basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE/*SENIOR SERTIFIKAAT*
NATIONAL SENIOR CERTIFICATE/
NASIONALE SENIOR SERTIFIKAAT

GRADE/*GRAAD* 12

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

SEPTEMBER 2021(2)

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

This memorandum consists of 17 pages.
Hierdie memorandum bestaan uit 17 bladsye.

QUESTION 1/*VRAAG 1*

1.1 D ✓✓ (2)

1.2 A ✓✓ (2)

1.3 B ✓✓ (2)

1.4 D ✓✓ (2)

1.5 A ✓✓ (2)

1.6 B ✓✓ (2)

1.7 A ✓✓ (2)

1.8 D ✓✓ (2)

1.9 C ✓✓ (2)

1.10 C ✓✓ (2)

[20]

QUESTION 2/*VRAAG 2*

2.1

2.1.1 C ✓ (1)

2.1.2 B/E ✓ (1)

2.1.3 E ✓ (1)

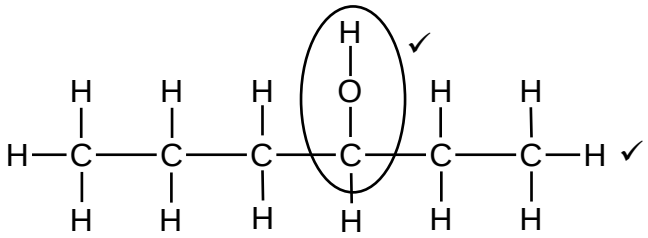
2.2

2.2.1 2-bromo-4-ethyl-3,3-dimethylhexane/*2-broom-4-etiel-3,3-dimetielheksaan*

Marking criteria/*Nasienkriteria*
- Correct stem i.e. hexane./*Korrekte stam: heksaan.* ✓
- All substituents (bromo, ethyl and dimethyl) correctly identified./*Alle substituente (broom, etiel en dimetiel) korrek geïdentifiseer.* ✓
- Substituents correctly numbered, in alphabetical order, hyphens and commas correctly used./*Substituente korrek genommer, in alfabetiese volgorde, koppeltekens en kommas korrek gebruik*. ✓

(3)

2.2.2



Marking criteria/*Nasienkriteria:*
- Six carbons in longest chain. *Ses koolstowwe in die langste ketting.* ✓
- Hydroxyl group on third carbon./*Hidroksielgroep op tweede koolstof*. ✓

Notes/*Aantekeninge*:
- One or more H atoms omitted/*Een of meer H-atome uitgelaat:* ½
- Condensed or semi-structural formula:/*Gekondenseerde of semi-struktuur-formule:* ½

(2)

2.2.3 Pentanal / *Pentanaal* ✓✓

Marking criteria/*Nasienkriteria:*
- Correct functional group i.e. -al/*Korrekte funksionele groep d.i. -al*. ✓
- Whole name correct/*Hele naam korrek*. ✓✓

(2)

2.3

2.3.1 Oxidation/combustion/*oksidasie/verbranding* ✓ (1)

2.3.2 C_8H_{18} ✓✓ **(2 or/*of* 0)** (2)

2.3.3

OPTION 1/OPSIE 1	**Marking criteria/*Nasienkriteria***
$V(CO_2) = 8 \times V_B$ $= 8(50)$ $= 400\ cm^3$ $V(H_2O) = \frac{18}{2} V_B$ $= 9(50)$ $= 450\ cm^3$ ✓ Total volume gas formed/ *Totale volume gas gevorm* ✓ $= 400 + 450$ $= 850\ cm^3$ ✓	• Use volume ratio/*Gebruik volume verhouding:* $V(CO_2) : V(B) = 2 : 1$ and/en $V(H_2O) : V(B) = 9 : 1$ ✓ • Add/*Tel bymekaar:* $V(CO_2)$ and/*en* $V(H_2O)$ ✓ • Final answer/*Finale antwoord:* $850\ cm^3$ ✓
OPTION 2/*OPSIE 2*	
2 mol C_XH_Y ..... 16 + 18 ✓ = 34 mol gas 50 mol C_XH_Y ..... 25 x 34 ✓ mol gas Total moles gas formed/*Totale volume gas gevorm* $= 850\ cm^3$ ✓	

(3)
[16]

QUESTION 3/*VRAAG 3*

3.1 No/*Nee* ✓ (1)

3.2 There is more than one independent variable. ✓
Daar is meer as een onafhanklike veranderlike.

OR/*OF*
Positions of functional groups and branching/chain length differ.
Posises van funksionele groepe en vertakking/kettinglengte verskil.

