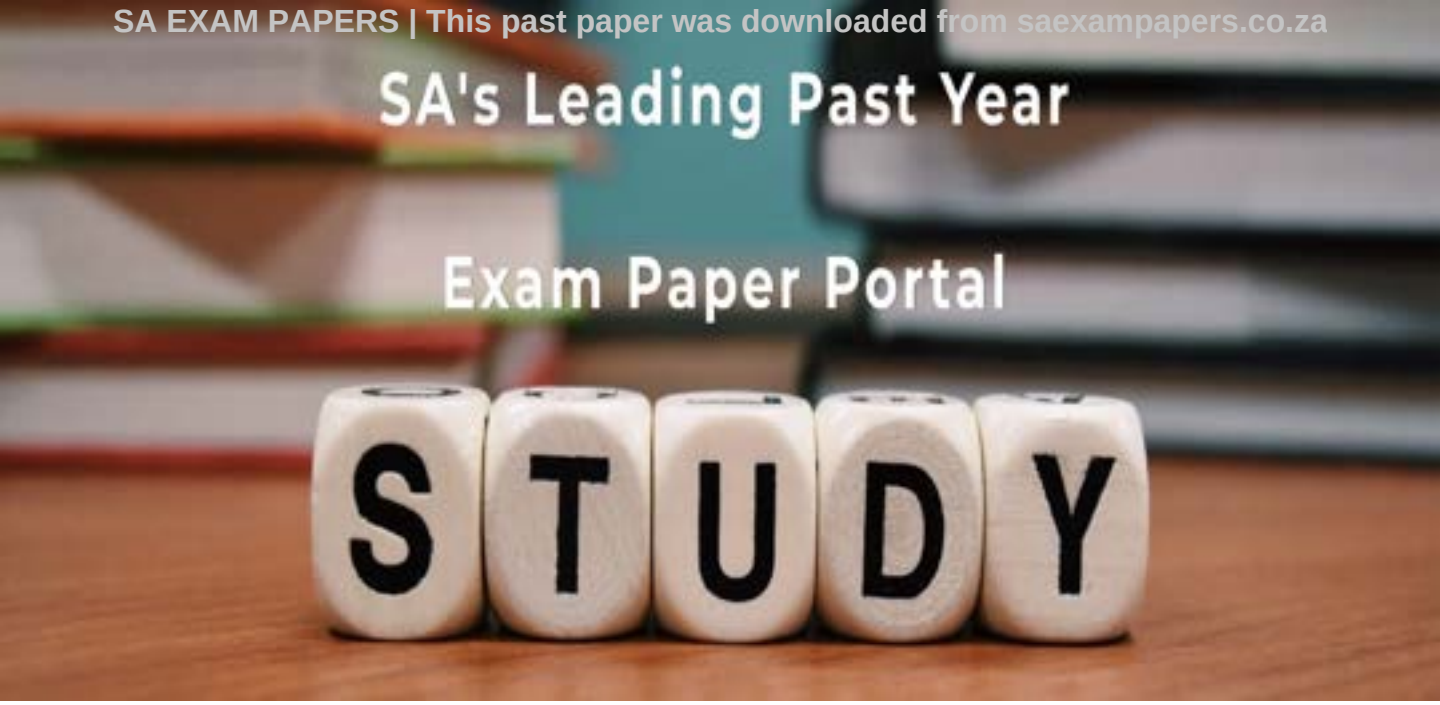


Western Cape Government
Education
FOR YOU

CAPE WINELANDS EDUCATION DISTRICT

PHYSICAL SCIENCES MEMORANDUM PAPER 2
GRADE 12

COMMON PRELIMINARY EXAMINATION

SEPTEMBER 2024

MARKS: 150

TIME: 3 hours

This marking guideline consists of 14 pages

QUESTION 1/ VRAAG 1 (MULTIPLE-CHOICE/ MEERVOUDIGEKEUSE)

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

[20]

QUESTION 2/ VRAAG 2

2.1 A series of organic compounds that can be described by the same general formula *OR* A series of organic compounds in which one member differs from the next with a CH_2 group. ✓✓

'n Reeks organiese verbindings wat deur dieselfde algemene formule beskryf kan word *OF* 'n Reeks organiese verbindings waarin een lid van die volgende verskil met 'n CH_2-groep. ✓✓

Marking criteria/Nasienkriteria:

If any of the underlined key phrases in the correct context is omitted, deduct 1 mark. Indien enige van die onderstreepte sleutelfrases in die korrekte konteks weggelaat word, trek 1 punt af.

