



education

Department:
Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE/GRAAD 12

**PHYSICAL SCIENCES: CHEMISTRY (P2)
FISIËSE WETENSKAPPE: CHEMIE (V2)**

MEMORANDUM

FEBRUARY/FEBRUARIEMARCH/MAART 2009

MARKS/PUNTE: 150

**This memorandum consists of 13 pages.
*Hierdie memorandum bestaan uit 13 bladsye.***

Learning Outcomes and Assessment Standards Leeruitkomst en Asseseringstandaarde		
LO 1/LU 1	LO 2/LU 2	LO 3/LU 3
<p>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.</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>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.</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>AS 12.1.3: Select and use appropriate problem-solving strategies to solve (unseen) problems.</p> <p><i>Kies en gebruik geskikte probleemoplossingstrategieë om (ongesiene) probleme op te los.</i></p> <p>AS 12.1.4: Communicate and defend scientific arguments with clarity and precision.</p> <p><i>Kommunikeer en verdedig wetenskaplike argumente duidelik en presies.</i></p>	<p>AS 12.2.1: Define, discuss and explain prescribed scientific knowledge.</p> <p><i>Definieer, bespreek en verduidelik voorgeskrewe wetenskaplike kennis.</i></p> <p>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.</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>AS 12.2.3: Apply scientific knowledge in everyday life contexts.</p> <p><i>Pas wetenskaplike kennis in kontekste van die alledaagse lewe toe.</i></p>	<p>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.</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>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.</p> <p><i>Evalueer die impak van wetenskaplike en tegnologiese navorsing en dui die bydrae tot die bestuur, benutting en ontwikkeling van bronne om volhoubaarheid kontinentaal en globaal te verseker, aan.</i></p>

SECTION A/AFDELING A

QUESTION 1/VRAAG 1

- 1.1 Functional group / \checkmark
Funksionele groep [12.2.1] (1)
- 1.2 (Primary) amines \checkmark
(Primêre) amiene [12.2.1] (1)
- 1.3 Activation energy \checkmark
Aktiveringsenergie [12.2.1] (1)
- 1.4 Electrolytic \checkmark
Elektrolities [12.2.1] (1)
- 1.5 Chlorine / Cl_2 \checkmark
Chloor / Cl_2 [12.2.1] (1)
- [5]**

QUESTION 2/VRAAG 2

- 2.1 G ($\text{C}_2\text{H}_5\text{OH}$) \checkmark [12.2.1] (1)
- 2.2 I ($\text{C}_6\text{H}_5(\text{CH}_3)$) \checkmark [12.2.3] (1)
- 2.3 B (reaction rate / *reaksietempo*) \checkmark [12.2.3] (1)
- 2.4 J (anode) \checkmark [12.2.1] (1)
- 2.5 D (Na^+) \checkmark [12.2.1] (1)
- [5]**

QUESTION 3/VRAAG 3

- 3.1 True / *Waar* $\checkmark\checkmark$ [12.2.1] (2)
- 3.2 True / *Waar* $\checkmark\checkmark$ [12.2.1] (2)
- 3.3 True / *Waar* $\checkmark\checkmark$ [12.2.3] (2)
- 3.4 False / *Onwaar* \checkmark
A temperature of 298 K (25 °C) / 'n *Temperatuur van 298 K (25 °C)* \checkmark [12.2.1] (2)
- 3.5 False / *Onwaar* \checkmark
Secondary cell ... / *Sekondêre sel* \checkmark
OR / *OF*
... is non-rechargeable / ... *is nie-herlaaibaar* [12.2.1] (2)
- [10]**

QUESTION 4/VRAAG 4

4.1	C ✓✓✓	[12.2.3]	(3)
4.2	C ✓✓✓	[12.1.2]	(3)
4.3	A ✓✓✓	[12.1.2]	(3)
4.4	B ✓✓✓	[12.3.2]	(3)
4.5	D ✓✓✓	[12.3.3]	(3)
			[15]

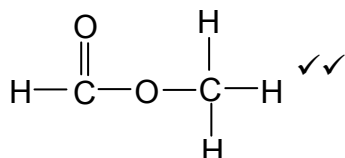
TOTAL SECTION A: 35
TOTAAL AFDELING A: 35

SECTION B/AFDELING B

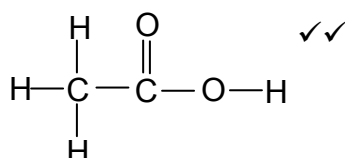
QUESTION 5/VRAAG 5

5.1 Compounds that have the same molecular formula but different structural formulae. ✓✓
Verbindings wat dieselfde molekulêre formule maar verskillende struktuurformules het. [12.2.1] (2)

