



Province of the  
**EASTERN CAPE**  
EDUCATION

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE/GRAAD 12**

**JUNE COMMON PAPER 2017**

**PHYSICAL SCIENCES P2/  
FISIESE WETENSKAPPE V2  
MEMORANDUM**

**MARKS: 150**

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This memorandum consists of 19 pages./  
*Hierdie memorandum bestaan uit 19 bladsye.*

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## 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:**

- 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.*
- 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.  $V \cdot m^{-1}$  in plaas van of  $N \cdot C^{-1}$ , en  $cm \cdot s^{-1}$  of  $km \cdot h^{-1}$  in plaas 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 stroombaand 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
$I = \frac{V}{R} \checkmark$ $= \frac{200}{25} \checkmark$ $= 8A \checkmark$	$R = \frac{V}{I} \checkmark$ $= \frac{200}{25} x$ $= 8A x$	$R = \frac{V}{I} x$ $= \frac{200}{25}$ $= 8A$	$R = \frac{V}{I} \checkmark$ $I = \frac{R}{V} x$ $= \frac{25}{200}$ $= 0,125 A x$	$I = \frac{V}{R} \checkmark$ $= 8A \checkmark$

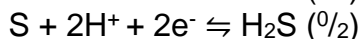
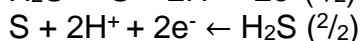
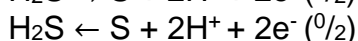
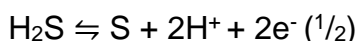
## 1.5 GENERAL PRINCIPLES OF MARKING IN CHEMISTRY/ ALGEMENE BEGINSELS VAN NASIEN BY CHEMIE

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  
$$\text{H}_2\text{S} \rightarrow \text{S} + 2\text{H}^+ + 2\text{e}^- \text{ (}^{2/2}\text{)}$$

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:*



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  $\text{Cu}^{2+}$  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 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  $E^{\theta}_{\text{cell}}$ ) 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  $E^{\theta}_{\text{sel}}$ ) 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 galvaniese sel 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 molekule 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.*

**QUESTION/VRAAG 1**

1.1 C ✓✓

1.2 A ✓✓

1.3 C ✓✓

1.4 B ✓✓

1.5 A ✓✓

1.6 D ✓✓

1.7 A ✓✓

1.8 C ✓✓

1.9 A ✓✓

1.10 B ✓✓

(10 x 2) [20]

**QUESTION/VRAAG 2**

2.1 2.1.1 G ✓ (1)

2.1.2 F ✓ (1)

2.2 2.2.1  $C_nH_{2n+2}$  ✓ (1)2.2.2 Carboxylic group ✓ / *Karboksiel-groep* (1)2.2.3  $CH_2$  ✓ (1)2.3 2.3.1 4-bromo-3-methylheptane  
*4-broom-3-metielheptaan***Marking criteria/ Nasienriglyne:**

- Stem i.e. heptane./*Stam d.i heptaan.* ✓
- Bromo and methyl/*Broom en metiel* ✓
- Substituents correctly numbered, hyphens, commas and sequence correctly used. ✓

*Substituentte korrek genommer, koppeltekens en kommas korrek gebruik.* (3)2.3.2 pentan-3-one ✓✓ / *pentan-3-oon*  
**Accept/Aanvaar:** 3-pentanone / *3-pentanoon***IF/INDIEN:**

