education

Department:
Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE/*GRAAD* 12

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

NOVEMBER 2009(1)

MEMORANDUM

MARKS/*PUNTE*: 150

This memorandum consists of 17 pages.
Hierdie memorandum bestaan uit 17 bladsye.

PHYSICAL SCIENCES GRADE 12 PAPER 2
FISIESE WETENSKAPPE GRAAD 12 VRAESTEL 2

Learning Outcomes and Assessment Standards ***Leeruitkomste en Assesseringstandaarde***		
LO1/*LU1*	**LO2/*LU2***	**LO3/*LU3***
AS12.1.1: 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.* **AS12.1.2:** 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 die tendense, gebruik wetenskaplike beredenering om gevolgtrekkings te maak en te evalueer, en formuleer veralgemenings.* **AS12.1.3:** Select and use appropriate problem-solving strategies to solve (unseen) problems. *Kies en gebruik geskikte probleem-oplossingstrategieë om (ongesiene) probleme op te los.* **AS12.1.4:** Communicate and defend scientific arguments with clarity and precision. *Kommunikeer en verdedig wetenskaplike argumente duidelik en presies.*	**AS12.2.1:** Define, discuss and explain prescribed scientific knowledge. *Definieer, bespreek en verduidelik voorgeskrewe wetenskaplike kennis.* **AS12.2.2:** Express and explain prescribed scientific principles, theories, models and laws by indicating the relationship between different facts and concepts in the candidate's own words. *Verduidelik en druk voorgeskrewe wetenskaplike beginsels, teorieë, modelle en wette uit deur die verwantskap tussen verskillende feite en konsepte in die kandidaat se eie woorde aan te dui.* **AS12.2.3:** Apply scientific knowledge in everyday-life contexts. *Pas wetenskaplike kennis in kontekste van die alledaagse lewe toe.*	**AS12.3.1** Research, discuss, compare and evaluate scientific and indigenous knowledge systems and knowledge claims by indicating the correlation among them, and explain the acceptance of different claims. *Doen navorsing, bespreek, vergelyk en evalueer wetenskaplike en inheemse kennissisteme en kennisaansprake deur die ooreenkoms tussen hulle aan te dui, en verduidelik die aanvaarding van verskillende aansprake.* **AS12.3.2:** 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.* **AS12.3.3:** 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 aan om volhoubaarheid kontinentaal en globaal te verseker.*

SECTION A/*AFDELING A*

QUESTION 1/*VRAAG 1*

1.1	Cracking / *Kraking* ✓	[12.2.1]	(1)
1.2	Collision theory / *Botsingsteorie* ✓	[12.2.1]	(1)
1.3	Activation energy / *Aktiveringsenergie* ✓	[12.2.1]	(1)
1.4	Oxidising agent / *Oksideermiddel* ✓	[12.2.1]	(1)
1.5	Eutrophication / *Eutrofisering* ✓	[12.2.1]	(1)
			[5]

QUESTION 2/*VRAAG 2*

2.1	… primary alcohol / *primêre alkohol* … ✓✓	[12.2.3]	(2)
2.2	… substitution reaction. / … *substitusiereaksie* ✓✓	[12.2.3]	(2)
2.3	... increases *the rate of a chemical reaction. / … verhoog die tempo van 'n chemiese reaksie.*	[12.2.2]	(2)
2.4	… the electrolyte is a solution of a soluble silver compound. /… *die elektroliet is 'n oplossing van 'n oplosbare silververbinding.* ✓✓	[12.2.3]	(2)
2.5	Carbon, hydrogen and oxygen .../ *Koolstof, waterstof en suurstof ...*✓✓ OR/*OF* ... the three primary nutrients .../... die drie primêre voedingstowwe ...	[12.2.2]	(2)
			[10]

