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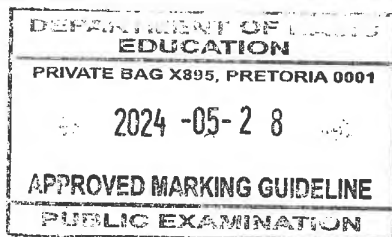
Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**SENIOR CERTIFICATE EXAMINATIONS/
NATIONAL SENIOR CERTIFICATE EXAMINATIONS
SENIORSERTIFIKAAT-EKSAMEN/
NASIONALE SENIORSERTIFIKAAT-EKSAMEN**

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

MAY/JUNE/MEI/JUNIE 2024

MARKING GUIDELINES/NASIENRIGLYNE



MARKS/PUNTE: 150

**These marking guidelines consist of 20 pages./
Hierdie nasienriglyne bestaan uit 20 bladsye.**

Approved
[Signature]
DBE Moderator
11-2024

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Umalusi Ex. Mod.

Approved!
[Signature]
Umalusi Ex. Moderator

QUESTION 1/VRAAG 1

- 1.1 A ✓✓ (2)
- 1.2 C ✓✓ (2)
- 1.3 A ✓✓ (2)
- 1.4 D ✓✓ (2)
- 1.5 D ✓✓ (2)
- 1.6 C ✓✓ (2)
- 1.7 B ✓✓ (2)
- 1.8 A ✓✓ (2)
- 1.9 B ✓✓ (2)
- 1.10 B ✓✓ (2)
- [20]**

QUESTION 2/VRAAG 2

- 2.1 Organic compounds that consist of hydrogen and carbon only. ✓✓ (2 or 0)
Organiese verbindings wat slegs uit waterstof en koolstof bestaan. (2 of 0) (2)
- 2.2.1 C and/en E ✓ (1)
- 2.2.2 D and/en H ✓✓ (2 or/of 0) (2)
- 2.2.3 A ✓ (1)

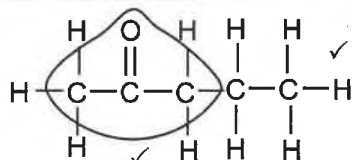
- 2.3
2.3.1

Marking criteria/Nasienkriteria:

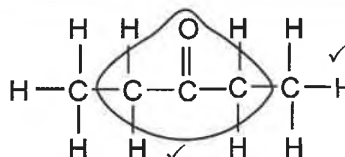
- Functional group. ✓
Funksionele groep.
- Whole structure correct. ✓
Hele struktuur korrek.

IF/INDIEN:

- More than one functional group/wrong functional group:
Meer as een funksionele groep/foutiewe funksionele groep: $\frac{0}{2}$
- If condensed structural formulae used/Indien gekondenseerde struktuurformules gebruik:
Max/Maks. $\frac{1}{2}$



OR/OF

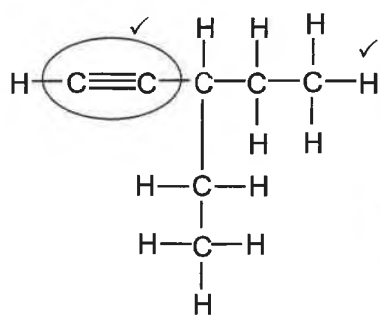


(2)

2.3.2 C_nH_{2n+2} ✓

(1)

2.3.3

**Marking criteria/Nasiënriteria:**

- Functional group $-C\equiv C-$. ✓
Funksionele groep $-C\equiv C-$.
- Whole structure correct. ✓
Hele struktuur korrek.

IF/INDIEN

- More than one functional group/wrong functional group:
Meer as een funksionele groep/foutiewe funksionele groep: $\frac{0}{2}$
- If condensed structural formulae used/Indien gekondenseerde struktuurformules gebruik:
Max/Maks. $\frac{1}{2}$

(2)

2.4.1 3-ethylhex-3-ene ✓✓✓/3-ethyl-3-hexene/3-etiëlheks-3-een/3-etiël-3-hekseen

Marking criteria:

- Correct stem i.e. hexene. ✓
- Substituent (ethyl) correctly identified. ✓
- IUPAC name completely correct including numbering, sequence, hyphens and commas. ✓

Nasiënriteria:

- *Korrekte stam d.i. hekseen.* ✓
- *Substituent (etiël) korrek geïdentifiseer.* ✓
- *IUPAC-naam heeltemal korrek insluitende nommering, volgorde, koppeltekens en kommas.* ✓

(3)

2.4.2 2,5-dichloro-2,4-dimethylhexane ✓✓✓/ 2,5-dichloro-2,4-dimetiëlheksaan

Marking criteria:

- Correct stem i.e. hexane. ✓
- All substituents (dichloro and dimethyl) correctly identified. ✓
- IUPAC name completely correct including numbering, sequence, hyphens and commas. ✓

Nasiënriteria:

- *Korrekte stam d.i. heksaan.* ✓
- *Alle substituentte (dichloro en dimetiël) korrek geïdentifiseer.* ✓
- *IUPAC-naam heeltemal korrek insluitende nommering, volgorde, koppeltekens en kommas.* ✓

(3)

2.4.3 2,2-dimethyl✓propanal✓/dimethylpropanal

2,2-dimetiëlpropanaal/dimetiëlpropanaal

(2)

NOTE/NOTA:2,2-dimethyl✓propan-1-al (Max/Maks: $\frac{1}{2}$)

N.
V.
P.
K.

2.5

Marking criteria/Nasienkriteria:

- Correct molecular formula: C_7H_{16} ✓
Korrekte molekulêre formula: C_7H_{16}
- Correct molecular formula of inorganic reactant and products. ✓
Korrekte molekulêre formule vir die anorganiese reaktans en produkte.
- Balancing/Balansering ✓

**Notes/Aantekeninge:**

- Ignore double arrows and phases. / Ignoreer dubbelpyle en fases.
- Marking rule 6.3.10/Nasienreël 6.3.10.
- If condensed structural formulae used: / Indien gekondenseerde struktuurformules gebruik: Max/Maks. $\frac{2}{3}$
- **ACCEPT:** multiple coefficients for this exam.
AANVAAR: veelvoude van koëffisiënte vir hierdie eksamen.

(3)

[22]

QUESTION 3/VRAAG 3

3.1

Marking criteria/Nasienkriteria

If any one of the underlined key phrases in the **correct context** is omitted, deduct 1 mark. / Indien enige van die onderstreepte frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.

The underlined phrases must be in the correct context. / Die onderstreepte frases moet in die korrekte konteks wees.

The temperature at which the vapour pressure (of a substance) equals atmospheric pressure. ✓✓

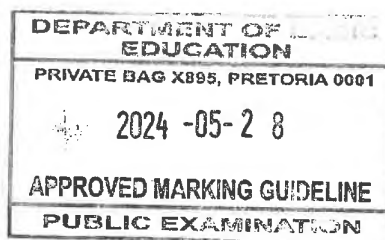
Die temperatuur waarby die dampdruk (van die stof) gelyk is aan atmosferiese druk.

