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 2023

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 19 pages.
Hierdie nasienriglyne bestaan uit 19 bladsye.

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QUESTION 1/*VRAAG 1*

1.1 D ✓✓ (2)

1.2 D ✓✓ (2)

1.3 A ✓✓ (2)

1.4 B ✓✓ (2)

1.5 D ✓✓ (2)

1.6 C ✓✓ (2)

1.7 C ✓✓ (2)

1.8 A ✓✓ (2)

1.9 B ✓✓ (2)

1.10 D ✓✓ (2)

[20]

QUESTION 2/*VRAAG 2*

2.1 Molecules <u>containing carbon atoms</u>. ✓
Molekule wat <u>koolstofatome bevat.</u> (1)

2.2

2.2.1 2,3-dimethyl✓but-1-ene✓/2,3-dimethyl-1-butene
2,3-dimetielbut-1-een/2,3-dimetiel-1-buteen

<u>Marking criteria:</u>	***<u>Nasienkriteria:</u>***
• Correct stem i.e. <u>but-1-ene</u>. ✓ • IUPAC name completely correct including numbering, sequence, hyphens and commas. ✓	• *Korrekte stam d.i.* <u>but-1-ene</u>. ✓ • *IUPAC-naam heeltemal korrek insluitende nommering, volgorde, koppeltekens en kommas.* ✓

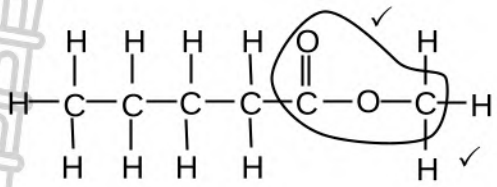
(2)

2.2.2 Butan-2-one/2-butanone/butanone ✓✓
Butan-2-oon/2-butanoon/butanoon (2)

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2.3

2.3.1

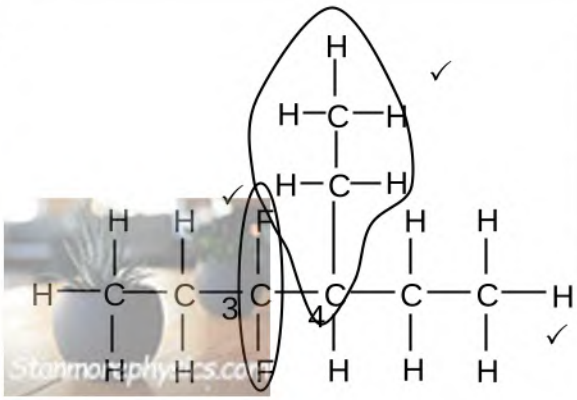


Marking criteria/*Nasienkriteria:*
- Functional group correct✓
  Funksionele groep korrek.
- Whole structure correct. ✓
  Hele struktuur korrek.

IF/*INDIEN*
- More than one functional group/wrong functional group:
  Meer as een funksionele groep/foutiewe funksionele groep: $^0/_2$
- If condensed structural formulae used/*Indien gekondenseerde struktuurformules gebruik:* Max./*Maks.* $^1/_2$

(2)

2.3.2

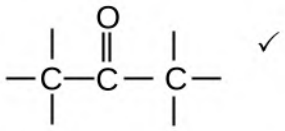


Marking criteria/*Nasienkriteria:*
- Six C atoms in longest chain. ✓
  Ses C-atome in langste ketting.
- Two F atoms on third C atom. ✓
  Twee F-atome op die derde C-atoom.
- Ethyl substituent on fourth C atom. ✓
  Etielsubstituent op die vierde C-atoom.

(3)

2.3.3 C_nH_{2n} ✓ (1)

2.3.4



(1)

2.3.5 Methanol/*Metanol* ✓✓ (2)

2.4.1 B ✓ (1)

2.4.2 D and/*en* G ✓ (1)

[16]

QUESTION 3/*VRAAG 3*

3.1

Marking criteria/*Nasienkriteria*
If any one of the underlined key phrases in the **correct context** is omitted, deduct 1 mark./*Indien enige van die onderstreepte frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*
The underlined phrases must be in the correct context. / *Die onderstreepte frases moet in die korrekte konteks wees.*

The temperature at which the vapour pressure of a substance equals atmospheric pressure. ✓✓
Die temperatuur waarby die dampdruk van die stof gelyk is aan atmosferiese druk. (2)

3.2

Marking criteria/*Nasienkriteria:*
- Dependent and independent variables correctly identified. ✓
  Afhanklike en onafhanklike veranderlikes korrek geïdentifiseer.
- Correct relationship between dependent and independent variables stated. ✓
  Korrekte verwantskap tussen die afhanklike en onafhanklike veranderlikes gestel