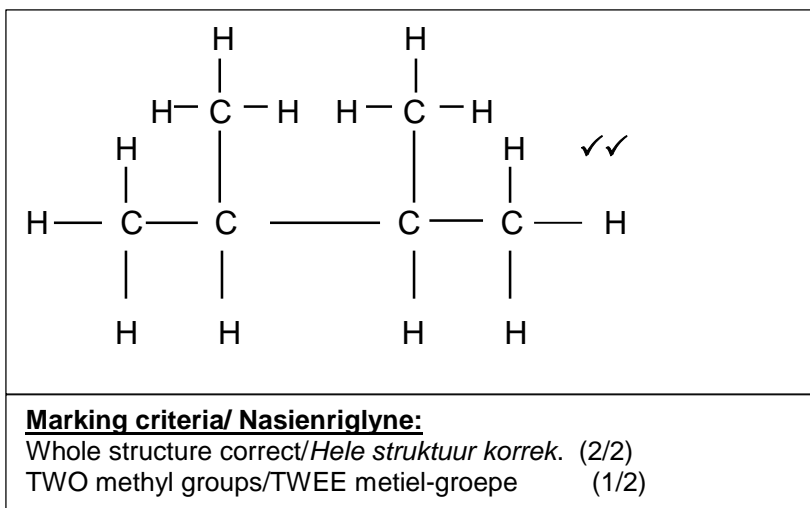
pentanone / pentanoon (1/2)

(2)

2.3.3 methyl ✓ methanoate ✓ / *metiel metanoaat* (2)



2.4

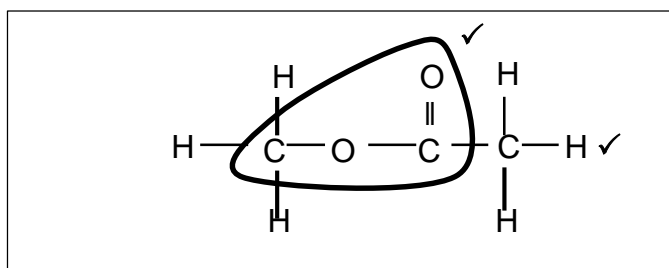


(2)

2.5 2.5.1 Sulphuric acid/ $H_2SO_4$  ✓  
*Swawelsuur/ H<sub>2</sub>SO<sub>4</sub>*

(1)

2.5.2

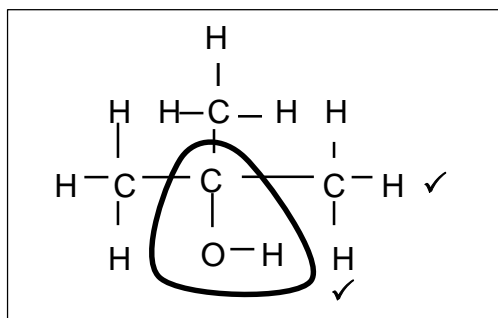
**Marking criteria/ Nasienriglyne:**Whole structure correct/*Hele struktuur korrek.* (2/2)Functional group correct/*Funksionele groep korrek* (1/2)**Notes/Aantekeninge:**Condensed structural formula or semi structural formule/  
*Gekondenseerde formule of semi-struktuurformule* (1/2)

(2)

2.5.3 Flammable/Volatile ✓  
*Vlambaar/Vlugtig*

(1)

2.6

**Marking criteria/ Nasionriglyne:**Whole structure correct/*Hele struktuur korrek.*Functional group correct/*Funksionele groep korrek* (2/2)**Notes/Aantekeninge:**

Condensed structural formula or semi structural formule/

*Gekondenseerde formule of semi-struktuurformule* (1/2)

2-methyl ✓propan-2-ol✓

*2-metiel propan-2-ol***Accept/Aanvaar:** 2-methyl-2-propanol/2-metiel-2-propanol**Marking criteria/ Nasionriglyne**

2-methyl/2-metiel

Propan-2-ol

(2)

2.7 CO<sub>2</sub>, ✓ H<sub>2</sub>O ✓

(2)

**[24]****QUESTION/VRAAG 3**

3.1 The temperature at which the vapour pressure equals the atmospheric (external) pressure. ✓✓

*Die temperatuur waar die dampdruk gelyk aan die atmosferiese (eksterne) druk is.***(2 or/of 0)** (2)

3.2.1 Chain length/surface area/molecular size(mass)/number of C atoms. ✓

*Kettinglengte/oppervlaks area/molekulêre grootte (massa)/aantal C atome.*

(1)

