

basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

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

Stanmorephysics.com

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

2022

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

Approved: DBE
DBE CM
3/06/2022

DBE IM
3/06/2022

Approved: Umalusi Modertors
3/06/2022
3/06/2022

These marking guidelines consist of 16 pages./
Hierdie nasienriglyne bestaan uit 16 bladsye.

DEPARTMENT OF BASIC EDUCATION
PRIVATE BAG X895, PRETORIA 0001
2022 -06- 03
APPROVED MARKING GUIDELINE
PUBLIC EXAMINATION

Copyright reserved/Kopiereg voorbehou

Please turn over/Blaai om asseblief

QUESTION 1/*VRAAG 1*

1.1 B ✓✓ (2)

1.2 D ✓✓ (2)

1.3 B ✓✓ (2)

1.4 D ✓✓ (2)

1.5 B ✓✓ (2)

1.6 D ✓✓ (2)

1.7 C ✓✓ (2)

1.8 A ✓✓ (2)

1.9 A ✓✓ (2)

1.10 B ✓✓ (2)
[20]

QUESTION 2/*VRAAG 2*

2.1
2.1.1 E ✓ (1)

2.1.2 F ✓ (1)

2.1.3 C ✓ (1)

2.1.4 H ✓ (1)

2.2
2.2.1 2-bromo-2,4,5-trimethylhexane/*2-broom-2,4,5-trimetielheksaan*

Marking criteria:	***Nasienkriteria:***
• Correct stem i.e. hexane. ✓ • All substituents (bromo and trimethyl) correctly identified. ✓ • IUPAC name completely correct including numbering, sequence, hyphens and commas. ✓	• *Korrekte stam d.i. heksaan.* ✓ • *Alle substituente (bromo and trimetiel) korrek geïdentifiseer.* ✓ • *IUPAC-naam heeltemal korrek insluitende volgorde, koppeltekens en kommas.* ✓

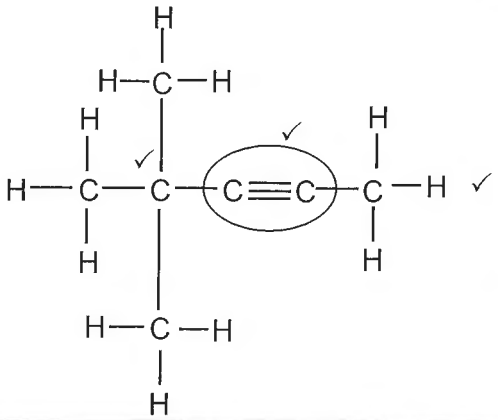
(3)

DEPARTMENT OF BASIC EDUCATION
PRIVATE BAG X895, PRETORIA 0001
2022 -06- 03
APPROVED MARKING GUIDELINE
PUBLIC EXAMINATION

Downloaded from st anmor ephysics.com

Copyright reserved/Kopiereg voorbehou

2.2.2



Marking criteria/*Nasienkriteria:*
- Five C atoms in longest chain + triple bond. ✓
  Vyf C-atome in langste ketting + drievoudige binding.
- Two methyl substituents. ✓
  Twee metielsubstituente.
- Whole structure correct.
  Hele struktuur korrek. ✓

IF/*INDIEN*
- More than one functional group/wrong functional group:
  Meer as een funksionele groep/foutiewe funksionele groep: 0/3
- If condensed structural formulae used/*Indien gekondenseerde struktuurformules gebruik:* Max/*Maks.*: 2/3

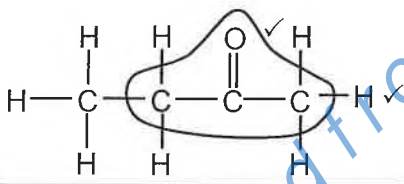
(3)

2.3

2.3.1 Aldehyde/*Aldehied* ✓ (1)

2.3.2 Formyl/*Formiel* ✓ (1)

2.3.3



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: 0/2
- If condensed structural formulae used/*Indien gekondenseerde struktuurformules gebruik:* Max/*Maks.*: 1/2

(2)

2.4

2.4.1 Methyl✓propane✓/2-methylpropane/*Metielpropaan/2-metielpropaan* (2)

2.4.2 $2C_4H_{10} + 13O_2$ ✓ $\rightarrow 8CO_2 + 10H_2O$ ✓ Bal. ✓

Ignore phases./*Ignoreer fases.*

Marking criteria/*Nasienkriteria:*
- Reactants ✓ Products ✓ Balancing: ✓
  Reaktanse *Produkte* *Balansering*
- Ignore double arrows./*Ignoreer dubbelpyle.*
- Marking rule 6.3.10/*Nasienreël 6.3.10.*

IF: Structural formula for C_4H_{10} Max. 2/3
INDIEN: Structural formula for C_4H_{10} Max. 2/3

(3)

[19]

DEPARTMENT OF BASIC EDUCATION
PRIVATE BAG X895, PRETORIA 0001
2022 -06- U 3
APPROVED MARKING GUIDELINE
PUBLIC EXAMINATION

downloaded from st anmor ephysics.com

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 temperature at which the vapour pressure of a substance equals atmospheric/external pressure. ✓✓
Die temperatuur waar die dampdruk van 'n stof gelyk is aan atmosferiese/ eksterne druk. (2)



3.2
3.2.1 Increases/*Neem toe* ✓ (1)

3.2.2 **From A to C:**
- Increase in molecular mass/size/chain length/surface area/number of C atoms. ✓
- Strength of the intermolecular forces increases/More sites for London forces. ✓
- More energy is needed to overcome/break intermolecular forces. ✓

