by the above energy profile. /
Skryf neer die algemene reaksie (met sy ooreenstemmende ⊿G) wat verteenwoordig word deur die bogenoemde energieprofiel. (1)

3.1.3 What is the sign of the △G value for the reverse reaction? /
Wat is die teken van die *⊿G waarde vir die omgekeerde reaksie?* (½)

.....

3.2 Consider the reactions below: /
Beskou die reaksies hieronder:

Reaction/ *Reaksie* 1: $A + P_i \rightarrow A\sim P + H_2O$ $\triangle G = + 4.5$ kcal/mol

Reaction/ *Reaksie* 2: $ATP + H_2O \rightarrow ADP + P_i$ $\triangle G = - 7.3$ kcal/mol

The above reactions are coupled. Write down the net coupled reaction as well as the △G for the net reaction. /
Die bogenoemde reaksies is gekoppel. Skryf neer die netto gekoppelde reaksie asook die ⊿G vir die netto reaksie. (2)

3.3 Name the two models that have been proposed to explain the binding of substrate to the active site of an enzyme. /
Noem die twee modelle wat voorgestel is om die binding van substraat aan die aktiewe sentrum van 'n ensiem te verklaar. (2)

.....

.....

3.4 Show by means of a graph how the rate of an enzyme-catalyzed reaction changes with enzyme concentration. /
Toon aan mbv 'n grafiek hoe die snelheid van 'n ensiem-gekataliseerde reaksie verander met ensiemkonsentrasie. (1½)

3.5 Which other 4 factors (other than enzyme concentration and inhibitors) influence enzyme activity? /
Watter ander 4 faktore (behalwe ensiemkonsentrasie en inhibitore) beïnvloed ensiemaktiwiteit? (2)

.....

.....

.....

.....

3.6 Complete the general reaction for an enzyme-catalyzed reaction <u>in the presence of a competitive inhibitor.</u> /
Voltooi die algemene reaksie vir 'n ensiem-gekataliseerde reaksie <u>in die teenwoordigheid van 'n kompeterende inhibitor</u>. (2)

$$E + S \leftrightarrows$$

3.7 Correct the underlined part of each of the following statements. /
Korrigeer die onderstreepte deel van elk van die volgende stellings. (2½)

A competitive inhibitor binds <u>irreversibly to the enzyme</u>. /
'n Kompeterende inhibitor bind <u>onomkeerbaar aan die ensiem</u>.

.....

A competitive inhibitor decreases both the Vm and Km of the enzyme reaction. /
'n Kompeterende inhibitor verlaag beide die Vm en Km van die ensiemreaksie.

.....

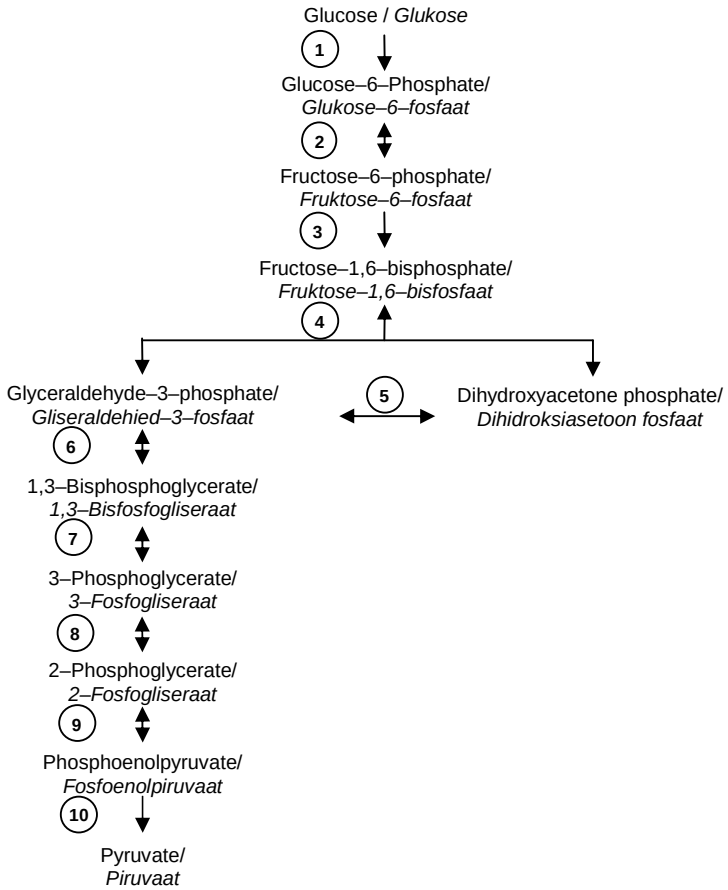
A non-competitive inhibitor binds to the active site of the enzyme and increases the Vm of the enzyme reaction. /
'n Nie-kompeterende inhibitor bind aan die aktiewe sentrum van die ensiem en verhoog die Vm van die ensiemreaksie.