3.2.2 Thermometer ✓/Termometer

(1)

3.3 C/ CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>OH ✓

(1)



3.4 **From A to C**

- Chain length/surface area/molecular size/molecular mass/number of C's in the chain increases. ✓
- Strength of intermolecular forces/London forces/induced dipole/dispersion forces increases. ✓
- More energy needed to overcome/break intermolecular forces. ✓

**Van A na C**

- Kettinglengte/oppervlaksarea/molekulêre grootte/molekulêre massa/aantal C's in ketting neem toe.
- Sterkte van intermolekulêre kragte/London kragte/geïnduseerde dipole/dispersie kragte vermeerder.
- Meer energie benodig om intermolekulêre kragte te oorkom/breek.

**From C to A**

- The chain length/surface area/molecular size/molecular mass/number of C's in the chain decreases. ✓
- Strength of intermolecular forces/London forces/induced dipole/dispersion forces decreases. ✓
- Less energy needed to overcome/break intermolecular forces.

**Van C na A**

- Kettinglengte/oppervlaksarea/molekulêre grootte/molekulêre massa/aantal C's in ketting neem af.
- Sterkte van intermolekulêre kragte/London kragte/geïnduseerde dipole/dispersie kragte verminder.
- Minder energie benodig om intermolekulêre kragte te oorkom/breek.

(3)

3.5 3.5.1 A series of organic compounds with the same general formula. ✓✓  
 OR in which one member differs from the next with a CH<sub>2</sub> group.  
*'n Reeks organiese verbindings met dieselfde algemene formule OF  
 waarin EEN lid van die volgende met 'n CH<sub>2</sub> groep verskil. (2 or/of 0) (2)*

3.5.2 Between molecules of **D** there are hydrogen bonds. ✓  
 Between molecules of **E** there are dipole-dipole forces. ✓.  
 Hydrogen bonds are stronger than dipole-dipole forces. ✓  
More energy needed to overcome/break intermolecular forces in **D**. ✓

*Tussen molekules van **D** is daar waterstofbindings.  
 Tussen molekules van **E** is daar dipool-dipool kragte.  
 Waterstofbindings is sterker as dipool-dipoolkragte.  
Meer energie benodig om intermolekulêre kragte te oorkom/breek in **D**.*

### OR/OF

Between molecules of **D** there are hydrogen bonds. ✓  
 Between molecules of **E** there are dipole-dipole forces. ✓  
 Dipole-dipole forces are weaker than hydrogen bonds. ✓  
Less energy needed to overcome/break intermolecular forces in **E**. ✓

*Tussen molekules van **D** is daar waterstofbindings.  
 Tussen molekules van **E** is daar dipool-dipool kragte.  
 Dipool-dipoolkragte is swakker as waterstofbindings.  
Minder energie benodig om intermolekulêre kragte te oorkom/breek in **E**.* (4)

3.5.3 **E** ✓  
 Higher boiling point ✓/Hoër kookpunt (2)  
**[16]**

### QUESTION/VRAAG 4

4.1 4.1.1 (a) Substitution/halogenation/bromination. ✓  
*Substitusie/halogenasie/halogenering/bromering (1)*

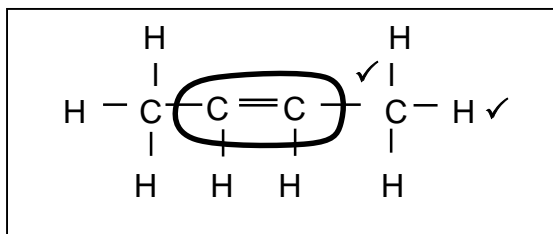
4.1.2 Elimination/dehydrohalogenation ✓  
*Eliminasie/dehalogenasie/dehidrogenering (1)*

