Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE/*GRAAD* 12

SEPTEMBER 2014

PHYSICAL SCIENCES P2
FISIESE WETENSKAPPE V2
MEMORANDUM

MARKS: 150

This memorandum consists of 20 pages.
Hierdie memorandum bestaan uit 20 bladsye.

GUIDELINES FOR MARKING/*RIGLYNE VIR NASIEN*

This section provides guidelines for the way in which marks will be allocated. The broad principles must be adhered to in the marking of Physical Sciences tests and examinations.

Hierdie afdeling verskaf riglyne vir die manier waarop punte toegeken sal word. Die breë beginsels moet tydens die nasien van Fisiese Wetenskappe toetse en eksamens gevolg word.

1.1 **MARK ALLOCATION/***PUNTETOEKENNING*

    1.1.1 **Definitions/***Definisies***:** Two marks will be awarded for a correct definition. No marks will be awarded for an incorrect or partially correct definition.
    Twee punte sal vir 'n korrekte definisie toegeken word. Geen punte sal vir 'n verkeerde of gedeeltelik korrekte definisie toegeken word nie.

    1.1.2 **Calculations/***Berekeninge***:**
       o Marks will awarded for: correct formula, correct substitution, correct answer with unit.
       Punte sal toegeken word vir: korrekte formule, korrekte substitusie, korrekte antwoord met eenheid.
       o 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.

    1.1.3 **Explanations and interpretations/Verduidelikings en interpretasie:**
    Allocation of marks to questions requiring interpretation or explanation e.g. AS 1.4, 2.2, 2.3, 3.1, 3.2 and 3.3, will differ and may include the use of rubrics, checklists, memoranda, etc. In all such answers emphasis must be placed on scientific concepts relating to the question.
    Toekenning van punte by vrae wat interpretasie of verduideliking vereis bv. AS 1.4, 2.2, 2.3, 3.1, 3.2 en 3.3, sal verskil en mag die gebruik van rubrieke, kontrolelyste, memoranda, ens. insluit. By al hierdie antwoorde moet die beklemtoning op die wetenskaplike konsepte, met betrekking tot die vraag, val.

1.2 **FORMULAE AND SUBSTITUTIONS/***FORMULES EN SUBSTITUSIE*

    1.2.1 Mathematical manipulations and change of subjects of appropriate formulae carry no marks, but if a candidate starts with the correct formula and then changes the subject of the formula incorrectly, marks will be awarded for the formula and the correct substitutions. The mark for the incorrect numerical answer is forfeited.
    Wiskundige manipulering en verandering van die voorwerp van toepaslike formules dra geen punte nie, maar as 'n kandidaat begin met die korrekte formule en dan die voorwerp van die formule verkeerd uitwerk, sal punte vir die formule en korrekte substitusie toegeken word.

1.2.2   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 substitusie toegeken word, maar **geen verdere punte** sal toegeken word nie.*

1.2.3   Marks are only awarded for a formula if a calculation had been **attempted,** i.e. substitutions have been made or a numerical answer given.
*Punte sal slegs toegeken word vir 'n formule as 'n **poging aangewend was** om 'n berekening te doen d.w.s. substitusie was gedoen of 'n numerieke antwoord word verskaf.*

1.2.4   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 gelys is nie.

1.2.5   All calculations, when not specified in the question, must be done to two decimal places.
Alle berekenings, wanneer nie in die vraag gespesifiseer word nie, moet tot twee desimale plekke gedoen word.

1.3   **UNITS/***EENHEDE*
1.3.1   Candidates will only be penalised once for the repeated use of an incorrect unit **within a question or sub-question.**
*'n Kandidaat sal slegs een keer gepenaliseer word vir die herhaaldelike gebruik van 'n verkeerde eenheid **in 'n vraag of subvraag.***

1.3.2   Units are only required in the final answer to a calculation.
Eenhede word slegs in die finale antwoord tot 'n vraag verlang.

1.3.3   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 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*

1.3.4   SI units must be used except in certain cases, e.g. $V \cdot m^{-1}$ instead of $N \cdot C^{-1}$, and $cm \cdot s^{-1}$ or $km \cdot h^{-1}$ instead of $m \cdot s^{-1}$ where the question warrants this. (This instruction only applies to Paper 1).
SI-eenhede moet gebruik word behalwe in sekere gevalle, bv. $V \cdot m^{-1}$ inplaas van of $N \cdot C^{-1}$, en $cm \cdot s^{-1}$ of $km \cdot h^{-1}$ inplaas van $m \cdot s^{-1}$ waar die vraag dit verlang. (Hierdie instruksie geld slegs by Vraestel 1).

1.4 **POSTIVE MARKING/*POSITIEWE NASIEN***

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

1.4.1 **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 word korrek in 3.2 of 3.3 vervang, word volpunte aan die daaropvolgende subvraag toegeken.

1.4.2 **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 aantal mol verkeerd bereken in 'n eerste stap as gevolg van 'n substitusiefout, verloor die kandidaat die punt vir die substitusie sowel as die finale antwoord.

1.4.3 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.

