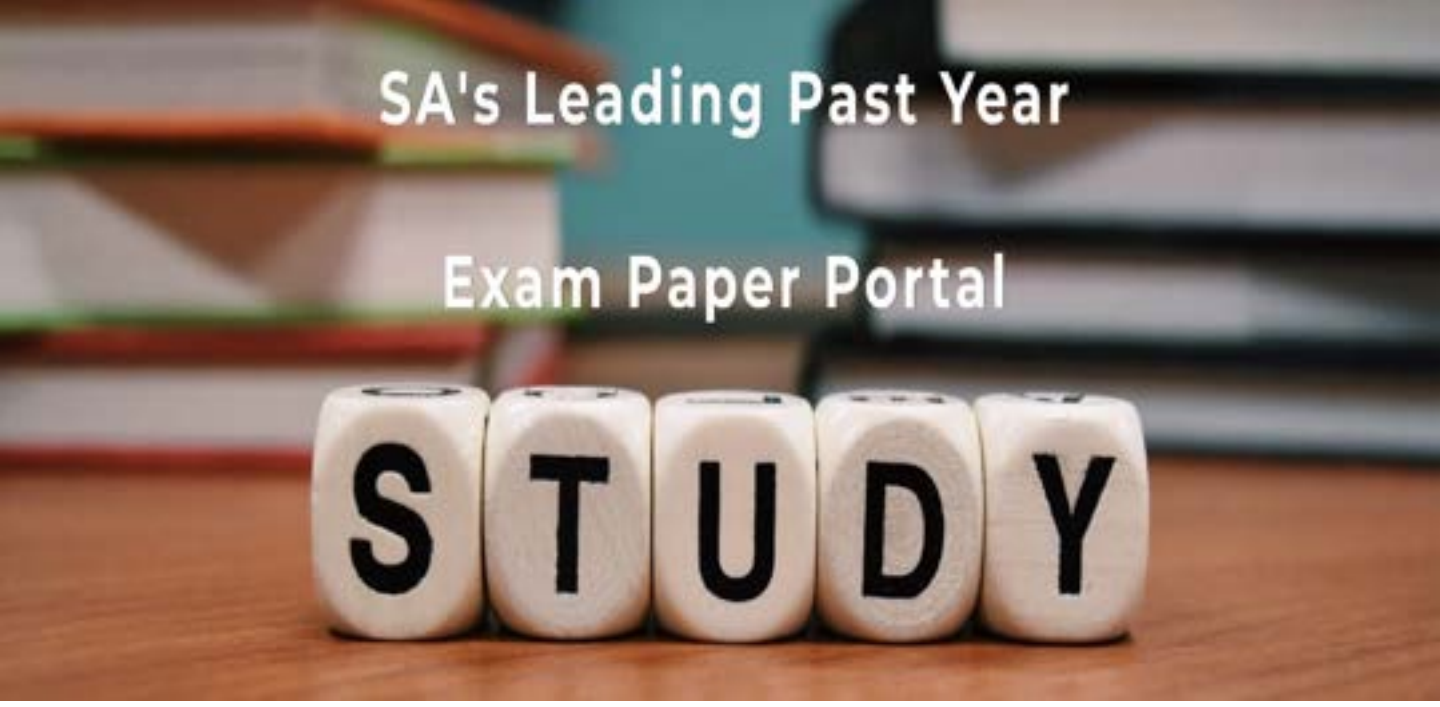

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PREPARATORY EXAMINATION/ *VOORBEREIDENDE EKSAMEN*

2022

MARKING GUIDELINES/*NASIENRIGLYNE*

10842

PHYSICAL SCIENCES: CHEMISTRY/*FISIESE WETENSKAPPE: CHEMIE*

PAPER/*VRAESTEL* 2

15 pages/*bladsye*

QUESTION/*VRAAG* 1

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

[20]