4.2 4.2.1 Bromine/Br<sub>2</sub> ✓  
*Bromied/Br<sub>2</sub> (1)*

4.2.2 Heat/Ultraviolet ✓  
*Hitte/Ultraviolet-lig (1)*

4.2.3 Butane/Butaan ✓✓ (2)

4.3



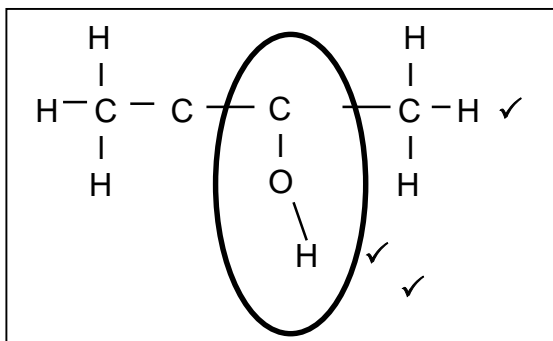
(2)

**Marking criteria/ Nasionriglyne:**

Whole structure/Hele struktuur (2/2)

Only functional group correct/Slegs funksionele groep korrek. (1/2)

4.4

**Marking criteria/ Nasionriglyne:**

Whole structure/Hele struktuur (2/2)

Only functional group correct/Slegs funksionele groep korrek. (1/2)

(2)

4.5 Dilute KOH ✓ and mild heat ✓  
 Verdunde KOH en matige hitte

(2)

**[12]****QUESTION/VRAAG 5**

5.1 The change in concentration/mass/number (amount) of moles/volume ✓ of reactants or products per unit time. ✓  
 Die verandering in konsentrasie ✓/massa/ aantal (hoeveelheid) mol/volume van reaktanse of produkte per eenheidstyd. ✓

(2)

5.2 Experiment/Eksperiment 1 ✓

- Highest temperature ✓/ Hoogste temperatuur
- Largest surface area ✓/ Grootste oppervlaksarea

(3)

5.3 5.3.1 Temperature ✓/Surface area/State of division.  
 Temperatuur/Oppervlak-area

(1)

5.3.2 Equal to ✓/Gelyk aan

Number/amount of mol/mass of Mg used is the same. ✓  
 Hoeveelheid/aantal mol/massa van Mg gebruik is dieselfde.

(2)

- 5.4 More than ONE independent variable. ✓  
 Meer as EEN onafhanklike veranderlike. (1)

5.5 **Marking criteria/ Nasienriglyne:**

- \* Formula/Formule :  $n = cV$  ✓
- \* Substitution into/Vervanging in:  $n = cV$  ✓
- \* Divide by 24 /Deel deur 24 ✓
- \* Use of ratio/Gebruik verhoudings.:  $n(\text{HCl}) = 2n(\text{Mg})$  ✓
- \*  $n(\text{HCl})$  remaining =  $n(\text{HCl})_{\text{initial}} - n(\text{HCl})_{\text{reacting}}$   $n(\text{HCl})$  ✓  
 $n(\text{HCl})_{\text{oorgebly}} = n(\text{HCl})_{\text{aanvanklik}} - n(\text{HCl})_{\text{gereageer}}$
- \* Substitution of 36,5 into  $n = m/M$  ✓  
 Vervanging van 36,5 in  $n = m/M$
- \* Final answer/Finale antwoord. ✓

$$n(\text{HCl})_{\text{initial/aanvanklik}} = c.V \checkmark$$

$$= 2 \times 80/1\ 000 \checkmark = 0,16 \text{ mol}$$

$$n(\text{Mg})_{\text{reacting/gereageer}} = m/M$$

$$= 0,24/24 \checkmark$$

$$= 0,01 \text{ mol}$$

$$n(\text{HCl})_{\text{reacting/gereageer}} = 2 \times 0,01 \checkmark = 0,02 \text{ mol}$$

$$n(\text{HCl})_{\text{remaining/oorgebly}} = 0,16 - 0,02 \checkmark = 0,14 \text{ mol}$$

$$m(\text{HCl})_{\text{remaining/oorgebly}} = nM = 0,14 \times 36,5 \checkmark = 5,11 \text{ g} \checkmark \quad (7)$$