(2)

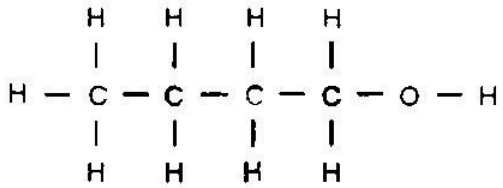
2.2.1 F✓ (1)

2.2.2 E & H✓ (1)

2.2.3 D✓ (1)

2.2.4 H✓ (1)

2.3



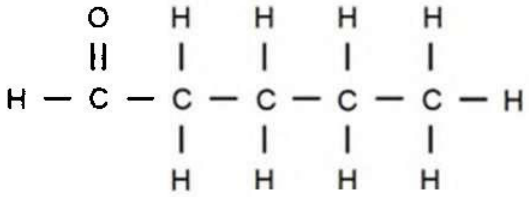
Mark allocation/ Puntetoekenning:
-OH on first carbon/ -OH op eerste koolstof✓
rest of molecule correct/ res van molekule korrek✓ (2)

2.4.1 3-methylpentan-2-one **Marking allocation:** 3-methyl✓pentan-2-one ✓
3-metielpentan-2-oon **Punte toekenning:** 3-metiel✓pentan-2-oon ✓ (2)

2.4.2 2,2,4-tribromo-3-ethylhexane / 2,2,4-tribromo-3-etielheksaan

Marking criteria / Nasienriglyne:
• Correct stem i.e. hexane. / Korrekte stam d.i. heksaan.
• All substituents correctly identified. / Alle substituente korrek geïdentifiseer.
• Substituents correctly numbered, in alphabetical order, hyphens and commas correctly used.
Substituente korrek genommer, in alfabetiese volgorde, koppeltekens en kommas korrek gebruik. (3)

2.5



Mark allocation/ Puntetoekenning:
Functional group (formyl group)/Funksionele groep (formielgroep)✓
Whole molecule correct/Hele molekule korrek✓ (2)

2.6 $C_9H_{20} + 14O_2 \rightarrow 9CO_2 + 10H_2O$
reactants/reaktante ✓ products/produkte ✓ balancing/balansering✓ (3)

[18]

QUESTION 3/ VRAAG 3

3.1 Boiling point is the temperature at which the vapour pressure of a substance is equal to the atmospheric pressure.✓✓
Kookpunt is die temperatuur waarby die dampdruk van 'n stof gelyk is aan die atmosferiese druk.✓✓
Marking criteria/Nasienkriteria:

If any of the underlined key phrases in the correct context is omitted, deduct 1 mark. Indien enige van die onderstreepte sleutelfrases in die korrekte konteks weggelaat word, trek 1 punt af.

(2)

3.2.1 **FROM A TO C**
- Increase branching/smaller surface area/more compact✓
- Weaker intermolecular forces✓
- Less energy needed to break the intermolecular forces✓
- Boiling point decreases✓

VANAF A TOT C
- Vergroot vertakking/kleiner oppervlakte/meer kompak
- Swakker intermolekulêre kragte
- Minder energie benodig om die intermolekulêre kragte te breek
- Kookpunt neem af (4)

3.2.2 C/2,2-dimethylpropane / 2,2-dimetielpropaan ✓ (1)

3.2.3 Lowest boiling point / Laagste kookpunt✓ (1)

3.3 Greater than (103 °C)✓
• Between compound D/pentanal molecules are dipole-dipole forces✓ (and London forces) and between compound E/butanoic acid are hydrogen bonds✓ (dipole-dipole and London forces).
• Dipole-dipole forces are weaker than hydrogen bonds.✓
OR
Intermolecular forces between compound D/pentanal molecules are weaker than those between compound E/butanoic acid molecules.
OR
Less energy is needed to break the intermolecular forces between pentanal molecules.