QUESTION/*VRAAG* 2

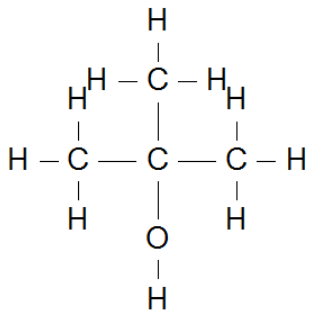
2.1	2.1.1	Ester/*Ester* ✓	(1)
	2.1.2	Methyl ✓propanoate✓/ *Metiel✓propanoaat✓*	(2)
2.2	2.2.1	Catalyst **OR** Speed up the reaction✓/ *Katalisator **OF** Om die reaksie te versnel✓* OR It lowers the activation energy / *dit verlaag die aktiveringsenergie* **Do not accept** dehydrating agent. Not in this reaction. *Dehidrateringsmiddel word **nie hier aanvaar nie**.*	(1)
	2.2.2	Propanoic Acid✓ and Methanol✓/*Propanoësuur✓ en Metanol✓*	(2)
	2.2.3	Esterification / *Esterifikasie✓* **OR** condensation / *kondensasie✓*	(1)
2.3	2.3.1	Carboxyl group / *Karboksielgroep✓*	(1)
	2.3.2	Carboxylic acids / *Karboksielsure✓*	(1)

2.3.3 **Homologous series**: A series of organic compounds that can be described by the same general formula **OR** in which one member differs from the next with a CH_2 group✓.
Functional group: A bond or an atom or a group of atoms that determine(s) the physical and chemical properties of a group of organic compounds. ✓
As long as learners indicate difference between two.
Homoloë reeks: *'n Reeks organiese verbindings wat deur dieselfde algemene formule beskryf kan word* ***OF*** *waarin die een lid van die volgende verskil met 'n CH_2-groep.* ✓
Funksionele groep: *'n Binding of 'n atoom of 'n groep atome wat die fisiese en chemiese eienskappe van 'n groep organiese verbindings bepaal.* (2)

2.4 2.4.1 Alcohols / *Alkohole*✓ (1)

2.4.2 Positional (isomers) / *Posisionele (isomere)* ✓ (1)

2.4.3



Marking criteria / *Nasienkriteria*
- methyl and alcohol both on 2nd C ✓/ *metiel en alkohol beide op 2de C*
- main chain / *hoofketting*: 3 C ✓
- Structural formulae complete / *Volledige struktuurformule* ✓

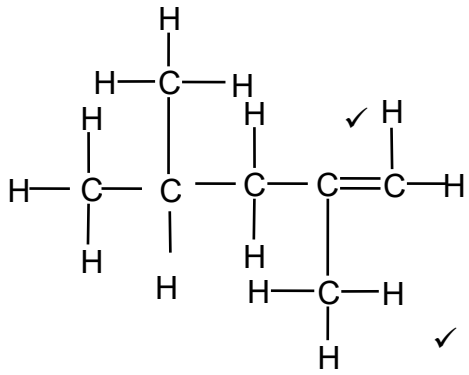
(3)

2.5 2.5.1 5-bromo-2,2-dimethylhexane /
5-bromo-2,2-dimetielheksaan

Marking criteria/*Nasienkriteria*
- Correct stem i.e. hexane ✓/ *Korrekte stam d.w.s. heksaan*✓
- All substituents: bromo and dimethyl ✓ do not accept methyl only / *Alle substituente: bromo en dimetiel*✓ *moenie net metiel aanvaar nie, moet dimetiel wees*
- Completely correct numbering, sequence, hyphens, commas ✓/ *Heeltemal korrekte nommering, volgorde, koppeltekens, kommas.* ✓

(3)

2.5.2



✓ ✓

Marking criteria/*Nasienkriteria*

- Whole structure correct / *Hele struktuur korrek* 2/2
- Only functional group correct /*Slegs funksionele groep korrek* 1/2
- Additional functional groups / *Addisionele funksionele groepe* 0/2

(2)
[21]

QUESTION/*VRAAG* 3

3.1 3.1.1 Same molecular formula, but different functional groups.
✓✓/*Dieselfde molekulêre formule maar verskillende funksionele groepe.* ✓✓ (2 or 0) (2)

3.1.2 Pentan-3-one ✓✓ / *Pentan-3-oon*✓✓ (2 or 0)
Accept 3-pentanone / *aanvaar 3-pentanoon* (2)

3.1.3 LOWER THAN / *LAER AS* ✓ (1)

3.1.4
- Aldehydes have dipole-dipole forces ✓ and alcohols have hydrogen bonds. ✓
- Dipole-dipole forces are much weaker than hydrogen bonds. **OR** The hydrogen bonds are stronger than Dipole-dipole forces.
OR
- Less energy is required to <u>overcome</u> the weak intermolecular force. **OR** More energy is required to <u>overcome</u> the strong intermolecular force. ✓ (Third mark is split – either one of the bullets)