QUESTION 3/*VRAAG 3*

3.1	D ✓✓	[12.2.3]	(2)
3.2	A ✓✓	[12.2.3]	(2)
3.3	B	[12.1.2]	(2)
3.4	B ✓✓	[12.1.2]	(2)
3.5	A ✓✓	[12.2.3]	(2)
			[10]

TOTAL SECTION A/*TOTAAL AFDELING A: 25*

SECTION B/*AFDELING B*

QUESTION 4/*VRAAG 4*

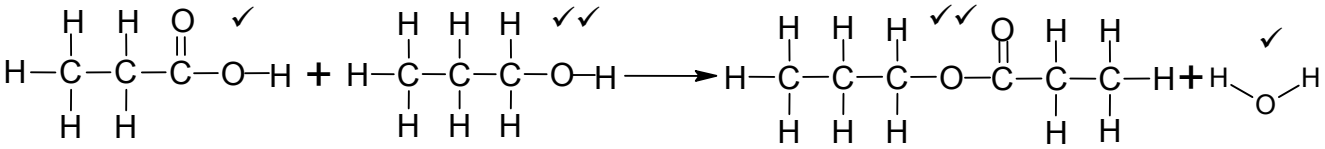
4.1

✓ OR/*OF*

NOTE: The structural formula of a compound shows which atoms are attached to which within the molecule. The atoms are represented by their chemical symbols, and lines are used to represent the bonds that hold the atoms together.
LET WEL: *Die struktuurformule van 'n verbinding toon watter atome aan watter in die molekuul gebind is. Die atome word voorgestel deur hul chemiese simbole, en lyne word gebruik om die bindings tussen atome voor te stel.*

[12.2.1] (1)

4.2.1

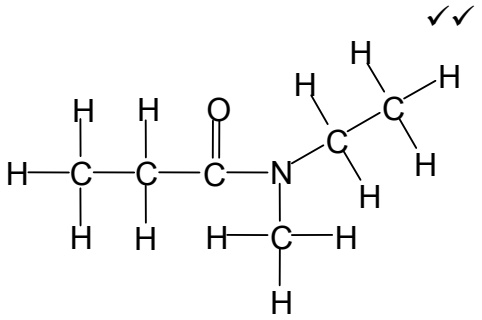


[12.2.3] (6)

4.2.2 Propyl propanoate / *Propielpropanoaat* ✓ [12.2.3] (1)

4.2.3 (concentrated) sulphuric acid / *(gekonsentreerde) swaelsuur* ✓ [12.2.3] (1)

4.3.1



[12.2.3] (2)

4.3.2 *N*-ethyl-*N*-methylpropanamide ✓ (1)
N-etiel-N-metielpropaanamied [12.2.2] **[12]**

QUESTION 5/*VRAAG 5*

5.1.1 Carboxylic acids / *Karboksielsure* ✓ [12.2.3] (1)

5.1.2 Alcohols / *Alkohole* ✓ [12.2.3] (1)

5.1.3 Aldehydes / *Aldehiede* ✓ [12.2.3] (1)

5.2.1 Propanal ✓ [12.2.3] (1)

5.2.2 Pentan-1-ol ✓ [12.2.3] (1)

5.3

Criteria for investigative question / *Kriteria vir ondersoekende vraag*:	**Mark**
Refers to relationship between dependent and independent variables. / *Verwys na die verwantskap tussen die afhanklike en onafhanklike veranderlikes.*	✓✓
Is stated as an question, not an aim. / Is as 'n vraag gestel, nie 'n doel nie.	

OPTION 1/*OPSIE 1*
Relationship: Boiling point and **type of functional group/homologous series**
Verwantskap: Kookpunt** en **tipe funksionele groep/homoloë reeks

Examples / *Voorbeelde:*

- What is the relationship between boiling point and the type of functional group / type of homologous series? ✓✓
  Wat is die verwantskap tussen kookpunt en die tipe funksionele groep / tipe homoloë reeks?

