GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATION

VOORBEREIDENDE EKSAMEN

2024

MEMO

PHYSICAL SCIENCES: CHEMISTRY

PAPER 2

15 pages/*bladsye*

QUESTION/*VRAAG* 1

1.1	C ✓✓	(2)
1.2	A ✓✓	(2)
1.3	B ✓✓	(2)
1.4	C ✓✓ (Accept A and D/*Aanvaar A en D*)	(2)
1.5	D ✓✓	(2)
1.6	A ✓✓	(2)
1.7	B ✓✓	(2)
1.8	B ✓✓ (Accept A/*Aanvaar A*)	(2)
1.9	C ✓✓	(2)
1.10	B ✓✓	(2)
		[20]

QUESTION/*VRAAG* 2

2.1 Saturated ✓
Only single bonds between C-atoms/No multiple bonds between C-atoms. ✓

Versadig
Slegs enkelbindings tussen C-atome/Geen meervoudige bindings tussen C-atome nie. (2)

2.2.1 E ✓ (1)

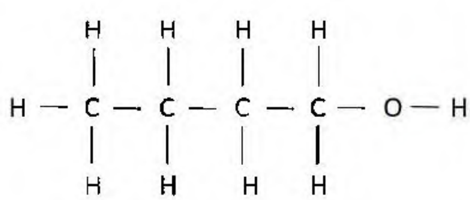
2.2.2 D ✓ (1)

2.2.3 B & E ✓ (1)

2.3.1 Primary ✓
The carbon that is bonded to the hydroxyl group (OH) is bonded to one carbon atom. ✓

Primêre
Die koolstof wat aan die hidroksielgroep (OH) gebind is, is gebind aan een ander koolstofatoom. (2)

2.3.2



butan-1-ol

MARKING CRITERIA/ ***NASIENKRITERIA***
✓ correct whole structure
✓ correct IUPAC name
Korrekte volledige struktuur
Korrekte IUPAC naam

(2)

2.4.1 ✓ ✓
2,3-dibromo-5-methylheptane (2)

2,3-dibromo-5-metielheptaan

2.4.2 Formyl ✓ group

Formiel groep (1)

2.5.1 100 – (40 + 53,3) = 6,7

	C:	H	O	**MARKING CRITERIA/ NASIENRIGLYNE**
$n = \frac{m}{M}$	$\frac{40}{12}$	$\frac{6,7}{1}$	$\frac{53,3}{16}$	✓6,7
	$\frac{3,33}{3,33}$	$\frac{6,67}{3,33}$	$\frac{3,33}{3,33}$	✓Divide by smallest number/ *deel deur kleinste getal*
	1	2	1	
	CH_2O			

Molar mass of/*Molêre massa van* CH_2O = 30 g·mol^{-1}

60 ÷ 30 = 2 ✓

∴ $C_2H_4O_2$ ✓

(NOTE: If only formula given, $\frac{1}{4}$)

(NOTA: As slegs formule gegee word, $\frac{1}{4}$*)* (4)

2.5.2 Ethanoic acid/*Etanoësuur* ✓
Methyl methanoate/*Metielmetanoaat* ✓ (2)

[18]

QUESTION/*VRAAG* 3

3.1 3.1.1 Organic molecules with the same molecular formula, but different structural formulae. ✓✓ (2 or 0)

Organiese molekule met dieselfde molekulêre formule, maar verskillende struktuurformules. (2)

3.1.2 **OPTION 1:**

- B (Hexane) has a larger surface area/longer straight chain than A (2,3-dimethylbutane) ✓
- Stronger intermolecular forces/London forces/Van Der Waals forces ✓
- More energy required to overcome/weaken the intermolecular forces (IMF) ✓

OR

OPTION 2:

- A (2,3-dimethylbutane) has a smaller surface area/more branched than B (hexane) (Accept: more spherical)
- Weaker intermolecular forces/London forces/Van Der Waals forces
- Less energy required to overcome/weaken the intermolecular forces (IMF)

OPSIE 1:

- *B (Heksaan) het 'n groter oppervlakarea/langer reguitketting as A (2,3-dimetielbutaan)*
- *Sterker intermolekulêre kragte/London kragte/Van der Waals kragte*
- *Meer energie benodig om intermolekulêre kragte (IMK) te oorkom/verswak*

OF

OPSIE 2:

- *A (2,3-dimetielbutaan) het 'n kleiner oppervlaksarea/meer vertakkings as B (heksaan) (Aanvaar: meer sferies)*
- *Swakker intermolekulêre kragte/London kragte/Van der Waals kragte*
- *Minder energie benodig om intermolekulêre kragte (IMK) te oorkom/verswak.* (3)

3.2 The pressure exerted by a vapour at equilibrium with its liquid in a closed system. ✓✓

Die druk uitgeoefen deur 'n damp in ewewig met sy vloeistof in 'n geslote sisteem.