DEPARTMENT OF BASIC EDUCATION
PRIVATE BAG X895, PRETORIA 0001
2022 -06- 03
APPROVED MARKING GUIDELINE
PUBLIC EXAMINATION

OR
From C to A:
- Decrease in molecular mass/size/chain length/surface area/number of C atoms. ✓
- Strength of the intermolecular forces decreases/Less sites for London forces. ✓
- Less energy is needed to overcome/break intermolecular forces. ✓

Van A na C:
- *Verhoging in molekulêre massa/molekulêre grootte/kettinglengte/reaksie-oppervlak/aantal C-atome.* ✓
- *Sterkte van die intermolekulêre kragte verhoog./Meer punte vir Londonkragte.* ✓
- *Meer energie benodig om intermolekulêre kragte te oorkom/breek.* ✓

OF
Van C na A:
- *Verlaging in molekulêre massa/molekulêre grootte/kettinglengte/reaksie-oppervlak/aantal C-atome.* ✓
- *Sterkte van die intermolekulêre kragte verlaag./Minder punte vir Londonkragte.* ✓
- *Minder energie benodig om intermolekulêre kragte te oorkom/breek.* ✓ (3)

3.3 No / *Nee* ✓
More than one independent variable./Molar mass and chain length (surface area) are changing. ✓
Meer as een onafhanklike veranderlike./Molêre massa (reaksie-oppervlak) en kettinglengte verander. (2)

Stanmorephysics.com

3.4

3.4.1 Functional group/homologous series/type of intermolecular forces/type of compound ✓ (1)
Funksionele groep/homoloë reeks/soort intermolekulêre kragte/tipe verbinding

3.4.2 Dipole-dipole forces/*Dipool-dipoolkragte* ✓ (1)

3.5 D / methylbutane / *metielbutaan* ✓

Lower boiling point/Weaker intermolecular forces ✓
Laer kookpunt/Swakker intermolekulêre kragte (2)
[12]

DEPARTMENT OF BASIC EDUCATION
PRIVATE BAG X895, PRETORIA 0001
2022 -06- 03
APPROVED MARKING GUIDELINE
PUBLIC EXAMINATION

QUESTION 4/*VRAAG 4*

4.1

4.1.1 Dehydrohalogenation/elimination/dehydrobromination ✓
Dehidrohalogenering/eliminasie/dehidrobrominering (1)

4.1.2 2-methylbut-2-ene / 2-methyl-2-butene ✓✓
2-metielbut-2-een / 2-metiel-2-buteen ✓✓ (2)

Marking criteria/*Nasienkriteria*
Methylbutene/*metielbuteen* ✓
IUPAC name correct/*IUPAC-naam korrek* ✓

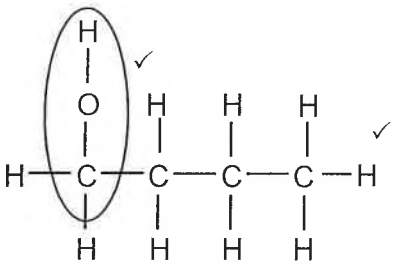
IF/*INDIEN*
Any error, e.g. hyphens omitted and/or incorrect sequence/*Enige fout, bv. koppeltekens weggelaat en/of verkeerde volgorde:* Max/*Maks:* $\frac{1}{2}$

4.1.3 Water/H_2O ✓ (1)

4.1.4 Heat/*Hitte* ✓
(Concentrated) sulphuric acid/catalyst ✓
(Gekonsentreerde) swawelsuur/katalisator (2)

ACCEPT/*AANVAAR*:
High temperature/
Hoë temperatuur

4.1.5



✓ ✓

Marking criteria/*Nasienkriteria*
• Whole structure correct/*Hele struktuur korrek:* $\frac{2}{2}$
• Only functional group correct:/*Slegs funksionele groep korrek:* Max/*Maks.:* $\frac{1}{2}$
IF/*INDIEN*
More than one functional group/*Meer as een funksionele groep* $\frac{0}{2}$

(2)

4.2

4.2.1 Catalyst/Lowers the activation energy./Increases the rate of the reaction. ✓
Katalisator/Verlaag die aktiveringsenergie./Laat reaksietempo toeneem. (1)

4.2.2 The bromine water/Br_2/solution decolourises. ✓
Die broomwater/Br_2/oplossing ontkleur.

OR/*OF*
Bromine water/Br_2/solution changes from brown/reddish to colourless.
Broomwater/Br_2/oplossing verander van bruin/rooi na kleurloos. (1)

4.2.3 Addition/halogenation/bromination ✓ (1)
Addisie/halogenering/brominering

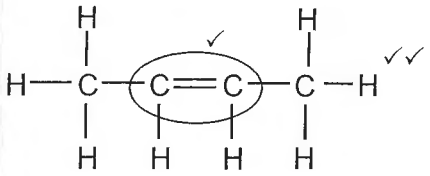
4.2.4 C_2H_6 ✓✓✓ **(3 or/*of* 0)** **OR/*OF*** C_4H_{10} **OR/*OF*** C_6H_{14}

IF structural/condensed formulae: **(2 or 0)**
INDIEN *struktuurformules/gekondenseerde formules gebruik:* ***(2 of 0)*** (3)