OR/*OF*
Compounds **A** and **B/C** are positional isomers and compounds **B** and **C** are chain isomers.
*Verbindings **A** en **B/C** is posisie-isomere en verbindings **B** en **C** is kettingisomere.* (1)

3.3

- B/butan-2-ol is less branched / less compact / less spherical/ has a longer chain length / has a larger surface area (over which intermolecular forces act).✓
- B/butan-2-ol has stronger / more intermolecular forces / Van der Waals forces / London forces / dispersion forces. ✓
- More energy needed to overcome or break intermolecular forces / Van der Waals forces in B/butan-2-ol. ✓

- *B/butan-2-ol is minder vertak / minder kompak / minder sferies / het 'n langer kettinglengte / het 'n groter oppervlak (waaroor intermolekulêre kragte werk).*
- *B/butan-2-ol het sterker / meer intermolekulêre kragte / Van der Waalskragte / London-kragte / dispersiekragte.*
- *Meer energie benodig om intermolekulêre kragte / Van der Waalskragte/ dispersiekragte / London-kragte te oorkom in B/butan-2-ol.*

OR/*OF*

- C/2-methylpropan-2-ol is more branched / more compact / more spherical / has a smaller surface area (over which intermolecular forces act).✓
- C/2-methylpropan-2-ol has weaker / less intermolecular forces / Van der Waals forces / London forces / dispersion forces. ✓
- Less energy needed to overcome or break intermolecular forces / Van der Waals forces in C/2-methylpropan-2-ol. ✓

- *C/2-metielpropan-2-ol is meer vertak / meer kompak / meer sferies / het 'n kleiner oppervlak (waaroor intermolekulêre kragte werk).*
- *C/2-metielpropan-2-ol het swakker/minder intermolekulêre kragte / Van der Waalskragte / Londonkragte / dispersiekragte.*
- *Minder energie benodig om intermolekulêre kragte / Van der Waalskragte/ dispersiekragte / Londonkragte te oorkom in C/ 2-metielpropan-2-ol.*

(3)

3.4

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.*

Compounds with the same molecular formula, but different positions of the side chain/substituents/functional groups on parent chain. ✓✓
Verbindings met dieselfde molekulêre formule, maar verskillende posisies van die syketting/substituente/funksionele groepe op die stamketting. (2)

3.5

3.5.1 A & B ✓ (1)

3.5.2 C ✓

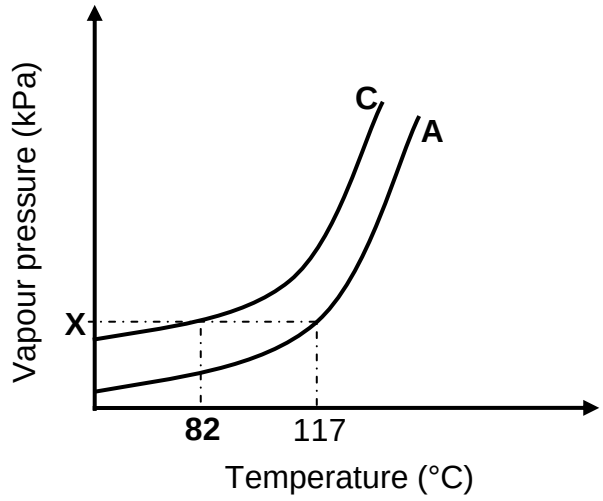
The C-atom bonded to the functional group/OH-group/hydroxyl (group) is bonded to three other C-atoms. ✓
Die C-atoom aan die funksionele groep/OH-groep/hidroksiel(groep) gebind is, is aan drie ander C-atome gebind.

OR/*OF*
The functional group/OH-group/hydroxyl (group) is bonded to a tertiary C-atom.
Die funksionele groep/OH-groep/hidroksiel(groep) is aan 'n *tersiêre C-atoom gebind.* (2)

3.6

3.6.1 101,3 (kPa) / 1,013 x 10^5 Pa / 1 atm / 760 mmHg ✓ (1)

3.6.2



Marking criteria/*Nasienkriteria*:
- Curve C is above A.
  Kurwe C is bokant A. ✓
- Value 82 °C on curve C where vapour pressure is X/ 101,3 kPa.
  Waarde 82 °C op kurwe C waar dampdruk gelyk is aan X/ 101,3 kPa. ✓

IF/*INDIEN*:
- Curves start at same point/*Indien kurwes by dieselfde punt begin:*
  Max./*Maks*. $\frac{1}{2}$
- Straight line graph/*Reguitlyn grafiek*. Max./*Maks*. $\frac{1}{2}$