OR/*OF*

- How does the boiling points of the carboxylic acid, aldehyde and alcohol compare? (
  Hoe vergelyk die kookpunte van karboksielsure, aldehiede en alkohole?

OR/*OF*

- How do the boiling points of compounds from the three homologous series differ / compare?
  Hoe verskil / vergelyk kookpunte van verbindings van die drie homoloë reekse?

OPTION 2/*OPSIE 2*
Relationship: Boiling point and **chain length / molar mass/ molecular size** (of compounds with same functional group / from same homologous series).
Verwantskap: Kookpunt *en* ***kettinglengte / molêre massa*** ***/*** **molekuulgrootte** *(van verbindings met dieselfde tipe funksionele groep / van dieselfde homoloë reeks).*

Examples / *Voorbeelde:*

- What is the relationship between boiling point and chain length / molar mass / molecular size? ✓✓
  Wat is die verwantskap tussen kookpunt en kettinglengte / molêre massa / molekuulgrootte?

OR/*OF*

- How does chain length / molar mass / molecular size influence boiling point? / *Hoe beïnvloed kettinglengte* / molêre massa / molekuulgrootte *die kookpunt?*

[12.1.1] (2)

5.4 **If Option 1 in Question 5.3 / *Indien Opsie 1 in Vraag 5.3:***

Molar mass / molecular mass / formula mass✓
Molêre massa / molekulêre massa / formule massa

If Option 2 in Question 5.3 / *Indien Opsie 2 in Vraag 5.3:*

Type of functional group / homologous series ✓
Tipe funksionele groep / homoloë reeks [12.1.1] (1)

5.5 Boiling point of carboxylic acids > alcohols > aldehydes. ✓✓
Kookpunte van karboksielsure > alkohole✓ > aldehiede. ✓✓ [12.1.2] (2)

5.6

Option 1/*Opsie 1*
Relationship: Boiling point and **type of functional group/homologous series**
Verwantskap: Kookpunt *en* ***tipe funksionele groep/homoloë reeks***

Carboxylic acids – highest boiling points due to strongest/more hydrogen bonding / formation of dimers. ✓
Alcohols – lower boiling points than carboxylic acids due to weaker/less hydrogen bonding higher boiling points than aldehydes due to strong hydrogen bonds between molecules. ✓
Aldehydes – lowest boiling points due to weak Van der Waals forces / weak intermolecular forces between molecules. ✓

Karboksielsure *– hoogste kookpunte a.g.v. sterkste/meer waterstobindings tussen molekule / vorm dimere.* ✓
Alkohole *– laer kookpunte as karboksielsure a.g.v. swakker/minder waterstofbindings tussen molekule. / hoër kookpunte as aldehiede a.g.v. sterk waterstofbindings tussen molekule.* ✓
Aldehiede *– laagste kookpunte a.g.v. swak Van der Waalskragte / swak intermolekulêre kragte tussen molekule.* ✓

OPTION 2/*OPSIE 2*

Relationship: Boiling point and **chain length / molar mass** (of compounds with same functional group / from same homologous series)
Verwantskap: Kookpunt *en* ***kettinglengte / molêre massa*** *(van verbindings met dieselfde tipe funksionele groep / van dieselfde homoloë reeks)*

Compounds in Exp. 2 have **higher boiling points** than compounds in Exp. 1. ✓
Chain length of compounds in Exp. 2 **longer** than in Exp. 1. ✓
Van der Waals forces / intermolecular forces increase with increase in chain length / molecular size (number of electrons). ✓

Verbindings in Eksp. 2 het ***hoër kookpunte*** *as verbindings in Eksp. 1.* ✓
Kettinglengte *van verbindings in Eksp. 2* ***langer*** *as die in Eksp. 1.* ✓
Van der Waals kragte / intermolekulêre kragte neem toe met kettinglengte / molekuulgrootte (aantal elektrone). ✓