1.4.4 Questions where a series of calculations have to be made (e.g. a circuit diagram question) do not necessarily always have to follow the same order. FULL MARKS will be awarded provided it is a valid solution to the problem. However, any calculation that will not bring the candidate closer to the answer than the original data, will not count any marks.
Vrae waar 'n reeks berekeninge gedoen moet word (bv. 'n stroombaan diagram vraag) hoef nie noodwendig altyd dieselfde orde te volg nie. VOLPUNTE sal toegeken word mits dit 'n geldige oplossing tot die probleem is. Maar, enige berekening wat nie die kandidaat nader aan die antwoord bring as die oorspronklike data, sal geen punte tel nie.

1.4.5 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.

1.4.6 Normally, if based on a conceptual mistake, an incorrect answer cannot be correctly motivated. 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 for 3.2 could be considered.

Normaalweg, as dit gebaseer is op 'n voorstellingsfout, kan 'n verkeerde antwoord nie korrek gemotiveer word nie. As die kandidaat derhalwe gevra word met 'n vraag in 3.2 om die antwoord in vraag 3.1 te motiveer, en 3.1 is verkeerd, sal geen punte vir vraag 3.2 toegeken word nie. Maar, as die antwoord in bv. 3.1 gebaseer is op 'n berekening, kan die motivering vir die verkeerde antwoord oorweeg word.

1.4.7 If instructions regarding method of answering are not followed, e.g. the candidate does a calculation when the instruction was to **solve by construction and measurement,** a candidate may forfeit all the marks for the specific question.

*Indien instruksies aangaande metode van beantwoording nie gevolg word nie, bv. die kandidaat doen 'n berekening wanneer die instruksie **los op deur konstruksie en meting** was, mag die kandidaat al die punte vir die spesifieke vraag verbeur.*

1.4.8 For an **error of principle, no marks** are awarded (Rule 1) e.g. If the potential difference is 200 V and resistance is 25 Ω, calculate the current.

*Vir 'n **foutdraendebeginsel,** sal **geen punte** toegeken word nie (Reël 1) bv. As die potensiaalverskil 200 V en die weerstand 25 Ω is, bereken die stroom.*

CORRECT *KORREK*	ANSWER (1) *ANTW. (1)*	POSSIBLE *MOONTLIK*	ANSWER (2) *ANTW. (2)*	POSSIBLE *MOONTLIK*
$I = \dfrac{V}{R}$ ✓ $= \dfrac{200}{25}$ ✓ $= 8A$ ✓	$R = \dfrac{V}{I}$ ✓ $= \dfrac{200}{25}$ x $= 8A$ x	$R = \dfrac{V}{I}$ x $= \dfrac{200}{25}$ $= 8A$	$R = \dfrac{V}{I}$ ✓ $I = \dfrac{R}{V}$ x $= \dfrac{25}{200}$ $= 0,125\,A$ x	$I = \dfrac{V}{R}$ ✓ $= 8A$ ✓

1.5 **GENERAL PRINCIPLES OF MARKING IN CHEMISTRY/** *ALGEMENE BEGINSELS VAN NASIEN BY CHEMIE*

The following are a number of guidelines that specifically apply to Paper 2.
Die volgende is 'n aantal riglyne wat spesifiek op Vraestel 2 van toepassing is.

1.5.1 When a chemical **FORMULA** is asked, and the **NAME** is given as answer, only one of the two marks will be awarded. The same rule applies when the **NAME** is asked and the **FORMULA** is given.
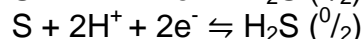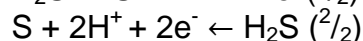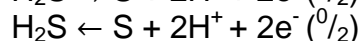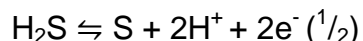
*Wanneer 'n chemiese **FORMULE** gevra word en die **NAAM** word as antwoord gegee, sal slegs een van die twee punte toegeken word. Dieselfde reël geld wanneer die **NAAM** gevra word en die **FORMULE** gegee word.*

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

$$H_2S \rightarrow S + 2H^+ + 2e^- \; (^2/_2)$$
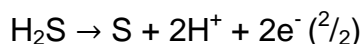
is the correct answer, the following marks will be given:
Wanneer redokshalfreaksies geskryf moet word, moet die korrekte pyltjie gebruik word. Indien die bostaande vergelyking die korrekte antwoord is, sal die volgende punte toegeken word:

$H_2S \leftrightharpoons S + 2H^+ + 2e^- \; (^1/_2)$
$H_2S \leftarrow S + 2H^+ + 2e^- \; (^0/_2)$
$S + 2H^+ + 2e^- \leftarrow H_2S \; (^2/_2)$
$S + 2H^+ + 2e^- \leftrightharpoons H_2S \; (^0/_2)$

1.5.3   When candidates are required to give an explanation involving the relative strength of oxidising and reducing agents, the following is unacceptable:

- 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 for instance be: Mg is a stronger reducing agent than Cu, and therefore Mg will be able to reduce 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 Cu^{2+}-ione na Cu te reduseer. Die antwoord kan ook in terme van die relatiewe sterkte van elektronakseptors of donors gegee word.*

1.5.4   One mark will be forfeited when the charge of an ion is omitted per equation.
Een punt sal verbeur word wanneer die lading van 'n ioon per vergelyking weggelaat is.