Groter as (103 °C)
• Tussen verbinding D/pentanaal molekules is dipool-dipoolkragte (en Londen-kragte) en tussen verbinding E/butanoësuur is waterstofbindings (dipool-dipool en Londen-kragte).
• Dipool-dipoolkragte is swakker as waterstofbindings.
OF
Intermolekulêre kragte tussen verbinding D/pentanaal molekules is swakker as dié tussen verbinding E/butanoësuur molekules.
OF
Minder energie benodig om die intermolekulêre kragte tussen pentanaal molekules te breek. (4)

3.4 Yes/Ja✓ (1)

3.5 Comparable molecular masses OR only functional group (homologous series) changed/only 1 independent variable✓

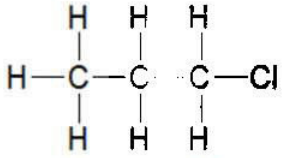
Vergelykbare molekulêre massas OF slegs funksionele groep (homoloë reeks) verander/slegs 1 onafhanklike veranderlike. (1)

[14]

QUESTION 4/ VRAAG 4

4.1.1 Hydrohalogenation/ Hydrochlorination✓
Hidrohalogenering/Hidrochlorinering (1)

4.1.2



1-chloropropane/ 1-chloropropaan

Mark allocation/Punte toekenning:
Cℓ on first carbon✓ Whole structural formula correct✓ Correct IUPAC name✓
Cℓ op eerste koolstof. Hele struktuurformule korrek. Korrekte IUPAC naam.
Note: Negative marking on naming if the structural formula is incorrect.
Let wel: Negatiewe nasien by benaming as die struktuurformule verkeerd is. (3)

4.1.3 No water present/ Geen water teenwoordig✓ (1)

4.2.1 Substitution/ Hydrolysis ✓
Substitusie/ Hidrolise (1)

4.2.2 The use of a concentrated strong base will result in an elimination reaction✓ thus producing propene and not a substitution reaction as desired.
Die gebruik van 'n gekonsentreerde sterk basis sal lei tot 'n eliminasiereaksie wat dus propeen produseer en nie 'n substitusiereaksie soos verlang nie. (1)

4.2.3 Primary✓
The carbon atom that is bonded to the hydroxyl group is attached to only one other carbon atom✓
OR
The functional group is attached to only one other carbon atom

Primêre
Die koolstofatoom wat aan die hidroksielgroep gebind is, is aan slegs een ander koolstofatoom geheg
OF
Die funksionele groep is aan slegs een ander koolstofatoom geheg (2)

4.2.4 Remain the same/ Bly dieselfde✓ (will only increase the rate of the reaction) (1)

4.3.1 Same molecular formula✓, but different positions of the side chain/substituents/functional groups on the parent chain. ✓
Dieselfde molekulêre formule, maar verskillende posisies van die syketting/ substituente/funksionele groepe op die moederketting. (2)

4.3.2 H_3PO_4/Phosphoric acid/Fosforsuur✓ **OR/OF** H_2SO_4/Sulphuric acid/Swaelsuur (1)

4.4 Propane/ Propaan✓✓ (2)

4.5.1 Esterification/ Condensation✓
Esterifikasie/ Kondensasie (1)

4.5.2 Propyl✓butanoate✓/ Propiel butanoaat (2)

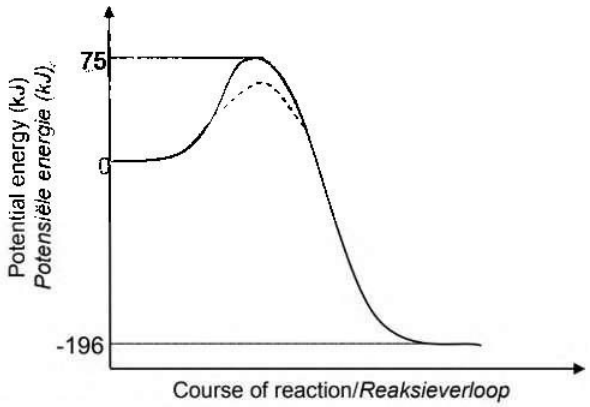
4.5.3 Catalyst/ Katalisator ✓ OR/OF Dehydrating agent/Dehidreermiddel (1)

