



Province of the
EASTERN CAPE
EDUCATION

Iphondo leMpuma Kapa: Isebe leMfundo
Provinsie van die Oos Kaap: Departement van Onderwys
Porafensie Ya Kapa Botjhabela: Lefapha la Thuto

NATIONAL SENIOR CERTIFICATE

KEREITI YA 12

LOETSE 2024

PHYSICAL SCIENCES P2 MARKING GUIDELINE/ FISIKALE SAENSESE P2 TATAISO YA HO TSHWAYA

MATSHWAO: 150

This marking guideline consists of 21 pages./
Tataiso ena ya ho tshwaya e na le maqephe a 21.

QUESTION 1 / POTSO YA 1

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

QUESTION 2 / POTSO YA 2

2.1 **Marking criteria/ Mokgwa wa ho tshwaya**

If any of the underlined key words/phrases in the **correct context** are omitted:
- 1 mark per word/phrase.

*Haeba e le nngwe ya mantswe/diratswana tse sehelletweng mola ka tlase di sihelletswe **maemong a nepahetseng**:*

-1 letshwao lentsweng/seratswaneng ka nngwe

A bond or an atom or a group of atoms that determine(s) the physical and chemical properties of a group of organic compounds. ✓✓

Bond kapa athomo kapa lequlwana la diathomo le dethemaenang fisikale le chemikale phopophatisi tsa lequlwana la diokanike khompaonde (2)

2.2.1 E ✓ (1)

2.2.2 A ✓ (1)

2.2.3 C ✓ (1)

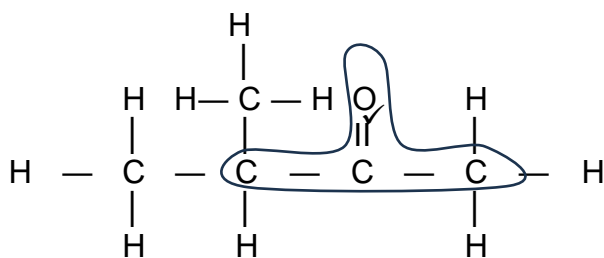
2.3 EQUAL TO. ✓

Compound **E** and ethyl methanoate are functional isomers / structural isomers / have the same molecular formula / same number and type of atoms / same number of C, H and O atoms ✓✓

E LEKANA LE

*Khompaonde ya **E** le ethyl methanoate ke difankeshenale isomer/diseteraketjharale isomer/di na le molecular fomulara/ nomoro e tshwanang kapa mofuta wa diathomo/nomoro tsa C, H le O tse tshwanang* (3)

2.4.1

**Marking criteria/Mokgwa wa ho tshwaya**

- Functional group correct ✓
Lequlwana la fankeshenale le nepahetseng
- Whole structure correct ✓
Seteraketjharale sohle se nepahetse

(2)

2.4.2 Propanoic acid / Propanoic asiti ✓✓ (2)

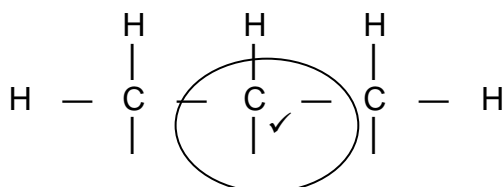
2.4.3 4-methylhex-2-yne
4-metielheks-2-yn

Marking criteria/ Mokgwa wa ho tshwaya

- Hexyne ✓
- Methyl ✓
- Whole name correct / Lebitso lohle le nepahetse ✓

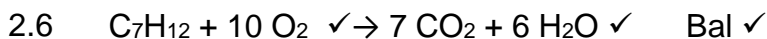
(3)

2.5

**Marking criteria/ Mokgwa wa ho tshwaya**

- Functional group on 2nd carbon ✓
Lequlwana la fankeshenale le ho 2nd carbon
- Whole structure correct ✓
Seteraketjharale sohle se nepahetse

(2)

**NOTES / DINOTO**

- Reactant / reeketente \checkmark Products/ diphorodakete \checkmark Balancing / ho balansa \checkmark

(3)
[20]

QUESTION 3 / POTSO YA 33.1.1 **Marking criteria/ Mokgwa wa ho tshwaya**

If any of the underlined key words/phrases in the **correct context** are omitted:
- 1 mark per word/phrase.