5.2



methylmethanoate ✓
metielmetanoaat



ethanoic acid ✓
etanoësuur

[12.2.3] (6)

5.3.1 Ethanoic acid / *etanoësuur* ✓

- The hydrogen bonds/intermolecular forces between ethanoic acid molecules are stronger than the Van der Waals forces/intermolecular forces ✓ between the ester molecules / *Die waterstofbindings/intermolekulêre kragte tussen etanoësuurmolekule is sterker as die Van der Waalskragte/intermolekulêre kragte tussen die estermolekule.*
- More energy needed to break bonds between ethanoic acid molecules. ✓ / *Meer energie* word benodig om bindings tussen etanoësuurmolekule te breek.

[12.2.3] (3)

5.3.2 Methylmethanoate / *metielmetanoaat* ✓

- The Van der Waals forces/intermolecular forces ✓ between the ester molecules are weaker than the hydrogen bonds/intermolecular forces between ethanoic acid molecules / *Die Van der Waalskragte/intermolekulêre kragte tussen die estermolekule is swakker as die waterstofbinding/intermolekulêre kragte tussen die etanoësuurmolekule.*
- Less energy needed to break bonds between the ester molecules. ✓ / *Minder energie* word benodig om bindings tussen die estermolekule te breek.

[12.2.3] (3)

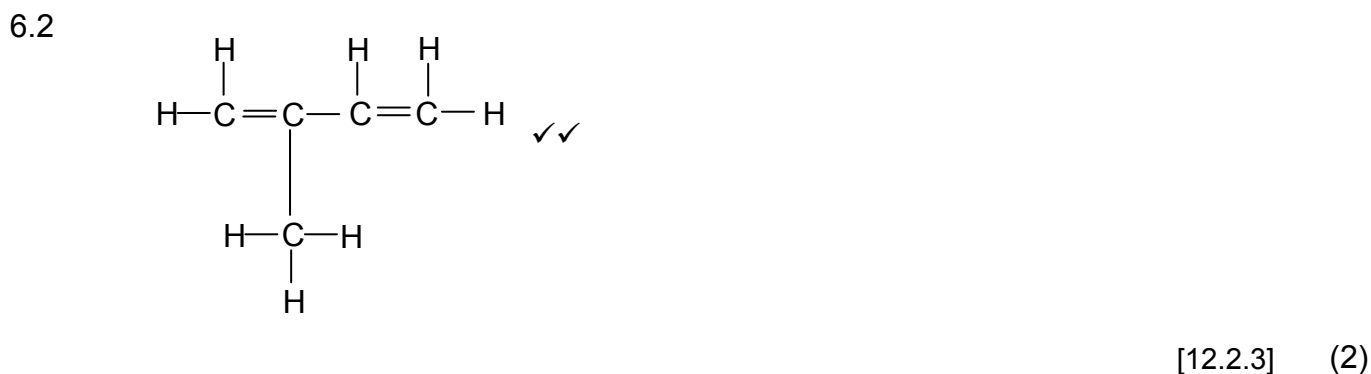
5.4 Decrease / *Afneem* ✓

Van der Waals forces increase with molecular size ✓✓ /
Van der Waalskragte neem met molekulêre grootte toe

[12.2.2] (3)
[17]

QUESTION 6/VRAAG 6

- 6.1 Unsaturated/*Onversadig* ✓
Not all C-C bonds are single bonds/*Nie alle C-C bindings is enkele bindings nie* ✓✓
OR/OF
Contains C-C double bonds/*Bevat dubbele bindings C-C* [12.2.3] (3)



- 6.3 Any TWO:
- Destruction of indigenous forests ✓ (leading to global warming)
 - Rubber is not biodegradable ✓ – disposal impacts negatively on environment
 - Burning of rubber releases toxic gases
- Enige TWEE:*
- *Verwoesting van inheemse woude (lei tot aardverwarming)*
 - *Rubber is nie-bioafbreekbaar nie – wegdoening daarmee het negatiewe impak op omgewing*
 - *Brand van rubber skei giftige gasse af*
- [12.3.3] (2)

- 6.4 Any TWO:
- Job creation ✓
 - Tyres for cars/gloves for medical industry/raincoats etc. ✓
 - Protective devices – insulation
- Enige TWEE:*
- *Werkskepping*
 - *Bande vir motors/handskoene vir mediese industrie/reënjasse, ens.*
 - *Beskermende toestelle - insulasie*
- [12.3.2] (2)
- [9]**