The higher the molecular mass the higher the boiling point. / As the molecular mass increases the boiling point increases. / The longer the C-chain length the higher boiling point / The boiling point and the molecular mass are proportional. ✓✓
Hoe hoër die molekulêre massa hoe hoër die kookpunt./Soos die molekulêre massa toeneem, neem die kookpunt ook toe. / Hoe langer die C-kettinglengte hoe hoër is die kookpunt. / Die kookpunt en die molekulêre massa is eweredig. (2)

3.3

Marking criteria:
- Compare the strength of intermolecular forces. ✓
- Compare the energy required to overcome intermolecular forces. ✓

Nasienkriteria:
- *Vergelyk die sterkte van intermolekulêre kragte.* ✓
- *Vergelyk die energie benodig om intermolekulêre kragte te oorkom.* ✓

- Strength of the intermolecular forces increases / More sites for London forces with increase of molar mass/chain length. ✓
- More energy is needed to overcome/break intermolecular forces. ✓

OR
- Strength of the intermolecular forces decreases / Less sites for London forces with decrease in molar mass/chain length. ✓
- Less energy is needed to overcome/break intermolecular forces. ✓

- *Sterkte van die intermolekulêre kragte verhoog / Meer punte vir Londonkragte met 'n toename in molêre massa/kettinglengte.* ✓
- *Meer energie benodig om intermolekulêre kragte te oorkom/breek.* ✓

OF
- *Sterkte van die intermolekulêre kragte verlaag / Minder punte vir Londonkragte met afname in molêre massa/kettinglengte.* ✓
- *Minder energie benodig om intermolekulêre kragte te oorkom/breek.* ✓

(2)

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3.4.1 Aldehyde / *Aldehiede* ✓ (1)

3.4.2

Marking criteria:	**Nasienkriteria:**
• Comparing the strength of intermolecular forces of aldehydes with alcohols and/or carboxylic acids. ✓	• *Vergelyk die sterkte van die intermolekulêre kragte van aldehiede met alkohole en/of karboksielsure.* ✓
• Linking the intermolecular forces to boiling point. ✓	• *Trek die verband tussen die intermolekulêre kragte en die kookpunte.* ✓

- The strength of the intermolecular forces in aldehydes is weaker than in alcohols / carboxylic acids. ✓
- Therefore aldehydes have lower boiling points than alcohols / carboxylic acids ✓

OR

- Carboxylic acids and alcohols have stronger intermolecular forces than aldehydes.
- Therefore carboxylic acids and/or alcohols have higher boiling points than aldehydes.

Stanmorephysics.com

- *Die sterkte van die intermolekulêre kragte tussen aldehiede is swakker as tussen alkohole / karboksielsure.* ✓
- *Dus het aldehiede 'n laer kookpunt as alkohole / karboksielsure.* ✓

OF

- *Karboksielsure en alkohole het sterker intermolekulêre kragte as aldehiede*
- *Dus het alkohole / karboksielsure 'n hoër kookpunt as aldehiede.* (2)

3.5

3.5.1 60 ($g \cdot mol^{-1}$) ✓ (1)

3.5.2 **POSITIVE MARKING FROM QUESTION 3.4/*POSITIEWE NASIEN VAN VRAAG 3.4***

Propan-1-ol/1-propanol ✓✓

Marking criteria:	**Nasienkriteria:**
• Correct chain length, 3 C-atoms ✓	• *Korrekte stamlengte, 3 C-atome.* ✓
• Correct IUPAC name ✓	• *Korrekte IUPAC-naam.* ✓

(2)

3.6

Marking criteria:
- State that carboxylic acids have two sites for hydrogen bonding. ✓
- State that alcohols have one site for hydrogen bonding. ✓
- Comparing the strength of IMF's / the energy needed to overcome IMF's. ✓

Nasienkriteria:
- *Stel dat karboksielsure twee plekke het vir waterstofbindings.*
- *Stel dat alkohole een plek het vir waterstofbinding.*
- *Vergelyk die sterkte van die IMK's / energie benodig om IMK's te oorkom.*

- Carboxylic acids/B have, in addition to London forces and dipole-dipole forces, two sites for hydrogen bonding between molecules. ✓

OR

Carboxylic acids can form dimers due to strong hydrogen bonding between molecules.

- Alcohols/A have, in addition to London forces and dipole-dipole forces, one site for hydrogen bonding between molecules. ✓
- Intermolecular forces in carboxylic acids are stronger./More energy needed to overcome/break intermolecular forces in carboxylic acid/B. ✓

- *Karboksielsure het, in toevoeging tot Londonkragte en dipool-dipoolkragte, twee punte vir waterstofbinding tussen molekule.*

OF

Karboksielsure kan dimere vorm as gevolg van sterk waterstofbindings tussen molekule.

