basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE EXAMINATIONS
SENIORSERTIFIKAAT-EKSAMEN

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

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 D ✓✓ (2)

1.2 A ✓✓ (2)

1.3 B ✓✓ (2)

1.4 B ✓✓ (2)

1.5 D ✓✓ (2)

1.6 C ✓✓ (2)

1.7 B ✓✓ (2)

1.8 D ✓✓ (2)

1.9 D ✓✓ (2)

1.10 C ✓✓ (2)

[20]

QUESTION 2/*VRAAG 2*

2.1

2.1.1 A ✓ (1)

2.1.2 D ✓ (1)

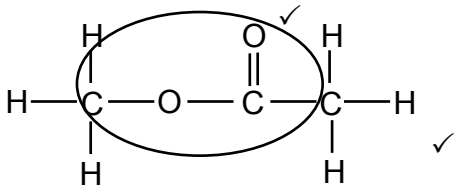
2.1.3 B ✓ (1)

2.1.4 E ✓ (1)

2.1.5 B ✓ (1)

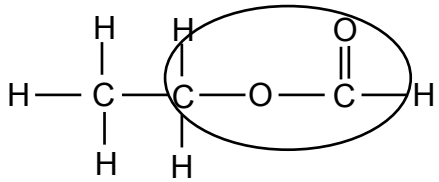
2.2

2.2.1



✓ ✓

OR/*OF*



Marking criteria/*Nasienriglyne*

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

Accept/Aanvaar

Any correct arrangement of correct number of atoms

Enige korrekte struktuur met die korrekte aantal atome.

(2)

2.2.2 **ANY ONE/*ENIGE EEN:***

Methyl ✓ethanoate ✓/*metieletanoaat*

OR/*OF*

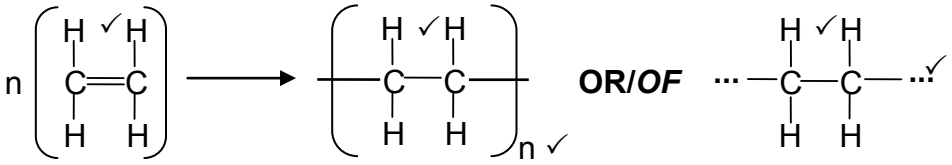
Ethyl ✓methanoate ✓//*etielmetanoaat* (2)

2.3

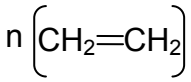
2.3.1 A large molecule ✓composed of smaller monomer units covalently bonded to each other in a repeating pattern. ✓
'n Groot molekuul ✓wat uit kleiner monomeer-eenhede bestaan wat kovalent aan mekaar in 'n herhalende patroon gebind is. ✓ (2)

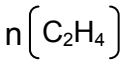
2.3.2 Polyethene ✓
Polieteen

Accept/*Aanvaar*:
Polyethylene/polythene
Poli-eteen/poli-etileen/politeen (1)

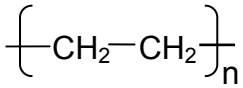
2.3.3 

Accept as reactant/*Aanvaar as reaktans:*





Accept as product/*Aanvaar as produk:*



Marking guidelines/*Nasienriglyne*
- Structure shows TWO C atoms with four bonds (ethene) each and FOUR H atoms./*Struktuur toon TWEE C-atome met vier bindings (eteen) elk na VIER H-atome.* ✓
- Structure of product / *Struktuur van produk.* ✓
- Multiple n and brackets correctly shown for reactant and product./*Veelvoud n en hakie korrek getoon vir reaktans en produk.* ✓

(3)

2.4 Hydrolysis/Substitution ✓
Hidrolise/Substitusie (1)

2.5
- Use concentrated strong base/NaOH/KOH/LiOH OR ethanolic/alcoholic strong base/NaOH/KOH/LiOH. ✓/Use ethanol instead of water./No water.
  Gebruik gekonsentreerde sterk basis/NaOH/KOH/LiOH OF etanoliese / alkoholiese sterk basis/NaOH/KOH/LiOH /Gebruik etanol in plaas van water./Geen water nie.
- Heat strongly/*Verhit sterk* ✓
  Accept/*Aanvaar*: Increase temperature/*Verhoog temperatuur* (2)

