



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.**

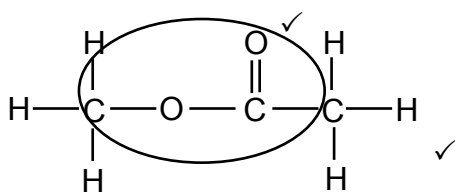
QUESTION 1/VRAAG 1

- 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]

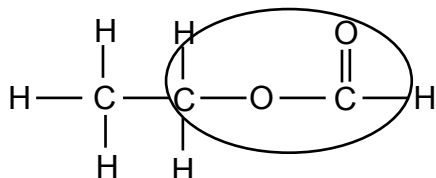
QUESTION 2/VRAAG 2

- 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: $\frac{2}{2}$
- Only functional group correct: / Slegs
funksionele groep korrek: Max/Maks.: $\frac{1}{2}$

Accept/Aanvaar

Any correct arrangement of correct number of atoms

Enige korrekte struktuur met die korrekte aantal atome.

- 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 molekule ✓ wat uit kleiner monomeer-eenhede bestaan wat kovalent aan mekaar in 'n herhalende patroon gebind is. ✓

(2)

2.3.2 Polyethene ✓

Polieteen

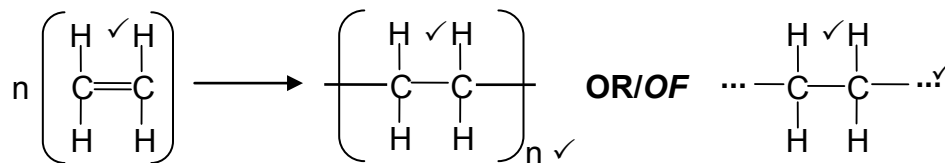
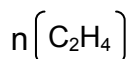
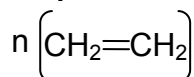
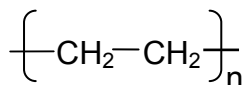
Accept/Aanvaar:

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/Nasienglyne**

- 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/brominerig/brominasie (1)

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

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

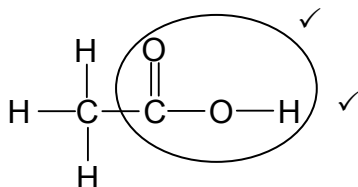
4.1.4 Addition/hydrohalogenation/hydrobromonation ✓
Addisie/hidrohalogenasie/hidrohalogenering/hidrobrominasie/hidrobromonering (1)

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



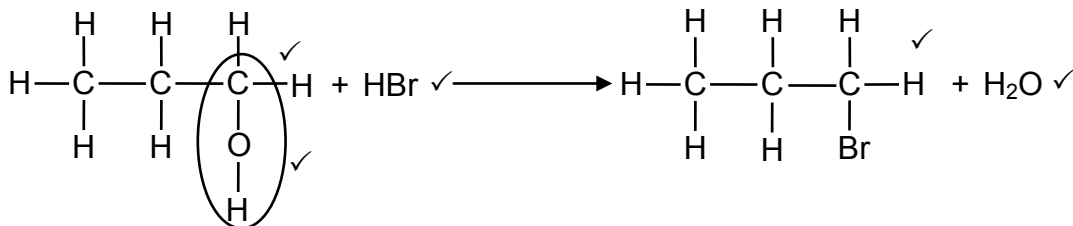
Marking criteria/Nasienriglyne:

- 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 \Rightarrow
- Accept HBr and H₂O as condensed. /Aanvaar HBr en H₂O 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 $m(\text{Mg})$ or $n(\text{Mg})$ ✓
Bereken verandering in $m(\text{Mg})$ of $n(\text{Mg})$
- Substitute/Vervang $24 \text{ g} \cdot \text{mol}^{-1}$ in $n = \frac{m}{M}$ ✓
- Use mol ratio/Gebruik molverhouding: $n(\text{Mg}) = n(\text{H}_2) = 1:1$ ✓
- Substitute/Vervang 25 dm^3 in $n = \frac{V}{V_m}$ ✓
- Final answer/Finale antwoord: $2,5 \text{ dm}^3$ ✓