- *Alkohole het, in toevoeging tot Londonkragte en dipool-dipoolkragte, een punt vir waterstofbinding tussen molekule.*
- *Intermolekulêre kragte in karboksielsure is sterker./Meer energie word benodig om intermolekulêre kragte in karboksielsure te oorkom/breek.*

(3)
[15]

QUESTION 4/*VRAAG 4*

4.1

4.1.1

Marking criteria/*Nasienkriteria*
If any one of the underlined key phrases in the **correct context** is omitted, deduct 1 mark./*Indien enige van die onderstreepte frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*
The underlined phrases must be in the correct context. / *Die onderstreepte frases moet in die korrekte konteks wees.*

The chemical process in which longer chain hydrocarbon molecules are broken down to shorter (more useful) molecules. ✓✓
Die chemiese proses waarin langer kettingkoolwaterstof-molekule afgebreek word in korter, (meer bruikbare), molekules. (2)

4.1.2 X = 12 ✓
Y = 2 ✓
Z = 4 ✓ (3)

4.1.3

Marking criteria/*Nasienkriteria*
- Reactants ✓ products ✓ / *Reaktanse produkte*
- Balancing✓/*Balansering*

$2C_6H_{14} + 19O_2$ ✓ → $12CO_2 + 14H_2O$ ✓ Bal ✓

Notes/*Aantekeninge:*
- Ignore double arrows and phases./*Ignoreer dubbelpyle en fases.*
- Marking rule 6.3.10/*Nasienreël 6.3.10.*
- If condensed structural formulae used:/*Indien gekondenseerde struktuurformules gebruik:* Max/*Maks.* $^2/_3$ (3)

4.2

4.2.1

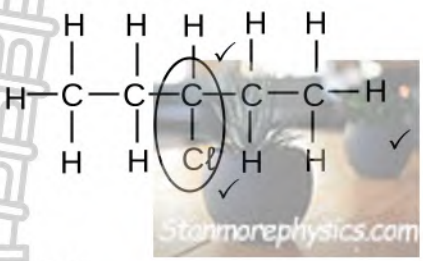
Marking criteria/*Nasienkriteria*
If any one of the underlined key phrases in the **correct context** is omitted, deduct 1 mark./*Indien enige van die onderstreepte frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*
The underlined phrases must be in the correct context. / *Die onderstreepte frases moet in die korrekte konteks wees.*

Compounds with the same molecular formula, but different positions of the side chain, substituents or functional groups on the parent chain. ✓✓
Verbindings met dieselfde molekulêre formule, maar verskillende posisies van die syketting, substituente of funksionele groepe op die stamketting. (2)

4.2.2 Addition/hydrohalogenation/hydrochlorination ✓
Addisie/hidrohalogenering/hidrochlorinering (1)

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4.2.3



Marking criteria/*Nasienkriteria*:
- Chlorine atom bonded to any C-atom ✓
  Chlooratoom gebind aan enige C-atoom
- Correct functional group on third C-atom ✓
  Korrekte funksionele groep op derde C-atoom
- Whole structure correct ✓
  Hele struktuur korrek

(3)

4.2.4 HCℓ ✓ (1)

4.2.5 Concentrated sulphuric acid/H_2SO_4(conc./gek.) ✓
Gekonsentreerde swawelsuur (1)

4.2.6 Concentrated strong base ✓
OR
Concentrated NaOH/KOH/LiOH/sodium hydroxide/ potassium hydroxide/ lithium hydroxide
OR
Strong base/NaOH/KOH/LiOH/sodium hydroxide/ potassium hydroxide/lithium hydroxide in ethanol.

Gekonsentreerde sterk basis
OF
Gekonsentreerde NaOH /KOH/ LiOH /natriumhidroksied/ kaliumhidroksied/ litiumhidroksied
OF
Sterk basis/NaOH /KOH/ LiOH / natriumhidroksied/kaliumhidroksied/litium-hidroksied in etanol (1)

4.2.7 Elimination ✓
Dehydrohalogenation/dehydrochlorination ✓

Eliminasie
Dehidrohalogenering/dehidrohalogenasie/dehidrochlorinasie/ dehidrochlonering (2)

[19]

QUESTION 5/*VRAAG 5*

5.1 **ANY ONE:**

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

ENIGE EEN:

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

5.2 Concentration (of $Na_2S_2O_3$)/*Konsentrasie van ($Na_2S_2O_3$)* ✓ (1)

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5.3

Marking criteria/*Nasienkriteria*:
- Substitute/*Vervang* 0,03 x 0,13 / 30 x 0,13✓
- Substitute/*Vervang* 50 OR/*OF* 0,05 ✓
- Final correct answer/*Finale korrekte antwoord*: 0,078 mol·dm^{-3} ✓
  Range 0,075 to 0,08 mol·dm^{-3}

