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**
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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

EERSTE SEMESTERTOETS : 17 APRIL 2007
FIRST SEMESTER TEST : 17 APRIL 2007

PUNTE TOEGEKEN *MARKS AWARDED*	

SURNAME AND INITIALS **SIGNATURE**
VAN EN VOORLETTERS ..... *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		**15**
2		**10**
3		**7**
4		**10**
5		**2**
6		**7**
7		**8**
8		**12**
9		**10**
10		**8**
11		**5**
12		**6**
TOTAL *TOTAAL*		**100**

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

FIRST SEMESTER TEST / *EERSTE SEMESTERTOETS*

2007-04-17

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

EXAMINERS / *EKSAMINATORE*:

Dr A Gaspar Dr Q Kritzinger

The test paper consists of 12 questions and 18 pages. **VERIFY IT !!**
Die toetsvraestel bestaan uit 12 vrae en 18 bladsye. ***KONTROLEER DIT !!***

QUESTION / *VRAAG* 1: [15]

1.1. Classify the following covalent bonds as non-polar or polar:/
Klassifiseer die volgende kovalente bindings as nie-polêr of polêr: (2½)

N—H .....

C—H .....

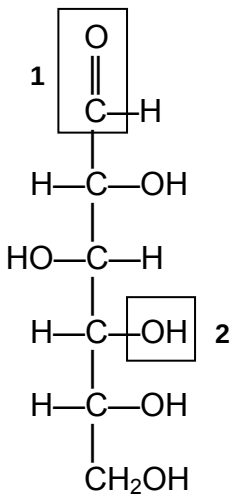
O—H .....

C—O .....

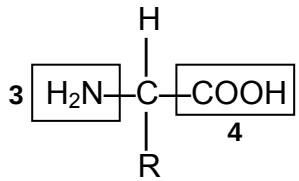
O—O .....

1.2 The following are the structures for two different monomers used for the synthesis of macromolecules. Consider these structures and answer the questions that follow:/
Die volgende is die strukture vir twee verskillende monomere wat gebruik word vir die biosintese van makromolekule. Beskou dié strukture en beantwoord dan die vrae wat volg:

A



B



1.2.1 Give the general names for the molecules represented by structures A and B./
Gee die algemene name vir die molekule wat verteenwoordig word deur strukture A en B. (1)

A: .....

B: .....

1.2.2 Name the functional groups of these molecules (indicated by numbers)./
Noem die funksionele groepe van hierdie molekule (aangedui deur nommers). (2)

1. .....

2. .....

3. .....

4. .....

1.2.3 Is structure A water soluble? Motivate your answer. /
Is struktuur A wateroplosbaar? Motiveer u antwoord. (2)

.....

.....

1.2.4 Explain by means of two suitable reactions why it can be said that structure B exhibits both acid and base properties./
Verduidelik met behulp van twee toepaslike reaksies waarom daar gesê kan word dat struktuur B beide suur en basis eienskappe vertoon. (2)

1.2.5 Draw the structure for the product that is formed when two molecules of structure B react with each other./
Teken die struktuur vir die produk wat vorm wanneer twee molekule van struktuur B met mekaar reageer. (1)

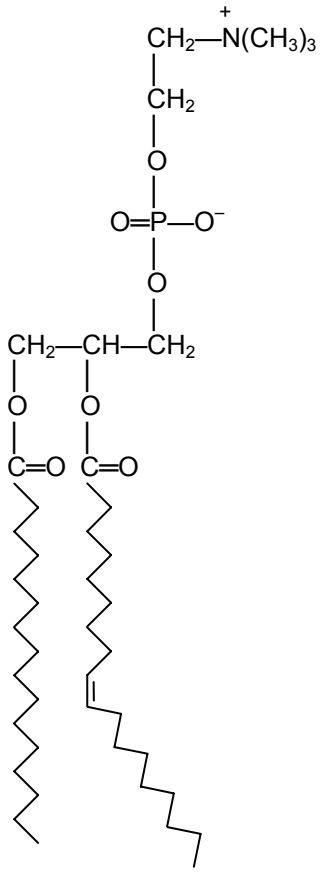
1.2.6 What is the name given for the bond formed in the structure drawn in (1.2.5)?/
Watter naam word gegee vir die binding wat vorm in die struktuur geteken in (1.2.5)? (½)

.....