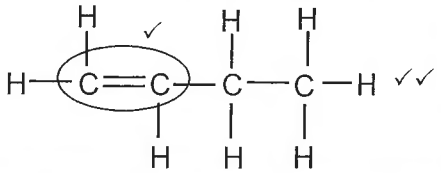
4.2.5

Marking criteria	***Nasienkriteria***
• Correct functional group i.e. double bond. ✓ • Correct number of C atoms in relation to answer in Q4.2.4. ✓ • Whole structure correct. ✓ **IF** condensed/molecular formulae used: Max. $^2/_3$	• *Korrekte funksionele groep d.i. dubbelbinding.* ✓ • *Korrekte aantal C-atome na aanleiding van antwoord in V4.2.4.* ✓ • *Hele struktuur korrek.* ✓ ***INDIEN*** *gekondenseerde/molekulêre formules gebruik:* Maks. $^2/_3$

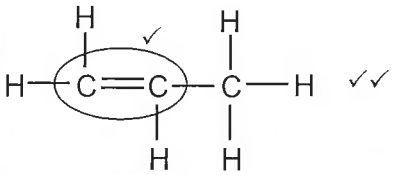
IF C_2H_6 in QUESTION 4.2.4/*INDIEN C_2H_6 in VRAAG 4.2.4*:



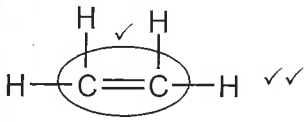
OR/*OF*



IF C_4H_{10} in QUESTION 4.2.4/ *INDIEN C_4H_{10} in VRAAG 4.2.4:*

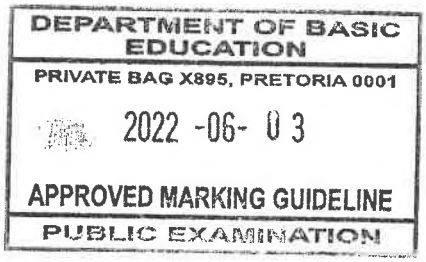


IF C_6H_{14} in QUESTION 4.2.4: *INDIEN C_6H_{14} in VRAAG 4.2.4:*



(3)
[17]





Copyright reserved/Kopiereg voorbehou

QUESTION 5/*VRAAG 5*

5.1

NOTE/*LET WEL*
Give the mark for per unit time only if in context of reaction rate.
Gee die punt vir per eenheidtyd slegs indien in konteks met reaksietempo.

ANY ONE:

- Change in concentration ✓ of products/reactants per (unit) time. ✓
- Change in amount/number of moles/volume/mass of products or reactants per (unit) time.
- Amount/number of moles/volume/mass of products formed/reactants used per (unit) time.
- Rate of change in concentration/amount/number of moles/volume/mass.✓✓ **(2 or 0)**

ENIGE EEN:

- *Verandering in konsentrasie van produkte/reaktanse per (eenheid) tyd.*
- *Verandering in hoeveelheid/getal mol/volume/massa van produkte of reaktanse per (eenheid) tyd.*
- *Hoeveelheid/getal mol/volume/massa van produkte gevorm/reaktanse gebruik per (eenheid) tyd.*
- *Tempo van verandering in konsentrasie/ hoeveelheid/getal mol/ volume/massa.* ***(2 of 0)*** (2)

5.2

- Surface area / state of division / particle size (of $MgCO_3$) ✓
- Concentration (of HCℓ) ✓
- *Reaksieoppervlak/toestand van verdeeldheid/deeltjie-grootte (van* $MgCO_3$)
- *Konsentrasie (van HCℓ)* (2)

5.3

- At a higher temperature particles move faster/have a higher kinetic energy. ✓
- More molecules have enough/sufficient kinetic energy for an effective collision. ✓
  OR More molecules have kinetic energy/E_k equal to or greater than the activation energy.
- More effective collisions per unit time/second. ✓
  OR Frequency of effective collisions increases.
- Reaction rate increases. ✓
- *By 'n hoër temperatuur beweeg die deeltjies vinniger/het die deeltjies hoër kinetiese energie.* ✓
- *Meer molekule het genoeg/voldoende kinetiese energie/*E_k *vir 'n effektiewe botsing.* ✓
  OF *Meer molekule het kinetiese energie gelyk aan of groter as die aktiveringsenergie.*
- *Meer effektiewe botsings per eenheidtyd/sekonde.* ✓
  OF *Frekwensie van effektiewe botsings verhoog.*
- *Reaksietempo neem toe.* ✓ (4)

DEPARTMENT OF BASIC EDUCATION
PRIVATE BAG X895, PRETORIA 0001
2022 -06- 03
APPROVED MARKING GUIDE
PUBLIC E

5.4.1

Marking criteria	***Nasienkriteria***
• Formula: $n = \frac{m}{M}$ ✓	• *Formule:* $n = \frac{m}{M}$ ✓
• Substitution of 84 g·mol^{-1} in $n = \frac{m}{M}$ ✓	• *Vervanging van 84 g·mol^{-1} in* $n = \frac{m}{M}$ ✓
• Use mole ratio: $n(MgCO_3)_{used} = n(CO_2)_{produced}$ ✓	• *Gebruik molverhouding:* $n(MgCO_3)_{gebruik} = n(CO_2)_{berei}$ ✓
• Substitution of 44 g·mol^{-1} in $n = \frac{m}{M}$ **or** to calculate rate in mol·min^{-1}. ✓	• *Vervanging van 44 g·mol^{-1} in* $n = \frac{m}{M}$ ***of*** *om tempo te bereken in mol·min^{-1}.* ✓
• Correct substitution of 0,5 in rate equation. ✓	• *Korrekte vervanging van 0,5 in tempovergelyking.* ✓
• Final answer: 5,238 to 5,28 min ✓	• *Finale antwoord: 5,238 tot 5,28 min* ✓