(2)
[13]

QUESTION 4/*VRAAG 4*

4.1

4.1.1 Substitution/halogenation/bromination ✓
Substitusie/halogenering/brominering (1)

4.1.2 Substitution/hydrolysis/*Substitusie/hidrolise* ✓ (1)

4.1.3 1-bromopropane/*1-bromopropaan* ✓✓

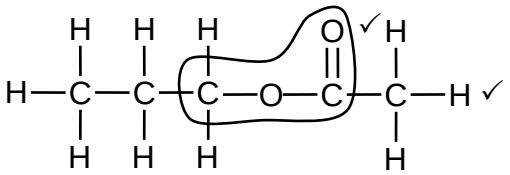
IF/*INDIEN*:
Bromopropane/*bromopropaan* **OR/*OF***
2-bromopropane/2-bromopropaan Max./*Maks*. ½ (2)

4.1.4 H_2SO_4/(concentrated) sulphuric acid/(gekonsentreerde)

swaelsuur ✓ (1)

4.1.5 Ethanoic acid/*Etanoësuur* ✓✓ (2)

4.1.6



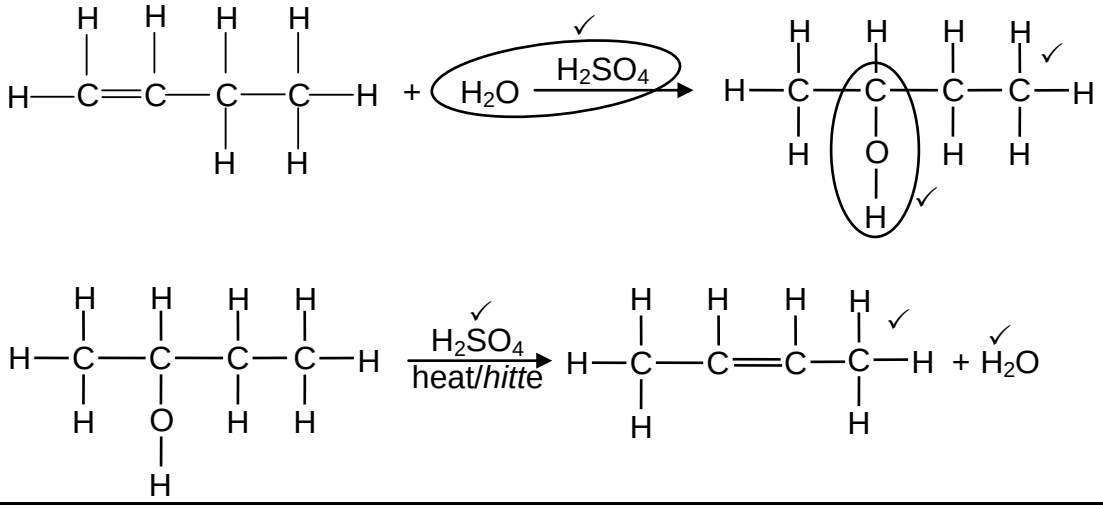
✓

Marking criteria/*Nasienkriteria:*
- Functional group correct. ✓
  Funksionele groep korrek.
- Whole structure correct. ✓✓
  Hele struktuur korrek.

Notes/*Aantekeninge*:
- One or more H atoms omitted: / *Een of meer H-atome uitgelaat:* ½
- Condensed or semi-structural formula: / *Gekondenseerde of semi-struktuur-formule:* ½

(2)

4.2



Notes/*Aantekeninge:*

- Condensed or semistructural formula: Max. $\frac{5}{6}$
  Gekondenseerde of semistruktuurformule: *Maks.* $\frac{5}{6}$
- Molecular formula/*Molekulêre formule*: Max./*Maks.* $\frac{3}{6}$
- Marking rule 6.3.10/*Nasienreël 6.3.10.*
- Any additional reactants or products: Max. $\frac{5}{6}$
  Enige addisionele reaktanse of produkte: *Maks.* $\frac{5}{6}$
- If arrow in equation omitted: Max. $\frac{5}{6}$
  Indien pyltjie in vergelyking uitgelaat is: *Maks.* $\frac{5}{6}$

(6)
[15]

QUESTION 5/*VRAAG 5*

5.1

5.1.1 Kinetic energy/*kinetiese energie* ✓ (1)

5.1.2 Number of particles/molecules ✓
Aantal deeltjies/molekule (1)

5.2

5.2.1 Activation energy/*Aktiveringsenergie* ✓ (1)

5.2.2 Increase/*Toeneem* ✓ (1)

5.3

- A catalyst provides an alternative pathway of lower activation energy. ✓
- More molecules have sufficient kinetic energy. ✓
- More effective collisions per unit time./Frequency of efffective collisions increases. ✓
- Increase raction rate. ✓