QUESTION 7/VRAAG 7

- 7.1 III - elimination/dehydration ✓
eliminasi/dehidrasie [12.1.2] (1)
- 7.2 I – hydration / *hidrasie* ✓
II – hydrohalogenation / *hidrohalogenering* ✓ [12.1.2] (2)
- 7.3
- $$\begin{array}{ccccccc} & \text{H} & \text{H} & \text{H} & \text{H} & & \\ & | & | & | & | & & \\ \text{H} & -\text{C} & -\text{C} & -\text{C} & -\text{C} & -\text{H} & \\ & | & | & | & | & & \\ & \text{H} & \text{H} & \text{OH} & \text{H} & & \end{array} \quad \checkmark\checkmark$$
- 2-butanol/butan-2-ol ✓ [12.2.3] (3)
- 7.4 H_2SO_4 ✓ [12.2.1] (1)
- 7.5
- $$\begin{array}{ccccccc} & \text{H} & \text{H} & \text{H} & \text{Br} & \text{H} & \\ & | & | & | & | & | & \\ \text{H} & -\text{C} & -\text{C} & -\text{C} & -\text{C} & -\text{C} & -\text{H} \\ & | & | & | & | & | & \\ & \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & \\ & & & & | & & \\ & & & & \text{H}-\text{C}-\text{H} & & \\ & & & & | & & \\ & & & & \text{H} & & \end{array} \quad \checkmark\checkmark$$
- 2-bromo-2-methylpentane ✓
2-bromo-2-metielpentaaan/2-broom-2-metielpentaaan [12.2.3] (3)
- 7.6 Alkenes/*alkene* ✓✓ [12.2.3] (2)

[12]

QUESTION 8/VRAAG 8

- 8.1 Neutralisation/acid-base reaction ✓
Neutralisasie/suur-basisreaksie [12.3.2] (1)
- 8.2.1 What is the relationship between temperature and the reaction rate of an antacid tablet with water? ✓✓
Wat is die verwantskap tussen temperatuur en reaksietempo van 'n teensuurtablet met water?
OR/OF
What happens with the reaction rate of the antacid tablet with water when the temperature changes (increases) (decreases)?
Wat gebeur met die reaksietempo van die teensuurtablet met water wanneer die temperatuur verander (toeneem) (afneem)?
OR/OF
How does temperature influence the time of dissolution of an antacid tablet in water?
Hoe beïnvloed temperatuur die oplossingstyd van 'n teensuurtablet in water? [12.1.1] (2)
- 8.2.2 The reaction rate (of an antacid tablet with water) will increase/decrease with increase/decrease in temperature. ✓✓
Die reaksietempo (van 'n teensuurtablet met water) sal toeneem/afneem met toename/afname in temperatuur.
OR/OF
The higher/lower the temperature the faster/slower the rate of dissolution/reaction.
Hoe hoër/laer die temperatuur hoe vinniger/stadiger is die tempo van oplossing/reaksie. [12.1.1] (2)
- 8.2.3
1. Use the measuring cylinder and measure a fixed volume of water and transfer it to the beaker.
Gebruik die maatsilinder en meet 'n vaste volume water af en dra dit oor na die beker.
 2. Record the temperature of the water.
Noteer die temperatuur van die water.
 3. Add one antacid tablet to the water and measure the time it takes to dissolve/react completely.
Voeg een teensuurtablet by die water en meet die tyd wat dit neem om volledig op te los/te reageer.
 4. Rinse the solution down the sink and repeat the experiment at at least two more different temperatures.
Spoel die oplossing in die wasbak af en herhaal die eksperiment by ten minste nog twee verskillende temperature.
 5. Repeat steps 1 to 4 for accuracy/compensate for experimental error.
Herhaal stappe 1 tot 4 vir akkuraatheid/kompenseer vir eksperimentele foute.

Checklist/Kontrolelys Criteria for procedure/ <i>Kriteria vir prosedure:</i>	Marks/ Punte
Measurement of fixed volume of water with measuring cylinder and transfer of water to beaker. / <i>Afmeting van vaste volume water met maatsilinder en die oordrag van water na beker.</i>	✓
Temperature of water taken with thermometer. <i>Neem van temperatuur van water met termometer.</i>	✓
Antacid tablet added to water and time taken to completely dissolve. <i>Teensuurtablet by water gevoeg e nnotering van tyd om volledig op te los.</i>	✓
Experiment repeated at two other temperatures. <i>Eksperiment word by twee ander temperature herhaal.</i>	✓

[12.1.1] (4)

