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***
AS 12.1.1: Design, plan and conduct a scientific inquiry to collect data systematically with regard to accuracy, reliability and the need to control variables. *Ontwerp, beplan en voer 'n wetenskaplike ondersoek uit om data te versamel ten opsigte van akkuraatheid, betroubaarheid en die kontroleer van veranderlikes.* **AS 12.1.2:** Seek patterns and trends, represent them in different forms, explain the trends, use scientific reasoning to draw and evaluate conclusions, and formulate generalisations. *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.* **AS 12.1.3:** Select and use appropriate problem-solving strategies to solve (unseen) problems. *Kies en gebruik geskikte probleemoplossingsstrategieë toe om (ongesiene) probleme op te los.*	**AS 12.2.1:** Define, discuss and explain prescribed scientific knowledge. *Definieer, bespreek en verduidelik voorgeskrewe wetenskaplike kennis.* **AS 12.2.2** Express and explain prescribed scientific principles, theories, models and laws by indicating the relationship between different facts and concepts in own words. *Verduidelik en druk voorgeskrewe wetenskaplike beginsels, teorieë, modelle en wette uit deur die verwantskap tussen verskillende feite konsepte in eie woorde aan te dui.* **AS 12.2.3:** Apply scientific knowledge in everyday life contexts. *Pas wetenskaplike kennis in kontekste van die alledaagse lewe toe.*	**AS 12.3.2:** 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. *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.* **AS 12.3.3:** 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. *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.*

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/W*aar* ✓✓	[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)
			[15]

TOTAL SECTION A/*TOTAAL AFDELING A:* 35

SECTION B/*AFDELING B*

QUESTION 5/*VRAAG 5*

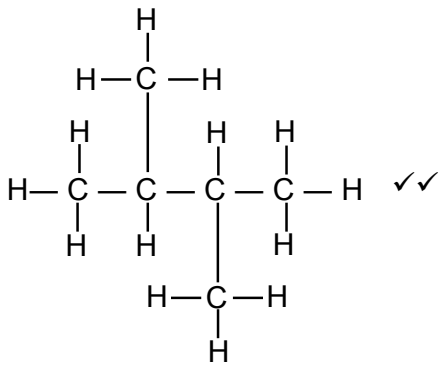
5.1 A group of organic compounds that can be represented by the same general formula./*'n Groep organise verbindings wat deur dieselfde algemene formule beskryf kan word.* ✓ [12.2.1] (2)

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)

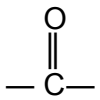
5.5.1 The thinners will dissolve the fats and oils in the skin, ✓and leave the skin dry and damaged. ✓
Die verdunner sal vette en olies in die vel oplos ✓en die vel droog en beskadig laat. ✓ [12.3.2] (2)

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 lagie 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

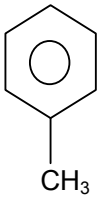


✓

2-pentanone/pentan-2-one ✓✓
2-pentanoon/pentaan-2-oon [12.2.3] (3)

6.2 *N*-Ethylpropylamine/*N-etielpropielamien* ✓✓ [12.2.3] (2)

6.3

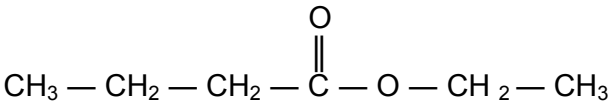


✓✓

[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



✓✓ [12.2.3] (2)
[11]

QUESTION 7/*VRAAG 7*

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

B: Substitution/*substitusie* ✓

C: Substitution/*substitusie* ✓

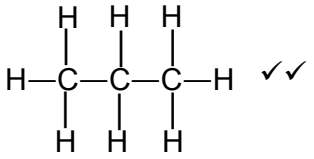
D: elimination/*eliminasie* ✓ OR/*OF*
dehydrohalogenation/*dehidrohalogenering* [12.1.2] (4)

7.2 $CH_3CH_2CH_2Br + H_2O$ ✓→ $CH_3CH_2CH_2OH + HBr$ ✓ bal ✓

OR/*OF*

$CH_3CH_2CH_2Br + OH^-$ ✓→ $CH_3CH_2CH_2OH + Br^-$ ✓ 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 $CH_3CH_2CH_2Br + KOH$ ✓→ $CH_2 = CHCH_3$ ✓+ $KBr + H_2O$ ✓ [12.2.3] (3)

