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# basic education

Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL  
SENIOR CERTIFICATE  
NASIONALE  
SENIOR SERTIFIKAAT**

**GRADE/GRAAD 12**

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

**NOVEMBER 2011**

**POSSIBLE ANSWERS  
MOONTLIKE ANTWOORDE**

**MARKS/PUNTE: 150**

**This memorandum consists of 25 pages.  
Hierdie memorandum bestaan uit 25 bladsye.**

<b>Learning Outcomes and Assessment Standards</b> <b>Leeruitkomst en Assesseringstandaarde</b>		
<b>LO/LU 1</b>	<b>LO/LU 2</b>	<b>LO/LU 3</b>
<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. <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. <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. <i>Kies en gebruik geskikte probleemoplossingsstrategieë om (ongesiene) probleme op te los.</i></p> <p><b>AS 12.1.4:</b> Communicate and defend scientific arguments with clarity and precision. <i>Kommunikeer en verdedig wetenskaplike argumente duidelik en presies.</i></p>	<p><b>AS 12.2.1:</b> Define, discuss and explain prescribed scientific knowledge. <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. <i>Verduidelik en druk voorgeskrewe wetenskaplike beginsels, teorieë, modelle en wette uit deur die verwantskap tussen verskillende feite en konsepte in eie woorde aan te dui.</i></p> <p><b>AS 12.2.3:</b> Apply scientific knowledge in everyday life contexts. <i>Pas wetenskaplike kennis in kontekste van die alledaagse lewe toe.</i></p>	<p><b>AS 12.3.1:</b> 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. <i>Doen navorsing, bespreek, vergelyk en evalueer wetenskaplike en inheemse kennisstelsels en kennis aansprake deur die ooreenkomst aan te dui en verduidelik die aanvaarding van verskillende aansprake.</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. <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. <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>

**GENERAL GUIDELINES/ALGEMENE RIGLYNE****1. CALCULATIONS/BEREKENINGE**

- 1.1 **Marks will be awarded for:** correct formula, correct substitution, correct answer with unit.

**Punte sal toegeken word vir:** korrekte formule, korrekte substitusie, korrekte antwoord met eenheid.

- 1.2 **No marks will be awarded if an incorrect or inappropriate formula is used,** even though there may be relevant symbols and applicable substitutions.

**Geen punte sal toegeken word waar 'n verkeerde of ontoepaslike formule gebruik word nie, selfs al is daar relevante simbole en relevante substitusies.**

- 1.3 When an error is made during **substitution into a correct formula**, a mark will be awarded for the correct formula and for the correct substitutions, but **no further marks** will be given.

*Wanneer 'n fout gedurende **substitusie in 'n korrekte formule** begaan word, sal 'n punt vir die korrekte formule en vir korrekte substitusies toegeken word, maar **geen verdere punte** sal toegeken word nie.*

- 1.4 If **no formula** is given, but **all substitutions are correct**, a candidate will **forfeit one mark**.

Example:

No  $K_c$  expression, correct substitution

$$K_c = \frac{(2)^2}{(2)(1)^3} \checkmark = 2 \checkmark \left(\frac{2}{3}\right)$$

*Indien **geen formule** gegee is nie, maar **al die substitusies is korrek, verloor die kandidaat een punt.***

Voorbeeld:

Geen  $K_c$ -uitdrukking, korrekte substitusie:

$$K_c = \frac{(2)^2}{(2)(1)^3} \checkmark = 2 \checkmark \left(\frac{2}{3}\right)$$

- 1.5 Marks are only awarded for a formula if a **calculation has been attempted**. i.e. substitutions have been made or a numerical answer given.

*Punte word slegs vir 'n formule toegeken indien 'n poging tot 'n berekening aangewend is, d.w.s. substitusies is gedoen of 'n numeriese antwoord is gegee.*

- 1.6 Marks can only be allocated for substitutions when values are substituted into formulae and not when listed before a calculation starts.

*Punte kan slegs toegeken word vir substitusies wanneer waardes in formules ingestel is en nie vir waardes wat voor 'n berekening genoem is nie.*

- 1.7 All calculations, when not specified in the question, must be done to two decimal places.

*Alle berekening, wanneer nie in die vraag gespesifiseer word nie, moet tot twee desimale plekke gedoen word.*



- 1.8 If a final answer to a calculation is correct, full marks will not automatically be awarded. Markers will always ensure that the correct/appropriate formula is used and that workings, including substitutions, are correct.

*Indien 'n finale antwoord tot 'n berekening korrek is, sal volpunte nie outomaties toegeken word nie. Nasieners sal altyd verseker dat die korrekte/toepaslike formule gebruik word en dat bewerkings, insluitende substitusies korrek is.*

## 2. UNITS/EENHEDE

- 2.1 Candidates will only be penalised once for the repeated use of an incorrect unit **within a question**.

*Kandidate sal slegs een keer gepenaliseer word vir die herhaaldelike gebruik van 'n verkeerde eenheid in 'n vraag.*

- 2.2 Units are only required in the final answer to a calculation.

*Eenhede word slegs in die finale antwoord tot 'n vraag verlang.*

- 2.3 Marks are only awarded for an answer and not for a unit *per se*. Candidates will therefore forfeit the mark allocated for the answer in each of the following situations:

- Correct answer + wrong unit
- Wrong answer + correct unit
- Correct answer + no unit

*Punte word slegs vir 'n antwoord en nie vir 'n eenheid per se toegeken nie.*

*Kandidate sal derhalwe die punt vir die antwoord in die volgende gevalle verbeur:*

- Korrekte antwoord + verkeerde eenheid
- Verkeerde antwoord + korrekte eenheid
- Korrekte antwoord + geen eenheid

- 2.4 Separate compound units with a multiplication dot, not a full stop, for example,  $\text{mol} \cdot \text{dm}^{-3}$ . Accept  $\text{mol.dm}^{-3}$  (or  $\text{mol/dm}^3$ ) for marking purposes.

*Skei saamgestelde eenhede met 'n vermenigvuldigingsteken en nie 'n punt nie, byvoorbeeld,  $\text{mol} \cdot \text{dm}^{-3}$ . Aanvaar  $\text{mol.dm}^{-3}$  (of  $\text{mol/dm}^3$ ).*

## 3. GENERAL/ALGEMEEN

- 3.1 If one answer or calculation is required, but two given by the candidate, only the first one will be marked, irrespective of which one is correct. If two answers are required, only the first two will be marked, etc.

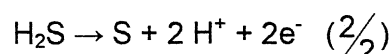
*Indien een antwoord of berekening verlang word, maar twee word deur die kandidaat gegee, sal slegs die eerste een nagesien word, ongeag watter een korrek is. Indien twee antwoorde verlang word, sal slegs die eerste twee nagesien word, ens.*

- 3.2 When a chemical **FORMULA** is asked, and the **NAME** is given as answer the candidate forfeits the marks. The same rule applies when the **NAME** is asked and the **FORMULA** is given.

