basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATIONS
SENIORSERTIFIKAAT-EKSAMEN

PHYSICAL SCIENCES: CHEMISTRY (P2)
FISIESE WETENSKAPPE: CHEMIE (V2)

2016

MEMORANDUM

MARKS/*PUNTE*: 150

This memorandum consists of 14 pages.
Hierdie memorandum bestaan uit 14 bladsye.

QUESTION/*VRAAG 1*

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

[20]

QUESTION/*VRAAG 2*

2.1

2.1.1 E ✓ (Accept/*Aanvaar:* methyl propanoate/*metiel propanoaat*) (1)

2.1.2 C ✓ (Accept/*Aanvaar:* butan-1-ol) (1)

2.1.3 D ✓ (Accept/*Aanvaar:* 2,2-dimethylpropane/*2,2-dimetielpropaan*) (1)

2.2

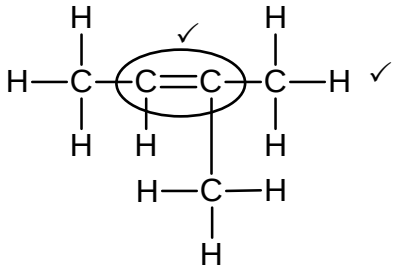
2.2.1 Pent-2✓-yne✓ /*Pent-2-yn*

OR/*OF*
2✓-pentyne✓/*2-pentyn*

Marking criteria/*Nasienriglyne:*
- Stem i.e. pentyne./*Stam d.i. pentyn.* ½
- Whole name correct./*Hele naam korrek.* 2/2

(2)

2.2.2



✓ ✓

Marking criteria/*Nasienriglyne:*
- Functional group correct./*Funksionele groep korrek.* ½
- Whole structure correct/*Hele struktuur korrek.* 2/2

(2)

2.2.3 2-methylbut-1-ene/*2-metielbut-1-een*

OR/*OF*
3-methylbut-1-ene/*3-metielbut-1-een*

Accept/Aanvaar 2-methyl-1-butene / *2-metiel-1-buteen*

Marking criteria/*Nasienriglyne:*
- Correct stem i.e. but-1-ene/1-butene./*Korrekte stam d.i. but-1-een /1-buteen.* ✓
- Only one type substituent ,methyl, correctly identified./*Slegs* een tipe *substituent metiel, korrek geïdentifiseer.* ✓
- Entire name correct./*Hele naam korrek.* ✓

(3)

2.3

2.3.1 Esters ✓ (1)

2.3.2 Sulphuric acid/H_2SO_4/*Swawelsuur* ✓ (1)

2.3.3 Methyl✓ propanoate ✓
Metiel✓propanoaat ✓

Marking criteria/*Nasienriglyne:*
Ignore spelling, e.g. methylpropanoate.
Ignoreer spelling, bv. metiel propanoaat.

(2)
[14]

QUESTION/*VRAAG 3*

3.1 The temperature at which the vapour pressure equals the atmospheric pressure (external pressure). ✓✓ **(2 marks or no marks)**
Die temperatuur waarby die dampdruk gelyk is aan die atmosferiese druk (eksterne druk). ***(2 punte of geen punte nie)*** (2)

3.2

Criteria for conclusion/*Riglyne vir gevolgtrekking*:	
Dependent and independent variables correctly identified. *Afhanklike en onafhanklike veranderlikes korrek geïdentifiseer.*	✓
Relationship between the independent and dependent variables correctly stated./*Verwantskap tussen die afhanklike en onafhanklike veranderlikes korrek genoem.*	✓

Examples/*Voorbeelde*:

- Boiling point increases with increase in number of (C) atoms/chain length/ molecular size/molecular mass.
  Kookpunt neem toe met styging in getal (C)-atome/kettinglengte/ molekulêre grootte/molekulêre massa.
- Boiling point decreases with decrease in number of C atoms/chain length/ molecular size/molecular mass.
  Kookpunt neem af met daling in getal C-atome/kettinglengte/molekulêre grootte/molekulêre massa.
- Boiling point is proportional to number of C atoms/chain length/molecular size/molecular mass.
  Kookpunt is eweredig aan getal C-atome/kettinglengte/molekulêre grootte/ molekulêre massa.