- 5.6 5.6.1 Number/Fraction of molecules/particles ✓  
 Aantal/Gedeelte van molekules/deeltjies (1)

- 5.6.2 P ✓ (1)

5.6.3 Increase in temperature/Toename in temperatuur

- Increases (average) kinetic energy of particles. ✓  
Toename in (gemiddelde) kinetiese energie van deeltjies.
- More particles have enough/sufficient (kinetic) energy to react./  
 $E_K \geq E_A \checkmark$   
Meer deeltjies het genoegsame (kinetiese) energie om te reageer./  $E_K \geq E_A$
- More effective collisions per unit time/second. ✓  
Meer effektiewe botsings per eenheidstyd/sekonde.

**OR/OF**

- Rate/Frequency of effective collisions increases. ✓  
Tempo/Frekwensie van effektiewe botsings neem toe.
- Increases reaction rate ✓  
Toename in reaksie-tempo. (4)

[22]

## QUESTION/VRAAG 6

6.1 The stage in a chemical reaction when the rate of the forward reaction is equal to the rate of the reverse reaction. ✓✓

*Die stadium in 'n chemiese reaksie wanneer die tempo van die voortwaartse reaksie gelyk aan die tempo van die terugwaartse reaksie is.* (2 or/of 0) (2)

6.2 6.2.1 Increases ✓/Toeneem (1)

6.2.2 Decreases ✓/Afneem



(1)

6.3 Change is opposed/Increase in pressure is opposed/The reaction that will oppose this increase in pressure/decrease the pressure will be favoured. ✓  
*Verandering is teengewerk/Toename in druk is teengewerk/Die reaksie wat hierdie toename in druk teenwerk/laat afneem sal bevoordeel word.*  
 Increase in pressure favours the reaction which produces less gas moles/volume. ✓

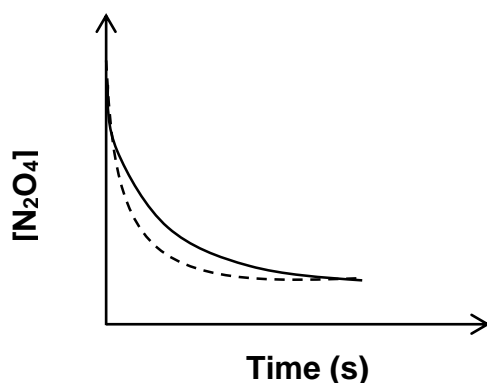
*Toename in druk bevoordeel die reaksie wat minder mol/volume gas produseer.*

The reverse reaction is favoured. ✓

*Die terugwaartse reaksie word bevoordeel.*

(3)

6.4

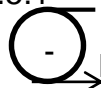


**Notes/Aantekeninge:**

- Curves starts at same concentration and intercept at the same final concentration. ✓  
*Kurwes begin by dieselfde konsentrasie en sny af by dieselfde finale konsentrasie.*
- Broken line on graph is below solid line and levels off faster than the solid line. ✓  
*Stippellyn op grafiek is onder vastelyn en neem vinniger af as vastelyn.*

(2)

6.5 6.5.1 T = 23 °C ✓

Largest  $K_C$  value. ✓ / Grootste  $K_C$  waarde.

(2)

6.5.2 **Marking criteria/ Nasienriglyne:**

- Correct  $K_C$  expression (formulae in square brackets). ✓  
*Korrekte  $K_C$  uitdrukking (formules in vierkanthakies)*
- Substitution of 0,32 for  $K_C$  value. ✓  
*Vervanging van 0,32 as  $K_C$  waarde.*
- Substitute 0,5 as  $[N_2O_4]$  / Vervang 0,5 as  $[N_2O_4]$  ✓
- $[NO_2]$  equilibrium /  $[NO_2]$  by ewewig ✓
- Change in concentration of  $NO_2$  / Verandering in konsentrasie van  $NO_2$  ✓
- Using ratio / Gebruik verhouding:  $N_2O_4 : NO_2 = 1 : 2$  ✓
- Initial  $[N_2O_4] =$  Equilibrium  $[N_2O_4] +$  Change in  $[N_2O_4]$  ✓  
*Aanvanklike  $[N_2O_4] =$  Ewewig  $[N_2O_4] +$  Verandering in  $[N_2O_4]$*