OPTION 1/OPSIE 1

$$\Delta m(\text{Mg}) = 2,6 - 0,2 \checkmark$$

$$= 2,4 \text{ g}$$

$$n(\text{Mg}_{\text{used/gebruik}}) = \frac{m}{M}$$

$$= \frac{2,4}{24} \checkmark$$

$$= 0,1 \text{ mol}$$

$$n(\text{H}_2) = n(\text{Mg}) = 0,1 \text{ mol} \checkmark$$

$$V(\text{H}_2) = nV_m$$

$$V(\text{H}_2) = (0,1)(25) \checkmark$$

$$= 2,5 \text{ dm}^3 \checkmark$$

OPTION 2/OPSIE 2

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

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

$$\Delta n(\text{Mg}) = 0,1083 - 0,0083 \checkmark$$

$$= 0,1 \text{ mol}$$

$$n(\text{H}_2) = n(\text{Mg}) = 0,1 \text{ mol} \checkmark$$

$$V(\text{H}_2) = nV_m$$

$$V(\text{H}_2) = (0,1)(25) \checkmark$$

$$= 2,5 \text{ dm}^3 \checkmark$$

OPTION 3/OPSIE 3

$$24 \text{ g Mg} \checkmark \longrightarrow 25 \text{ dm}^3 \text{ H}_2$$

$$\therefore 2,4 \text{ g} \checkmark \longrightarrow x \text{ dm}^3 \text{ H}_2$$

$$x = \frac{2,4 \times 25}{24} \checkmark$$

$$= 2,5 \text{ dm}^3 \checkmark$$

(5)

5.3.2

Marking criteria/Nasienriglyne

- Substitute/Vervang $2,08 \times 10^{-4}$ in ave rate / *gem. tempo* = $\frac{\Delta n}{\Delta t}$ ✓
- Substitute/Vervang 10×60 s (600 s) in ave rate / *gem. tempo* = $\frac{\Delta n}{\Delta t}$ ✓
- Use mol ratio/Gebruik *molverhouding*: $n(\text{Mg}) = n(\text{H}_2) = 1:1$ ✓
- Substitute/Vervang $24 \text{ g} \cdot \text{mol}^{-1}$ in $m = nM$. ✓
- Final answer/Finale antwoord: 3 g ✓ (Range/Gebied 2,995 – 3,12 g)

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

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

$$\therefore \Delta n = 0,125 \text{ mol}$$

$$n(\text{Mg}) = n(\text{H}_2) = 0,125 \text{ mol} \checkmark$$

$$m(\text{Mg}) = nM$$

$$m(\text{Mg}) = 0,125 \times 24 \checkmark$$

$$= 3 \text{ g} \checkmark \text{ (2,995 g)}$$

(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 $V = 3 \text{ dm}^3$ 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

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

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

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

$$K_c = \frac{[C]^3}{[A]^2[B]} \checkmark$$

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

$$= 6,75 \checkmark$$

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. $\frac{4}{7}$

OPTION 2/OPSIE 2

| | A | B | C |
|--|---------------|---------------|----------------|
| Initial quantity (mol) <i>Aanvangshoeveelheid (mol)</i> | 16 | 8 | 0 |
| Change (mol) <i>Verandering (mol)</i> | 8 | 4 | 12 |
| Quantity at equilibrium (mol) <i>Hoeveelheid by ewewig (mol)</i> | 8 ✓ | 4 ✓ | 12 ✓ |
| Equilibrium concentration (mol·dm ⁻³) <i>Ewewigkonsentrasie (mol·dm⁻³)</i> | $\frac{8}{3}$ | $\frac{4}{3}$ | $\frac{12}{3}$ |

Divide by
/deel deur
3 dm³ ✓

$$K_c = \frac{[C]^3}{[A]^2[B]} \checkmark$$

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

$$= 6,75 \checkmark$$

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·dm ⁻³) <i>Aanvangskonsentrasie (mol·dm⁻³)</i> | $\frac{16}{3} = 5,33$ | $\frac{8}{3} = 2,67$ | 0 |
| Change (mol·dm ⁻³) <i>Verandering (mol·dm⁻³)</i> | $\frac{8}{3} = 2,67$ | $\frac{4}{3} = 1,33$ | $\frac{12}{3} = 4$ |
| Equilibrium concentration (mol·dm ⁻³) <i>Ewewigkonsentrasie (mol·dm⁻³)</i> | $\frac{8}{3} = 2,67 \checkmark$ | $\frac{4}{3} = 1,33 \checkmark$ | $\frac{12}{3} = 4 \checkmark$ |

÷3
dm³ ✓

$$K_c = \frac{[C]^3}{[A]^2[B]} \checkmark$$

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

$$= 6,75 \checkmark$$

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 ✓
Titrasië/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 (H₃O⁺) in solution/when dissolved in water. ✓✓
Sure vorm waterstofione(H⁺)/hidroniumione (H₃O⁺) in oplossing/wanneer opgelos in water.