IF/*INDIEN*:
Boiling point is DIRECTLY proportional to number of C atoms/chain length/molecular size/molecular mass: Max. $\frac{1}{2}$
Kookpunt is DIREK eweredig aan getal C-atome/kettinglengte/molekulêre grootte/molekulêre massa: *Maks.* $\frac{1}{2}$ (2)

3.3

3.3.1 P ✓ (1)

3.3.2 R ✓ (1)

3.4

- Between alkane molecules are London forces/dispersion forces/induced dipole forces.
  Tussen alkaanmolekule is London-kragte/dispersiekragte/geïnduseerde dipoolkragte. ✓
- In addition to London forces and dipole-dipole forces each alcohol molecule has (one site) for hydrogen bonding. ✓
  Behalwe London-kragte en dipool-dipoolkragte het elke alkohol-molekuul een punt vir waterstofbindings.
- In addition to London forces and dipole-dipole forces each carboxylic acid molecule has two sites for hydrogen bonding. ✓ (Accept: more sites/*Aanvaar meer punte*)
  Behalwe London-kragte en dipool-dipoolkragte het elke karboksielsuur-molekuul twee punte vir waterstofbindings.
- Intermolecular forces in carboxylic acids are stronger than intermolecular forces in alkanes and alcohols./Intermolecular forces between alkane and alcohol molecules are weaker than intermolecular forces between carboxylic acid molecules.✓
  Intermolekulêre kragte in karboksielsure is sterker as intermolekulêre kragte in alkane en alkohole./Intermolekulêre kragte tussen alkane en alkohole is swakker as intermolekulêre kragte tussen karboksielsuur-molekule.
- More energy is needed to overcome/break intermolecular forces in carboxylic acids than in the other two compounds. ✓
  Meer energie word benodig om intermolekulêre kragte in karboksielsure as in die ander twee verbindings te oorkom/breek.

(5)
[11]

QUESTION/*VRAAG 4*

4.1

4.1.1 Addition/Hydrogenation ✓
Addisie/Hidrogenasie/Hidrogenering (1)

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

4.1.3 Substitution/Halogenation/Bromination ✓
Substitusie/Halogenering/Halogenasie/Brominering (1)

4.2

4.2.1 Pt/Ni/Pd/platinum/nickel/*nikkel*/palladium ✓ (1)

4.2.2 H_2SO_4/H_3PO_4/sulphuric acid/phosphoric acid ✓
H_2SO_4/H_3PO_4/swawelsuur/fosforsuur (1)

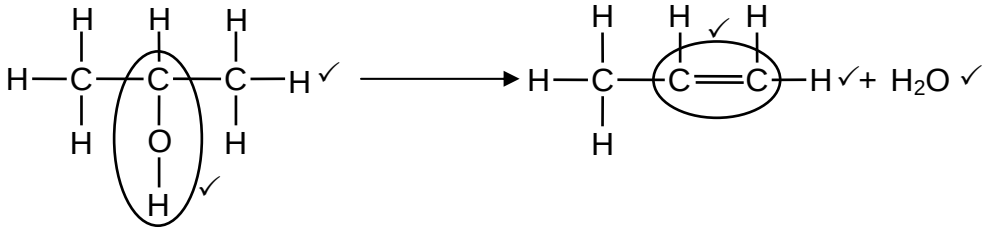
4.2.3 Hydration/*Hidrasie/Hidratering* ✓ (1)

4.2.4 2✓-bromopropane ✓

Marking criteria/*Nasienriglyne:*
- Bromopropane/*Bromopropaan:* ½
- 2-bromopropane
  2-bromopropaan 2/2

(2)

4.3



Notes/*Aantekeninge:*
Whole structure of alkene correct/*Hele struktuur van alkeen korrek:* ✓✓
Only functional group correct/*Slegs funksionele groep korrek:* ✓

Notes/*Aantekeninge:*
- Condensed or semistructural formula: Max. $\frac{4}{5}$
  Gekondenseerde of semistruktuurformule: *Maks.* $\frac{4}{5}$
- Molecular formula/*Molekulêre formule*: $\frac{1}{5}$
- Marking rule 3.9/*Nasienreël 3.9*
- Any additional reactants or products: Max. $\frac{4}{5}$
  Enige addisionele reaktanse of produkte: Maks. $\frac{5}{5}$
- If arrow in equation omitted: Max. $\frac{4}{5}$
  Indien pyltjie in vergelyking uitgelaat is: *Maks.* $\frac{4}{5}$