1.2.7 What is represented by R in structure B? /
Wat word verteenwoordig deur R in struktuur B? (1)

.....

1.3 Consider the structure given below and then answer the questions that follow:/
Beskou die struktuur gegee hieronder en beantwoord dan die vrae wat volg:



1.3.1 Identify the biomolecule (general name)./
Identifiseer die biomolekuul (algemene naam). (½)

.....

1.3.2 On the above structure encircle the hydrophilic head and hydrophobic tails./
Omsirkel op die bogenoemde struktuur die hidrofiliese kop en hidrofobiese sterte. (1)

1.3.3 Indicate with an arrow on the above structure the unsaturated fatty acid./
Dui m.b.v. 'n pyltjie die onversadigde vetsuur op bogenoemde struktuur aan. (½)

1.3.4 Biomolecules containing both hydrophobic and hydrophilic portions are known as

……. molecules./

Biomolekule wat beide hidrofobiese en hidrofiliese dele bevat staan bekend as

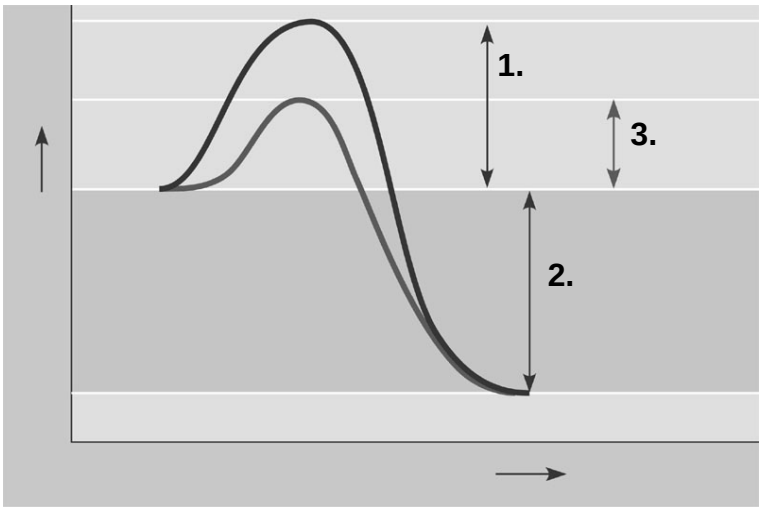
……. *molekule*. (½)

1.3.5 Where are these biomolecules found? /
Waar word hierdie biomolekule gevind? (½)

.....

QUESTION / *VRAAG* 2: [10]

2.1 The following graph represents the energy profile for reaction A→B in the absence and presence of an enzyme./
Die volgende grafiek verteenwoordig die energieprofiel vir reaksie A→B in die teenwoordigheid en afwesigheid van 'n ensiem.



2.1.1 Provide the missing information for the above graph./
Verskaf die ontbrekende inligting vir die bogenoemde grafiek. (2)

1. .....

2. .....

3. .....

2.1.2 Is reaction A→B exer- or endergonic? Motivate your answer./
Is reaksie A→B ekser- of endergonies? Motiveer u antwoord. (1)

.....

2.2 Which non-covalent interactions are disrupted when enzymes are exposed to temperatures above their temperature optimum?/
Watter nie-kovalente interaksies word versteur wanneer ensieme blootgestel word aan temperature bo hul temperatuur-optimum? (1½)

.....

.....

2.3 Show graphically how the rate of an enzyme catalyzed reaction is affected by increasing the substrate concentration. Provide labels for both the x- and y-axis, indicate Vm and Km on the graph./
Toon grafies aan hoe die tempo van 'n ensiem-gekataliseerde reaksie beïnvloed word deur 'n toename in die substraatkonsentrasie. Verskaf byskrifte vir beide die x- en y-as en dui Vm en Km aan op die grafiek. (3)

2.4 How does a competitive inhibitor influence the Km and Vm of an enzyme catalyzed reaction?/
Hoe beïnvloed 'n kompeterende inhibitor die Vm en Km van 'n ensiem gekataliseerde reaksie? (1)

.....