*Haeba e le nngwe ya mantswe/diseratswana tse sehelletweng mola ka tlase di sihelletswe **maemong a nepahetseng**:*

-1 letshwao lentsweng/seratswaneng ka nngwe

The temperature at which the vapour pressure of a substance / liquid equals the atmospheric pressure $\checkmark\checkmark$

Themphereitjhara eo vapour pressure ya sabosetense/likhwiti e lekanang le atmospheric pressure

(2)

3.1.2 All Primary alcohols / Ke diporayimari alekohole kaofela \checkmark

(1)

3.1.3 London forces / dispersion forces/ induced-dipole forces \checkmark

Di-London fose/ di-dispersion fose/ di-induced-dipole fose

(1)

3.1.4 Pentan-1-ol / 1-pentanol $\checkmark\checkmark$

(2)

3.2.1 Compound **C** / propanoic acid \checkmark

*Khompaonte ya **C** / propanoic asiti*

(1)

3.2.2 **Marking criteria/Mokgwa wa ho tshwaya**

- Type of intermolecular forces in compound A \checkmark
- Compound B and C have hydrogen bonds \checkmark
- Compare the number of sites for hydrogen bonding in B and C \checkmark
- Compare the strength of intermolecular forces \checkmark
- Compare energy required to overcome the intermolecular forces \checkmark
- *Mofuta wa di-intermolecular fose ho khompaonde ya A*
- *Khompaonde ya B le ya C di na le di-hydrogen bond*
- *Bapisa nomoro ya di-site tsa hydrogen bonding ho B le ho C*
- *Bapisa seterenthe sa di-intermolecular fose*
- *Bapisa eneji e hlokehang ho hlola di-intermolecular fose*

- Compound A/butanone has dipole-dipole forces ✓ (and London forces / dispersion forces/ induced-dipole forces)
- Compound B/butan-1-ol and C/propanoic acid has hydrogen bonds ✓ (and London forces / dispersion forces/ induced-dipole forces)
- Compound B/butan-1-ol has one site for hydrogen bonding and C/propanoic acid has two sites for hydrogen bonding ✓
- Strength of the intermolecular forces increases from compound A / butanone to compound B / butan-1-ol to compound C / propanoic acid ✓
- More energy is needed to overcome the intermolecular forces in compound C / propanoic acid than compounds A/ butanone and B/butan-1-ol ✓
- *Khompaonte ya A/butanone e na le di-dipole-dipole fose (le di-London fose/di-dispersion fose/ di-induced-dipole fose)*
- *Khompaonde ya B/butan-1-ol le ya C/propanoic asiti e na le di-hydrogen bond (le di-London fose / di-dispersion fose/ di-induced-dipole fose)*
- *Khompaonde ya B/butan-1-ol e na le site e le nngwe ya hydrogen bonding le C/propanoic asiti e na le di-site tse pedi tsa hydrogen bonding*
- *Seterenthe sa di-intermolecular fose se a ata ho tloha ho khompaonde ya A / butanone ho ya ho khompaonde ya B / butan-1-ol ho ya ho khompaonde ya C / propanoic asiti*
- *Eneji e ngata e hlokeha ho hlola di-intermolecular fose ho khompaonde ya C / propanoic asiti ho e na le khompaonde ya A/ butanone le B/butan-1-ol)*

(5)

[12]

QUESTION 4 / POTSO YA 4

- 4.1.1 UNSATURATED ✓ It contains a double bond between its carbon-carbon atoms in the hydrocarbon chain ✓

UNSATURATED. E na le double bond pakeng tsa di-carbon-carbon athomo ho hydrocarbon chain

(2)

- 4.1.2 Substitution / Hydrolysis of a haloalkane ✓

Sabositjhushene/Haeterolisisi ya haloalkane

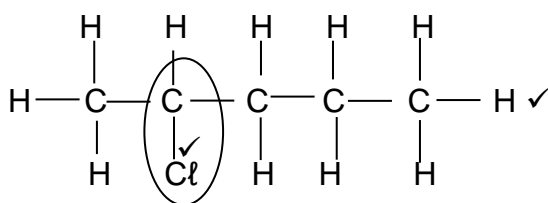
(1)

- 4.1.3 Elimination / dehydrohalogenation of haloalkanes ✓

Elimineishene/dehydrohalogenation ya di-haloalkane

(1)

- 4.1.4



Marking criteria/Mokgwa wa ho tshwaya

- Functional group correct ✓
Lequlwana la fankeshenale le nepahetse
- Whole structure correct ✓
Seteraketjhara sohle se nepahetse

(2)

- 4.1.4 Pentan-2-ol / 2-pentanol ✓✓

(2)

- 4.1.6 Dilute strong base / NaOH ✓ and mild heat ✓

Beisi e matla e daelutuweng/NaOH le mild heat

(2)

- 4.1.7 Positional isomers ✓✓

Di-positional isomer

(2)

4.2

Marking criteria / Mokgwa wa ho tshwaya**Reaction 1:**

Dehydration reaction and correct chemicals. ✓

Reactants with correct condensed structural formula ✓

Products with correct condensed structural formula ✓

Reekeshene ya 1:

Dehydration reekeshene le dikhemikale tse nepahetseng.