$n(MgCO_3) = \frac{m}{M}$ ✓

$= \frac{5}{84}$ ✓

$= 0,06$ mol (0,0595 mol)

$n(CO_2)_{produced/gevorm} = n(MgCO_3)$ ✓ $= 0,06$ mol

$n(CO_2) = \frac{m}{M}$

$0,06 = \frac{m}{44}$ ✓

$m(CO_2) = 2,64$ g

Ave rate/*gem tempo* $= \frac{\Delta m(CO_2)}{\Delta t}$

$0,5$ ✓$= \frac{2,64}{\Delta t}$

$\Delta t = 5,28$ min ✓

Ave rate/*gem tempo* in mol·min^{-1}:

$\frac{0,5}{44}$ ✓$= 0,0114$ mol·min^{-1}

Ave rate/*gem tempo* $= \frac{\Delta n(CO_2)}{\Delta t}$

$0,0114 = \frac{0,06}{\Delta t}$

$\Delta t = 5,28$ min ✓

(6)

5.4.2 **POSITIVE MARKING FROM QUESTION 5.4.1.**
POSITIEWE NASIEN VANAF VRAAG 5.4.1.

Marking criteria	***Nasienkriteria***
• Substitution of $n(CO_2)$ AND 1,5 dm^3 in $n = \frac{V}{V_m}$. ✓	• *Vervanging van* $n(CO_2)$ EN 1,5 dm^3 in $n = \frac{V}{V_m}$. ✓
• Final answer:	• *Finale antwoord:*
• \25 to 25,21 dm^3·mol^{-1}✓	25 dm^3 *tot* 25,21 dm^3·mol^{-1} ✓

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

$0,06 = \frac{1,5}{V_m}$ ✓

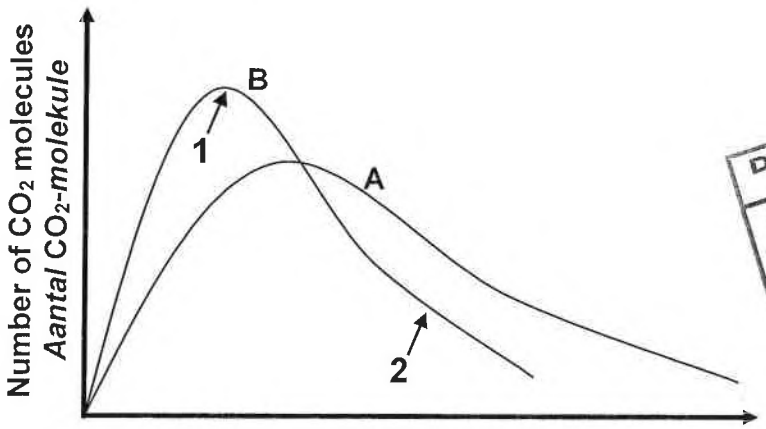
$V_m = 25$ dm^3·mol^{-1} ✓ (25,21 dm^3·mol^{-1})

ACCEPT/*AANVAAR*: 25 dm^3

DEPARTMENT OF BASIC EDUCATION
PRIVATE BAG X895, PRETORIA 0001
2022 -06- 03
APPROVED MARKING GUIDELINE
PUBLIC EXAMINATION

(2)

5.5



DEPARTMENT OF BASIC EDUCATION
PRIVATE BAG X895, PRETORIA 0001
2022 -06- 03
APPROVED MARKING GUIDELINE
PUBLIC EXAMINATION

Marking criteria/*Nasienkriteria*		
1	Curve **B** has a higher peak to the left of curve **A**. *Kurwe **B** het hoër piek aan die linkerkant van kurwe **A**.*	✓
2	Curve **B** is below curve **A** beyond the peak of curve **A**./*Kurwe **B** is onder kurwe **A** na die piek van kurwe **A**.*	✓
If BOTH graphs not labelled (**A** and **B**): no marks *Indien BEIDE grafieke nie benoem nie (**A** en **B**): geen punte*		

(2)
[18]

QUESTION 6/*VRAAG 6*

6.1.1 2 (mol·dm^{-3}) ✓ (1)

6.1.2

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.*

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. (2)

Stanmorephysics.com

6.1.3 Cooled/*Afgekoel* ✓ (1)

6.1.4
- A decrease in temperature favours the exothermic reaction./An increase in temperature favours the endothermic reaction. ✓
- The forward reaction is favoured./HI concentration increases./Equilibrium (position) shifts to the right. ✓
- The forward reaction is exothermic./Reverse reaction is endothermic. ✓

- *Afname in temperatuur bevoordeel die eksotermiese reaksie./Toename in temperatuur bevoordeel die endotermiese reaksie.* ✓
- *Die voorwaartse reaksie word bevoordeel./ HI-konsentrasie neem toe./Die ewewigs(posisie) skuif na regs.* ✓
- *Voorwaatse reaksie is eksotermies./Die terugwaartse reaksie is endotermies.* ✓

(3)

6.2

6.2.1 Products can be converted back to reactants. ✓
OR
Both forward and reverse reactions can take place.
OR
A reaction which can take place in both directions.

