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 : 10 MARCH 2009
EERSTE SEMESTERTOETS : 10 MAART 2009

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		**12**
2		**17**
3		**16**
4		**14**
5		**6**
6		**9**
7		**7**
8		**6**
9		**6**
10		**7**
TOTAL *TOTAAL*		**100**

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

FIRST SEMESTER TEST / *EERSTE SEMESTERTOETS*

2009-03-10

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

EXAMINERS / *EKSAMINATORE*:

Dr A Gaspar Dr Q Kritzinger

The test paper consists of 10 questions and 17 pages. **VERIFY IT !!**
Die toetsvraestel bestaan uit 10 vrae en 17 bladsye. ***KONTROLEER DIT !!***

QUESTION / *VRAAG* 1: [12]

1.1 Fill in the following table regarding the important functional groups of organic molecules.
Voltooi die volgende table aangaande die belangrike funksionele groepe in organiese molekule. (5)

Functional group / *Funksionele groep*	**Structure / *Struktuur***	**Name of organic compounds (class) / *Naam van organiese verbindings (klas)***
	-OH	
		Aldehyde or ketone / *Aldehied of ketoon*
Carboxyl / *Karboksiel*		
	$-NH_2$	
		Thiols / *Tiole*

1.2 The carbonic acid / bicarbonate system is an important biological buffer.
Die karboonsuur / bikarbonaat sisteem is 'n belangrike biologiese buffer.

$$H_2CO_3 \leftrightarrows HCO_3^- + H^+$$

1.2.1 Identify the acid-conjugate base pair for the above reaction.
Identifiseer die suur-gekonjugeerde basispaar vir die bogenoemde reaksie. (1)

1.2.2 In which direction will the reaction proceed
In watter rigting sal die reaksie beweeg (1)

when the pH begins to fall? / *indien die pH begin daal?*

……

when the pH rises above the normal level? / *indien die pH bo die normale vlak styg?*

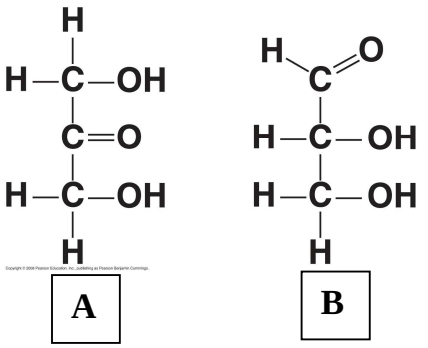
.....

1.3 Complete the following table.
Voltooi die volgende tabel. (5)

$[H^+]$ (M)	**$[OH^-]$ (M)**	**pH**	**Acid, Basic or Neutral / *Suur, Basies of Neutraal***
	10^{-11}	3	Acidic / *Suur*
10^{-8}			
	10^{-7}		
		14	

QUESTION / *VRAAG* 2: [17]

2.1 Consider the structures of the monosaccharides below and answer the questions that follow:
Beskou die strukture van die monosakkariede onder en beantwoord die vrae wat volg:



2.1.1 Explain why both A and B are known as trioses.
Verduidelik waaarom beide A en B bekend staan as trioses. (½)

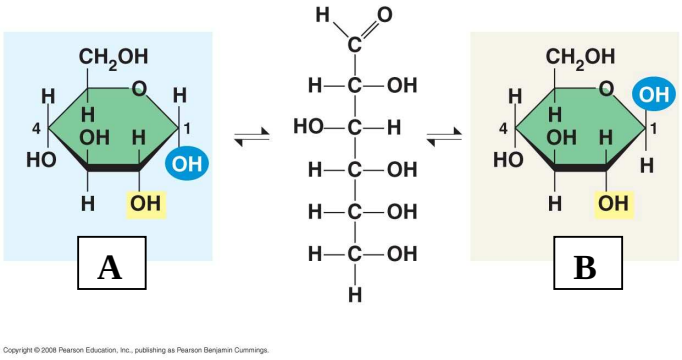
……

2.1.2 Which one of the above monosaccharides is an aldose? Motivate your answer.
Watter een van die bogenoemde monosakkariede is 'n aldose? Motiveer jou antwoord. (1)

.....

.....

