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)

FEBRUARY/MARCH/*FEBRUARIE/MAART* 2018

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 15 pages.
Hierdie nasienriglyne bestaan uit 15 bladsye.

QUESTION 1/*VRAAG 1*

1.1 C ✓✓ (2)

1.2 D ✓✓ (2)

1.3 B ✓✓ (2)

1.4 C ✓✓ (2)

1.5 B ✓✓ (2)

1.6 B ✓✓ (2)

1.7 B ✓✓ (2)

1.8 C ✓✓ (2)

1.9 A ✓✓ (2)

1.10 D ✓✓ (2)

[20]

QUESTION 2/*VRAAG 2*

2.1

2.1.1 A ✓ (1)

2.1.2 B ✓ (1)

2.1.3 D ✓ (1)

2.1.4 D ✓ (1)

2.2

2.2.1 Butanal/*Butanaal* ✓ (1)

2.2.2 5-ethyl-6,6-dimethyloctan-3-ol/*5-etiel-6,6-dimetieloktan-3-ol*

OR/*OF*

5-ethyl-6,6-dimethyl-3-octanol/*5-etiel-6,6-dimetiel-3-oktanol*

Marking criteria/*Nasienriglyne:*

- Stem, i.e. octan./*Stam d.i. oktan.* ✓
- Correct functional group, i.e. –ol./*Korrekte funksionele groep d.i. –ol.* ✓
- Two methyl groups and one ethyl group.
  Twee metielgroepe en een etielgroep. ✓
- Correct numbering of substituents and functional group ✓
  Korrekte nommering van substituente en funksionele groep.

IF/*INDIEN:*

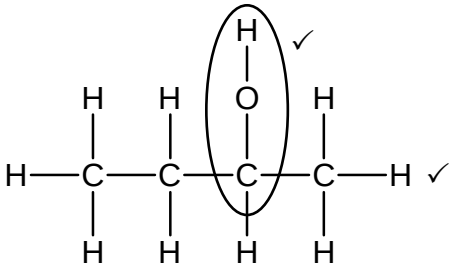
Any error e.g. hyphens omitted and/or incorrect sequence:

Enige fout bv. koppeltekens weggelaat en/of verkeerde volgorde: Max./*Maks.* $^{3}/_{4}$ (4)

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

2.4

2.4.1

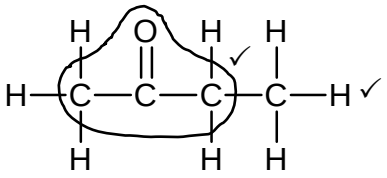


Marking criteria/*Nasienriglyne:*
- Whole structure correct:
  Hele struktuur korrek: 2/2
- Only functional group correct:/*Slegs funksionele groep korrek:* Max/*Maks.*: 1/2

IF/*INDIEN*:
More than one functional group:
Meer as een funksionele groep: 0/2

(2)

2.4.2

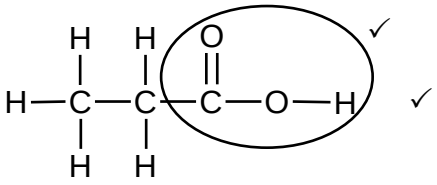


Marking criteria/*Nasienriglyne:*
- Whole structure correct:
  Hele struktuur korrek: 2/2
- Only functional group correct:/*Slegs funksionele groep korrek:* Max/*Maks.*: 1/2

IF/*INDIEN*:
More than one functional group:
Meer as een funksionele groep: 0/2

(2)

2.4.3



Marking criteria/*Nasienriglyne:*
- Whole structure correct:
  Hele struktuur korrek: 2/2
- Only functional group correct:/*Slegs funksionele groep korrek:* Max/*Maks.*: 1/2

IF/*INDIEN*:
More than one functional group:
Meer as een funksionele groep: 0/2

(2)
[17]

QUESTION 3/*VRAAG 3*

3.1 150 kPa ✓ (1)

3.2

3.2.1 The temperature at which the vapour pressure equals atmospheric/external pressure. ✓✓ (2 or 0)
Die temperatuur waar die dampdruk gelyk is aan atmosferiese/eksterne druk. (2)

3.2.2 55 °C ✓ (1)