- *'n Katalisator verskaf 'n alternatiewe roete van laer aktiveringsenergie.*
- *Meer molekule het voldoende kinetiese energie.*
- *Meer effektiewe botsings per eenheidtyd./Frekwensie van effektiewe botsings neem toe.*
- *Verhoog reaksietempo*. ✓ (4)

5.4

5.4.1 Temperature / Surface area / Amount or mass of $CaCO_3$ ✓
Temperatuur / Reaksie-oppervlak / Hoeveelheid of massa $CaCO_3$ (1)

5.4.2

Criteria for conclusion/*Kriteria vir gevolgtrekking*:	
Dependent (reaction rate) and independent (concentration) variables correctly identified./*Afhanklike(reaksietempo) en onafhanklike (konsentrasie) veranderlikes korrek geïdentifiseer.*	✓
Relationship between the independent and dependent variables correctly stated. *Verwantskap tussen die afhanklike en onafhanklike veranderlikes korrek genoem.*	✓

Example/*Voorbeeld*:
Reaction rate is directly proportional to concentration.
Reaksietempo is direk eweredig aan konsentrasie.

IF/*INDIEN*
Reaction rate increases with increase in concentration.
Reaksietempo neem toe met toename in konsentrasie.

OR/*OF*
Reaksietempo is eweredig aan konsentrasie.
Reaction rate is proportional to concentration. *Max./Maks.* $\frac{1}{2}$ (2)

5.5

Marking criteria/*Nasienkriteria:*

- Substitute 50 $cm^3 \cdot min^{-1}$ and 26 minutes in rate = $\frac{\Delta V}{\Delta t}$ ✓
- Substitute/ *Vervang* 1 300 cm^3 /1,3 dm^3 **OR/*OF*** 24 000 $cm^3 \cdot mol^{-1}$/ 24 $dm^3 \cdot mol^{-1}$ in n = $\frac{V}{V_m}$ ✓
- Use ratio/*Gebruik verhouding* $n(CO_2) = n(CaCO_3) = 1:1$ ✓
- Substitute/*Vervang* 100 $g \cdot mol^{-1}$ in n = $\frac{m}{M}$ ✓
- Calculate % purity/*Bereken % suiwerheid* = $\frac{m(CaCO_3)}{m(\text{Sample/ } monster)}$ ✓ x 100
- Final answer/*Finale antwoord:* 90,33% ✓
  Range/*Gebied*: 83,33% to 90,33%

OPTION 1

Rate/*tempo* = $\frac{\Delta V}{\Delta t}$

$50 = \frac{\Delta V}{26}$ ✓

$\Delta V = 1\ 300\ cm^3$

$n(CO_2) = \frac{1300}{24\ 000}$ ✓ **OR** $\frac{1,3}{24}$

$= 0,0542$ mol

$n(CaCO_3) = n(CO_2)$

$= 0,0542$ mol ✓

$m(CaCO_3) = nM$ ✓

$= 0,0542 \times 100$

$= 5,42$ g

% purity/*suiwerheid* = $\frac{5,42}{6}$ ✓ x 100

$= 90,33\%$ ✓

OPTION 2:

Rate/*tempo* = $\frac{50}{24\ 000}$ ✓

$= 0,00208\ mol \cdot min^{-1}$ ✓

$n(CO_2) = 0,00208 \times 26$

$= 0,0542$ mol

$n(CaCO_3) = n(CO_2) = 0,0542$ mol ✓

$m(CaCO_3) = nM$ ✓

$= 0,0542(100)$

$= 5,42$ g

% purity/*suiwerheid* = $\frac{5,42}{6}$ ✓ x 100

$= 90,33\%$ ✓

(6)
[17]

QUESTION 6/*VRAAG 6*

6.1 The stage in a chemical reaction when the rate of forward reaction equals the rate of reverse reaction. ✓✓ **(2 or 0)**
Die stadium in 'n chemiese reaksie waar die tempo van die voorwaartse reaksie gelyk is aan die tempo van die terugwaartse reaksie. ***(2 of 0)***

OR/*OF*
The stage in a chemical reaction when the concentrations of reactants and products remain constant. **(2 or 0)**
Die stadium in 'n chemiese reaksie waar die konsentrasies van die reaktanse en produkte konstant bly. ***(2 of 0)*** (2)