$$K_C = [NO_2]^2 / [N_2O_4] \quad \checkmark$$

$$0,32 \quad \checkmark = [NO_2]^2 / 0,5 \quad \checkmark$$

$$[NO_2] = 0,4 \text{ mol.dm}^{-3}$$

	$N_2O_4$	$NO_2$
Initial concentration (mol.dm <sup>-3</sup> ) <i>Aanvangskonsentrasie (mol.dm<sup>-3</sup>)</i>	✓ 0,7	0
Change in concentration (mol.dm <sup>-3</sup> ) <i>Verandering in konsentrasie (mol.dm<sup>-3</sup>)</i>	0,2	0,4 ✓
Equilibrium concentration (mol.dm <sup>-3</sup> ) <i>Ewewigskonsentrasie (mol.dm<sup>-3</sup>)</i>	0,5	0,4 ✓

Ratio ✓  
Verhouding

(7)

6.5.3 Exothermic. ✓ / Eksotermies

When temperature increases,  $K_C$  decreases ✓ therefore [products] decreases.*Wanneer die temperatuur toeneem, sal  $K_C$  toeneem daarom neem [produkte] af.*

Reverse reaction is favoured. ✓

*Terugwaartse reaksie word bevoordeel.*

Increase in temperature favours the endothermic reaction (reverse reaction). ✓

*Toename in temperatuur bevoordeel endotermiese reaksie (terugwaartse reaksie.)*

(4)

[22]



## QUESTION/VRAAG 7

7.1 7.1.1 An acid that donates one proton ( $H^+$ ) ✓ per molecule.  
 'n Suur wat een proton ( $H^+$ ) per molekkuul skenk. (2)

7.1.2  $CH_3COO^-$  ✓ (1)

7.1.3 Weak acid ✓/Swak suur



Low  $K_a$  value ✓/Lae  $K_a$  waarde (2)

7.2 7.2.1 **OPTION/OPSIE 1**  
 $K_w = [OH^-][H_3O^+]$   
 $10^{-14} = 1 \times 10^{-5} [H_3O^+]$  ✓  
 $[H_3O^+] = 10^{-9} \text{ mol.dm}^{-3}$

$$\begin{aligned} \text{pH} &= -\log [H_3O^+] \checkmark \\ &= -\log 10^{-9} \checkmark \\ &= 9 \checkmark \end{aligned}$$

**OPTION/OPSIE 2**  
 $\text{pOH} = -\log [OH^-] \checkmark$   
 $= -\log(1 \times 10^{-5}) \checkmark$   
 $= 5$

$$\begin{aligned} 14 &= \text{pH} + \text{pOH} \\ 14 &= \text{pH} + 5 \checkmark \\ \text{pH} &= 9 \checkmark \end{aligned}$$

(4)

7.2.2  $c_1V_1 = c_2V_2$   
 $(1 \times 10^{-5})(10) \checkmark = (1 \times 10^{-6})V_2 \checkmark$   
 $V_2 = 100 \text{ cm}^{-3} \checkmark$  (3)

7.3 7.3.1  $n = cV \checkmark$   
 $= (0,8(100/1\ 000)) \checkmark$   
 $= 0,08 \checkmark \text{ (mol)}$  (3)