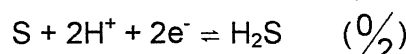
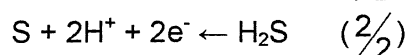
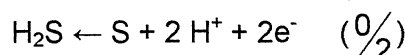
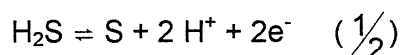
*Wanneer 'n chemiese formule gevra word, en die NAAM word as antwoord gegee, sal die kandidaat punte verbeur. Dieselfde reël geld wanneer die NAAM gevra word en die FORMULE gegee word.*



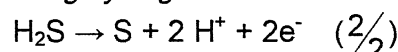
- 3.3 When redox half-reactions are to be written, the correct arrow should be used.  
If the equation



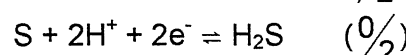
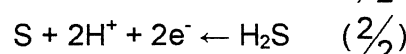
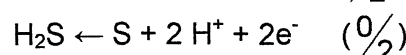
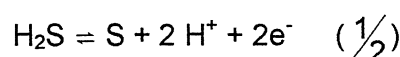
is the correct answer, the marks must be given as follows:



*Wanneer redokshalfreaksies geskryf moet word, moet die korrekte pyltjie gebruik word. Indien die vergelyking*



*die korrekte antwoord is, moet die punte soos volg toegeken word:*



- 3.3 When candidates are required to give an explanation involving the relative strength of oxidising and reducing agents, do not accept the following:

- Stating the position of a substance on table 4 only (e.g. Cu is above Mg).
- Using relative reactivity only (e.g. Mg is more reactive than Cu).
- The correct answer would be for instance: Mg is a stronger reducing agent than Cu, and therefore Mg will be able to reduce  $\text{Cu}^{2+}$  ions to Cu. The answer can also be given in terms of the relative strength as electron acceptors and donors.

*Wanneer kandidate 'n verduideliking moet gee oor die relatiewe sterkte van oksideer- en reduseermiddels, is die volgende onaanvaarbaar:*

- *Meld slegs die posisie van 'n stof op tabel 4 (bv. Cu is bo Mg).*
- *Gebruik slegs relatiewe reaktiwiteit (bv. Mg is meer reaktief as Cu).*
- *Die korrekte antwoord sal byvoorbeeld wees: Mg is 'n sterker reduseermiddel as Cu en derhalwe sal Mg in staat wees om  $\text{Cu}^{2+}$ -ione na Cu te reduseer. Die antwoord kan ook in terme van die relatiewe sterkte van elektronskenkers of -ontvangers gegee word.*

- 3.4 One mark is forfeited when the charge of an ion is omitted per equation.(not for the charge on an electron)

*Een punt sal verbeur word wanneer die lading van 'n ioon per vraag weggelaat is.*

- 3.5 The error-carrying principle does not apply to chemical equations or half-reactions. For example, if a learner writes the wrong oxidation/reduction half-reaction in the sub-question and carries the answer to another sub-question (balancing of equations or calculation of  $E_{\text{cell}}^{\ominus}$ ) then the learner must not be credited for this substitution.

*Die foutdraende beginsel geld nie vir chemiese vergelykings of halfreaksies nie. Byvoorbeeld, indien 'n leerder die verkeerde oksidasie/reduksie-halfreaksie vir die subvraag skryf en die antwoord na 'n ander subvraag oordra (balansering van vergelyking of  $E_{\text{sel}}^{\ominus}$ ) dan word die leerder nie vir die substitusie gekrediteer nie.*

- 3.6 In the structural formula of an organic molecule all hydrogen atoms must be shown. Marks must be deducted if hydrogen atoms are omitted.

*In die struktuurformules van 'n organiese molekule moet alle waterstofatome getoon word. Punte sal afgetrek word vir die weglating van waterstofatome.*

- 3.7 When a structural formula is asked, marks must be deducted if the learner writes the condensed formula.

*Wanneer 'n struktuurformule gevra word, sal punte afgetrek word indien die leerder die gekondenseerde formule skryf.*

- 3.8 When an IUPAC name is asked and the candidate omits the hyphen (e.g. instead of pent-1-ene or 1-pentene the candidate writes pent 1 ene or 1 pentene), marks must be forfeited.

*Wanneer die IUPAC-naam gevra word en die koppelteken(s) in die naam word uitgelaat (bv. in plaas van pent-1-ene of 1-pentene skryf 'n kandidaat pent 1 een of 1 penteen), sal punte verbeur word.*

- 3.9 When a chemical reaction is asked, marks are awarded for correct reactants, correct products and correct balancing.

If only a reactant(s) followed by an arrow, or only a product(s) preceded by an arrow, is/are written, marks may be awarded for the reactant(s) or product(s). If only a reactant(s) or only a product(s) are written, without an arrow, no marks are awarded for the reactant(s) or product(s).

Examples:  $\text{N}_2 + 3\text{H}_2 \checkmark \rightarrow 2\text{NH}_3 \checkmark$  bal.  $\checkmark$

$\text{N}_2 + \text{H}_2 \rightarrow \checkmark$   $\frac{1}{3}$

$\rightarrow \text{NH}_3 \checkmark$   $\frac{1}{3}$

$\text{N}_2 + \text{H}_2$   $\frac{0}{3}$

$\text{NH}_3$   $\frac{0}{3}$

*Wanneer 'n chemiese reaksie gevra word, word punte toegeken vir korrekte reaktanse, korrekte produkte en korrekte balansering.*

Indien slegs 'n reaktans(e) gevolg deur 'n pyl, of slegs 'n produk(te) voorafgegaan deur 'n pyl, geskryf word, word punte vir die reaktans(e) of produkte gegee. Indien slegs reaktanse of slegs produk(te) geskryf word sonder 'n pyl, word geen punte gegee nie.

Voorbeelde:  $\text{N}_2 + 3\text{H}_2 \checkmark \rightarrow \text{NH}_3 \checkmark$  bal.  $\checkmark$

$\text{N}_2 + 3\text{H}_2 \rightarrow \checkmark$   $\frac{1}{3}$

$\rightarrow \text{NH}_3 \checkmark$   $\frac{1}{3}$

$\text{N}_2 + 3\text{H}_2$   $\frac{0}{3}$

$\text{NH}_3$   $\frac{0}{3}$

#### 4. POSITIVE MARKING/POSITIEWE NASIEN

Positive marking regarding calculations will be followed in the following cases: *Positiewe nasien met betrekking tot berekenings sal in die volgende gevalle geld:*

- 4.1 **Sub-question to sub-question:** When a certain variable is calculated in one sub-question (e.g. 3.1) and needs to be substituted in another (3.2 or 3.3), e.g. if the answer for 3.1 is incorrect and is substituted correctly in 3.2 or 3.3, **full marks** are to be awarded for the subsequent sub-questions.

**Subvraag na subvraag:** Wanneer 'n sekere veranderlike in een subvraag (bv. 3.1) bereken word en dan in 'n ander vervang moet word (3.2 of 3.3), bv. indien die antwoord vir 3.1 verkeerd is en korrek in 3.2 of 3.3 vervang word, word **volpunte** aan die daaropvolgende subvraag toegeken.

- 4.2 **A multi-step question in a sub-question:** If the candidate has to calculate, for example, current in the first step and gets it wrong due to a substitution error, the mark for the substitution and the final answer will be forfeited.

**'n Vraag met veelvuldige stappe in 'n subvraag:** Indien 'n kandidaat byvoorbeeld die stroom verkeerd bereken in 'n eerste stap as gevolg van 'n substitusiefout, verloor die kandidaat die punt vir sowel die substitusie as die finale antwoord.

#### 5. NEGATIVE MARKING/NEGATIEWE NASIEN

Normally an incorrect answer cannot be correctly motivated if based on a conceptual mistake. If the candidate is therefore required to motivate in question 3.2 the answer given to question 3.1, and 3.1 is incorrect, no marks can be awarded for question 3.2. However, if the answer for e.g. 3.1. is based on a calculation, the motivation for the incorrect answer in 3.2 could be considered.