[19]

QUESTION 5/ VRAAG 5

5.1.1 The minimum energy needed for a reaction to take place. ✓✓ (2 or 0)
Die minimum energie benodig vir 'n reaksie om plaas te vind. (2 of 0) (2)

5.1.2



Marking criteria/*Nasienriglyne*:	
Shape of curve for exothermic reaction as shown. *Vorme van kurwe vir eksotermiese reaksie soos getoon.*	✓
Energy of activated complex shown as 75 kJ in line with the peak. *Energie van geaktiveerde kompleks aangetoon as 75 kJ in lyn met die piek.*	✓
Energy of products shown as − 196 kJ below the zero. *Energie van produkte getoon as − 196 kJ onderkant die nulpunt.*	✓
IF/*INDIEN*: Wrong shape, e.g. straight line./*Verkeerde vorm bv. reguitlyn.*	0/3

(3)

5.1.3 **Marking criteria/Nasienriglyne**

- Dotted line (---) on graph in QUESTION 5.1.2 showing lower energy for activated complex.✓
  Stippellyn (---) op grafiek in VRAAG 5.1.2 wat laer energie vir geaktiveerde kompleks toon.
- Dotted curve starts at/above energy of reactants and ends at/above energy of products on the inside of the original curve.✓
  Stippellyn kurwe begin by/bokant energie van reaktanse en eindig by/bokant energie van produkte aan die binnekant van die oorspronklike kurwe.

Note/Aantekening:
Allocate marks only if curve for either exothermic or endothermic reaction drawn in QUESTION 5.1.2.
Ken punte slegs toe indien kurwe vir endotermiese of eksotermiese reaksie in VRAAG 5.1.2 geteken is.

(2)

5.2.1

$$\text{Ave rate/}\textit{Gem. tempo} = \frac{\Delta V}{\Delta t}$$
$$= \frac{52 - 16}{40 - 10} \checkmark$$
$$= 1{,}2 \text{ (dm}^3\cdot\text{s}^{-1}) \checkmark$$

Accept/*Aanvaar*:
- Volume range/*gebied*: 16 to/*tot* 17 cm^3
- Answer range/*Antwoordgebied*: 1,167 to 1,2 $dm^3 \cdot s^{-1}$

(3)

5.2.2

Marking criteria/*Nasienriglyne:*

- $V(O_2) = 60\ dm^3$ AND/*EN* divide volume by 24./*deel volume deur* 24 ✓
- Use ratio/Gebruik *verhouding*: $n(H_2O_2) = 2n(O_2) = 1:2$ ✓
- Use $34\ g \cdot mol^{-1}$ in $n = \frac{m}{M}$ or in ratio calculation. ✓

  Gebruik 34 $g \cdot mol^{-1}$ *in* $n = \frac{m}{M}$ *of in verhoudingsberekening.*
- Final answer/*Finale antwoord*: 170 g ✓

OPTION 1/*OPSIE 1*

$n(O_2) = \frac{V}{V_M}$

$= \frac{60}{24}$ ✓

$= 2,5\ mol$

$n(H_2O_2) = 2n(O_2)$

$= 2(2,5)$ ✓

$= 5\ mol$

$n(H_2O_2) = \frac{m}{M}$

$\therefore 5 = \frac{m}{34}$ ✓

$\therefore m = 170\ g$ ✓

OPTION 2/*OPSIE 2*

$24\ dm^3 : 1\ mol$

$60\ dm^3 : 2,5\ mol$ ✓

$n(H_2O_2) = 2n(O_2)$

$= 2(2,5)$ ✓

$= 5\ mol$

34 g ✓ : 1 mol

x : 5 mol

$x = 170\ g$ ✓

OPTION 3/*OPSIE 3*

$n(O_2) = \frac{V}{V_M}$

$= \frac{60}{24}$ ✓

$= 2,5\ mol$

$n(O_2) = \frac{m}{M}$

$\therefore 2,5 = \frac{m}{32}$

$\therefore m = 80\ g$

2(34) g ✓ H_2O_2 : 32 g O_2

x g H_2O_2 ..... 80 g O_2

$m(H_2O_2) = 170\ g$ ✓

(4)