7.4 Propane-1-ol/*propaan-1-ol* ✓✓

OR/*OF*

[12.2.3] (2)

1-propanol **[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?*

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

[12.1.1] (2)

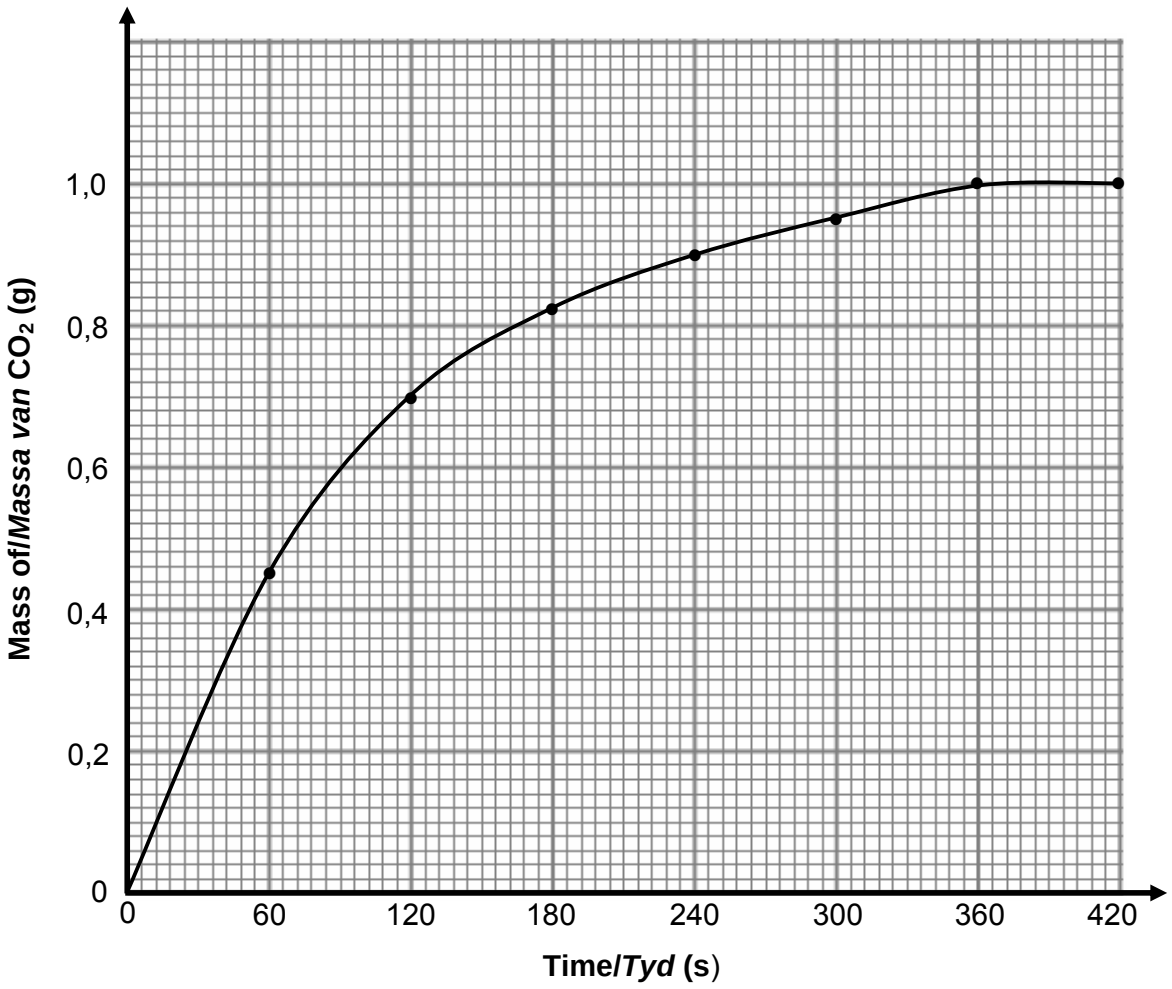
8.2 The initial mass of the conical flask and its contents/*Die aanvanklike massa van die koniese fles en inhoud*. ✓ [12.1.1] (1)

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_2 PRODUCED AGAINST TIME
GRAFIEK VAN MASSA CO_2 VRYGESTEL TEENOOR TYD