*'n Verkeerde antwoord, indien dit op 'n konseptuele fout gebaseer is, kan normaalweg nie korrek gemotiveer word nie. Indien 'n kandidaat gevra word om in vraag 3.2 die antwoord op vraag 3.1 te motiveer en 3.1 is verkeerd, kan geen punte vir vraag 3.2 toegeken word nie. Indien die antwoord op bv. 3.1 egter op 'n berekening gebaseer is, kan die motivering vir die verkeerde antwoord in 3.2 oorweeg word.*

**SECTION A / AFDELING A****QUESTION 1 / VRAAG 1**

- 1.1 Haloalkane / Haloalkaan ✓
- |  |
|--|
| <b>Notes/Aantekeninge:</b><br><br><b>Accept:</b> halogenoalkane / alkyl halide<br><b>Aanvaar:</b> alkielhalied |
|--|
- (1)
- 1.2 Hydrocarbons / Koolwaterstowwe ✓ (1)
- 1.3 (Dynamic) equilibrium / (Chemical) equilibrium ✓  
(Dinamiese) ewewig / (Chemiese) ewewig ✓ (1)
- 1.4 Cryolite / sodiumhexafluoraluminate / Sodium aluminiumhexafluoride ✓  
Krioliet / natriumheksafluoraluminium / natriumaluminiumheksafluoried ✓
- |   |
|---|
| <b>Notes/Aantekeninge:</b><br><b>Accept / Aanvaar:</b><br><br>$\text{Na}_3\text{AlF}_6$ |
|---|
- (1)
- 1.5 (Cell) capacity / (Sel) kapasiteit ✓ (1)
- [5]**

**QUESTION 2 / VRAAG 2**

- 2.1 B ✓✓ (2)
- 2.2 B ✓✓ (2)
- 2.3 C ✓✓ (2)
- 2.4 D ✓✓ (2)
- 2.5 D ✓✓ (2)
- 2.6 C /  $E_a$  ✓✓ (2)
- 2.7 A ✓✓ (2)
- 2.8 A ✓✓ (2)
- 2.9 B ✓✓ (2)
- 2.10 C / + 2 ✓✓ (2)
- [20]**

**TOTAL SECTION A / TOTAAL AFDELING: 25**



## SECTION B / AFDELING B

## QUESTION 3 / VRAAG 3

3.1

3.1.1 D ✓

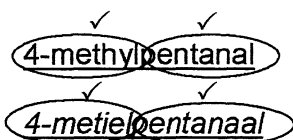
(1)

3.1.2 C ✓

(1)

3.2

3.2.1

**Notes / Aantekeninge****Accept:** 4-methyl-1-pentanal

4-methylpentan-1-al

**Aanvaar:** 4-metiel -1-pentanaal

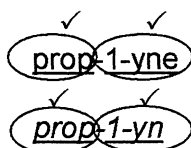
4-metielpentan-1-aal

- If hyphen omitted: Max.  $\frac{1}{2}$

Indien koppelteken uitgelaat: Maks.  $\frac{1}{2}$ 

(2)

3.2.2

**Notes / Aantekeninge****Accept / Aanvaar:**prop $\checkmark$ yne $\checkmark$  / prop $\checkmark$ yn $\checkmark$ 1-prop $\checkmark$ yne $\checkmark$  / 1-prop $\checkmark$ yn $\checkmark$ 

- If hyphens omitted: Max.  $\frac{1}{2}$

Indien koppelteken uitgelaat: Maks.  $\frac{1}{2}$ 

(2)

3.3

H<sub>2</sub>O / water ✓CO<sub>2</sub> / carbon dioxide ✓CO<sub>2</sub> / koolstofdioksied / koolsuurgas ✓**Notes / Aantekeninge****Accept:**

carbon(IV) oxide

**Aanvaar:**

koolstof(IV) oksied

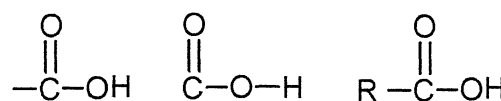
(2)

3.4

3.4.1 Esters ✓

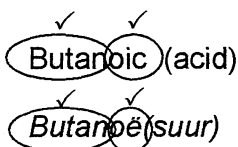
(1)

3.4.2

**Notes / Aantekeninge****Accept / Aanvaar:**

(1)

3.4.3

**Notes / Aantekeninge****Accept:**

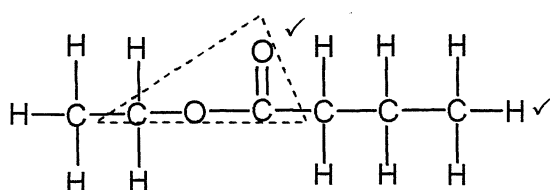
1-butanoic acid / butan-1-oic acid

**Aanvaar:**

1-butanoësuur / butan-1-oësuur

(2)

3.4.4 **NO positive marking from QUESTION 3.4.3.**  
**GEEN positiewe nasien van VRAAG 3.4.3 nie.**



Functional group encircled: ✓  
Whole structure correct ✓

Funksionele groep omkring ✓  
Hele struktuur korrek ✓

**Notes/Aantekeninge:**

Condensed or semi-structural formula / Gekondenseerde of semistruktuurformule:  $\frac{1}{2}$

Molecular formula / Molekulêre formule:  $\frac{0}{2}$

(2)  
[14]

**QUESTION 4 / VRAAG 4**

- 4.1 (Structural) isomers ✓  
(Struktuur)isomere ✓

**Notes/Aantekeninge:**

**Accept:** Isomerism / isometry

**Aanvaar:** isomerie / isometrie

(1)

4.2

- 4.2.1 Boiling point / Kookpunt ✓

(1)

- 4.2.2 Branching / Vertakking ✓

**Notes / Aantekeninge:**

**Accept:** structure / structural formula / isomers /  
surface area / main chain length / number of side  
chains / / hydrocarbons

**Aanvaar:** struktuur / struktuurformule / isomere /  
reaksieoppervlakte / hoofkettinglengte / aantal  
sykettings / koolwaterstowwe

(1)

- 4.2.3 Number of C atoms / Aantal C-atome ✓

**OR / OF**

Molecular or molar mass or molecular formula /  $C_5H_{12}$  ✓

Molekulêre of molêre massa of molekulêre formule /  $C_5H_{12}$  ✓

(1)

- 4.3 Saturated / Versadig ✓  
 No double (or triple) bonds. ✓✓  
Geen dubbelbindings (of trippelbindings). ✓✓

**OR / OF**

- Saturated / Versadig ✓  
 They contain the maximum number of H atoms  
bonded to C atoms. ✓✓  
Bevat die maksimum getal H-atome gebind aan C-  
atome. ✓✓

**OR / OF**

- Saturated / Versadig ✓  
 Only single bonds. / Slegs enkelbindings. ✓✓

**OR / OF**

- Saturated / Versadig ✓  
 No multiple bonds. / Geen meervoudige bindings. ✓✓

**Notes / Aantekeninge:**

**IF:**

Saturated.

They are alkanes. /

$C_nH_{2n+2}$  Max.  $\frac{2}{3}$

**INDIEN:**

Versadig.

Hulle is alkane. /

$C_nH_{2n+2}$  Maks.  $\frac{2}{3}$

(3)

4.4

4.4.1 A ✓

(1)

4.4.2



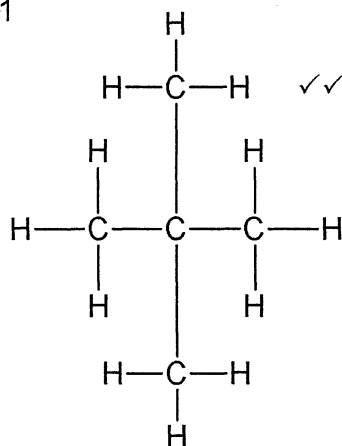
### Notes / Aantekeninge

Mark for '–ane' only awarded if prefix refers to number of C atoms in an organic compound.

