



# education

Department:  
Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL SENIOR CERTIFICATE  
NASIONALE SENIOR SERTIFIKAAT**

**GRADE/GRAAD 12**

**PHYSICAL SCIENCES CHEMISTRY (P2)  
FISIESE WETENSKAPPE: CHEMIE (P2)**

**ADDITIONAL EXEMPLAR/ADDISIONELE MODEL 2008**

**MEMORANDUM**

**MARKS/PUNTE: 150**

**This memorandum consists of 14 pages.  
Hierdie memorandum bestaan uit 14 bladsye.**

LEARNING OUTCOMES AND ASSESSMENT STANDARDS LEERUITKOMSTE EN ASSESSERINGSTANDAARDE		
LO 1/LU 1	LO 2/LU 2	LO 3/LU 3
<p><b>AS 12.1.1:</b> Design, plan and conduct a scientific inquiry to collect data systematically with regard to accuracy, reliability and the need to control variables.</p> <p><i>Ontwerp, beplan en voer 'n wetenskaplike ondersoek uit om data te versamel ten opsigte van akkuraatheid, betroubaarheid en die kontroleer van veranderlikes.</i></p> <p><b>AS 12.1.2:</b> Seek patterns and trends, represent them in different forms, explain the trends, use scientific reasoning to draw and evaluate conclusions, and formulate generalisations.</p> <p><i>Soek patrone en tendense, stel dit in verskillende vorms voor, verduidelik tendense, gebruik wetenskaplike beredenering om gevolgtrekkings te maak en te evalueer, en formuleer veralgemenings.</i></p> <p><b>AS 12.1.3:</b> Select and use appropriate problem-solving strategies to solve (unseen) problems.</p> <p><i>Kies en gebruik geskikte probleemoplossingsstrategieë toe om (ongesiene) probleme op te los.</i></p>	<p><b>AS 12.2.1:</b> Define, discuss and explain prescribed scientific knowledge.</p> <p><i>Definieer, bespreek en verduidelik voorgeskrewe wetenskaplike kennis.</i></p> <p><b>AS 12.2.2</b> Express and explain prescribed scientific principles, theories, models and laws by indicating the relationship between different facts and concepts in own words.</p> <p><i>Verduidelik en druk voorgeskrewe wetenskaplike beginsels, teorieë, modelle en wette uit deur die verwantskap tussen verskillende feite konsepte in eie woorde aan te dui.</i></p> <p><b>AS 12.2.3:</b> Apply scientific knowledge in everyday life contexts.</p> <p><i>Pas wetenskaplike kennis in kontekste van die alledaagse lewe toe.</i></p>	<p><b>AS 12.3.2:</b> Research case studies and present ethical and moral arguments from different perspectives to indicate the impact (pros and cons) of different scientific and technological applications.</p> <p><i>Vors gevallestudies na en lewer etiese en morele argumente uit verskillende perspektiewe om die impak (voordele en nadele) van verskillende wetenskaplike en tegnologiese toepassings aan te dui.</i></p> <p><b>AS 12.3.3:</b> Evaluate the impact of scientific and technological research and indicate the contribution to the management, utilisation and development of resources to ensure sustainability continentally and globally.</p> <p><i>Evalueer die impak van wetenskaplike en tegnologiese navorsing en dui die bydrae tot bestuur, benutting en ontwikkeling van bronne om volhoubaarheid kontinentaal en globaal te verseker.</i></p>

## SECTION A/AFDELING A

## QUESTION 1/VRAAG 1

- 1.1 Arenes or aromatic compounds/*arene of aromatiese verbindings of aromate* ✓ [12.2.1] (1)
- 1.2 heat of reaction/enthalpy change ✓  
*reaksiewarmte/entalpieverandering* [12.2.1] (1)
- 1.3 Electrolysis/*elektrolise* ✓ [12.2.1] (1)
- 1.4 Bauxite/*bauxiet* ✓ [12.2.1] (1)
- 1.5 Fractional distillation of liquid air/*fraksionele distillasie van vloeibare lug* ✓ [12.2.1] (1)  
**[5]**

## QUESTION 2/VRAAG 2

- 2.1 D ✓ [12.2.1] (1)
- 2.2 A ✓ [12.2.1] (1)
- 2.3 E ✓ [12.2.1] (1)
- 2.4 F ✓ [12.2.1] (1)
- 2.5 H ✓ [12.2.1] (1)  
**[5]**