6.2 **CALCULATIONS USING NUMBER OF MOLES**
BEREKENINGE WAT AANTAL MOL GEBRUIK

Marking criteria/*Nasienkriteria*

- Substitute/*Vervang* 18 g·mol^{-1} in $n = \frac{m}{M}$ ✓
- $\Delta n(CO_2) = \Delta n(C) =$ 0,225 mol. ✓
- Use mole ratio/Gebruik $n(C) : n(H_2O) : n(CO_2) : n(H_2) = ! : 2 : 1 : 2$ ✓
- Equilibrium/*Ewewig* $n(H_2O)$ = initial/*aanvaklike* $n(H_2O) - \Delta n(H_2O)$
  Equilibrium/*Ewewig* $n(H_2)$ = initial/*aanvanklike* $n(H_2) + \Delta n(H_2)$
  Equilibrium/*Ewewig* $n(CO_2)$ = initial/*aanvanklike* $n(CO_2) + \Delta n(CO_2)$ ✓
- Divide equilibrium moles of H_2O, H_2 AND/*EN* CO_2 by/*deur* 2 dm^3.✓
- Correct K_c expression (formulae in square brackets). ✓
  Korrekte K_c uitdrukking (formules in vierkantige hakies).
- Substitution of concentrations into correct K_c expression. ✓
  Vervanging van konsentrasies in korrekte K_c-uitdrukking.
- Final answer/*Finale antwoord*: 0,00948 ✓
  Range/*Gebied*: 0,00948 to/*tot* 0,01 (9,48 x 10^{-3} to/*tot* 1 x 10^{-2})

OPTION 1/*OPSIE 1*

$n(H_2O)_{initial/aanvanklik} = \frac{m}{M} = \frac{36}{18}$ ✓ = 2 mol

	H_2O	H_2	CO_2
Initial amount (moles) *Aanvangs hoeveelheid (mol)*	2		
Change in amount (moles) *Verandering in hoeveelheid (*mol)	0,45	0,45	0,225 ✓
Equilibrium amount (moles) *hoeveelheid (*mol)	1,55	0,45	0,225 ✓
Equilibrium concentration (mol·dm^{-3}) *Ewewigskonsentrasie (mol·dm^{-3})*	0,775	0,225	0,1125

ratio ✓ *verhouding*

Divide by/ Deel deur 2 dm^3 ✓

$K_c = \frac{[H_2]^2[CO_2]}{[H_2O]^2}$ ✓

$= \frac{[0,225]^2[0,1125]}{[0,775]^2}$ ✓

$= 0,00948$ ✓

No K_c expression, correct substitution/*Geen K_c-uitdrukking*, *korrekte substitusie*: Max./*Maks.* $\frac{7}{8}$

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

CALCULATIONS USING CONCENTRATION
BEREKENINGE WAT KONSENTRASIE GEBRUIK

- Substitute/*Vervang* 18 g·mol^{-1} in $n = \frac{m}{M}$ ✓
- Divide initial/*Deel aanvanklik*e $n(H_2O)$ AND $\Delta n(CO_2)$ by/*deur* 2 dm^3.✓
- $\Delta n(CO_2) = \Delta n(C) = \underline{0,225}$ mol OR/*OF* $\Delta c(CO_2) = 0,1125$ mol·dm^{-3}. ✓
- Use mole ratio/*Gebruik molverhouding* $n(H_2O) : n(CO_2) : n(H_2) = 2 : 1 : 2$ ✓
- Equilibrium/*Ewewig* $c(H_2O)$ = initial/*aanvanklike* $c(H_2O) - \Delta c(H_2O)$
  Equilibrium/*Ewewig* $c(H_2)$ = initial/*aanvanklike* $c(H_2) + \Delta c(H_2)$
  Equilibrium/*Ewewig* $c(CO_2)$ = initial/*aanvanklike* $c(CO_2) + \Delta c(CO_2)$ ✓
- Correct K_c expression (formulae in square brackets). ✓
  Korrekte K_c uitdrukking (formules in vierkantige hakies).
- Substitution of concentrations into correct K_c expression. ✓
  Vervanging van konsentrasies in korrekte K_c-uitdrukking.
- Final answer/*Finale antwoord*: 0,00948 ✓
  Range/*Gebied*: 0,00948 – 0,01)