3.3

3.3.1 Z ✓ (1)

3.3.2
- Carboxylic acids have, in addition to London forces and dipole-dipole forces, two sites for hydrogen bonding between molecules. ✓
Karboksielsure het, in toevoeging tot Londonkragte en dipool-dipoolkragte, twee punte vir waterstofbinding tussen molekule.
OR/*OF*
Carboxylic acids can form dimers due to strong hydrogen bonding between molecules.
Karboksielsure kan dimere vorm as gevolg van sterk waterstofbindings tussen molekule.
- Alcohols have, in addition to London forces and dipole-dipole forces, one site for hydrogen bonding between molecules. ✓
Alkohole het, in toevoeging tot Londonkragte en dipool-dipoolkragte, een punt vir waterstofbinding tussen molekule.
- Ketones has, in addition to London forces, dipole-dipole forces between molecules. ✓
Ketone het, in toevoeging tot Londonkragte, dipool-dipoolkragte tussen molekule.
- Intermolecular forces in carboxylic acids is the strongest./Most energy needed to overcome/break intermolecular forces in ethanoic acid. ✓
Intermolekulêre kragte in karboksielsure is die sterkste./Die meeste energie word benodig om intermolekulêre kragte in karboksielsure te oorkom/breek. (4)

3.3.3 Propanone/*Propanoon* ✓

OR/*OF*
Propan-2-one/*Propan-2-oon*

OR/*OF*
2-propanone/2-p*ropanoon* (1)
[10]

QUESTION 4/*VRAAG 4*

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

4.2
4.2.1 III ✓ (1)

4.2.2 II ✓ (1)

4.2.3 I ✓ (1)

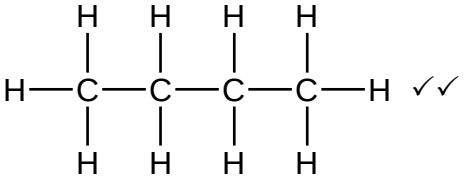
4.3
4.3.1 Heat/Light /UV light ✓
Hitte/Lig/UV Lig (1)

4.3.2 P or/*of* S ✓ (1)

4.3.3 Ethene/*Eteen* ✓ (1)

4.3.4 C_8H_{18} ✓✓ (Correct Structural formula/*Korrekte struktuurformule* : $\frac{1}{2}$) (2)

4.3.5

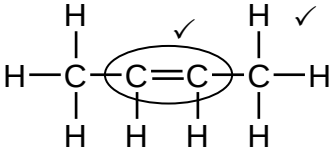


✓✓

Marking criteria/*Nasienriglyne:*
- Whole structure correct:
  Hele struktuur korrek: $\frac{2}{2}$
- 4 C atoms in chain:/*4 C-atome in ketting:* Max/*Maks.*: $\frac{1}{2}$
- Correct condensed formula/*Korrekte gekondenseerde formule*: $\frac{1}{2}$

(2)

4.3.6



✓ ✓

Marking criteria/*Nasienriglyne:*
- Whole structure of alkene/haloalkane correct:
  Hele struktuur van alkeen/haloalkaan korrek: $\frac{2}{2}$
- Only functional group correct/*Slegs funksionele groep korrek:* $\frac{1}{2}$
- Correct condensed structure/*Korrekte gekondenseerde struktuur*:
  $CH_3CH=CHCH_3$ $\frac{1}{2}$

(2)

[14]