## QUESTION 3/VRAAG 3

- 3.1 False/*Onwaar* ✓  
... because they are harmful to the environment./... because they deplete the ozone layer ✓  
*... omdat hulle skadelik vir die omgewing is./...omdat hulle die osoonlaag vernietig.* [12.3.3] (2)
- 3.2 True/*Waar* ✓✓ [12.2.2] (2)
- 3.3 False/*Onwaar* ✓  
$$K_c = \frac{[H_2O]}{[H_2]}$$
 [12.2.3] (2)
- 3.4 False/*Onwaar* ✓  
... converts electrical energy to chemical energy./... *skakel elektriese energie om na chemiese energie.* ✓ [12.2.1] (2)
- 3.5 True/*Waar* ✓✓ [12.2.3] (2)  
**[10]**

**QUESTION 4/VRAAG 4**

4.1	B ✓✓✓	[12.2.3]	(3)
4.2	C ✓✓✓	[12.2.3]	(3)
4.3	A ✓✓✓	[12.2.3]	(3)
4.4	D ✓✓✓	[12.2.3]	(3)
4.5	C ✓✓✓	[12.2.1]	(3)
			<b>[15]</b>

**TOTAL SECTION A/TOTAAL AFDELING A: 35**


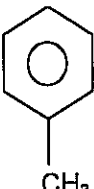
## SECTION B / AFDELING B

## QUESTION 5 / VRAAG 5

- 5.1 A group of organic compounds that can be represented by the same general formula. / 'n Groep organiese verbindings wat deur dieselfde algemene formule beskryf kan word. ✓ [12.2.1] (2)
- 5.2 Molecular mass/size of molecules increase ✓ therefore Van der Waals forces increase. ✓  
Molekulêre grootte/grootte van molekule neem toe ✓ en dus neem die Van der Waalskragte toe. ✓ [12.2.2] (2)
- 5.3 Straight chain alkanes have higher boiling points ✓ than that of corresponding branched chains. / Reguitketting alkane het hoër kookpunte ✓ as die ooreenstemmende vertakte kettings.
- Branched chains become more compact/surface contact decreases ✓ therefore intermolecular forces are weaker, ✓ hence lower boiling point. / Vertakte kettings is meer kompak/kleiner kontak oppervlakte ✓ dus swakker intermolekulêre kragte, ✓ en dus laer kookpunte. [12.1.2] [12.2.2] (3)
- 5.4
- ✓✓
- [12.2.3] (2)
- 5.5.1 The thinners will dissolve the fats and oils in the skin, ✓ and leave the skin dry and damaged. ✓  
Die verdunner sal vette en olies in die vel oplos ✓ en die vel droog en beskadig laat. ✓ [12.3.2] (2)
- 5.6.1 Viscosity/viskositeit ✓ [12.2.1] (1)
- 5.6.2 The Vaseline will form a layer on the skin that traps heat ✓ and increase the pain from the burns. ✓  
Die Vaseline sal 'n laagie op die vel vorm wat hitte vasvang ✓ en dus die pyn as gevolg van brandwonde vererger. ✓ 12.3.2] (2)

[14]

## QUESTION 6/VRAAG 6

- 6.1
-  ✓
- 2-pentanone/pentan-2-one ✓✓  
2-pentanoon/pentaaan-2-oon [12.2.3] (3)
- 6.2
- N*-Ethylpropylamine/*N*-etielpropielamien ✓✓  
OR/OF  
*N*-ethylpropan – 1-amine/*N*-etielpropaan-1-amien [12.2.3] (2)
- 6.3
-  ✓✓
- [12.2.3] (2)
- 
- 6.4
- Compound D (unsaturated) will decolorise bromine water quickly, ✓  
while 4-methylhexane (saturated) will not decolorise bromine water  
unless placed in sunlight or heated. ✓  
*Verbinding D (onversadigd) sal broomwater vinnig ontkleur, ✓terwyl 4-*  
*metielheksaan (versadigd) nie broomwater sal ontkleur voordat in die*  
*son geplaas word of verhit word nie. ✓* [12.2.3] (2)
- 6.5
- $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \overset{\text{O}}{\parallel}{\text{C}} - \text{O} - \text{CH}_2 - \text{CH}_3$  ✓✓ [12.2.3] (2)
- [11]

**QUESTION 7/VRAAG 7**

7.1 A: Substitution/*substitusie* ✓ OR/OF halogenation/*halogenering*

B: Substitution/*substitusie* ✓

C: Substitution/*substitusie* ✓

D: elimination/*eliminasië* ✓ OR/OF

dehydrohalogenation/*dehidrohalogenering*

[12.1.2] (4)

