education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE
NASIONALE SENIOR SERTIFIKAAT

GRADE/*GRAAD* 12

PHYSICAL SCIENCES: CHEMISTRY (P2)
FISIESE WETENSKAPPE: CHEMIE (V2)

MARKING GUIDELINES/*NASIENRIGLYNE*

SEPTEMBER 2025

MARKS/*PUNTE*: 150

These marking guidelines consist of 13 pages
Hierdie nasienriglyne bestaan uit 13 bladsy

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Please turn over/*Blaim om asseblief*

QUESTION/*VRAAG* 1

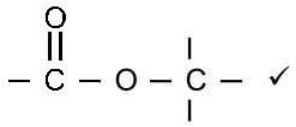
1.1.	D	✓✓	(2)
1.2	B	✓✓	(2)
1.3	D	✓✓	(2)
1.4	A	✓✓	(2)
1.5	B	✓✓	(2)
1.6	A	✓✓	(2)
1.7	D	✓✓	(2)
1.8	C	✓✓	(2)
1.9	C	✓✓	(2)
1.10	D	✓✓	(2)

[20]

QUESTION/*VRAAG* 2

2.1. A bond or an atom or a group of atoms that determine(s) the physical and chemical properties of a group of organic compounds. ✓✓ (2 or 0)
'n Chemiese binding of 'n atom of 'n groep atome wat die fisiese en chemiese eienskappe van 'n groep organiese verbindings bepaal. (2 of 0) (2)

2.2



(1)

2.3

2.3.1 F ✓ (1)

2.3.2 Butanal/*Butanaal* ✓✓ (2)

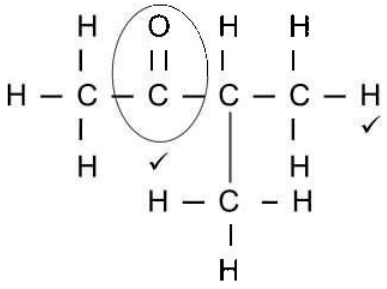
2.3.3 2,3-dichloro-4,5-dimethylheptane✓✓✓
2,3-dichloro-4,5-dimetielheptaan

Marking criteria/*Nasienkriteria:*

- Correct stem i.e. heptane.✓
- All substituents (dichloro and dimethyl) correctly identified.✓
- IUPAC name completely correct including numbering, sequence, hyphens and commas. ✓
- *Korrekte stam d.i heptaan* ✓
- *Alle sunstituente (dichloro en dimetiel) korrek geïndentifiseer*
- *IUPAC naam heeltemal korrek insluitende nommering, volgorde, koppeltekens en kommas.*

(3)

2.3.4

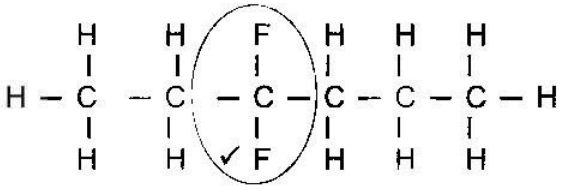


Marking criteria/*Nasienkriteria*

- Functional group✓
- Whole strucure corect✓
- Funksionele groep ✓
- Hele struktuur korrek ✓

(2)

2.3.5



Marking criteria/*Nasienkriteria*

- Flourines on C_3 ✓
- Whole strucure correct ✓
- *Fluore op C_3* ✓
- *Hele struktuur korrek* ✓

(2)

2.4.1 Organic molecules with the same molecular formula, ✓but different structural formulae ✓
Organiese molekules met dieselfde molekulêre formule, maar verskillende struktuurformules ✓ (2)

2.4.2 Propan-1-ol/ 1-propanol ✓ and Propan-2-ol/ 2-propanol✓
Propan-1-ol/ 1-propanol en Propan-2-ol/ 2-propanol ✓ (2)

2.5 Aldehyde✓and ketone ✓**OR** carboxylic acid and ester
*Aldehied ✓en ketoon ✓**OF** karboksielsuur en ester* (2)
[19]

QUESTION/*VRAAG* 3

3.1 The temperature at which the vapour pressure of a substance equals atmospheric pressure✓✓
Die temperatuur waarby die dampdruk van 'n stof gelyk is aan die atmosferiese druk.