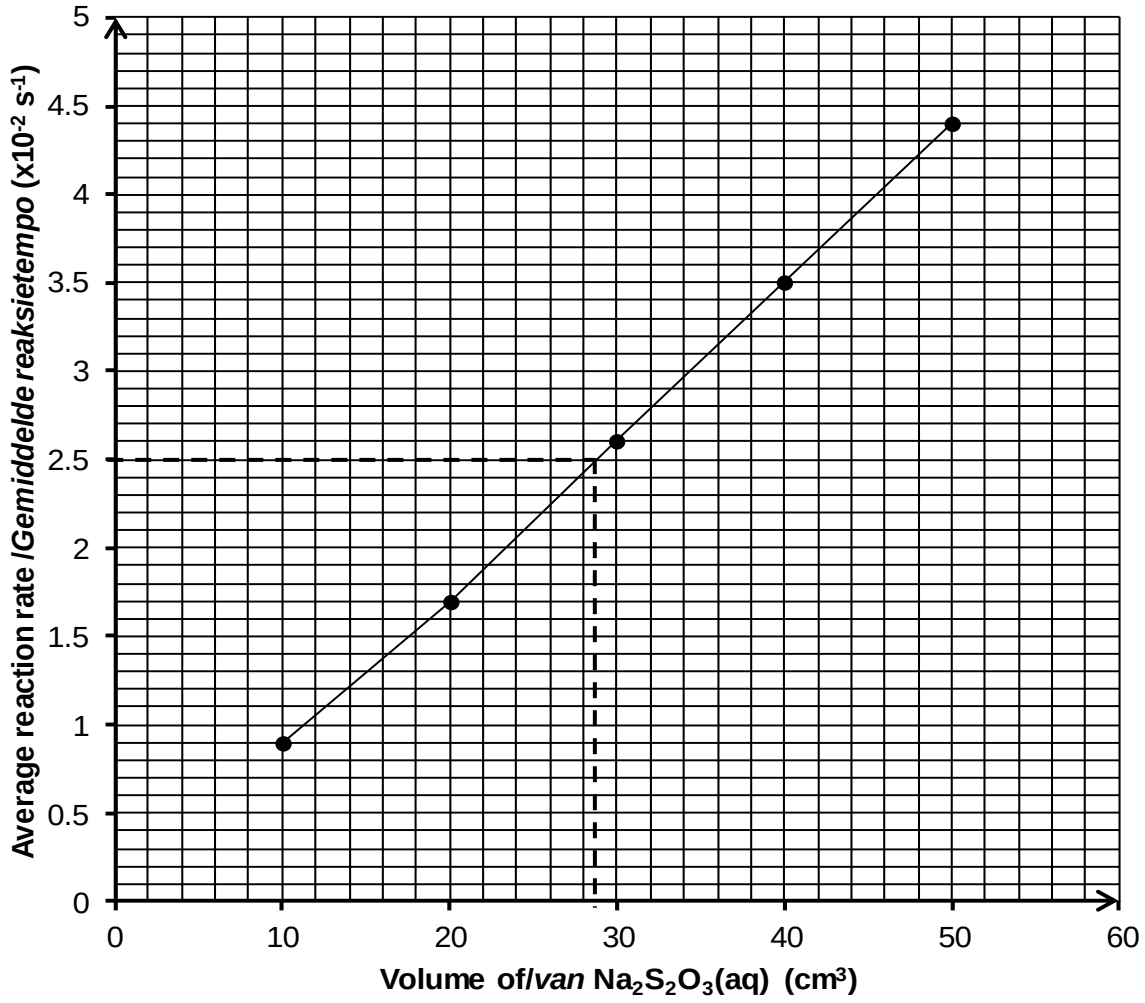
QUESTION 5/*VRAAG 5*

5.1 **ONLY ANY ONE OF/*SLEGS ENIGE EEN VAN*:**

- Change in concentration ✓ of a reactant/product per unit time. ✓
  Verandering in konsentrasie van reaktanse/produkte per eenheidtyd.
- *Rate of change in concentration.* ✓✓
  Tempo van verandering in konsentrasie.
- *Change in amount/number of moles/volume/mass of products/reactants per (unit) time./Verandering in hoeveelheid/getal mol/volume/massa van produkte/reaktanse per (eenheid)tyd.*
- *Amount/number of moles/volume/mass of products formed OR reactants used per (unit) time./Hoeveelheid/getal mol/volume/massa van produkte gevorm OF reaktanse gebruik per (eenheid)tyd.* (2)

5.2 More than/*Groter as* ✓
Accept/*Aanvaar*
Equal to/*Gelyk aan* (1)

5.3 **Graph of average reaction rate versus volume of $Na_2S_2O_3(aq)$**
Grafiek van gemiddelde reaksietempo teenoor volume $Na_2S_2O_3(aq)$