7.2  $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br} + \text{H}_2\text{O} \checkmark \rightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{OH} + \text{HBr} \checkmark$  bal ✓

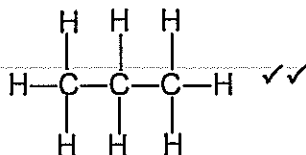
OR/OF

$\text{CH}_3\text{CH}_2\text{CH}_2\text{Br} + \text{OH}^- \checkmark \rightarrow \text{CH}_3\text{CH}_2\text{CH}_2\text{OH} + \text{Br}^- \checkmark$  bal ✓

(react with dilute base in ethanol/*reageer met verdunde basis in etanol*)

[12.2.3] (3)

7.3



[12.2.3] (2)

7.4  $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br} + \text{KOH} \checkmark \rightarrow \text{CH}_2 = \text{CHCH}_3 \checkmark + \text{KBr} + \text{H}_2\text{O} \checkmark$

[12.2.3] (3)

7.4 Propane-1-ol/*propaan-1-ol* ✓✓

OR/OF

1-propanol

[12.2.3] (2)

[14]

**QUESTION 8/VRAAG 8**

8.1 Use the checklist/*Gebruik die kontrolelys:*

Examples/*voorbeelde:*

What is the relationship between the reaction rate and size of particles?*/Wat is die verwantskap tussen die reaksietempo en die grootte van die deeltjies?*

Does the rate of reaction depend on surface area /particle size of reactants?*/Is die reaksietempo afhanklik van die oppervlakarea/deeltjiegrootte van die reaktante?*

How will the rate of reaction change when the surface area of particles change?*/Hoe sal die reaksietempo verander wanneer die oppervlakarea van deeltjies verander?*

<b>Checklist/Kontrolelys</b>	
<b>Criteria for investigative question/Kriteria vir ondersoekende vraag:</b>	<b>Mark/Punt</b>
Question that refers to independent variable./ <i>Vraag wat na onafhanklike vernaderlike verwys.</i>	✓
Question that refers to dependent variable./ <i>Vraag wat na afhanklike veranderlike verwys.</i>	✓

[12.1.1] (2)

8.2 The initial mass of the conical flask and its contents/*Die aanvanklike massa van die koniese fles en inhoud. ✓*

[12.1.1] (1)

8.3 To ensure a fair test/*Om 'n regverdige toets te verseker ✓*

[12.1.1.] (1)

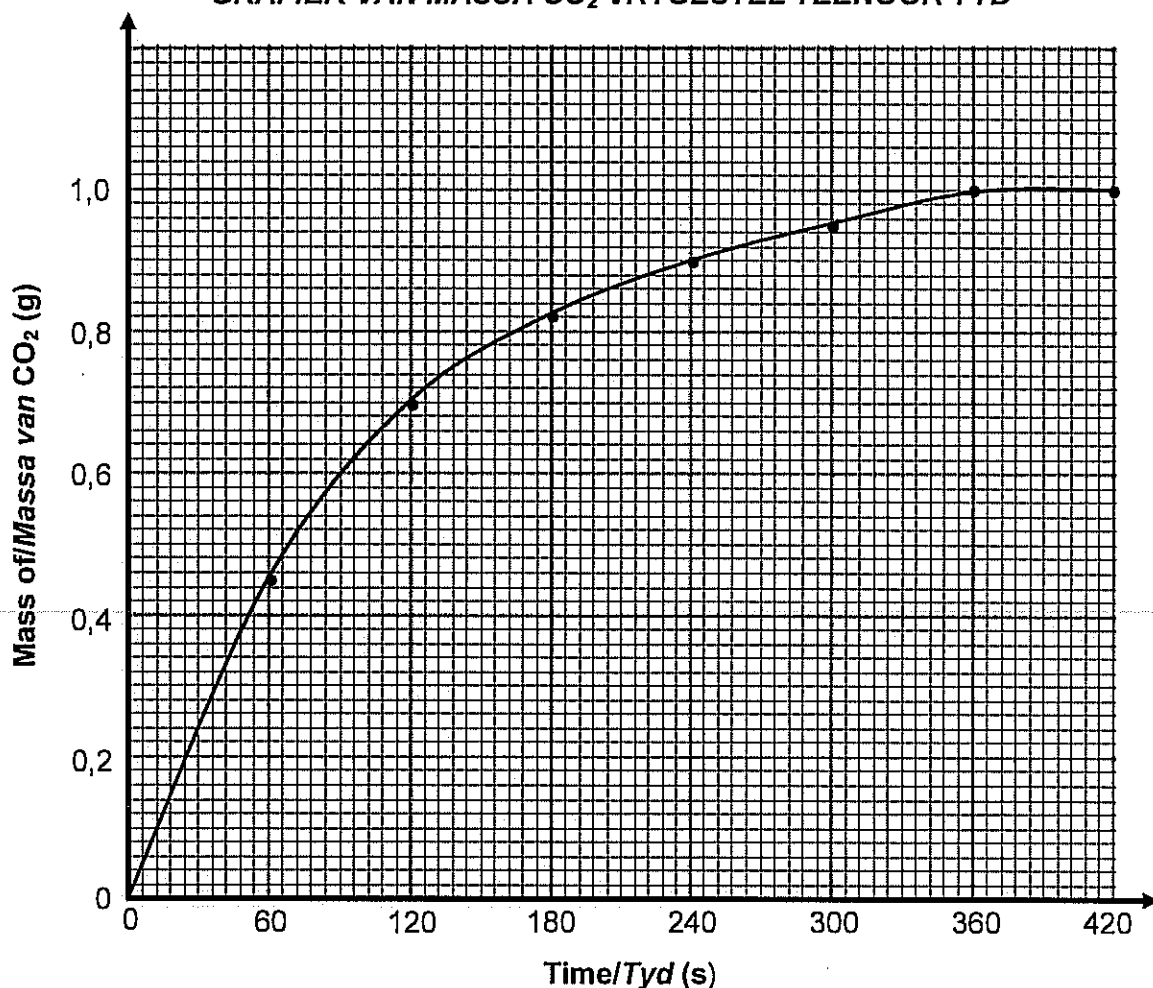
8.4 The time must be taken from the moment the calcium carbonate is added to the acid./*Die tyd moet geneem word van die oomblik dat die kalsiumkarbonaat by die suur gevoeg is. ✓*