(5)

4.4
- Higher temperature/*Hoër temperatuur* ✓
- Concentrated base/Base dissolved in ethanol ✓
  Gekonsentreerde basis/Basis opgelos in etanol

(2)
[15]

QUESTION/*VRAAG 5*

5.1 **ANY TWO/*ENIGE TWEE*:**
Temperature (of reaction mixture)/*Temperatuur (van reaksiemengsel)* ✓
(Addition of a) catalyst/*(Byvoeging van 'n) katalisator* ✓
Concentration (of reactants)/*Konsentrasie (van reaktanse)* (2)

5.2 Sulphur/S/*Swawel* ✓ (1)

5.3 Water is used to dilute/change the concentration (of the $Na_2S_2O_3(aq)$) ✓
Water word gebruik (om die $Na_2S_2O_3(aq)$) te verdun/se konsentrasie te verander. (1)

5.4

Criteria for investigative question/*Kriteria vir ondersoekende vraag:*	
The dependent and independent variables are stated correctly. *Die afhanklike en onafhanklike veranderlikes word korrek genoem.*	✓
Asks a question about the relationship between dependent and independent variables./*Vra 'n vraag oor die verwantskap tussen afhanklike en onafhanklike veranderlikes.*	✓

Dependent variable: rate (of reaction)/(reaction rate)
Afhanklike veranderlike: *(reaksie)tempo*

Independent variable: concentration
***Onafhanklike veranderlike*:** *konsentrasie*

Examples/*Voorbeelde:*

- What is the relationship between concentration and reaction rate?
  Wat is die verwantskap tussen konsentrasie en reaksietempo?
- How does the reaction rate change with change in concentration?
  Hoe verander die reaksietempo met verandering in konsentrasie? (2)

5.5 A ✓ (1)

5.6 **Experiment B/*Eksperiment B:***

- The concentration of $Na_2S_2O_3(aq)$ is higher./More $Na_2S_2O_3$ particles per unit volume. ✓Accept: higher volume of $Na_2S_2O_3(aq)$ is used
  Die konsentrasie van $Na_2S_2O_3(aq)$ is hoër./Meer $Na_2S_2O_3$-deeltjies per eenheid volume. Aanvaar: Groter volume $Na_2S_2O_3(aq)$ is gebruik
- More particles with correct orientation / *Meer deeltjies met korrekte oriëntasie.* ✓
- More effective collisions per unit time / Higher frequency of effective collisions. ✓
  Meer effektiewe botsings per eenheid tyd./Hoër frekwensie van effektiewe botsings.

OR/*OF*

Experiment D/*Eksperiment D*:

- The concentration of $Na_2S_2O_3(aq)$ is lower./Less $Na_2S_2O_3$ particles per unit volume. ✓
  Die konsentrasie van $Na_2S_2O_3(aq)$ is laer./Minder $Na_2S_2O_3$-deeltjies per eenheid volume.
- Less particles with correct orientation./*Minder deeltjies met korrekte oriëntasie.* ✓
- Less effective collisions per unit time./Lower frequency of effective collisions. ✓
  Minder effektiewe botsings per eenheid tyd./Laer frekwensie van effektiewe botsings. (3)

5.7

Marking guidelines for Option 1 and 2/*Nasienriglyne vir Opsie 1 en 2:*

- Formula/*Formule*: $c = \frac{m}{MV}$ / Both/*Beide* $n = \frac{m}{M}$ and/*en* $c = \frac{n}{V}$ or/*of* ratio / *verhouding* ✓
- Use/*Gebruik* 158 g·mol^{-1} ✓
- Use volume (250 cm^3) to calculate c($Na_2S_2O_3$) or m($Na_2S_2O_3$). ✓
  Gebruik volume (250 cm^3) *om c($Na_2S_2O_3$) of m($Na_2S_2O_3$) te bereken.*
- Calculate n($Na_2S_2O_3$)./*Bereken n($Na_2S_2O_3$).* ✓
- Use ratio/*Gebruik verhouding*: n(S) = ($Na_2S_2O_3$) = 1: 1 ✓
- Use/*Gebruik* 32 g·mol^{-1}. ✓
- Final answer/*Finale antwoord*: 0,51 g ✓
- Accepted range/*Aanvaarde gebied*: 0,50 to 0,51 g