Produkte kan omgeskakel word na reaktanse. ✓
OF
Beide voor-en terugwaartse reaksies kan plaasvind.
OF
'n Reaksie wat in beide rigtings kan plaasvind. (1)

6.2.2

Marking criteria	***Nasienkriteria:***
a) $\Delta n(N_2O_4) = n(N_2O_4)_{eq} - n(N_2O_4)_{ini}$. ✓	(a) $\Delta n(N_2O_4) = n(N_2O_4)_{ewe} - n(N_2O_4)_{aanv}$. ✓
b) USING ratio: $n(NO_2) : n(N_2O_4) = 2 : 1$ ✓	(b) *GEBRUIK verhouding:* $n(NO_2) : n(N_2O_4) = 2 : 1$ ✓
c) $n(NO_2)_{eq} = n(NO_2)_{ini} - \Delta n(NO_2)$ ✓	(c) $n(NO_2)_{ewe} = n(NO_2)_{aanv} - \Delta n(NO_2)$ ✓
d) Divide BOTH by 1 dm^3 ✓	(d) *Deel BEIDE deur* 1 dm^3 ✓
e) Correct K_c expression (formulae in square brackets). ✓	(e) *Korrekte K_c uitdrukking (formules in vierkantige hakies).* ✓

	NO_2	N_2O_4	
Initial amount (moles) *Aanvangshoeveelheid (mol)*	x	0	
Change in amount (moles) *Verandering in hoeveelheid* (mol)	1,62	0,81 (a) ✓	ratio (b) ✓ *verhouding*
Equilibrium amount (moles) *Ewewigshoeveelheid (mol)*	x – 1,62 (c) ✓	0,81	
Equilibrium concentration ($mol \cdot dm^{-3}$) *Ewewigskonsentrasie ($mol \cdot dm^{-3}$)*	x – 1,62	0,81	÷ dm^3 (d) ✓

$$K_c = \frac{[N_2O_4]}{[NO_2]^2} \checkmark \text{ (e)}$$
$$= \frac{(0,81)}{(x-1,62)^2}$$

Wrong or no K_c expression/*Verkeerde of geen K_c-uitdrukking*: Max./*Maks.* 4/5

(5)

DEPARTMENT OF BASIC EDUCATION
PRIVATE BAG X895, PRETORIA 0001
2022 -06- 03
APPROVED MARKING GUIDELINE
PUBLIC EXAMINATION

6.2.3 **POSITIVE MARKING FROM QUESTION 6.2.2**
POSITIEWE NASIEN VAN VRAAG 6.2.2.

Marking criteria	***Nasienkriteria:***
a) Add 0,79 mol to $n(N_2O_4)_{ini}$. ✓ b) USING ratio: $n(NO_2) : n(N_2O_4) = 2 : 1$ to calculate $\Delta n(N_2O_4)$ as 0,6 mol. ✓ c) $n(NO_2)_{eq} = n(NO_2)_{ini} + \Delta n(NO_2)$ $n(N_2O_4)_{eq} = n(N_2O_4)_{ini} - \Delta n(N_2O_4)$ ✓ d) Substitution of concentrations into correct K_c expression. ✓ e) Equating K_c expresssion from Q6.1.3 and Q6.2.3. ✓ f) Final answer: 12,42 ✓ (Range: 11,27 – 12,42)	*(a) Voeg 0,79 mol by $n(N_2O_4)_{aanv}$.* ✓ *(b) GEBRUIK verhouding:* *$n(NO_2) : n(N_2O_4) = 2 : 1$* *om $\Delta n(N_2O_4)$ as 0,6 mol te bereken.* ✓ *(c) $n(NO_2)_{ewe} = n(NO_2)_{aanv} + \Delta n(NO_2)$* *$n(N_2O_4)_{ewe} = n(N_2O_4)_{aanv} - \Delta n(N_2O_4)$* ✓ *(d) Vervanging van konsentrasies in korrekte K_c-uitdrukking.* *(e) Stel K_c-uitdrukking van Q6.1.3 en Q6.2.3 gelyk aan mekaar.* ✓ *(f) Finale antwoord: 12,42* ✓ *(Gebied: 11,27 – 12,42)*

	NO_2	N_2O_4	
Initial amount (moles) *Aanvangs hoeveelheid (mol)*	x – 1,62	0,81 + 0,79 ✓ = 1,6	(a)
Change in amount (moles) *Verandering in hoeveelheid* (mol)	1,2	0,6 ✓	(b)
Equilibrium amount (moles) *Ewewigshoeveelheid* (mol)	x – 1,62 +1,2	1 ✓	(c)
Equilibrium concentration ($mol \cdot dm^{-3}$) *Ewewigskonsentrasie ($mol \cdot dm^{-3}$)*	x – 0,42	1	

$$K_c = \frac{[N_2O_4]}{[NO_2]^2}$$

$$\frac{(0,81)}{(x-1,62)^2} \overset{(e)}{=} \frac{1}{(x-0,42)^2} \checkmark(d)$$

$$x = 12,42 \text{ (mol)} \checkmark(f)$$

Wrong K_c expression/*Verkeerde K_c- uitdrukking*: Max./*Maks.* $^4/_6$
No K_c expression/*Geen K_c- uitdrukking*: $^6/_6$

(6)
[19]

DEPARTMENT OF BASIC EDUCATION
PRIVATE BAG X895, PRETORIA 0001
2022 -06- 03
APPROVED MARKING GUIDELINE
PUBLIC EXAMINATION

QUESTION 7/VRAAG 7



7.1
7.1.1 An acid is a proton (H^+ ion) donor. ✓✓
'n Suur is 'n protondonor/skenker of H^+-ioon donor/skenker. (2)