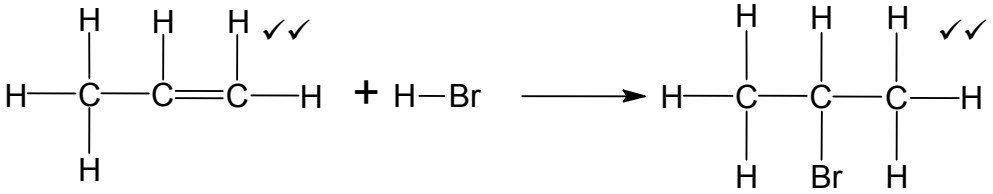
[12.1.4] (3)
[13]

QUESTION 6/*VRAAG 6*

6.1 Contains a double bond (between two carbon atoms). / *Bevat 'n dubbelbinding* (tussen twee koolstofatome). ✓

OR/*OF*
Carbon not bonded to the maximum number of (H) atoms.
Koolstof is nie aan die maksimum aantal (H)-atome gebind nie. [12.2.2] (1)

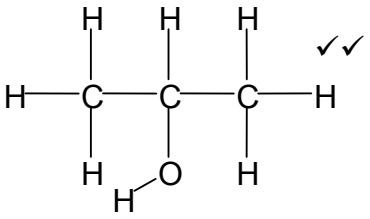
6.2



[12.1.2] (4)

6.3 Addition / hydrohalogenation / hydrobromination ✓
Addisie / hidrohalogenering / hidrobrominering [12.1.2] (1)

6.4



Propan-2-ol ✓
Accept/Aanvaar: 2-propanol [12.1.2] (3)

6.5 Hydrolysis */ hidrolise* ✓ [12.1.2] (1)

6.6.1 Water ✓ [12.2.3] (1)

6.6.2 H_3PO_4 / H_2SO_4 / HCℓ / HBr ✓ [12.2.3] (1)

6.6.3 Addition / hydration ✓
Addisie / hidrasie / hidratering [12.2.3] (1)

6.7.1 prop-1-ene */ prop-1-een* [12.2.3] (1)

6.7.2 Dehydrohalogenation / *Dehidrohalogenering*

OR/*OF*
Elimination / *Eliminasie* [12.2.3] (1)
[15]

QUESTION 7/*VRAAG 7*

7.1 Smaller than / *kleiner as* ✓ [12.1.2] (1)

7.2

Criteria for hypothesis/*Kriteria vir hipotese*:	**Mark**
Refers to **relationship between dependent and independent variables.** / *Verwys na die* ***verwantskap tussen die afhanklike en onafhanklike veranderlikes.***	✓✓
Statement *that can be proved correct or incorrect. –* ***prediction based on (prior) knowledge.*** ***Stelling*** *wat reg of verkeerd bewys kan word –* ***voorspelling gebaseer op (vooraf) kennis.***	

7.2 Examples / *Voorbeelde*:

- Reaction rate (or volume of hydrogen gas produced per unit time) increases with increase in concentration.
  Reaksietempo (of volume waterstofgas gevorm per eenheidstyd) neem toe met toename in konsentrasie.

OR/*OF*

- Reaction rate (or volume of hydrogen gas produced per unit time) decreases with increase in concentration.
  Reaksietempo (of volume waterstofgas gevorm per eenheidstyd) neem af met afname in konsentrasie.

OR/*OF*

- The higher the concentration (of HCℓ) the faster the rate of the reaction.
  Hoe hoër die konsentrasie (van HCℓ) hoe vinniger die reaksietempo. [12.1.1] (2)

7.3 To make a fair comparison / test. ✓✓
Om dit 'n regverdige vergelyking / toets te maak.

OR/*OF*
Magnesium is a controlled variable. / Magnesium is 'n gekontroleerde veranderlike.
Accept: Magnesium is a constant.