8.2.4

Temperature / <i>Temperatuur (°C)</i>	Time/Tyd (s)		Average time/ <i>Gemiddelde tyd (s)</i>
	Trial/ <i>Lopie</i> 1	Trial/ <i>Lopie</i> 2	

Checklist/Kontrolelys Criteria for table/ <i>Kriteria vir tabel:</i>	Marks/ Punte
Temperature and unit as column/row heading <i>Temperatuur en eenheid as kolom/ry-opskrif</i>	✓
Time and unit as column or row heading <i>Tyd en eenheid as kolom/ry-opskrif</i>	✓
Table indicates at least two trials <i>Tabel toon ten minste twee lopies</i>	✓
Column/row for average time and unit <i>Kolom/ry vir gemiddelde tyd en eenheid</i>	✓

[12.1.2] (4)

8.3 Warm water / *Warm water* ✓

- The rate at which it will bring relieve will be faster at a higher temperature / *Die tempo waarteen dit verligting bring, sal vinniger by 'n hoër temperatuur wees* ✓

[12.3.2] (2)
[15]

QUESTION 9/VRAAG 9

9.1 During exercise more air is breathed ✓ and more toxic ozone/nitrogen dioxide will be inhaled, resulting in lung problems/poor performance due to oxygen deficiency. ✓
Gedurende oefening word meer lug ingeasem en dus meer giftige osoon/stikstofdioksied wat lei tot longprobleme / swak prestasie a.g.v. suurstoftekort. [12.3.2] (2)

9.2

- Supply more and safe public transport to decrease cars on road. ✓
Verskaf meer en veilige openbare vervoer om motors op paaie te verminder.
- Make catalytic converters compulsory in exhaust systems of cars ✓ [12.3.2]
Maak katalitiese omskakelaars in motoruitlaatstelsels verpligtend [12.3.3] (2)

9.3 The high temperature will favour the forward ✓ endothermic reaction ✓ and more NO(g) is formed.
Die hoë temperatuur bevoordeel die voorwaartse endotermiese reaksie en meer NO(g) word gevorm. [12.1.2] (2)

9.4

	N ₂	O ₂	NO	
Molar ratio/Molverhouding	1	1	2	
Initial quantity (mol)/ Aanvangshoeveelheid (mol)	1	1	0 ✓	
Change (mol)/ Verandering (mol)	0,1	0,1	0,2	✓
Quantity at equilibrium (mol)/ Hoeveelheid by ewewig(mol)	0,9	0,9	0,2	✓
Concentration (mol·dm ⁻³) Konsentrasie (mol·dm ⁻³)	0,45	0,45	0,1	✓

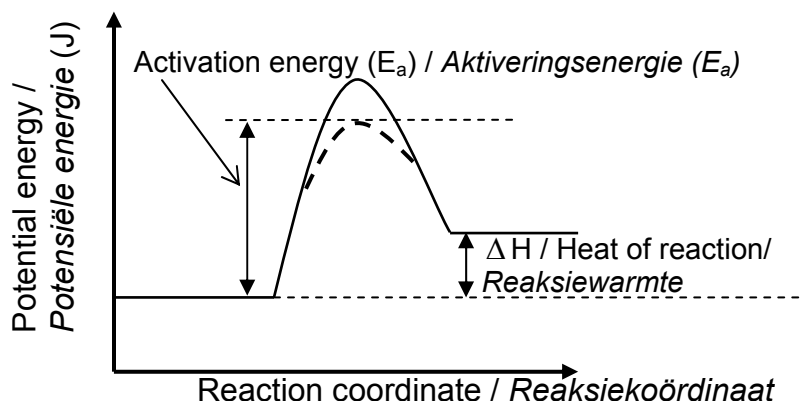
$$K_c = \frac{[\text{NO}]^2}{[\text{N}_2][\text{O}_2]} \checkmark = \frac{(0,1)^2}{(0,45)(0,45)} \checkmark = 0,049 = 0,05 \checkmark$$

[12.1.3] (7)

9.5 9.5.1 No effect / geen effek ✓✓ [12.2.3] (2)

9.5.2 No effect / geen effek ✓ [12.2.3] (1)

9.6



Checklist/Kontrolelys	
Criteria for diagram/ <i>Kriteria vir diagram</i>	Marks/ <i>Punte</i>
Both axes drawn and correctly labelled. <i>Beide asse geteken en korrek benoem.</i>	✓
Shape of graph drawn correctly. <i>Vorm van grafiek korrek geteken.</i>	✓
Activation energy correctly indicated. <i>Aktiveringsenergie korrek aangetoon.</i>	✓
Heat of reaction correctly indicated. <i>Reaksiewarmte korrek aangetoon.</i>	✓
Path with catalyst correctly indicated <i>Pad met katalisator korrek aangetoon.</i>	✓