[12.1.1] (1)



8.5

GRAPH OF MASS OF CO<sub>2</sub> PRODUCED AGAINST TIME  
GRAFIEK VAN MASSA CO<sub>2</sub> VRYGESTEL TEENoor TYD



CHECKLIST/KONTROLELYS	
<b>Criteria for graph/Kriteria vir grafiek:</b>	
Appropriate heading/Geskikte opskrif	✓
Independent variable with unit indicated on the x-axis /Onafhanklike veranderlike met eenheid op die x-as aangedui	✓
Dependant variable with unit indicated on the y-axis/Afhanklike veranderlike met eenheid op die y-as aangedui	✓
Appropriate scale on both axes/Geskikte skaal op beide asse	✓
Points correctly plotted/Punte korrek gestip	✓
Best curve drawn through points/Beste kurwe deur punte getrek	✓

[12.1.2] (6)

- 8.6 The mass of  $\text{CO}_2$  produced each time interval decreases ✓✓ as the concentration of reactants decreases until the reaction stops and no  $\text{CO}_2$  is produced. / Die massa  $\text{CO}_2$  gevorm in elke tydsinterval neem af ✓✓ soos wat die konsentrasie van die reaktante afneem totdat die reaksie ophou en geen  $\text{CO}_2$  meer gevorm word nie.

OR/OF

The rate of the reaction/production of  $\text{CO}_{2(g)}$  decrease as the reaction proceeds. / Die tempo van die reaksie/produksie van  $\text{CO}_{2(g)}$  neem af soos wat reaksie verloop.

[12.1.2] (2)  
[13]

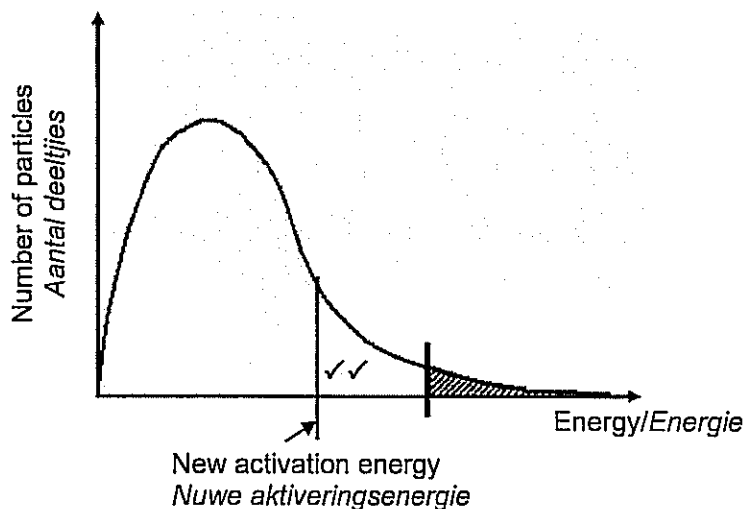
### QUESTION 9/VRAAG 9

- 9.1.1 The catalyst provides an alternative pathway/route for the reaction ✓ with a lower activation energy ✓. More molecules/particles have enough energy ✓ and more effective collisions occur ✓, increasing the rate of reaction.