OPTION 2/*OPSIE 2*

$n(H_2O)_{initial/aanvanklik} = \frac{m}{M} = \frac{36}{18}$✓ = 2 mol

	H_2O	H_2	CO_2
Initial concentration (mol·dm^{-3}) *Aanvangskonsentrasie (mol·dm^{-3})*	1		
Change (mol·dm^{-3}) ✓ *Verandering (*mol·dm^{-3}*)*	0,225	0,225	0,1125 ✓
Equilibrium concentration (mol·dm^{-3}) *Ewewigskonsentrasie (mol·dm^{-3})*	0,775	0,225	0,1125

Divide by/*Deel deur* 2 dm^3 ✓ ratio ✓ *verhouding*

$K_c = \frac{[H_2]^2[CO_2]}{[H_2O]^2}$✓

$= \frac{[0,225]^2[0,1125]}{[0,775]^2}$✓

$= 0,00948$ ✓

No K_c expression, correct substitution/*Geen K_c-uitdrukking*, *korrekte substitusie*: Max./*Maks.* $\frac{7}{8}$

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

(8)

6.3

6.3.1 Steam is used up./Amount of steam decreases./Concentration of steam decreases./Reactants are used up. ✓
Water word opgebruik./Hoeveelheid stoom neem af./Konsentrasie van stoom neem af./Reaktanse word opgebruik. (1)

6.3.2 Catalyst was added./*Katalisator is bygevoeg*. ✓ (1)

6.3.3 Endothermic/*Endotermies* ✓ (1)

6.3.4
- The forward reaction is favoured./*Die voorwaartse reaksie word bevoordeel.* ✓
- Increase in temperature favours the endothermic reaction. ✓
  Toename in temperatuur bevoordeel die endotermiese reaksie. (2)

[15]

QUESTION 7/VRAAG 7

7.1 A base forms hydroxide ions (OH^-) in water/aqueous solution/$OH^-(aq)$. ✓✓
'n Basis vorm hidroksiedione (OH^-) in water/waterige oplossing/$OH^-(aq)$.

IF/*INDIEN*:
A base ionises to form hydroxide ions (OH^-). ✓
'n Basis ioniseer om hidroksiedione (OH^-) te vorm. *Max./Maks.* $\frac{1}{2}$

(2)

7.2 $n(KOH) = cV$
$= 0,1 \times 0,4$ ✓
$= 0,04$ mol
$n(OH^-) = n(KOH) = 0,04$ mol✓

(2)

7.3

7.3.1 **POSITIVE MARKING FROM Q7.2/*POSITIEWE NASIEN VANAF V7.2***

Marking criteria/*Nasienkriteria*
- Use formula/*Gebruik formule*: $pH = -\log[H_3O^+]$
- Substitute/*Vervang* pH = 13/pOH = 1
- Substitute/*Vervang* 1×10^{-13} in K_w/Calculate/*Bereken* pOH
- Substitute/*Vervang* of 0,1 x 0,9
- Calculate/*Bereken* $n(OH^-)$ = n(in C) – n(in B) ✓
- Use mol ratio/*Gebruik molverhouding*: $n(Ba(OH)_2) : n(OH^-) = 1 : 2$. ✓
- Substitute/*Vervang* 0,5 dm^3. ✓
- Final answer/*Finale antwoord*: 0,05 $mol \cdot dm^{-3}$ ✓
  Range/*Gebied*: 0,05 to 0,06 $mol \cdot dm^{-3}$

OPTION 1/*OPSIE 1*

$pH = -\log[H_3O^+]$ **OR/*OF*** $[H_3O^+] = 10^{-pH}$ ✓
13 ✓$= -\log[H_3O^+]$ **OR/*OF*** $[H_3O] = 10^{-13}$
$[H_3O^+] = 1 \times 10^{-13}$ mol·dm^{-3}
↓
$[H_3O^+][OH^-] = 1 \times 10^{-14}$
$(1 \times 10^{-13})[OH^-] = 1 \times 10^{-14}$ ✓
$[OH^-] = 0,1$ mol·dm^{-3}
↓
$n(OH^-) = cV$
$= 0,1 \times 0,9$ ✓
$= 0,09$ mol

OPTION 2/*OPSIE 2*

$pOH = 14 - 13 = 1$ ✓
$pOH = -\log[OH^-]$ ✓
1 ✓ $= -\log[OH^-]$
$[OH^-] = 0,1$ mol·dm^{-3}
↓
$n(OH^-) = cV$
$= 0,1 \times 0,9$ ✓
$= 0,09$ mol

$n(OH^-)$ from/*van* $Ba(OH)_2$ in beaker/*beker* **C** $= 0,09 - 0,04$✓
$= 0,05$ mol