2.2 The following is the equilibrium reaction for the linear, α- and β-ring forms of glucose.
Die volgende is die ewewigsreaksie vir die liniêre, α- en β-vorms van glukose.



2.2.1 Number the C-atoms of the linear structure in the above figure.
Nommer die C-atome van die liniêre struktuur in die bogenoemde figuur. (½)

2.2.2 Identify the α- and the β- ring forms of glucose, respectively.
Identifiseer die α- en β-ring vorms van glukose, onderskeidelik. (1)

A: ……

B: ……

2.2.3 Draw the structure for the disaccharide that forms when two of the α- rings are linked by an α (1-4) glycosidic bond.
Teken die struktuur vir die disakkaried wat vorm waaneer twee van die α- ringe gekoppel is deur 'n α (1-4) glikosidiese binding. (2)

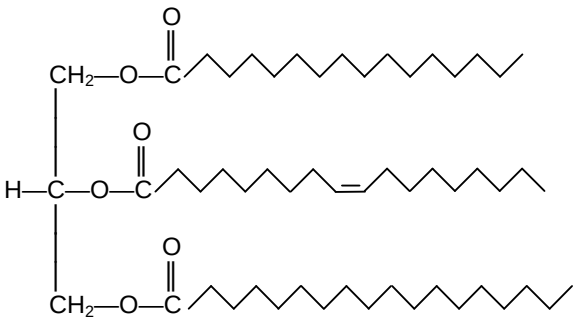
2.2.4 Give the name for the disaccharide drawn in 2.2.3.
Gee die naam vir die disakkaried geteken in 2.2.3. (½)

……

2.2.5 Which polymer consists of repeating units of the above disaccharide?
Watter polimeer bestaan uit herhalende eenhede van die bogenoemde disakkaried?
(½)

……

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



2.3.1 Identify the biomolecule (general name).
Identifiseer die biomolekule (algemene naam). (½)

……

2.3.2 On the above structure circle the hydrophobic part of the molecule.
Omsirkel op die bogenoemde struktuur die hidrofobiese deel van die molekuul. (½)

2.3.3 On the above structure circle the glycerol part of the molecule.
Omsirkel op die bogenoemde struktuur die gliserol deel van die molekuul. (½)

2.3.4 Indicate <u>one</u> ester bond on the above structure.
Dui <u>een</u> esterbinding aan op die bogenoemde struktuur. (½)

2.4 Draw the structures for the amino acids alanine (R group = - CH_3) and serine (R group = -CH_2OH).
Teken die strukture vir die aminosure alanien (R groep = -CH_3) en serien (R groep = - CH_2OH). (2)

2.4.1 Draw the structure for the dipeptide (alanine-serine).
Teken die struktuur vir die dipeptied (alanien-serien). (2)

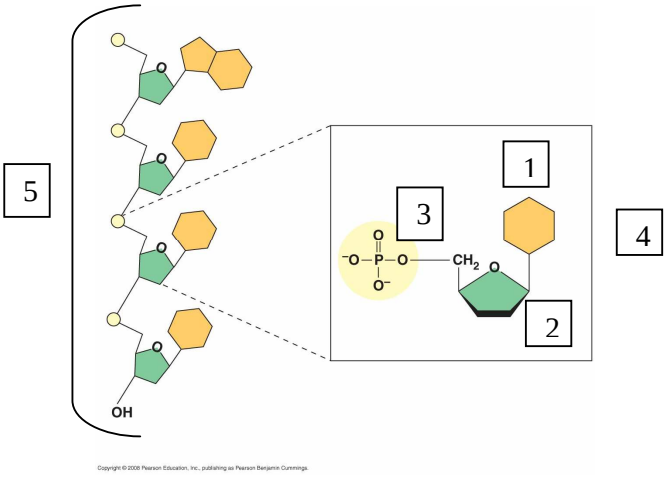
2.4.2 Indicate the peptide bond in the dipeptide drawn above.
Dui die peptiedbinding aan op die dipeptied geteken bo. (½)

2.4.3 Which of these amino acids has a polar and a non-polar R group, respectively?
Watter van hierdie aminosure het 'n polêre en 'n nie- polêre R groep, onderskeidelik? (1)

Polar/ *Polêr* : ……..

Non-polar/ *Nie- polêr :* .....