[18]

QUESTION 3/*VRAAG 3*

3.1
- **Structure/*Struktuur*:**
  The chain length/molecular size /molecular structure/molecular mass/ surface area increases. ✓
  Die *kettinglengte/molekulêre grootte/molekulêre struktuur/molekulêre massa/oppervlakte neem toe.*
- **Intermolecular forces/*Intermolekulêre kragte*:**
  Increase in strength of intermolecular forces/induced dipole /London/ dispersion /Van der Waals forces/momentary dipoles. ✓
  Toename in sterkte van intermolekulêre kragte/geïnduseerde dipoolkragte/Londonkragte/dispersiekragte/Van der Waalskragte / momentele dipool.
- **Energy/*Energie*:**
  More energy needed to overcome/break intermolecular forces. ✓
  Meer *energie benodig om intermolekulêre kragte te oorkom/breek.*

OR/*OF*

- **Structure/*Struktuur*:**
  From 4 C atoms to 1 C atom/bottom to top the chain length/molecular size/molecular structure/molecular mass/surface area decreases. ✓
  Van 4 C-atome na 1 C-atoom/onder na bo neem die kettinglengte/ molekulêre grootte/molekulêre struktuur/molekulêre massa/oppervlakte af.
- **Intermolecular forces/*Intermolekulêre kragte:***
  Decrease in strength of intermolecular forces/ induced dipole forces/ London forces/dispersion forces. ✓
  Afname in sterkte van intermolekulêre kragte/geïnduseerde dipoolkragte/ Londonkragte/dispersiekragte.
- **Energy/*Energie*:**
  Less energy needed to overcome/break intermolecular forces. ✓
  Minder energie benodig om intermolekulêre kragte te oorkom/breek. (3)

3.2
- Alkanes have London/dispersion/induced dipole forces. ✓
  Alkane het London-/dispersie-/geïnduseerde dipoolkragte.
- Alcohols have hydrogen bonding (in addition to London/dispersion/ induced dipole forces and dipole dipole forces). ✓
  Alkohole het waterstofbinding (in toevoeging tot London-/dispersie-/ geïnduseerde dipoolkragte en dipoolkragte).
- Hydrogen bonding are stronger intermolecular forces than London/ dispersion/ induced dipole forces. ✓
  Waterstofbindings is sterker intermolekulêre kragte as *London-/dispersie-/geïnduseerde dipoolkragte.*
  OR/*OF*
  More energy needed to overcome/break intermolecular forces in alcohols
  Meer energie benodig om intermolekulêre kragte te oorkom/breek in alkohole.
- Alcohols have higher boiling points than alkanes. ✓
  Alkohole het hoër kookpunte as die alkane. (4)

3.3 Decrease/*Neem af* ✓ (1)

3.4 Lower than/*Laer as* ✓

2-methylpropane/It is more branched/has a smaller surface area/has a shorter chain length (than butane/chain isomer) ✓
2-metielpropaan/Dit is vertak/het 'n kleiner oppervlakte/het 'n korter kettinglengte (as butaan/ketting-isomeer).

OR/*OF*
Butane/chain isomer is less branched /has larger surface area/longer chain length (than 2-methylpropane).
Butaan/ketting-isomeer is minder vertak/het 'n groter oppervlakte/het 'n langer kettinglengte (as 2-metielpropaan). (2)

[10]

QUESTION 4/*VRAAG 4*

4.1

4.1.1 Substitution/halogenation/bromonation✓
Substitusie/halogenering/halogenasie/brominering/brominasie (1)

4.1.2 Elimination/dehydration ✓
Eliminasie/dehidrasie/dehidratering (1)

4.1.3 Esterification/condensation ✓
Esterifikasie/verestering/kondensasie (1)

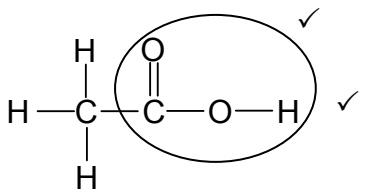
4.1.4 Addition/hydrohalogenation/hydrobromonation ✓
Addisie/hidrohalogenasie/hidrohalogenering/hidrobrominasie/hidrobromonering (1)