.....

.....

QUESTION / *VRAAG* 4: [10]

4.1 The following is an outline of the 10 reactions of glycolysis. /
Die volgende is verteenwoordigend van die 10 reaksies van glikolise.



Answer die following questions by giving the number/s for the reaction/s: /
Beantwoord die volgende vrae deur die nommer/s vir die reaksie/s te gee:

4.1.1 Which reactions require ATP? /
Watter reaksies benodig ATP? (1)

.....

4.1.2 Where is ATP produced? /
Waar word ATP gevorm? (1)

.....

4.1.3 Which reaction is a redox reaction? /
Watter reaksie is 'n redoks reaksie? (½)

.....

4.1.4 Name the oxidizing agent required by the above redox reaction. /
Noem die oksideermiddel benodig deur die bogenoemde redoksreaksie. (½)

.....

4.1.5 Give <u>any one example</u> of a substrate-level phosphorylation reaction./
Gee <u>enige een voorbeeld</u> van 'n substraat-vlak fosforilasiereaksie. (½)

.....

4.1.6 Give <u>any one example</u> of a reaction that is catalyzed by an allosteric enzyme. /
Gee <u>enige een voorbeeld</u> van 'n reaksie wat gekataliseer word deur 'n allosteriese ensiem. (½)

.....

4.2 Consider the reaction: /
Beskou die reaksie:

Pyruvate/ Piruvaat + NADH + H^+ → Lactate/ Melksuur + NAD^+

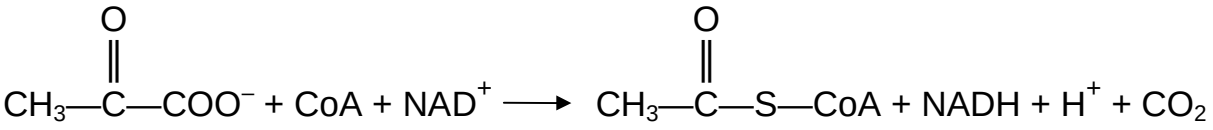
4.2.1 Indicate on the above reaction the oxidation and reduction half-reactions. /
Dui op die bogenoemde reaksie aan die oksidasie en reduksie halfreaksies. (1)

4.2.2 Wat is the purpose of this reaction? /
Wat is die doel van hierdie reaksie? (1)

.....

.....

4.3 In the presence of oxygen, pyruvate is converted firstly to molecule X. /
In die teenwoordigheid van suurstof word piruvaat eerstens omgeskakel na molekuul X.



Pyruvate/
Piruvaat

Molecule X/
Molekuul X

4.3.1 Identify molecule X. /
Identifiseer molekuul X. (½)

.....

4.3.2 Indicate on the reaction above the part of the pyruvate molecule that is released as CO_2. /
Dui aan op die bogenoemde reaksie die deel van piruvaat wat vrygestel word as CO_2. (½)

4.3.3 Where specifically in the cell does this reaction take place? /
Waar spesifiek in die sel vind hierdie reaksie plaas? (1)

.....

4.3.4 Which two metabolic pathways are linked by the above reaction? /
Watter twee metabolise padweë word gekoppel deur die bogenoemde reaksie? (1)

.....

.....