Punt vir '–ane' slegs toegeken indien voorvoegsel na die aantal C-atome in 'n organiese verbinding verwys.

(2)

4.5.1



### Notes/Aantekeninge:

- Condensed or semi-structural formula / Gekondenseerde of semistruktuurformule: Max. / Maks.  $\frac{1}{2}$
- Molecular formula / Molekulêre formule:  $\frac{0}{2}$
- All bonds shown, one or more H-atoms omitted  
Alle bindings getoon, een of meer H-atome uitgelaat:  
Max. / Maks.  $\frac{1}{2}$
- Wrong number of bonds e.g. C not having 4 bonds. /  
Aantal bindings verkeerd bv. C vorm nie 4 bindings nie:  $\frac{0}{2}$

(2)

4.5.2

- Structure:**  
Most branching / Molecules most compact or spherical / Smallest surface area (over which intermolecular forces act.) / Shortest chain length. ✓
- Intermolecular forces:**  
Least / Weakest intermolecular forces / Van der Waals forces / London forces / dispersion forces. ✓
- Energy:**  
Least energy needed to overcome intermolecular forces. ✓
- Struktuur:**  
Die meeste vertak. / Molekule mees kompak of sferies / Kleinste oppervlakte (waaroor intermolekulêre kragte werk.) / Kortste kettinglengte. ✓
- Intermolekulêre kragte:**  
Minste / Swakste intermolekulêre kragte / Van der Waalskragte / Londonkragte / dispersiekragte. ✓
- Energie:**  
Die minste energie benodig om intermolekulêre kragte te oorkom. ✓

**OR / OF**

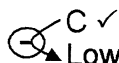
- **Structure:**  
A and B are less branched/have less compact or spherical molecules./ have larger surface areas (over which intermolecular forces act.) / longer chain lengths. ✓
- **Intermolecular forces:**  
More / Stronger intermolecular forces / Van der Waals forces / London forces / **dispersion forces.** ✓
- **Energy:**  
More energy needed to overcome intermolecular forces. ✓
- **Struktuur:**  
A en B is minder vertak./ minder kompak of sferies./ het groter oppervlakte (waaroor intermolekulêre kragte werk.) / het langer kettinglengtes. ✓
- **Intermolekulêre kragte:**  
Meer / Sterker intermolekulêre kragte / Van der Waalskragte / Londonkragte / dispersiekragte. ✓
- **Energie:**  
Meer energie benodig om intermolekulêre kragte te oorkom. ✓

**Notes / Aantekeninge**

Mark each statement independently. / Sien elke stelling onafhanklik na.

(3)

4.6



Lowest boiling point / Laagste kookpunt ✓

(2)

**[17]****QUESTION 5/VRAAG 5**

5.1

5.1.1

Addition / hydration ✓  
Addisie / hidratering / hidrasie ✓

(1)

5.1.2

Substitution / Hydrolysis ✓  
Substitusie / Hidrolise ✓

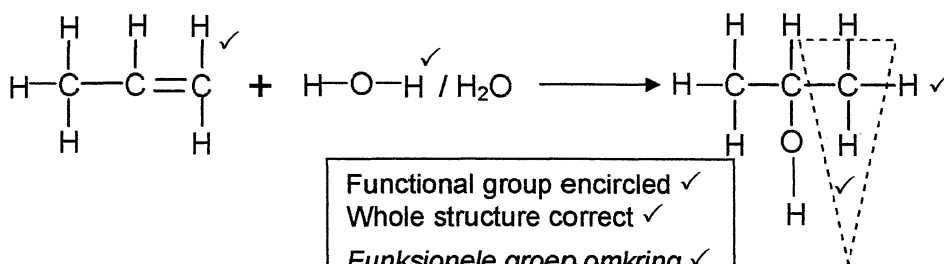
(1)

5.1.3

Elimination / Dehydrohalogenation / Dehydrobromination ✓  
Eliminasie / Dehidrohalogenering / Dehidrobrominering ✓

(1)

5.2



Functional group encircled ✓  
Whole structure correct ✓  
Funksionele groep omkring ✓  
Hele struktuur korrek ✓

**Notes / Aantekeninge:**

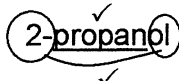
- IF arrow omitted: Maks.  $\frac{3}{4}$  / INDIEN pyltjies weggelaat is: Maks.  $\frac{3}{4}$
- IF: Structures of only both reactants OR only product correctly given without an arrow. Max.  $\frac{1}{4}$   
*INDIEN: Strukture van slegs beide reaktante OF slegs produk korrek gegee sonder 'n pyltjie. Maks.  $\frac{1}{4}$*
- Accept -OH in structural formula / Aanvaar -OH in struktuurformule
- Condensed/semi-structural formulae or mixture of both: Max.  $\frac{3}{4}$   
*Gekondenseerde/semistruktuur formules of mengsel van beide: Maks.  $\frac{3}{4}$*
- Molecular formula for all structures (accept  $\text{H}_2\text{O}$ ), e.g.  $\text{C}_3\text{H}_6$  Max.  $\frac{1}{4}$   
*Molekulêre formules vir alle strukture (Aanvaar  $\text{H}_2\text{O}$ ), bv. Maks.  $\frac{1}{4}$*
- Any additional reactant or products: Max.  $\frac{3}{4}$   
*Enige addisionele reaktante of produkte: Maks.  $\frac{3}{4}$*
- Everything correct, wrong balancing: Max.  $\frac{3}{4}$   
*Alles korrek, verkeerde balansering: Maks.  $\frac{3}{4}$*

(4)

5.3



Accept / Aanvaar:

**Notes/Aantekeninge**

- IF/INDIEN:  
Propanol Max. / Maks.  $\frac{1}{2}$
- If hyphens omitted: Max  $\frac{1}{2}$   
*Indien koppeltekens uitgelaat: Maks.  $\frac{1}{2}$*
- Any additional substituents: minus 1 mark  
*Enige addisionele substituenten: minus 1 punt*

(2)

5.4

**ANY TWO / ENIGE TWEE**

- Dilute / Aqueous base / KOH / NaOH OR Excess water ✓  
*Verdunde / Waterige basis / KOH / NaOH OF Oormaat water ✓*
- Mild heat / low heat / warming / heat ✓  
*Matige hitte / lae hitte / verhit / verwarming ✓*
- Haloalkane dissolved in ethanol. ✓  
*Haloalkaan opgelos in etanol. ✓*

(2)

[11]



**QUESTION 6/VRAAG 6**

- 6.1 (Gas) syringe / burette / measuring cylinder ✓  
(Gas)spruit / buret / maatsilinder ✓

**Accept:** Any graduated cylinder or flask

**Aanvaar:** Enige gegradieerde silinder of fles

(1)

- 6.2  $24 \text{ cm}^3$  ✓✓

**Accept / Aanvaar:**  $0,024 \text{ dm}^3$  ✓✓ /  $2,4 \times 10^{-5} \text{ m}^3$  ✓✓ /  $24 \text{ ml}$  ✓✓ /  $0,024 \text{ l}$  ✓✓

**Notes / Aantekeninge**

- If wrong unit/no unit after 24: Max.  $\frac{1}{2}$

Indien verkeerde/geen eenheid na 24: Maks.  $\frac{1}{2}$

- The numerical value of the CONVERSION must be correct first before mark for unit can be awarded.