Marking criteria
If any one of the underlined key words phrases in the correct context (vapour pressure) is omitted, deduct 1 mark.

Nasienkriteria
Indien enige een van die onderstreepte woorde /frases in die korrekte konteks uitgelaat word, trek 1 punt af.

(2)

3.3 B (Hexane) ✓
Has weaker/less London (dispersion) forces than C (methyl propanoate)
OR
Has a lower boiling point than C (methyl propanoate) ✓

B (Heksaan)
Het swakker/minder London (dispersie) kragte as C (metielpropanoaat)
OF
Het 'n laer kookpunt as C (metielpropanoaat) (2)

3.4 3.4.1 Y ✓ (1)

3.4.2
- C (methyl propanoate) has dipole-dipole forces and D (pentan-1-ol) has hydrogen bonding between molecules. ✓
- D has stronger intermolecular forces than C. ✓
- More energy required to overcome/weaken the intermolecular forces in D. ✓

- *C (metielpropanoaat) het dipool-dipoool kragte en D (pentan-1-ol) het waterstofbinding tussen molekules.*
- *D het sterker intermolekulêre kragte as C.*
- *Meer energie benodig om intermolekulêre kragte te oorkom/verswak in D.*

(3)
[13]

QUESTION/*VRAAG* 4

4.1 4.1.1 Addition/Hydrohalogenation/Hydrobromination ✓
Addisie/Hidrohalogenering/Hidrobrominering (1)

4.1.2 Elimination/Dehydrohalogenation/Dehydrobromination ✓
Eliminasie/Dehidrohalogenering/Dehidrobrominering (1)

4.2 Pt/platinum ✓ (Also accept/*Aanvaar ook*: Pd or/of Ni) (1)

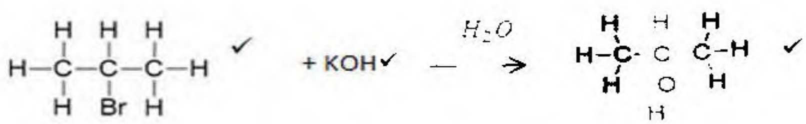
4.3 4.3.1 Hydrolysis ✓
Hidrolise (1)

4.3.2
- Dilute strong base
(NaOH(aq)/KOH(aq)/LiOH(aq)/sodium hydroxide(aq)/potassium hydroxide(aq)/lithium hydroxide(aq))✓
- Heat ✓ (NOTE: Do NOT accept temperature)

- *Verdunde sterk basis*
(NaOH(aq)/KOH(aq)/LiOH(aq)/natriumhidroksied(aq)/kaliumhidroksied (aq)/ litiumhidroksied(aq))
- *Hitte (NOTA: Moet NIE temperatuur aanvaar NIE)* (2)

4.3.3 Propan-2-ol ✓✓ (Accept/*Aanvaar*: 2-propanol) (2 or zero) (2)

4.4



+ KBr
(optional) (3)

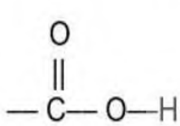
4.5 4.5.1 Esterification/Condensation ✓
Esterifikasie/Kondensasie (1)

4.5.2 Water ✓
(NOTE: Do NOT accept chemical formula)
(NOTA: Moet NIE die chemiese formule aanvaar nie) (1)

4.5.3 (Concentrated) sulphuric acid/ *(Gekonsentreerde) swawelsuur* ✓
(NOTE: Do NOT accept chemical formula)
(NOTA: Moet NIE die chemiese formule aanvaar nie) (1)

4.5.4 Hexanoic acid ✓✓ (2 or zero)
Heksanoësuur (2)

4.6



✓
(NOTE: Indicate all four bonds around carbon)
(NOTA: Dui al vier bindings rondom koolstof aan) (1)
[17]

QUESTION/*VRAAG* 5

5.1 5.1.1 **OPTION 1:**
What is the relationship between the concentration and rate of reaction? ✓✓
OR
OPTION 2:
What is the relationship between the state of division and rate of reaction? ✓✓
OR
OPTION 3:
How is the rate of the reaction affected by the degree of purity?