CHECKLIST/*KONTROLELYS*	
Criteria for graph/*Kriteria vir grafiek:*	
Appropriate heading/Geskikte *opskrif*	✓
Independant variable with unit indicated on the x-axis /Ona*fhanklike 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)

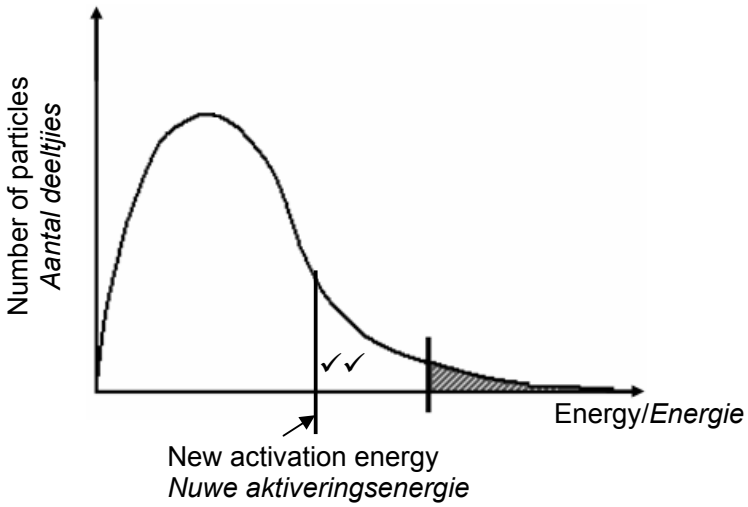
8.6 The mass of CO_2 produced each time interval decreases ✓✓ as the concentration of reactants decreases until the reaction stops and no CO_2 is produced./*Die massa CO_2 gevorm in elke tydsinterval neem af ✓✓ soos wat die konsentrasie van die reaktante afneem totdat die reaksie ophou en geen CO_2 meer gevorm word nie.*
OR/*OF*
The rate of the reaction/production of $CO_{2(g)}$ decrease as the reaction proceeds./*Die tempo van die reaksie/produksie van $CO_{2(g)}$ 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 effektiewe 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_2 was increased. /Some H_2 was added at t_1. ✓ The concentration of HI then increased/more HI was formed✓ while some H_2 and I_2 were used up ✓until equilibrium was re-established at t_2. ✓ [12.1.2] (4)

10.1.3

	H_2	I_2	HI
Initial number of mole (mol) *Aanvanklike aantal mol (mol)*	0,3	0,3	0✓
Number of moles used/formed (mol) *Aantal mol gereageer/gevorm*	x	x	2x ✓
Number of moles at equilibrium(mol) *Aantal mol by ewewig (mol)*	0,3 - x	0,3 - x	2x ✓
Equilibrium [ ] (mol·dm^{-3}) *Ewewig [ ] (mol·dm^{-3})*	$\frac{0,3-x}{2}$	$\frac{0,3-x}{2}$	$\frac{2x}{2}$ ✓

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

$\therefore$ x = 0,23 mol ✓

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_2 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/voorwaarste reaksie bevoordeel✓ d.i. meer HbO_2 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/*lood* ✓
Stronger reducing agent/*sterker reduseermiddel*

OR/*OF*

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

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

11.1.3 $E^\theta_{cell} = E^\theta_{cathode} - E^\theta_{anode}$ / $E^\theta_{sel} = E^\theta_{katode} - E^\theta_{anode}$ ✓
= 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 ($Cu^{2+}(aq)$) decreases. ✓ At the same time the concentration of the products ($Pb^{2+}(aq)$) 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 ($Cu^{2+}(aq)$) af. ✓ *Terselfdertyd neem die konsentrasie van die produkte ($Pb^{2+}(aq)$) 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 $Zn(s) + HgO(s) \rightarrow ZnO(s) + Hg(\ell)$ ✓✓ [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 $2\ H_2O + 2e^- \rightarrow H_2 + 2OH^-$ ✓✓ [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/
OR the chlorine will react with the OH^- ions to form bleach. ✓✓ [12.3.2]
OR/*OF*
Products formed will be contaminated/*Produkte wat vorm sal gekontamineer wees.* (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	NH_4NO_3 ✓✓	[12.2.3]	(2)
13.1.4	$(NH_4)_2SO_4$✓✓	[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