- *Aldehiede het dipool-dipool kragte ✓en alkohole het waterstofbindings.* ✓
- *Dipool-dipool kragte is baie swakker as waterstofbindings.* ***OF*** *Waterstofbindings is sterker as Dipool-dipool kragte.*
OF
- *Minder energie word benodig om die swak intermolekulêre kragte te <u>oorkom</u>.* ***OF*** *Meer energie word benodig om die sterker intermolekulêre kragte te <u>oorkom</u>.* ✓ *(Derde punt – enige een van die laaste twee bullets)* (3)

3.1.5 HIGHER THAN ✓
- Ketones have dipole-dipole forces and alcohols have hydrogen bonds. ✓
- Dipole-dipole forces are much weaker than hydrogen bonds. ✓

OR

- Less energy is required to overcome the weak intermolecular forces.

HOËR AS ✓
- *Ketone het dipool-dipool kragte en alkohol het waterstofbindings.* ✓
- *Dipool-dipool kragte is baie swakker as waterstofbindings.* ✓

OF

- *Minder energie word benodig om die swak intermolekulêre kragte te oorkom.* ✓ (3)

3.2 3.2.1 The temperature at which the vapour pressure equals the atmospheric pressure. / *Die temperatuur waarby die dampdruk van die stof gelyk is aan die atmosferiese druk.* ✓✓ (2 or 0) (2)

3.2.2 Length of the chain / Molar mass / number of carbons in the chain / surface area of molecule
Lengte van die ketting / molêre massa / aantal koolstowwe in die ketting / kontakoppervlakte van molekule ✓ (1)

3.2.3 London forces or dispersion forces or induced dipole forces / *Londonkragte of dispersiekragte of geïnduseerde dipoolkragte.* ✓ (1)

3.2.4 Positive marking from 3.2.2
As the chain length increases ✓ the boiling point increases. ✓ If given as direct proportion (1/2)

Positiewe nasien vanaf 3.2.2
Soos die kettinglengte toeneem, ✓
neem die kookpunt toe. ✓ As direk eweredig (1/2) (2)
[17]

QUESTION/*VRAAG* 4

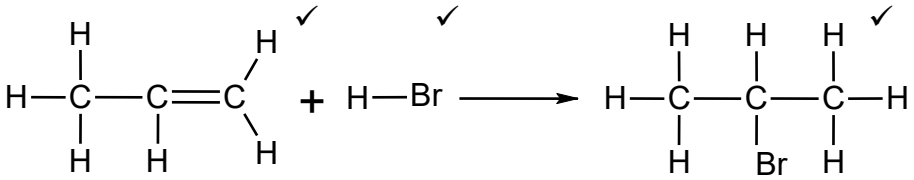
4.1 Elimination / Dehydration / *Eliminasie / Dehidrasie* ✓ (1)

4.2 4.2.1 The <u>addition</u> of <u>water</u> to a compound ✓✓ / *Die <u>addisie</u> van <u>water</u> aan 'n verbinding* ✓✓(2 or 0) (2)

4.2.2 H_2SO_4 / H_3PO_4 (formula has to be correct) **OR / *OF***
sulphuric acid / phosphoric acid / *swaelsuur / fosforsuur* ✓ (1)

4.3 4.3.1
- No water / No H_2O ✓/ *Geen water* ✓
- (concentrated) strong acid as catalyst / *(gekonsentreerde) sterk suur as katalisator* ✓(as in CAPS on P113) (2)

4.3.2



MARKING CRITERIA / *NASIENKRITERIA* (3)

• Whole structure of propene corrects – bromine must be on C 2 (rule of Markovnikov) / *Die hele struktuur van propeen korrek – broom moet op C 2 wees (reel van Markovnikov)* ✓	
Accept/*Aanvaar* HBr Ignore/*Ignoreer*: ⇌	
• **Condensed/semi-structural formulae/Gekondenseerde/ semi-struktuurformules** Max/*Maks*: $^2/_3$	
• **Molecular formula/*Molekulêre formule*** $^0/_3$	
Any additional reactant or products/*Enige addisionele reactant of produkte*: Max/*Maks.*: $^2/_3$	**Everything correct, *wrong balancing/Alles korrek, verkeerde balansering*** Max/*Maks.* $^2/_3$