2.5 Provide labels for the following components / molecule in the figure below.
Verskaf byskrifte vir die volgende komponente / molekuul in die figuur onder. (2½)



1: ..... 2: .....

3: ..... 4: ……..

5: ……

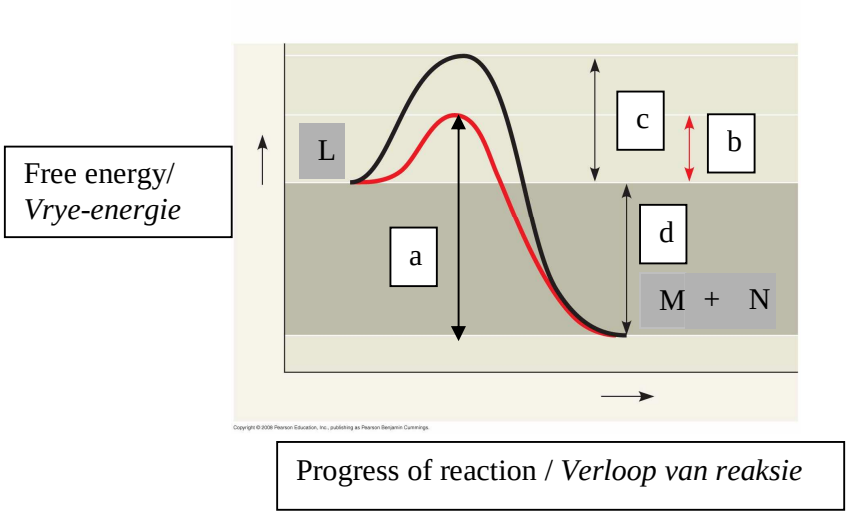
2.6 Indicate the 5’ and 3’ ends of molecule 5 on the above structure.
Dui die 5’ en 3’ ente van molekuul 5 op die bogenoemde figuur aan. (1)

QUESTION / *VRAAG* 3: [16]

3.1 Provide the terms that best fit the following descriptions.
Verskaf die terme wat die volgende beskrywings die beste pas. (2)

Description / *Beskrywing*	**Term**
pathways that require energy to combine molecules / *padweë wat energie benodig om molekule te kombineer*	
enzymes that change between two shapes, depending on whether an activator or inhibitor is bound to them / *ensieme wat tussen twee vorms verander, afhangend of ‘n aktiveerder of ‘n inhibitor aan hul gebind is*	
the measure of disorder or randomness in the universe / *die mate van wanorde of willekeurigheid in die heelal*	
organic molecules that bind to enzymes and are necessary for their functioning / *organiese molekule wat aan ensieme bind en wat benodig word vir die ensiem se funksie*	

3.2 Use the diagram below to answer the following questions:
Gebruik die diagram onder om die volgende vrae te beantwoord.



3.2.1 Which line in the diagram indicates the △G of the enzyme-catalyzed reaction?
Watter lyn in die diagram dui die ⊿G van die ensiem-gekataliseerde reaksie aan?
(½)

……

3.2.2 Which line in the diagram represents the activation energy of the non-catalyzed reaction?
Watter lyn in die diagram verteenwoordig die aktiveeringsenergie van die nie-gekataliseerde reaksie? (½)

……

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

3.2.4 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)

……

3.3 Consider the reactions below:
Beskou die reaksies hieronder:

Reaction/ *Reaksie* 1: $Glu + NH_3 \rightarrow Glu\text{-}NH_2$ $\triangle G = + 3.4$ 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)