1.5.5   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 calculations of E^θ_{cell}) then the learner is not credited for this substitution.
Die foutdraendebeginsel 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 dra (balansering van vergelyking of E^θ_{sel}) dan word die leerder nie vir die substitusie gekrediteer nie.

1.5.6   When a calculation of the cell potential of a galvanic cell is expected, marks will only be awarded for the formula if one of the formulae indicated on the data sheet (Table 2) is used. The use of any other formula using abbreviations etc. will carry no marks.
Wanneer 'n berekening van die selpotensiaal van 'n galvaniesesel verlang word, sal punte slegs vir die formule toegeken word as een van die formules op die gegewensblad (Tabel 2) gebruik word. Die gebruik van enige ander formule, die gebruik van afkortings, ens. Sal geen punte dra nie.

1.5.7   In the structural formula of an organic molecule all hydrogen atoms must be shown. Marks will be deducted if hydrogen atoms are omitted.
In die struktuurformules van 'n organiese molekuul moet alle waterstofatome getoon word. Punte sal afgetrek word vir die weglating van waterstofatome.

1.5.8   When a structural formula is asked, marks will be deducted if the candidate writes the condensed formula.
Wanneer 'n struktuurformule gevra word, sal punte afgetrek word indien die leerder die gekondenseerde formule skryf.

1.5.9   When an IUPAC name is asked, and the candidate omits the hyphen (e.g. instead of 1-pentene the candidate writes 1 pentene), marks will be forfeited.
Wanneer die IUPAC naam gevra word en die koppelteken(s) in die naam word uitgelaat (bv. In plaas van pent-1-een of 1-penteen skryf 'n kandidaat pent 1 een of 1 penteen), sal punte verbeur word.

SECTION/*AFDELING A*

QUESTION/*VRAAG 1*

1.1   A ✓✓   (2)

1.2   B ✓✓   (2)

1.3   D ✓✓   (2)

1.4   A ✓✓   (2)

1.5   A ✓✓   (2)

1.6   C ✓✓   (2)

1.7   B ✓✓   (2)

1.8   C ✓✓   (2)

1.9   A ✓✓   (2)

1.10   D ✓✓   (2)

TOTAL SECTION/TOTAAL AFDELING A: 20

SECTION/AFDELING B

QUESTION/VRAAG 2

2.1   √
   2,3-dibromobutane √
   2,3-dibroombutaan

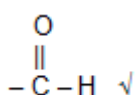| CORRECT IUPAC NAME, BUT ONE OR MORE OF THE FOLLOWING ERRORS: OMITTING HYPHENS AND/OR COMMAS; INCLUDING EXTRA HYPHENS AND /OR SPACES **MAX/MAKS ½** *KORREKTE IUPAC-NAAM MAAR EEN OF MEER VD VOLGENDE FOUTE GEMAAK: WEGLATING VAN KOPPELTEKENS EN/OF KOMMAS; INSLUITING VAN EKSTRA SPASIES EN/OF KOPPELTEKENS* |

(2)

2.2 C_nH_{2n+1}-OH √   (1)

2.3   **OR/OF**
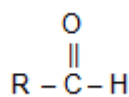
  OR/OF   (1)

2.4

| √ – functional group/funksionele groep |
| √ – rest of structure correct/res van struktuur korrek |

(2)

2.5

| √ – functional group/funksionele groep |
| √ – rest of structure correct/ res van struktuur korrek |

OR/OF

(2)
[8]

QUESTION 3

3.1   3.1.1   addition √
               addisie   (1)
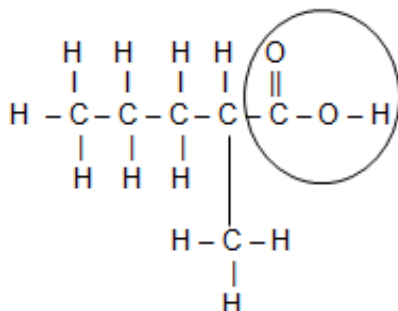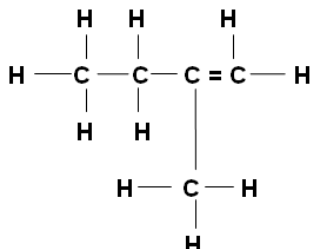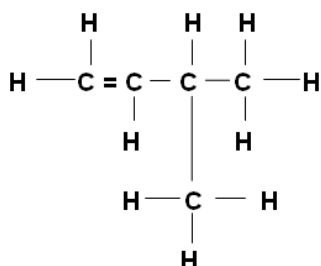
         3.1.2   elimination √
               eliminasie   (1)

         3.1.3   substitution √
               substitusie   (1)

3.2.1/3.2.2/3.4.1 **NAMES ONLY/** ***ALLEENLIK NAME AND/EN***   V3.3/3.4.3 **FORMULAE ONLY/** ***ALLEENLIK FORMULES***

3.2   3.2.1   water √   (1)