*Die numeriese waarde van die OMSKAKELING moet eers korrek wees voordat punt aan eenheid toegeken kan word.*

(2)

- 6.3 Decreases ✓

⊖ The gradient / m / slope of the graph decreases. / Curve is less steep. / The longer the time the smaller the increase in volume. ✓

⊖ Verminder ✓

⊖ Die gradiënt / m / helling van die grafiek neem af. / Kurwe is minder steil. / Hoe langer die tyd hoe kleiner die toename in volume. ✓

(2)

- 6.4 Catalyst / Katalisator ✓

Increases the reaction rate. / Speeds up the reaction. / Decreases the activation energy. / Provides an alternate pathway or route.

*Verhoog die reaksietempo. / Versnel die reaksietempo. / Verlaag die aktiveringsenergie. / Verskaf 'n alternatiewe roete.*

(1)

- 6.5  $\text{H}_2\text{O}$  / water ✓

$\text{CuO}$  / copper(II) oxide / copper oxide / cupric oxide ✓

*CuO / koper(II)oksied / koperoksied* ✓

(2)

- 6.6 **In terms of lump: / In terme van soliede stuk:**

Smaller (exposed) surface area / contact area ✓

Less hydrogen peroxide molecules per unit time comes in contact with the catalyst. / Less effective collisions per unit time. / Frequency of effective collisions decreases. ✓

*Kleiner (blootgestelde) reaksieoppervlakte / kontakarea.* ✓

*Minder waterstofperoksied per eenheidstyd kom in kontak met katalisator. / Minder effektiewe botsings per eenheid tyd. / Frekwensie van effektiewe botsings neem af.* ✓

(2)

**OR/OF**

**In terms of powder: / In terme van poeier:**

Larger (exposed) surface area / contact area ✓

More hydrogen peroxide molecules per unit time comes in contact with the catalyst. / More effective collisions per unit time. / Frequency of effective collisions increases. ✓

Groter (blootgestelde) reaksieoppervlakte / kontakarea. ✓

Meer waterstofperoksied per eenheidstyd kom in kontak met katalisator. / Meer effektiewe botsing per eenheid tyd. / Frekwensie van effektiewe botsings neem toe. ✓

- 6.7 Decomposition of hydrogen peroxide releases oxygen that ✓  
counters / resists the functioning of the bacteria. / decreases bacterial activity.  
/ kills / destroys / oxidises the bacteria. ✓

Ontbinding van waterstofperoksied stel suurstof vry wat ✓

die werking van bakterieë teenwerk. / bakteriese aktiwiteit verminder. / bakterieë doodmaak / vernietig / oksideer. ✓

(2)

[12]

## QUESTION 7/VRAAG 7

7.1

- 7.1.1 When the equilibrium in a closed system is disturbed ✓  
the system will shift the equilibrium position **OR** re-instate a new equilibrium  
as to **OR** favour the reaction that will ✓  
oppose **OR** cancel **OR** counteract the change **OR** disturbance. ✓

*Wanneer die ewewig in 'n geslote sisteem versteur word, ✓  
skuif die sisteem die ewewigsposisie sodanig deur **OF** word 'n nuwe ewewig  
ingestel deur **OF** die reaksie bevoordeel wat ✓  
die effek van die versteuring **OF** verandering teen te werk **OF** te kanselleer. ✓*

**OR / OF**

When a stress / change is placed on a system in equilibrium ✓  
The system shifts the equilibrium (position) **OR** re-instate a new equilibrium ✓  
so as to remove **OR** cancel **OR** oppose the stress / change. ✓

*Wanneer 'n sisteem in ewewig onderhewig is aan 'n spanning **OF**  
verandering, ✓  
skuif die sisteem die ewewig (posisie) sodanig **OF** word 'n nuwe ewewig  
ingestel ✓ deur  
die spanning / verandering te verwyder **OF** teen te werk **OF** te kanselleer. ✓*

**OR / OF**

When the conditions affecting an equilibrium are changed, ✓  
the equilibrium (position) shifts in such a way ✓  
as to oppose the change **OR** cancel the change. ✓  
*Wanneer die toestande wat 'n ewewig beïnvloed, verander word, ✓  
sal die ewewig (posisie) sodanig verskuif ✓  
dat die verandering teengewerk word **OF** gekanselleer word. ✓*

(3)

7.1.2 Decreases ✓

- When the pressure is increased, the reaction that produced the smaller volume or amount of gas is favoured. / 4 mol or volumes of gas produces 2 mol or volumes of gas. ✓  
Thus the reverse reaction is favoured. ✓

➤ Verminder ✓

- Wanneer die druk verhoog word, word die reaksie wat 'n kleiner volume of aantal mol vorm, bevoordeel. / 4 mol of volumes gas reageer om 2 mol of volumes gas te vorm. ✓  
Dus word die terugwaartse reaksie bevoordeel. ✓

(3)

7.1.3 Products form at faster rate. / Increase in rate. / More effective collisions per unit time ✓  
Higher yield of products / Forward reaction is favoured. ✓

*Produkke vorm teen 'n vinniger tempo. / Toename in tempo. / Meer effektiewe botsings per eenheid tyd. ✓  
Groter opbrengs van produkte / Voorwaartse reaksie bevoordeel. ✓*

(2)

7.2

7.2.1

**CALCULATIONS USING NUMBER OF MOLES****BEREKENINGE WAT AANTAL MOL GEBRUIK****Mark allocation / Puntetoekenning**

- Using ratio / Gebruik verhouding  $n(\text{H}_2) = n(\text{H}_2\text{O}) = n(\text{CO}) = n(\text{CO}_2)$  ✓
- Equilibrium / Ewig:  $n(\text{H}_2) = x - 0,2$  (mol) ;  $n(\text{CO}_2) = 0,1$  mol  
[Initial amount – change / Aanvangshoeveelheid - verandering] ✓
- Equilibrium / Ewig:  $n(\text{CO}) = 0,2$  (mol)  
[Initial amount + change / Aanvangshoeveelheid + verandering] ✓
- Divide by volume / Gedeel deur volume ( $10 \text{ dm}^3$ ) ✓
- Correct  $K_c$  expression (formulae in square brackets) / Korrekte  $K_c$  - uitdrukking (formules in vierkanthakies) ✓
- Substitution of  $K_c$  value / Vervanging van  $K_c$ -waarde ✓
- Substitution of concentrations / Vervanging van konsentrasies ✓
- Final answer / Finale antwoord:  $0,3 \text{ mol}$  ✓

**Option 1 / Opsie 1:** $n(\text{H}_2\text{O})$  at equilibrium / by ewewig =  $0,2 \text{ mol}$  (given)

$n(\text{H}_2\text{O})$  formed / gevorm =  $n(\text{CO})$  formed/gevorm =  $0,2 \text{ (mol)}$   
 $n(\text{H}_2)$  reacted =  $(0,2 \text{ mol})$ ;  $n(\text{CO}_2)$  reacted =  $(0,2 \text{ mol})$

} Ratio/verhouding ✓

At equilibrium / By ewewig:

$n(\text{H}_2) = (x - 0,2)/(x - \text{change / verandering})$   
 $n(\text{CO}_2) = 0,1 \text{ (mol)}/(0,3 - \text{change / verandering})$