OPSIE 1:
Wat is die verband tussen die konsentrasie en die reaksietempo?
OF
OPSIE 2:
Wat is die verband tussen die toestand van verdeeldheid en die reaksietempo?
OF
OPSIE 3:
Hoe word die reaksietempo beïnvloed deur die graad van suiwerheid? (2)

5.1.2 **IF OPTION 1 IN 5.1.1:**
Temperature/state of division (surface area)/mass of impure $CaCO_3$ ✓

IF OPTION 2 IN 5.1.1:
Temperature/concentration/mass of impure $CaCO_3$ ✓

IF OPTION 3 IN 5.1.1:
Temperature/concentration/state of division (surface area)/mass of impure $CaCO_3$ ✓

INDIEN OPSIE 1 IN 5.1.1:
Temperatuur/toestand van verdeeldheid (oppervlakarea)/massa onsuiwer $CaCO_3$

INDIEN OPSIE 2 IN 5.1.1:
Temperatuur/konsentrasie/massa onsuiwer $CaCO_3$

INDIEN OPSIE 3 IN 5.1.1:
Temperatuur/konsentrasie/massa onsuiwer $CaCO_3$ (1)

5.1.3 Rate of reaction/volume of gas per unit time ✓
Reaksietempo/volume gas per eenheid tyd (1)

5.2 Rate between time 0 s and 20 s is faster(higher)/rate between time 30 s and 50 s is slower(lower) ✓

Tempo tussen 0 s en 20 s is vinniger(hoër)/tempo tussen 30 s en 50 s is stadiger(laer) (1)

5.3 Reaction stop/**calcium carbonate** is used up/reaction is complete. ✓
(**NOTE:** Hydrochloric acid is in excess)

*Die reaksie stop/**kalsiumkarbonaat** is opgebruik/reaksie is voltooi.*
*(**LET WEL:** Soutsuur is in oormaat)* (1)

5.4

MARKING CRITERIA/*NASIENKRITERIA*	
(a)	Any applicable formula *Enige toepaslike formule*
(b)	Dividing volume of CO_2 (from graph) by 24 dm^3 *Deel volume CO_2 (vanaf grafiek) deur 24 dm^3*
(c)	Using mole ratio for CO_2 to $CaCO_3$ (1:1) *Gebruik molverhouding vir CO_2 tot $CaCO_3$ (1:1)*
(d)	Multiplying $n(CaCO_3)$ with 100 in the correct formula *Vermenigvuldig n(CaCO3) met 100 in die korrekte formule*
(e)	Final answer *Finale antwoord*

$n = \frac{V}{Vm}$ ✓^{a}

$= \frac{0,025}{24}$ ✓^{b}

$= 1,042 \times 10^{-3}$ mol

From the balanced equation/*van die gebalanseerde vergelyking*:

$n(CO_2) : n(CaCO_3)$
1 : 1 ✓^{c}
$n(CaCO_3) = 1,042 \times 10^{-3}$ mol

$m(CaCO_3) = nM$
$= 1,042 \times 10^{-3} \times 100$ ✓^{d}
$= 0,104$ g ✓^{e} (0,10g) (5)

5.5 ***Positive marking from QUESTION 5.4/ Positiewe nasien vanaf VRAAG 5.4***

$$\% \text{ purity/}\textit{suiwerheid} = \frac{\text{pure mass sample/}\textit{suiwer massa monster}}{\text{impure mass sample/}\textit{onsuiwer massa monster}} \times 100$$

$$= \frac{0,104}{0,3} \times 100 \checkmark$$

$$= 34,67\ \% \checkmark \quad (33,33\text{-}34,67\%)$$ (2)

5.6 5.6.1 Steeper gradient/*Steiler gradiënt* ✓

(1)

5.6.2
- Increase in concentration increases the number of particles per unit volume. ✓
- More effective collisions per unit time. /Frequency of effective collisions increases. ✓
- Rate of reaction increases. ✓