IF/INDIEN:

Acids produce hydrogen ions (H⁺)/hydronium ions (H₃O⁺). ✓
Sure vorm waterstofione(H⁺)/hidroniumione (H₃O⁺). (2)

7.4 H₂SO₄ ionises completely. / H₂SO₄ 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 cm³ / 0,0125 dm³ ✓

OPTION 1/OPSIE 1

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

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

$$\therefore V_a = 12,5 \text{ cm}^3 \quad \checkmark$$

OPTION 2/OPSIE 2

$$c_b = \frac{n}{V} \quad \checkmark$$

$$0,1 = \frac{n}{0,025} \quad \checkmark$$

$$n_b = 2,5 \times 10^{-3} \text{ mol}$$

$$n_a = \frac{1}{2} n_b = \frac{1}{2} (2,5 \times 10^{-3}) \quad \checkmark$$

$$= 1,25 \times 10^{-3} \text{ mol}$$

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

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

$$\therefore V_a = 0,0125 \text{ dm}^3 / 12,5 \text{ cm}^3 \quad \checkmark$$

(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 $V = 0,0425 \text{ dm}^3$ ✓
- Use/Gebruik $[\text{H}_3\text{O}^+] : [\text{H}_2\text{SO}_4] = 2 : 1$ ✓
- Formula/Formule: $\text{pH} = -\log[\text{H}_3\text{O}^+]$ ✓
- Substitute/Vervang $[\text{H}^+]$ ✓
- Final answer/Finale antwoord: 1,63 ✓

OPTION 1/OPSIE 1

$$\begin{aligned} n_{\text{a(excess/oormaat)}} &= cV \checkmark \\ &= (0,1)(0,005) \checkmark \\ &= 5 \times 10^{-4} \text{ mol} \end{aligned}$$

$$\begin{aligned} c_{\text{a}} &= \frac{n}{V} \\ &= \frac{5 \times 10^{-4}}{4,25 \times 10^{-2}} \checkmark \\ &= 1,18 \times 10^{-2} \text{ mol} \cdot \text{dm}^{-3} \end{aligned}$$

$$\begin{aligned} c(\text{H}^+) &= 2c_{\text{a}} \\ &= 2(1,18 \times 10^{-2}) \checkmark \\ &= 2,36 \times 10^{-2} \text{ mol} \cdot \text{dm}^{-3} \end{aligned}$$

$$\begin{aligned} \text{pH} &= -\log[\text{H}_3\text{O}^+] \checkmark \\ &= -\log(2,36 \times 10^{-2}) \checkmark \\ &= 1,63 \checkmark \end{aligned}$$

OPTION 2/OPSIE 2

$$\begin{aligned} n_{\text{a(final/finaal)}} &= cV \checkmark \\ &= (0,1)(0,0175) \checkmark \\ &= 1,75 \times 10^{-3} \text{ mol} \end{aligned}$$

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

$$\begin{aligned} c_{\text{a}} &= \frac{n}{V} \\ &= \frac{5 \times 10^{-4}}{4,25 \times 10^{-2}} \checkmark \\ &= 1,18 \times 10^{-2} \text{ mol} \cdot \text{dm}^{-3} \end{aligned}$$

$$\begin{aligned} c(\text{H}^+) &= 2c_{\text{a}} \\ &= 2(1,18 \times 10^{-2}) \checkmark \\ &= 2,36 \times 10^{-2} \text{ mol} \cdot \text{dm}^{-3} \end{aligned}$$

$$\begin{aligned} \text{pH} &= -\log[\text{H}_3\text{O}^+] \checkmark \\ &= -\log(2,36 \times 10^{-2}) \checkmark \\ &= 1,63 \checkmark \end{aligned}$$

(7)