Marking guidelines for Option 3 and 4/*Nasienriglyne vir Opsie 3 en 4:*

- Use volume (250 cm^3)/*Gebruik volume* (250 cm^3)
- Use m($Na_2S_2O_3$). 62,5 g✓/Gebruik *m($Na_2S_2O_3$)= 62,5 g*
- Use/*Gebruik* 158 g·mol^{-1} ✓
- Calculate n($Na_2S_2O_3$) or m($Na_2S_2O_3$)./*Bereken n($Na_2S_2O_3$) of m($Na_2S_2O_3$).* ✓
- Use ratio/*Gebruik verhouding*: n(S) = ($Na_2S_2O_3$) = 1: 1 ✓
- Use/*Gebruik* 32 g·mol^{-1}. ✓
- Final answer/*Finale antwoord*: 0,51 g ✓
- Accepted range/*Aanvaarde gebied*: 0,50 to 0,51 g

OPTION/*OPSIE* 1

$c = \frac{m}{MV}$ ✓

$= \frac{62,5}{✓(158)(0,25)}$ ✓

$= 1,58 \text{ mol} \cdot \text{dm}^{-3}$

OPTION/*OPSIE* 2

$n = \frac{m}{M}$ ✓

$= \frac{62,5}{158}$ ✓

$= 0,396$ mol

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

$= \frac{0,396}{0,25}$ ✓

$= 1,58 \text{ mol} \cdot \text{dm}^{-3}$

OPTION/*OPSIE* 3

250 cm^3 ..... 62,5 g

10 cm^3 ..... $\frac{10}{250}$ ✓x 62,5✓

∴ m($Na_2S_2O_3$ in D) = 2,5 g

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

$= \frac{2,5}{158}$ ✓ } ✓

= 0,0158 mol

OPTION/*OPSIE* 4

250 cm^3 ..... 62,5 g

10 cm^3 .... $\frac{10}{250}$ ✓ x 62,5✓

∴ m($Na_2S_2O_3$ in D) = 2,5 g

158 g ..... 32 g S ✓

2,5 g .....x g

m (x) = $\frac{2,5 \times 32}{158}$ ✓ } ✓

= 0,51 g ✓

n($Na_2S_2O_3$ in D) = cV
= (1,58)(0,01) ✓
= 0,0158 mol

n(S) = ($Na_2S_2O_3$) ✓
= 0,0158

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

$0,0158 = \frac{m}{32}$ ✓

$m = 0,51 \text{ g}$ ✓

(7)
[17]

QUESTION/*VRAAG 6*

6.1 Reversible reaction/*Omkeerbare reaksie* ✓ (1)

6.2 Endothermic/*Endotermies* ✓

ΔH is positive./ΔH > 0/(Net) energy is absorbed./More energy is absorbed than released/Energy of product > energy of reactant. ✓
ΔH is positief./ΔH > 0/(Netto) energie word opgeneem./Meer energie word geabsorbeer as vrygestel./Energie van produk > Energie van reaktans (2)

6.3 Larger than/Groter as ✓

$K_c > 1$ ✓ (2)

6.4

CALCULATIONS USING NUMBER OF MOLES
BEREKENINGE WAT GETAL MOL GEBRUIK

Mark allocation/*Puntetoekenning:*

- Calculate $n(CO)_{equilibrium}$ i.e. divide m by 28 $g \cdot mol^{-1}$ OR substitute 6 mol for equilibrium mole of CO. ✓
  Bereken $n(CO)_{ewewig}$ d.i. deel m deur 28 $g \cdot mol^{-1}$ OF vervang 6 mol vir ewewigsmol van CO.
- Change in n(*CO*) = equilibrium n(*CO*) – initial n(*CO*) ✓
  Verandering in n(*CO*) = *ewewig* n(*CO*) – *aanvanklike* n(*CO*)
- **USING** ratio/***GEBRUIK*** *verhouding:* $CO_2 : CO = 1 : 2$ ✓
- Equilibrium $n(CO_2)$= initial $n(CO_2)$ - change $n(CO_2)$. ✓
  Ewewig $n(CO_2)$= aanvanklike $n(CO_2)$ - verandering $n(CO_2)$.
- Equilibrium mole of both CO_2 and CO divided by 2 dm^3. ✓
  Ewewigsmol van beide CO_2 en CO gedeel deur 2 dm^3
- Correct K_c expression (formulae in square brackets). ✓
  Korrekte K_c-uitdrukking (formules in vierkanthakies).
- Substitution of concentrations into K_c expression. ✓
  Vervanging van konsentrasies in K_c-uitdrukking.
- Substitution of K_c value/*Vervanging van K_c-waarde*. ✓
- Final answer/*Finale antwoord*: 4,28–4,29 (mol) ✓