7.1.2 (-) HY ✓

For the SAME acid concentration:
Lower pH / higher H^+ or H_3O^+ concentration / more ionised. ✓
Vir DIESELFDE suurkonsentrasie:
Laer pH / hoër H^+/H_3O^+ konsentrasie / meer geïoniseer. (2)

7.1.3 (-) Lower than./*Laer as* ✓

$K_a < 1$ / HX ionises incompletely. / HX has a small K_a value. / HX is a weak acid. ✓
$K_a < 1$ / *HX ioniseer onvolledig. / HX het 'n klein K_a-waarde. / HX is 'n swak suur.* (2)

7.2

7.2.1 $pH = -\log[H_3O^+]$ **OR/*OF*** $[H_3O^+] = 10^{-pH}$ ✓

2 ✓ $= -\log[H_3O^+]$

$[H_3O^+] = 0,01 \text{ mol·dm}^{-3}$ ✓ $(1 \times 10^{-2} \text{ mol·dm}^{-3})$ (3)

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

Marking criteria for OPTION 1:	***Nasienkriteria vir OPSIE 1:***
• Substitute $c(HC\ell)_{excess}$ and $0,35 \text{ dm}^3$ to calculate $n(HC\ell)_{excess}$.✓ • Substitute to calculate $n(HC\ell)_{initial}$ ✓ • $n(HC\ell)_{react} = n(HC\ell)_{ini} - n(HC\ell)_{excess}$.✓✓ • Use ratio: $n(NaOH) = n(HC\ell)$ ✓ • Substitute $0,15 \text{ dm}^3$ in $c = \frac{n}{V}$. ✓ • Final answer: $0,02 \text{ mol·dm}^{-3}$ ✓ **or** $0,0167 \text{ mol·dm}^{-3}$ **or** $0,017 \text{ mol·dm}^{-3}$	• *Vervang $c(HC\ell)_{oormaat}$ en $0,35 \text{ dm}^3$ om $n(HC\ell)_{oormaat}$ te bereken.*✓ • *Vervang om $n(HC\ell)_{aanv}$ te bereken.* ✓ • *$n(HC\ell)_{rea} = n(HC\ell)_{aanv} - (HC\ell)_{oormaat}$*✓✓ • *Gebruik verhouding: $n(NaOH) = n(HC\ell)$* ✓ • *Vervang $0,15 \text{ dm}^3$ in $c = \frac{n}{V}$* ✓ • *Finale antwoord*: $0,02 \text{ mol·dm}^{-3}$ ✓ ***of*** $0,0167 \text{ mol·dm}^{-3}$ ***of*** $0,017 \text{ mol·dm}^{-3}$

OPTION 1/*OPSIE 1*

$n(HC\ell)_{excess/oormaat} = cV$

$= \underline{0,01 \times 0,35}$ ✓

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

$n(HC\ell)_{initial/aanv} = cV$

$= 0,03 \times 0,2$ ✓

$= 0,006$ mol

$n(HC\ell)_{reacted/reageer} = \underline{0,006 - 3,5 \times 10^{-3}}$ ✓✓

$= 0,0025$ mol

$n(NaOH)_{reacted/reageer} = n(HC\ell)_{reacted/reageer} = 0,0025$ mol ✓

$c(NaOH) = \frac{n}{V}$

$= \frac{0,0025}{0,15}$ ✓

$= 0,02 \text{ mol·dm}^{-3}$ ✓ $(0,0167 \text{ mol·dm}^{-3}$ **or/*of*** $0,017 \text{ mol·dm}^{-3})$

DEPARTMENT OF BASIC EDUCATION
PRIVATE BAG X895, PRETORIA 0001
2022 -06- 03
APPROVED MARKING GUIDELINE
PUBLIC EXAMINATION

OPTION 2/*OPSIE 2*

Concentration ratio in final solution:
Konsentrasie verhouding in finale oplossing:
$HC\ell : H_3O^+ = 1 : 1$ ✓

Thus/dus $[HC\ell] = 0,01\ mol\cdot dm^{-3}$ ✓✓

$[HC\ell]_{react} = [HC\ell]_{initial} - [HC\ell]_{excess}$
$= \underline{0,03 - 0,01}$ ✓✓
$= 0,02\ mol\cdot dm^{-3}$

Concentration ratio in final solution:
Konsentrasie verhouding in oorspronklike oplossing:
$HC\ell : NaOH = 1 : 1$ ✓

$[NaOH] = 0,02\ mol\cdot dm^{-3}$ ✓

Marking criteria

- Ratio $HC\ell : H_3O^+ = 1 : 1$ ✓
- $c(HC\ell)_{excess} = 0,01\ (mol\cdot dm^{-3})$ ✓✓
- $n(HC\ell)_{react} = n(HC\ell)_{ini} - (HC\ell)_{excess}$. ✓✓
- Use ratio:
  $n(NaOH) = n(HC\ell)$ ✓
- Final answer: $0,02\ mol\cdot dm^{-3}$ ✓

Nasienkriteria

- *Verhouding $HC\ell : H_3O^+ = 1 : 1$* ✓
- *$c(HC\ell)_{oormaat} = 0,01\ (mol\cdot dm^{-3})$* ✓✓
- *$n(HC\ell)_{reag} = n(HC\ell)_{aanv} - (HC\ell)_{oormaat}$.* ✓✓
- *Gebruik verhouding:*
  $n(NaOH) = n(HC\ell)$ ✓
- *Finale antwoord: $0,02\ mol\cdot dm^{-3}$* ✓