- *Verhoging in konsentrasie verhoog die aantal deeltjies per eenheid volume.*
- *Meer effektiewe botsings per eenheid tyd./Frekwensie van effektiewe botsings neem toe*
- *Reaksietempo neem toe* (3)

[17]

QUESTION/*VRAAG* 6

6.1 (Chemical equilibrium is a dynamic equilibrium) when the rate of the forward reaction equals the rate of the reverse reaction. (2 or 0) ✓✓

(Chemiese ewewig is 'n dinamiese ewewig) wanneer die tempo van die voorwaartse reaksie gelyk is aan die tempo van die terugwaartse reaksie. (2)

6.2 6.2.1 More orange/*Meer oranje* ✓ (1)

6.2.2
- Nitric acid ionises completely in the solution thereby increasing the concentration of hydrogen ions ✓
- Forward reaction is favoured to decrease the concentration of hydrogen ions ✓
- Thus the concentration of (yellow) CrO_4^{2-} ions decrease and the concentration of (orange) $Cr_2O_7^{2-}$ ions increase ✓

- *Salpetersuur ioniseer volledig in oplossing, dus verhoog die konsentrasie waterstofione.*
- *Die voorwaartse reaksie word bevoordeel om die konsentrasie van die waterstofione te verminder.*
- *Dus sal die konsentrasie van die (geel) CrO_4^{2-} ione afneem en die konsentrasie van die (oranje) $Cr_2O_7^{2-}$ ione toeneem.* (3)

6.3 6.3.1 Exothermic/*Eksotermies* ✓ (1)

6.3.2
- An increase in temperature favours an endothermic reaction. ✓
- The mixture turns yellow, indicates that reverse reaction was favoured. ✓
- Thus the reverse reaction is endothermic✓ and forward reaction is exothermic.

- *'n Toename in temperatuur bevoordeel 'n endotermiese reaksie.*
- *Die mengsel word geel, dui daarop dat die terugwaartse reaksie bevoordeel was.*
- *Dus is die terugwaartse reaksie endotermies en die voorwaartse reaksie is eksotermies.* (3)

6.4 **MARKING CRITERIA/*NASIENKRITERIA*:**

(a)	Calculate equilibrium moles $Cr_2O_7^{2-}$ *Bereken die ewewigsmol $Cr_2O_7^{2-}$*
(b)	USE ratio **2**CrO_4^{2-}: **2**H^{1+}: **1**$Cr_2O_7^{2-}$ *GEBRUIK die verhouding **2**CrO_4^{2-}: **2**H^{1+}: **1**$Cr_2O_7^{2-}$*
(c)	Calculate equilibrium moles of CrO_4^{2-} **and** H^{1+} by subtraction. *Bereken die ewewigsmol van CrO_4^{2-} **en** H^{1+} deur aftrekking.*
(d)	Divide equilibrium moles by 0,5 ($mol{\cdot}dm^{-3}$) *Deel ewewigsmolle deur 0,5 ($mol{\cdot}dm^{-3}$)*
(e)	Correct Kc expression (formulae in square brackets) *Korrekte Kc uitdrukking (formules in blokhakies)*
(f)	Substitution of Kc value into expression *Vervang Kc waarde in Kc uitdrukking*
(g)	Substitution of concentrations into <u>correct</u> Kc expression *Vervang konsentrasies in <u>korrekte</u> Kc uitdrukking*
(h)	Final answer: 10,25 mol *Finale antwoord: 10,25 mol*

	CrO_4^{2-}	H^+	$Cr_2O_7^{2-}$
Initial amount (moles) *Aanvanklike hoeveelheid (mol)*	11	x	0
Change in amount (moles) *Verandering in hoeveelheid (mol)*	9	9	4,5 ✓ **b**
Equilibrium amount (moles) *Ewewigshoeveelheid (mol)*	2 ✓**c**	x-9	(9x0,5) =4,5 ✓ **a**
Equilibrium concentration ($mol{\cdot}dm^{-3}$) *Ewewigskonsentrasie ($mol{\cdot}dm^{-3}$)*	2÷0,5 =4 ✓**d**	(x-9)÷0,5 =2x-18	9

$$Kc = \frac{[Cr_2O_7^{2-}]}{[CrO_4^{2-}]^2\,[H^{1+}]^2} \checkmark e$$

$$(0{,}09) \checkmark f = \frac{(9)}{(4)^2\,(2x-18)^2} \checkmark g$$

$$(0{,}3)^2 = \frac{(3)^2}{(4)^2\,(2x-18)^2}$$

$$x = 10{,}25 \text{ (mol)} \checkmark h$$

- No Kc expression, correct substitution
  Max: 7/8
- Wrong Kc expression
  Max: 5/8
- *Geen Kc uitdrukking, korrekte vervanging*
  Maks: 7/8
- *Verkeerde Kc uitdrukking*
  Maks: 5/8