         3.2.2   (dilute)sulphuric acid / (dilute)phosphoric acid √   (1)
                 (verdunde)swawelsuur / (verdunde)fosforsuur

3.3

-1 FOR CONDENSED/ MOLECULAR FORMULAE   *-1 VIR GEKONDENSEERD/ MOLEKULÊRE FORMULES*   **IGNORE RULE 3.10/***IGNOREER REËL 3.10*   *-1 FOR ADDITIONAL REACTANTS/ PRODUCTS / VIR ADDISIONELE REAGENSE /PRODUKTE*   **-1 IF ARROW OMITTED/** *GEEN PYLTJIE*

                                                                  (4)

3.4   3.4.1   propanoic acid √√
               propanoësuur   (2)

         3.4.2   esterification √ or (acid catalysed) condensation
               esterifikasie of (suur gekataliseerde) kondensasie   (1)

3.4.3
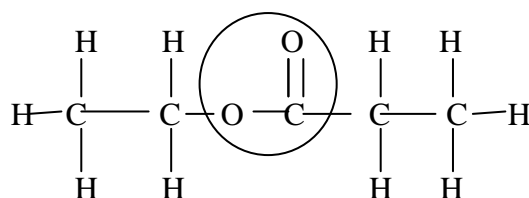
> √ – functional group/funksionele groep
> √ – rest of structure correct/ res van struktuur korrek
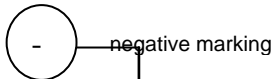
OR/OF
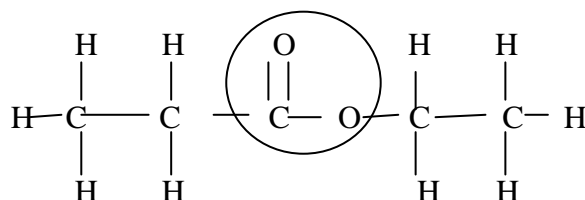
(2)

3.5   3.5.1   a molecule containing a <u>large number of atoms</u> √
'n molekule wat uit 'n <u>groot aantal atome</u> bestaan

(1)

3.5.2   <u>addition</u> √ (polimerisation)/*addisie (polimerisasie)*

(1)

3.5.3   **(Any TWO of)/(enige TWEE van)**
used to make plastic bags/squeeze bottles/clingwrap √√
word gebruik om plastieksakke/spuitbottels/kleefplastiek te maak

(2)

[18]

QUESTION 4

4.1   <u>Relative molecular mass</u>/molar mass √
Relatiewe molekulêre massa/molêre massa

(1)

4.2   4.2.1   Boiling point √
Kookpunt

(1)

4.2.2   <u>Type of organic compound</u>/homologous series/functional group √
Tipe organiese verbinding/homoloë reeks/funksionele groep

(1)

4.3   4.3.1   Saturated√ – single bonds only between C-atoms √
Versadig – alleenlik enkelbindings tussen C-atome

(2)

4.3.2   LOWER THAN/*LAER AS* √   (-)———negative marking

(1)

4.3.3
- 2-methylpropane is a spherical molecule, therefore <u>smaller surface area</u> √ is presented to other molecules(sphere is 3D shape with lowest surface-to-volume ratio)
- <u>Less surface area at which van der Waals interactions with other molecules can occur</u> √ /fewer van der Waals interactions/fewer cohesive interactions
- <u>Less energy required</u> √ to overcome cohesive forces as liquid hydrocarbon is vaporised

- *2-metielpropaan is 'n sferiese molekule wat 'n <u>kleiner oppervlaksarea</u> aan ander molekule bied(sfeer is 3D vorm met die laagste oppervlak-tot-volume verhouding)*
- *<u>Minder</u> oppervlakarea waarby <u>van der Waals-interaksies</u> met <u>ander molekule kan plaasvind</u>/minder van der Waals interaksies/minder kohesie interaksies*
- *<u>Minder energie benodig</u> om kohesie kragte te oorkom soos die vloeibare koolwaterstof verdamp*   (3)

4.4   ethanoic acid – it is possible <u>for 2</u> √ <u>H-bonds</u> (at C=O and O-H) to form
C   between adjacent carboxylic acid molecules
               Therefore H-bonds stronger in carboxylic acid √
               Therefore more energy required to √ overcome the stronger
               Forces of attraction/to break the bonds BETWEEN molecules

OR

propan-1-ol — <u>H-bonds weaker in alcohol</u> √ as it is only possible for <u>1 H</u>√
B   <u>bond</u> at O-H to form between adjacent molecules of alcohol
                therefore <u>less energy required</u> √ to overcome the strong
                forces of attraction/to break the bonds BETWEEN
                molecules

etanoësuur   – <u>H-bindings sterker in karbosielsuur</u> omdat
C   dit moontlik is vir <u>2 H-bindings</u> om te vorm tussen
*   aangrensende molekule van die karboksielsure*
*   (by C=O and O-H) en dus word meer energie benodig om*
*   Die sterker aantrekkingskragte te oorkom/bindings TUSSEN*
*   Molecule te breek*
OF

propan-1-ol – H-bindings <u>swakker in alkohole</u> omdat dit net
B   moontlik is vir <u>1 H-binding</u> om te vorm tussen
*   aangrensende molekule van alkohole en <u>dus minder energie</u>*
*   <u>benodig</u> om die sterker aantrekkingskragte te*
*   oorkom/bindings TUSSEN molekule te breek*   (3)
[12]