OPTION 3/OPSIE 3

$$\begin{aligned} n_{\text{a(excess/oormaat)}} &= cV \checkmark \\ &= (0,1)(0,005) \checkmark \\ &= 5 \times 10^{-4} \text{ mol} \end{aligned}$$

$$\begin{aligned} n(\text{H}^+) &= 2n_{\text{a(excess/oormaat)}} \\ &= 2(5 \times 10^{-4}) \checkmark \\ &= 1 \times 10^{-3} \text{ mol} \end{aligned}$$

$$\begin{aligned} c(\text{H}^+) &= \frac{n}{V} \\ &= \frac{1 \times 10^{-3}}{4,25 \times 10^{-2}} \checkmark \\ &= 2,36 \times 10^{-2} \text{ mol} \cdot \text{dm}^{-3} \end{aligned}$$

$$\begin{aligned} \text{pH} &= -\log[\text{H}_3\text{O}^+] \checkmark \\ &= -\log(2,36 \times 10^{-2}) \checkmark \\ &= 1,63 \checkmark \end{aligned}$$

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

Notes/Aantekeninge

- $\text{Fe}^{3+} + \text{e}^- \leftarrow \text{Fe}^{2+}$ (2/2) $\text{Fe}^{3+} + \text{e}^- \rightleftharpoons \text{Fe}^{2+}$ (0/2)
- $\text{Fe}^{2+} \rightleftharpoons \text{Fe}^{3+} + \text{e}^-$ (1/2) $\text{Fe}^{3+} + \text{e}^- \rightarrow \text{Fe}^{2+}$ (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. $\text{Fe}^2 \rightarrow \text{Fe}^3 + \text{e}^-$ /Indien lading op ion uitgelaat is bv. $\text{Fe}^2 \rightarrow \text{Fe}^3 + \text{e}^-$ Max./Maks: 1/2

(2)

8.1.4

OPTION/OPSIE 1

$$E_{\text{cell}}^{\ominus} = E_{\text{reduction}}^{\ominus} - E_{\text{oxidation}}^{\ominus} \quad \checkmark$$

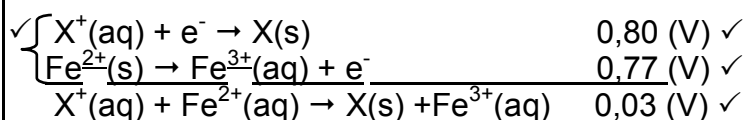
$$0,03 \checkmark = E_{\text{X}/\text{X}^{2+}}^{\ominus} - (0,77) \checkmark$$

$$E_{\text{X}/\text{X}^{2+}}^{\ominus} = 0,80 \text{ (V)} \checkmark$$

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

OPTION/OPSIE 2

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

Notes/Aantekeninge

- Reactants ✓ Products ✓ Balancing ✓
Reaktanse Produkte 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 $\text{Cu}(\text{NO}_3)_2$ ✓ (1)9.3 Iron rod/*Ysterstaaf* ✓
Reduction takes place./*Reduksie vind plaas.* ✓ (2)9.4 $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$ ✓✓**Notes/Aantekeninge**

- $\text{Cu}^{2+} + 2\text{e}^- \leftarrow \text{Cu}$ (2/2) $\text{Cu}^{2+} + 2\text{e}^- \rightleftharpoons \text{Cu}$ (0/2)
 $\text{Cu} \rightleftharpoons \text{Cu}^{2+} + 2\text{e}^-$ (1/2) $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$ (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. $\text{Cu} \rightarrow \text{Cu}^2 + 2\text{e}^-$ /Indien lading op ioon uitgelaat is bv. $\text{Cu} \rightarrow \text{Cu}^2 + 2\text{e}^-$ Max./Maks: 1/2

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/N₂/Stikstof ✓ (1)10.2.2 NO₂/nitrogen dioxide/Stikstofdioksied ✓ (1)10.2.3 Nitric acid/HNO₃/Salpetersuur ✓ (1)

10.3

10.3.1 $2\text{NH}_3 + \text{H}_2\text{SO}_4 \checkmark \rightarrow (\text{NH}_4)_2\text{SO}_4 \checkmark$ 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 $4\text{NH}_3 + 5\text{O}_2 \checkmark \rightarrow 4\text{NO} + 6\text{H}_2\text{O} \checkmark$ 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

$$\% \text{ N} = \frac{28}{80} \times 100 \checkmark$$

$$= 35\% \checkmark$$

(3)

[14]**TOTAL/TOTAAL: 150**