2.5 ……. enzymes are constructed from two or more polypeptide chains or subunits. Inhibitors bind to <u>the active-site</u> / <u>regulatory site</u> (encircle your choice) on these enzymes, changing their ...../
……. ensieme word opgebou uit twee of meer polipeptied-kettings of subeenhede. Inhibitore bind aan hul <u>aktiewe setel</u> / <u>regulerings-setel</u> (omkring u keuse) op hierdie ensieme, om sodoende hul ..... te verander. (1½)

QUESTION / *VRAAG* 3: [7]

3.1 Redox reactions play an important role in metabolism. Consider the following general redox reaction and then answer the questions below:/
Redoksreaksies speel 'n belangrike rol in metabolisme. Beskou die volgende algemene redoksreaksie en beantwoord die vrae wat volg:

$$SH_2 + NAD^+ \longrightarrow S + NADH + H^+$$

3.1.1 Indicate in the reaction above the oxidation half-reaction./
Dui aan in die bogenoemde reaksie die oksidasie halfreaksie. (½)

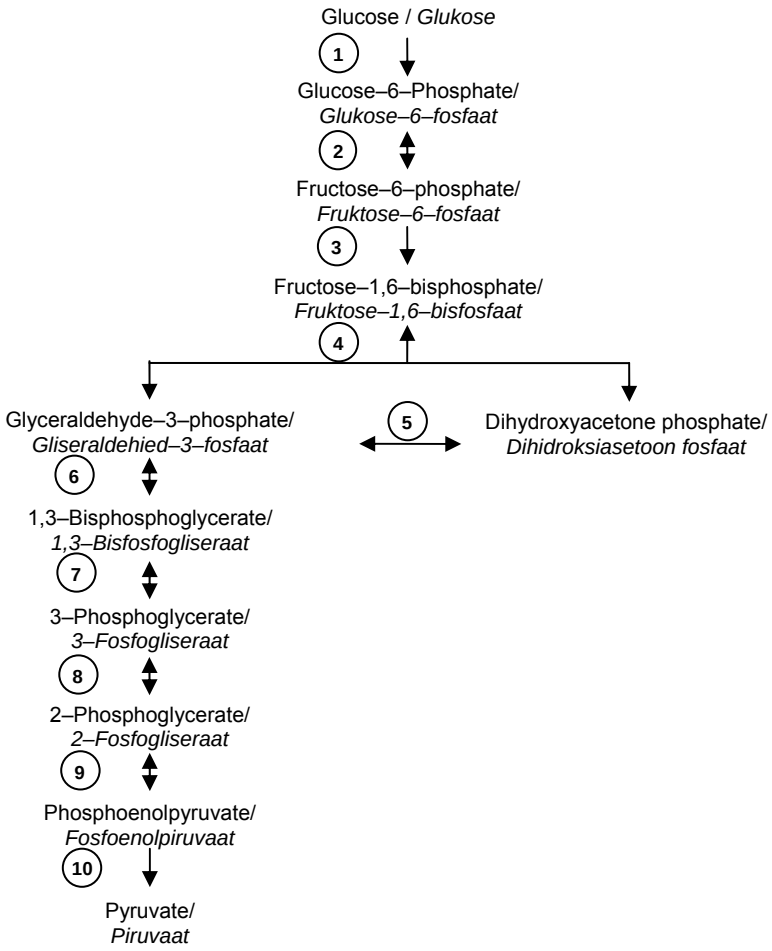
3.1.2 Identify the oxidizing agent./
Identifiseer die oksideermiddel. (½)

.....

3.1.3 Which vitamin is required for the biosynthesis of NAD^+?/
Watter vitamien word benodig vir die biosintese van NAD^+? (½)

.....