4.2

4.2.1 Catalyst/dehydrating agent/speeds up reaction ✓
Katalisator/dehidreermiddel/versnel die reaksie (1)

4.2.2 Propyl ✓ ethanoate ✓/*Propieletanoaat* (2)

4.2.3



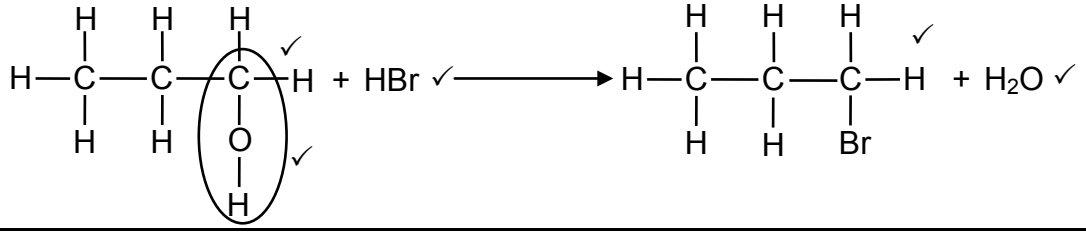
✓ ✓

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

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

(2)

4.3



Notes/*Aantekeninge*:

- Ignore/*Ignoreer* ⇌
- Accept HBr and H_2O as condensed. /*Aanvaar HBr en H_2O as gekondenseerd.*
- Any additional reactants and/or products
  Enige addisionele reaktanse en/of produkte: Max./*Maks.* $\frac{4}{5}$
- Accept coefficients that are multiples.
  Aanvaar koëffisiënte wat veelvoude is.
- Incorrect balancing/*Verkeerde balansering*: Max./*Maks.* $\frac{4}{5}$
- Molecular/condensed formulae
  Molekulêre/gekondenseerde formule: Max./*Maks.* $\frac{2}{5}$

(5)
[14]

QUESTION 5/*VRAAG 5*

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

- Change in concentration of products/reactants ✓ per (unit) time. ✓
  Verandering in konsentrasie van produkte/reaktanse per (eenheids)tyd.
- Rate of change in concentration. ✓✓
  Tempo van verandering in konsentrasie.
- Change in amount/number of moles/volume/mass ✓ of products or reactants per (unit) time. ✓
  Verandering in hoeveelheid/aantal mol/volume/massa van produkte of reaktanse per (eenheids)tyd.
- Amount/number of moles/volume/mass (of products) formed/(reactants) used✓ per (unit) time.✓
  Hoeveelheid/aantal mol/volume/massa (van produkte) gevorm/(reaktanse) gebruik per (eenheids)tyd. (2)

5.2

5.2.1 Surface area/State of division ✓
Oppervlakte/Toestand van verdeeldheid (1)

5.2.2 **ANY ONE/*ENIGE EEN:***

- Amount/mass of magnesium ✓
  Hoeveelheid/massa magnesium
- Concentration of HCℓ/acid/*Konsentrasie van HCℓ /suur*
- (Initial) temperature/*(Aanvanklike) temperatuur* (1)

5.3

5.3.1

Marking criteria/*Nasienriglyne*

- Calculate change in m(Mg) or n(Mg) ✓
  Bereken verandering in m(Mg) *of* n(Mg)
- Substitute/*Vervang* 24 g·mol^{-1} in $n = \frac{m}{M}$ ✓
- Use mol ratio/*Gebruik molverhouding*: n(Mg) = n(H_2) = 1:1 ✓
- Substitute/*Vervang* 25 dm^3 in $n = \frac{V}{V_m}$. ✓
- Final answer/*Finale antwoord:* 2,5 dm^3 ✓