$n[Ba(OH)_2] = ½\, n(OH^-)$
$= ½\,(0,05)$ ✓
$= 0,025$ mol

$c[Ba(OH)_2] = \frac{n}{V}$

$= \frac{0,025}{0,5}$ ✓

$\therefore x = 0,05$ mol·dm^{-3} ✓

(8)

7.3.2 Weak (acid)/*Swak (suur)* ✓

Ionises/dissociates incompletely/partially. ✓
Ioniseer/dissosieer onvolledig/gedeeltelik. (2)

7.3.3 **POSITIVE MARKING FROM Q7.3.1/*POSITIEWE NASIEN VANAF V7.3.1***

Marking criteria/*Nasienkriteria*

- Formula/*Formule*: $c = \frac{n}{V}$ / $\frac{c_a \times V_a}{c_b \times V_b} = \frac{n_a}{n_b}$. ✓
- Substitution of/*Vervanging van* 0,1 x 15 / 0,1 x 0,015 ✓ **OR/*OF***
  Use/*Gebruik* V_a = 30 cm^3
- Use mol ratio/*Gebruik molverhouding* 1 : 1 ✓
- Final answer/*Finale antwoord*: 0,05 $mol \cdot dm^{-3}$.✓

OPTION 1/*OPSIE 1*

$n(OH^-) = cV$ ✓
$= 0,1 \times 0,015$ ✓
$= 0,0015$ mol

$n(CH_3COOH) = n(OH^-)$
$= 0,0015$ mol ✓

$c = \frac{n}{V}$
$= \frac{0,0015}{0,03}$
$= 0,05\ mol \cdot dm^{-3}$ ✓

OPTION 2/*OPSIE 2*

$\frac{c_a \times V_a}{c_b \times V_b} = \frac{n_a}{n_b}$ ✓
$\frac{c_a \times 30}{0,1 \times 15} \checkmark = \frac{1}{1}$ ✓
$c_a = 0,05\ mol \cdot dm^{-3}$ ✓

(4)
[18]

QUESTION 8/*VRAAG 8*

8.1

8.1.1 Zinc/Zn ✓ (1)

8.1.2 Platinum/Pt /Carbon/C/*Koolstof* ✓ (1)

8.1.3 Iron(III) ions/Fe^{3+}(aq)/Fe^{3+} ions/*Yster(III)-ione/*Fe^{3+}*-ione* ✓ (1)

8.2

8.2.1 Conductor (to complete circuit). /Provides surface area for the reaction to take place. ✓
Geleier (om die stroombaan te voltooi./Verskaf oppervlak vir die reaksie om plaas te vind. (1)

8.2.2 $Fe^{3+} + e^- \rightarrow Fe^{2+}$ ✓✓

Marking criteria/*Nasienkriteria*
- $Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$ $\frac{1}{2}$ $Fe^{2+} \rightleftharpoons Fe^{3+} + e^-$ $\frac{0}{2}$
  $Fe^{2+} \leftarrow Fe^{3+} + e^-$ $\frac{2}{2}$ $Fe^{2+} \rightarrow Fe^{3+} + e^-$ $\frac{0}{2}$
- Ignore if charge omitted on electron./*Ignoreer indien lading weggelaat op elektron.*
- If charge (+) omitted on Fe^{2+} and/or Fe^{3+} *Indien lading (+) weggelaat op* Fe^{2+} and/or Fe^{3+} Max./*Maks:* $\frac{1}{2}$ Example/*Voorbeeld:* $Fe^{3} + e^- \rightarrow Fe^{2}$

(2)

8.2.3 $2Fe^{3+}(aq) + Zn$ ✓ $\rightarrow 2Fe^{2+}(aq) + Zn^{2+}(aq)$ ✓ Bal ✓

Notes/*Aantekeninge*
- Reactants ✓ Products ✓ Balancing ✓
  Reaktanse ✓ *Produkte* ✓ *Balansering* ✓
- Ignore/*Ignoreer* → and phases / *en fases*
- Marking rule 6.3.10/*Nasienreël 6.3.10*

(3)

8.3

OPTION 1/*OPSIE 1*

$E^{\theta}_{cell} = E^{\theta}_{reduction} - E^{\theta}_{oxidation}$ ✓
= 0,77 ✓– (-0,76) ✓
= 1,53 V ✓

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:* $\frac{3}{4}$

OPTION 2/*OPSIE 2*

$Fe^{3+} + e \rightarrow Fe^{2+}$ ✓ $E^{\theta} = 0,77$ V ✓
$Zn \rightarrow Zn^{2+}(aq) + 2e^-$ $E^{\theta} = 0,76$ V ✓
$Zn + 2Fe^{3+} \rightarrow Zn^{2+} + 2Fe^{2+}$ $E^{\theta} = 1,53$ V ✓