3.4 Distinguish between isolated and open systems. /
Onderskei tusse geïsoleerde en oop sisteme. (2)

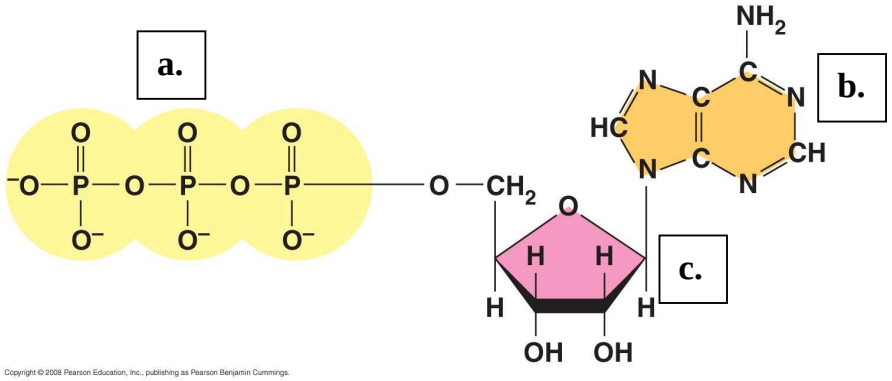
……

……

……

……

3.5 Refer to the figure below to answer the questions that follow:
Verwys na die figuur onder om die vrae wat volg te beantwoord:



3.5.1 Provide labels for the three components.
Verskaf byskrifte vir die drie komponente (1½)

a: ..... b: .....

c: .....

3.5.2 Number the atoms in component c.
Nommer die atome in komponent c. (½)

3.6 Show by means of a graph how the rate of an enzyme-catalyzed reaction changes with substrate concentration.
Toon aan mbv 'n grafiek hoe die snelheid van 'n ensiem-gekataliseerde reaksie verander met substraatkonsentrasie. (3½)

3.7 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)

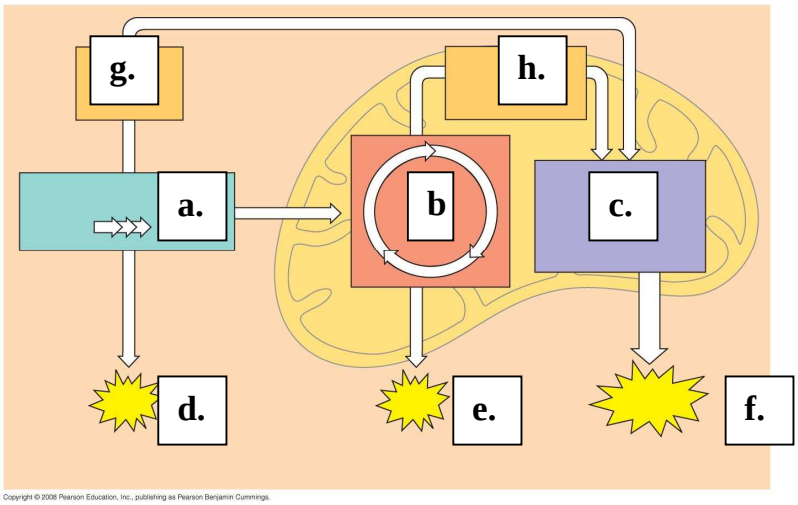
E + S ⇆

QUESTION / *VRAAG* 4: [14]

4.1 Write down the net reaction for respiration.
Skryf neer die netto reaksie vir respirasie. (1)

4.2 Indicate on the above reaction which molecules become oxidized and reduced, respectively.
Dui aan op die bogenoemde reaksie watter molekule ondergaan oksidasie en reduksie, onderskeidelik. (1)

4.3 Give the three stages of respiration (a-c). Indicate whether ATP is formed by substrate-level phosphorylation or oxidative phosphorylation (d-f). Indicate electrons carried by NADH or NADH / $FADH_2$ (g-h).
Gee die drie fases van respirasie (a-c). Dui aan of ATP gevorm word deur substraat-vlak fosforilasie of oksidatiewe fosforilasie (d-f). Dui aan elektrone wat oorgedra word deur NADH of NADH / $FADH_2$ (g-h). (4)



a: ..... b: …… c: ……

d: …… e: …… f: ……...

g: …….. h: ……

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

……

……

4.5 The first reaction in glycolysis is:
Die eerste reaksie in glikolise is:

Glucose / + ATP → Glucose-6-phosphate/ + ADP
Glukose *Glukose-6-fosfaat*

Indicate the exergonic and endergonic components for the above reaction, respectively.
Dui die eksergoniese en endergoniese komponente vir die bogenoemde reaksie aan, onderskeidelik. (1)

……

……

4.6 The following reaction is the only redox reaction in glycolysis.
Die volgende reaksie is die enigste redoks reaksie in glikolise.