OPTION 1/*OPSIE 1*

$\triangle$m(Mg) = 2,6 - 0,2 ✓
= 2,4 g

$n(Mg_{used\ /gebruik}) = \frac{m}{M}$
$= \frac{2,4}{24}$ ✓
= 0,1 mol

n(H_2) = n(Mg) = 0,1 mol ✓

V(H_2) = nV_m
V(H_2) = (0,1)(25) ✓
= 2,5 dm^3 ✓

OPTION 2/*OPSIE 2*

$n(Mg)_{t=2s} = \frac{m}{M} = \frac{2,6}{24}$ ✓ = 0,1083 mol

$n(Mg)_{t=10s} = \frac{0,2}{24}$ = 0,0083 mol

$\triangle$n(Mg) = 0,1083 - 0,0083 ✓
= 0,1 mol

n(H_2) = n(Mg) = 0,1 mol ✓

V(H_2) = nV_m
V(H_2) = (0,1)(25) ✓
= 2,5 dm^3 ✓

OPTION 3/*OPSIE 3*

24 g Mg ✓ ⟶ 25 dm^3 H_2
∴ 2,4 g ✓ ⟶ x dm^3 H_2

$x = \frac{2,4 \times 25}{24}$ ✓ ✓
= 2,5 dm^3 ✓

(5)

5.3.2

Marking criteria/*Nasienriglyne*

- Substitute/*Vervang* 2,08 x 10^{-4} in ave rate / *gem. tempo* $= \frac{\Delta n}{\Delta t}$ ✓
- Substitute/*Vervang* 10 x 60 s (600 s) in ave rate / *gem. tempo* $= \frac{\Delta n}{\Delta t}$ ✓
- Use mol ratio/*Gebruik molverhouding*: n(Mg) = n(H_2) = 1:1 ✓
- Substitute/*Vervang* 24 g·mol^{-1} in m = nM. ✓
- Final answer/*Finale antwoord:* 3 g ✓ (Range/*Gebied* 2,995 – 3,12 g)

ave rate / *gem. tempo* $= \frac{\Delta n}{\Delta t}$

$\therefore$ 2,08 x 10^{-4} ✓ = $\frac{\Delta n}{(10 \times 60) - 0}$ ✓

$\therefore$ Δn = 0,125 mol

n(Mg) = n(H_2) = 0,125 mol ✓

m(Mg) = nM
m(Mg) = 0,125 x 24 ✓
= 3 g ✓ (2,995 g) (5)

5.4

- Larger surface area/state of division. ✓
  Groter reaksieoppervlak/toestand van verdeeldheid
- More particles (per volume) with correct orientation/*Meer deeltjies (per volume) met korrekte oriëntasie*. ✓
  OR/*OF*
  More contact points./*Meer kontakpunte.*
- More effective collisions per (unit) time./Frequency of effective collisions increases./More particles collide with sufficient kinetic energy & correct orientation per (unit) time.✓✓
  Meer effektiewe botsings per (eenheids)tyd./Frekwensie van effektiewe botsings verhoog./Meer deeltjies bots met genoeg kinetiese energie & korrekte oriëntasie per tyd(seenheid). (3)

[17]

QUESTION 6/*VRAAG 6*

6.1 The stage in a chemical reaction when the rate of forward reaction equals the rate of reverse reaction./Both forward and reverse reactions take place at same rate. ✓✓
Die stadium in 'n chemiese reaksie wanneer die tempo van die voorwaartse reaksie gelyk is aan die tempo van die terugwaartse reaksie./Beide voor- en terugwaartse reaksies vind teen dieselfde tempo plaas.
OR/*OF*
The stage in a chemical reaction when the concentrations of reactants and products remain constant. ✓✓
Die stadium in 'n chemiese reaksie wanneer die konsentrasies van reaktanse en produkte konstant bly. (2)

6.2
6.2.1 2 ✓ (1)

6.2.2 1 ✓ (1)

6.2.3 3 ✓ (1)

6.3 **POSITIVE MARKING FROM QUESTION 6.2.**
POSITIEWE NASIEN VANAF VRAAG 6.2.