Direeketente tse nang le seteraketjharele fomulara se khondensuweng se nepahetse

Diprodakete tse nang le seteraketjharale fomulara se khondensuweng se nepahetse

Reaction 2:

Addition reaction and correct chemicals used. ✓

Reactants with correct condensed structural formula ✓

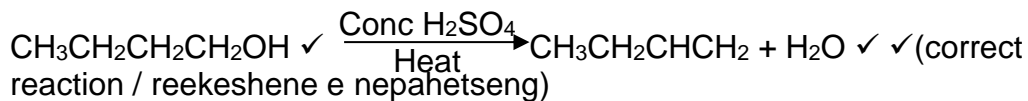
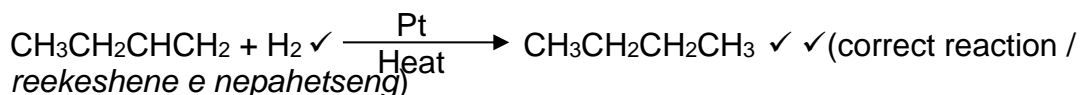
Products with correct condensed structural formula ✓

Reekeshene ya 2:

Addition reekeshene le dikhemikhale tse nepahetseng di sebedisitswe.

Direeketente tse nang le seteraketjharale fomulara se khondensuweng se nepahetse

Diprodakete tse nang le seteraketjharale fomulara se khondensuweng se nepahetse

Reaction 1 / Reekeshene ya 1**Reaction 2 / Reekeshene ya 2**(6)
[18]

QUESTION 5 / POTSO YA 5

5.1

Marking criteria/ Mokgwa wa ho tshwaya

If any of the underlined key words/phrases in the **correct context** are omitted: - 1 mark per word/phrase.

*Haeba e le nngwe ya mantswa/diseratswana tse sehelletweng mola ka tlase di sihelletswe **maemong a nepahetseng**:*

-1 letshwao lentsweng/seratswaneng ka nngwe

ANY ONE

Change in concentration ✓ of reactant or product per (unit) time. ✓

Change in amount/number of moles/volume/mass of products or reactants per (unit) time. ✓✓

Change in amount/number of moles/volume/mass of products formed or reactants used reactants per (unit) time. ✓✓

LE HA E LE EFE E LE NNGWE

Ho tihentjha ha konsentereshene ya reeketente kapa porotakete per (unit) time.

Ho tihentjha ha amaonte/number of moles/volume/mass ya diporotakete kapa direekenente per (unit) time.

Ho tihentjha ha amaonte/number of moles/volume/mass ya doporotakete tse entsweng kapa direeketente tse sebedisitsweng per (unit) time.

OR/KAPA

The rate of change in concentration / amount of moles / number of moles / volume / mass. ✓✓ **(2 or 0).**

Reithi ya ho tihentjha ha khosentereishene/ amaonte ya di-mole /number of moles / volume / mass. **(2 or 0).**

(2)

5.2

Marking Criteria for investigative question / Mokgwa wa ho tshwaya investigative question

The independent and dependent variables are stated ✓

Independent le dependent variables di hlalositse

Ask a question about the relationship between the independent and dependent variables ✓

Botsa potso ka kamano dipakeng tsa independent le dependent variables

What is the effect of the increase / decrease / change of concentration on the reaction rate? ✓✓

Ke efe tshusumetso ya ho atisa/fokotsa/ho tihentjha konsentereishene ho reaction rate?

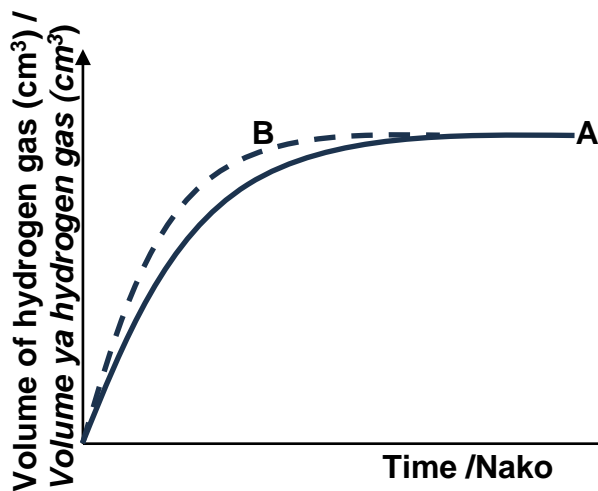
OR / KAPA

What is the relationship between the concentration and reaction rate? ✓✓

Ke efe kamano dipakeng tsa konsenteireshene le reaction rate? (2)

5.3.1 HIGHER THAN / KA HODIMO HO ✓ (1)

5.3.2



Marking criteria / Mokgwa wa ho tshwaya

- Gradient B of is higher than A ✓
Gradient ya B e hodimo ho na le ya A
- Final volume of curve A and B is the same and is horizontal /
Final volume ya mothinya wa A le B e a tshwana ho horizontal✓

NOTE: A or B must be indicated
Ignore the labels of the axes.

ELELLWA: A le B di tlameha ho bontswa.