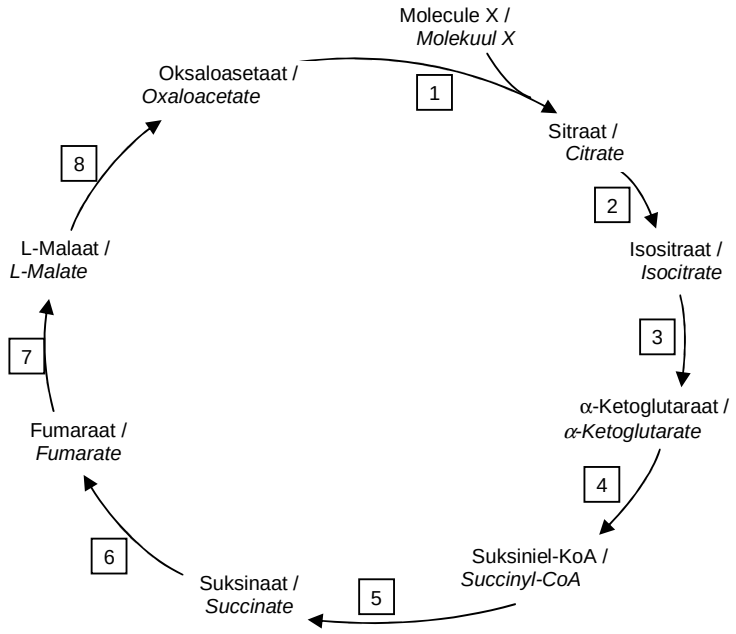
4.3.5 Which vitamins are required for the biosynthesis of NAD^+ and CoA, respectively? /
Watter vitamiene word benodig vir die biosintese van NAD^+ en CoA, onderskeidelik? (1)

.....

.....

QUESTION / *VRAAG* 5: [8]

5.1 Consider the following scheme to answer the questions that follow: /
Beskou die volgende skema om die vrae wat volg te antwoord:



Answer die following questions by giving the number/s for the reaction/s: /
Beantwoord die volgende vrae deur die nommer/s vir die reaksie/s te gee:

5.1.1 At which reaction/s is CO_2 released? /
By watter reaksie/s word CO_2 vrygestel? (1)

.....

5.1.2 Give <u>one reaction only</u> where NADH is produced. /
Gee <u>*slegs een reaksie*</u> *waar NADH gevorm word.* (½)

.....

5.1.3 How many C-atoms are there in citrate and oxaloacetate, respectively? /
Hoeveel C-atome is daar in sitraat en oksaloasetaat, onderskeidelik? (1)

.....

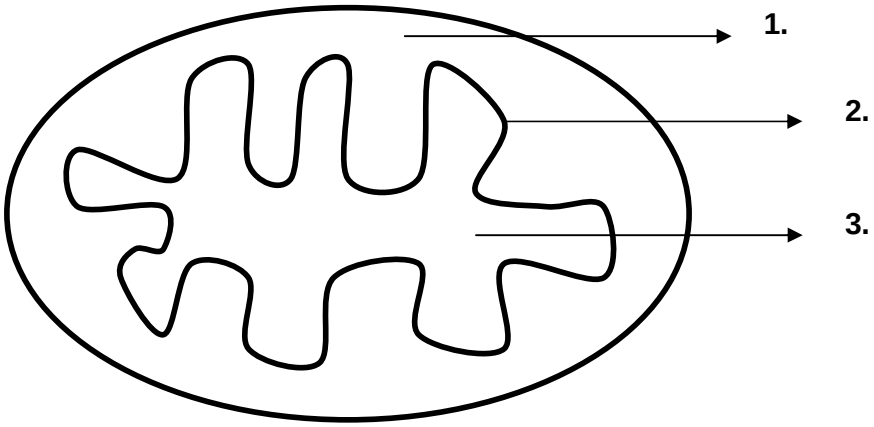
5.1.4 Where is $FADH_2$ formed? /
Waar word $FADH_2$ gevorm? (½)

.....

5.1.5 Which other <u>macromolecules</u> (give two examples) can also be catabolized to yield molecule X? /
W*atter ander <u>makromolekule</u> (gee twee voorbeelde) kan ook gekataboliseer word om molekuul X te lewer?* (1)

.....

5.2 The following is a schematic representation of a mitochondrion. /
Die volgende is 'n skematiese voorstelling van 'n mitochondrion.



5.2.1 Provide the corresponding labels. /
Verskaf die ooreenstemmende byskrifte. (1½)

1: .....

2: .....

3: .....