OPTION 3/*OPSIE 3*

$\frac{c_1V_1}{c_2V_2} = \frac{n_1}{n_2}$

$\frac{c_1(200)}{(0,01)(350)}$ ✓ $= \frac{1}{1}$ ✓

$c_1 = 0,0175\ mol\cdot dm^{-3}$

$c(HC\ell)_{react} = c(HC\ell)_{ini} - c(HC\ell)_{excess}$
$= \underline{0,03 - 0,0175}$ ✓✓
$= 0,0125\ mol\cdot dm^{-3}$

$\frac{c_aV_a}{c_bV_b} = \frac{n_a}{n_b}$

$\frac{(0,0125)(200)}{c_b(150)}$ ✓ $= \frac{1}{1}$ ✓

$c(NaOH) = 0,0167\ mol\cdot dm^{-3}$ ✓

($0,0167\ mol\cdot dm^{-3}$
or/*of* $0,017\ mol\cdot dm^{-3}$)

Marking criteria

- Substitute $350\ cm^3$ in $\frac{c_1V_1}{c_2V_2} = \frac{n_1}{n_2}$ ✓
- Ratio of $HC\ell : H_3O^+ = 1 : 1$ ✓
- $n(HC\ell)_{react} = n(HC\ell)_{ini} - (HC\ell)_{excess}$. ✓✓
- Use ratio: $n(NaOH) = n(HC\ell)$ ✓
- Substitute $150\ cm^3$ in $\frac{c_1V_1}{c_2V_2} = \frac{n_1}{n_2}$ ✓
- Final answer: $0,02\ mol\cdot dm^{-3}$ ✓
  or $0,0167\ mol\cdot dm^{-3}$
  or $0,017\ mol\cdot dm^{-3}$

Nasienkriteria

- *Vervang $350\ cm^3$ in $\frac{c_1V_1}{c_2V_2} = \frac{n_1}{n_2}$* ✓
- *Verhouding $HC\ell : H_3O^+ = 1 : 1$* ✓
- *$n(HC\ell)_{reag} = n(HC\ell)_{aanv} - (HC\ell)_{oormaat}$.* ✓✓
- *Gebruik verhouding:*
  $n(NaOH) = n(HC\ell)$ ✓
- *Vervang $150\ cm^3$ in $\frac{c_1V_1}{c_2V_2} = \frac{n_1}{n_2}$* ✓
- *Finale antwoord: $0,02\ mol\cdot dm^{-3}$* ✓
  of *$0,0167\ mol\cdot dm^{-3}$*
  of *$0,017\ mol\cdot dm^{-3}$*

(7)
[16]

Stanmorephysics.com

DEPARTMENT OF BASIC EDUCATION
PRIVATE BAG X895, PRETORIA 0001
2022 -06- 03
APPROVED MARKING GUIDELINE
PUBLIC EXAMINATION

QUESTION 8/*VRAAG 8*

8.1

8.1.1 Temperature/*Temperatuur*: 25 °C/298 K ✓
Pressure/*Druk*: 101,3 kPa/1 atmosphere ✓
Concentration/*Konsentrasie*: 1 mol·dm^{-3} ✓ (3)

8.1.2

OPTION 1/*OPSIE 1*

$E^{\theta}_{cell} = E^{\theta}_{reduction} - E^{\theta}_{oxidation}$ ✓
2,89 ✓ $= E^{\theta}_{reduction} - (-1,66)$ ✓
$E^{\theta}_{reduction}$ = 1,23 (V) ✓

X is O_2/oxygen/*suurstof* ✓

[X marked independently/
X onafhanklik nagesien]

Notes/*Aantekeninge*

- Accept any other correct formula from the data sheet./*Aanvaar enige ander korrekte formule vanaf gegewensblad.*
- Any other formula using unconventional abbreviations, e.g. $E°_{cell} = E°_{OA} - E°_{RA}$ followed by correct substitutions:/*Enige ander formule wat onkonvensionele afkortings gebruik bv.* $E°_{sel} = E°_{OM} - E°_{RM}$ *gevolg deur korrekte vervangings* $^{4}/_{5}$

OPTION 2/*OPSIE 2*

$O_2(g) + 4H^+ + 4e^- \rightarrow 2H_2O$ ✓ E^{θ} = +1,23 V ✓
$A\ell(s) \rightarrow A\ell^{3+}(aq) + 3e^-$ E^{θ} = +1,66 V ✓
$4A\ell(s) + 3O_2(g) + 12H^+ \rightarrow 4A\ell^{3+}(aq) + 6H_2O$ E^{θ} = +2,89 (V) ✓

X is O_2/oxygen/*suurstof* ✓

[X marked independently/*X onafhanklik nagesien*] (5)

8.1.3 $A\ell$ ✓ (1)

8.1.4 $O_2(g) + 4H^+ + 4e^- \rightarrow 2H_2O$ ✓✓

Ignore phases./*Ignoreer fases.*

Marking criteria/*Nasienkriteria:*

- $2H_2O \leftarrow O_2(g) + 4H^+ + 4e^-$ ($^{2}/_{2}$) $O_2(g) + 4H^+ + 4e^- \rightleftharpoons 2H_2O$ ($^{1}/_{2}$)
  $O_2(g) + 4H^+ + 4e^- \leftarrow 2H_2O$ ($^{0}/_{2}$) $2H_2O \rightleftharpoons O_2(g) + 4H^+ + 4e^-$ ($^{0}/_{2}$)
- Ignore if charge omitted on electron./*Ignoreer indien lading weggelaat op elektron.*
- If charge (+) omitted on H^+/ *Indien lading (+) weggelaat op* H^+: Max./*Maks:* $^{1}/_{2}$
  Example/*Voorbeeld:* $O_2(g) + 4H + 4e^- \rightarrow 2H_2O$ ✓ (2)