4.4 4.4.1 Substitution / *Substitusie* ✓ (1)

4.4.2 Substitution / Hydrolysis / *Substitusie / Hidrolise* ✓ (1)

4.5 4.5.1
- Alkene dissolved in a non-polar solvent OR no water / *Alkeen opgelos in 'n nie-polêre oplosmiddel OF geen water* ✓
- (Catalyst) Pt / Pd / Ni / (*Katalisator) Pt / Pd / Ni* ✓ (2)

4.5.2 Production of margarine / to harden unsaturated plant oils ✓
Produksie van margarien / om onversadigde plantolies te verhard ✓
There can be other options. Must be applicable to the food industry. (1)

[14]

QUESTION/*VRAAG* 5

5.1 5.1.1 Endothermic / *Endotermies* ✓ (1)

5.1.2 $\Delta H = E_{products} - E_{reactants}$ / $\Delta H = E_{produkte} - E_{reaktante}$
$\Delta H = 420 - 0$
$\Delta H = 420\ kJ \cdot mol^{-1}$ ✓ ✓
If learner only writes the correct answer with unit – allocate 2 marks
No unit – only one mark
Slegs korrekte antwoord met eenheid – gee 2 punte
Geen eenheid – slegs een punt (2)

5.1.3 $E_{A\ reverse} = 60\ (kJ \cdot mol^{-1})$/ $E_{A\ terugwaarts} = 60\ (kJ \cdot mol^{-1})$ ✓ (1)

5.2 5.2.1 The change in concentration of reactants or products per unit time /
Die verandering in konsentrasie van reaktante of produkte per eenheid tyd ✓✓ (2 or 0) (2)

5.2.2 The number of particles with <u>sufficient energy</u> for <u>effective collisions</u>.
Or with <u>enough energy</u> for <u>effective collisions</u> /
Die hoeveelheid deeltjies met <u>genoegsame energie</u> vir <u>effektiewe botsings</u>. Of met <u>voldoende energie</u> vir <u>effektiewe botsings</u>. ✓ (1)

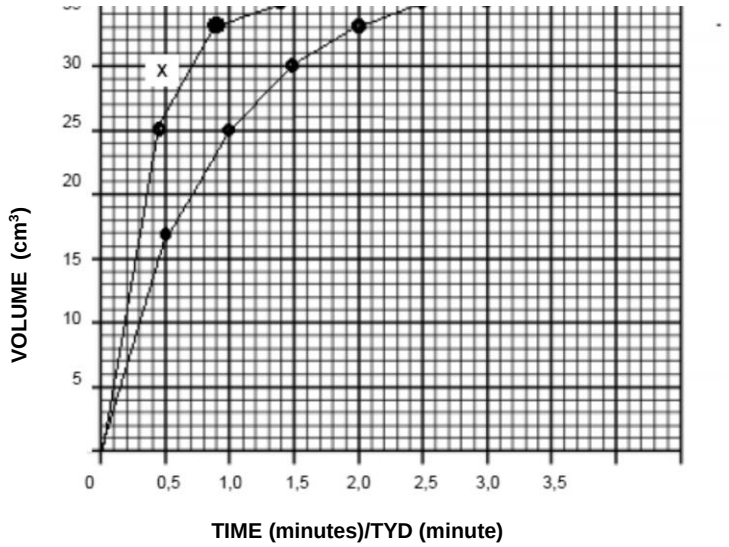
5.2.3 Sample S / *Monster* S ✓ (1)

5.2.4
- When the temperature is increased the particles gain kinetic energy. ✓
- More particles will have sufficient energy/the number of effective collisions will increase. ✓
- More particles will therefore have energy greater than the activation energy, so the area under the graph to the right of line T increases. ✓