(2)

3.2

C ✓

(1)



N.
Vig
H
K



3.3

Marking criteria:

- Compare structures. ✓
- Compare the strength of intermolecular forces. ✓
- Compare the energy required to overcome intermolecular forces. ✓

Nasienkriteria:

- Vergelyk strukture. ✓
- Vergelyk die sterkte van intermolekulêre kragte. ✓
- Vergelyk die energie benodig om intermolekulêre kragte te oorkom. ✓

Accept: IMF for this exam/**Aanvaar:** IMK vir hierdie eksamen**A/CH₃CH₂CH₂CH₂Cl /1-chlorobutane**

- **Structure:**
Longer chain length/larger surface area (over which intermolecular forces act). ✓
- **Intermolecular forces:**
Stronger/more intermolecular forces/Van der Waals forces/London forces/dipole-dipole forces. ✓
- **Energy:**
More energy needed to overcome or break intermolecular forces/Van der Waals forces/dipole-dipole forces. ✓

OR

B/CH₃CH(CH₃)CH₂Cl/1-chloro-2-methylpropane

- **Structure:**
Shorter chain length / branched / compact / more spherical / smaller surface area (over which intermolecular forces act). ✓
- **Intermolecular forces:**
Weaker/less intermolecular forces/Van der Waals forces/London forces/dipole-dipole forces. ✓
- **Energy:**
Less energy needed to overcome or break intermolecular forces/Van der Waals forces/dipole-dipole forces. ✓

A/CH₃CH₂CH₂CH₂Cl /1-chlorobutaan

- **Struktuur:**
Langer kettinglengte/groter oppervlak (waaroor intermolekulêre kragte werk). ✓
- **Intermolekulêre kragte:**
Sterker/meer intermolekulêre kragte/Van der Waalskragte/Londonkragte/dipool-dipoolkragte. ✓
- Meer energie benodig om intermolekulêre kragte/Van der Waalskragte/Londonkragte/dipool-dipoolkragte te oorkom/breek. ✓

OF

B/CH₃CH(CH₃)CH₂Cl/1-chloro-2-metielpropan

- **Struktuur:**
Korter kettinglengte / vertak / kompak / meer sferies / kleiner oppervlak (waaroor intermolekulêre kragte werk). ✓
- **Intermolekulêre kragte:**
Swakker/minder intermolekulêre kragte/Van der Waalskragte/Londonkragte/dipool-dipoolkragte. ✓
- **Energie:**
Minder energie benodig om intermolekulêre kragte/Van der Waalskragte/Londonkragte/dipool-dipoolkragte te oorkom/breek. ✓

(3)

N.
V.
G.
M.

3.4.1 75 (°C) ✓

(1)

3.4.2

Marking criteria:

- Compare the strength of intermolecular forces. ✓
- Compare the energy required to overcome intermolecular forces. ✓

Nasienkriteria:

- *Vergelyk die sterkte van intermolekulêre kragte.* ✓
- *Vergelyk die energie benodig om intermolekulêre kragte te oorkom.* ✓

• **Intermolecular forces:**

C (CH₃CH₂CH₂CH₂OH/butanol) has stronger intermolecular forces than D (CH₃CH₂CH₂CHO/butanal). ✓

• **Energy:**

More energy needed to overcome or break intermolecular forces. ✓

Accept: Boiling point of C will be more (in relation to C and D/118°C vs 75°C).

OR

• **Intermolecular forces:**

D (CH₃CH₂CH₂CHO/butanal) has weaker intermolecular forces than C (CH₃CH₂CH₂CH₂OH/butanol)

• **Energy:**

Less energy is needed to overcome or break intermolecular forces.

Accept: Boiling point of D will be less (in relation to C and D/118°C vs 75°C).

OR

• **Intermolecular forces:**

A (CH₃CH₂CH₂CH₂Cl) is a more polar molecule than D (CH₃CH₂CH₂CHO) increasing the intermolecular forces

• **Energy:**

More energy is needed to overcome or break intermolecular forces.

Accept: Boiling point of D will be less (in relation to A and D).

OR

• **Intermolecular forces:**

Electron density of A (CH₃CH₂CH₂CH₂Cl) is greater than D (CH₃CH₂CH₂CHO) increasing the intermolecular forces

• **Energy:**

More energy is needed to overcome or break intermolecular forces.

Accept: Boiling point of D will be less (in relation to A and D).

• **Intermolekulêre kragte:**

C (CH₃CH₂CH₂CH₂OH/butanol) het sterker intermolekulêre kragte as D (CH₃CH₂CH₂CHO/butanaal). ✓

• **Meer energie benodig om intermolekulêre kragte te oorkom/breek.** ✓

Aanvaar: Kookpunt van D sal minder wees (met betrekking tot C en D)

OF

• **Intermolekulêre kragte:**

D (CH₃CH₂CH₂CHO/butanaal) het swakker intermolekulêre kragte as C (CH₃CH₂CH₂CH₂OH/butanol).

• **Minder energie benodig om intermolekulêre kragte te oorkom/breek.**

Aanvaar: Kookpunt van C sal meer wees (met betrekking tot C en D)



OF

• **Intermolekulêre kragte:**

A ($\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Cl}$) is 'n meer polêre molekule as D wat sterker intermolekulêre kragte tot gevolg het.

• Meer energie benodig om intermolekulêre kragte te oorkom/breek.

Aanvaar: Kookpunt van D sal minder wees (met betrekking tot A en D)

OF

• **Intermolekulêre kragte:**

Elektrondigtheid van A ($\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Cl}$) is groter wat sterker intermolekulêre kragte tot gevolg het.

• Meer energie benodig om intermolekulêre kragte te oorkom/breek.

Aanvaar: Kookpunt van D sal minder wees (met betrekking tot A en D)

(2)

3.5 Decreases/Neem af ✓

(1)

[10]

QUESTION 4/VRAAG 4

4.1

4.1.1 (Concentrated) sulphuric acid/ $\text{H}_2\text{SO}_4(\text{aq})$ ✓

(Gekonsentreerde) swawelsuur

(1)

4.1.2 Esterification / Condensation ✓ / Verestering / Esterifikasie / Kondensasie

(1)

4.1.3 **ANY TWO/ENIGE TWEE:**• Alcohol/methanol/reactant is flammable/catches fire easily. ✓

Alkohol/metanol/reaktans is vlambaar/slaan maklik aan die brand.

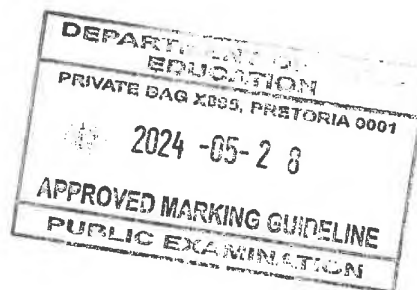
• To heat evenly/A steady/controlled/gradual increase in temperature. ✓

Om eweredig/gekontroleerd/gelydelik te verhit/n Eweredige toename in temperatuur.

• Alcohol/methanol will evaporate too quickly/is volatile.

Alkohol/metanol sal te vinnig verdamp/is vlugtig.