5.2.2 Indicate on the above figure where the reactions (of scheme 5.1) and the process of electron transport occur, respectively. /
Dui op die bogenoemde figuur aan waar die reaksies (van skema 5.1) asook die proses van elektrontransport plaasvind, onderskeidelik. (1)

5.2.3 Indicate on the figure above the flow direction of protons during the process of electron transport. /
Dui op die bogenoemde figuur aan die vloeirigting van protone tydens die proses van elektrontransport. (½)

5.2.4 Complete the following net reaction for electron transport. /
Voltooi die volgende nettoreaksie vir elektrontransport. (1)

$FADH_2 + ½ O_2 \rightarrow$

QUESTION / *VRAAG* 6: [8]

6.1 Why do electron microscopes have a much higher resolution than any light microscope? / *Hoekom het elektronmikroskope 'n baie hoër resolusie as enige ligmikroskoop?* (1)

……

……

6.2 How does the plasma membrane help maintain homeostasis? / *Hoe help die plasmamembraan om homeostase te handhaaf?* (1)

……

……

6.3 Complete the following sentences by filling in the correct word where indicated. / *Voltooi die volgende sinne deur die korrekte woord in die betrokke spasies in te vul.* (6)

6.3.1 Bacteria are prokaryotes since they do not contain a ……,

but they do however contain a …… .

Bakterieë is prokariote aangesien hulle geen ……

besit nie, maar wel 'n …… *besit.*

6.3.2 During fractionation cells are subjected to various

…….. steps to prepare different fractions.

Tydens fraksionering word selle aan verskeie ……

- stappe onderwerp om verskillende fraksies voor te berei.

6.3.3 Chloroplasts contain the pigment ……, that is located in membrane sacs called ……., that are stacked into structures called ……..

Chloroplaste bevat die pigment …… in membraansakkies genaamd ……., wat in stapel-strukture genaamd …….. voorkom.

QUESTION / *VRAAG* 7: [6]

7.1 For the following medical conditions, name the most likely cellular organelle or structure that has been affected in such a way as to cause the condition. /
Vir die volgende mediese kondisies, noem die mees waarskynlike sellulêre organel of struktuur wat aangetas is op so 'n manier dat dit die kondisie veroorsaak.

7.1.1 A person dies within minutes after ingesting cyanide because ATP is no longer being synthesized. /
'n Persoon sterf binne 'n paar minute nadat sianied ingeneem word omdat ATP nie meer vervaardig word nie. (1)

…….....

7.1.2 A person having familial hypercholesterolemia, an inherited disease characterised by very high levels of cholesterol in the blood. /
'n Persoon het familiale hipercholesterolemia, 'n oorerflike siekte gekenmerk deur baie hoë vlakke van cholesterol in die bloed. (1)

……

7.2 Which cell structures or components would you associate the following with? Complete the table. /
Watter selstrukture of komponente sal jy met die volgende assosieer? Voltooi die tabel. (4)

	Cell structure ***Selstruktuur***
plasmodesmata / *plasmodesmata*	
enzymes that produce and degrade hydrogen peroxide / *ensieme wat waterstofperoksied vervaardig en afbreek*	
the synthesis of oils, phospholipids, and steroids / *sintese van olies, fosfolipiede en steroïede*	
apoptosis / *apoptose*	

QUESTION / *VRAAG* 8: [7]

A bacterial pathogen has entered the body of a person. Describe the sequence of events that lead to the production of enzymes that will hydrolytically destroy the bacterial cell. Begin with the events in the nucleus and end with the destruction of the pathogen. /
'n Bakteriese patogeen het die liggaam van 'n persoon binne gedring. Beskryf die volgorde van gebeurtenisse wat sal lei na die vervaardiging van ensieme wat die bakteriese sel hidrolities sal vernietig. Begin met die gebeure in die selkern en eindig met die vernietiging van die patogeen.
(7)

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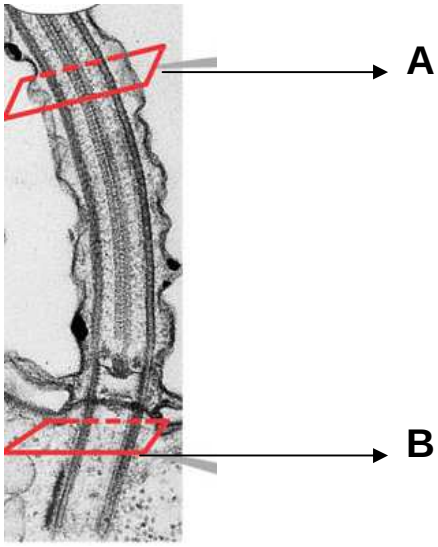
QUESTION / *VRAAG* 9: [8]

Answer the following questions with regard to the longitudinal section of a cilium below. /
Beantwoord die volgende vrae oor die onderstaande lengtesnee van 'n silium.