QUESTION 5

5.1   activation energy √
aktiveringsenergie   (1)

5.2   5.2.1   negative marking
C √ → total area under graphs A and C more or less the same , but
more molecules with greater average E_k therefore area X of graph C
greater – more molecules with greater average E_k√

negatiewe merk
_C → totale area onder grafieke A en C min of meer dieselfde, maar
meer molekule met hoër gemiddelde E_k, dus is area X van
grafiek C groter meer molecule met hoer gemiddelde E_k_   (2)

5.2.2   • Increased temperature therefore increased average kinetic energy
of molecules √
• More of these molecules will have sufficient kinetic energy √ to
react
• More effective collisions per second/unit time √
• Increased rate of reaction √

• _Verhoogde temperatuur daarom verhoogde gemiddelde kinetiese
energie van molekules_
• _Meer molekules het genoegsame kinetiese energie om te reageer_
• _Meer effektiewe botsings per sekonde/eenheidstyd_
• _Verhoogde reaksietempo_   (4)

5.3   5.3.1   A catalyst will speed up a chemical reaction √   (2)
without itself undergoing permanent change √

_'n Katalisator versnel 'n chemiese reaksie
sonder dat dit self 'n permanente verandering ondergaan_

5.3.2   INCREASES/NEEM TOE√   negative marking   (1)

5.3.3   A catalyst will create an alternative path of lower activation energy √
"line Y" moves to the left √ – therefore area X increases in size.

_'n Katalisator skep 'n alternatiewe roete van laer aktiveringsenergie
"lyn Y" beweeg na links – daarom neem area X toe in grootte_   (2)

[12]

QUESTION 6/VRAAG 6

6.1 $4NH_3$ + $5O_2$ ⇌ $4NO$ + $6H_2O$ (8)

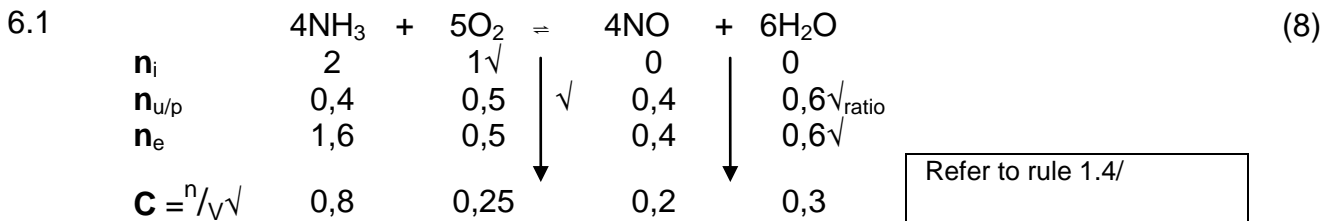|				
n_i	2	1√	0	0
$n_{u/p}$	0,4	0,5 √	0,4	0,6√ ratio
n_e	1,6	0,5	0,4	0,6√
$C = {}^n/_V$ √	0,8	0,25	0,2	0,3

Refer to rule 1.4/

Verwys na reël 1.4

$$K_c = \frac{[H_2O]^6[NO]^4}{[NH_3]^4[O_2]^5} \; \checkmark$$

$$= \frac{(0,3)^6(0,2)^4}{(0,8)^4(0,25)^5} \; \checkmark \;\; = 0,0029\checkmark$$

- n_i (NH_3) =2 and n_i (O_2)=1
- n_e (H_2O)=0.6
- **USE** correct ratio (4:5:4:6)
  ***GEBRUIK** die regte verhouding (4:5:4:6)*
- Add and subtract correctly.
  Tel op en trek korrek af
- Calculate concentration ($n_e \div 2$ in every column)
  Bereken die konsentrasie ($n_e \div 2$ in elke kolom)
- Correct K_c expression/ korrekte *uitdrukking*
- Substitution correct/*Korrekte substitusie*
- Answer correct/*Korrekte antwoord*

Option 2/Opsie 2

	$4NH_3$	+	$5O_2$ ⇌	$4NO$	+	$6H_2O$
c_i	1		0,5√	0		0
$c_{u/p}$	0,2		0,25	0,2		0,3√ ratio√
c_e	0,8		0,25 √	0,2		0,3√

$$K_c = \frac{[H_2O]^6[NO]^4}{[NH_3]^4[O_2]^5} \; \checkmark \; = \frac{(0,3)^6(0,2)^4}{(0,8)^4(0,25)^5} \; \checkmark \; = 0,0029\checkmark$$

- Calculate concentration(n_e / 2 in every column)
- Bereken die konsentrasie (n_e / 2 in elke kolom)
- [NH_3] = 1 AND [O_2] = 0,5
- [H2O] = 0,3   (+ marking)
- **USE** correct ratio (4:5:4:6)