(2)



N.
V.
K.



4.1.4

Marking criteria:

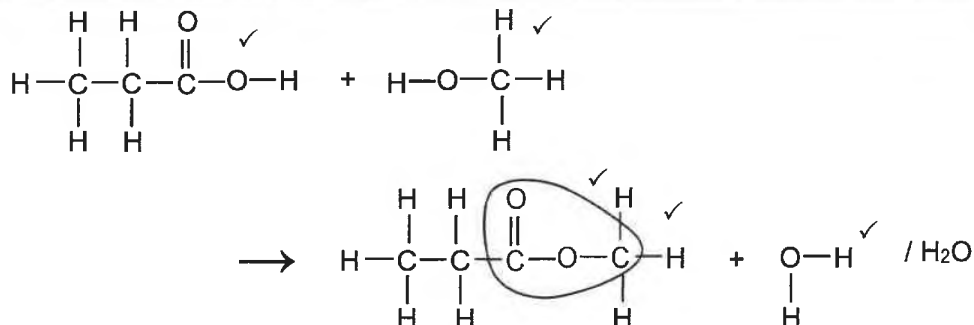
- Whole structural formula correct for propanoic acid. ✓
- Whole structural formula correct for methanol. ✓
- Functional group of ester correct. ✓
- Whole structural formula of ester correct. ✓
- H₂O ✓

Nasienkriteria:

- Hele struktuurformule vir propanoësuur korrek. ✓
- Hele struktuurformule vir metanol korrek. ✓
- Funksionele groep van ester korrek. ✓
- Hele struktuurformule van ester korrek. ✓
- H₂O ✓

IF/INDIEN

- Any error e.g. omission of all H atoms, condensed or semi structural formula/Enige fout bv. weglating van alle H-atome, gekondenseerde of semi-struktuurformule: Max/Maks. 2/5 (Functional group, H₂O/Funksionele groep, H₂O)
- Any additional reactants or products /Enige addisionele reaktanse of produkte: Subtract 1 mark./Trek 1 punt af.
- Molecular formulae used:/Molekulêre formule gebruik: Max/Maks. 1/5 (water)
- No arrows: The first two structures given are considered as reactants and can be marked/Geen pyltjie: die eerste twee strukture geskryf, word beskou as reaktanse en kan gemerk word.



(5)

4.1.5 Methyl ✓propanoate ✓/Metielpropanoaat

(2)

4.2.1 Hydrogen/H₂ ✓/Waterstof(gas)

(1)

4.2.2 3,3-dimethyl ✓/but-1-ene ✓/3,3-dimethyl-1-butene
3,3-dimetiel but-1-een/3,3-dimetiel-1-buteen

(2)

4.2.3 elimination **OR** dehydrohalogenation ✓ eliminasi **OF** dehidrohalogenering

(1)

4.2.4 H₂SO₄/H₃PO₄ **OR/OF** Sulphuric acid/Phosphoric acid ✓
Swawelsuur/Fosforsuur

(1)

4.2.5 3,3-dimethyl ✓/butan-2-ol ✓/3,3-dimethyl-2-butanol
3,3-dimetiel butan-2-ol/3,3-dimetiel-2-butanol

(2)

4.2.6 Addition/hydration ✓ Addisie/hidrasie

(1)

4.2.7 Secondary ✓/Sekondêr

(1)

[20]

N.
V.
K.

QUESTION 5/VRAAG 5

5.1.1 Exothermic/Eksotermies ✓

Lower (potential) energy of the products than reactants. $\Delta H < 0$ / ΔH negative /
 $\Delta H = -121,7$ kJ/More energy is released than absorbed. ✓

Laer (potensiële) energie van produkte as die reaktanse./ $\Delta H < 0$ / ΔH negatief /
 $\Delta H = -121,7$ kJ/Meer energie word afgegee as wat opgeneem is. (2)

5.1.2 (The number of) particles with sufficient/enough (kinetic) energy (with a catalyst) OR $E_K \geq E_A$ (which can undergo effective collisions.) ✓

(Die hoeveelheid) deeltjies met genoeg/voldoende (kinetiese) energie (met 'n katalisator) OF $E_K \geq E_A$ (om effektiewe botsings te ondergaan). (1)

5.1.3 240,8 – 208,2 ✓ = 32,6 (kJ) ✓ (2)

IF: only answer award 2 marks//**INDIEN:** slegs antwoord gee 2 punte

5.2

5.2.1 Decreases/Afneem ✓ (1)

5.2.2 Remains the same/Bly dieselfde ✓ (1)

5.2.3 Remains the same/Bly dieselfde ✓ (1)

5.3.1 Concentration (of sulphuric acid/ $H_2SO_4(aq)$)/Konsentrasie (van swawelsuur) ✓ (1)5.3.2 • More (H_2SO_4) particles per unit volume. ✓

• More effective collisions per unit time./Higher frequency of effective collisions. ✓

• Higher reaction rate. ✓

OR

• Less (H_2SO_4) particles per unit volume. ✓

• Less effective collisions per unit time./Lower frequency of effective collisions. ✓

• Lower reaction rate ✓

• Meer (H_2SO_4) deeltjies per eenheid volume. ✓

• Meer effektiewe botsings per eenheidtyd./Hoër frekwensie van effektiewe botsings. ✓

• Hoër reaksietempo. ✓

OF

• Minder (H_2SO_4)-deeltjies per eenheid volume. ✓

• Minder effektiewe botsings per eenheidtyd./Laer frekwensie van effektiewe botsings. ✓

• Laer reaksietempo. ✓ (3)