Se natse di-leobole tsa di-axes

(2)

5.4 **Marking criteria**

- a) Subst. into rate equation ✓
- b) Subst. 486,62 and 25 000 into $n = \frac{V}{V_m}$ ✓
- c) Use of mol ratio $n(\text{Zn}) : n(\text{H}_2)$ ✓
- d) Subst. 0,02 and 65 into $m = nM$ ✓
- e) Final answer ✓

Mokwa wa ho tshwaya

- a) *Sabst. ho ekweishene ya reithi*
- b) *Sabst 486,62 le 25 000 ho $n = \frac{V}{V_m}$*
- c) *Tshebediso ya mol ratio $n(\text{Zn}) : n(\text{H}_2)$*
- d) *Sabst 0,02 le 65 ho $m = nM$*
- e) *Karabo ya ho qetela*

$$\text{rate} = \frac{\Delta V}{\Delta t}$$

$$8,39 = \frac{V - 0}{58} \quad (a) \quad \checkmark$$

$$V = 486,62 \text{ cm}^3$$

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

$$n = \frac{486,62}{24000} \quad (b) \quad \checkmark$$

$$n(\text{H}_2) = 0,020 \text{ mol}$$

$$n(\text{Zn}) = n(\text{H}_2) = 0,020 \quad (c) \quad \checkmark$$

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

$$m(\text{Zn}) = (0,020)(65) \quad (d) \quad \checkmark$$

$$m(\text{Zn}) = 1,30 \text{ g} \quad (e) \quad \checkmark$$

(5)

5.5 INCREASES / NYOLOHA ✓

(1)

- 5.6
- At higher temperature the average kinetic energy of the particles is higher ✓
 - More particles have enough / sufficient kinetic energy or more particles have kinetic energy equal or higher than the activation energy ✓
 - More effective collisions per unit time/ Higher frequency of effective collisions ✓
 - Ho themphereitjhara e hodimo average kinetic energy ya di-particle e a nyoloha
 - Di-particle tse ngata di na le enough / sufficient kinetic energy kapa pi-particle tse ngata di na le kinetic energy e lekanang kapa e hodimo ho na le ya activation energy
 - Di-effective collision tse ngata per unit time/ Frequency e hodimo ya di-effective collision

(3)

[16]

QUESTION 6 / POTSO YA 6

6.1.1 **Marking criteria/ Mokgwa wa ho tshwaya**

If any of the underlined key words/phrases in the **correct context** are omitted:
- 1 mark per word/phrase.

*Haeba e le nngwe ya mantswe/diseratswana tse sehelletweng mola ka tlase di sihelletswe **maemong a nepahetseng**:*

-1 letshwao lentsweng/seratswaneng ka nngwe

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

Ha ekwiliboriamo ho closed system e phatsamisitswe, system we tla re-instata ekwiliboriamo e ntjha ka ho feiva reekeshene e tla opposa/khansela phatsamiso. (2)

6.1.2 Forward (reaction). ✓ The equilibrium concentration of B is higher than A. ✓
Fowade (reekeshene). Ekwiliboriamo konsentereishene ya B e hodimo hon a le ya A. (2)

6.1.3 INCREASES/ NYOLOHA ✓ (1)

6.1.4 NO EFFECT/HA HO TSHUSUMETSO ✓ (1)

6.1.5 EXOTHERMIC ✓ (1)

- 6.1.6
- The concentration of A increased / [B] decreased ✓
 - (According to Le Chatelier's principle) an increase in temperature favours the endothermic reaction. ✓
 - The reverse reaction was favoured / The equilibrium position shifted towards the left ✓
 - Konsentereishene ya A e nyolohile / [B] o theohile
 - (Ho ya ka Le Chatelier's principle) ho nyoloha ha themphereitjhara ho feiva endothermic reaction.
 - Revese reekeshene e ile ya feivuwa / Equilibrium position e shifotetse ka ho le letshehadi

(3)

6.2 **OPTION 1: CONCENTRATION : Marking criteria**

- Correct K_c expression with square brackets ✓
- Substitution of $6,34 \times 10^{-4}$ into correct K_c expression ✓
- Correct substitution of $[Br_2]$ into correct K_c expression ✓
- Use of the correct ratio $[Br_2] : [Br]$ ✓
- Determine initial $[Br_2]$ ✓
- Substitution into $c = n/V$ ✓
- Final answer ✓

KGETHO YA 1: KONSENTEREISHENE / Mokgwa wa ho tshwaya

- K_c expression e nepahetseng e nang le di-square bracket
- Sabosititjhushene ya $6,34 \times 10^{-4}$ ho K_c expression e nepahetseng
- Sabosititjhushene e nepaheng ya $[Br_2]$ ho K_c expression e nepahetseng
- Tshebdiso ya ratio e nepahetseng $[Br_2] : [Br]$
- Fumana $[Br_2]$ ya qalong
- Sabosititjhushene ho $c = n/V$
- Karabo ya ho qetela