Marking criteria/*Nasienriglyne:*

- Substitute/*Vervang* 8 mol in $c = \frac{n}{V}$ ✓
- Substitute/*Vervang* 4 mol in $c = \frac{n}{V}$ ✓
- Substitute/*Vervang* 12 mol in $c = \frac{n}{V}$ ✓
- Substitute/*Vervang* V = 3 dm^3 in the above THREE formulae/*in die bostaande DRIE formules*. ✓
- K_c expression/*uitdrukking* ✓
- Substitution of concentrations into K_c expression ✓
  Vervanging van konsentrasies in K_c-uitdrukking.
- Final answer/*Finale antwoord*: 6,75 ✓

OPTION 1/OPSIE 1

$[A] = \frac{8}{3}$ ✓ = 2,67 $mol \cdot dm^{-3}$

$[B] = \frac{4}{3}$ ✓ = 1,33 $mol \cdot dm^{-3}$ Divide by/*Deel deur* 3 dm^3 ✓

$[C] = \frac{12}{3}$ ✓ = 4 $mol \cdot dm^{-3}$

$K_c = \frac{[C]^3}{[A]^2[B]}$ ✓

$= \frac{(4)^3}{(2{,}67)^2(1{,}33)}$ ✓

= 6,75 ✓

No K_c expression, correct substitution /*Geen K_c-uitdrukking, korrekte substitusie:* Max./*Maks.* $\frac{6}{7}$

Wrong K_c expression /*Verkeerde K_c-uitdrukking*: Max./*Maks.* $\frac{4}{7}$

OPTION 2/*OPSIE 2*

	A	B	C
Initial quantity (mol) *Aanvangshoeveelheid (mol)*	16	8	0
Change (mol) *Verandering (mol)*	8	4	12
Quantity at equilibrium (mol) *Hoeveelheid by ewewig (mol)*	8 ✓	4 ✓	12 ✓
Equilibrium concentration ($mol \cdot dm^{-3}$) *Ewewigskonsentrasie ($mol \cdot dm^{-3}$)*	$\frac{8}{3}$	$\frac{4}{3}$	$\frac{12}{3}$

Divide by /*deel deur* 3 dm^3 ✓

$$K_c = \frac{[C]^3}{[A]^2[B]} \checkmark$$
$$= \frac{(4)^3}{(2{,}67)^2(1{,}33)} \checkmark$$
$$= 6{,}75 \checkmark$$

No K_c expression, correct substitution /*Geen K_c-uitdrukking*, *korrekte substitusie:* Max./*Maks.* $\frac{6}{7}$

Wrong K_c expression /*Verkeerde K_c-uitdrukking*: Max./*Maks.* $\frac{4}{7}$

(7)

USING CONCENTRATION/*GEBRUIK KONSENTRASIE*
OPTION 3/*OPSIE 3*

	A	B	C
Initial concentration ($mol \cdot dm^{-3}$) *Aanvangskonsentrasie ($mol \cdot dm^{-3}$)*	$\frac{16}{3} = 5{,}33$	$\frac{8}{3} = 2{,}67$	0
Change ($mol \cdot dm^{-3}$) *Verandering* ($mol \cdot dm^{-3}$)	$\frac{8}{3} = 2{,}67$	$\frac{4}{3} = 1{,}33$	$\frac{12}{3} = 4$
Equilibrium concentration ($mol \cdot dm^{-3}$) Ewewigskonsentrasie ($mol \cdot dm^{-3}$)	$\frac{8}{3} = 2{,}67$ ✓	$\frac{4}{3} = 1{,}33$ ✓	$\frac{12}{3} = 4$ ✓

÷3 dm^3 ✓

$$K_c = \frac{[C]^3}{[A]^2[B]} \checkmark$$
$$= \frac{(4)^3}{(2{,}67)^2(1{,}33)} \checkmark$$
$$= 6{,}75 \checkmark$$

No K_c expression, correct substitution /*Geen K_c-uitdrukking*, *korrekte substitusie:* Max./*Maks.* $\frac{6}{7}$

Wrong K_c expression /*Verkeerde K_c-uitdrukking*: Max./*Maks.* $\frac{4}{7}$

(7)

6.4 Endothermic/*Endotermies* ✓

- (An increase in temperature) favours the reverse reaction. ✓
  (*'n Toename in temperatuur)bevoordeel die terugwaartse reaksie.*
- An increase in temperature favours an endothermic reaction. ✓
  'n Toename in temperatuur bevoordeel 'n endotermiese reaksie.