N.
Vus
G
K

5.3.3

<p>Marking criteria:</p> <p>(a) Substitute $(2,6)(60)(40)$ cm³ OR $(156)(40)$ in rate formula ✓</p> <p>(b) Substitute $27\ 000$ cm³ / 27 dm³ and volume in $n(\text{H}_2) = \frac{V}{V_m}$ ✓</p> <p>(c) USE mole ratio $n(\text{Al}) = \frac{2}{3}n(\text{H}_2)$ ✓</p> <p>(d) Substitution 27 and reacting mole in $n(\text{Al}) = \frac{m}{M}$ ✓</p> <p>(e) Substitution of $\frac{4,05}{5}(100)$ ✓</p> <p>(f) Final answer: 83,2 % ✓ Range: 81 – 83,3 %</p>	<p>Nasienkriteria:</p> <p>(a) Vervang $2,6(60)(40)$ cm³ OF $(156)(40)$ in tempo formule ✓</p> <p>(b) Vervang $27\ 000$ cm³ / 27 dm³ en volume in $n(\text{H}_2) = \frac{V}{V_m}$ ✓</p> <p>(c) GEBRUIK molverhouding $n(\text{Al}) = \frac{2}{3}n(\text{H}_2)$ ✓</p> <p>(d) Vervang 27 en mol gereageer in $n(\text{Al}) = \frac{m}{M}$ ✓</p> <p>(e) Vervang van $\frac{4,05}{5}(100)$ ✓</p> <p>(f) Finale antwoord: 81 % ✓ Gebied: 81 – 83,3 %</p>
<p>OPTION 1/OPSIE 1:</p> $\text{Rate/Tempo} = \frac{\Delta V_{\text{H}_2}}{\Delta t}$ $40 = \frac{\Delta V_{\text{H}_2}}{2,6(60)} \quad \checkmark \text{ (a)}$ $V(\text{H}_2) = 6\ 240 \text{ cm}^3$ $n(\text{H}_2) = \frac{V}{V_m}$ $= \frac{6\ 240}{27\ 000} \quad \checkmark \text{ (b)}$ $= 0,23 \text{ mol}$ $n(\text{Al}) = \frac{2}{3} n(\text{H}_2)$ $n(\text{Al}) = \frac{2}{3} (0,23) \quad \checkmark \text{ (c)}$ $= 0,15 \text{ mol}$ $n(\text{Al}) = \frac{m}{M}$ $0,15 = \frac{m}{27} \quad \checkmark \text{ (d)}$ $m = 4,05 \text{ g}$ $\% \text{ purity/suiwerheid} = \frac{4,05}{5}(100) \quad \checkmark \text{ (e)}$ $= 81 \% \quad \checkmark \text{ (f)}$	<p>OPTION 2/OPSIE 2:</p> $\text{rate H}_2 = 40 \text{ cm}^3 \cdot \text{s}^{-1}$ $\text{Rate in } n(\text{H}_2) = \frac{V}{V_m}$ $= \frac{40}{27\ 000} \quad \checkmark \text{ (b)}$ $= 0,00148 \text{ mol} \cdot \text{s}^{-1}$ $\text{Rate}(\text{Al}) = \frac{2}{3} n(\text{H}_2)$ $= \frac{2}{3} (0,00148) \quad \checkmark \text{ (c)}$ $= 9,88 \times 10^{-4} \text{ mol} \cdot \text{s}^{-1}$ $n(\text{Al}) = \frac{m}{M}$ $9,88 \times 10^{-4} = \frac{m}{27} \quad \checkmark \text{ (d)}$ $m = 0,0267 \text{ g} \cdot \text{s}^{-1}$ $\text{Rate/Tempo} = \frac{\Delta m_{\text{Al}}}{\Delta t}$ $0,0267 = \frac{\Delta m_{\text{Al}}}{2,6(60)}$ $m(\text{Al}) = 4,16 \text{ g}$ $\% \text{ purity/suiwerheid} = \frac{4,16}{5}(100) \quad \checkmark \text{ (e)}$ $= 83,2 \% \quad \checkmark \text{ (f)}$

N. Vied

(a) both/beide

(6)
[18]



QUESTION 6/VRAAG 6

6.1

Marking criteria/Nasienkriteria:

If any one of the underlined key phrases in the **correct context** is omitted, deduct 1 mark./Indien enige van die onderstreepte frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.

The underlined phrases must be in the correct context. / Die onderstreepte frases moet in die korrekte konteks wees.

When the equilibrium in a closed system is disturbed, the system will re-instate a new equilibrium by favouring the reaction that will cancel/oppose the disturbance. ✓✓

Wanneer die ewewig in 'n geslote sisteem versteur word, sal die sisteem 'n nuwe ewewig instel deur die reaksie te bevoordeel wat die versteuring kanselleer/teenwerk.

IF "isolated" system -1/**INDIEN:** "geïsoleerde" sisteem -1)

(2)

6.2

(Chemical) equilibrium/Concentrations of reactants and products remain constant./Rate of the forward and reverse reactions are equal. ✓

(Chemiese) ewewig/Konsentrasies van reaktanse en produkte bly konstant./ Tempo van voorwaartse en terugwaartse reaksie is gelyk.

(1)

6.3

OPTION 1/OPSIE 1:

Exothermic/Eksotermies ✓

**OPTION 2/OPSIE 2:**

Endothermic/Endotermies ✓



6.4

- With an increase in temperature the endothermic reaction is favoured. ✓
- The reverse reaction is favoured./ Equilibrium shifts to the left. / Reactants / $[P_2Q]$ increases OR Products / $[PQ_2]$ decreases ✓
- 'n Toename in temperatuur bevoordeel die endotermiese reaksie.
- Die terugwaartse reaksie word bevoordeel./ Ewewig skuif na links. / Reaktante / $[P_2Q]$ neem toe OF Produkte / $[PQ_2]$ neem af



- With an increase in temperature the endothermic reaction is favoured. ✓
- The forward reaction is favoured./ Equilibrium shifts to the right. Reactants / $[PQ_2]$ increases OR Products / $[P_2Q]$ decreases ✓
- 'n Toename in temperatuur bevoordeel die endotermiese reaksie.
- Die voorwaartse reaksie word bevoordeel./ Ewewig skuif na regs./ Reaktante / $[PQ_2]$ neem toe OF Produkte / $[P_2Q]$ neem af



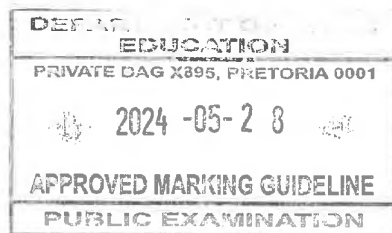
6.5

Less than/Kleiner as ✓

Greater than/Groter as ✓

(1)

N.
V.
K.



6.6

METHOD 1/METODE 1: Using lines/Gebruik lyne**CALCULATIONS USING CONCENTRATION****Marking criteria:**

- (a) Correct K_c expression (formulae in square brackets). ✓✓
(If solid is included deduct 1 mark)
- (b) Substitute 0,49 into K_c expression. ✓
- (c) Substitute equilibrium concentration (0,35) into correct K_c expression. ✓
- (d) Change in concentration/mole ✓
- (e) **USE** ratio: $P_2Q : 2PQ_2 = 1 : 2$ ✓
- (f) Substitute 2 dm^3 in $n = cV$. ✓
- (g) Final answer = 0,85 (mol) OR 1,11 (mol) OR 3,09 (mol) ✓

Nasienkriteria:

- (a) Korrekte K_c uitdrukking (formules in vierkantige hakies). ✓✓
(Indien vastestof inervang is, trek 1 punt af)
- (b) Vervang 0,49 in K_c -uitdrukking. ✓
- (c) Vervang ewewigkonsentrasie (0,35) in korrekte K_c -uitdrukking. ✓
- (d) Verandering in konsentrasie/mol ✓
- (e) **GEBRUIK** verhouding: $P_2Q : PQ_2 = 1 : 2$ ✓
- (f) Vervang 2 dm^3 in $n = cV$. ✓
- (g) Finale antwoord = 0,85 (mol) OF 1,11 (mol) OF 3,09 (mol) ✓

OPTION 1/OPSIE 1:

	P_2Q	PQ_2
Initial concentration (mol·dm ⁻³) Aanvangskonsentrasie (mol·dm ⁻³)	x	0
Change in concentration (mol·dm ⁻³) Verandering in konsentrasie (mol·dm ⁻³)	0,175 ✓(e)	0,35
Equilibrium concentration (mol·dm ⁻³) Ewewigskonsentrasie (mol·dm ⁻³)	✓(d) x - 0,175	0,35

$$K_c = \frac{[PQ_2]^2}{[P_2Q]} \quad \checkmark\checkmark \text{ (a)}$$

$$0,49 \checkmark\text{(b)} = \frac{(0,35)^2 \checkmark\text{(c)}}{(x - 0,175)}$$

$$x = 0,425 \text{ mol}\cdot\text{dm}^{-3}$$

$$n(P_2Q) = cV$$

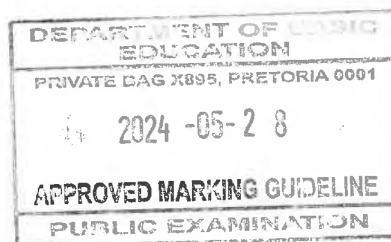
$$= 0,425 \times 2 \checkmark\text{(f)}$$

$$= 0,85 \text{ mol} \checkmark\text{(g)}$$

No K_c expression, correct substitution/Geen K_c -uitdrukking, korrekte substitusie: Max./Maks. $\frac{6}{8}$

Wrong K_c expression/
Verkeerde K_c -uitdrukking: Max./Maks. $\frac{5}{8}$

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OPTION2/OPSIE 2:

$$K_c = \frac{[PQ_2]^2}{[P_2Q]}$$

$$0,49 \checkmark (b) = \frac{(0,35)^2 \checkmark (c)}{P_2Q}$$

$$P_2Q = 0,25 \text{ mol} \cdot \text{dm}^{-3}$$

No K_c expression, correct substitution/Geen K_c -uitdrukking, korrekte substitusie: Max./Maks. $\frac{6}{8}$

Wrong K_c expression/
Verkeerde K_c -uitdrukking: Max./Maks. $\frac{5}{8}$

	P ₂ Q	PQ ₂
Initial concentration (mol·dm ⁻³) Aanvangskonsentrasie (mol·dm ⁻³)	✓ (d) 0,425	0
Change in concentration (mol·dm ⁻³) Verandering in konsentrasie (mol·dm ⁻³)	-0,175	✓ (e) 0,35
Equilibrium concentration (mol·dm ⁻³) Ewewigskonsentrasie (mol·dm ⁻³)	0,25	0,35

$$n(P_2Q) = cV$$

$$= 0,425(2) \checkmark (f)$$

$$= 0,85 \text{ mol} \checkmark (g)$$

CALCULATIONS USING NUMBER OF MOLES

OPTION 3/OPSIE 3:

	P ₂ Q	PQ ₂
Initial quantity (mol) Aanvangshoeveelheid (mol)	x	0
Change (mol) Verandering (mol)	✓ (e) 0,35	0,7
Quantity at equilibrium (mol) Hoeveelheid by ewewig (mol)	✓ (d) x - 0,35	0,7
Equilibrium concentration (mol·dm ⁻³) Ewewigskonsentrasie (mol·dm ⁻³)	✓ (f) $\frac{x - 0,35}{2}$	0,35

$$K_c = \frac{[PQ_2]^2}{[P_2Q]}$$

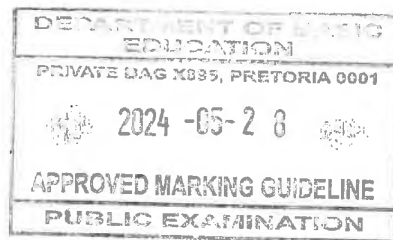
$$0,49 \checkmark (b) = \frac{(0,35)^2 \checkmark (c)}{\left(\frac{x - 0,35}{2}\right) \checkmark (a)}$$

$$x = 0,85 \text{ mol} \checkmark (g)$$

No K_c expression, correct substitution/Geen K_c -uitdrukking, korrekte substitusie: Max./Maks. $\frac{6}{8}$

Wrong K_c expression/
Verkeerde K_c -uitdrukking: Max./Maks. $\frac{5}{8}$

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OPTION 4/OPSIE 4:

$$K_c = \frac{[PQ_2]^2}{[P_2Q]} \quad \checkmark \checkmark \text{ (a)}$$

$$0,49 \checkmark \text{ (b)} = \frac{(0,35)^2 \checkmark \text{ (c)}}{[P_2Q]}$$

$$[P_2Q] = 0,25 \text{ mol} \cdot \text{dm}^{-3}$$

Wrong K_c expression/

Verkeerde K_c -uitdrukking: Max./Maks. 5/8

No K_c expression, correct substitution/Geen K_c -uitdrukking, korrekte substitusie: Max./Maks. 6/8

	P ₂ Q	PQ ₂
Initial quantity (mol) Aanvangshoeveelheid (mol)	✓(g) 0,85	0
Change (mol) Verandering (mol)	✓(e) -0,35	0,7 ✓(d)
Quantity at equilibrium (mol) Hoeveelheid by ewewig (mol)	0,5	0,7
Equilibrium concentration (mol·dm ⁻³) Ewewigskonsentrasie (mol·dm ⁻³)	0,25	0,35

METHOD 2/METODE 2: Using labels/Gebruik byskrifte

OPTION 1/OPSIE 1:

	P ₂ Q	PQ ₂
Initial concentration (mol·dm ⁻³) Aanvangskonsentrasie (mol·dm ⁻³)	x	0
Change in concentration (mol·dm ⁻³) Verandering in konsentrasie (mol·dm ⁻³)	✓(e) -0,207	0,414 ✓(d)
Equilibrium concentration (mol·dm ⁻³) Ewewigskonsentrasie (mol·dm ⁻³)	0,35	0,414

$$K_c = \frac{[PQ_2]^2}{[P_2Q]} \quad \checkmark \checkmark \text{ (a)}$$

$$\text{(b)} \checkmark 0,49 = \frac{[PQ_2]^2 \checkmark \text{ (c)}}{(0,35)}$$

$$[PQ_2] = 0,414 \text{ mol} \cdot \text{dm}^{-3}$$

$$\text{initial } n(P_2Q) = (0,35 + 0,207)(2) \checkmark \text{ (f)} \\ = 1,11 \text{ mol} \checkmark \text{ (g)}$$

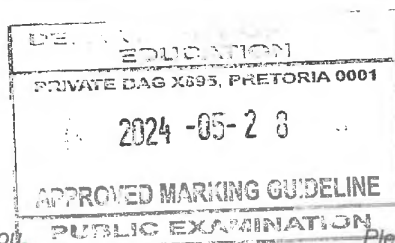
No K_c expression, correct

substitution/Geen K_c -uitdrukking, korrekte substitusie: Max./Maks. 6/8

Wrong K_c expression/

Verkeerde K_c -uitdrukking: Max./Maks. 5/8

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OPTION 2/OPSIE 2:

	P ₂ Q	PQ ₂
Initial quantity (mol) Aanvangshoeveelheid (mol)	x	0
Change (mol) Verandering (mol)	0,414	0,828 ✓(e)
Quantity at equilibrium (mol) Hoeveelheid by ewewig (mol)	0,7	0,828
Equilibrium concentration (mol·dm ⁻³) Ewewigkonsentrasie (mol·dm ⁻³)	0,35 ✓(f)	0,414

$$K_c = \frac{[PQ_2]^2}{[P_2Q]} \quad \checkmark\checkmark \text{ (a)}$$

$$(b) \checkmark 0,49 = \frac{[PQ_2]^2}{(0,35)} \quad \checkmark \text{ (c)}$$

$$[PQ_2] = 0,414 \text{ mol}\cdot\text{dm}^{-3}$$

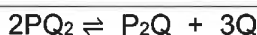
No K_c expression, correct substitution/Geen K_c-uitdrukking, korrekte substitusie: Max./Maks. 6/8

$$x - 0,414 = 0,7 \quad \checkmark \text{ (d)}$$

$$x = 1,11 \text{ mol P}_2\text{Q} \quad \checkmark \text{ (g)}$$

Wrong K_c expression/
Verkeerde K_c-uitdrukking: Max./Maks. 5/8

METHOD 3/METODE 3: (Equation written as reverse/Vergelyking omgekeerd geskryf)



	PQ ₂	P ₂ Q
Initial quantity (mol) Aanvangshoeveelheid (mol)	x	0
Change (mol) Verandering (mol)	1,4	0,7 ✓(e)
Quantity at equilibrium (mol) Hoeveelheid by ewewig (mol) (d) ✓	x - 1,4	0,7
Equilibrium concentration (mol·dm ⁻³) Ewewigkonsentrasie (mol·dm ⁻³)	$\frac{x - 1,4}{2}$	0,35

$$K_c = \frac{[P_2Q]}{[PQ_2]^2} \quad \checkmark\checkmark \text{ (a)}$$

$$(b) \checkmark 0,49 = \frac{(0,35)}{[PQ_2]^2} \quad \checkmark \text{ (c)}$$

$$\frac{x - 1,4}{2} = 0,845 \quad \checkmark \text{ (f)}$$

$$x = 3,09 \text{ mol P}_2\text{Q} \quad \checkmark \text{ (g)}$$

No K_c expression, correct substitution/Geen K_c-uitdrukking, korrekte substitusie: Max./Maks. 6/8

Wrong K_c expression/
Verkeerde K_c-uitdrukking: Max./Maks. 5/8

METHOD 4/METODE 4: Reading from graph/Af lees van grafiek

OPTION 1/OPSIE 1

$$K_c = \frac{[PQ_2]^2}{[P_2Q]} = 0,49 \quad \text{Initial } [P_2Q] = 0$$

$$n = 0 \text{ (mol)} \quad \checkmark\checkmark\checkmark\checkmark\checkmark\checkmark\checkmark\checkmark \text{ (8/8)}$$

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OPTION 2/OPSIE 2:

	P ₂ Q	PQ ₂
Initial concentration (mol·dm ⁻³) <i>Aanvangskonsentrasie (mol·dm⁻³)</i>	→ 0	y
Change in concentration (mol·dm ⁻³) <i>Verandering in konsentrasie (mol·dm⁻³)</i>	-0,207	0,414
Equilibrium concentration (mol·dm ⁻³) <i>Ewewigskonsentrasie (mol·dm⁻³)</i>	0,35	0,414

n = 0 (mol) ✓✓✓✓✓✓✓✓ (8/8) ←

(8)

6.7 Pressure was decreased/volume of the container was increased. ✓
Druk is verlaag/volume van die houer is vergroot.

(1)

6.8 **OPTION 1/OPSIE 1:** Using labels/*Gebruik byskrifte*

- Favours the reaction that increases the number of moles (of gas) ✓/
Bevoordeel die reaksie wat aantal mol (gas) laat toeneem
- [P₂Q] increased/*neem toe* ✓ **OR/OF** [PQ₂] decreased/*neem af*

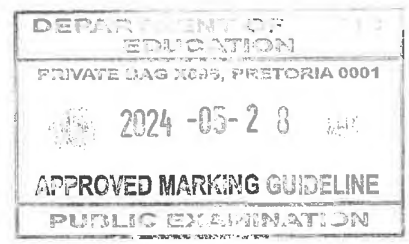
OPTION 2/OPSIE 2: Using lines/*Gebruik lyne*

- Favours the reaction that increases the number of moles (of gas) ✓/
Bevoordeel die reaksie wat aantal mol (gas) laat toeneem
- [PQ₂] increased/*neem toe* ✓ **OR/OF** [P₂Q] decreased/*neem af*

(2)

[18]

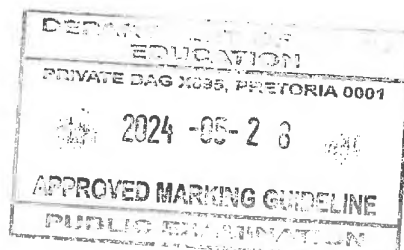
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QUESTION 7/VRAAG 7

- | | | | |
|-------|--|---|-----|
| 7.1 | Marking criteria: <ul style="list-style-type: none"> • Any formula $c = \frac{m}{MV}$ or $n = \frac{m}{M}$ or $c = \frac{n}{V}$ ✓ • Substitute <u>10, 106 and 0.7</u> into formula ✓ • Final answer: <u>0,13 mol·dm⁻³</u> ✓ | Nasienkriteria: <ul style="list-style-type: none"> • Enige formule $c = \frac{m}{MV}$ of $n = \frac{m}{M}$ of $c = \frac{n}{V}$ ✓ • Vervang <u>10, 106 and 0.7</u> in formula ✓ • Finale antwoord: <u>0,13 mol·dm⁻³</u> ✓ | |
| 7.1.1 | OPTION 1/OPSIE 1:
$c = \frac{m}{MV} \checkmark$ $= \frac{10}{(106)(0,7)} \checkmark$ $= 0,13 \text{ mol} \cdot \text{dm}^{-3} \checkmark$ | OPTION 2/OPSIE 2:
$n = \frac{m}{M} \checkmark$ $= \frac{10}{106} \checkmark$ $= 0,09 \checkmark$ $c = \frac{n}{V} \checkmark$ $= \frac{0,09}{0,7} \checkmark$ $= 0,13 \text{ mol} \cdot \text{dm}^{-3} \checkmark$ | (3) |
| 7.1.2 | Greater than/Groter as ✓ | | (1) |
| 7.1.3 | $\text{CO}_3^{2-}(\text{aq}) + \text{H}_2\text{O}(\ell) \checkmark \rightleftharpoons \text{HCO}_3^-(\text{aq}) + \text{OH}^-(\text{aq}) \checkmark$
OR/OF
$\text{CO}_3^{2-}(\text{aq}) + 2\text{H}_2\text{O}(\ell) \checkmark \rightleftharpoons \text{H}_2\text{CO}_3(\text{aq}) + 2\text{OH}^-(\text{aq}) \checkmark$
OR/OF
$\text{Na}_2\text{CO}_3(\text{aq}) + \text{H}_2\text{O}(\ell) \checkmark \rightleftharpoons \text{NaHCO}_3(\text{aq}) + \text{NaOH}(\text{aq}) \checkmark$
OR/OF
$\text{Na}_2\text{CO}_3(\text{aq}) + 2\text{H}_2\text{O}(\ell) \checkmark \rightleftharpoons \text{H}_2\text{CO}_3(\text{aq}) + 2\text{NaOH}(\text{aq}) \checkmark$ | Marking criteria/Nasienkriteria: <ul style="list-style-type: none"> • Reactants ✓ Products ✓ • Reaktanse ✓ Produkte ✓ • Ignore/Ignoreer → and phases/en fases • Marking rule 6.3.10/Nasienreël 6.3.10 | (2) |
| 7.1.4 | <p>⊖ P ✓</p> <p>(Titration of) weak base and a strong acid./The equivalence point is lower than pH 7. ✓</p> <p>(Titrasië van) 'n swak basis en 'n sterk suur./ Die ekwivalente punt is laer as 'n pH van 7.</p> | | (2) |
| 7.2 | | | |
| 7.2.1 | Dilute acid contains small amount/number of moles of acid in proportion to the volume of water. ✓✓ (2 or/of 0)
Verdunde sure bevat 'n klein hoeveelheid/getal mol suur in verhouding met die volume water. | | (2) |