- No K_c expression, correct substitution / Ha ho K_c expression, sabosititjhushene e nepahetseng. Max / Maks 6/7
- Wrong K_c expression / K_c expression e fosahetse. Max. Maks 3/7

$$K_c = \frac{[Br]^2}{[Br_2]} \quad (a) \checkmark$$

$$6,34 \times 10^{-4} (b) \checkmark = \frac{[Br]^2}{(2,074)} \quad (c) \checkmark$$

$$[Br] = 0,03626 \text{ mol} \cdot \text{dm}^{-3}$$

	Br_2	$2 Br$
Initial conc	2,09213 ✓ (e)	-
Change in conc <i>Ho tjhentjha ha kons.</i>	-0,01813	0,03626 ✓ (d)
Equilibrium conc.	2,074	0,03626

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

$$V = \frac{1,05}{2,09213} \quad (f) \checkmark$$

$$V = 0,50 \text{ dm}^3 \quad (g) \checkmark$$

OPTION 2: CONCENTRATION: Marking criteria

- Determine $\Delta [\text{Br}_2]$ ✓
- Use of the correct ratio $[\text{Br}_2] : [\text{Br}]$ ✓
- Correct K_c expression with square brackets ✓
- Substitution of $6,34 \times 10^{-4}$ into correct K_c expression ✓
- Correct substitution of $[\text{Br}_2]$ and $[\text{Br}]$ into correct K_c expression ✓
- Substitution into $c = n/V$ ✓
- Final answer ✓

KGETHO YA 2: KONSENTEREISHENE / Mokgwa wa ho tshwaya

- Fumana $\Delta [\text{Br}_2]$
- Sebedisa ratio ya $[\text{Br}_2] : [\text{Br}]$ e nepahetseng
- K_c expression e nepahetseng e nang le di-square bracket
- Sabosititjhushene ya $6,34 \times 10^{-4}$ e nepahetseng ho K_c -expression
- Sabosititjhushene ya $[\text{Br}_2]$ le $[\text{Br}]$ tse nepahetseng ho K_c -expression
- Sabosititjhushene ho $c = n/V$
- Karabo ya ho qetela

$$\Delta[\text{Br}_2] = x(0,865/100) = 0,0865x \quad \checkmark \text{ (a)}$$

	Br_2	2 Br
Initial conc	x	-
Change in conc Ho tjhentjha ha knons	$-0,00865x$	$0,0173x \quad \checkmark \text{ (b)}$
Equilibrium conc.	$2,074$	$0,0173x$

$$K_c = \frac{[\text{Br}]^2}{[\text{Br}_2]} \quad \text{(c) } \checkmark$$

$$6,34 \times 10^{-4} \quad \text{(d) } \checkmark = \frac{(0,0173x)^2}{(2,074)} \quad \text{(e) } \checkmark$$

$$x / [\text{Br}_2]_0 = 2,096 \text{ mol} \cdot \text{dm}^{-3}$$

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

$$V = \frac{1,05}{2,096} \quad \text{(f) } \checkmark$$

$$V = 0,50 \text{ dm}^3 \quad \text{(g) } \checkmark$$

- No K_c expression, correct substitution / Ha ho K_c expression, sabosititjhushene e nepahetseng. Max / Maks 6/7
- Wrong K_c expression / K_c expression e fosahetse. Max. Maks 3/7

OPTION 3: MOLE CALCULATION : Marking criteria

- Determine $\Delta \text{ mol Br}_2$ ✓
- Use of the correct ratio $\text{Br}_2 : \text{Br}$ ✓
- Correct K_c expression with square brackets ✓
- Substitution of $6,34 \times 10^{-4}$ into correct K_c expression ✓
- Correct substitution of $[\text{Br}]$ and $[\text{Br}_2]$ into correct K_c expression ✓
- Substitution into $c = n/V$ ✓
- Final answer ✓

KGETHO YA 3: KKAHETJHULEISHENE YA MOLE: Mokgwa wa ho tshwaya

- Fumana $\Delta \text{ mol}$ ya Br_2
- Sebedisa ratio ya $\text{Br}_2 : \text{Br}$ e nepahetseng
- K_c expression e nepahetseng e nang le di-square bracket
- Sabosititjhushene ya $6,34 \times 10^{-4}$ e nepahetseng ho K_c -expression
- Sabosititjhushene ya $[\text{Br}_2]$ le $[\text{Br}]$ tse nepahetseng ho K_c -expression
- Sabosititjhushene ho $c = n/V$
- Karabo ya ho qetela

$$\Delta n(\text{Br}_2) = 1,05 \times 0,865 / 100 = 0,0090825 \text{ mol} \checkmark \text{ (a)}$$