Marking criteria/*Nasienriglyne:*	
Any 3 points correctly plotted./*Enige 3 punte korrek gestip.*	✓
All (5) points correctly plotted./*Alle (5) punte korrek gestip.*	✓
Straight line drawn./*Reguitlyn getrek.*	✓

(3)

5.4

5.4.1

Marking criteria/*Nasienriglyne:*
y axis/*y-as*: 2,5 x 10^{-2} s^{-1} ✓
Dotted line drawn from the y-axis to the x-axis as shown. ✓ *Stippellyn getrek van y-as na x-as soos getoon.*
V = 28 to 30 cm^3 ✓

(3)

5.4.2

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*:

- Reaction rate of reaction increases with an increase in concentration/volume of sodium thiosulphate.
  Reaksietempo neem toe met 'n toename in konsentrasie/volume van natriumtiosulfaat.
- Reaction rate decreases with a decrease in concentration/volume of sodium thiosulphate.
  Reaksietempo neem af met 'n afname in konsentrasie/volume van natriumtiosulfaat.
- Reaction rate is (directly) proportional to concentration/volume of sodium thiosulphate.
  Reaksietempo is (direk) eweredig aan konsentrasie/volume van natriumtiosulfaat.

(2)

5.5

- More($Na_2S_2O_3$) particles per unit volume. ✓
  Meer $Na_2S_2O_3$-deeltjies per eenheid volume.
- More effective collisions per unit time./Higher frequency of effective collisions. ✓
  Meer effektiewe botsings per eenheid tyd./Hoër frekwensie van effektiewe botsings.
- Increase in reaction rate./*Toename in reaksietempo.* ✓

(3)

5.6

OPTION 1/*OPSIE 1*

$n(S)_{produced/gevorm} = \frac{m}{M}$

$= \frac{1,62}{32}$ ✓

$= 0,0506$ mol

$n(Na_2S_2O_3) = n(S) = 0,0506$ mol ✓

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

$0,0506 = \frac{m}{158}$ ✓

$\therefore m(Na_2S_2O_3) = 7,99$ g ✓

[Range/*Gebied*: 7,90 to 8,06]

Marking criteria/*Nasienriglyne:*

- Substitute/*Vervang* 32 in $n = \frac{m}{M}$ ✓
- Use ratio/*Gebruik verhouding*: $Na_2S_2O_3$: S = 1 : 1 ✓
- Substitute/*Vervang* 158 in $n = \frac{m}{M}$ ✓
- Final answer/*Finale antwoord*: 7,90 to/*tot* 8,06 g ✓

OPTION 2/*OPSIE 2*

158 g ✓ $Na_2S_2O_3 \longrightarrow$ 32 g ✓ S

$\therefore$ x $\longrightarrow$ 1,62 g S ✓

$x = \frac{158 \times 1,62}{32} = 7,99$ g ✓

[Range/*Gebied*: 7,90 to 8,06]

(4)

[18]

QUESTION 6/*VRAAG 6*

6.1

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 oppose the disturbance. ✓✓
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)

6.1.2
- Percentage yield increases with an increase in temperature. ✓
  Persentasie opbrengs verhoog met toename in temperatuur.
- Forward reaction is favoured. ✓
  Voorwaartse reaksie word bevoordeel.
- Increase in temperature favours an endothermic reaction. ✓
  Toename in temperatuur bevoordeel die endotermiese reaksie. (3)

6.1.3 When the pressure increases, the reaction that leads to a decrease in the number of moles will be favoured. ✓✓
Wanneer die druk verhoog, word die reaksie wat tot 'n afname in die aantal mol lei, bevoordeel.
Accept/*Aanvaar*
When the pressure increases, the yield increases ✓ because the equilibrium position shifts to the right. ✓
Wanneer die druk toeneem, neem die opbrengs toe omdat die ewewigsposisie na regs skuif. (2)