OPTION 1/*OPSIE 1*

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

$= \frac{168}{28}$ ✓

$= 6$ mol

	CO_2	CO
Initial quantity (mol) *Aanvangshoeveelheid (mol)*	x	0
Change (mol) *Verandering (mol)*	3	6 ✓
Quantity at equilibrium (mol)/ *Hoeveelheid by ewewig (mol)*	x – 3 ✓	6
Equilibrium concentration ($mol \cdot dm^{-3}$) *Ewewigskonsentrasie ($mol \cdot dm^{-3}$)*	$\frac{x-3}{2}$	3

ratio ✓ *verhouding*

Divide by 2 ✓

$K_c = \frac{[CO]^2}{[CO_2]}$ ✓

14 ✓ $= \frac{(3)^2}{\frac{x-3}{2}}$ ✓

$\therefore$ x = 4,29 mol ✓

No K_C expression, correct substitution/*Geen K_c-uitdrukking*, *korrekte substitusie*: Max./*Maks.* $^8/_9$

Wrong K_C expression/*Verkeerde K_c-uitdrukking*: Max./*Maks.* $^6/_9$

OPTION 2/*OPSIE 2*

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

$= \frac{168}{28}$ ✓

$= 6$ mol

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

$= \frac{6}{2}$ Divide by/*Deel deur* 2 ✓

$= 3 \text{ mol} \cdot \text{dm}^{-3}$

	CO_2	CO
Initial concentration ($mol \cdot dm^{-3}$) *Aanvangskonsentrasie ($mol \cdot dm^{-3}$)*	x	0
Change ($mol \cdot dm^{-3}$) *Verandering* ($mol \cdot dm^{-3}$)	1,5	3 ✓
Equilibrium concentration ($mol \cdot dm^{-3}$) *Ewewigskonsentrasie ($mol \cdot dm^{-3}$)*	x – 1,5 ✓	3

ratio ✓ *verhouding*

$K_c = \frac{[CO]^2}{[CO_2]}$ ✓

14 ✓ $= \frac{[3]^2}{x-1,5}$ ✓

$\therefore$ x = 2,14 $mol \cdot dm^{-3}$

No K_C expression, correct substitution/*Geen K_c-uitdrukking*, *korrekte substitusie*: Max./*Maks.* $^8/_9$

Wrong K_C expression/*Verkeerde K_c-uitdrukking*: Max./*Maks.* $^6/_9$

$n(CO_2) = cV$

$= (2,14)(2)$

$= 4,29$ mol ✓

OPTION 3/*OPSIE 3*

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

$= \frac{168}{28}$ ✓

$= 6$ mol

	CO_2	CO
Initial quantity (mol) *Aanvangshoeveelheid (mol)*	4,28✓	0
Change (mol) *Verandering (mol)*	3	6
Quantity at equilibrium (mol)/ Hoeveelheid by ewewig (mol)	1,28 ✓	6✓
Equilibrium concentration ($mol \cdot dm^{-3}$) Ewewigskonsentrasie ($mol \cdot dm^{-3}$)	0,64	3

ratio ✓
verhouding

multiply by 2✓
vermenigvuldig met 2

$K_c = \frac{[CO]^2}{[CO_2]}$ ✓

14 ✓ $= \frac{[3]^2}{[CO_2]}$ ✓

$\therefore [CO_2] = 0,64 \ mol \cdot dm^{-3}$

No K_C expression, correct substitution/*Geen K_c-uitdrukking*, *korrekte substitusie*: Max./*Maks.* 8/9

Wrong K_C expression/*Verkeerde K_c-uitdrukking*: Max./M*aks.* 6/9

(9)