	Br_2	2 Br
Initial mol	1,05	-
Change in mol <i>Ho tjhentjha ha mol</i>	-0,0090825	0,0818165 ✓ (b)
Equilibrium mol.	2,074V	0,0818165
Equilibrium conc. <i>Ekwilliboriamo kons</i>	2,074	0,018165 / V

$$K_c = \frac{[\text{Br}]^2}{[\text{Br}_2]} \text{ (c) } \checkmark$$

$$6,34 \times 10^{-4} \text{ (d) } \checkmark = \frac{[\text{Br}]^2}{(2,074)} \text{ (e) } \checkmark$$

$$[\text{Br}]_0 = 0,03626 \text{ mol} \cdot \text{dm}^{-3}$$

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

$$0,03626 = \frac{0,018165}{V} \text{ (f) } \checkmark$$

$$V = 0,50 \text{ dm}^3 \text{ (g) } \checkmark$$

- No K_c expression, correct substitution / *Ha ho K_c expression, sabosititjhushene e nepahetseng.* Max / Maks 6/7
- Wrong K_c expression / K_c expression e fosahetse. Max. Maks 2/7

OPTION 4: MOLE CALCULATION: Marking criteria

- Correct K_c expression with square brackets ✓
- Substitution of $6,34 \times 10^{-4}$ into correct K_c expression ✓
- Correct substitution of $[Br]$ and $[Br_2]$ into correct K_c expression ✓
- Determine change in mol Br ✓
- Use of the correct ratio $[Br_2] : [Br]$ ✓
- Substitution into $n_e = n_i - \Delta n$ for Br_2 ✓
- Final answer ✓

KGETHO YA 4: KHALETJHULEISHENE YA MOL/Mokgwa wa ho tshwaya

- K_c expression e nepahetseng e nang le di-square bracket
- Sabosititjhushene ya $6,34 \times 10^{-4}$ ho K_c expression e nepahetseng
- Sabosititjhushene e nepaheng ya $[Br_2]$ ho K_c expression e nepahetseng
- Fumana ho tjhentjha ha mol ho Br
- Tshebediso ya ratio e nepahetseng $[Br_2] : [Br]$
- Sabosititjhushene ho $n_e = n_i - \Delta n$ ho Br_2
- Karabo ya ho qetela

$$K_c = \frac{[Br]^2}{[Br_2]} \quad (a) \checkmark$$

$$6,34 \times 10^{-4} (b) \checkmark = \frac{[Br]^2}{(2,074)} (c) \checkmark$$

- No K_c expression, correct substitution / *Ha ho K_c expression, sabosititjhushene e nepahetseng.* Max / Maks 6/7
- Wrong K_c expression / K_c expression e fosahetse. Max. Maks 2/7

$$[Br] = 0,03626 \text{ mol} \cdot \text{dm}^{-3}$$

	Br₂	2 Br
Initial mol	1,05	-
Change in mol <i>Ho tjhentjha ho mol</i>	-0,01813V ✓ (e)	0,03626V ✓ (d)
Equilibrium mol.	2,074V	0,03626V
Equilibrium conc. <i>Ekwiliboriamo kons</i>	2,074	0,03626

$$n_e = n_i - \Delta n$$

$$2,074V = 1,05 - 0,01813V \checkmark (f)$$

$$V = 0,5 \text{ dm}^3 \checkmark (g)$$

(7)
[17]

QUESTION 7 / POTSO YA 7

7.1.1 Strong acids ionise completely in water ✓ to produce a high concentration of the hydronium ions / (H₃O⁺) ✓

Di-strong acid ayonaisa metsing ka botlalo ✓ ho porodusa konsentereishene e hodimo ya di-hydronium ion / (H₃O⁺) (2)

7.1.2 It donates two protons/ H⁺ / E doneitha di-proton tse pedi / H⁺ ✓ (1)

7.1.3 H₂O ✓ (1)

7.1.4 HSO₄⁻ ✓✓ (2)

7.1.5 **Marking criteria/ Mokgwa wa ho tshwaya**

- a) Ratio [H₃O⁺] : [H₂SO₄] ✓
- b) Formula / *Fomulara* pH = - log [H₃O⁺] ✓
- c) pH value substituted into formula / *pH vaue e sabositijhuwe ho fomulara* ✓
- d) Final answer / *Karabo ya ho qetela* ✓

$$[\text{H}_3\text{O}^+] = 2(0,1) \checkmark \text{ (a) } = 0,2 \text{ mol} \cdot \text{dm}^{-3}$$