5.2.3 Equal to / Gelyk aan✓ (1)

5.3.1 Q✓ (1)

5.3.2 P✓ (1)

[17]

QUESTION 6/ VRAAG 6

6.1.1 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.

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 korrekte konteks wees. (2)

6.1.2 Endothermic.✓
According to Le Chatelier's principle an increase in temperature will favour the endothermic reaction.✓

When the temperature was increased the K_c value increased, therefore $[CO_2]$ increased/more product formed, ✓therefore the forward reaction was favoured.✓
Therefore the forward reaction is endothermic.

Endotermies.
Volgens Le Chatelier se beginsel sal 'n toename in temperatuur die endotermiese reaksie bevoordeel.
Toe die temperatuur verhoog is, the K_c toegeneem, dus het $[CO_2]$ verhoog/produkte vermeeder en dus word die voorwaartse reaksie bevoordeel.
Dus is die voorwaartse reaksie endotermies. (4)

6.2.1 **Marking criteria OPTION 1-3/ Nasienkriteria OPSIE 1-3:**

a) Calculate $n(SO_3) = cV = (0,65)(3) = 1,95$ mol
b) Calculate $n(SO_3)_{formed/gevorm} = n_{equilibrium/ewewig} - n_{initial/begin} = 1,95$
c) Use mole ratio 2:1:2
d) $n(O_2)_{initial} = \frac{x}{32}$ (Show substitution of M = 32 g.mol^{-1})
e) Calculate $n(SO_2)_{equilibrium/ewewig}$ & $n(O_2)_{equilibrium/ewewig}$: $n_{initial/begin} - n_{used/gebruik}$
f) Calculate concentration by dividing $n_{equilibrium/ewewig}$ by 3dm^3
g) Correct K_c expression
h) Substitute equilibrium concentrations and K_c value into K_c expression
i) Answer: x = m(O_2) = 137,94 g (Answer range: 137,80g - 138,45g)

OPTION/OPSIE 1

	SO_2	O_2	SO_3	
Mole ratio/ Mol verhouding	**2**	**1**	**2**	
Initial mol/ Aanvanklike mol	**3,45**	$\frac{x}{32}$ ✓	0	
Change in mol/ Verandering in mol	1,95	0,975	1,95✓	*Ratio*✓
Mol at equilibrium/ Mol by ewewig	✓1,5	$\frac{x}{32}$ - 0,975	1,95✓	
Concentration at equilibrium/ Konsentrasie by ewewig	0,5	$\frac{x-31,2}{96}$	**0,65**	*Divide by 3*✓

$$K_c = \frac{[SO_3]^2}{[SO_2]^2[O_2]}$$ ✓

$$1,52 = \frac{(0,65)^2}{(0,5)^2(\frac{x-31,2}{96})}$$ ✓

$$x = 137,94g$$ ✓

OPTION/OPSIE 2

	SO_2	O_2	SO_3	
Mole ratio/ Mol verhouding	**2**	**1**	**2**	
Initial mol/ Aanvanklike mol	**3,45**	y	0	
Change in mol/ Verandering in mol	1,95	0,975	1,95✓	*Ratio*✓
Mol at equilibrium/ Mol by ewewig	✓1,5	y - 0,975	1,95✓	
Concentration at equilibrium/ Konsentrasie by ewewig	0,5	$\frac{y-0,975}{3}$	**0,65**	*Divide by 3*✓