6.1.4 I ✓✓ (2)

6.2

Mark allocation/*Puntetoekenning*
- Substitution of/*Vervanging van 36,5 g·mol^{-1} in* $n = \frac{m}{M}$. ✓
- Change/*Verandering* n(HCℓ) = initial/*aanvanklik* – equilibrium/*ewewig.* ✓
- USING ratio/*GEBRUIK verhouding:* 4 : 1 : 2 : 2 ✓
- Equilibrium: n(O_2) & n(H_2O) & n($C\ell_2$) = initial ± change ✓
  Ewewig: : n(O_2) & n(H_2O) & n($C\ell_2$) = aanvanklik ± verandering
- Divide by volume/*Gedeel deur volume* (0,2 dm^3) ✓
- Correct K_c expression (formulae in square brackets). ✓
  Korrekte K_c -uitdrukking (formules tussen vierkanthakies).
- Substitution of reactant concentrations/*Vervanging van reaktanskonsentrasies.* ✓
- Substitution of product concentrations./*Vervanging van produk-konsentrasies.* ✓
- Final answer/*Finale antwoord:* 13,966 to/*tot* 18,72 ✓
  Range/*Gebied:* 13,966 to/*tot* 18,72

OPTION 1/*OPSIE 1*

	$HC\ell$	O_2	$C\ell_2$	H_2O
Initial quantity/*Aanvangs-hoeveelheid (mol)*	0,2	0,11	0	0
Change/*Verandering (mol)*	0,15 ✓	0,0375	0,075	0,075
Quantity at equilibrium *Hoeveelheid by ewewig (mol)*	$\frac{1,825}{36,5}$ = 0,05 ✓	0,0725	0,075	0,075
Equilibrium concentration/*Ewewigskonsentrasie (mol·dm^{-3})*	0,25	0,3625	0,375	0,375

ratio ✓ *verhouding*

✓

Divide by 0,2✓ *Deel deur 0,2*

$$K_c = \frac{[C\ell_2]^2[H_2O]^2}{[HC\ell]^4[O_2]} \checkmark = \frac{(0,375)^2(0,375)^2}{(0,25)^4(0,3625)} \checkmark = 13,97 \checkmark$$

No K_C expression, correct substitution/*Geen K_c-uitdrukking, korrekte vervanging:* Max./*Maks.* $\frac{8}{9}$

Wrong K_C expression/*Verkeerde K_c-uitdrukking*: Max./*Maks.* $\frac{5}{9}$

(9)

OPTION 2/*OPSIE 2:*

$n(HC\ell)_{equilibrium/ewewig} = \frac{m}{M} = \frac{1,825}{36,5}$ ✓ = 0,05 mol

$n(HC\ell)_{reacted/reageer}$ = 0,2 – 0,05 = 0,15 mol ✓

$n(O_2)_{reacted/reageer} = ¼n(HC\ell)_{reacted/reageer} = ¼ \times 0,15 = 0,0375$ mol
$n(C\ell_2)_{formed/gevorm} = ½n(HC\ell)_{reacted/reageer} = ½ \times 0,15 = 0,075$ mol
$n(H_2O)_{formed/gevorm} = ½n(HC\ell)_{reacted/reageer} = ½ \times 0,15 = 0,075$ mol
} Using ratio ✓

$n(O_2)_{equilibrium/ewewig} = 0,11 – 0,0375 = 0,0725$ mol
$n(C\ell_2)_{equilibrium/ewewig} = n(H_2O)_{equilibrium/ewewig} = 0,075$ mol
} ✓

$c(O_2)_{equilibrium/ewewig} = \frac{n}{V} = \frac{0,0375}{0,2} = 0,3625$ mol·dm^{-3}

$c(C\ell_2)_{equilibrium/ewewig} = c(H_2O)_{equilibrium/ewewig} = \frac{n}{V}$

$= \frac{0,075}{0,2} = 0,375$ mol·dm^{-3}

} Divide by/ *deel deur* 0,2✓

$$K_c = \frac{[H_2O]^2[C\ell_2]^2}{[HC\ell]^4[O_2]} \checkmark = \frac{(0,375)^2(0,375)^2}{(0,25)^4(0,3625)} \checkmark = 13,97 \checkmark$$

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

Wrong K_C expression/*Verkeerde K_c-uitdrukking*: Max./*Maks.* $\frac{5}{9}$

(9)