OPTION 1/*OPSIE 1*

$c = \frac{n}{V}$

$0,13 = \frac{n}{0,03}$ ✓

$n = 3,9 \times 10^{-3}$ moles/*mol*

$c = \frac{n}{V}$ ↓

$c = \frac{3,9 \times 10^{-3}}{0,05}$ ✓

$= 0,078$ mol·dm^{-3} ✓

OPTION 2/*OPSIE 2*

$c_1V_1 = c_2V_2$

$(0,13)(0,030)$ ✓ $= c_2\,(0,50)$ ✓

$c_2 = 0,078$ mol·dm^{-3} ✓

OPTION 3/*OPSIE 3*

Marking criteria/*Nasienkriteria*:
- Substitute/*Vervang* 0,05 x 0,13 OR/*OF* 50 x 0,13 ✓
- Substitute/*Vervang* 50 OR/*OF* 0,05 ✓
- Final correct answer/*Finale korrekte antwoord*: 0,078 mol·dm^{-3} ✓
  Range 0,075 to 0,08 mol·dm^{-3}

$c = \frac{n}{V}$

$0,13 = \frac{n}{0,05}$ ✓

$n = 6,5 \times 10^{-3}$ moles/*mol*

$V_2 : V_1$

$3 : 5$

$3,9 \times 10^{-3} : 6,5 \times 10^{-3}$

$c = \frac{n}{V}$ ↓

$c = \frac{3,9 \times 10^{-3}}{0,05}$ ✓

$= 0,078$ mol·dm^{-3} ✓

OR/*OF*

$c = \frac{n}{V}$

$0,10 = \frac{n}{0,05}$ ✓

$n = 5 \times 10^{-3}$ moles/*mol*

$V_2 : V_1$ ↓

$3 : 4$

$3,75 \times 10^{-3} : 5 \times 10^{-3}$

$c = \frac{n}{V}$ ↓

$c = \frac{3,75 \times 10^{-3}}{0,05}$ ✓

$= 0,075$ mol·dm^{-3} ✓

OPTION 4/*OPSIE 4*

$\frac{3}{5}$ ✓ x 0,13 ✓ $= 0,078$ mol·dm^{-3} ✓

(3)

5.4

Marking criteria:

- Substitute to calculate n(S): $\frac{0,21}{32}$ ✓
- Use mol/M ratio: n(S) = $n(Na_2S_2O_3)$ ✓
- Substitute M = 158 g·mol^{-1} in formula $n(Na_2S_2O_3) = \frac{m}{M}$ ✓
- Substitute t = 20,4 s into rate formula. ✓
- Final correct answer: 0,051 (g·s^{-1}) ✓

Range: 0,050 to 0,080 (g·s^{-1})

Nasienkriteria:

- *Vervang om te bereken* n(S): $\frac{0,21}{32}$ ✓
- *Gebruik mol/M-verhouding:* n(S) = $n(Na_2S_2O_3)$ ✓
- *Vervang* M = 158 g·mol^{-1} in formula $n(Na_2S_2O_3) = \frac{m}{M}$ ✓
- *Vervang t = 20,4 s in tempo formule.* ✓
- *Finale korrekte antwoord*: 0,051 (g·s^{-1})✓

Range/*Gebied: 0,050 to 0,080* (g·s^{-1})

OPTION 1/*OPSIE 1*

$n(S) = \frac{m}{M}$

$= \frac{0,21}{32}$ ✓

= 0,00656 moles/*mol* ($6,56 \times 10^{-3}$)

$n(S) = n(Na_2S_2O_3)$

= 0,00656 moles/*mol* ✓

$n(Na_2S_2O_3) = \frac{m}{M}$

$0,00656 = \frac{m}{158}$ ✓

$m(Na_2S_2O_3)$ = 1,04 g

OPTION 2/*OPSIE 2*

158 g $Na_2S_2O_3$ ✓ → 32 g S ✓

x g → 0,21 g ✓

x = 1,04 g

Rate/*Tempo* = $\frac{\Delta m}{\Delta t}$

$= \frac{1,04}{20,4}$ ✓

= 0,051 (g·s^{-1}) ✓

ACCEPT/*AANVAAR:*

$c = \frac{n}{V}$

$0,13 = \frac{n}{0,05}$

= 0,00656

$n(Na_2S_2O_3) = \frac{m}{M}$

$0,00656 = \frac{m}{158}$ ✓

= 1,03 g (1,027)