Markingcriteria/*Nasienkriteria*
If any one of the underlined key phrases in the **correct context** is omitted, deduct 1 mark.*Indien enige van die onderstreepte frases in die korrekte konteks uitgelaat is, trek 1 punt af.*

(2)

3.2

3.2.1 Carboxylic acid/*Karboksielsuur*✓ (1)

3.2.2 Hydrogen bond or dipole-dipole bond.✓
Waterstofbinding of dipool-dipool binding (1)

3.3 From A to D boiling point increases✓

- **Structure:**
  The chain length/number of carbon atoms/molar mass/ surface area/ contact area increases ✓ from compound A to D.
- **Intermolecular forces:**
  The strength of the London forces/induced dipole/Van der Waals/ intermolecular forces increase. ✓
- **Energy:**
  More energy needed to overcome/break the intermolecular forces from A to D.✓

OR

Boiling point decrese from D to A ✓

- **Structure:**
  The chain length/number of carbon atoms/molar mass/ surface area/ contact area decreases from compound D to A.✓
- **Intermolecular forces:**
  The strength of the intermolecular forces/London forces decrease from D to A ✓
- **Energy:**
  Lesser energy needed to weaken/overcome/break the intermolecular forces from D to A.✓

Van A na D neem die kookpunt toe

- ***Struktuur:***
  Die kettinglengte/aantal koolstowwe/molêre massa/reaksieoppervlak/kontakarea neem toe van verbinding A na D.
- ***Intermolekulêre kragte:***
  Die sterkte van die Londonkragte/geïnduseerde dipoolkragte/Van der Waalskragte neem toe.
- ***Energie:***
  Meer energie benodig om intermolekulêre kragte te oorkom/breek van A na D.

Van D na A neem die kookpunt af

- ***Struktuur:***
  Die kettinglengte/ aantal koolstowwe/molêre massa/reaksieoppervlak/kontakarea neem af van verbinding D na A..
- ***Intermolekulêre kragte:***
  Die sterkte van die Londonkragte/geïnduseerde dipoolkragte/Van der Waalskragte neem af.
- ***Energie:***
  Minder energie benodig om intermolekulêre kragte te oorkom/breek van D na A. (4)

3.4 C/butanoic acid ✓it has the highest/higher boiling point✓
C/butanoësuur ✓ dit het die hoogste/hoër kookpunt ✓ (2)

3.5 Pentanoic acid/*Pentanoësuur* ✓✓ (2)

3.6
- Compound D/Pentanoic acid/carboxylic acid has two sites for hydrogen bond ✓
- Esters has dipole-dipole forces✓
- Intermolecular forces in compound D/pentanoic acid are stronger than Intermolecular forces in esters ✓
  OR
  Intermolecular forces in ester are weaker than in compound D
- Less energy needed to overcome/break the intermolecular forces in ester than in compound D/pentanoic acid.✓
  OR
  More energy needed to overcome/break the intermolecular forces in D than in ester.

- *Verbinding D/Pentanoësuur/carboksielsuur het twee plekke vir waterstofbinding* ✓
- *Ester het dipool-dipoolkragte*✓
- *Intermolekulêrekragte in verbinding D/pentanoësuur is sterker as die intermolekulêrekragte in esters* ✓
  OF
  Intermolekulêrekragte in ester is swakker as in vebinding D
  Minder energie benodig om die intermolekulêre kragte te oorkom/breek in esters as in verbinding D/pentanoësuur.✓
  OF
  Meer energie benodig om die intermolekulêre kragte te oorkom/breek in verbinding D/pentanoësuur as in esters.✓ (4)

[16]

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QUESTION/*VRAAG* 4

4.1.1 Substitution/Hydrolysis reaction. ✓
Substitusie/Hidrolise reaksie (1)

4.1.2 **NOTE/*NOTA***
Penalise 1 mark if a hyphen is missing/*Penaliseer as daar 'n koppelteken uitgelaat is.*

1-chloropropane/*1-chloropropaan* ✓✓ (2)

4.2 Primary alcohol ✓
Alcohol in which the carbon atom bonded to the functional group(-OH) is attached to one carbon atom. ✓ ✓
Primêre alkohol
Alkohol waar die koolstofatoom gebind aan die funksionele groep(-OH) gebind is aan een ander koolstofatoom. (3)

4.3.1 Dehydration reaction/*Dehidrasie reaksie* ✓ (1)

4.3.2 $CH_3CH_2CH_2OH$ ✓ → CH_3CHCH_2✓ + H_2O ✓ (3)

4.4 Propane/*Propaan* ✓✓ (2)

4.5.1 **NOTE/*NOTA***
No mark for dilute H_2SO_4/*Geen punt vir verdunde* H_2SO_4