3.2 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:

3.2.1 Where is ATP hydrolysis used to drive endergonic reactions?/
Waar word ATP hidrolise gebruik om endergoniese reaksies te dryf? (1)

.....

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

.....

3.2.3 Where is NAD^+ used?/
Waar word NAD^+ gebruik? (½)

.....

3.2.4 Give <u>one example</u> of a substrate-level phosphorylation reaction./
Gee <u>een voorbeeld</u> van 'n substraat-vlak fosforilasie-reaksie. (½)

.....

3.3 How many C-atoms are there in glyceraldehyde–3–phosphate?/
Hoeveel C-atome is daar in gliseraldehied–3–fosfaat? (½)

.....

3.4 Name <u>one</u> high-energy organophosphate molecule that forms during glycolysis./
Noem <u>een</u> hoë-energie organofosfaat molekuul wat vorm tydens glikolise. (½)

.....

3.5 A high intracellular level of ATP inhibits the activity of the enzyme catalyzing reaction 3 (see scheme given in 3.2). What is this type of inhibition called?/
'n Hoë intrasellulêre vlak van ATP inhibeer die aktiwiteit van die ensiem wat reaksie 3 kataliseer (sien skema gegee in 3.2). Wat word hierdie soort inhibisie genoem? (½)

.....

3.6 The enzyme catalyzing step 3 in scheme 3.2 is a <u>non-allosteric</u> / <u>allosteric</u> enzyme. (Choose correct one.)/
Die ensiem wat stap 3 in skema 3.2 kataliseer is 'n <u>nie-allosteriese</u> / <u>allosteriese</u> ensiem. (Kies korrekte een.) (½)

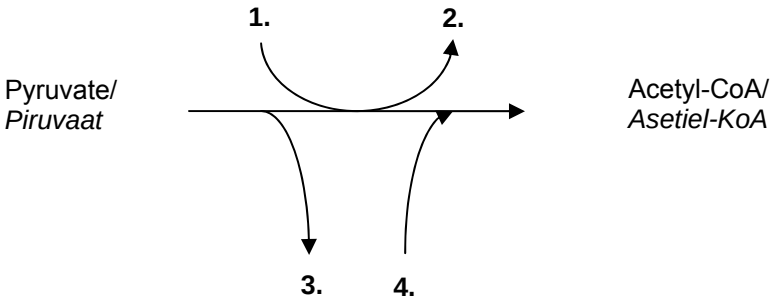
.....

3.7 Under anaerobic conditions muscle cells convert pyruvate to:/
Onder anaerobiese kondisies skakel spierselle piruvaat om na: (½)

.....

QUESTION / *VRAAG* 4: [10]

4.1 In the presence of oxygen, pyruvate is converted to acetyl-CoA./
In die teenwoordigheid van suurstof word piruvaat omgeskakel na asetiel-KoA.



4.1.1 Complete the above reaction by providing the missing information./
Voltooi die bogenoemde reaksie deur die ontbrekende inligting te verskaf. (2)

1. …….. .....

2. ……. .....

3. ……. .....

4. …… .....

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

.....

4.2 Acetyl-CoA is catabolized by the Krebs-cycle reactions. Indicate the number of moles of the products produced per mole of acetyl-CoA entering the Krebs-cycle./
Asetiel-KoA word gekataboliseer deur die Krebs-siklus reaksies. Dui aan die aantal mol van die produkte wat gevorm word per mol asetiel-KoA wat die Krebs-siklus binnegaan. (2)

CO_2: ……. .....

NADH: .....

$FADH_2$: .....

GTP: …….....

4.3 Name the 4C molecule that is re-generated with every turn of the Krebs-cycle./
Noem die 4C molekuul wat geregenereer word met elke draai van die Krebs-siklus. (1)

.....

4.4 The following is the net reaction for the process of electron transport./
Die volgende is die netto reaksie vir die proses van elektrontransport.

$$NADH+H^+ + ½\ O_2 \longrightarrow NAD^+ + H_2O$$

4.4.1 Where <u>specifically</u> in the cell does electron transport occur?/
Waar <u>spesifiek</u> in die sel vind elektrontransport plaas? (1)

.....