} ✓

$n(\text{H}_2\text{O}) = n(\text{CO}) = 0,2 \text{ (mol)}$  ✓

Equilibrium concentration / Ewewigskonsentrasies:

$$\begin{aligned}
 c(\text{H}_2) &= \frac{n}{V} = \frac{x - 0,2}{10} \\
 c(\text{CO}_2) &= \frac{n}{V} = \frac{0,1}{10} \\
 c(\text{H}_2\text{O}) &= \frac{n}{V} = \frac{0,2}{10} \\
 c(\text{CO}) &= \frac{n}{V} = \frac{0,2}{10}
 \end{aligned}$$

} Divide by 10 / Gedeel deur 10 ✓

$$K_c = \frac{[\text{CO}][\text{H}_2\text{O}]}{[\text{H}_2][\text{CO}_2]} \checkmark \therefore \frac{(0,02)(0,02)}{\left(\frac{x - 0,2}{10}\right)(0,01)} \checkmark = 4 \checkmark$$

 $\therefore x = 0,3 \therefore n(\text{H}_2) = 0,3 \text{ mol}$  ✓No  $K_c$  expression, correct substitutionGeen  $K_c$  -uitdrukking, korrekte substitusie: Max. / Maks.  $\frac{7}{8}$ Wrong  $K_c$  expressionVerkeerde  $K_c$ -uitdrukking: Max. / Maks.  $\frac{5}{8}$

**Option 2/Opsie 2**

	H <sub>2</sub>	CO <sub>2</sub>	H <sub>2</sub> O	CO	
Initial quantity (mol) <i>Aanvangshoeveelheid (mol)</i>	x	0,3	0	0	
Change (mol) <i>Verandering (mol)</i>	- 0,2	-0,2	+ 0,2	+ 0,2	ratio ✓ <i>verhouding</i>
Quantity at equilibrium (mol)/ <i>Hoeveelheid by ewewig (mol)</i>	x - 0,2	0,1 ✓	0,2	0,2 ✓	
Equilibrium concentration (mol·dm <sup>-3</sup> ) <i>Ewewigskonsentrasie (mol·dm<sup>-3</sup>)</i>	$\frac{x - 0,2}{10}$	0,01	0,02	0,02	Divide by 10 ✓ <i>Deel deur 10</i>

$$K_c = \frac{[\text{CO}][\text{H}_2\text{O}]}{[\text{H}_2][\text{CO}_2]} \checkmark \therefore \frac{(0,02)(0,02)}{\left(\frac{x - 0,2}{10}\right)(0,01)} \checkmark = 4 \checkmark$$

$$\therefore x = 0,3 \therefore n(\text{H}_2) = 0,3 \text{ mol } \checkmark$$

No K<sub>c</sub> expression, correct substitutionGeen K<sub>c</sub>-uitdrukking, korrekte substitusie: Max. / Maks.  $\frac{7}{8}$ Wrong K<sub>c</sub> expressionVerkeerde K<sub>c</sub>-uitdrukking: Max. / Maks.  $\frac{5}{8}$ **CALCULATIONS USING CONCENTRATION****BEREKENINGE WAT KONSENTRASIE GEBRUIK****Mark allocation / Puntetoekenning**

- Divide by volume / Gedeel deur volume (10 dm<sup>3</sup>) ✓  
[Initial / Aanvangs c(H<sub>2</sub>)  $\frac{x}{10}$ ; c(CO<sub>2</sub>) = 0,03; c(H<sub>2</sub>O) = 0,02]
- Using ratio / Gebruik verhouding c(H<sub>2</sub>) = c(H<sub>2</sub>O) = c(CO) = c(CO<sub>2</sub>) ✓
- Equilibrium / Ewewig: c(H<sub>2</sub>) =  $\frac{x}{10} - 0,02$ ; c(CO<sub>2</sub>) = 0,01 (mol·dm<sup>-3</sup>)  
[Initial conc. – change in conc. / Aanvangskons. – verandering in kons.] ✓
- Equilibrium / Ewewig: c(CO) = 0,02 (mol·dm<sup>-3</sup>)  
[Initial conc. + change in conc. / Aanvangskons. + verandering in kons.] ✓
- Correct K<sub>c</sub> expression (formulae in square brackets) / Korrekte K<sub>c</sub>-uitdrukking (formules in vierkanthakies) ✓
- Substitution of K<sub>c</sub> value / Vervanging van K<sub>c</sub>-waarde ✓
- Substitution of concentrations / Vervanging van konsentrasies ✓
- Final answer / Finale antwoord: 0,3 mol ✓



## Option 3 / Opsie 3

	H <sub>2</sub>	CO <sub>2</sub>	H <sub>2</sub> O	CO	
Initial concentration (mol·dm <sup>-3</sup> ) <i>Aanvangskonsentrasie (mol·dm<sup>-3</sup>)</i>	$\frac{x}{10}$	0,03	0	0	Divide by 10 ✓
Change in concentration (mol·dm <sup>-3</sup> ) <i>Verandering in konsentrasie (mol·dm<sup>-3</sup>)</i>	0,02	0,02	0,02	0,02	ratio ✓
Equilibrium concentration (mol·dm <sup>-3</sup> ) <i>Ewewigskonsentrasie (mol·dm<sup>-3</sup>)</i>	$\frac{x}{10} - 0,02$	0,01 ✓	0,02	0,02 ✓	

$$K_c = \frac{[\text{CO}][\text{H}_2\text{O}]}{[\text{H}_2][\text{CO}_2]} \checkmark \therefore \frac{(0,02)(0,02)}{(0, x - 0,02)(0,01)} \checkmark = 4 \checkmark$$

$$\therefore x = 0,3 \therefore n(\text{H}_2) = 0,3 \text{ mol } \checkmark$$

No K<sub>c</sub> expression, correct substitution

Geen K<sub>c</sub>-uitdrukking, korrekte substitusie: Max. / Maks.  $\frac{7}{8}$

Wrong K<sub>c</sub> expression

Verkeerde K<sub>c</sub>-uitdrukking: Max. / Maks.  $\frac{5}{8}$

## EXAMPLE 1 / VOORBEELD 1

	H <sub>2</sub>	CO <sub>2</sub>	H <sub>2</sub> O	CO	
Initial quantity (mol) <i>Aanvangshoeveelheid (mol)</i>	x	0,3	0	0	
Change (mol) <i>Verandering (mol)</i>	0,2	0,2	0,2	0,2	✓
Quantity at equilibrium (mol)/ <i>Hoeveelheid by ewewig (mol)</i>	x - 0,2	0,1 ✓	0,2	0,2 ✓	
Equilibrium concentration (mol·dm <sup>-3</sup> ) <i>Ewewigskonsentrasie (mol·dm<sup>-3</sup>)</i>	$\frac{x - 0,2}{10}$	0,01	0,02	0,02	✓

At equilibrium: n(H<sub>2</sub>) = n(CO<sub>2</sub>) = 0,1 (wrong assumption/verkeerde aanname)

$$\frac{x - 0,2}{10} = 0,01$$

$$\therefore n(\text{H}_2) = 0,3 \text{ mol}$$

Max./Maks.  $\frac{4}{8}$

## EXAMPLE 2 / VOORBEELD 2

$$\text{Assume } [\text{H}_2] = [\text{CO}_2] = 0,01 \therefore \frac{x - 0,2}{10} = 0,01$$

$$\therefore n(\text{H}_2) = 0,3 \text{ mol}$$

$\frac{0}{8}$

**EXAMPLE 3 / VOORBEELD 3**

	H <sub>2</sub>	CO <sub>2</sub>	H <sub>2</sub> O	CO	
Initial quantity (mol) <i>Aanvangshoeveelheid (mol)</i>		0,3	0	0	
Change (mol) <i>Verandering (mol)</i>	- 0,2	-0,2	+ 0,2	+ 0,2	✓
Quantity at equilibrium (mol)/ <i>Hoeveelheid by ewewig (mol)</i>	x	0,1	0,2	0,2	✓
Equilibrium concentration (mol·dm <sup>-3</sup> ) <i>Ewewigskonsentrasie (mol·dm<sup>-3</sup>)</i>	$\frac{x - 0,2}{10}$	0,01	0,02	0,02	✓

$$K_c = \frac{[\text{CO}][\text{H}_2\text{O}]}{[\text{H}_2][\text{CO}_2]} \quad \therefore \quad \frac{(0,02)(0,02)}{(0,1x)(0,01)} = 4 \quad \checkmark$$

$$\therefore x = 0,1$$

$$\text{Initial } n(\text{H}_2) = x + 0,2 = 0,3 \text{ mol} \quad \checkmark$$

$$\left( \frac{8}{8} \right)$$

(8)