Rate/*Tempo* = $\frac{\Delta m}{\Delta t}$

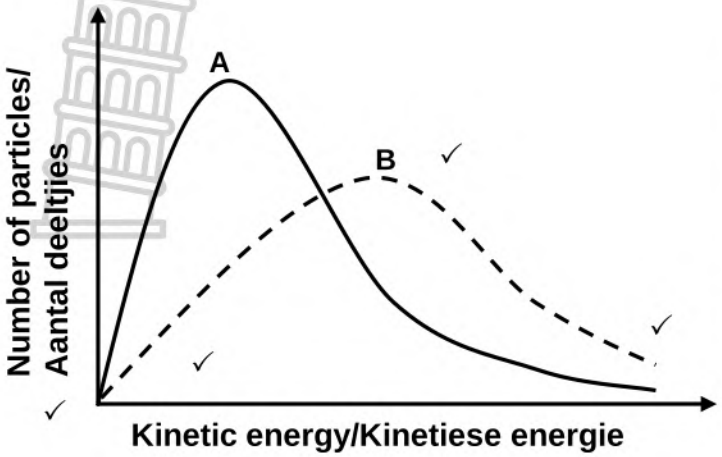
$= \frac{1,03}{20,4}$ ✓

= 0,05 (g·s^{-1}) ✓

Max/*Maks.* $^3/_5$

(5)

5.5



Marking criteria/*Nasienkriteria:*

- Both axis labelled correctly. ✓
  Beide asse korrek benoem
- Both curves start at origin and have correct shape. ✓
  Beide kurwes begin by die oorsprong en het dieselfde vorm.
- Peak of curve B must be lower than curve A. ✓
  Maksimum van kurwe B moet laer wees as kurwe A.
- Peak of curve B must have higher kinetic energy than curve A up to end of curve. ✓
  Maksimum van kurwe B moet hoër wees as kinetiese energie van kurwe A tot by die einde.

(4)

5.6

- At a higher temperature particles move faster/have higher kinetic energy. ✓

- More molecules have enough/sufficient kinetic energy for an effective collision. ✓

OR More molecules have kinetic energy/E_k equal to or greater than the activation energy.

- More effective collisions per unit time/second. ✓

OR Frequency of effective collisions increases.

- Reaction rate increases. ✓

- *By 'n hoër temperatuur beweeg die deeltjies vinniger/het die deeltjies hoër kinetiese energie.* ✓

- *Meer molekule het genoeg/voldoende kinetiese energie/E_k vir 'n effektiewe botsing.* ✓

***OF** Meer molekule het kinetiese energie gelyk aan of groter as die aktiveringsenergie.*

- *Meer effektiewe botsings per eenheidtyd/sekonde.* ✓

***OF** Frekwensie van effektiewe botsings verhoog.*

- *Reaksietempo neem toe.* ✓

(4)
[19]

QUESTION 6/*VRAAG 6*

6.1 A reaction is reversible when products can be converted back to reactants (and vice versa). ✓
'n Reaksie is omkeerbaar wanneer produkte terug na reaktanse, en (omgekeerd), omgeskakel kan word. (1)

6.2

Marking criteria/*Nasienkriteria:*
If any one of the underlined key phrases in the **correct context** is omitted, deduct 1 mark./*Indien enige van die onderstreepte frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*
The underlined phrases must be in the correct context. / *Die onderstreepte frases moet in die korrekte konteks wees.*

When the equilibrium in a closed system is disturbed, the system will re-instate a new equilibrium by favouring the reaction that will cancel/oppose the disturbance. ✓✓
Wanneer die ewewig in 'n geslote sisteem versteur word, sal die sisteem 'n nuwe ewewig instel deur die reaksie te bevoordeel wat die versteuring kanselleer/teenwerk. (2)

6.3.1 The amount of $A_2(g)$ was increased./A_2 was added into the container. ✓
Die hoeveelheid $A_2(g)$ is verhoog./A_2 is bygevoeg in die houer. (1)

6.3.2
- Increase in A_2 favours the reaction that uses or decreases the amount/concentration of A_2. ✓
- The reverse reaction is favoured/amount or concentration of products decreases/amount or concentration of reactants increases. ✓

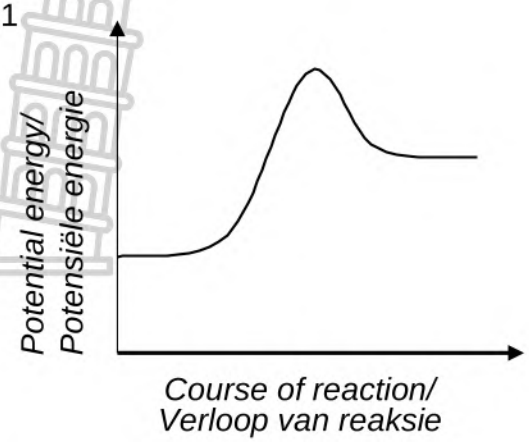
- *'n Toename in A_2 bevoordeel die reaksie wat die hoeveelheid/konsentrasie van A_2 verlaag*
- *Die terugwaartse reaksie is bevoordeel/hoeveelheid of konsentrasie van die produkte neem af/die hoeveelheid of konsentrasie van die reaktante neem toe.* (2)