Glyceraldehyde-3-phosphate/ + P_i + NAD^+ → 1,3-Bisphosphoglycerate/ + NADH + H^+
Gliseraldehied-3-fosfaat *1,3-Bisfosfogliseraat*

4.6.1 Which molecules undergo oxidation and reduction, respectively?
Watter molekule ondergaan oksidasie en reduksie, onderskeidelik? (1)

……

……

4.6.2 Identify the oxidizing agent in the above redox reaction.
Identifiseer die oksideermiddel in die bogenoemde redoksreaksie. (½)

……

4.6.3 What is P_i?
Wat is P_i? (½)

……

4.6.4 What type of reaction follows on the above reaction during glycolysis?
Watter soort reaksie volg op die bogenoemde reaskie tydens glikolise? (½)

……

4.7 How many molecules of pyruvate (PYR), NADH and ATP (net) are produced during the glycolytic degradation of one molecule of glucose?
Hoeveel molecule piruvaat (PYR), NADH en ATP (netto) vorm tydens die glikolitiese afbraak van een molekuul glukose? (1½)

PYR: ……

NADH : ……..

ATP: ……..

4.8 Show with one reaction how the NAD^+ required for glycolysis is regenerated in muscle cells during anaerobic conditions.
Toon aan mbv een reaksie hoe NAD^+ wat benodig word vir glikolise ge-regenereer word in spierselle tydens anaërobiese toestande. (2)

QUESTION / *VRAAG* 5: [6]

5.1 Name two factors that influence the resolution of a microscope.
Noem twee faktore wat die resolusie van 'n mikroskoop beïnvloed. (2)

……

……

5.2 What advantage does light microscopy have over both TEM (transmission electron microscopy) and SEM (scanning electron microscopy)?
Watter voordeel het ligmikroskopie bo beide TEM (transmissie elektronmikroskopie) en SEM (skandeer elektronmikroskopie)? (1)

……

……

5.3 What features of an object does a SEM show best?
Watter kenmerke van 'n voorwerp word die beste deur 'n SEM vertoon? (1)

……

5.4 The cells of an ant and an elephant are on average, the same size; an elephant just has more cells. What is the main advantage of small cell size?
Die selle van 'n mier en 'n olifant is min of meer dieselfde grootte; 'n olifant het net meer selle. Wat is die hoofvoordeel van klein selgrootte? (2)

……

……

……

……

QUESTION / *VRAAG* 6: [9]

6.1 Answer the following questions by choosing the correct answer from the list below:
Beantwoord die vrae hieronder deur om die regte antwoord van die onderstaande lys te kies:

A. muscle cell in the thigh muscle of a long-distance runner
spiersel in die dyspier van 'n langafstandatleet
B. pancreatic cell that manufactures digestive enzymes
pankreatiese sel wat verteringsensieme produseer
C. a cell that produces cytoplasmic enzymes
'n sel wat sitoplasmiese ensieme produseer
D. macrophage that engulfs bacteria
makrofaag wat bakterieë verswelg
E. ovarian cell that produces oestrogen (steroid hormone)
eierstoksel wat estrogeen vervaardig (steroïedhormoon)

In which cell would you expect to find the:
In watter sel sal jy verwag om die volgende te vind:

6.1.1 the most ribosomes (free)? / *die meeste ribosome (vry)?* (1)

.....

6.1.2 the most lysosomes? / *die meeste lisosome?* (1)

.....

6.1.3 the most smooth endoplasmic reticulum? / *die meeste gladde endoplasmiese retikulum?* (1)

.....

6.1.4 the most bound ribosomes? / *die meeste gebonde ribosome?* (1)

.....

6.1.5 the most mitochondria? / *die meeste mitochondria?* (1)

.....

6.2 Use the organelles / structures below to give the sequence of events that accurately describes glycoprotein processing and movement in eukaryotic cells. Take note: Not all the structures are involved in this process AND some structures can be used more than once.
Maak van die organelle / strukture hieronder gebruik om die volgorde van gebeurtenisse wat in die verwerking en beweging van glikoproteïne in eukariotiese selle plaasvind, akkuraat te beskryf. Let wel: Nie al die strukture is by die proses betrokke nie EN sekere strukture kan meer as een keer gebruik word. (6 x ½)

A. Rough ER / *Growwe ER*
B. *Trans* face of the Golgi complex / Trans-*gebied van die Golgi-kompleks*
C. Ribosomes / *Ribosome*
D. *Cis* face of the Golgi complex / Cis-*gebied van die Golgi-kompleks*
E. Transport vesicle / *Vervoervesikel*
F. Grana / *Grana*
G. Plasma membrane / *Plasmamembraan*

Sequence / *Volgorde* (Give the alphabet letters / *Verskaf slegs die alfabet letters*):

.....