$K_c = \frac{[SO_3]^2}{[SO_2]^2[O_2]}$ ✓

$1,52 = \frac{(0,65)^2}{(0,5)^2(\frac{y-0,975}{3})}$ ✓

$y = 4,3105\ mol$

$m(O_2) = nM = (4,3105)(32)$ ✓

$x = m(O_2) = 137,94g$ ✓

OPTION/OPSIE 3

	SO_2	O_2	SO_3	
Mole ratio/ Mol verhouding	**2**	**1**	**2**	
Initial mol/ Aanvanklike mol	**3,45**	y	0	
Change in mol/ Verandering in mol	1,95	0,975	1,95✓	*Ratio*✓
Mol at equilibrium/ Mol by ewewig	1,5✓	y - 0,975	1,95✓	
Concentration at equilibrium/ Konsentrasie by ewewig	0,5	$[O_2]$	**0,65**	*Divide by 3*✓

$K_c = \frac{[SO_3]^2}{[SO_2]^2[O_2]}$ ✓

$1,52 = \frac{(0,65)^2}{(0,5)^2[O_2]}$ ✓

$[O_2] = 1,1118\ mol.dm^{-3}$

$$y - 0,975 = (1,1118)(3)$$
$$y = 4,3105\ mol$$

$m(O_2) = nM = (4,3105)(32)$✓

$x = m(O_2) = 137,94g$✓

Marking criteria OPTION 4-5/ Nasienkriteria OPSIE 4-5:

a) Calculate initial concentration by dividing $n_{initial/aanvanklik}$ by 3dm^3
b) Calculate $c(SO_3)_{formed/gevorm} = c_{initial/aanvanklik} + c_{equilibrium/ewewig} = 0,65$ (mol.dm^{-3})
c) Use mole ratio 2:1:2
d) $c(O_2)_{initial} = \frac{x}{32\times3}$ (Show substitution of M = 32 g.mol^{-1})
e) Divide by 3 dm^3 to calculate concentration OR Multiply by 3 dm^3 to calculate mass($m(O_2) = cMV$)
f) Calculate $c(SO_2)_{equilibrium/ewewig}$ & $c(O_2)_{equilibrium/ewewig} = c_{initial/begin} - c_{used/gebruik}$
g) Correct K_c expression
h) Substitute equilibrium concentrations and K_c value into K_c expression
i) Answer: x = m(O_2) = 137,94 g (Answer range: 137,80g - 138,45g)

OPTION/OPSIE 4

	SO_2	O_2	SO_3	
Mole ratio/ Mol verhouding	**2**	**1**	**2**	
Initial concentration/ Aanvanklike konsentrasie	✓ $\frac{3,45}{3} = 1,15$	$\frac{x}{32\times3} = \frac{x}{96}$	0	*M = 32*✓ *Divide by 3*✓
Change in concentration/ Verandering in konsentrasie	0,65	0,325	0,65 ✓	*Ratio*✓
Concentration at equilibrium/ Konsentrasie by ewewig	0,5✓	$\frac{x}{96} - 0,325$	**0,65**	

$K_c = \frac{[SO_3]^2}{[SO_2]^2[O_2]}$✓

$1,52 = \frac{(0,65)^2}{(0,5)^2(\frac{x}{96} - 0,325)}$✓

$x = m(O_2) = 137,94g$✓

OPTION/OPSIE 5

	SO_2	O_2	SO_3	
Mole ratio/ Mol verhouding	**2**	**1**	**2**	
Initial concentration/ Aanvanklike konsentrasie	✓ $\frac{3,45}{3} = 1,15$	y	0	
Change in concentration/ Verandering in konsentrasie	0,65	0,325	0,65✓	*Ratio*✓
Concentration at equilibrium/ Konsentrasie by ewewig	0,5✓	$y - 0,325$	**0,65**	

$$K_c = \frac{[SO_3]^2}{[SO_2]^2[O_2]}\checkmark$$

$$1,52 = \frac{(0,65)^2}{(0,5)^2(y - 0,325)}\checkmark$$

$$y = 1,4368\ mol.dm^{-3}$$

$$m(O_2) = cMV = (1,4368)(32)(3)\checkmark\checkmark$$

$$m(O_2) = 137,94g\checkmark$$

(9)