6.4

Marking criteria/*Nasienkriteria:*	**OPTION 1/*OPSIE 1***
• Correct Kc expression./ *Korrekte K_c-uitdrukking.* ✓ • Substitution of $[A_2]$ and $[B_2]$ at equilibrium. ✓ *Substitusie van $[A_2]$ en $[B_2]$ by ewewig.* • Substitution of [AB] at equilibrium. ✓ *Substitusie van [AB] by ewewig.* • Final correct answer/*Finale korrekte antwoord*: 0,16✓ **IF/INDIEN:** Wrong or no K_c expression: *Verkeerde of geen K_c- uitdrukking*: *Max./Maks.* $^2/_4$ Moles substituted/*Mol vervang Max./Maks.* $^2/_4$	$Kc = \frac{[A_2][B_2]}{[AB]^2}$ ✓ $= \frac{\left(\frac{8}{4}\right)\left(\frac{2}{4}\right)}{\left(\frac{10}{4}\right)^2}$ ✓ ✓ = 0,16 ✓
	OPTION 2/*OPSIE 2*
	$Kc = \frac{[A_2][B_2]}{[AB]^2}$ ✓ $= \frac{(2)(0,5)}{(2,5)^2}$ ✓ ✓ = 0,16 ✓

(4)

6.5.1



Marking criteria/*Nasienkriteria:*
- Both axes correctly labelled and correct shape of Ep curve. ✓
  Asse korrek benoem en korrekte vorm van Ep-kurwe
- Shape of Ep curve for endothermic reaction as shown. ✓✓
  Vorm van kurwe vir endotermiese reaksie soos getoon.

(3)

6.5.2
- Smaller than ✓

- Products/B_2/A_2 amount/concentration decreases. ✓
- Reactants/AB amount/concentration increases. ✓

OR

The reverse reaction is favoured. / Equilibrium (position) shifts to the left.✓✓

- *Kleiner as*

- *Produkte/B_2/A_2 hoeveelheid/ konsentrasie neem af.*
- *Reaktanse/AB hoeveelheid/konsentrasie neem toe.*

OF

Die terugwaartse reaksie word bevoordeel./Die ewewigs(posisie) skuif na links. (3)

6.6
- Both forward and reverse reaction rates increase equally. / Gradient of three curves will be steeper. ✓✓
- Reaches equilibrium sooner/less than 40 s. / The graph becomes horizontal sooner. ✓

- *Beide die voorwaartse en terugwaartse reaksietempo verhoog dieselfde. / Gradiënt van al drie kurwes is steiler.*
- *Ewewig word vinniger/korter tyd/minder as 40 s bereik. / Grafiek neem korter tyd om horisontaal te word.*

(3)
[19]

QUESTION 7/VRAAG 7

7.1 A strong base ionises/dissociates completely ✓ in water. ✓
Sterk basis ioniseer/dissosieer volledig in water. (2)

7.2.1 $n(Ba(OH)_2) = cV$ ✓
$= 0,15 \times 0,02$ ✓
$= 0,003$ mol ✓ (3)

7.2.2 **POSITIVE MARKING FROM QUESTION 7.2.1/**
POSITIEWE NASIEN VAN VRAAG 7.2.1

Marking citeria:	**Nasienkriteria:**
(a) Use ratio: $2nBa(OH)_2$ (7.2.1) = $nHNO_3$ ✓	***(a)*** *Gebruik verhouding:* $2nBa(OH)_2$ *(7.2.1)* = $nHNO_3$ ✓
(b) Substitute nH_3O^+ or $nHNO_3$ and 0,045 dm^3 in $c = \frac{n}{V}$ ✓	***(b)*** *Vervang* nH_3O^+ *of* $nHNO_3$ *en* *0,045* dm^3 *in* $c = \frac{n}{V}$ ✓
(c) Formula: $pH = -\log[H_3O^+]$ ✓	***(c)*** *Formule:* $pH = -\log[H_3O^+]$ ✓
(d) Substitute $[H_3O^+]$ in pH formula ✓	***(d)*** *Vervang* $[H_3O^+]$ *in pH formule* ✓
(e) Final correct answer: 0,89✓ Range: 0,88 to 0,89	***(e)*** *Finale korrekte antwoord: 0,89* ✓ Gebied: 0,88 tot 0,89

$nHNO_{3\ reacted} = 2nBa(OH)_2$
$= 2(0,003)$ ✓**(a)**
$= 0,006$ mol

OPTION 1/ *OPSIE 1*

$n(H_3O^+) = n(HNO_3)$
$= 0,006$ mol

$[H_3O^+] = \frac{n}{V}$
$= \frac{0,006}{0,045}$ ✓**(b)**
$= 0,13$ mol·dm^{-3}

OPTION 2/*OPSIE 2*

$[HNO_3] = \frac{n}{V}$
$= \frac{0,006}{0,045}$ ✓**(b)**
$= 0,13$ mol·dm^{-3}

$[H_3O^+] = [HNO_3]$
$= 0,13$ mol·dm^{-3}

$pH = -\log[H_3O^+]$ ✓**(c)**
$= -\log(0,13)$ ✓**(d)**
$= 0,89$ ✓**(e)** (5)