(8)

[18]

QUESTION/*VRAAG* 7

7.1 7.1.1 pH = $-\log[H_3O^+]$ ✓ or $[H_3O^+] = 10^{-pH}$
4,2✓= $-\log[H_3O^+]$
$[H_3O^+] = 10^{-4,2}$
$[H_3O^+] = 6,31 \times 10^{-5}\ mol\cdot dm^{-3}$ ✓ (3)

7.1.2 WEAKER THAN✓

- H_2CO_3 has smaller Ka value than H_2SO_4, indicating that it ionises incompletely/partially.
  OR
- H_2CO_3 has a concentration of 0,02 $mol\cdot dm^{-3}$, but $[H_3O^+]$ is calculated at $6,31 \times 10^{-5}\ mol\cdot dm^{-3}$. Therefore carbonic acid ionises incompletely/partially and is weaker than sulphuric acid that will ionise completely.
  OR
- H_2CO_3 has a pH of 4,2. Sulphuric acid has a lower pH.

(ACCEPT ANY ONE OF THE OPTIONS AS MOTIVATION) ✓

SWAKKER AS

- *H_2CO_3 het 'n laer Ka waarde as H_2SO_4 wat aandui dat dit onvolledig ioniseer.*
  OF
- *H_2CO_3 het 'n konsentrasie van 0,02 $mol\cdot dm^{-3}$, maar $[H_3O^+]$ is bereken as $6,31 \times 10^{-5}\ mol\cdot dm^{-3}$. Dus het koolsuur/karbonaatsuur onvolledig ioniseer en is swakker as swawelsuur wat wel volledig ioniseer.*
  OF
- *H_2CO_3 het 'n pH van 4,2. Swawelsuur het 'n laer pH.*

(AANVAAR ENIGE EEN VAN DIE OPSIES AS MOTIVERING) (2)

7.2 7.2.1 Hydrolysis is the reaction of <u>a salt with water</u>. ✓
Hidrolise is die reaksie van <u>'n sout met water</u>. (1)

7.2.2 GREATER THAN 7/*GROTER AS 7*✓ (1)

7.2.3 $CH_3COO^- + H_2O$ ✓→ $CH_3COOH + OH^-$ ✓
(Accept/Aanvaar: $CH_3COONa + H_2O \rightarrow CH_3COOH + NaOH$)

- Hydrolysis of acetate forms hydroxide ions✓

OR

- An increased concentration of hydroxide ions will make the solution more alkaline/increase pH

OR

- A weak acid (vinegar) reacting with a strong base (NaOH) results in an alkaline solution. (3)

- *Hidrolise van asetaat vorm hidroksied-ione*

OF

- *'n Toename in die konsentrasie hidroksied-ione sal die oplossing meer alkalies maak/die pH verhoog*

OF

- *As swak suur (asyn) reageer met 'n sterk basis (NaOH) sal die oplossing alkalies wees*

7.3 7.3.1

OPTION 1/*OPSIE 1:*

$n_{(HCl)\ initially/aanvanklik} = cV$ ✓
$= (0,3)(0,025)$ ✓
$= 0,01$ mol ✓

OPTION 2/*OPSIE 2:*

$n_{(HCl)\ initially/aanvanklik} = cV$ ✓
$= (0,3)(0,025)$ ✓
$= 0,0075$ mol ✓ (3)

7.3.2

OPTION 1/*OPSIE 1:*
Positive marking from 7.3.1

$n_{(NaOH)\ added/bygesit}$
$= cV$
$= (0,1)(0,015)$ ✓
$= 0,0015$ mol

$n_{(NaOH)}: n_{(HCl)\ left/oor}$
1:1 ✓
$n_{(HCl)\ left/oor} = 0,0015$ mol

$n_{(HCl)\ reacted/gereageer}$
$= n_{(HCl)\ initially/aanvanklik} - n_{(HCl)\ left/oor}$
$= (0,01) - (0,0015)$ ✓
$= 0,0085$ mol ✓