OR/*OF*
To ensure that there is only one independent variable (concentration).
Om te verseker dat daar slegs een onafhanklike veranderlike (konsentrasie). [12.1.1] (2)

7.4 Magnesium is the limiting reagent. ✓✓
Magnesium is die beperkende reagens.

OR/*OF*
When Mg is used up, the reaction will stop.
Wanneer Mg opgebruik is, sal die reaksie stop.

OR/*OF*
The same amount (mass/volume) of Mg will react with the same amount of acid in each experiment.
Dieselfde hoeveelheid (massa/volume) magnesium sal in elke eksperiment met dieselfde hoeveelheid suur reageer. [12.1.1] (2)

7.5.1 60 cm^3 ✓ [12.1.2] (1)

7.5.2 42 cm^3 ✓ [12.1.2] (1)

7.6 Experiment / *Eksperiment* 1 ✓

The gradient / slope (of tangent to graph) is steeper. ✓
Die gradiënt / helling (van die raaklyn aan die grafiek) is steiler. [12.1.2] (2)

7.7 The <u>number of moles / amount / mass of Mg</u> used in both experiments were the <u>same</u>. ✓
Die aantal mol / <u>hoeveelheid / massa Mg</u> gebruik in beide eksperimente was <u>dieselfde</u>. [12.1.1] (1)

7.8 Reaction rate increases with increase in concentration. ✓✓
Reaksietempo neem toe met toename in konsentrasie.

OR/*OF*
Reaction rate (volume of hydrogen gas formed per unit time) decreases with decrease in concentration.
Reaksietempo (volume waterstofgas gevorm per eenheidstyd) neem af met afname in konsentrasie. [12.1.2] (2)

7.9.1 Remains the same / *Bly dieselfde* ✓ [12.1.2] (1)

7.9.2 Increases / *Vermeerder* ✓ [12.1.2] (1)
[16]

QUESTION 8/*VRAAG 8*

8.1 Reactants and products are in different phases.
Reaktanse en produkte is in verskillende fases.

OR/*OF*
The reactant and one of the products are solids and the other product is a gas. / *Die reaktanse en een van die produkte is vaste stowwe en die ander produk is 'n gas.* [12.2.1] (1)

8.2

Option 1/*Opsie 1:*

$K_c = [CO_2]$ ✓
$0{,}0108 = [CO_2]$
$\therefore [CO_2] = 1{,}08 \times 10^{-2}$ mol·dm^{-3}

$n(CO_2) = cV$ ✓
$= (1{,}08 \times 10^{-2})$ ✓ (0,5) ✓
$= 5{,}4 \times 10^{-3}$ mol
$n(CaCO_3)_{used} = n(CO_2)$ ✓
$\therefore n(CaCO_3)_{used} = 5{,}4 \times 10^{-3}$ mol

$m(CaCO_3)_{used} = nM$ ✓$= (5{,}4 \times 10^{-3})(100)$ ✓ $= 0{,}54$ g

Mass/Massa (at equilibrium *by ewewig)* $= 5 \overset{✓}{-} 0{,}54 = 4{,}46$ g ✓

Option 2/*Opsie 2:*

$K_c = [CO_2]$ ✓

	$CaCO_3$	⇌	CaO +	CO_2
n(initial/*aanvanklik*):	0,05			0
n(react/*reageer*):	0,0054 ✓			0,0054
n(equilibrium/*ewewig*):				0,0054 ✓✓
c(equilibrium/*ewewig*):				0,0108 ✓

$n(CaCO_3)_i = \frac{m}{M}$
$= \frac{5}{100} = 0{,}05$ mol

$n(CaCO_3)_{eq.} = 0{,}05 \overset{✓}{-} 0{,}0054$
$= 0{,}045$ mol

$m(CaCO_3)_{eq./} = nM$ ✓
$= (0{,}045)(100)$ ✓
$= 4{,}46$ g ✓

$m(CaCO_3)_{used} = nM$ ✓
$= (5{,}4 \times 10^{-3})(100)$ ✓
$= 0{,}54$ g (0,5 g)