- *Wanneer die temperatuur verhoog, verkry die deeltjies meer kinetiese energie.* ✓
- *Meer deeltjies sal genoegsame energie hê / hoeveelheid effektiewe botsings sal toeneem.* ✓
- *Meer deeltjies sal dus energie meer as die aktiverings energie hê en die area onder die grafiek aan die regterkant van lyn T sal toeneem.* ✓ (3)

5.3 5.3.1

GRAPH INDICATING THE RELATIONSHIP BETWEEN THE VOLUME OF $H_{2(g)}$ PRODUCED PER UNIT TIME/*GRAFIEK WAT DIE VERHOUDING AANDUI TUSSEN DIE VOLUME $H_{2(g)}$ GEPRODUSEER PER EENHEIDSTYD*



ON GRAPH PAPER/*OP DIE GRAFIEKPAPIER*
✓ All points correctly plotted/*Alle punte korrek geplot*
✓ Points connected into correct shape/*Punte verbind en die vorm reg* (2)

5.3.2 The reaction rate is decreasing because the reactants decrease.
The reaction rate is decreasing because the gradient of the graph is decreasing.
The reaction has run to completion. The reactant has been used up. ✓ (any one)
Die reaksietempo neem af want die reaktante neem af.
Die reaksietempo neem af omdat dit gradiënt van die grafiek afneem.
Die reaksie is voltooi. Die reaktant is alles opgebruik. ✓ (enige een) (1)

5.3.3 ON GRAPH PAPER/*OP DIE GRAFIEKPAPIER*
✓ Steeper gradient / Steiler gradiënt
✓ Reach completion earlier / Bereik gouer voltooiing (2)

5.3.4 $n_{(H_2)} = \frac{V}{V_m} = \frac{0,035}{24,47}$ ✓

= 1,43 x 10^{-3} mol

$n_{(HCl)} = 2\ n_{(H_2)}$ = 2,86 x 10^{-3} mol

$c = \frac{n_{HCl}}{V}$ ✓

$0,25 = \frac{2,86x10^{-3}}{V}$

$V = \frac{2,86x10^{-3}}{0,25}$ ✓

= 0,011 dm^3 ✓

If learner used Mg:

$n = \frac{m}{M}$

$= \frac{11}{24}$ ✓

= 0,458 mol

$n_{(Mg)} = 2\ n_{(HCl)}$ =0,917 mol ✓

$c = \frac{n_{HCl}}{V}$ ✓

0,25 ✓ $= \frac{0,917}{V}$

V = 3,67 dm^3 ✓

Marking criteria/*Nasienkriteria*

- Divide by / *Deel deur* 24,47 in $n_{(H_2)} = \frac{V}{V_m}$
- Ratio/*Verhouding* $n_{(HCl)} = 2\ n_{(H_2)}$ ✓
- Substitute/*Substitusie* 0,25 in $c = \frac{n_{HCl}}{V}$
- Final answer/*Finale antwoord*: 0,011 dm^3/11 cm^3 ✓

(4)
[20]

QUESTION/*VRAAG* 6

6.1 6.1.1 Concentration of N_2 increases/*Konsentrasie van N_2 verhoog* ✓ (1)

6.1.2 Pressure increased/*Druk verhoog* ✓ (1)

6.1.3 Temperature increased/*Temperatuur verhoog* ✓ (1)

6.2 When equilibrium in a closed system is disturbed, the system will reinstate a new equilibrium by favouring the reaction that will oppose the disturbance. ✓✓ **(2 or 0)**

Wanneer die ewewig in 'n geslote sisteem versteur word, stel die sisteem 'n nuwe ewewig in deur die reaksie wat die versteuring teenwerk, te bevoordeel ✓✓**(2 of 0)** (2)

6.3 6.3.1 Decreases / *Verminder* ✓ (1)

6.3.2
- The pressure will decrease. ✓
- The system will favour the reaction that increases the number of gas molecules or number of particles. ✓
- Hence, the reverse reaction will be favoured. ✓

- Die druk sal verminder. ✓
- Die sisteem bevoordeel die reaksie wat die hoeveelheid gas molekule sal vermeerder. ✓
- Gevolglik, sal die terugwaartse reaksie bevoordeel word. ✓ (3)