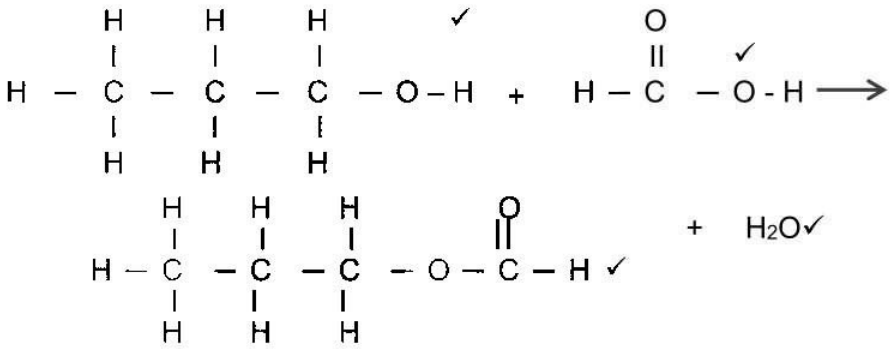
Sulphuric acid/Hydrogen sulphate/H_2SO_4/Phosphoric acid/H_3PO_4 ✓
Swawelsuur/Waterstofsulfaat/H_2SO_4*/Fosforsuur/* H_3PO_4 (1)

4.5.2 **Marking criteria/*Nasienkriteria*:**

- Correct structural formula for methanoic acid ✓
- Correct structural formula for alcohol ✓
- The whole structural formula for ester correct ✓
- H_2O ✓
- *Korrekte struktuurformule vir metanoësuur* ✓
- *Korrekte struktuurformule vir alkohol* ✓
- *Die hele struktuurformule vir die ester is korrek* ✓
- *H_2O* ✓

IF/*INDIEN*
Condensed structural formula used/*Gekondenseerde struktuur formule gebruik* Max/***Maks ¼***

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(4)
[17]

QUESTION/*VRAAG* 5

5.1 **ANY ONE:**

- Change in concentration ✓of products/reactants per unit time.✓
- Change in amount/number of mole/volume/mass ✓of products/reactants per unit time.✓
- Amount/number of mole/volume/mass of products formed/reactants used✓ per unit time.✓
- Rate of change in concentration/amount/number of moles/volume/mass.✓✓ (**2 or 0**)

ENIGE EEN:

- *Verandering in konsentrasie ✓van produkte/reaktanse per eenheidtyd.✓*
- *Verandering in hoeveelheid/getal mol/volume/massa ✓van produkte/reaktanse per eenheidtyd.✓*
- *Hoeveelheid/getal mol/volume/massa produkte gevorm/reaktanse gebruik✓ per eenheidtyd.✓*
- *Tempo van verandering in konsentrasie/hoeveelheid/getal mol/volume/massa.✓✓(**2 or 0**)* (2)

NOTE/*NOTA*
Give the mark for per unit time only if in correct context of reaction rate
Gee die punt vir per eenheidtyd slegs indien in korrekte konteks met reaksietempo.

5.2 Surface area/State of division✓
Kontakoppervlak/Toestand van verdeeldheid (1)

5.3 Experiment/*Eksperiment* II✓ (1)

5.4

- The surface area increase/Experiment 2 has a larger surface area/ more particles exposed (to oxygen gas)✓
- More particles will have enough kinetic energy✓
- More effective collision per unit time/second/Higher frequency of effective collisions ✓
- *Die kontakoppervlak vergroot/Eksperiment 2 het 'n groter kontakoppervlak/meer deeltjies word blootgestel (aan suurstofgas)*
- *Meer deeltjies het genoeg/voldoende kinetiese energie*
- *Meer effektiewe botsings per eenheidtyd/sekonde/hoër frekwensie van effektiewe botsings* (3)

5.5.1

Marking criteria/*Nasienkriteria*:

- Δm (7,36-0) ✓ & Δt (5,2-0) ✓
- Answer/*Antwoord* 1,42 ($g \cdot s^{-1}$) ✓

Rate/*Tempo* =Δm/Δt
= (7,36-0) ✓/ (5,2-0) ✓
= 1,42 ($g \cdot s^{-1}$) ✓ (3)