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7.2.2

Marking criteria:	Nasienkriteria:
<p>(a) USE of ratio: $n(\text{KOH})_{\text{reacted}} = 2n(\text{H}_2\text{SO}_4)_{\text{reacted}} /$ $[\text{KOH}]_{\text{reacted}} = 2n[\text{H}_2\text{SO}_4]_{\text{reacted}} \checkmark$</p> <p>(b) Subtract: $n(\text{KOH})_{\text{initial}} - n(\text{KOH})_{\text{reacted}} /$ $[\text{KOH}]_{\text{initial}} - [\text{KOH}]_{\text{reacted}} \checkmark \checkmark$</p> <p>(c) Divide n by 0,20 dm³ in $c = \frac{n}{V}$ ✓</p> <p>(d) Either formulae: $\text{pH} = -\log[\text{H}_3\text{O}^+] /$ $\text{pH} = -\log[\text{H}^+] / \text{pOH} = -\log[\text{OH}^-] \text{ AND}$ $[\text{H}_3\text{O}^+][\text{OH}^-] = 10^{-14} /$ $\text{pH} + \text{pOH} = 14 \checkmark$</p> <p>(e) Substitute calculated $[\text{OH}^-]$ in $[\text{H}_3\text{O}^+][\text{OH}^-] /$ in $\text{pOH} = -\log[\text{OH}^-] \checkmark$</p> <p>(f) Substitute calculated $[\text{H}_3\text{O}^+]$ in pH formula/ pOH in $\text{pH} + \text{pOH} = 14 \checkmark$</p> <p>(g) Final answer: 12,3 ✓</p> <p>OPTION 1/OPSIE 1: $n(\text{KOH})_{\text{reacted}} = 2n(\text{H}_2\text{SO}_4)_{\text{reacted}}$ $= 2(0,01) \checkmark \text{ (a)}$ $= 0,02$</p> <p>$n(\text{KOH})_{\text{excess}} = 0,024 - 0,02 \checkmark \checkmark \text{ (b)}$ $= 0,004 \text{ mol}$</p> <p>$[\text{OH}^-] = \frac{n}{V}$ $= \frac{0,004}{0,20} \checkmark \text{ (c)}$ $= 0,02 \text{ mol} \cdot \text{dm}^{-3}$</p> <p>$[\text{H}_3\text{O}^+][\text{OH}^-] = 10^{-14}$ $[\text{H}_3\text{O}^+] (0,02) = 1 \times 10^{-14} \checkmark \text{ (e)}$ $[\text{H}_3\text{O}^+] = 5 \times 10^{-13} \text{ mol} \cdot \text{dm}^{-3}$</p> <p>$\text{pH} = -\log[\text{H}_3\text{O}^+]$ $= -\log(5 \times 10^{-13}) \checkmark \text{ (f)}$ $= 12,3 \checkmark \text{ (g)}$</p> <p>OPTION 3/OPSIE 3 $\text{pOH} = -\log[\text{OH}^-]$ $\text{pOH} = -\log(0,02) \checkmark \text{ (e)}$ $\text{pOH} = 1,7$</p> <p>$\text{pH} + \text{pOH} = 14$ $\text{pH} + 1,7 = 14 \checkmark \text{ (f)}$ $\text{pH} = 12,3 \checkmark \text{ (g)}$</p>	<p>(a) GEBRUIK verhouding: $n(\text{KOH})_{\text{gereageer}} = 2n(\text{H}_2\text{SO}_4)_{\text{gereageer}}$ $[\text{KOH}]_{\text{gereageer}} = 2n[\text{H}_2\text{SO}_4]_{\text{gereageer}} \checkmark$</p> <p>(b) Aftrek: $n(\text{KOH})_{\text{aanvanklik}} - n(\text{KOH})_{\text{gereageer}}$ $[\text{KOH}]_{\text{aanvanklik}} - [\text{KOH}]_{\text{gereageer}} \checkmark \checkmark$</p> <p>(c) Deel n deur 0,20 dm³ in $c = \frac{n}{V}$ ✓</p> <p>(d) Enige een v formules: $\text{pH} = -\log[\text{H}_3\text{O}^+] /$ $\text{pH} = -\log[\text{H}^+] / \text{pOH} = -\log[\text{OH}^-] \text{ EN}$ $[\text{H}_3\text{O}^+][\text{OH}^-] = 10^{-14} /$ $\text{pH} + \text{pOH} = 14 \checkmark$</p> <p>(e) Vervang berekende $[\text{OH}^-]$ in $[\text{H}_3\text{O}^+][\text{OH}^-] /$ in $\text{pOH} = -\log[\text{OH}^-] \checkmark$</p> <p>(f) Vervang berekende $[\text{H}_3\text{O}^+]$ in pH formule/ pOH in $\text{pH} + \text{pOH} = 14 \checkmark$</p> <p>(g) Finale antwoord: 12,3 ✓</p> <p>OPTION 2/OPSIE 2: $[\text{KOH}] = \frac{n}{V}$ $= \frac{0,024}{0,20}$ $= 0,12 \text{ mol} \cdot \text{dm}^{-3} \checkmark \text{ (c)}$</p> <p>$[\text{H}_2\text{SO}_4] = \frac{n}{V}$ $= \frac{0,01}{0,20}$ $= 0,05 \text{ mol} \cdot \text{dm}^{-3}$</p> <p>$[\text{KOH}]_{\text{reacted}} = 2[\text{H}_2\text{SO}_4]_{\text{reacted}}$ $= 2(0,05) \checkmark \text{ (a)}$ $= 0,1 \text{ mol} \cdot \text{dm}^{-3}$</p> <p>$[\text{KOH}]_{\text{excess}} = 0,12 - 0,1 \checkmark \checkmark \text{ (b)}$ $= 0,02 \text{ mol} \cdot \text{dm}^{-3}$</p> <p>$[\text{H}_3\text{O}^+][\text{OH}^-] = 10^{-14}$ $[\text{H}_3\text{O}^+] (0,02) = 1 \times 10^{-14} \checkmark \text{ (e)}$ $[\text{H}_3\text{O}^+] = 5 \times 10^{-13} \text{ mol} \cdot \text{dm}^{-3}$</p> <p>$\text{pH} = -\log[\text{H}_3\text{O}^+]$ $= -\log(5 \times 10^{-13}) \checkmark \text{ (f)}$ $= 12,3 \checkmark \text{ (g)}$</p> <p>Either/ Enige een ✓ (d) Both/ Beide ✓ (c) Either/ Enige een ✓ (d)</p>
<p><i>N. Vind</i></p>	<p>Any one/Enige een ✓ (d)</p>

(8)
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QUESTION 8/VRAAG 8

8.1 Aluminium/Al ✓ (1)

8.2 0,325 (mol·dm⁻³) ✓✓
Range/Gebied: 0,32 – 0,33 (mol·dm⁻³) (2)8.3 Decreases / *Neem af* ✓
M²⁺ is reduced/ M²⁺ used up/M²⁺ is the oxidising agent. ✓ (2)
M²⁺ word gereduseer/ M²⁺ opgebruik/M²⁺ is die oksideermiddel.