6.2.2.1 Remains the same✓
Bly dieselfde✓ (1)

6.2.2.2 Decrease✓
Verminder✓ (1)

[17]

QUESTION 7/ VRAAG 7

7.1 A proton donor. ✓✓ (2 or 0)
'n Proton skenker. (2 of 0) (2)

7.2
pH = -log[H_3O^+] ✓
12✓ = -log[H_3O^+]
[H_3O^+] = 1 ×10^{-12}

K_w = [H_3O^+][OH^-]✓
1×10^{-14} = [1×10^{-12}][OH^-]✓
[OH^-] = 1 ×10^{-2} mol.dm^{-3}✓

Mark allocation:
a)pH formula/ pH formule
b)Substitution into pH formula/ Vervanging in pH formule
c)K_w formula/ K_w formule
d)Substitution into K_w formula/ Vervanging in K_w formule
e)Final answer correct/ Finale antwoord korrek (5)

7.3 $Ba(OH)_2(aq) + 2HC\ell(aq) \rightarrow BaC\ell_2(aq) + 2H_2O(\ell)$

$n(HC\ell) = cV$
$= (0,75)(2)$ ✓
$= 1,5$ mol

$n(Ba(OH)_2)_{reacts} = ½\ n(HC\ell)$
$= (0,5)(1,5)$ ✓
$= 0,75$ mol

$n(Ba(OH)_2)_{excess} = ½\ n(OH^-)$
$= ½\ cV$
$= (0,5)(1\times10^{-2})(4)$ ✓ **Positive marking from Q7.2**
$= 0,02$ mol

$n(Ba(OH)_2)_{total} = 0,75 + 0,02$ ✓
$= 0,77$ mol

$m(Ba(OH)_2) = nM$
$= (0,77)(171)$ ✓ $M = (137 + (2 \times 16) + 2) = 171\ g.mol^{-1}$
$= 131,67$ g

$\%purity = \frac{131,67}{150} \times 100$ ✓
$= 87,78\%$ ✓

Mark allocation:	**Puntetoekenning:**
a)Calculate n(HCℓ)	a)Bereken n(HCℓ)
b)Mole ratio of $Ba(OH)_2$ to HCℓ used	b)Molverhouding van $Ba(OH)_2$ tot HCℓ gebruik
c)Calculate $n(Ba(OH)_2)_{excess}$	c)Bereken $n(Ba(OH)_2)_{oormaat}$
d)Calculate $n(Ba(OH)_2)_{total}$	d)Bereken $n(Ba(OH)_2)_{totaal}$
e)Substitution of M = 171 $g.mol^{-1}$ and $n(Ba(OH)_2)_{total}$ into $n = \frac{m}{M}$	e)Vervanging van M = 171 $g.mol^{-1}$ en $n(Ba(OH)_2)_{totaal}$ in $n = \frac{m}{M}$
f)$m(Ba(OH)_2) \div 150g \times 100$	f)$m(Ba(OH)_2) \div 150g \times 100$
g)Final answer = 87,78%	g)Finale antwoord = 87,78%

(7)

7.4 Bromothymol blue/ Broomtimolblou ✓ (1)

7.5 Barium hydroxide is a strong base ✓and hydrochloric acid is a strong acid.✓
The salt that is formed is neutral and at the endpoint the pH will be (around) 7. ✓

Bariumhidroksied is 'n sterk basis en soutsuur is 'n sterk suur.
Die sout wat gevorm word is neutral en die pH by die eindpunt is (ongeveer) 7. (3)

[18]

QUESTION 8/ VRAAG 8

8.1 Ni✓

Ni is a stronger reducing agent. / Ni has a higher reducing ability. / Ni is the anode. / Ni loses electrons. / Ni is oxidised.✓
Ni is die sterker reduseermiddel. / Ni het sterker reduserende vermoë. / Ni is die anode. / Ni verloor elektrone. / Ni word geoksideer. (2)

8.2 ✓ ✓ ✓ Ignore phase and concentrations
$Ni \mid Ni^{2+} \parallel Ag^{+} \mid Ag$ Ignoreer fases en konsentrasies (3)