6.5

6.5.1 Remains the same/*Bly dieselfde* ✓ (1)

6.5.2 Decreases/*Verminder* ✓ (1)

6.5.3 Increases/*Vermeerder* ✓ (1)

[17]

QUESTION/*VRAAG 7*

7.1

7.1.1 An acid is a *proton/ H^+ donor.* ✓✓ **NOTE**: not H_3O^+ (2 or/*of* 0)
'n Suur is 'n protondonor/ H^+ skenker. ***LET WEL*** *nie H_3O^+ nie* (2)

7.1.2 H_2O ✓
H_2CO_3 ✓ (2)

7.1.3 H_2O ✓

OR/*OF*
HCO_3^- (1)

7.2

7.2.1 $n(HCl) = cV$ ✓
$= (0,1)(0,5)$ ✓
$= 0,05$ mol

$n(NaHCO_3) = cV$
$= (0,25)\ (0,8)$ ✓
$= 0,2$ mol

$n(NaHCO_3)_{reacted/gereageer} = n(HCl)$
$= 0,05$ mol ✓

$n(NaHCO_3)_{excess/oormaat} = \underline{0,2 - 0,05}$ ✓
$= 0,15$ mol

$n(OH^-) = n(NaHCO_3)$ ✓
$= 0,15$ mol

$c(OH^-) = \frac{n}{V}$

$= \frac{0,15}{1,3}$ ✓

$= 0,12 \text{ mol} \cdot \text{dm}^{-3}$ ✓

Marking guidelines/*Nasienriglyne:*
- Formula/*Formule:*
  $c = \frac{n}{V}$ / $n = cV$ ✓
- Substitution of (0,1)(0,5). ✓
  Vervanging van (0,1)(0,5).
- Substitution of (0,8)(0,25). ✓
  Vervanging van (0,8)(0,25).
- Use $n(NaHCO_3) = n(HCl) = 1:1$. ✓
  Gebruik $n(NaHCO_3) = n(HCl) = 1:1$.
- $n_{b(in\ excess)} = n_{b(initial)} - n_{b(reacted)}$
  $n_{b(in\ oormaat)} = n_{b(aanvanklik)} - n_{b(gereageer)}$
- Use $n(OH^-) = n(NaHCO_3) = 1:1$. ✓
  Gebruik $n(OH^-) = n(NaHCO_3) = 1:1$.
- Substitute V = 1,3 dm^3 in $c = \frac{n}{V}$
  Vervang V = 1,3 dm^3 in $c = \frac{n}{V}$
- Final answer/*Finale antwoord:*
  0,12 $mol \cdot dm^{-3}$ ✓

(8)

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

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$K_w = [H_3O^+][OH^-] = 1 \times 10^{-14}$ $1 \times 10^{-14} = [H_3O^+](0,12)$ ✓ $[H_3O^+] = 8,33 \times 10^{-14}$ mol·dm^{-3} pH = - log $[H_3O^+]$ ✓ = - log$(8,33 \times 10^{-14})$ ✓ = 13,08 ✓	pOH = -log$[OH^-]$ ✓ = -log(0,12) ✓ = 0,92 pH + pOH = 14 pH + 0,92 = 14 ✓ pH = 13,08 ✓

(4)
[17]

QUESTION/*VRAAG 8*

8.1 Electrons are transferred./*Elektrone word oorgedra*. ✓

OR/*OF*
The oxidation number of Mg/H changes.
Die oksidasiegetal van Mg/H verander.

OR/*OF*
Mg is oxidised / H^+ is reduced.
Mg word geoksideer / H^+ word gereduseer. (1)

8.2 H^+ ions/HCl/H^+(aq)/HCl(aq) ✓ (1)

8.3 Ag is a weaker reducing agent ✓(than H_2) and will not be oxidised ✓to Ag^+ ✓
Ag is 'n swakker reduseermiddel (as H_2) en sal nie na Ag^+ geoksideer word nie.