8.4 M ✓ (1)

8.5

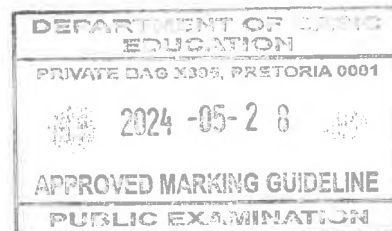
OPTION 1/OPTION 1	NOTE/LET WEL
$E_{\text{cell}}^{\ominus} = E_{\text{reduction}}^{\ominus} - E_{\text{oxidation}}^{\ominus}$ ✓ $2 \checkmark \checkmark = E_{\text{cathode}}^{\ominus} - (-1,66)$ ✓ $E_{\text{cathode}}^{\ominus} = 0,34$ (V) ✓ M is copper/Cu/koper ✓	<ul style="list-style-type: none"> Accept any other correct formula from the data sheet. <i>Aanvaar enige ander korrekte formule vanaf gegewensblad.</i> Any other formula using unconventional abbreviations, e.g. $E_{\text{cell}}^{\ominus} = E_{\text{OA}}^{\ominus} - E_{\text{RA}}^{\ominus}$ followed by correct substitutions: <i>Enige ander formule wat onkonvensionele afkortings gebruik, bv. $E_{\text{sel}}^{\ominus} = E_{\text{OM}}^{\ominus} - E_{\text{RM}}^{\ominus}$ gevolg deur korrekte vervangings</i> ^{5/6}
OPTION 2/OPSIE 2	
$M^{2+}(\text{aq}) + 2e^{-} \rightarrow M(\text{aq})$ $Al(\text{s}) \rightarrow Al^{3+}(\text{aq}) + 3e^{-}$ $2Al(\text{s}) + 3M^{2+}(\text{aq}) \rightarrow 2Al^{3+}(\text{aq}) + 3M(\text{s})$ $x = 0,34$ (V) ✓ M is copper/Cu/koper ✓	$E = +x$ V $E = +1,66$ V ✓ $E = 2,00$ (V) ✓✓

(6)

8.6.1 Magnesium/Mg ✓ (1)

8.6.2 Al³⁺ is a stronger oxidising agent than Mg²⁺ ✓, therefore, Mg will be oxidised ✓ (to Mg²⁺).
Mg²⁺ is a weaker oxidising agent than Al³⁺ ✓, therefore, Mg will be oxidised ✓ (to Mg²⁺).*Al³⁺ is 'n sterker oksideermiddel as Mg²⁺, daarom sal Mg geoksideer word (tot Mg²⁺)./**Mg²⁺ is 'n swakker oksideermiddel as Al³⁺, daarom sal Mg geoksideer word (tot Mg²⁺).***ACCEPT/AANVAAR:**

Mg ion and Al ion/Mg ion en Al ion

(2)
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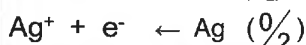
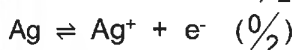
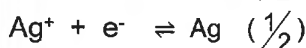
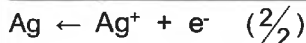
QUESTION 9/VRAAG 9

9.1 Electrical to chemical (energy)/Elektriese na chemiese (energie) ✓ (1)

9.2 P ✓ (1)

9.3 $Ag^+ + e^- \rightarrow Ag$ ✓✓

Marking criteria/Nasienkriteria:



Ignore if charge omitted on electron. / Ignoreer indien lading weggelaat op elektron. (2)

9.4

<p>Marking criteria:</p> <p>(a) Substitute 3,25 and 108 in the formula $n = \frac{m}{M}$ ✓</p> <p>(b) Substitute $6,02 \times 10^{23}$ in $n(e^-) = \frac{N}{N_A}$ ✓</p> <p>(c) Substitute 0,03 mol in $n(e^-) = \frac{N}{N_A}$ ✓ (Substitute 96 500 in formula $Q = nF$)</p> <p>(d) Substitute 30(60) OR 1 800 ✓</p> <p>(e) Final answer: 1,61 A ✓</p> <p>OPTION 1/OPSIE 1:</p> <p>$n(Ag) = \frac{m}{M}$ $= \frac{3,25}{108}$ ✓(a) $= 0,03 \text{ mol}$</p> <p>$n(e^-) = \frac{N}{N_A}$</p> <p>(c) ✓ $0,03 = \frac{N}{6,02 \times 10^{23}}$ ✓(b)</p> <p>$N e^- = 1,81 \times 10^{22}$</p> <p>$N e^- = \frac{Q}{e} \text{ OF/OR } \frac{Q}{q_e}$</p> <p>$1,81 \times 10^{22} = \frac{Q}{1,6 \times 10^{-19}}$ $Q = 2 889,6 \text{ C}$</p> <p>$I = \frac{Q}{\Delta t}$ $= \frac{2 889,6}{30(60)}$ ✓(d) $= 1,61 \text{ A}$ ✓(e)</p>	<p>Nasienkriteria:</p> <p>(a) Vervang 3,25 en 108 in die formule $n = \frac{m}{M}$ ✓</p> <p>(b) Vervang $6,02 \times 10^{23}$ in $n(e^-) = \frac{N}{N_A}$ ✓</p> <p>(c) Vervang 0,03 mol in $n(e^-) = \frac{N}{N_A}$ ✓ (Vervang 96 500 in formule $Q = nF$)</p> <p>(d) Vervang 30(60) OF 1 800 ✓</p> <p>(e) Finale antwoord: 1,61 A ✓</p> <p>OPTION 2/OPSIE 2:</p> <p>$n(Ag) = \frac{m}{M}$ $= \frac{3,25}{108}$ ✓(a) $= 0,03 \text{ mol} = n e^-$</p> <p>$Q = 0,03 \times 96 500$ ✓(c) $= 2 895 \text{ C}$</p> <p>$I = \frac{Q}{\Delta t}$ $= \frac{2 895}{30(60)}$ ✓(d) $= 1,61 \text{ A}$ ✓(e)</p>
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TOTAL/TOTAAL: (5) [9] 150