7.3 **POSITIVE MARKING FROM QUESTION 7.2.2/**
POSITIEWE NASIEN VAN VRAAG 7.2.2

Marking citeria:	***Nasienkriteria**:*
(a) Substitute [HNO_3] = 0,4 mol·dm^{-3} and 0,025 dm^3 ✓	**(a)** *Vervang: [HNO_3] = 0,4 mol·dm^{-3} en 0,025 dm^3* ✓
(b) Subtract: $n(HNO_3)_{ini} - n(HNO_3)_{excess}$ (7.2.2) ✓ ✓	**(b)** *Trek af:* $n(HNO_3)_{aanv} - n(HNO_3)_{oormaat}$ *(7.2.2)* ✓✓
(c) Use of ratio $n(MCO_3) = ½n(HNO_3)$ ✓	**(c)** *Gebruik verhouding:* $n(MCO_3) = ½n(HNO_3)$ ✓
(d) Calculate the pure $m(MCO_3)$ ✓	**(d)** *Bereken suiwer* $m(MCO_3)$ ✓
(e) Substitute $n(MCO_3)$ and $m(MCO_3)$ in $n = \frac{m}{M}$ ✓	**(e)** *Vervang* $n(MCO_3)$ *en* $m(MCO_3)$ *in* $n = \frac{m}{M}$ ✓
(f) Calculation of 24 g·mol^{-1} ✓	**(f)** *Berekening van* 24 g·mol^{-1} ✓
(g) Correct answer: Mg ✓	**(g)** *Korrekte antwoord: Mg* ✓

$n(HNO_3)_{ini} = cV$
$= 0,4 \times 0,025$ ✓ **(a)**
$= 0,01$ mol

$n(HNO_3)_{react} = n(HNO_3)_{ini} - n(HNO_3)_{excess}$
$= 0,01 - 0,006$ ✓✓ **(b)**
$= 0,004$ mol

$n(MCO_3) = ½n(HNO_3)$
$= ½(0,004)$ ✓**(c)**
$= 0,002$ mol

$m(MCO_3) = \frac{85}{100} \times 0,198$ ✓**(d)**
$= 0,168$ g

$n(MCO_3) = \frac{m}{M}$
$0,002 = \frac{0,168}{M}$ ✓**(e)**
$M(MCO_3) = 84$ g·mol^{-1}

Molar mass (M) = 84 - 60 ✓**(f)**
$= 24$ g·mol^{-1}
Therefore metal M is Mg ✓**(g)**

(8)
[18]

QUESTION 8/*VRAAG 8*

8.1.1 Copper strip becomes thinner/decreases in mass/solid/silver coloured particles in solution/the copper becomes plated with silver ✓
Koper plaatjie word dunner/massa neem af/vaste stof/silwer-kleurige deeltjies in oplossing. (1)

8.1.2 Ag^+ ion/*-ioon* / Silver ion/Silwer-ioon ✓ (1)

8.2 Ag^+ ion is a stronger oxidising agent ✓ than Cu^{2+} ion ✓ and will oxidise Cu to (blue) Cu^{2+} ion. ✓
OR
Cu^{2+} ion is a weaker oxidising agent ✓ than Ag^+ ion ✓ and Cu will be oxidised to Cu^{2+} ion. ✓
OR
Cu/Copper is a stronger reducing agent ✓ than Ag/Silver ✓ and will reduce silver ions to silver. ✓

Ag^+ -ioon is 'n sterker oksideermiddel as Cu^{2+} -ioon en sal Cu na (blou) Cu^{2+} - ioon oksideer.
OF
Cu^{2+} -ioon is 'n swakker oksideermiddel as Ag^+ -ioon en daarom sal Cu na (blou) Cu^{2+} -ioon geoksideer word.
OF
Cu/Koper is 'n sterker reduseermiddel as Ag/Silwer en sal silwer-ione na silwer reduseer. (3)

8.3

8.3.1 Silver/Ag/*Silwer* ✓ (1)

8.3.2 $CuSO_4$/Cu^{2+} /Copper (II) ions/copper(II) sulphate/*Koper(II)-ione/ koper(II)sulfaat* ✓ (1)

ACCEPT/*AANVAAR*:
Any soluble copper(II) salt/*Enige oplosbare koper(II)sout*

8.3.3 $2Ag^+(aq) + Cu(s) \rightarrow 2Ag(s) + Cu^{2+}(aq)$ ✓ ✓ Bal ✓

Marking criteria/*Nasienkriteria:*
- Reactants ✓ *Reaktanse* Products ✓ *Produkte* Balancing: ✓ *Balansering*
- Ignore double arrows./*Ignoreer dubbelpyle.*
- Ignore phases./*Ignoreer fases.*
- Marking rule 6.3.10./*Nasienreël 6.3.10.* (3)

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8.4 K^+ ✓
The positive ions move to the silver ion solution to maintain the ion balance/electrical neutralitity/[Ag^+] decreases. ✓
OR
It is the cathode.
OR
Positive charges decrease.