(3)
[15]

QUESTION 7/*VRAAG 7*

7.1 Titration/Volumetric analysis ✓
Titrasie/Volumetriese analise (1)

7.2 To measure the (exact) volume of acid needed to reach endpoint/to neutralise the base. ✓
Om die (presiese) volume suur te meet wat benodig word om die eindpunt te bereik/om die basis te neutraliseer. (1)

7.3 Acids produce hydrogen ions (H^+)/hydronium ions (H_3O^+) in solution/when dissolved in water. ✓✓
Sure vorm waterstofione(H^+)/hidroniumione (H_3O^+) in oplossing/wanneer opgelos in water.

IF/*INDIEN*:
Acids produce hydrogen ions (H^+)/hydronium ions (H_3O^+). ✓
Sure vorm waterstofione(H^+)/hidroniumione (H_3O^+). (2)

7.4 H_2SO_4 ionises completely./ *H_2SO_4 ioniseer volledig*. ✓ (1)

7.5 Blue to yellow/*Blou na geel* ✓ (1)

7.6

Marking guidelines/*Nasienriglyne:*

- Formula/*Formule:* $c = \frac{n}{V}$ /n = cV/ $\frac{c_a \times V_a}{c_b \times V_b} = \frac{n_a}{n_b}$ ✓
- Substitution of/*Vervanging van:* (0,1)(25)/(0,1)(0,025) ✓
- Use mol ratio/*Gebruik molverhouding:* $n_a : n_b = 1 : 2$ ✓
- Final answer/*Finale antwoord:* 12,5 cm^3 / 0,0125 dm^3 ✓

OPTION 1/*OPSIE 1*

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

$\frac{(0,1)V_a}{(0,1)(25)} = \frac{1}{2}$ ✓✓

$\therefore V_a$ = 12,5 cm^3 ✓

OPTION 2/*OPSIE 2*

$c_b = \frac{n}{V}$ ✓

$0,1 = \frac{n}{0,025}$ ✓

n_b = 2,5 x 10^{-3} mol

$n_a = \frac{1}{2} n_b = \frac{1}{2}$ (2,5 x 10^{-3}) ✓
= 1,25 x 10^{-3} mol

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

$0,1 = \frac{1,25 \times 10^{-3}}{V}$

$\therefore V_a$ = 0,0125 dm^3 /12,5 cm^3 ✓ (4)

7.7 **POSITIVE MARKING FROM QUESTION 7.6.**
POSITIEWE NASIEN VANAF VRAAG 7.6.

Marking guidelines/*Nasienriglyne:*

- Formula/*Formule*: $c = \frac{n}{V}$ ✓
- Substitution of/*Vervanging van:* (0,1)(0,005)/0,0175 in n = cV ✓
- Substitute/*Vervang* V = 0,0425 dm^3 ✓
- Use/*Gebruik* $[H_3O^+] : [H_2SO_4] = 2 : 1$ ✓
- Formula/*Formule:* $pH = -\log[H_3O^+]$ ✓
- Substitute/*Vervang* $[H^+]$ ✓
- Final answer/*Finale antwoord:* 1,63 ✓

OPTION 1/*OPSIE 1*

$n_{a(excess/oormaat)} = cV$ ✓
$= (0,1)(0,005)$ ✓
$= 5 \times 10^{-4}$ mol

$c_a = \frac{n}{V}$
$= \frac{5 \times 10^{-4}}{4,25 \times 10^{-2}}$ ✓
$= 1,18 \times 10^{-2}$ mol·dm^{-3}