4.4.2 The energy released by the above reaction is used to pump ……. from the

…… to the …… generating a

…… gradient./

Die energie vrygestel deur die bogenoemde reaksie word gebruik om

……. te pomp vanaf die …… na die

…… om 'n ……. gradient te vorm. (2)

4.4.3 Which complex (give name) uses the energy stored in the gradient to drive ATP synthesis?/
Watter kompleks (gee naam) gebruik die gestoorde energie in die gradient om ATP sintese te dryf? (1)

.....

QUESTION / *VRAAG* 5: [2]

5.1 What is the primary objective of cell fractionation? /
Wat is die primêre doel van selfraksionering? (1)

.....……

……....

5.2 Some cells are very large, seemingly in defiance of maintaining a large surface area to volume ratio. Name a strategy or adaptation that these cells may use in order to maintain a reasonable surface area to volume ratio. /
Sommige selle is baie groot, oënskynlik teenstrydig met die handhawing van die groot oppervlakarea tot volume verhouding. Noem een strategie of aanpassing wat hierdie selle kan gebruik om 'n redelike oppervlakte tot volume verhouding te handhaaf. (1)

.....……

……....

QUESTION / *VRAAG* 6: [7]

6.1 Refer to the following six terms to answer the following questions. Choose the most appropriate term for each phrase. Each term may be used once, more than once, or not at all. There is, however, only one correct answer for each phrase. /
Verwys na die volgende ses terme om die volgende vrae te beantwoord. Kies die mees geskikte term vir elke frase. Elke term mag een keer, meer as een keer of glad nie gebruik word nie. Daar is egter net een korrekte antwoord vir elke frase.

A. lysosome / *lisosoom*
B. rough endoplasmic reticulum / *growwe endoplasmiese retikulum*
C. vacuole / *vakuool*
D. mitochondrion / *mitochondrion*
E. Golgi apparatus / *Golgi-apparaat*
F. smooth endoplasmic reticulum / *gladde endoplasmiese retikulum*

6.1.1 produces and modifies polysaccharides that will be secreted / *vervaardig en wysig polisakkariede wat afgeskei gaan word* (1)

……...

6.1.2 synthesis of lipids / *sintese van lipiede* (1)

…….

6.1.3 helps to recycle the animal cell's organic material / *help om die diersel se organiese materiaal te herwin* (1)

…….

6.1.4 provides energy for the movement of flagella / *verskaf energie vir die beweging van flagellums* (1)

…….

6.1.5 contains its own DNA and ribosomes / *bevat sy eie DNS en ribosome* (1)

……

6.1.6 maintains turgor pressure in plant cells / *handhaaf turgordruk in plantselle* (1)

……

6.2 A child experiences kidney failure due to Fabry's disease where the cells lining the inside of the kidney tubule accumulate abnormally large amounts of glycolipids that are usually degraded by enzymes. Name the likely cellular organelle that has been affected in some way as to cause this condition. /
'n Kind ondergaan nierversaking a.g.v. Fabry se siekte, waar die selle wat die binnekant van die nierbuisies uitvoer abnormale hoeveelhede glikolipiede akkumuleer, wat gewoonlik deur ensieme afgebreek word. Noem die sellulêre organel wat op een of ander manier beinvloed is om hierdie kondisie te veroorsaak. (1)

.....

QUESTION / *VRAAG* 7: [8]

7.1 Microtubules, microfilaments and intermediate filaments play an important role in the maintenance of cell shape. /
Mikrobuisies, mikrofilamente en intermediêre filamente speel 'n belangrike rol in die handhawing van selvorm.

7.1.1 Name two processes in the cell where microfilaments play a functional role. /
Noem twee prosesse in die sel waar mikrofilamente 'n funksionele rol speel. (2 x ½)

……

……

7.1.2 How do microfilaments and intermediate filaments differ in terms of structure? /
Hoe verskil mikrofilamente en intermediêre filamente in terme van struktuur? (2)

……

……

……

……

7.2 The transport vesicles among the membranes of the endomembrane system depend on the function of the cytoskeleton. /
Die vervoervesikels tussen die membrane van die endomembraansisteem is afhanklik van die funksionering van die sitoskelet.