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5.5.2

Marking criteria:	***Nasienkriteria:***
• Formula $n=\frac{m}{M}$ ✓ • Substituting 94 g·mol^{-1} ✓in $n=\frac{m}{M}$ • USE mol ratio n(K) = 2n(K_2O) ✓ • Substitution of 39 g·mol^{-1} and reacting mole in $n=\frac{m}{M}$ ✓ • Substitution of $\frac{6,11}{6,92}(100)$✓ • Answer 88,25%✓ Range: 88,25% - 89,05%	• *Formule* $n=\frac{m}{M}$ ✓ • *Vervanging van 94 g·mol^{-1} ✓in* $n=\frac{m}{M}$ • *GEBRUIK molverhouding n(K) = 2n(K_2O)* ✓ • *Vervanging van 39 g·mol^{-1} en reagerende mol in* $n=\frac{m}{M}$ ✓ • *Vervanging van* $\frac{6,11}{6,92}(100)$ ✓ • *Antwoord 88,25%*✓ *Range: 88,25% - 89,05%*

$n = \frac{m}{M}$✓

$n = \frac{7,36}{94}$ ✓
= 0,0783 mol

n(K) = 2 x 0,783 ✓
= 0,1566 mol

n(K) = m/M
m(K) = 0,1566 x 39✓
= 6,11g

% purity/*suiwerheid* = $\frac{6,11}{6,92}(100)$ ✓

= 88,25% ✓

(6)

5.6 Negative ✓ Exothermic reaction/energy of the product < energy of the reactant/ energy of the reactant > energy of the product ✓
Negatief ✓ Eksotermiese reaksie/energie van die produkte < energie van die reaktanse/ energie van die reaktanse > energie van die produkte ✓

ACCEPT/AANVAAR
More energy is released than absorbed/*Meer energie word vrygestel as wat geabsorbeer word.*
Combustion reaction. It releases energy/Verbrandingsreaksie. Stel energie vry (2)
[18]

QUESTION/*VRAAG* 6

6.1 The dynamic equilibrium when) the rate of the forward reaction equals the rate of the reverse reaction.✓✓ (**2** or **0)**
OR
The stage in a chemical reaction when the concentration of reactants and products remain constant
*(Die dinamiese ewewig wanneer) die tempo van die voorwaartse reaksie gelyk is aan die tempo van die terugwaartse reaksie. (**2** of **0**)*
OF
Die stadium in 'n chemiese reaksie waar die konsentrasie van die reaktanse en produkte konstant bly. (2)

6.2 Endothermic/*Eksotermies* ✓✓

6.3
- Decrease in temperature favours the the reaction that decreases temperature (exothermic reaction) ✓
- The reverse reaction is favoured✓
- Concentration of reactant/NO_2 increases ✓
  OR
  Concentration of products/NO and O_2 decreases
- *Afname in temperatuur bevoordeel die eksotermiese reaksie* ✓
- *Die terugwaartse reaksie word bevoordeel*✓
- *Konsentrasie van reaktanse/NO_2 neem toe* ✓
  OF
  Konsentrasie van produkte/NO en O_2 neem af

(3)

6.4

CALCULATIONS USING NUMBER OF MOLES/*BEREKENING DEUR MOL TE GEBRUIK*

Marking criteria:
a) Change in n(NO_2) = equilibrium nNO_2) - initial n(NO_2) = x - 0,6 ✓
b) Using ratio: NO : N_2O : O_2 = 2: 2: 1 ✓
c) Equilibrium n(NO) = intial n(NO) + change in n(NO)
Equilibrium n(O_2) = intial n(O_2) + change in n(O_2) ✓
d) Dividing by 2 ✓
e) Correct Kc expression in square brackets✓
f) Substitution of equilibrium constant✓
g) Substitution of equilibrium concentrations into Kc expressions✓
h) Final answer. 1,48 mol✓

Nasienkriteria:
a) Verandering in n(NO_2) = ewewig nNO_2) - aanvanklike n(NO_2) = x -0,6✓
b) gebruik verhouding: NO : N_2O : O_2 = 2: 2: 1 ✓
c) Ewewig n(NO) = aanvanklike n(NO) + verandering in n(NO)
Ewewig n(O_2) = aanvanklike n(O_2) + verandering in n(O_2) ✓
d) Korrekte Kc uitdrukking in vierkantige hakkies✓
e) Deel deur 2 ✓
f) Vervanging van ewewigskonstante ✓
g) Vervanging van ewewigskonsentrasies in Kc uitdrukking✓
i) Finale antwoord. 1,48 mol✓