         GEBRUIK die regte verhouding (4:5:4:6)
- Add and subtract correctly (+marking)
  Tel op en trek korrek af
- Correct Kc-expression/korrekte uitdrukking
- Substituion correct/Korrekte substitusie (+marking)
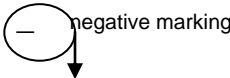- Answer correct/Korrekte antwoord

6.2   [products] < [reactants] √ **OR/OF**   (1)
           Incomplete forward rxn/*onvolledige voorwaartse reaksie* **OR/OF**
           Low yield/Lae obrengs

6.3   REMAIN THE SAME√/BLY DIESELFDE   (1)

6.4   A decrease in pressure causes/'n afname in druk veroorsaak
- equilibrium to shift towards side with greater number of gas moles√
- *ewewig verskuif na die kant met die groter hoeveelheid mol gas*
- equilibrium shifts to the right (9 : 10) √ /forward reaction is favoured
- *ewewig verskuif na regs (9:10)/ voorwaartse reaksie word bevoordeel*
- Yield of NO increases √ / increased yield/*toename in opbrengs*
- Number of moles of NO increases/*Aantal mol NO neem toe*   (3)

6.5   negative √/*negatief*   (–) negative marking   (1)

6.6
- decrease in temp <u>favours exothermic reaction</u> √
- increase in Kc implies <u>greater [products]</u> √
- <u>forward reaction is favoured</u> √ therefore
  <u>forward reaction is exothermic</u> √

- *afname in temperatuur <u>bevoordeel eksotermiese reaksie</u>*
- *toename in Kc impliseer <u>hoër [produkte]</u>*
- *<u>voorwaartse reaksie word bevoordeel</u> en dus
  is <u>voorwaartse reaksie eksotermies</u>*   (4)

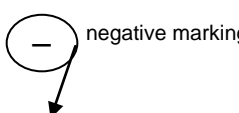   **[18]**

QUESTION 7 (Start on a new page.)

7.1   <u>complete ionisation</u> in solution √ to produces <u>a high concentration of H_3O^+-ions</u> in solution √

<u>volledige ionisasie</u> in oplossing en lewer 'n <u>hoë konsentrasie H_3O^+</u>   (2)

7.2   7.2.1   pH = 3 ∴ pH = – log [H^+] √
                    3 = – log [H^+]   pH=3 ∴
                    [H^+] = 10^{-3} mol·dm^{-3} √   **OR/OF**   [H^+] = 10^{-3} mol·dm^{-3} (2)

         7.2.2   Weaker than HCℓ √ ⊝ negative marking   (1)
                    Swakker as HCℓ

         7.2.3   [H^+] = 10^{-3} mol·dm^{-3} which <u>is less than</u> the [H^+] = 10^{-2} mol·dm^{-3} of HCℓ√

                    ∴ acid <u>not ionised completely</u> √ therefore weaker than HCℓ

                                    OR
                    pH = 3 is <u>greater</u> than pH = 2 for the <u>same concentration</u> of HCℓ

                    (Higher pH implies weaker acid)

                    [H^+] = 10^{-3} mol·dm^{-3} is <u>laer as</u> die [H^+] =10^{-2} mol·dm^{-3} van HCℓ

                         ∴suur het <u>nie volledig geïoniseer</u> nie en is dus swakker
                                    OF
                    pH=3 is <u>groter as</u> pH=2 vir <u>dieselfde konsentrasie</u> van HCℓ

                    (Hoër pH dui op swakker suur)   (2)

7.3   7.3.1   Reaction of <u>a salt</u> √ <u>with water</u> √ /reaksie van 'n <u>sout</u> √ <u>met water</u> √   (2)

         7.3.2   √   √   √
                    $NH_4Cℓ + H_2O \rightarrow NH_3 + H_3O^+ + Cℓ^-$

                         OR/OF

                    $NH_4^+ + H_2O \rightarrow NH_3 + H_3O^+$ (3)

         7.3.3   red √√ /*rooi*   (2)

7.4   Consider reaction 2/*Beskou reaksie 2*

$$\frac{n_a}{n_b} = \frac{c_a.V_a}{c_b.V_b} \ \checkmark$$

$$\therefore \frac{1}{2} \ \checkmark = \frac{(1)}{(0,5).28} \ \checkmark$$

$$V_a = 7cm^3 \ \checkmark$$

$V_a = 7cm^3$ used in reaction 2

$\therefore V_a = (50-7) = 43cm^3$ used in reaction 1 $\checkmark$

Consider reaction 1/*Beskou reaksie 1*

$n_a = C_aV_a = (1)(0,043) = 0,043 \ \checkmark \ mol \ H_2SO_4$

$\quad n_{H_2SO_4} = n_{CaCO_3} = 0,043$ mol $\checkmark$ (ratio 1:1)

$\quad \therefore m_{CaCO_3} = nM \ \checkmark$

$\quad\quad = (0,043)(40 + 12 + 3(16)) \checkmark$

$\quad\quad = \underline{4,3g} \ \checkmark$

<div align="center">**OR/OF**</div>

Consider reaction 2/*Beskou reaksie 2*

$n_{NaOH} = cV \ \checkmark$

$(0,5)(0,028) = 0,014$ mol NaOH $\checkmark$

$2n_{H2SO4} : n_{NaOH} \ \checkmark => 0,007$ mol $H_2SO_4 \ \checkmark$ (ratio 2:1)