$m_{eq} = 5 \overset{✓}{-} 0{,}54$
$= 4{,}46$ g ✓

Option 3/*Opsie 3:*

$K_c = [CO_2]$ ✓ = 0,0108$[CO_2]$ = 1,08 x 10^{-2} mol·dm^{-3}

$n(CO_2) = cV$ ✓
= (1,08 x 10^{-2}) ✓ (0,5) ✓
= 5,4 x 10^{-3} mol

	$CaCO_3$	⇌	CaO +	CO_2
n(initial/*aanvanklik*):	0,05			0
n(change/*verandering)*:	0,0054 ✓			0,0054
n(equilibrium/*ewewig*):	0,0446 ✓			0,0054

$m(CaCO_3)_{used} = nM$ ✓ = (0,0446)(100) ✓ = = 4,46 g ✓

Option 4/*Opsie 4:*

	$CaCO_3$	⇌	CaO +	CO_2
n(initial/*aanvanklik*):	0,05			0
n(change/*verandering*):	x			x ✓ (1:1)
n(equilibrium/*ewewig*):	0,05 – x			x

c(equilibrium/*ewewig*): $\frac{x}{0,5}$ ✓ ($c = \frac{n}{V}$)

$K_c = [CO_2]$ ✓ = 0,0108

$\frac{x}{0,5}$ ✓ = 0,0108 ✓ ∴ x = 0,0054 mol

$n(CaCO_3)_{initial} = \frac{m}{M} = \frac{5}{100} = 0,05$ mol

$n(CaCO_3)_{equilibrium} = 0,05 - 0,0054 = 0,045$ mol ✓

$m(CaCO_3)_{equilibrium\ /ewewig} = nM$ ✓
= (0,045)(100) ✓
= 4,46 g ✓

$m(CaCO_3)_{used} = nM$ ✓
= (5,4 x 10^{-3})(100) ✓
= 0,54 g (0,5 g)

$m_{(equilibrium/ewewig)} = 5 - 0,54$ ✓
= 4,46 g ✓

Option 5/*Opsie 5:*

$K_c = [CO_2]$ ✓

	$CaCO_3$	⇌	CaO +	CO_2
n(initial/*aanvanklik*):	0,05		0	0
m(initial/*aanvanklik*):	0,54 (0,5)		0,3024 ✓ (0,28)	0,2376✓
n(change/*verandering*):			0,0054 ✓	0,0054
n(equilibrium/*ewewig*):				0,0054 ✓✓
c(equilibrium/*ewewig*):				0,0108 ✓

$m(CaCO_3)_{\text{equilibrium /ewewig}} = 5 - 0{,}54$ ✓
$= 4{,}46$ g ✓

[12.1.3] (9)

8.3 Endothermic / *Endotermies* ✓

According to Le Chatelier's principle an increase in temperature will favour the endothermic reaction. / the reaction that uses energy. ✓
When T was increased, K_c increased, therefore $[CO_2]$ increased / more products form, therefore forward reaction was favoured. ✓

Volgens Le Chatelier se beginsel sal 'n toename in temperatuur die endotermiese reaksie bevoordeel. / reaksie wat energie gebruik. ✓
Toe die temperatuur verhoog is, het Kc toegeneem, dus $[CO_2]$ het verhoog en dus is die voorwaartse reaksie bevoordeel. / ewewigsposisie skuif na regs. ✓

[12.1.4] (3)

8.4.1 Remains the same / *Bly dieselfde* ✓ [12.2.3] (1)

8.4.2 Increases / *Vermeerder* ✓ [12.2.3] (1)

8.4.3 Remains the same / *Bly dieselfde* ✓ [12.2.3] (1)

8.5 Remains the same / *Bly dieselfde* ✓ [12.2.3] (1)

[17]