$$\text{pH} = -\log[\text{H}_3\text{O}^+] \checkmark \text{ (b)}$$

$$\text{pH} = -\log(0,2) \checkmark \text{ (c)}$$

$$\text{pH} = 0,70 \checkmark \text{ (d)} \quad (4)$$

7.2.1

OPTION 1/ KGETHO YA 1

$$c = \frac{m}{MV} \checkmark$$

$$c = \frac{1,2}{(90)(50 \times 10^{-3})} \checkmark$$

$$c = 0,27 \text{ mol} \cdot \text{dm}^{-3} \checkmark$$

OPTION 2 / KGETHO YA 2

$$n = \frac{m}{M}$$

$$n = \frac{1,2}{90}$$

$$n = 0,013 \text{ mol} \cdot \text{dm}^{-3}$$

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

$$c = \frac{0,013}{50 \times 10^{-3}} \checkmark$$

$$c = 0,26 \text{ mol} \cdot \text{dm}^{-3} \checkmark \quad (3)$$

7.2.2

**Positive marking from / Ho tshwaya
ho phositifo ho tloha ho 7.2.1**

Marking criteria / Tsela ya ho tshwaya

- Subst. values of $\text{H}_2\text{C}_2\text{O}_4$ into $n = cV$ / Sabst divelu tsa $\text{H}_2\text{C}_2\text{O}_4$ ho $n = cV$ ✓
- Using** ratio / **Sebedisa** ratio $\text{H}_2\text{C}_2\text{O}_4$: NaOH 1:2 ✓
- Subst of values of /Sebedisa divelu tsa NaOH into/ ho $c = n/V$ ✓
- Subst into values / Sabst ho divelu NaOH into/ ho $c_1V_1 = c_2V_2$
- Formula / Fomulara $m = cMV$ ✓
- Subst into / Sabst ho $m = cMV$ ✓
- Final answer / Karabo ya ho qetela ✓

$$\begin{aligned} n(\text{H}_2\text{C}_2\text{O}_4) &= cV \\ &= 0,27 \times 25 \times 10^{-3} \text{ (a) } \checkmark \\ &= 6,75 \times 10^{-3} \text{ mol} \end{aligned}$$

$$n(\text{NaOH}) = 2 \times 6,75 \times 10^{-3} \text{ (b) } \checkmark$$

$$n(\text{NaOH}) = 0,0135 \text{ mol}$$

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

$$c(\text{NaOH}) = \frac{0,0135}{43,8 \times 10^{-3}} \text{ (c) } \checkmark$$

$$c(\text{NaOH}) = 0,308 \text{ mol} \cdot \text{dm}^{-3}$$

$$c_1V_1 = c_2V_2$$

$$c_1(25) = (0,308)(100) \text{ (d) } \checkmark$$

$$c_1 = 1,232 \text{ mol} \cdot \text{dm}^{-3}$$

$$m = cMV \text{ (e) } \checkmark$$

$$m = (1,232)(40)(2) \text{ (f) } \checkmark$$

$$m = 98,56 \text{ g} \text{ (g) } \checkmark$$

**Positive marking from / Ho
tshwaya ho phositifo ho tloha
ho 7.2.1**

**Marking criteria / Tsela ya ho
tshwaya**

- Subst. values of/Sabst. Divelu tsa n_a / n_b into/ho $\frac{c_aV_a}{c_bV_b} = \frac{n_a}{n_b}$ ✓
- Subst. values of/ Sabst. Divelu tsa c_aV_a into/ho $\frac{c_aV_a}{c_bV_b} = \frac{n_a}{n_b}$ ✓
- Subst. values of/ Sabst. Divelu tsa V_b into/ho $\frac{c_aV_a}{c_bV_b} = \frac{n_a}{n_b}$ ✓
- Subst into values/ Sabst ho divelu tsa NaOH into/ ho $c_1V_1 = c_2V_2$ ✓
- Formula / Fomulara $m = cMV$ ✓
- Subst into/Sabst ho $m = cMV$ ✓
- Final answer/Karabo ya ho qetela ✓

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

$$\frac{(0,27)(25) \text{ (b) } \checkmark}{c_b(43,8) \text{ (c) } \checkmark} = \frac{1}{2} \text{ (a) } \checkmark$$

$$c_b = 0,308 \text{ mol} \cdot \text{dm}^{-3}$$

(7)
[20]

QUESTION 8 / POTSO YA 8

8.1 Chemical energy to electrical energy ✓✓
Chemical energy ho ya ho electrical energy (2)

8.2 Provide path for movement of ions / E porovaida tsela ya motsamaho wa di-ion
 Ensures electrical neutrality in the cell /E nnetefatsa electrical neutrality ho sele
 (Any one/ Le ha efe e le nngwe) ✓ (1)

8.3 $\text{Fe}^{3+} + \text{e}^- \rightarrow \text{Fe}^{2+}$ ✓✓ (2)

Marking criteria / Tsela ya ho tshwaya

- $\text{Fe}^{3+} + \text{e}^- \rightleftharpoons \text{Fe}^{2+}$ $\frac{1}{2}$
- $\text{Fe}^{2+} \leftarrow \text{Fe}^{3+} + \text{e}^-$ $\frac{2}{2}$
- $\text{Fe}^{2+} \rightleftharpoons \text{Fe}^{3+} + \text{e}^-$ $\frac{0}{2}$
- $\text{Fe}^{2+} \rightarrow \text{Fe}^{3+} + \text{e}^-$ $\frac{0}{2}$