9.1 Which cytoskeleton component is responsible for the movement of this structure? /
Watter sitoskelet komponent is verantwoordelik vir die beweging van dié struktuur? (1)

……..

9.2 Briefly describe the structure and composition of these cytoskeleton components. /
Beskryf kortliks die struktuur en samestelling van hierdie sitoskelet komponente. (2)

……

……

……

……

9.3 How does the <u>arrangement</u> of the components, as represented by A, differ from the arrangement in the basal body, represented by B? /
Hoe verskil die <u>rangskikking</u> van die komponente, soos voorgestel deur A, met dié in die basale liggaam, voorgestel deur B? (2)

……

……

……

……

9.4 Name the motor protein that plays a role in the movement of the cilium. /
Noem die motorproteïen wat 'n rol speel in die beweging van die silium. (1)

……..

9.5 What is actually responsible for the bending action of the cilium? Explain briefly. /
Wat is eintlik verantwoordelik vir die buig aksie van die silium? Verduidelik kortliks. (2)

……

……

……

……

QUESTION / *VRAAG* 10: [6]

Indicate whether each statement is TRUE or FALSE. Motivate your answers. /
Dui aan of elke stellings WAAR of ONWAAR is. Motiveer jou antwoorde.

10.1 Facilitated diffusion can move molecules against a concentration gradient. /
Fasiliteerde diffusie kan molekules teen 'n konsentrasie gradient beweeg. (1)

……

……

10.2 Fluidity of a membrane increases as the percentage of unsaturated fatty acids in the phospholipids goes up. /
Vloeibaarheid van 'n membraan neem toe soos wat die persentasie onversadigde vetsure in die fosfolipiede toeneem. (1)

……

……

10.3 A plant cell placed in a hypertonic solution will undergo plasmolysis.
'n Plantsel wat in 'n hipertoniese oplossing geplaas word sal plasmolise ondergaan. (1)

……

……

10.4 A phospholipid is known as an amphipathic molecule. /
'n Fosfolipied staan bekend as 'n amfipatiese molekuul. (1)

……

……

10.5 Peripheral proteins extend completely through the membrane. /

Periferale proteïene strek regdeur die membraan. (1)

……

……

10.6 Glycoproteins contain carbohydrate chains that are orientated toward the inner surface of the membrane. /
Glikoproteïne bevat koolhidraatkettings wat na die binne oppervlakte van die membraan georienteer is. (1)

……

……

QUESTION / *VRAAG* 11: [10]

11.1 Which molecules cannot pass through, or find it difficult to pass through the plasma membrane? /
Watter molekules kan nie, of vind dit baie moeilik om deur die plasmamembraan te dring? (2)

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.....

11.2 Fill in the missing words regarding the co-transport of sucrose into the veins of leaves. /
Vul in die ontbrekende woorde oor die ko-transport (vervoer) van sukrose in die are van blare. (6)

A special …… protein uses the diffusion of ……. down its

……. gradient into the cell to drive the uptake of sucrose.

This gradient is maintained by a …….. pump that concentrates ……..

outside the cell, thus storing potential energy. The pump is powered by

…….. .

'n Spesiale ……. proteïen maak gebruik van die diffusie van

……. by sy ……. gradient af tot binne die sel om die

opname van sukrose te dryf. Hierdie gradient word onderhou deur 'n ……..

pomp wat …….. buite die sel konsentreer, wat sodoende potensiele energie

berg. Die pomp word deur …….. gedryf.

11.3 Explain what happens with the transport protein, sodium ions and potassium ions during the de-phosphorylation stage of the sodium-potassium pump. /
Verduidelik wat met die vervoerproteïen, natrium ione en kalium ione gebeur tydens die de-fosforileringstadium van die natrium-kaliumpomp. (2)

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