8.1.5 $A\ell(s) \mid A\ell^{3+}(aq) \parallel O_2(g) \mid H^+(aq) \mid H_2O(\ell) \mid Pt(s)$ ✓ ✓ ✓

OR/*OF*
$A\ell(s) \mid A\ell^{3+}(aq) \parallel O_2(g) \mid H^+(aq) \mid H_2O(\ell) \mid C(s)$

OR/*OF*
$A\ell \mid A\ell^{3+} \parallel O_2 \mid H^+ \mid H_2O \mid Pt$ (3)

DEPARTMENT OF BASIC EDUCATION
PRIVATE BAG X895, PRETORIA 0001
2022 -06- U 3
APPROVED MARKING GUIDELINE
PUBLIC EXAMINATION

8.2 Copper/*Koper* ✓

- Cu is a weaker reducing agent than Ni ✓and will not reduce Ni^{2+} (to Ni). / Cu will not be oxidised (to Cu^{2+}).✓
- Zn is a stronger reducing agent than Ni ✓and will reduce Ni^{2+} (to Ni). / Zn will be oxidised (to Zn^{2+}).

- *Cu is 'n swakker reduseermiddel as Ni en sal nie Ni^{2+} (na Ni) reduseer nie. / Cu sal nie geoksideer word nie na (Cu^{2+}).*
- *Zn is 'n sterker reduseermiddel as Ni en sal Ni^{2+} (na Ni) reduseer. / Zn sal geoksideer word (na Zn^{2+}).*

NOTE/LET WEL:
The mark for 'reduce' can be awarded at any ONE of the two comparisons.
Die punt vir 'reduseer' kan toegeken word by ENIGEEN van die twee vergelykings.

(4)
[18]

QUESTION 9/*VRAAG 9*

9.1

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.*

ANY ONE/*ENIGE EEN:*

- The chemical process in which electrical energy is converted to chemical energy. ✓✓
- The use of electrical energy to produce a chemical change.
- Decomposition of an ionic compound by means of electrical energy.
- The process during which an electric current passes through a solution/ionic liquid/molten ionic compound.

- *Die chemiese proses waarin elektriese energie omgeskakel word na chemiese energie. ✓✓*
- *Die gebruik van elektriese energie om 'n chemiese verandering te weeg te bring.*
- *Ontbinding van 'n ioniese verbinding met behulp van elektriese energie.*
- *Die proses waardeur 'n elektriese stroom deur 'n oplossing/ioniese vloeistof/gesmelte ioniese verbinding beweeg.*

(2)

9.2
9.2.1 X ✓ (1)

DEPARTMENT OF BASIC EDUCATION
PRIVATE BAG X895, PRETORIA 0001
2022 -06- 03
APPROVED MARKING GUIDELINE
PUBLIC EXAMINATION

9.2.2 $2H_2O(\ell) + 2e^- \rightarrow H_2(g) + 2OH^-(aq)$ ✓✓

Ignore phases/*Ignoreer fases*

Marking criteria/*Nasienkriteria:*
- $H_2(g) + 2OH^-(aq) \leftarrow 2H_2O(\ell) + 2e^-$ ($^2/_2$) $2H_2O(\ell) + 2e^- \rightleftharpoons H_2(g) + 2OH^-(aq)$ ($^1/_2$)
  $H_2(g) + 2OH^-(aq) \rightleftharpoons 2H_2O(\ell) + 2e^-$ ($^0/_2$) $2H_2O(\ell) + 2e^- \leftarrow H_2(g) + 2OH^-(aq)$ ($^0/_2$)
- Ignore if charge omitted on electron./*Ignoreer indien lading weggelaat op elektron.*
- If charge (-) omitted on OH^- /*Indien lading (-) weggelaat op* OH^-:
  Example/*Voorbeeld:* $2H_2O(\ell) + 2e^- \rightarrow H_2(g) + 2OH(aq)$ ✓ Max./*Maks:* $^1/_2$

(2)

9.2.3 X to/*na* Y ✓ (1)

9.2.4 $2H_2O(\ell) + 2C\ell^-(aq)$ ✓ $\rightarrow C\ell_2(g) + H_2(g) + 2OH^-(aq)$ ✓ Bal ✓

OR/*OF*
$2H_2O(\ell) + 2NaC\ell(aq) \rightarrow C\ell_2(g) + H_2(g) + 2NaOH(aq)$

Ignore phases/*Ignoreer fases*

Marking criteria/*Nasienkriteria:*
- Reactants ✓ *Reaktanse* Products ✓ *Produkte* Balancing: ✓ *Balansering*
- Ignore double arrows./*Ignoreer dubbelpyle.*
- Marking rule 6.3.10/*Nasienreël 6.3.10.*

(3)

9.3 Increases / *Toeneem* ✓ (1)

9.4 Solution becomes basic / alkaline **OR** NaOH / OH^- (ions) form ✓
Oplossing word basies / alkalies ***OF*** *NaOH / OH^-(-ione) vorm* (1)
[11]

TOTAL/*TOTAAL*: 150

DEPARTMENT OF BASIC EDUCATION
PRIVATE BAG X895, PRETORIA 0001
2022 -06- 03
APPROVED MARKING GUIDELINE
PUBLIC EXAMINATION

Copyright reserved/Kopiereg voorbehou