OPTION 2/*OPSIE 2:*
Positive marking from 7.3.1

$n_{(NaOH)\ added/bygesit}$
$= cV$
$= (0,1)(0,015)$ ✓
$= 0,0015$ mol

$n_{(NaOH)}: n_{(HCl)\ left/oor}$
1:1 ✓
$n_{(HCl)\ left/oor} = 0,0015$ mol

$n_{(HCl)\ reacted/gereageer}$
$= n_{(HCl)\ initially/aanvanklik} - n_{(HCl)\ left/oor}$
$= (0,0075) - (0,0015)$ ✓
$= 0,006$ mol ✓

(4)

7.3.3 **OPTION 1/*OPSIE 1*:**
Positive marking from 7.3.2

$n_{(Y2CO3)}$: $n_{(HCl)}$ reacted with Y2CO3/ *gereageer met* Y2CO3

1:2✓

$n_{(Y2CO3)}$ = 0,0085÷2
= 0,00425 mol

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

$$0{,}00425 = \frac{0{,}5865}{M} \checkmark$$

= 138 g·mol^{-1}

Mr (CO_3) = 12+(3x16)
= 60 g·mol^{-1}

Mr (Y_2) = 138 – 60 ✓
= 78 g·mol^{-1}

Ar (Y) = 78÷2 = 39 g·mol^{-1}✓

Element Y is POTASSIUM/K✓
Element Y is KALIUM/K

OPTION 2/*OPSIE 2*:
Positive marking from 7.3.2

$n_{(Y2CO3)}$: $n_{(HCl)}$ reacted with Y2CO3/ *gereageer met* Y2CO3

1:2✓

$n_{(Y2CO3)}$ = 0,006÷2
= 0,003 mol

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

$$0{,}003 = \frac{0{,}5865}{M} \checkmark$$

= 195,5 g·mol^{-1}

Mr (CO_3) = 12+(3x16)
= 60 g·mol^{-1}

Mr (Y_2) = 195,5 – 60 ✓
= 135,5 g·mol^{-1}

Ar (Y) = 135,5÷2 = 67,75 g·mol^{-1}✓

Element Y is ZINC/Zn (Ar=65)✓
Element Y is SINK/Zn

OR/OF

Element Y is GALLIUM/Ga (Ar=70)

OR/OF

Element Y cannot be identified from periodic table/
Element Y kan nie vanaf die periodieke tabel identifiseer word nie (5)

[22]

QUESTION/*VRAAG* 8

8.1 8.1.1 NICKEL/*NIKKEL* ✓ (1)

8.1.2 $Cd \rightarrow Cd^{2+} + 2e^-$ ✓✓

> **Marking criteria/*Nasienkriteria:***
> - Reactants ✓ Products ✓
>   *Reaktanse* ✓ *Produkte* ✓
> - Ignore phases/*Ignoreer fases*
> - Ignore if charge omitted on electron./*Ignoreer indien lading weggelaat op elektron.*
> - Marking rule 6.3.10/*Nasienreël 6.3.10:*
> $Cd^{2+} + 2e^- \leftarrow Cd$ $(\frac{2}{2})$
> $Cd \rightleftharpoons Cd^{2+} + 2e^-$ $(\frac{1}{2})$
> $Cd^{2+} + 2e^- \rightleftharpoons Cd$ $(\frac{0}{2})$
> $Cd \leftarrow Cd^{2+} + 2e^-$ $(\frac{0}{2})$

(2)

8.1.3 INCREASE ✓
Increasing the Ni^{2+} ion concentration will favour the forward reaction✓

TOENEEM
Deur Ni^{2+} ioon konsentrasie te verhoog sal die voorwaartse reaksie bevoordeel word (2)

8.2 8.2.1 $Cu(s) + 2Ag^+(aq)$ ✓$\rightarrow 2Ag(s) + Cu^{2+}(aq)$ ✓ bal ✓ (3)

8.2.2 <u>CATHODE/*KATODE*: ($2Ag^+ + 2e^- \rightarrow 2Ag$)</u>

$n_{(Ag^+)\ \text{reacted/}\textit{gereageer}} = cV$
$= (0,5)(0,2)$ ✓
$= 0,1\ mol$