8.3

OPTION 1/*OPSIE 1*	**Notes/*Aantekeninge***
$E^{\theta}_{cell} = E^{\theta}_{reduction} - E^{\theta}_{oxidation}$ ✓ $= 0{,}80$ ✓ $- (-0{,}27)$ ✓ $= 1{,}07$ V ✓	• Accept any other correct formula from the data sheet./*Aanvaar enige ander korrekte formule vanaf gegewensblad.* • Any other formula using unconventional abbreviations, e.g. $E°_{cell} = E°_{OA} - E°_{RA}$ followed by correct substitutions:/*Enige ander formule wat onkonvensionele afkortings gebruik bv.* $E°_{sel} = E°_{OM} - E°_{RM}$ *gevolg deur korrekte vervangings.* $^{3}/_{4}$
OPTION 2/*OPSIE 2*	
$Ag^{+} + e^{-} \rightarrow Ag$] ✓	$E^{\theta} = 0{,}80$ V ✓
$Ni \rightarrow Ni^{2+} + 2e^{-}$	$E^{\theta} = +0{,}27$ V ✓
$Ag^{+} + Ni \rightarrow Ag + Ni^{2+}$	$E^{\theta} = +1{,}07$ V ✓

(4)

8.4 Increases / Verhoog✓ (1)

[10]

QUESTION 9/ VRAAG 9

9.1.1 $2Cl^- \rightarrow Cl_2 + 2e^-$ ✓✓

$2Cl^- \leftrightharpoons Cl_2 + 2e^-$	1/2	$Cl_2 + 2e^- \leftarrow 2Cl^-$	2/2
$2Cl^- \leftarrow Cl_2 + 2e^-$	0/2	$Cl_2 + 2e^- \leftrightharpoons 2Cl^-$	0/2

(2)

9.1.2 $Cu^{2+} + 2e^- \rightarrow Cu$ ✓✓

$Cu^{2+} + 2e^- \leftrightharpoons Cu$	1/2	$Cu \leftarrow Cu^{2+} + 2e^-$	2/2
$Cu^{2+} + 2e^- \leftarrow Cu$	0/2	$Cu \leftrightharpoons Cu^{2+} + 2e^-$	0/2

(2)

9.2 S ✓
Oxidation occurs there / Cl^- is oxidised at S / Cl^- is a reducing agent✓
Oksidasie vind daar plaas / Cl^- word geoksideer by S / Cl^- 'n reduseermiddel✓ (2)

9.3.1 $Q = I\Delta t$
$= (2,5)(5 \times 60 \times 60)$✓ OR $(2,5)(18\ 000)$
$= 45\ 000$ C $(4,5 \times 10^4$ C)✓ (2)

9.3.2 $n = \frac{Q}{e}$ OR $n = \frac{Q}{q_e}$
$= \frac{45\ 000}{1,6 \times 10^{-19}}$ ✓ **Positive marking from Q9.3.1**
(Divide by electron charge)
$= 2,8125 \times 10^{23}$ (electrons)

$N(Cu\ atoms) = \frac{2,8125 \times 10^{23}}{2}$ ✓ (Use ratio)
$= 1,40625 \times 10^{23}$

$n(Cu) = \frac{1,40625 \times 10^{23}}{6,02 \times 10^{23}}$ ✓ (Divide by Avogadro's number)
$= 0,23356$ mol

$m(Cu) = nM$
$= (0,23356)(63,5)$ ✓ (Substitute M_r in formula)
$= 14,83$ g ✓ (Answer range: 14,61g -14,83g) (5)

9.4.1 Cu is a stronger reducing agent✓ than Cl^- ✓ and thus Cu will be oxidised from Cu to Cu^{2+}✓. (no Cl_2 gas formed but Cu will dissolve/break up)
Cu is 'n sterker reduseermiddel ✓ as Cl^- ✓en sal dus van Cu word geoksideer na Cu^{2+}✓. (3)

9.4.2 S ✓ (1)

TOTAL: 150 **[17]**