7.2.1 Which cytoskeleton component is responsible for the movement of these vesicles? /
Watter sitoskelet komponent is verantwoordelik vir die beweging van dié vesikels? (1)

……

7.2.2 Which motor "MAP" is needed for this movement to occur? /
Watter motor "MAP" word benodig vir hierdie beweging? (1)

……

7.2.3 Briefly describe how this motor "MAP" interacts with the cytoskeleton component to bring about movement of these vesicles. /
Beskryf kortliks hoe hierdie motor "MAP" met die sitoskelet komponent reageer om beweging van die vesikels te bewerkstellig. (3)

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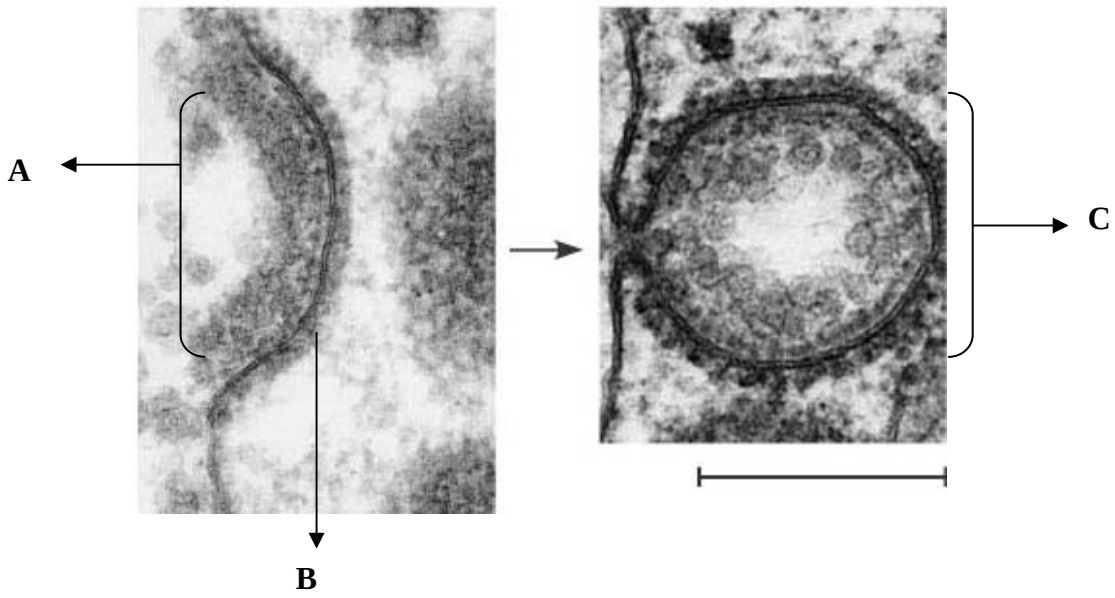
QUESTION / *VRAAG* 8: [12]

8.1 Compare the processes of facilitated diffusion and active transport by completing the table below. / *Vergelyk die prosesse van fasiliteerde diffusie en aktiewe vervoer deur die onderstaande tabel te voltooi.* (6 x ½)

	Facilitated diffusion / *Fasiliteerde diffusie*	**Active transport / *Aktiewe vervoer***
Direction / *Rigting*		
Membrane protein needed / *Membraanproteïen benodig*		
ATP needed / *ATP benodig*		

8.2.



8.2.1 Name the process that is depicted by the micrographs above. /
Noem die proses wat deur die mikrofoto's voorgestel word. (1)

……

8.2.2 Which type of microscope was used to provide this image? Provide a reason for your answer. /
Noem die tipe mikroskoop wat gebruik was om hierdie beeld te verkry. Verskaf 'n rede vir jou antwoord. (2)

……

……

……

8.2.3. Provide labels for A, B and C. / *Verskaf byskrifte vir A, B en C.* (3)

A = …….