Ignore if the charge omitted on electron / Se natse ha tihatjhe ya eleketrone e sihelletswe

8.4 $E^\theta_{\text{cell}} = E^\theta_{\text{cathode/reduction/oxidising agent}} - E^\theta_{\text{anode/oxidation/reducing agent}}$ ✓

$E^\theta_{\text{cell}} = (0,77) \checkmark - (-0,13) \checkmark$

$E^\theta_{\text{cell}} = 0,90 \text{ V} \checkmark$

Marking criteria/Tsela ya ho tshwaya

- Any other formula using unconventional abbreviation, e.g. /
 $E^\theta_{\text{cell}} = E^\theta_{\text{OA}} - E^\theta_{\text{RA}}$ followed by the correct substitution Max $\frac{3}{4}$
 Le ha e le efe fomulara e sebedisang unconventional abbreviation, mohl. $E^\theta_{\text{sel}} = E^\theta_{\text{OM}} - E^\theta_{\text{RM}}$ e latelwe ke sabositijhushene e nepahetseng Maks $\frac{3}{4}$

8.5.1 Increases / E a ata ✓ (1)

8.5.2 Remains the same / E dula e tshwana ✓ (1)

8.5.3 Increases / E a ata ✓ (1)

8.6 Zn is a stronger reducing agent than Pb ✓
More energy per unit charge is released for the reaction between Zn and Fe^{3+} / The reaction between Zn and Fe^{3+} is more strongly product-favoured / equilibrium position lies further to the right than Pb and Fe^{3+} ✓

Zn ke reducing agent e matla ho na le Pb ✓
Eneji e ngata e ya tswa per unit charge ho reekeshene e dipakeng tsa Zn le Fe^{3+} / Reekeshene e dipakeng tsa Zn le Fe^{3+} e product-favoured haholo ka matla/ equilibrium position e itshetlehlile haholo ka ho le letona ho na le ya Pb le Fe^{3+} ✓

(2)
[14]

QUESTION 9 / POTSO YA 9

- 9.1 The chemical process in which electrical energy is converted to chemical energy **(2 or 0)** ✓✓
 Chemical process eo electrical energy e fetohelang ho chemical energy **(2 or 0)**

OR / KAPA

The use of electrical energy to produce a chemical change **(2 or 0)** ✓✓
 Ho sebediswa ha electrical energy ho produsisa chemical change **(2 or 0)** ✓✓

(2)

- 9.2 Battery/Leshala ✓

(1)

- 9.3 Hydrogen gas/ H₂ ✓

(1)

- 9.4 $2 \text{Cl}^- (\text{aq}) + 2\text{e}^- \rightarrow \text{Cl}_2(\text{g})$ ✓✓ Ignore phases / Se natse di-phase

Marking criteria / Mokgwa wa ho tshwaya

- | | |
|--|-----|
| | 1/2 |
| • $2 \text{Cl}^- (\text{aq}) + 2\text{e}^- \rightleftharpoons \text{Cl}_2(\text{g})$ | 2/2 |
| • $\text{Cl}_2(\text{g}) \leftarrow 2 \text{Cl}^- (\text{aq}) + 2\text{e}^-$ | 0/2 |
| • $\text{Cl}_2(\text{g}) \rightleftharpoons 2 \text{Cl}^- (\text{aq}) + 2\text{e}^-$ | 0/2 |
| • $\text{Cl}_2(\text{g}) \rightarrow 2 \text{Cl}^- (\text{aq}) + 2\text{e}^-$ | |

Ignore if the charge omitted on electron/
 Se natse haeba tjhatjhe ya eleketerone e
 sihelletswe

(2)

- 9.5 Pink / Pinki ✓ . OH⁻ ✓

(2)

- 9.6.1 Zinc ✓

(1)

9.6 2 **Marking criteria / Mokgwa wa ho tshwaya**

- a) **Using** ratio / **Ho sebedisa** ratio Cu: $e^- = 1:2$ ✓
 b) Subst. of values of / *Subst. divelu tsa Cu into/ho* $m = nM$ ✓
 c) Adding the mass of Cu reduced to initial mass / *Ho eketsa mass ya Cu ka mora tlhwakiso*
 d) Final answer / *Karabo ya ho qetela* ✓

$$n(\text{Cu}) = \frac{1}{2} \times 1,38 \times 10^{-2} \text{ (a) } \checkmark$$

$$n(\text{Cu}) = 6,9 \times 10^{-3} \text{ mol}$$

$$m = nM$$

$$m = (6,9 \times 10^{-3})(63,5) \text{ (b) } \checkmark$$

$$m = 0,43815 \text{ g}$$

$$m(\text{cathode}) = 2 + \underline{0,43815} \text{ (c) } \checkmark$$

$$m(\text{cathode}) = 2,43815 \text{ g (d) } \checkmark$$

(4)
[13]

MATSHWAO KAOFELA: 150