$n_{(Cu)\ \text{reacted/}\textit{gereageer}} : n_{(Ag^+)\ \text{reacted/}\textit{gereageer}}$
1:2 ✓
$n_{(Cu)\ \text{reacted/}\textit{gereageer}} = 0,1 \div 2$
$= 0,05\ mol$

ANODE: ($Cu \rightarrow Cu^{2+} + 2e^-$)

$n_{(Cu)\ \text{reacted}/\textit{gereageer}} : n_{(Cu^{2+})\ \text{released}/\textit{vrygestel}}$

1:1

$n_{(Cu^{2+})\ \text{released}/\textit{vrygestel}} = 0{,}05$ mol

$n_{(Cu^{2+})\ \text{initially}/\textit{aanvanklik}} = cV$

$= (1)\ ✓\ \times (0{,}2)\ ✓$

$= 0{,}2$ mol

$n_{(Cu^{2+})\ \text{fina/finaal}} = n_{(Cu^{2+})\ \text{initially}/\textit{aanvanklik}} + n_{(Cu^{2+})\ \text{released}/\textit{vrygestel}}$

$= (0{,}2) + (0{,}05)\ ✓$

$= 0{,}25$ mol

$c_{(Cu^{2+})\ \text{final}/\textit{finaal}} = \dfrac{n_{(Cu^{2+})\ \text{final}/\textit{finaal}}}{V}$

$c = \dfrac{0{,}25}{0{,}2}\ ✓$

$= 1{,}25\ mol \cdot dm^{-3}\ ✓$ (7)

[15]

QUESTION/*VRAAG* 9

9.1 The anode is the electrode where oxidation takes place. ✓✓
Die anode is die elektrode waar oksidasie plaasvind. (2)

9.2 **DO NOT MARK 9.2**
X
Concentrated sodium chloride/brine contains chlorine ions that will oxidise at electrode X/positive electrode OR
Concentrated sodium chloride/brine enters the membrane cell on the anode side OR
Chlorine ions are negative and will be attracted by a positive electrode
(ANY ONE OF THE MOTIVATIONS FOR ONE MARK)
X
Gekonsentreerde natriumchloried/pekel bevat chloriedione wat sal oksideer by elektrode X/positiewe elektrode OF
Gekonsentreerde natriumchloried/pekel dring die membraansel aan die anode kant binne OF
Chloriedione is negatief en sal deur die positiewe elektrode aangetrek word
(ENIGE EEN VAN DIE MOTIVERINGS VIR EEN PUNT)

9.3 9.3.1 Chlorine gas/$C\ell_2$ ✓✓ (ACCEPT: Hydrogen gas/H_2) (2)
Chloorgas/$C\ell_2$ (AANVAAR: Waterstof gas/H_2)

9.3.2 **DO NOT MARK 9.3.2**
Water/H_2O

9.4 $2H_2O + 2e^- \rightarrow H_2 + 2OH^-$

Marking criteria/*Nasienkriteria:*
• Reactants ✓ *Reaktanse*   Products ✓ *Produkte*   Balancing ✓ *Balansering*
• Ignore phases/*Ignoreer fases*
• Ignore if charge omitted on electron./*Ignoreer indien lading weggelaat op elektron.*
• Marking rule 6.3.10/*Nasienreël 6.3.10:* $2H_2O + 2e^- \leftarrow H_2 + 2OH^-$ (1/3) $H_2 + 2OH^- \rightleftharpoons 2H_2O + 2e^-$ (1/3) $2H_2O + 2e^- \rightleftharpoons H_2 + 2OH^-$ (2/3) $H_2 + 2OH^- \leftarrow 2H_2O + 2e^-$ (3/3)

(3)

9.5
- H_2O is a stronger oxidising agent ✓than Na^+ ✓and is reduced (to H_2)✓
OR
- Na^+ is a weaker oxidising agent than H_2O and therefore H_2O is reduced

- *H_2O is 'n sterker oksideermiddel as Na^+ en sal dus reduseer (tot H_2)*
OF
- *Na^+ is 'n swakker oksideermiddel as H_2O en sal dus reduseer H_2O* (3)

[10]

TOTAL/*TOTAAL*: 150