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Mol	$2NO_2$	2NO	O_2	
Initial mole *Aanvanklike mol*	x	0	0	
Change in mole *Verandering in mol*	x-0,6✓	x-0,6	x-0,6)/2	✓
Equilibrium mole *Mol by ewewig*	0,6	x-0,6	(x-0,6)/2	✓
Concentration	0,3	(x-0,6)/2	x-0,6/2 ÷ 2	✓

$$Kc = \frac{[NO]^2 \times [O_2]}{[NO_2]^2} \checkmark$$

$$0,48 \checkmark = \frac{(x - 0,6)/2)^2 \times (x-0,6/4)}{(0,3)^2} \checkmark \quad x = 1,48 \text{ mol} \checkmark$$

(8)

[15]

QUESTION/*VRAAG 7*

7.1.1 Solution with known concentration ✓✓
Oplossing met bekende konsentrasie (2)

7.1.2

Marking criteria/*Nasienkriteria*:
- Formula $c = \frac{m}{MV}$✓ or n=n/M or c=n/V
- Substituting/*vervanging van* 40 g·mol^{-1} and 4g✓
- Dividing by/*deel deur* 0,5dm^3 ✓
- Answer/*Antwoord*✓

OPTION 1/OPSIE 1	**OPTION 2/*OPSIE 2***
c = m/MV ✓ c= 4/(40x0,5) ✓ ✓ c= 0,2 mol·dm^{-3} ✓	n = n/M = 4/40 ✓ = 0.1 mol Any one/*Enige een* ✓ c = n/V = 0.1/0.5 ✓ = 0.2 mol·dm^{-3} ✓

(4)

7.1.3

Marking criteria/*Nasienkriteria*:
- Formula $\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b}$ ✓
- Substitution on C_aV_a and Substitution on C_bV_b✓/ Substitution on n= cV and n=cV
- Ratio 1:1✓
- Final answer 0,17 mol·dm^{-3}✓
- *Formule* $\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b}$ ✓
- *Vervanging in C_aV_a & vervanging in C_bV_b✓ Vervanging van n=cV en n = cV*
- *Verhouding 1:1*✓
- *Finale antwoord 0,17 mol·dm^{-3}*✓

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OPTION 1/OPSIE 1:	***OPTION 2/OPSIE 2:***
$\frac{c_a v_a}{c_b v_b} = \frac{n_a}{n_b}$ ✓ $\frac{c_a x 35}{0,2 x 30}$ ✓ $= \frac{1}{1}$ ✓ c_a = 0,17 mol·dm^{-3} ✓	n (NaOH) = cV ✓ = 0,2 x 0,03 = 0,006 mol Ratio: 1 : 1 n (HCl) = 0,006 mol ✓ $c = \frac{n}{V}$ ✓ $= \frac{0,006}{0,035}$ = 0,17 mol•dm^{-3} ✓

(4)

7.1.4 NO ✓
It is a salt of strong acid and a strong base. ✓
Dit is 'n sout van 'n sterk suur en 'n sterk basis (2)

7.2.1 Neutral ✓
$[H_3O^+] = [OH^-] = 1x10^{-7}$ mol•dm^{-3} or pH = 7 ✓

ACCEPT/*AANVAAR*
$[H_3O^+] = [OH^-]$ (2)

7.2.2

OPTION 1/*OPSIE 1:*	**OPTION 2/*OPSIE 2:***
pOH = -log $[OH^-]$ ✓ pOH = -log (3 x 10^{-7}) ✓ pOH = 6,52 ✓ pH + pOH = 14 pH + 6,52 = 14 ✓ pH = 14-6,52 pH = 7,48 ✓	$[H_3O^+][OH^-] = 1x10^{-14}$ $[H_3O^+][3x10^{-7}] = 1x10^{-14}$ ✓ $[H_3O^+]$ = 3.33x10^{-8} (mol•dm^{-3}) ✓ Any one ✓ pH = -log $[H_3O^+]$ = -log [3.33x10^{-8}] ✓ = 7.48 ✓

(5)
[19]

QUESTION/*VRAAG* 8

8.1
- Concentration must be 1 mol·dm^{-3}✓
- Temperature must be 25°C/298K✓
- *Konsentrasie moet 1 mol·dm^{-3} wees*✓
- *Temperatuur moet 25°C/298K wees*✓

(2)

8.2 Sodium chloride/NaCℓ/Potassium chloride/KCℓ or any suitable electrolyte✓
Natriumchloried/ NaCℓ*/Kaliumchloried/* KCℓ*/ of enige geskikte elektroliet*

ACCEPT/*AANVAAR*
Any metal nitrates/Enige metal *nitrate* (1)