6.3 Why are lysosomes considered to be part of the endomembrane system?
Waarom word lisosome as deel van die endomembraansisteem beskou? (1)

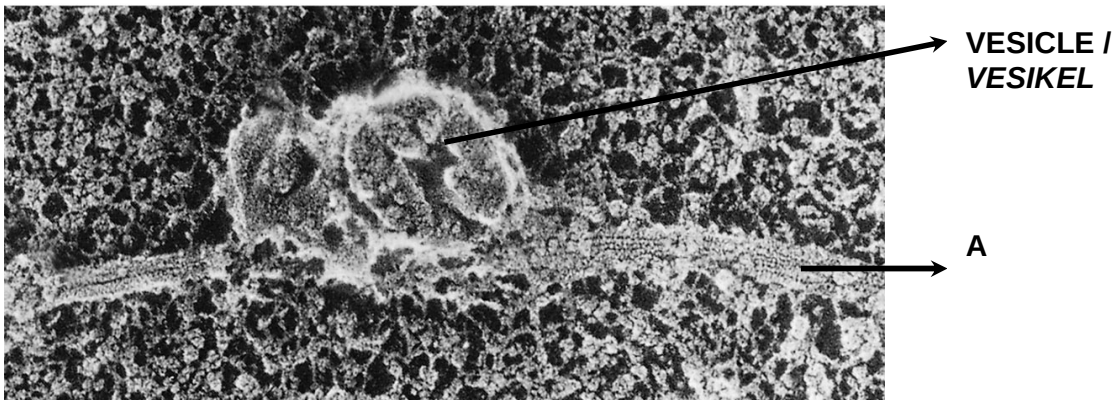
……

……

……

QUESTION / *VRAAG* 7: [7]

7.1 Study the figure below and answer the questions that follow.
Bestudeer die figuur hieronder en beantwoord die vrae wat volg.



7.1.1 Name the cytoskeletal component that is depicted by A.
Verskaf die naam van die sitoskelet komponent wat deur A voorgestel word. (1)

……

7.1.2 Briefly describe how a motor protein can move a transport vesicle down structure A. Include all necessary steps and components.
Beskryf kortliks hoe 'n vervoerproteïen 'n vervoervesikel al langs struktuur A kan laat af beweeg. Sluit al die noodsaaklike stappe en komponente in. (4)

……

……

……

……

……

……

……

……

7.2 Researchers have noticed that some men who were sterile because their sperm cells were unable to move also had chronic infections of the respiratory tract. What might be the connection between these two symptoms?
Navorsers het opgemerk dat sekere mans wat steriel is omdat hulle spermselle nie kan beweeg nie, ook aan chroniese infeksies van die respiratoriese kanaal ly. Wat kan die moontlike verband tussen dié twee simptome wees? (2)

……

……

……

……

QUESTION / *VRAAG* 8: [6]

Are the following statements True of False? **If your answer is False, <u>motivate why</u>**.
Is die volgende stellings Waar of Vals? ***Indien jou antwoord Vals is, <u>motiveer hoekom</u>.***

8.1 Eukaryotic cells contain a variety of intracellular organelles that are absent in all prokaryotic cells.
Eukariotiese selle bevat 'n verskeidenheid intrasellulêre organelle wat ontbreek in alle prokariotiese selle. (1)

……

……

8.2 Each cilium and flagella has a basal body at its base, which is found in the cytoplasm.
Elke silium en flagellum het 'n basale liggaampie aan die basis wat in die sitoplasma geleë is. (1)

……

……

8.3 In plants, the secondary cell wall often contains structural components, like lignin, that form a rigid and complex network within the cell wall.
In plante bevat die sekondêre selwand gewoonlik strukturele komponente, soos lignien, wat 'n rigiede en komplekse netwerk in die selwand vorm. (1)