$V_{H2SO4} = {}^n/_c = {}^{0,007}/_1 = 0,007$ dm^3 $\checkmark$

Consider reaction 1/*Beskou reaksie 1*

V_{H2SO4} reacting with $CaCO_3 = 0,05 - 0,007$ dm$^3 = 0,043$ dm^3 $\checkmark$

nH_2SO_4 reacting with $CaCO_3 = cV$

$\quad\quad\quad\quad = (1)(0,043)$

$\quad\quad\quad\quad = 0,043$ mol $\checkmark$

$nH_2SO_4 = nCaCO_3 = 0,043$ mol $\checkmark$ (ratio 1:1)

$mCaCO_3 = nM \ \checkmark = (0,043)(100) \ \checkmark = \underline{4,3}$ g

<div align="center">**OR/OF**</div>

Consider reaction 2/*Beskou reaksie 2*

$n_{NaOH} = cV \ \checkmark$

$\quad (0,5)(0,028) = 0,014$ mol $\checkmark$ NaOH

$\quad 2n_{H2SO4\ excess} = n_{NaOH} \ \checkmark = 0,007$ mol $\checkmark$ (ratio 2:1)

Consider reaction 1/ *Beskou reaksie 1*

$\quad n_{H2SO4\ total} = cV = 1(0,05) = 0,05$ mol $\checkmark$

$\quad n_{H2SO4}$ reacting with $CaCO_3 = 0,05 - 0,007$

$\quad\quad\quad\quad\quad = 0,043$ mol $\checkmark$

$\quad n_{H2SO4} = nCaCO_3 = 0,043$ mol $\checkmark$ (ratio 1:1)

$\quad m_{CaCO3} = nM \ \checkmark = (0,043)(100) \ \checkmark = \underline{4,3\ g} \ \checkmark$

(10)

[24]

QUESTION 8

8.1   8.1.1
- Oxalic acid half-reaction has a <u>lower E^θvalue</u> than the dichromate half reaction √
- <u>dichromate ions</u> are therefore the <u>strongest oxidising agents</u> √
- and <u>will therefore be reduced</u> √ while oxalic acid is oxidized

<div align="center">**OR**</div>

- Oxalic acid half-reaction has a <u>lower E^θvalue</u> than the dichromate half reaction √
- oxalic acid molecules will therefore be the <u>strongest reducing agents</u> √
- and <u>will therefore be oxidised</u> while dichromate ions are reduced√

<div align="center">**OR**</div>

$E^\theta_{cell} = E^\theta_{oxidising\ agent} - E^\theta_{reducing\ agent}$
     $= (1,33)$ √$- (-0,49)$√
     $= +$ √ (positive) 1,82 V

- _Oksaalsuur half-reaksie het 'n <u>laer E^θ waarde</u> as die dichromaat half-reaksie_
- _<u>dichromaat ione</u> is dus <u>sterkste oksideermiddels</u> en sal dus_
- _<u>gereduseer word</u> terwyl oksaalsuur geoksideer word_

<div align="center">_**OF**_</div>

- _Oksaalsuur half-reaksie het 'n <u>laer E^θ waarde</u> as die dichromaat half-reaksie_
- _<u>Oksaalsuurmolekule</u> is dus <u>sterkste reduseermiddels</u> en sal dus <u>geoksideer</u> word terwyl dichromaatione gereduseer word_
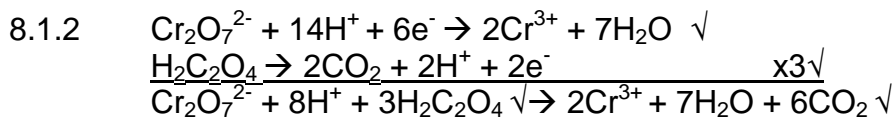
<div align="center">_**OF**_</div>

$E^\theta_{sel} = E^\theta_{oksideermiddel} - E^\theta_{reduseermiddel}$
     _$= (1,33) - (-0,49)$_
     $= +$ (positief) 1,82 V   (3)

8.1.2 $Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$ √
<u>$H_2C_2O_4 \rightarrow 2CO_2 + 2H^+ + 2e^-$ x3√</u>
$Cr_2O_7^{2-} + 8H^+ + 3H_2C_2O_4$ √$\rightarrow 2Cr^{3+} + 7H_2O + 6CO_2$ √

                                         -1 for charges omitted/
                                         -1 as lading uitgelaat is

                                         -1 for/_vir_ ⇋

                                         -1 for additional reactants/products

                                         -1 vir addisionele reaktante/produkte   (4)

8.2   8.2.1   B √√   (2)

8.2.2 $Cu \rightarrow Cu^{2+} + 2e^-$ √√ $Cu \rightleftharpoons Cu^{2+} + 2e^-$ $^1/_2$
                                         $Cu \leftarrow Cu^{2+} + 2e^-$ $^0/_2$
                                         $Cu^{2+} + 2e^- \leftarrow Cu$ $^2/_2$
                                         $Cu^{2+} + 2e^- \rightleftharpoons Cu$ $^0/_2$ (2)