CALCULATIONS USING CONCENTRATIONS
BEREKENINGE WAT KONSENTRASIES GEBRUIK

Mark allocation/*Puntetoekenning*

- Substitution of/*Vervanging van 36,5 g·mol*$^{-1}$ n = $\frac{m}{M}$. ✓
- Initial concentration of reactants/*Aanvanklike konsentrasie van reaktanse*: c(HCℓ) = 1,0 & c(O_2) = 0,55 mol·dm^{-3} ✓
- Change: c(HCℓ) = 0,75 mol·dm^{-3} (initial – equilibrium) ✓
  Verandering: c(HCℓ) = 0,75 mol·dm^{-3} *(aanvanklik – ewewig)*
- USING ratio/*GEBRUIK verhouding:* 4 : 1 : 2 : 2 ✓
- Equilibrium/*Ewewig*: c(H_2O) = c($C\ell_2$) = 0,3625 mol·dm^{-3} (initial+change) and c(O_2) = 0,3625 mol·dm^{-3} (initial – change) ✓
  Ewewig: c(H_2O) = c($C\ell_2$) = 0,3625 mol·dm^{-3} (*aanvanklik* + *verandering*) en c(O_2) = 0,0,3625 mol·dm^{-3} *(aanvanklik – verandering)*
- Correct K_c expression (formulae in square brackets). ✓
  Korrekte K_c -uitdrukking (formules tussen vierkanthakies).
- Substitution of reactant concentrations./*Vervanging van reaktanskonsentrasies.* ✓
- Substitution of product concentrations./*Vervanging van produkkonsentrasies.* ✓
- Final answer/*Finale antwoord*: 13,97 ✓
  Range/*Gebied:* 13,966 to/*tot* 18,72

OPTION 3/*OPSIE 3*

$$n(HC\ell)_{equilibrium/ewewig} = \frac{m}{M}$$
$$= \frac{1,825}{36,5} \checkmark$$
$$= 0,05 \text{ mol}$$

	HCℓ	O_2	H_2O	$C\ell_2$	
Initial concentration/ *Aanvangskonsentrasie (mol·dm^{-3})*	1,0 ✓	0,55	0	0	Divide by 0,2 ✓ *Deel deur 0,2*
Change in concentration *Verandering in konsentrasie* (mol·dm^{-3})	0,75 ✓	0,1875	0,375	0,375	ratio ✓ *verhouding*
Equilibrium concentration Ewewigskonsentrasie (mol·dm^{-3})	0,25	0,3625	0,375	0,375	✓

$$K_c = \frac{[C\ell_2]^2[H_2O]^2}{[HC\ell]^4[O_2]} \checkmark = \frac{(0,375)^2(0,375)^2 \checkmark}{(0,25)^4(0,3625) \checkmark} = 13,97 \checkmark$$

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

Wrong K_C expression/*Verkeerde K_c-uitdrukking*:
Max./*Maks.* $\frac{5}{9}$

(9)
[18]

QUESTION 7/*VRAAG 7*

7.1

7.1.1 H_2O ✓

HSO_4^- ✓ (2)

7.1.2 Strong/*Sterk* ✓
Completely ionised (in water)./*Volledig geïoniseer (in water).* ✓ (2)

7.2

7.2.1

Marking Criteria/*Nasienriglyne*

- Formula/*Formule:* $\frac{c_a \times V_a}{c_a \times V_b} = \frac{n_a}{n_b} / c = \frac{n}{V}$ ✓
- Substitute/*Vervang* 0,15 x 24 **OR/*OF*** 0,15 x 0,024 ✓
- Use/*Gebruik* 26 cm^3 **OR/*OF*** 0,026 dm^3 ✓
- Use mole ratio/*Gebruik molverhouding*: 1:2 ✓
- Final answer/*Finale antwoord:* 0,28 $mol \cdot dm^{-3}$ ✓ (0.2769… $mol \cdot dm^{-3}$)

OPTION 1/*OPSIE 1*

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

$\frac{0{,}15 \times 24}{c_b \times 26} = \frac{1}{2}$ ✓ ✓

c(NaOH) = 0,28 $mol \cdot dm^{-3}$ ✓

OPTION 2/*OPSIE 2*

$n(H_2SO_4) = cV$ ✓
$= (0{,}15)(0{,}024)$ ✓
$= 3{,}6 \times 10^{-3}$ mol

$n(NaOH) = \underline{2}(3{,}6 \times 10^{-3})$ ✓
$= 7{,}2 \times 10^{-3}$ mol

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

$= \frac{7{,}2 \times 10^{-3}}{0{,}026}$ ✓

$= 0{,}28$ $mol \cdot dm^{-3}$ ✓ (5)