## 7.2.2 Exothermic ✓

⊖ A decrease in  $K_c$  implies:

Lower product concentration / less products **OR** higher reactant concentration / more reactants. ✓

Reverse reaction favoured. ✓

This means the forward reaction is exothermic.

⊖ Eksotermies ✓

⊖ 'n Afname in  $K_c$  beteken:

'n laer produkkonsentrasie / minder produkte **OF** hoër reaktanskonsentrasie / meer reaktanse. ✓

Terugwaartse reaksie bevoordeel. ✓

Dus is die voorwaartse reaksie eksotermies.

**OR / OF**

⊖ Exothermic

⊖ Decrease in  $K_c$  – reverse reaction is favoured ✓

Increase in temperature favours the endothermic reaction ✓

∴ Forward reaction is exothermic.

⊖ Eksotermies

⊖ Afname in  $K_c$  – terugwaartse reaksie word bevoordeel ✓

Toename in temperatuur bevoordeel die endotermiese reaksie ✓

∴ Voorwaartse reaksie is eksotermies.

(3)

[19]

## QUESTION 8/VRAAG 8

8.1 Chemical (energy) to electrical (energy) ✓  
*Chemiese (energie) na elektriese (energie) ✓* (1)

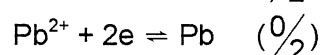
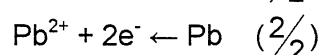
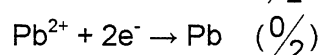
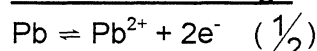
8.2 Completes the circuit. / Voltooi die stroombaan. ✓

### OR / OF

Maintains electrical neutrality. / Transports ions. ✓  
*Handhaaf elektriese neutraliteit. / Vervoer ione. ✓* (1)

8.3  $\text{Pb} \rightarrow \text{Pb}^{2+} + 2\text{e}^-$  ✓✓

#### Notes/Aantekeninge



(2)

8.4 Pb to/na Cu ✓

#### Notes/Aantekeninge:

IF:  $\text{Pb}^{2+}$  to  $\text{Cu}^{2+}$  - No mark

INDIEN:  $\text{Pb}^{2+}$  to  $\text{Cu}^{2+}$  - geen punt

(1)

8.5  $\text{Pb} + \text{Cu}^{2+} \rightarrow \text{Pb}^{2+} + \text{Cu}$  ✓ Bal. ✓

#### Notes / Aantekeninge

- Reactants ✓; Products ✓; Balancing ✓  
*Reaktanse ✓; Produkte ✓; Balansering ✓*
- Ignore / Ignoreer =
- Marking rule 3.9 / Nasienreël 3.9

(3)

8.6 Exothermic / eksotermies ✓

(1)

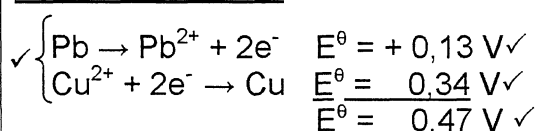
#### Option 1 / Opsie 1

$$E^\theta_{\text{cell}} = E^\theta_{\text{cathode}} - E^\theta_{\text{anode}} \quad \checkmark$$

$$= 0,34 \checkmark - (-0,13) \checkmark$$

$$E^\theta_{\text{cell}} = 0,47 \text{ V} \quad \checkmark$$

#### Option 2 / Opsie 2



#### 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.  $E^\theta_{\text{cell}} = E^\theta_{\text{OA}} - E^\theta_{\text{RA}}$  followed by correct substitutions:  $\frac{3}{4}$   
*Enige ander formule wat onkonvensionele afkortings gebruik bv.  $E^\theta_{\text{sel}} = E^\theta_{\text{OM}} - E^\theta_{\text{RM}}$  gevolg deur korrekte vervangings:  $\frac{3}{4}$*
- Accept emf for  $E^\theta_{\text{cell}}$   
*Aanvaar emk vir  $E^\theta_{\text{cell}}$*

(4)

- 8.8 Measurements not done at:  
 Temperature of  $25\text{ }^{\circ}\text{C}$  /  $298\text{ K}$  ✓✓  
 Concentration of  $1\text{ mol}\cdot\text{dm}^{-3}$  ✓✓

*Metings nie gedoen by:*  
*Temperatuur van  $25\text{ }^{\circ}\text{C}$  /  $298\text{ K}$  ✓✓*  
*Konsentrasie van  $1\text{ mol}\cdot\text{dm}^{-3}$  ✓✓*

**OR / OF**

Concentration  $>$  or  $<$   $1\text{ mol}\cdot\text{dm}^{-3}$  ✓✓  
 Temperature  $>$  or  $<$   $25\text{ }^{\circ}\text{C}$  /  $298\text{ K}$  ✓✓

*Konsentrasie  $>$  or  $<$   $1\text{ mol}\cdot\text{dm}^{-3}$  ✓✓*  
*Temperatuur  $>$  or  $<$   $25\text{ }^{\circ}\text{C}$  /  $298\text{ K}$  ✓✓*

**OR / OF**

Not at  $25\text{ }^{\circ}\text{C}$  /  $298\text{ K}$  ✓✓  $1\text{ mol}\cdot\text{dm}^{-3}$  ✓✓  
*Nie by  $25\text{ }^{\circ}\text{C}$  /  $298\text{ K}$  ✓✓ en  $1\text{ mol}\cdot\text{dm}^{-3}$  nie. ✓✓*

**Notes/Aantekeninge:**

- Not at standard temperature ✓ and standard concentration ✓  
*Nie by standaardtemperatuur ✓ en standaardkonsentrasie ✓ nie.*
- Not done at standard conditions ✓  
*Nie by standaardtoestande nie. ✓*

(4)  
[17]**QUESTION 9/VRAAG 9**

- 9.1 A substance that forms free (positive and negative) ions when melted or dissolved. ✓✓

*'n Stof wat vrye (positiewe en negatiewe) ione vorm wanneer gesmelt of opgelos word.*

**OR / OF**

A solution that conducts electricity. / *'n Oplossing wat elektrisiteit gelei.* ✓✓

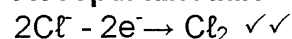
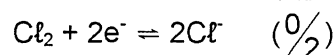
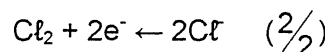
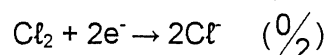
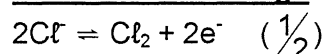
**OR / OF**

A liquid / solution / melted substance that conducts electricity through the movement of free ions. ✓✓

*A vloeistof / oplossing / gesmelte stof wat elektrisiteit gelei deur die beweging van vry ione.* ✓✓