Die positiewe ione beweeg na die silwerioon-oplossing om ioon-balans/elektriese neutralitiet te handhaaf/[Ag^+] neem af.
OF
Dit is die katode.
OF
Positiewe ladings verminder. (2)
[12]

QUESTION 9/*VRAAG 9*

9.1 **ANY ONE/*ENIGE EEN:***
- The chemical process in which electrical energy is converted to chemical energy. ✓✓
  Die chemiese proses waarin elektriese energie omgeskakel word na chemiese energie.
- The use of electrical energy to produce a chemical change.
  Die gebruik van elektriese energie om 'n chemiese verandering te weeg te bring.
- Decomposition of an ionic compound by means of electrical energy.
  Ontbinding van 'n ioniese verbinding met behulp van elektriese energie.
- The process during which an electric current passes through a solution/ionic liquid/molten ionic compound.
  Die proses waardeur 'n elektriese stroom deur 'n oplossing/ioniese vloeistof/gesmelte ioniese verbinding beweeg. (2)

9.2 $Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$ ✓✓
Ignore phases/*Ignoreer fases*

Marking criteria/*Nasienkriteria:*
- $Cu(s) \leftarrow Cu^{2+}(aq) + 2e^-$ ($^2/_2$) $Cu^{2+}(aq) + 2e^- \rightleftharpoons Cu(s)$ ($^1/_2$)
  $Cu^{2+}(aq) + 2e^- \leftarrow Cu(s)$ ($^0/_2$) $Cu(s) \rightleftharpoons Cu^{2+}(aq) + 2e^-$ ($^0/_2$)
- Ignore if charge omitted on electron./*Ignoreer indien lading weggelaat op elektron.*
- If charge (+) omitted on Cu^{2+}/*Indien lading (+) weggelaat op* Cu^{2+}:
  Example/*Voorbeeld:* $Cu^2(aq) + 2e^- \rightarrow Cu(s)$ Max./*Maks:* $^1/_2$ (2)

9.3 R to/*na* Q ✓ (1)

9.4

Marking criteria:	***Nasienkriteria:***
(a) Substitution of 63,5 into $n = \frac{m}{M}$ ✓	**(a)** *Vervang 63,5 in* $n = \frac{m}{M}$ ✓
(b) N(electrons) = N(Cu atoms) x 2 ✓	**(b)** *N(elektrone) = N(Cu-atome) x 2* ✓
(c) Substitute 1,6 x 10^{-19} C in $n = \frac{Q}{e}$ ✓	**(c)** *Vervang 1,6 x 10^{-19} C in* $n = \frac{Q}{e}$ ✓
(d) Substitute (5)(60)(60) in $I = \frac{Q}{\Delta t}$ ✓	**(d)** *Vervang (5)(60)(60) in* $I = \frac{Q}{\Delta t}$ ✓
(e) Final correct answer: 2,68 A ✓ Range: 2,68 *to 2,70* A	**(e)** *Finale korrekte antwoord: 2,68 A* ✓ *Gebied: 2,68 tot 2,70 A*

$n(Cu) = \frac{m}{M}$

$n(Cu) = \frac{16}{63,5}$ ✓**(a)**

$= 0,25$ mol

$n \text{ atoms}(Cu) = \frac{N}{N_A}$

$0,25 = \frac{N}{6,02 \times 10^{23}}$

$= 1,5 \times 10^{23}$ atoms

N electrons = $(1,5 \times 10^{23})(2)$ ✓**(b)**

$= 3 \times 10^{23}$ electrons

N electrons = $\frac{Q}{e}$ **OR/*OF*** $\frac{Q}{q_e}$

$3 \times 10^{23} = \frac{Q}{1,6 \times 10^{-19}}$ ✓**(c)**

$= 48\,160$ C

$I = \frac{Q}{\Delta t}$

$= \frac{48\,160}{(5)(60)(60)}$ ✓**(d)**

$= 2,68$ A ✓**(e)**

(5)

9.5 Ag/silver is a weaker reducing agent ✓ than Cu/coper or Zn/zinc ✓ and will not be oxidised.
Ag/silwer is 'n swakker reduseermiddel as Cu/koper of Zn/sink en sal nie geoksideer word nie.
Voltage of power source is not effective enough to oxidise Ag/silver./ ✓✓
Die potensiaalverskil van die energiebron is nie effektief genoeg om die Ag/silwer te oksideer nie.

(2)
[12]

TOTAL/*TOTAAL*: 150

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