7.2.2

Marking Criteria/*Nasienriglyne*

- Calculate/*Bereken* n(NaOH): 0,02 x 0,28✓
- Calculate/*Bereken* $n(H_2SO_4)$: 0,03 x 0,15 ✓
- Use ratios/*Gebruik molverhouding*: $n(H_2SO_4) = ½n(NaOH)$ ✓
- $n(H_2SO_4)_{excess} = n(H_2SO_4)_{initial} – n(H_2SO_4)_{used} = 0,0045 – 0,0028$ ✓
- Substitute/*Vervang* 0,05 dm^3 in $c = \frac{n}{V}$ ✓
- Substitution/*Vervang* 2 x 0,034 in $2[H_2SO_4]$ ✓
- Formula/*Formule:* $-\log[H_3O^+]$ **OR/*OF*** Substitute/*Vervang:* -log(0,068) ✓
- Final answer: 1,10 to/*tot* 1,167 ✓

OPTION 1/*OPTION 1*

$n(NaOH) = cV$
$= 0,02 \times 0,28$ ✓
$= 0,0056$ mol
$n(H_2SO_4) = 0,03 \times 0,15$ ✓
$= 0,0045$ mol

$n(H_2SO_4)_{used} = ½n(NaOH)$ ✓
$= 0,0028$
$n(H_2SO_4)_{excess} = 0,0045–0,0028$ ✓
$= 0,0017$ mol

$[H_2SO_4] = \frac{n}{V} = \frac{0,0017}{0,05}$ ✓
$= 0,034 mol \cdot dm^{-3}$

$[H_3O^+] = 2[H_2SO_4]$
$= 2 \times 0,034$ ✓
$= 0,068 mol \cdot dm^{-3}$

$pH = -\log[H_3O^+]$ **OR/*OF*** -log(0,068) ✓
$= 1,17$ ✓ (1,167)

OPTION 2/*OPTION 2*

$n(NaOH) = cV$
$= 0,02 \times 0,28$ ✓
$= 0,0056$ mol
$n(H_2SO_4) = 0,03 \times 0,15$ ✓
$= 0,0045$ mol

$n(H_3O^+) = 2n(H_2SO_4)$ ✓
$= 2 \times 0,0045$
$= 0,009$ mol
$n(H_3O^+)_{excess} = 0,009 – 0,0045$ ✓
$= 0,0034$ mol

$c(H_3O^+) = \frac{n}{V}$
$= \frac{0,0034}{0,05}$ ✓
$= 0,068 mol \cdot dm^{-3}$

$pH = -\log[H_3O^+]$ **OR/*OF*** -log(0,068) ✓
$= 1,17$ ✓ (1,167)

(8)
[17]

QUESTION 8/*VRAAG 8*

8.1

8.1.1 A substance that loses/donates electrons./*'n Stof wat elektrone verloor/skenk*. ✓✓ (2 or 0) (2)

8.1.2 Platinum/Pt ✓ (1)

8.1.3 Sn^{2+}(aq)/tin(II) ions/*tin(II)-ione* ✓ (1)

8.1.4 Pt | Sn^{2+}(aq) , Sn^{4+}(aq) ✓ || Ag^{+}(aq) ✓ | Ag(s) ✓

OR/*OF*

Pt| Sn^{2+}(1 mol·dm^{-3}) ,Sn^{4+} (1 mol·dm^{-3}) || Ag^{+} (1 mol·dm^{-3}) | Ag(s)

ACCEPT/*AANVAAR*

Pt| Sn^{2+} | Sn^{4+} || Ag^{+} | Ag (3)

8.1.5

OPTION 1/*OPSIE 1*	**Notes/*Aantekeninge***
$E^{\theta}_{cell} = E^{\theta}_{reduction} - E^{\theta}_{oxidation}$ ✓ = +0,80 ✓ - (+0,15) ✓ = 0,65 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: Max/Maks:* $^{3}/_{4}$