$c(H^+) = 2c_a$
$= 2(1,18 \times 10^{-2})$ ✓
$= 2,36 \times 10^{-2}$ mol·dm^{-3}

$pH = -\log[H_3O^+]$ ✓
$= -\log(2,36 \times 10^{-2})$ ✓
$= 1,63$ ✓

OPTION 2/*OPSIE 2*

$n_{a(final/finaal)} = cV$ ✓
$= (0,1)(0,0175)$ ✓
$= 1,75 \times 10^{-3}$ mol

$n_{a(exs/oor)} = n_{a(final/finaal)} - n_{a(react/reageer)}$
$= 1,75 \times 10^{-3} – 1,25 \times 10^{-3}$
$= 5 \times 10^{-4}$ mol

$c_a = \frac{n}{V}$
$= \frac{5 \times 10^{-4}}{4,25 \times 10^{-2}}$ ✓
$= 1,18 \times 10^{-2}$ mol·dm^{-3}

$c(H^+) = 2c_a$
$= 2(1,18 \times 10^{-2})$ ✓
$= 2,36 \times 10^{-2}$ mol·dm^{-3}

$pH = -\log[H_3O^+]$ ✓
$= -\log(2,36 \times 10^{-2})$ ✓
$= 1,63$ ✓

(7)

OPTION 3/*OPSIE 3*

$n_{a(excess/oormaat)} = cV$ ✓
$= (0,1)(0,005)$ ✓
$= 5 \times 10^{-4}$ mol

$n(H^+) = 2n_{a(excess/oormaat)}$
$= 2(5 \times 10^{-4})$ ✓
$= 1 \times 10^{-3}$ mol

$c(H^+) = \frac{n}{V}$
$= \frac{1 \times 10^{-3}}{4,25 \times 10^{-2}}$ ✓
$= 2,36 \times 10^{-2}$ mol·dm^{-3}

$pH = -\log[H_3O^+]$ ✓
$= -\log(2,36 \times 10^{-2})$ ✓
$= 1,63$ ✓

[17]

QUESTION 8/*VRAAG 8*

8.1

8.1.1 Galvanic (cell)/Voltaic (cell) ✓
Galvaniese (sel)/Voltaïese (sel) (1)

8.1.2 Indicates phase boundary./Interphase /phase separator✓
Dui faseskeiding aan/Interfase /fase onderskeier (1)

8.1.3 $Fe^{2+} \rightarrow Fe^{3+} + e^-$ ✓✓

Notes/*Aantekeninge*
- $Fe^{3+} + e^- \leftarrow Fe^{2+}$ $(2/2)$ $Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$ $(0/2)$
  $Fe^{2+} \rightleftharpoons Fe^{3+} + e^-$ $(1/2)$ $Fe^{3+} + e^- \rightarrow Fe^{2+}$ $(0/2)$
- Ignore if charge on electron is omitted./*Ignoreer indien lading op elektron uitgelaat is.*
- If a charge of an ion is omitted e.g. $Fe^2 \rightarrow Fe^3 + e^-$/*Indien lading op ioon uitgelaat is bv.* $Fe^2 \rightarrow Fe^3 + e^-$ Max./*Maks*: $1/2$

(2)

8.1.4

OPTION/*OPSIE 1*

$E^\theta_{cell} = E^\theta_{reduction} - E^\theta_{oxidation}$ ✓
0,03 ✓ = $E^\theta_{X/X^{2+}}$ - (0,77) ✓
$E^\theta_{X/X^{2+}}$ = 0,80 (V) ✓

X = Silver / Ag ✓

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. $E^\theta_{cell} = E^\theta_{OA} - E^\theta_{RA}$ followed by correct substitutions:/*Enige ander formule wat onkonvensionele afkortings gebruik bv.* $E^\theta_{sel} = E^\theta_{OM} - E^\theta_{RM}$ *gevolg deur korrekte vervangings: Max/Maks:* $4/5$

OPTION/*OPSIE 2*

✓ $X^+(aq) + e^- \rightarrow X(s)$ 0,80 (V) ✓
$Fe^{2+}(s) \rightarrow Fe^{3+}(aq) + e^-$ 0,77 (V) ✓
$X^+(aq) + Fe^{2+}(aq) \rightarrow X(s) + Fe^{3+}(aq)$ 0,03 (V) ✓