8.2.3 $Cu_{(s)}/ Cu^{2+}_{(aq)}$ √ $\| H^{+}_{(aq)}, H_2O_{2(aq)}/ O_{2(g)}/Pt_{(s)}$ √ √saltbridge
            $Cu_{(s)}/ Cu^{2+}_{(aq)} \| H_2O_{2(aq),} H^{+}_{(aq)} / O_{2(g)}/Pt_{(s)}$
            Accept/*aanvaar:* $Cu_{(s)}/ Cu^{2+}_{(aq)} \| O_{2(g)}/ H^{+}_{(aq)}, H_2O_{2(aq)}/Pt_{(s)}$
            $Cu_{(s)}/ Cu^{2+}_{(aq)} \| O_{2(g)}/ H_2O_{2(aq),} H^{+}_{(aq)} /Pt_{(s)}$ (3)
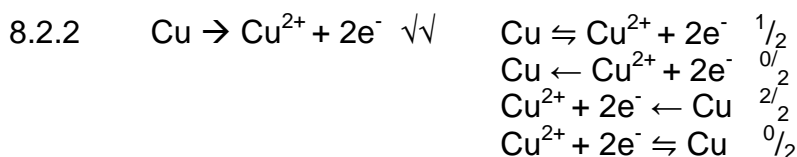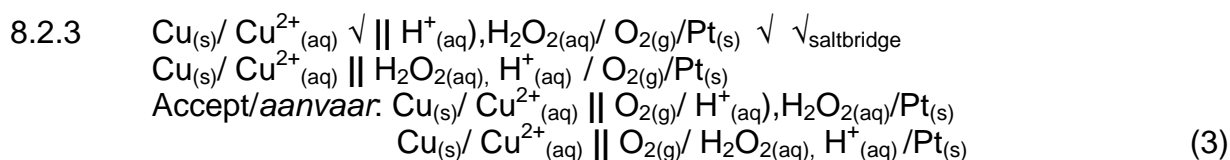
8.2.4 $E^{\theta}_{cell} = E^{\theta}_{cathode/katode} - E^{\theta}_{anode}$ √   **OR** any other formula from datasheet/ *OF*
                $= 0,68$ √ $- (0,34)$ √   *enige ander formule van inligtingsblaai af*
                $= 0,34$ V √

                                                                    -1 for using unconventional abbreviations/
                                                                    onkonvensionele afkortings gebruik   (4)

8.2.5   decrease in V_{cell} as [product ions] increase √
            and [reactant ions] decrease √
            rate of forward reaction decrease while rate of reverse reaction
            increase √
            $V_{cell} = 0$ and no current flows when
            dynamic equilibrium is reached i.e. when
            rate of forward reaction = rate of reverse reaction √

            afname in V_{sel} as [produk ione] toeneem
            [reaktant ione] afneem
            reaksietempo vir voorwaartse reaksie neem af terwyl reaksietempo
            vir teruwaartse reaksie toeneem
            $V_{sel} = 0$ en geen stroom vloei meer nie sodra
            dinamiese ewewig ingestel word, dus as reaksietempo van
            voorwaartse reaksie = reaksietempo van terugwaartse reaksie   (4)
                                                                                    [22]

QUESTION 9 (Start on a new page.)

9.1 fractional distillation of liquid air √
fraksionele distillasie van vloeibare lug (1)

9.2 $N_2 + 3H_2$ √ $\leftrightarrows 2NH_3$ √ balanced √ (3)

9.3 Ammonium sulphate √√
Ammoniumsulfaat (2)

9.4 Vanadium pentoxide √
Reactants come into contact with layers of the catalyst. √

Vanadiumpentoksied √
Reagense kom in kontak met lae van die katalisator. √ (2)

9.5 ANY TWO OF:
- contain lower levels of nutrients √ therefore use more of it/cost more √
- variable composition √/lead to lower yield of crop/crop failure √
- may contain animal and plant pathogens √ cause diseases in animals/humans √
- organically grown produce is expensive √ poorer people cannot afford to buy √

ENIGE TWEE VAN:
- *bevat laer vlakke van voedingstof moet dus meer gebruik/koste verhoog*
- *samestelling varieer en kan lei tot laer opbrengs van oes/mislukte oes*
- *mag plant- of dierpatogene bevat wat siektes by mense en diere veroorsaak*
- *organies geproduseerde produkte is baie duur en armer mense kan dit nie bekostig nie* (4)

9.6 9.6.1 $^5/_9$ x 26% √ = 14,44% K √ (2)

9.6.2
- Healthy growth /healthy development of good quality flowers and fruit √
- Keep plant frost/disease resistant √

- *Gesonde groei/gesonde ontwikkeling van goeie kwaliteit blomme en vrugte*
- *Hou plante bestand teen ryp/siektes* (2)

[16]

TOTAL SECTION B/*TOTAAL AFDELING B:* **130**
GRAND TOTAL/*GROOTTOTAAL:* **150**