QUESTION 9/*VRAAG 9*

9.1 Temperature / *Temperatuur:* 298 K (25 °C) ✓
Concentration of electrolyte / *Konsentrasie van elektroliet:*
1 mol·dm^{-3} ✓ [12.2.1] (2)

9.2 $Mg(s) \rightarrow Mg^{2+}(aq) + 2e^-$ ✓✓ [12.2.3] (2)

9.3 $Mg(s) \mid Mg^{2+}(1 mol \cdot dm^{-3})$ ✓ ✓ $|| Pb^{2+}(s) (1 mol \cdot dm^{-3}) \mid Pb(s)$ ✓ [12.2.3] (3)

9.4 $E^{\theta}_{Cell} = E^{\theta}_{cathode} - E^{\theta}_{anode}$ ✓
$= - 0,13$ ✓ $- (-2,36)$ ✓
$= 2,23$ V ✓ [12.2.3] (4)

9.5.1 Decreases / *Verminder* ✓ [12.2.2] (1)

9.5.2 Increases / *Vermeerder* ✓ [12.2.2] (1)

9.6 Half-cell A to half-cell B / *Halfsel A na halfsel B* ✓✓

- Concentration of positive ions / cations / Pb^{2+} ions decreases in half-cell B. / K*onsentrasie van positiewe ione / katione /* Pb^{2+}-ions *neem af in halfsel B.* ✓

  OR/OF
  Concentration of positive ions / cations/Mg^{2+} ions increase in half-cell A. ✓ / K*onsentrasie van positiewe ione / katione/* Mg^{2+}*-ione neem toe in halfsel A.*

- To prevent a build-up of positive ions in half-cell A and negative ions in half-cell B / For electrical neutrality,
  positive ions migrate from/through the salt bridge. ✓
  Om 'n opbou van positiewe ione in halfsel A en negatiewe ione in halfsel B te voorkom / Vir elektriese neutraliteit, migreer positiewe ione vanaf/deur die soutbrug. [12.1.4] (4)

[17]

QUESTION 10/*VRAAG 10*

10.1 The process in which electricity is used to bring about a chemical change / decompose/break compounds into components. / *Die proses waartydens elektrisiteit gebruik word om 'n chemiese verandering teweeg te bring / verbindings in komponente op te breek.* ✓✓

OR/*OF*
A process in which electrical energy is converted to chemical energy.
'*n Proses waartydens elektriese energie omgeskakel word na chemiese energie.* [12.2.1] (2)

10.2 P ✓

P is the positive (electrode) /anode. ✓
P *die positiewe electrode /anode.*

Oxidation takes place at the positive electrode/anode. ✓
Oksidasie vind by die positiewe elektrode (anode) plaas. [12.2.3] (3)

10.3 $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ ✓✓ [12.2.3] (2)

10.4 Pt and Ag are both weaker reducing agents ✓(than copper) and will not be oxidised. ✓
Pt en Ag is beide swakker reduseermiddels (as koper) en sal nie geoksideer word nie.

OR/*OF*
Cu is a stronger reducing agent (than Pt and Ag) ✓
and will be oxidised. ✓/ *Cu is 'n sterker reduseermiddel (as Pt en Ag) en sal geoksideer word.* [12.2.3] (2)

10.5 The rate at which copper is oxidised (at the anode) is equal to the rate at which copper ions are reduced (at the cathode). ✓✓
Die tempo waarteen koper (by die anode) geoksideer word is gelyk aan die tempo waarteen koperione (by die katode) gereduseer word. [12.2.3] (2)

10.6 Contains valuable / expensive metals. ✓✓
Bevat waardevolle / duur metale.

OR/*OF*
Platinum and silver are valuable / expensive metals.
Platinum en silwer is waardevolle / duur metale. [12.3.2] (2)
[13]

QUESTION 11/*VRAAG 11*

11.1 A liquid / solution that conducts electricity. ✓✓

'n Vloeistof / oplossing wat elektrisiteit gelei. [12.2.1] (2)