8.3 Electrode where reduction takeplace✓✓
Elektrode waar reduksie plaasvind (2)

8.4

Marking guidelines/*Nasienkriteria:*
- $Pb^{2+} + 2e^- \rightleftharpoons Pb$ ($^1/_2$)
- $Pb \leftarrow Pb^{2+} + 2e^-$ ($^2/_2$)
- $Pb \rightleftharpoons Pb^{2+} + 2e^-$ ($^0/_2$)
- $Pb \rightarrow Pb^{2+} + 2e^-$ ($^0/_2$)
- Ignore charges omitted on electron/*Ignoreer indien lading weggelaat is op elektron*
- If charge (+) omitted on Pb^{2+} / *Indien (+) lading weggelaat is op* Pb^{2+} Max. ($^1/_2$)

Example/*Voorbeeld*: $Pb^2 + 2e^- \rightarrow Pb$ ✓

$Pb^{2+} + 2e^- \rightarrow Pb$ ✓✓ (2)

8.5 $E^{\ominus}_{cell} = E^{\ominus}_{reduction} - E^{\ominus}_{oxidation}$✓
$E^{\ominus}_{cell} = -0,13$✓ – (-0,91) ✓
= 0,78V✓ (4)

Notes/*Aantekeninge*:
- Accept any other correct formula from the data sheet./*Aanvaar enige ander korrekte formule vanaf gegewensblad*
- Any other formula using unconventional abbreviations, e.g $E^{\ominus}_{cell} = E^{\ominus}_{OA} - E^{\ominus}_{RA}$ followed by correct substitutions/*Enige ander formule wat onkonvensionele afkortings gebruik bv.* $E^{\ominus}_{sel} = E^{\ominus}_{OM} - E^{\ominus}_{RM}$ gevolg deur korrekte vervangings: ¾

8.6

Marking criteria/*Nasienkriteria:*
- oxidation✓ double line✓ reduction ✓
- oksidasie ✓ dubbellyn ✓ reduksie ✓

Cr(s)/ Cr^{2+} (aq)(1 mol•dm^{-3})✓*II* ✓ Pb^{2+}(aq)(1 mol•dm^{-3})/ Pb(s)✓ (3)

8.7 Increases/*Verhoog*✓
Cr is oxidised to Cr^{2+}✓
Cr is geoksideer na Cr^{2+} (2)
[16]

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QUESTION/*VRAAG* 9

9.1 Cell in which electric energy is converted to chemical energy.✓✓ **(2 or 0)**
Sel waarin elektriese energie omgeskakel is na chemiese energie .✓✓ **(2 or 0)** (2)

9.2 Copper/*Koper* (Cu)✓ (1)

9.3 X ✓
Oxidation takes place at X/ X loses electrons ✓
Oksiedasie vind by X plaas/X verloor elektrone (2)

9.4

Marking guidelines/*Nasienkriteria:*
- $Cu^{2+} + 2e^- \rightleftharpoons Cu$ ($^1/_2$)
- $Cu \leftarrow Cu^{2+} + 2e^-$ ($^2/_2$)
- $Cu \rightleftharpoons Cu^{2+} + 2e^-$ ($^0/_2$)
- $Cu \rightarrow Cu^{2+} + 2e^-$ ($^0/_2$)
- Ignore charges omitted on electron/*Ignoreer indien lading weggelaat is op elektron*
- If charge (+) omitted on Cu^{2+}
  Indien lading (+) lading weggelaat is op Cu^{2+} Max. ($^1/_2$)

  Example/*Voorbeeld*: $Cu^2 + 2e^- \rightarrow Cu$ ✓

$Cu^{2+} + 2e^- \rightarrow Cu$ ✓✓ (2)

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9.5

Marking criteria/*Nasienkriteria:*
- Reactants✓ Products✓ Balancing✓
- Ignore double arrows
- Ignore phases
- Marking rule 6.3.10
- *Reaktanse✓ Produkte✓ Balansering✓*
- *Ignoreer dubbel pyle*
- *Ignoreer fases*
- *Nasienreël 6.3.10*

$Cu^{2+}(aq) + 2C\ell^{-}(aq)$✓→ $Cu(s)$✓+ $C\ell_2$ bal✓

ACCEPT/*AANVAAR*
$CuCl_2(aq)$ ✓ → $Cu(s)$✓+ $C\ell_2$ bal✓ (3)

[10]

TOTAL/*TOTAAL*: 150

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