7.3.2 **Marking criteria/Nasienriglyne:**

- $n(\text{KOH}) = cV \checkmark$
- Substitution of  $c$  and  $V$  to find  $n(\text{KOH}) \checkmark$
- *Substitusie van  $c$  en  $V$  om  $c(\text{KOH})$  te bereken.*
- Use MOL RATIO/Gebruik MOLVERHOUDING:  $n(\text{H}_2\text{SO}_4) : n(\text{KOH}) = 1 : 2 \checkmark$
- $n(\text{H}_2\text{SO}_4)_{\text{reacted/gereageer}} = n(\text{H}_2\text{SO}_4)_{\text{initial/aanvanklik}} - n(\text{H}_2\text{SO}_4)_{\text{excess/oormaat}} \checkmark$
- Use MOL RATIO/Gebruik MOLVERHOUDING:  $n(\text{H}_2\text{SO}_4) : n(\text{Na}_2\text{CO}_3) = 1 : 1 \checkmark$
- Substitution into  $m = nM$  to calculate  $m(\text{Na}_2\text{CO}_3) \checkmark$   
*Substitusie in  $m = nM$  om  $m(\text{Na}_2\text{CO}_3)$  te bereken.*
- Final answer/Finale antwoord: 7.92 g/ 7.95 g ✓



**POSITIVE MARKING from QUESTION 7.3.1**  
**POSITIEWE NASIEN vanaf VRAAG 7.3.1**

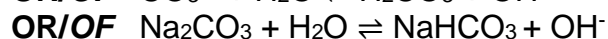
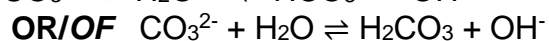
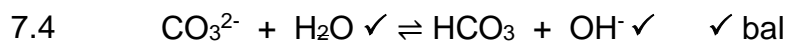
$$n(\text{KOH}) = cV \checkmark = (0,3)(0,035) \checkmark = 0,01 \text{ mol}$$

$$n(\text{H}_2\text{SO}_4) = 1/2n(\text{KOH}) = 0,5(0,01) \checkmark = 0,005 \text{ mol}$$

$$n(\text{H}_2\text{SO}_4)_{\text{reacted/gereageer}} = 0,08 - 0,005 \checkmark = 0,075 \text{ mol}$$

$$n(\text{Na}_2\text{CO}_3) = n(\text{H}_2\text{SO}_4)_{\text{reacted/gereageer}} = 0,075 \text{ mol} \checkmark$$

$$m(\text{Na}_2\text{CO}_3) = nM = (0,075)(106) \checkmark = 7,95 \text{ g} \checkmark \quad (8)$$



**Accept/Aanvaar:** Single arrow/Enkel pyltjie

**Marking guidelines/ Merkriglyne:**

- |   |                                 |                                     |
|---|---------------------------------|-------------------------------------|
| • Reactants ✓<br><i>Reaktanse</i>               | • Products ✓<br><i>Produkte</i> | • Balancing ✓<br><i>Balansering</i> |
| • Marking rule 6.3.10/ <i>Nasienreël 6.3.10</i> |                                 |                                     |

(3)  
[26]

**QUESTION/VRAAG 8**

- 8.1 8.1.1 Percentage yield decreases as the temperature increases. ✓  
*Persentasie opbrengs neem af soos die temperatuur toeneem.*

**OR/OF**

Percentage yield increases as the temperature decreases. ✓  
*Persentasie opbrengs neem toe soos die temperatuur afneem.* (2)

8.1.2 50 ✓ (%) (1)

8.1.3 200 ✓ (atmosphere/atmosfeer) (1)

8.2  $n(\text{N}_2) = m/M = 112/28 \checkmark = 4 \text{ mol}$

$n(\text{NH}_3) = 2n(\text{N}_2) = 2(4) \checkmark = 8 \text{ mol}$

% Yield = Actual yield/Theoretical yield x 100

% Opbrengs = *Werklike opbrengs/Teoretiese opbrengs* x 100

$60 = \text{Actual yield/Werklike opbrengs} \times 100/8 \checkmark$

Actual yield/*Werklike opbrengs* = 4,8 mol ✓ (4)

**[8]****TOTAL/TOTAAL: 150**