X = Silver/Ag/*Silwer* ✓

(5)

8.2

8.2.1 Pt ✓ (1)

8.2.2 Iron(III) (ions)Ferric ions✓
Yster(III)-(ione)/Ferri ione (1)

8.2.3 $2Fe^{3+} + Cu$ ✓$\rightarrow 2Fe^{2+} + Cu^{2+}$ ✓ Bal. ✓

Notes/*Aantekeninge*
- Reactants ✓ *Reaktanse* Products ✓ *Produkte* Balancing ✓ *Balansering*
- Ignore phases./*Ignoreer fases*.
- Ignore double arrows./*Ignoreer dubbelpyle.*
- Marking rule 6.3.10/*Nasienreël 6.3.10.*

(3)

[14]

QUESTION 9/*VRAAG 9*

9.1

9.1.1 Electrolyte/*Elektroliet* ✓ (1)

9.1.2 Conduct electricity/*Carry charges* ✓
Gelei elektrisiteit/Dra ladings. (1)

9.2 $Cu(NO_3)_2$ ✓ (1)

9.3 Iron rod/*Ysterstaaf* ✓

Reduction takes place./*Reduksie vind plaas.* ✓ (2)

9.4 $Cu \rightarrow Cu^{2+} + 2e^-$ ✓✓

Notes/*Aantekeninge*
- $Cu^{2+} + 2e^- \leftarrow Cu$ $(2/2)$ $Cu^{2+} + 2e^- \rightleftharpoons Cu$ $(0/2)$
  $Cu \rightleftharpoons Cu^{2+} + 2e^-$ $(1/2)$ $Cu^{2+} + 2e \rightarrow Cu$ $(0/2)$
- Ignore if charge on electron is omitted./*Ignoreer indien lading op elektron uitgelaat is.*
- If a charge of an ion is omitted e.g. $Cu \rightarrow Cu^2 + 2e^-$/*Indien lading op ioon uitgelaat is bv.* $Cu \rightarrow Cu^2 + 2e^-$ Max./*Maks*: $1/2$

(2)

9.5

9.5.1 Copper(II) (ions)/Cu^{2+} ✓and silver (ions)/Ag^+ ✓
Koper(II)-(ione) /Cu^{2+} *en silwer-(ione)* /Ag^+
Accept/*Aanvaar*
Cu (ions) and Ag (ions) (Ions are stated in the question.)
Cu(-ione) en Ag(-ione) (Ione word in vraag genoem.) (2)

9.5.2 Ag^+/silver(I) ions is a stronger oxidising agent ✓ than Cu^{2+}/Copper(II) ions and will be reduced (more readily) ✓ to form silver/Ag on the iron rod.
Ag^+/silwer(I) ione is 'n sterker oksideermiddel as Cu^{2+}/Copper(II) ione en sal (meer geredelik) gereduseer word om silwer/Ag op die ysterstaaf te vorm. (2)
[11]

QUESTION 10/*VRAAG 10*

10.1

10.1.1 (Catalytic) oxidation (of ammonia)/(*Katalitiese) oksidasie (van ammoniak)*✓ (1)

10.1.2 Neutralisation/acid-base reaction ✓
Neutralisasie/suur-basisreaksie (1)

10.2

10.2.1 Nitrogen/N_2/*Stikstof* ✓ (1)

10.2.2 NO_2/nitrogen dioxide/*Stikstofdioksied* ✓ (1)

10.2.3 Nitric acid/HNO_3/*Salpetersuur* ✓ (1)

10.3

10.3.1 $2NH_3 + H_2SO_4$ ✓ $\rightarrow (NH_4)_2SO_4$ ✓ Bal. ✓

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

10.3.2 $4NH_3 + 5O_2$ ✓ $\rightarrow 4NO + 6H_2O$ ✓ Bal. ✓

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

10.4 $\%\ N = \frac{28}{80} \times 100$ ✓ ✓
$= 35\%$ ✓ (3)

[14]

TOTAL/*TOTAAL:* 150