OPTION 2/*OPSIE 2*

✓ $Ag^{+}(aq) + e^{-} \rightarrow Ag(s)$ 0,80 V ✓
$Sn^{2+}(aq) \rightarrow Sn^{4+}(aq) + 2e^{-}$ -0,15 V ✓
$2Ag^{+}(aq) + Sn^{2+}(aq) \rightarrow Sn^{4+}(aq) + 2Ag(s)$ 0,65 V ✓ (4)

8.2

8.2.1 Magnesium becomes smaller./Brown solid forms/Mg disappears/eaten away/Mg changes colour. ✓
Magnesium word kleiner./Bruin vaste stof vorm/Mg verdwyn/weggevreet/Mg verander van kleur. (1)

8.2 2 Cu^{2+} is a stronger oxidising agent ✓(than Mg^{2+}) and will be reduced to ✓ Cu. ✓
Cu^{2+} is 'n sterker oksideermiddel (as Mg^{2+}*) en sal na* Cu *gereduseer word.*

OR/*OF*

Mg is a stronger reducing agent ✓(than Cu) and will reduce Cu^{2+} to Cu.
Mg is 'n sterker reduseermiddel (as Cu*) en sal* Cu^{2+} *na* Cu *reduseer.* (3)

[15]

QUESTION 9/*VRAAG 9*

9.1 The chemical process in which electrical energy is converted to chemical energy. ✓✓
'n Chemiese proses waarin elektriese energie omgeskakel word na chemiese energie.

OR/*OF*
The use of electrical energy to produce a chemical change.
Die gebruik van elektriese energie om 'n chemiese verandering te weeg te bring. (2)

9.2 B ✓ (1)

9.3 $Cu^{2+}(aq) + 2e^- \rightarrow Cu$ ✓✓ (2)

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

9.4
$$\%\ \text{purity/}suiwerheid = \frac{m(Cu)}{m(Cu)_{\text{impure/}onsuiwer}} \times 100$$
$$= \frac{4{,}4\checkmark}{5\checkmark} \times 100\checkmark$$
$$= 88\%\ \checkmark$$ (4)

Marking criteria/*Nasienriglyne:*
- Substitute/*Vervang* 4,4 ✓
- Substitute/*Vervang* 5 ✓
- x 100 ✓
- Final answer/*Finale antwoord:* 88% ✓

[9]

QUESTION 10/*VRAAG 10*

10.1

10.1.1 $N_2(g) + 3H_2(g)$ ✓ $\rightarrow 2NH_3(g)$ ✓ bal ✓

Notes/*Aantekeninge:*
• Reactants ✓ Products ✓ Balancing ✓ *Reaktanse* ✓ *Produkte* ✓ *Balansering* ✓
• Ignore if phases are omitted/*Ignoreer indien fases uitgelaat word*
• Ignore/*Ignoreer* ⇌
• Marking rule/*Nasienreël* 3.9

(3)

10.1.2 $(NH_4)_2SO_4$ ✓ (1)

10.1.3 Ostwald process/*Ostwaldproses* ✓ (1)

10.1.4 Ammonium nitrate/*Ammoniumnitraat* ✓ (1)

10.2

10.2.1 The ratio of nitrogen (N), phosphorous (P) and potassium (K) in a certain fertiliser.✓
Die verhouding van stikstof (N), fosfor (P) en kalium (K) in 'n sekere kunsmis.
Accept/*Aanvaar* :
nitrogen, phosphorous and potassium/*stikstof, fosfor en kalium*. (1)

10.2.2 Percentage fertiliser in the bag./*Persentasie kunsmis in die sak.* ✓ (1)

10.2.3

OPTION 1/*OPSIE 1*:	**OPTION 2/*OPSIE 2:***
% K = $\frac{5}{12}$ ✓ x 22% ✓ = 9,17% $\therefore$ m(N) = $\frac{9{,}17}{100} \times 10$ kg ✓ = 0,92 kg ✓	m(nutrients/*voedingstowwe*): $\frac{22}{100}$ ✓ x 10 = 2,2 kg ↓ $\therefore$ m(K) = $\frac{5}{12}$ ✓ (2,2) ✓ = 0,92 kg ✓

(4)
[12]

TOTAL/*TOTAAL*: 150