B = ……...

C = ……

8.2.4. Briefly describe the fate of structure C. Be sure to mention what happens to the contents of structure C. /
Beskryf kortliks die bestemming van struktuur C. Maak seker om te noem wat met die inhoud van struktuur C gebeur. (3)

……

……

……

……

……

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……

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……

……

……

QUESTION / *VRAAG* 9: [10]

9.1 Provide the correct scientific term for each of the following descriptions. / *Verskaf die korrekte wetenskaplike naam vir elk van die volgende beskrywings.* (4)

	Description / *Beskrywing*	**Term**
9.1.1	The **precise** location of chromosomes within the cell. / *Die **presiese** ligging van chromosome in die sel.*	
9.1.2	Characteristic of the plasma membrane due to its ability to allow certain molecules but not others to pass through. / *Kenmerk van die plasmamembraan deur sy vermoë om sekere stowwe te laat deurbeweeg en ander nie.*	
9.1.3	The process by which white blood cells engulf bacteria. / *Die proses waarby bakterieë deur witbloedselle verswelg word.*	
9.1.4	Proteins that are found on either surface of the plasma membrane. / *Proteïene wat op beide oppervlaktes van die plasmamembraan voorkom.*	

9.2 Winter wheat is planted in the early autumn, grows during the winter when the weather is colder, and is harvested in the spring. As the temperature drops, the makeup of the plasma membrane of winter wheat changes. Unsaturated fatty acids replace saturated fatty acids in the phospholipids of the membrane. Why is this a suitable adaptation? / *Winterkoring word in vroeg herfs geplant, groei tydens winter wanneer die weer kouer is, en word in die lente geoes. Soos wat die temperatuur afneem, verander die samestelling van die plasmamembraan in die winterkoring. Onversadigde vetsure vervang versadigde vetsure in die fosfolipiede van die membraan. Hoekom is hierdie 'n geskikte aanpassing?* (2)

.....

.....

.....

.....

9.3. Complete the following: / *Voltooi die volgende:*

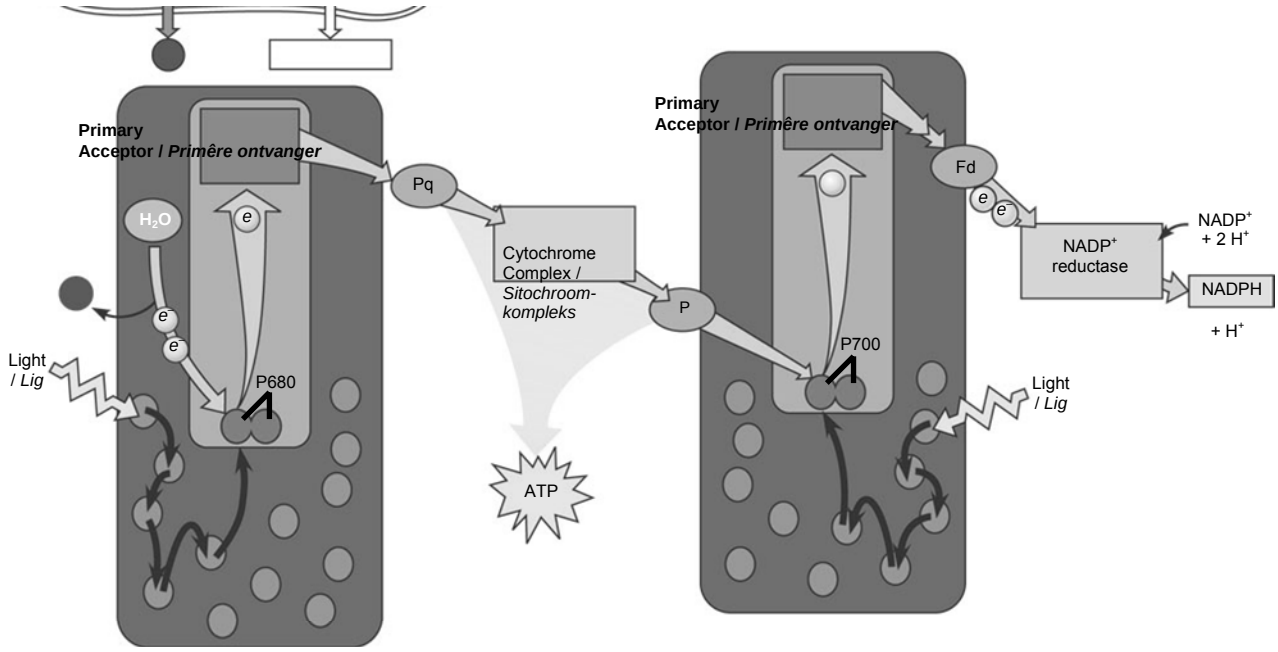
Fill in the missing words regarding the Sodium - Potassium pump. /
Vul die ontbrekende woorde oor die Natrium – Kaliumpomp in. (8 x ½)