6.4 **CALCULATION USING NUMBER OF MOLES/*BEREKENING MET DIE AANTAL MOL***

Mark allocation/*Puntetoekening*:

a. Use of/*gebruik van* n = $\frac{m}{M}$✓
b. $n(NH_3)$ at equilibrium/*by ewewig* = 1,2 mol ✓
c. Using/*Gebruik* ratio/*verhouding* $n(N_2)$: $n(H_2)$: $n(NH_3)$ = 1:3:2 ✓
d. $n(N_2)$ at equilibrium (initial – change)/*$n(N_2)$ by ewewig (aanvanklik – verander)* ✓
e. $n(H_2)$ at equilibrium (initial – change)/*$n(H_2)$ by ewewig (aanvanklik – verander)* ✓
f. Divide by volume/*deel deur volume*✓
g. K_c expression/*uitdrukking* ✓
h. Substitution into K_c expression/*Vervang in K_c uitdrukking* ✓
i. Final answer/*Finale antwoord*: 0,25 ✓

$n_{(NH_3)} = \frac{m}{M}$

$= \frac{20,4}{17}$✓ **a**

= 1,2mol✓ **b**

OR/*OF*

give two marks in table for 1,2 mol/*gee twee punte in tabel vir 1,2 mol*

	N_2	H_2	NH_3	
Molar ratio/*Molêre verhouding*	1	3	2	
Initial moles/*Aanvanklike mol*	5	5	0	
Change in moles/*Verandering in mol*	0,6	1,8	1,2	✓Ratio/*Verhouding* **c**
Equilibrium moles/*Ewewig mol*	4,4✓ **d**	3,2✓ **e**	1,2	
Concentration at equilibrium/ *Konsentrasie by ewewig*	0,88	0,64	0,24	✓Divide by/ *Deel deur 5* **f**

carry over

$K_c = \frac{[NH_3]^2}{[N_2][H_2]^3}$ ✓ **g**

$= \frac{(0,24)^2}{(0,88)(0,64)^3}$ ✓ **h**

= 0,25✓ **i**

CALCULATIONS USING NUMBER OF CONCENTRATIONS/ *BEREKENINGE MET BEHULP VAN KONSENTRASIES*

Mark allocation/*Puntetoekening*:

a. Use of/*gebruik van* c = $\frac{m}{MV}$✓

b. (NH_3) at equilibrium/*by ewewig* = 0,24 mol·dm^{-3} ✓

c. Using concentration ratio/*Gebruik konsentrasieverhouding*
[N_2]: [H_2] : [NH_3] = 1:3:2 ✓

d. Divide by volume/Ver*deel volgens volume*✓

e. Equilibrium concentration of N_2 (initial – change)/Ewewingskonsentrasie van N_2 (aanvanklik – verander)/✓

f. Equilibrium concentration of H_2 (initial – change)/Ewewingskonsentrasie van H_2 (aanvanklik – verander)/ ✓

g. K_c expression/*uitdrukking* ✓

h. Substitution into K_c expression/*Substitusie in K_c uitdrukking* ✓

i. Final answer/*Finale antwoord*: 0,25 ✓

	N_2	H_2	NH_3	
Molar ratio/*Molêre verhouding*	1	3	2	
Initial concentration/ *Aanvanklike konsentrasie*	1	1	0	
Change in concentration/ *Verandering in konsentrasie*	0,6	1,8	1,2	✓ Divide by/ *Verdeel deur 5* **d**
Equilibrium concentration/ *Ewewigskonsentrasie*	0,12	0,36	0,24 ✓ **b**	
Concentration at equilibrium/ *Konsentrasie by ewewig*	0,88✓ **e**	0,64✓ **f**	0,24✓ **a**	✓ Ratio/ *Verhouding* **c**

$K_c = \frac{[NH_3]^2}{[N_2][H_2]^3}$ ✓ **g**

$= \frac{(0,24)^2}{(0,88)(0,64)^3}$ ✓ **h**

= 0,25✓ **i**

c = $\frac{m}{MV}$

$= \frac{20,4}{17 \times 5}$

= 0,24

(9)

6.5 Decrease/*Verlaag* ✓✓ (2)

[20]

QUESTION/*VRAAG* 7

7.1 An acid is a substance that produces hydrogen ions (H^+)/hydronium ions (H_3O^+) when it dissolves in water. ✓✓ **(2 or 0)**
'n Suur is 'n stof wat waterstofione (H^+)/hidroniumione(H_3O^+) produseer wanneer dit in water oplos ✓✓ **(2 or 0)**. (2)