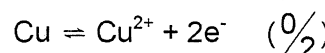
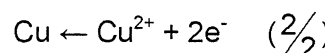
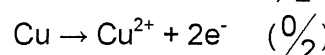
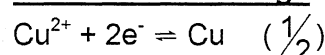
(2)

- 9.2  
 9.2.1  $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$  ✓✓

**Accept/Aanvaar:****Notes / Aantekeninge**

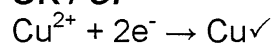
(2)

- 9.2.2  $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$  ✓✓

**Notes / Aantekeninge**

(2)

9.3

Q ✓  
⊖Reduction takes place. / It gains electrons.*Reduksie vind plaas. / Wins aan / Opname van elektrone. ✓***OR / OF****Notes / Aantekeninge****IF:** It is the negative electrode. / Copper is formed. Max.  $\frac{1}{2}$  (No mark for reason.)**INDIEN:** Dit is die negatiewe elektrode. / Koper word gevorm. Maks.  $\frac{1}{2}$ *(Geen punt vir rede.)*

(2)

9.4

9.4.1

Cu / (Electrode) P is a stronger reducing agent ✓ than the  $\text{Cl}^-$  ions. ✓Cu / (Electrode) P will be oxidised / loses electrons, ✓

resulting in the plate becoming eroded.

Cu / (Elektrode) P is 'n sterker reduseermiddel ✓ as die  $\text{Cl}^-$ -ione. ✓Cu / (Elektrode) P sal geöksideer word / elektrone verloor, ✓

wat tot gevolg het dat die plaat verweer.

**OR / OF**The  $\text{Cl}^-$  ion is a weaker reducing agent ✓ than Cu ✓and will therefore not be oxidised. ✓Die  $\text{Cl}^-$ -ioon is 'n swakker reduseermiddel ✓ as Cu ✓en sal dus nie geöksideer word nie.

(3)

9.4.2

P ✓

(1)

**[12]**



**QUESTION 10/VRAAG 10**

- 10.1 Allows only positive ions (cations/ $\text{Na}^+$  ions) to migrate to cathode half-cell. /  
To prevent the  $\text{Cl}^-$  ions from mixing with NaOH. ✓  
*Laat slegs positiewe ione (katione/  $\text{Na}^+$ -ione) toe om na die katode-halfsel te migreer.* / *Om te verhoed dat  $\text{Cl}^-$  ione met NaOH meng.* ✓

**OR / OF**Prevents chloride ions/ $\text{Cl}^-$  ions from migrating to the cathode half-cell.Verhoed dat chloried-ione/ $\text{Cl}^-$ -ione na die katodehalfsel migreer.

(1)

- 10.2 Y ✓

⊖ Chloride ions are oxidised at Y. / Brine enters the cell at the anode chamber. /  
 Oxidation takes place at Y.  
*Chloriedione word by Y geoksideer.* / *Soutwater kom die sel aan die anodekant binne.* ✓

**OR/ OF**Chloride ions are negative and must be attracted to Y. ✓Chloriedione is negatief en word deur Y aangetrek. ✓

(2)

- 10.3

10.3.1 Hydrogen /  $\text{H}_2$  ✓

*Waterstof /  $\text{H}_2$*  ✓

(1)

10.3.2 Chlorine /  $\text{Cl}_2$  ✓

*Chloor /  $\text{Cl}_2$*  ✓

(1)

10.3.3 Sodium hydroxide / NaOH / Caustic soda ✓

*Natriumhidroksied / NaOH / Bytsoda* ✓

(1)

10.4  $2\text{H}_2\text{O} + 2\text{Cl}^- \rightarrow \text{H}_2 + 2\text{OH}^- + \text{Cl}_2$  ✓ Bal. ✓

**OR / OF** $2\text{H}_2\text{O} + 2\text{NaCl} \rightarrow \text{H}_2 + 2\text{NaOH} + \text{Cl}_2$  ✓ Bal. ✓**Notes/Aantekeninge**

- Reactants ✓; Products ✓; Balancing ✓  
*Reaktanse ✓; Produkte ✓; Balansering ✓*
- Ignore/Ignoreer =
- Marking rule 3.9 / Nasienreël 3.9
- Marking rule 3.4: One mark is forfeited when the charge of an ion is omitted per equation (not for the charge on an electron).  
*Nasienreël 3.4: Een punt word verbeur per vergelyking indien die lading op 'n ioon uitgelaat word (nie vir die lading op 'n elektron nie.)*

(3)

- 10.5 Uses huge amounts of electricity / energy. ✓

Combustion of coal during generation of electricity releases huge amounts of carbon dioxide into atmosphere. ✓Gebruik groot hoeveelhede elektrisiteit. ✓Verbranding van steenkool tydens opwekking van elektrisiteit stel groot hoeveelhede koolstofdioksied in die atmosfeer vry. ✓

(2)

**[11]**

**QUESTION 11 / VRAAG 11**

11.1

11.1.1 Ostwald (process) / Ostwald (proses) ✓ (1)

11.1.2  $2\text{NO} + \text{O}_2 \checkmark \rightarrow 2\text{NO}_2 \checkmark$  Bal. ✓**Notes/Aantekeninge:**

- Reactants ✓; Products ✓; Balancing ✓
- Ignore =
- Marking rule 3.9
- Accept multiples of balancing coefficients

(3)

11.2  $\text{H}_2\text{O}$  / water ✓**Notes / Aantekeninge:**

If answer is part of equation:

*Indien antwoord deel is van vergelyking:* $\text{NH}_3 + \text{O}_2 \rightarrow \text{water} \checkmark + \text{NO}$ 

(1)

11.3  $4\text{NO}_2 + \underline{\text{O}_2} \checkmark + 2\text{H}_2\text{O} \rightarrow 4\text{HNO}_3$  Bal. ✓**Notes / Aantekeninge:**Only  $\text{O}_2$  / Slegs  $\text{O}_2$  ✓

Not part of an equation

*Nie deel van vergelyking*

(2)

11.4.

**Option 1 / Opsie 1**

30% of 50 kg = 15 kg

$$\frac{3}{9} \checkmark \times 15 \checkmark = 5 \text{ kg } \checkmark$$

**Option 2 / Opsie 2**

30% of 50 kg = 15 kg

$$(33,33\%) \checkmark \text{ of } 15 \checkmark = 5 \text{ kg } \checkmark$$

**Option 3 / Opsie 3**

$$\frac{3}{9} \checkmark \times 30 \checkmark = 10\%$$

10% of 50 kg = 5 kg ✓

(3)

11.5

**ANY ONE / ENIGE EEN:**

- Fish / Aquatic life dies. ✓  
Results in loss of income / jobs / food. ✓  
*Vis / Waterlewe gaan dood. ✓*  
*Lei tot verlies aan inkomste / werk / voedsel. ✓*
- Leads to poor water quality. / Excess of nitrates in water. ✓  
Not enough drinking water. / Poses health risk. / Leads to blue baby syndrome. ✓  
*Lei tot swak waterkwaliteit. / Oormaat nitrate in water. ✓*  
*Nie genoeg drinkwater nie. / Gesondheidsrisiko. / Lei tot bloubabasindroom. ✓*
- Water recreation areas become unattractive / dangerous. ✓  
Lack of income due to decline in tourism. / Less recreation facilities. ✓  
*Waterontspanningsareas word onaansienlik/gevaarlik. ✓*  
*Verlies aan inkomste as gevolg van afname in toerisme. ✓*

(2)

**[12]****TOTAL SECTION B/TOTAAL AFDELING B:****125****GRAND TOTAL/GROOTTOTAAL:****150**