Die katalisator verskaf 'n alternatiewe roete ✓ vir die reaksie met 'n laer aktiveringsenergie. ✓ Meer molekule/deeltjies beskik oor voldoende energie ✓ en meer effeketiewe botsings ✓ vind plaas.

[12.2.3] (4)

9.1.2



[12.1.2] (2)

- 9.2 At higher temperature, average kinetic energy of molecules increases ✓ and the number of effective collisions increase ✓ hence the spoiling process goes faster ✓ than at lower temperatures.

By hoër temperature neem die gemiddelde kinetiese energie van molekule toe ✓ en die aantal effeketiewe botsings verhoog. ✓ Gevolglik vind die proses van bederwing vinniger plaas ✓ as by laer temperature.

[12.3.2] (3)  
[9]

**QUESTION 10/VRAAG 10**

10.1.1 The system reached equilibrium./Die sisteem het ewewig bereik. ✓ [12.1.2] (1)

10.1.2 Concentration of H<sub>2</sub> was increased. /Some H<sub>2</sub> was added at t<sub>1</sub>. ✓ The concentration of HI then increased/more HI was formed ✓ while some H<sub>2</sub> and I<sub>2</sub> were used up ✓ until equilibrium was re-established at t<sub>2</sub>. ✓ [12.1.2] (4)

10.1.3

	H <sub>2</sub>	I <sub>2</sub>	HI
Initial number of mole (mol) <i>Aanvanklike aantal mol (mol)</i>	0,3	0,3	0 ✓
Number of moles used/formed (mol) <i>Aantal mol gereageer/gevorm</i>	x	x	2x ✓
Number of moles at equilibrium(mol) <i>Aantal mol by ewewig (mol)</i>	0,3 - x	0,3 - x	2x ✓
Equilibrium [ ] (mol·dm <sup>-3</sup> ) <i>Ewewig [ ] (mol·dm<sup>-3</sup>)</i>	$\frac{0,3-x}{2}$	$\frac{0,3-x}{2}$	$\frac{2x}{2}$ ✓

$$K_c = \frac{[HI]^2}{[H_2][I_2]} \checkmark \therefore 50,5 = \frac{\left(\frac{2x}{2}\right)^2}{\left(\frac{0,3-x}{2}\right)^2} \checkmark \therefore 7,11 = \frac{2x}{0,3-x}$$

$$\therefore x = 0,23 \text{ mol } \checkmark$$

Number of moles HI = 2x = 2(0,23) = 0,46 mol ✓ [12.1.3] (8)

10.2.1 Use oxygen masks / carry an extra supply of oxygen. ✓✓ [12.3.2] (2)

10.2.2 An increase in oxygen concentration will shift the equilibrium to the right/favour the forward reaction ✓ i.e. more HbO<sub>2</sub> molecules in the blood. ✓ Hence more oxygen will be transported to the tissues minimising the threat of hypoxia. ✓

*'n Toename in suurstofkonsentrasie sal die ewewig na regs skuif/voorwaarde reaksie bevoordeel ✓ d.i. meer HbO<sub>2</sub> molekule in die bloed. ✓ Gevolglik word meer suurstof na die weefsels vervoer en die risiko van hypoksie verminder. ✓*

[12.3.2] (3)  
[18]

### QUESTION 11/VRAAG 11

- 11.1.1 Lead/lod ✓  
Stronger reducing agent/sterker reduseermiddel

OR/OF

Is oxidised preferably/word by voorkeur geöksideer ✓ [12.2.3] (2)

- 11.1.2  $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cu}(\text{s})$  ✓✓ [12.2.3] (2)

- 11.1.3  $E_{\text{cell}}^{\ominus} = E_{\text{cathode}}^{\ominus} - E_{\text{anode}}^{\ominus} / E_{\text{sel}}^{\ominus} = E_{\text{kathode}}^{\ominus} - E_{\text{anode}}^{\ominus}$  ✓  
= 0,34 ✓ – (- 0,13) ✓  
= 0,47 V ✓