7.2 7.2.1 X ✓ (1)

7.2.2 $NH_4^+ + H_2O$ ✓ ⇌ $H_3O^+ + NH_3$ ✓ ✓(Balancing / *Balansering*) (3)

7.2.3 Acidic/*Suur*✓
Hydronium ions (H_3O^+) are formed in the solution./*Hidroniumione (H_3O^+) word gevorm in die oplossing* ✓ (2)

7.3 7.3.1 **c =** $\frac{m}{MV}$ ✓

= $\frac{4}{(40)(0,5)}$ ✓

= 0,2 mol.dm^{-3}✓

OR/*OF*

$n_{(NH3)}$ = $\frac{m}{M}$ **=** $\frac{4}{40}$ =0,1 mol

c = $\frac{n}{V}$ ✓

= $\frac{0,1}{0,5}$ ✓

= 0,2 mol•dm^{-3} ✓ (3)

7.3.2

OPTION/*OPSIE* 1

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

$\frac{c_a (25)}{(0,2)(12,5)}$ ✓ $= \frac{1}{2}$ ✓

$c_a = 0,05 \text{ mol•dm}^{-3}$

$[H_3O^+] = 2\ (0,05)$ ✓

$pH = -\log [H_3O^+]$ ✓

$pH = -\log (0,1)$ ✓

$pH = 1$ ✓

OPTION/*OPSIE* 2

$c_b V_b = n_b$

$(0,2)(0,0125) = n_b$ ✓

$n_b = 0,0025$ mol

$n_a = 1/2(0,0025)$ ✓

$c_a = \frac{n_a}{V_a}$

$c_a = \frac{0,00125}{0,025}$ ✓

$c_a = 0,05 \text{ mol.dm}^{-3}$

$[H_3O^+] = 2\ (0,05)$ ✓

$pH = -\log [H_3O^+]$ ✓

$pH = -\log (0,1)$ ✓

$pH = 1$ ✓ (7) **[18]**

QUESTION/*VRAAG* 8

8.1 Temperature/*Temperatuur:* 298 K (25 °C) ✓
Concentration of electrolyte / *Konsentrasie van die elektroliet*: 1 mol·dm^{-3} ✓ (2)

8.2 B ✓ (1)

8.3 $Ba(s) \rightarrow Ba^{2+}(aq) + 2e^-$ ✓✓ double arrow – penalise by one mark. (2)

8.4 Ba(s) | Ba^{2+}(aq)✓ (1mol.dm^{-3})||✓ Cu^{2+}(aq) (1mol.dm^{-3})|Cu (s) ✓

(The concentration and phases can be omitted. / *Die konsentrasie en fases kan weggelaat word.*)

Ba | Ba^{2+}✓ ||✓ Cu^{2+} | Cu ✓ (3)

8.5 $E^\theta_{cell} = E^\theta_{\text{cathode/}katode} - E^\theta_{\text{anode/}anode}$ ✓ (no abbreviations in formula allowed/ *geen afkortings in formule toegelaat nie*)

$= 0,34$✓$ - (-2,90)$✓
$= 3,24$ V ✓ (4)

8.6 8.6.1 **Do not mark/ *Moenie nasien nie*** (0)

8.6.2 Decreases / *Verlaag* ✓✓ (2)
[14]

QUESTION/*VRAAG* 9

9.1 Electrical energy ✓ to Chemical energy ✓

Elektriese energie ✓ na Chemiese energie ✓ (2)

9.2 A layer of copper will be deposited on the electrode/ mass increase ✓

'n Lagie koper sal op die elektrode neerslaan/die massa vermeerder ✓ (1)

9.3 Not possible for this cell – allocate 2 marks to all learners / *Nie moontlik vir hierdie sel nie – ken 2 punte toe aan alle leerders* ✓ ✓ (2)

9.4 The blue colour will go lighter or go clear. **OR** the blue colour will remain unchanged. ✓

Die blou kleur sal ligter word of kleurloos wees. ***OF*** *die blou kleur sal onveranderd bly.* ✓ (1)
[6]

TOTAL/*TOTAAL*: 150