[12.1.2] (5)
[21]

QUESTION 10/VRAAG 10

- 10.1 galvanic/voltaic cell ✓
galvaniese/voltaïese sel [12.2.1] (1)
- 10.2 Incomplete circuit/No salt bridge ✓
Onvoltooide stroombaan/Geen soutbrug [12.1.2] (1)
- 10.3 0,76 V ✓ [12.2.3] (1)
- 10.4 Zero ✓ [12.2.3] (1)
- 10.5 $\text{Zn(s)} \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{e}^-$ ✓✓ [12.2.3] (2)

- 10.6.1 Mg ✓
Mg is oxidised/Mg is geoksideer ✓ [12.2.3] (2)
- 10.6.2 $E_{\text{cell / sel}}^0 = E_{\text{oxidising agent / oksideermiddel}}^0 - E_{\text{reducing agent / reduseermiddel}}^0$ ✓
= - 0,76 ✓ - (- 2,36) ✓
= + 1,6 V ✓ [12.2.3] (4)
- 10.6.3 As the cell functions, the concentration of zinc ions (reactants) decreases relative to standard conditions ✓ and the concentration of magnesium ions (products) increases relative to standard conditions ✓. The reverse reaction starts opposing the forward reaction causing the emf to decrease relative to standard conditions.
- Soos wat die sel funksioneer, neem die konsentrasie van sinkione (reaktante) af relatief tot standaardtoestande en die konsentrasie van magnesiumione (produkte) neem toe relatief tot standaardtoestande. Die terugwaartse reaksie begin die voorwaartse reaksie teenwerk wat veroorsaak dat die emk afneem relatief tot standaardtoestande.* [12.2.3] (2)
- 10.7
- Neutralise acid before disposal/Neutraliseer suur voor weggooi ✓
 - Recycle plastic casing and lead electrodes/Herwin plastiese omhulsels en loodelektrodes ✓
- [12.3.3] (2)
- [16]**

QUESTION 11/VRAAG 11

- 11.1 cathode/katode ✓ [12.1.2] (1)
- 11.2 Silver/silwer ✓ [12.1.2] (1)
- 11.3 $\text{Ag}^+ + \text{e}^- \rightarrow \text{Ag}$ ✓✓ [12.2.3] (2)
- 11.4 The rate of oxidation of silver at the anode ✓ is equal to the rate of reduction of silver ions at the cathode. ✓
Die tempo van oksidasie van silwer by die anode is gelyk aan die tempo van reduksie van silwerione by die katode. [12.1.4] (2)
- 11.5 Plastic is a non-conductor/Graphite is a conductor ✓✓
Plastiek is 'n nie-geleier/Grafiet is 'n geleier [12.3.2] (2)
- 11.6 Platinum is expensive/more durable than other metals ✓
Platinum is duur/meer duursaam as ander metale [12.3.3] (1)
- [9]**

QUESTION 12/VRAAG 12

- 12.1 Fractional distillation of (liquid) air ✓
Fraksionele distillasie van vloeibare lug [12.1.2] (1)
- 12.2 $N_2 + 3 H_2 \rightleftharpoons 2 NH_3$ ✓ bal ✓ [12.1.2] (3)
- 12.3 $2SO_2 + O_2 \rightleftharpoons 2SO_3$ ✓ bal ✓ [12.2.1] (3)
- 12.4 $H_2S_2O_7$ ✓
Oleum/pyrosulphuric acid/*piroswa(w)elsuur* ✓ [12.2.1] (2)
- 12.5 $(NH_4)_2SO_4$ ✓✓
Ammonium sulphate/*ammoniumsulfaat* ✓ [12.1.2] (3)
- 12.6.1 • Soil cannot replenish nutrients at a fast enough rate to sustain growth. *Grond kan nie voedingstowwe teen 'n voldoende tempo (vinnig genoeg) aanvul om groei te onderhou nie.* ✓
• Globally a bigger demand for food/*Globale hoër aanvraag na voedsel* ✓ [12.3.3] (2)
- 12.6.2 • Increase in oil price/*Styging in olieprys* ✓
• Increase in price of raw materials/*Styging in prys van grondstowwe* ✓ [12.3.2] (2)

TOTAL SECTION/TOTAAL AFDELING B: 115

GRAND TOTAL/GROOTTOTAAL: 150