……

……

8.4 Nicolson and Singer proposed that cell membranes are a mosaic of protein molecules in a fluid bilayer of phospholipids.
Nicolson en Singer het voorgestel dat selmembrane 'n mosaïek van proteïenmolekules is wat in 'n vloeistof dubbellaag van fosfolipiede voorkom. (1)

……

……

8.5 Transmembrane proteins are composed of a middle region consisting of α helical stretches of hydrophilic amino acids, with hydrophobic regions at both ends of the protein.
Transmembraanproteïne bestaan uit 'n middel gedeelte van α heliks dele van hidrofiliese aminosure, met hidrofobiese areas op albei ente van die proteïen. (1)

……

……

8.6 Chlorophyll pigments are found in the stroma of the chloroplast.
Chlorofilpigmente word in die stroma van die chloroplast aangetref. (1)

……

……

QUESTION / *VRAAG* 9: [6]

9.1 Why is facilitated diffusion considered as passive transport?
Hoekom word gefasiliteerde diffusie as passiewe vervoer gesien? (1)

……

……

9.2 When biomedical researchers design drugs that must enter cells to be effective, they sometimes add methyl (CH_3) groups to make the drug molecules more likely to pass through plasma membranes. Briefly explain why this strategy makes sense.
Wanneer biomediese navorsers geneesmiddels (medisyne) ontwikkel wat selle moet binnedring om effektief te kan wees, voeg hulle partykeer metielgroepe (CH_3) by die geneesmiddelmolekules om dit te help om deur plasmamembrane te beweeg. Verduidelik kortliks hoekom hierdie strategie sin maak. (2)

……

……

……

……

9.3 The sodium-potassium pump is the major electrogenic pump found in animal cells.
Die natrium-kalium pomp is die hoof elektrogeniese pomp wat in dierselle gevind word.

9.3.1 What is the major electrogenic pump found in plant cells?
Wat is die hoof elektrogeniese pomp wat in plantselle gevind word? (1)

……

9.3.2 The sodium-potassium pump exchanges sodium ions for potassium ions, both of which are cations (positively charged ions). How does this exchange generate a membrane potential?
Die natrium-kalium pomp ruil natriumione vir kaliumione, wat albei katione (positief gelaaide ione) is. Hoe dra hierdie uitruiling by tot die membraanpotensiaal? (2)

……

……

……

……

QUESTION / *VRAAG* 10: [7]

10.1 Cholesterol is a sterol that is found in the membranes of animal cells. Answer the following questions about cholesterol.
Cholesterol is 'n sterol wat in die membrane van dierselle voorkom. Beantwoord die volgende vrae oor cholesterol.

10.1.1 How is cholesterol transported into human cells? Give the name of the process.
Hoe word cholesterol tot in mensselle vervoer? Gee die naam van die proses. (1)

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10.1.2 Briefly explain why cholesterol accumulates in the blood of individuals with the disease hypercholesteremia.
Verduidelik kortliks hoekom cholesterol in die bloed van mense met die siekte hipercholesteremia, akkummuleer. (2)

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10.2 Unicellular organisms that live in extremely cold habitats have an unusually high proportion of unsaturated fatty acids in their plasma membranes. Some of these membranes even contain polyunsaturated fatty acids, which have more than one double bond in each hydrocarbon chain. Researchers have proposed that the lack of saturation helps these membranes maintain a semifluid state at low temperatures instead of becoming semisolid or solid. Comment on the hypothesis that membranes with unsaturated fatty-acid tails function better at cold temperatures than do membranes with saturated fatty-acid tails.
Eensellige organismes wat in baie koue habitatte leef het 'n ongewone hoë verhouding van onversadigde vetsure in hul plasmamembrane. Sommige van hierdie membrane het selfs poli-onversadigde vetsure, wat meer as een dubbelbinding in elke waterstof-koolstof ketting het. Navorsers het voorgestel dat die tekort aan versadigheid die membrane help om 'n semi-vloeistof staat by lae temperature te handhaaf, in plaas van om semi-solied of solied te word. Lewer kommentaar oor die hipotese dat membrane met onversadigde vetsure beter funksioneer by koue temperature as membrane met versadigde vetsure. (4)

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