Bulb will not light, ✓ energy from cell not sufficient / gloeilamp sal nie brand nie, energie vanaf sel nie voldoende nie

OR/OF

Emf of cell is much less than 2 V needed for the bulb/emk van sel is baie minder as wat gloeilamp benodig. [12.1.3] (5)

- 11.1.4 While the cell is in operation, the concentration of the reactants ( $\text{Cu}^{2+}(\text{aq})$ ) decreases. ✓ At the same time the concentration of the products ( $\text{Pb}^{2+}(\text{aq})$ ) increases. ✓ The result is a gradual decrease in the cell potential until there is no further change in concentration and equilibrium is reached ✓ where the cell potential will be zero.

Terwyl die sel in werking is, neem die konsentrasie van die reaktante ( $\text{Cu}^{2+}(\text{aq})$ ) af. ✓ Terselfdertyd neem die konsentrasie van die produkte ( $\text{Pb}^{2+}(\text{aq})$ ) toe. ✓ Die resultaat is 'n geleidelike afname in selpotensiaal totdat daar geen verdere veranderinge in konsentrasie is nie en ewewig bereik word ✓ waar die selpotensiaal nul sal wees.

[12.2.2] (3)

- 11.2.1  $\text{Zn}(\text{s}) + \text{HgO}(\text{s}) \rightarrow \text{ZnO}(\text{s}) + \text{Hg}(\text{l})$  ✓ [12.2.3] (2)

- 11.2.2 Mercury is poisonous/Kwik is giftig ✓ [12.3.2] (1)

[15]

**QUESTION 12/VRAAG 12**

- 12.1 A: Chlorine/*chloor* ✓  
B: Hydrogen/*waterstof* ✓ [12.2.1] (2)
- 12.2 Allows only the cations (positive ions) to pass through it./*Laat slegs katione (positiewe ione) deur.* ✓ [12.2.3] (1)
- 12.3  $2 \text{H}_2\text{O} + 2\text{e}^- \rightarrow \text{H}_2 + 2\text{OH}^-$  ✓✓ [12.2.3] (2)
- 12.4 Any one/*Enigeen*  
Manufacture of PVC✓, paper, drugs etc.  
*Vervaardiging van PVC, papier, medisyne, ens.*  
Disinfectant for water/*Ontsmettingsmiddel vir water* [12.3.2] (1)
- 12.5 In a single pot the chlorine will react with water to form chlorine water./*In 'n enkele houer sal die chloor met water reageer om chloorwater te vorm* ✓✓  
OR/OF  
The chlorine will react with the OH<sup>-</sup> ions to form bleach./*Die chloor sal met die OH<sup>-</sup>-ione reageer om 'n bleikmiddel te vorm.*  
OR/OF  
Products formed will be contaminated/*Produkte wat vorm sal gekontamineer wees.* [12.3.2] (2)

**[8]**

**QUESTION 13/VRAAG 13**

13.1.1	Ammonia/ammoniak ✓	[12.1.2]	(1)
13.1.2	Ostwald process/proses ✓	[12.1.2]	(1)
13.1.3	$\text{NH}_4\text{NO}_3$ ✓✓	[12.2.3]	(2)
13.1.4	$(\text{NH}_4)_2\text{SO}_4$ ✓✓	[12.2.3]	(2)
13.2.1	The NPK ratio gives the proportion/ratio of nitrogen, phosphorous and potassium in a fertiliser./NPK gee die verhouding waarin stikstof, fosfor en kalium in kunsmis gemeng is. ✓✓	[12.2.1]	(2)
13.2.2	4:5:8 ✓	[12.3.2]	(1)
13.2.3	Lower N to prevent too much leaf growth at the cost of fruit growth./Laer N om oormatige blaargroei ten koste van vrugte te voorkom. ✓✓	[12.3.2]	(2)
13.3	Environment/Omgewing: Eutrophication/eutrofisering ✓ OR/OF Dead zones/dooie sones  Humans/mense: water poisoning/watervergiftiging ✓ OR/OF blue baby syndrome/Bloubabasindroom OR/OF nitrates potentially carcinogenic/nitrate is potensieel karsinogenies	[12.3.3]	(2)

**[13]**

**TOTAL SECTION B/TOTAAL AFDELING B: 115**  
**GRAND TOTAL/GROOTTOTAAL: 150**