OR/*OF*
H_2 is a stronger reducing agent ✓ (than Ag) and will be oxidised ✓ to H^+.✓
H_2 is 'n sterker reduseermiddel (as Ag) en sal na H^+ geoksideer word. (3)

8.4 Electrode/Conductor of electrons (in hydrogen half-cell) ✓
Elektrode/Geleier van elektrone in waterstofhalfsel. (1)

8.5
8.5.1 Chemical energy to electrical energy ✓
Chemiese energie na elektriese energie (1)

8.5.2 Provides path for movement of ions./Completes the circuit./Ensures electrical neutrality in cell. ✓
Verskaf pad vir die beweging van ione./Voltooi die stroombaan./Verseker elektriese neutraliteit in sel. (1)

8.5.3 $2H^+ + 2e^- \rightarrow H_2$ ✓✓

Notes/*Aantekeninge*

$H_2 \leftarrow 2H^+ + 2e^-$ $(2/2)$	$2H^+ + 2e^- \rightleftharpoons H_2$ $(1/2)$
$H_2 \rightleftharpoons 2H^+ + 2e^-$ $(0/2)$	$2H^+ + 2e \leftarrow H_2$ $(0/2)$

(2)

8.5.4 $Mg(s) \overset{\checkmark}{|} Mg^{2+}(aq) \overset{\checkmark}{||} H^+(aq) | H_2(g) \overset{\checkmark}{|} Pt$

OR/*OF*
$Mg(s) | Mg^{2+}(1\ mol{\cdot}dm^{-3}) || H^+(1\ mol{\cdot}dm^{-3}) | H_2(g) | Pt$

Accept/*Aanvaar*
$Mg | Mg^{2+} || H^+ | H_2 | Pt$ (3)

8.6

OPTION 1/*OPSIE 1*

$E^\theta_{cell} = E^\theta_{reduction} - E^\theta_{oxidation}$ ✓
$= 0{,}00$ ✓ $- (-2{,}36)$ ✓
$= 2{,}36$ V ✓

Notes/*Aantekeninge*

- 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*

$H^+(aq) + e^- \rightarrow H_2(g)$ $E^\theta = 0{,}00$V ✓
$Mg(s) \rightarrow Mg^{2+}(aq) + 2e^-$ ✓ $E^\theta = +2{,}36$ V ✓
$E^\theta = +2{,}36$ V ✓

(4)

8.7 Increases/*Verhoog* ✓ (1)

[18]

QUESTION/*VRAAG 9*

9.1
9.1.1 Electrolyte/*Elektroliet* ✓ (1)

9.1.2 Electrolytic (cell)/*Elektrolitiese (sel)* ✓

Electrolysis / *Elektroliese* $^{0}/_{1}$ (1)

9.2 A to/*na* B ✓ (1)

9.3
9.3.1 B ✓ (1)

9.3.2 A ✓ (1)

9.4 

Decreases/*Verminder* ✓

Copper (Cu) is oxidised to Cu^{2+}/Oxidation takes place at A/Electrons are lost. ✓
Koper (Cu) word na Cu^{2+} *geoksideer/Oksidasie vind by A plaas/Verlies van elektrone* (2)
[7]

QUESTION/*VRAAG 10*

10.1
10.1.1 Air/*Lug* ✓ (1)

10.1.2 Natural gas/methane/oil/coal ✓
Aardgasse/metaan/olie/steenkool (1)

10.1.3 Sulphur/iron pyrite/Iron sulphide ✓
Swawel/ysterpiriet/ystersulfied (1)

10.2
10.2.1 Haber ✓ (1)

10.2.2 Ammonia/*Ammoniak* ✓ (1)

10.2.3 H_2SO_4 ✓ (1)

10.2.4 $SO_3 + H_2SO_4$ ✓ → $H_2S_2O_7$ ✓ Bal. ✓

Notes/*Aantekeninge:*
- Reactants ✓ Products ✓ Balancing ✓
  Reaktanse *Produkte* *Balansering*
- Ignore double arrows./*Ignoreer dubbele pyle.*
- Marking rule 6.3.10./*Nasienreël 6.3.10.* (3)

10.3

10.3.1 $\%N[NH_4NO_3] = \frac{28}{80}$ ✓ x 100 = 35%

$\%N[(NH_4)_2SO_4] = \frac{28}{132}$ ✓ x 100 = 21,21% } ✓

Ammonium nitrate (has the highest percentage of nitrogen) ✓
Ammoniumnitraat (het die hoogste persentasie) stikstof. (4)

10.3.2 Ostwald (process/*proses*) ✓ (1)

[14]

TOTAL/*TOTAAL:* 150