11.2 Contains (positive / Na^+ and negative / $C\ell^-$) ions that are free to move. ✓
Bevat (positiewe / Na^+ en negatiewe / $C\ell^-$) *ione wat vry is om te beweeg.* [12.2.3] (1)

11.3 Chloride ions / Sodium chloride ✓
Chloriedione / *Natriumchloried*

$C\ell^-$ ions/$C\ell^-$ *-ione* Max./*Maks.* or/*of* $\frac{1}{2}$

Chloride ions are oxidised / lose electrons ✓ (to form $C\ell_2$).
Chloriedione word geoksideer / verloor elektrone (om $C\ell_2$ te vorm).

OR/OF
Chloride ions reduce water / causes reduction of water.
Chloriedione reduseer water / veroorsaak reduksie van water. [12.2.3] (2)

11.4 $2H_2O(\ell) + 2e^- \rightarrow H_2(g) + 2OH^-(aq)$ ✓✓ [12.2.3] (2)

11.5 Anode ✓

$C\ell^-(aq)$ is oxidised to / *word geoksideer na* $C\ell_2(g)$ – oxidation at the anode / *oksidasie by die anode.* ✓

OR/*OF*
$2C\ell^-(aq) \rightarrow C\ell_2(g) + 2e^-$ [12.2.3] (2)

11.6 The (selectively permeable) membrane ✓ separates the chloride ions from the cathode compartment.
by allowing only positive ions / cations (Na^+) ✓ to move from the anode compartment to the cathode. / by preventing negative ions / anions to pass through.

Die (selektief-deurlaatbare) membraan skei die chloriedione van die katodekompartement deur slegs positiewe ione / katione (Na^+) toe te laat om vanaf die anodekompartement na die katode te beweeg. / deur te verhoed dat negatiewe ione / anione daardeur gaan. [12.2.1] (2)

11.7 Any ONE/*Enige EEN:*

- Chlorine is poisonous ✓/ dangerous / harmful to humans and the environment.
  Chloor is giftig ✓/ gevaarlik / skadelik vir mense en die omgewing.
- Leaching of sodium hydroxide into groundwater / water carriers is a health risk to humans and the environment.
  Insyfer van natriumhidroksied in grondwater / waterdraers hou 'n gesondheidrisiko vir mense en die omgewing in.
- Hydrogen gas can result in an explosion.
  Waterstofgas kan 'n ontploffing veroorsaak. [12.3.2] (1)

[12]

QUESTION 12/*VRAAG 12*

12.1 Secondary cells / *Sekondêre selle* ✓ [12.2.1] (1)

12.2.1 Equation / *vergelyking* II ✓

OR/*OF*
$NiO_2(s) + 2H_2O(\ell) + 2e^- \rightarrow Ni(OH)_2(s) + 2OH^-(aq)$

Reduction (takes place at cathode). / Electrons gained (at cathode) ✓
Reduksie (vind by die katode plaas). / Elektrone opgeneem (by katode) [12.2.3] (2)

12.2.2 $NiO_2(s) + Cd(s) + 2H_2O(\ell)$ ✓→ $Ni(OH)_2(s) + Cd(OH)_2(s)$ ✓ Bal ✓ [12.2.3] (3)

12.2.3 W = Vq ✓
= 1,4 ✓x $2(9{,}65 \times 10^4)$ ✓
= $2{,}7 \times 10^5$ J ✓

OR/*OF*
W = Vq ✓
= 1,4 ✓ x $2(1{,}6 \times 10^{-19})(6{,}03 \times 10^{23})$ ✓
= $2{,}7 \times 10^5$ J ✓ [12.2.3] (4)

[10]

TOTAL SECTION B/*TOTAAL AFDELING B*: 125

GRAND TOTAL/*GROOTTOTAAL*: 150