(4)

8.4 Decreases/*Verlaag* ✓ (1)

[14]

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. ✓✓
  Die chemiese proses waarin elektriese energie omgeskakel word na chemiese energie.
- The use of electrical energy to produce a chemical change.
  Die gebruik van elektriese energie om 'n chemiese verandering te weeg te bring.
- Decomposition of an ionic compound by means of electrical energy.
  Ontbinding van 'n ioniese verbinding met behulp van elektriese energie.
- The process during which an electric current passes through a solution/ ionic liquid/molten ionic compound.
  Die proses waardeur 'n elektriese stroom deur 'n oplossing/ioniese vloeistof/gesmelte ioniese verbinding beweeg. (2)

9.2 Copper(II) ions/Cu^{2+}/*koper(II)-ione* ✓
Zinc(II) ions/Zn^{2+}/*sink(II)-ione* ✓ (2)

9.3 Cu^{2+} (aq) + $2e^-$ → Cu (s) ✓✓

Notes/*Aantekeninge*
$Cu^{2+} + 2e^- \rightleftharpoons Cu$ ($^1/_2$) $Cu \leftarrow Cu^{2+} + 2e^-$ ($^2/_2$)
$Cu \rightleftharpoons Cu^{2+} + 2e^-$ ($^0/_2$) $Cu^{2+} + 2e \leftarrow Cu$ ($^0/_2$)

- Ignore if charge omitted on electron./*Ignoreer indien lading weggelaat op elektron.*
- If charge (+) omitted on Cu^{2+}/*Indien lading (+) weggelaat op*
  Cu^{2+} Max./*Maks:* $^1/_2$ Example/*Voorbeeld:* $Cu^2 + 2e^- \rightarrow Cu$
- Ignore phases. / *Ignoreer fases*. (2)

9.4 Zn^{2+} is a weaker oxidising agent ✓ than Cu^{2+} ✓ and will not be reduced to Zn. ✓
Zn^{2+} is 'n swakker oksideermiddel as Cu^{2+} en sal nie na Zn gereduseer word nie. (3)

9.5 n(Cu) = ½$n_{electrons/elektrone}$
= ½(0,6) ✓
= 0,3 mol
m = nM
= 0,3 x 63,5 ✓
= 19,05 g ✓

Marking criteria/*Nasienkriteria*
- Use mol ratio/*Gebruik molverhouding*: n(Cu) : n(electrons) = 1 : 2. ✓
- Substitute/*Vervang* 63,5 $g \cdot mol^{-1}$ in m = nM ✓
- Final answer/*Finale antwoord*: 19,05 g ✓

(3)
[12]

QUESTION 10/*VRAAG 10*

10.1

10.1.1 Nitrogen/N_2/*Stikstof* ✓ (1)

10.1.2 Iron/Iron(II) oxide/Fe/FeO/*yster/yster(II)oksied* ✓ (1)

10.1.3 Ammonia/NH_3/*ammoniak* ✓ (1)

10.1.4 (Fractional) distillation (of liquid air) ✓
(Fraksionele) distillasie (van vloeibare lug) (1)

10.1.5 $2NH_3 + H_2SO_4$✓ → $(NH_4)_2SO_4$✓ bal ✓

Notes/*Aantekeninge*
- Reactants ✓ Products ✓ Balancing ✓
  Reaktanse ✓ *Produkte* ✓ *Balansering* ✓
- Ignore/*Ignoreer* ⇌ and phases / *en fases*
- Marking rule 6.3.10/*Nasienreël 6.3.10* (3)

10.2

Marking criteria/*Nasienkriteria*
- Calculate/*Bereken* m(N,P,K). ✓
- Determine/*Bepaal* m(x). ✓
- Final answer/*Finale antwoord:* 3 : 6 : 5 ✓

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
%(N, P, K) = 35% $m(N,P,K) = \frac{35}{100} \times 40$ ✓ = 14 kg ↙ m(N + P + K) = 5 + x + 2x ✓ = 14 x = 3 kg N : P : K = 3 : 6 : 5 ✓	%(N, P, K) = 35% $m(N,P,K) = \frac{35}{100} \times 40$ ✓ = 14 kg ↓ m(N & P) = 14 – 5 = 9 kg ✓ $x = \frac{1}{3} \times 9 = 3$ kg ↙ 2x = 6 kg N : P : K = 3 : 6 : 5 ✓

(3)

[10]

TOTAL/*TOTAAL*: 150