Sodium ion concentration is …….. outside the cell and ……. inside, while potassium ion concentration is …… outside and …… inside. The pump oscillates between two conformational states which translocates …… sodium ions out of the cell for every …….. potassium ions pumped into the cell. …….. powers the changes in conformation by …… the ……..... protein.

Natrium-ioon konsentrasie is …… buite die sel en …… binne, terwyl kalium-ioon konsentrasie …… buite en …….. binne is. Die pomp verander tussen twee konformasie (struktuur) stadiums wat …….. natrium-ione buite die sel translokeer vir elke …….. kalium-ione wat binne gepomp is. …… dryf die veranderinge in konformasie deur …… van die ……..... proteïen.

QUESTION / *VRAAG* 10: [8]

Answer the questions below about the following schematic diagram. / *Beantwoord die vrae hieronder oor die volgende skematiese diagram.*



10.1 Where precisely does the above process take place in plant cells? /
Waar presies in plantselle vind die bostaande proses plaas? (1)

……

10.2 Which wavelengths of light get absorbed the best during this process? /
Watter golflengtes van lig word die beste geabsorbeer tydens die proses? (1)

……

10.3 Is this a cyclic or a non-cyclic process? Motivate your answer. /
Is hierdie proses siklies of nie-siklies? Motiveer jou antwoord. (2)

……

……

……

……

……

10.4 In which photosystem is water split? / *In watter fotosisteem word water gesplits?* (1)

……..

10.5 For what reason(s) is water split? /
Om watter rede(s) word water gesplits? (2)

……

……

……

……

……

10.6 Give the name of the process that describes how ATP is formed. / *Gee die naam van die proses wat beskryf hoe ATP gevorm word.*

…… (1)

QUESTION / *VRAAG* 11: [5]

11.1 Explain how a poison that inhibits an enzyme in the Calvin Cycle will also inhibit the light-dependent reactions of photosynthesis. /
Verduidelik hoe 'n gifstof wat 'n ensiem in die Calvinsiklus inhibeer, ook die ligafhanklike reaksies van fotosintese sal inhibeer. (2)

……

……

……

……

……

……

11.2. Indicate which statements are TRUE or FALSE and motivate your answer. / *Dui aan watter stellings REG of VERKEERD is en motiveer u antwoord*.

11.2.1 C_4 plants don't have any rubisco enzyme. / *C_4 plante het geen rubisco ensiem.* (1)

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11.2.2 Photorespiration produces oxygen. / *Fotorespirasie produseer suurstof.* (1)

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11.2.3 The pH of the thylakoid lumen decreases when photosynthesis is active. / *Die pH van die tilakoïedholte neem af wanneer fotosintese aktief is.* (1)

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QUESTION / *VRAAG* 12: [6]

12.1 Why do the leaves of CAM plants have a large amount of malate in the mornings? / *Hoekom het die blare van CSM plante 'n groot hoeveelheid malaat in die oggende?* (3)

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12.2 Why can CAM plants survive in arid (dry) environments? /
Waarom kan CAM-plante in droë gebiede groei? (3)

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