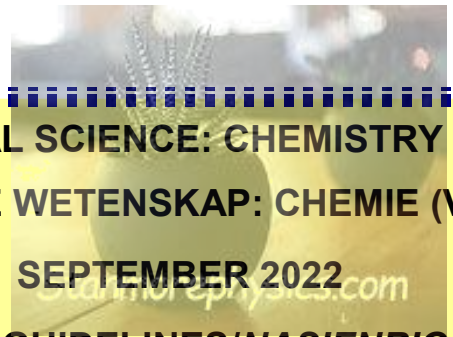
education

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NASIONALE SENIOR SERTIFIKAAT

GRADE 12/*GRAAD 12*



PHYSICAL SCIENCE: CHEMISTRY (P2)
FISIESE WETENSKAP: CHEMIE (V2)
SEPTEMBER 2022
MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 17 pages including the cognitive grid.
Hierdie nasienriglyne bestaan uit 17 bladsye insluitend die kognitiewe tabel.

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QUESTION 1/*VRAAG 1*

1.1.	C	✓✓	(2)
1.2	C	✓✓	(2)
1.3	A	✓✓	(2)
1.4	B	✓✓	(2)
1.5	B	✓✓	(2)
1.6	D	✓✓	(2)
1.7	A	✓✓	(2)
1.8	C	✓✓	(2)
1.9	C	✓✓	(2)
1.10	D	✓✓	(2)

[20]

QUESTION 2/*VRAAG 2*

2.1 3–methyl✓heptane ✓✓/*3-metiel✓heptaan* ✓✓

Marking criteria
- Correct stem i.e. heptane.✓
- Substituent (methyl)correctly identified.✓
- IUPAC name correct including numering and hyphen. ✓

Nasienriglyne
- *Korrekte stam bv heptaan.*✓
- *Sytak (metiel) korrek geïdentifiseer.*✓
- *IUPAC naam heeltemal korrek insluitende volgorde en koppelteken.* ✓

(3)

2.2

2.2.1 Organic compounds having same molecular formula ✓but different structural formula✓/*Organiese verbindings met dieselfde molekulêre formule*✓*maar verskillende struktuurformules* ✓. (2)

2.2.2 Functional isomer✓ /*Funksionele isomere* ✓ (1)

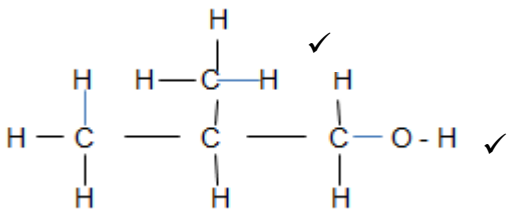
2.2.3 Aldehyde✓/*Aldehied* ✓ (1)

2.3

2.3.1 Secondary✓/*Sekondêre* ✓ (1)

2.3.2 The carbon bonded to the hydroxyl group/-OH is bonded to two other carbon atoms✓✓/*Die koolstof gebind aan die hidroksielgroep/OH$^-$ is gebind aan twee ander koolstofatome* ✓✓ (2)

2.4



✓ ✓

Marking criteria
- -OH on the first carbon ✓
- Whole structure correct ✓

Nasienriglyne
- -OH op die eerste koolstof ✓
- Hele struktuur korrek ✓

(2)

2.5.

2.5.1 Carboxyl group✓/*Karboksielgroep* ✓ (1)

2.5.2 Propanoic acid✓✓/*Propanoësuur* ✓✓ (2)

2.6

2.6.1 C_nH_{2n} ✓ (1)

2.6.2 CH_3CH_3 ✓ (1)

[17]



QUESTION 3/*VRAAG 3*:

3.1 Saturated✓/*Versadig*✓

No multiple bond/ single bonds **only** ✓between carbon atoms in their hydrocarbon chain
*Geen meervoudige bindings/**slegs** enkel bindings ✓ tussen die koolstofatome in die koolwaterstofketting.* (2)

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

3.2 Temperature at which vapour pressure is equal to the atmospheric pressure✓✓
Temperatuur waarby die dampdruk gelyk is aan die atmosferiese druk ✓✓ (2)

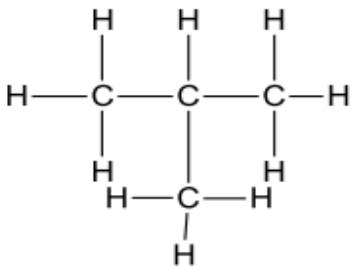
3.3

3.3.1 Homologous series✓/*Homoloë reeks*✓ (1)

3.3.2 Pentane/Hexane✓/*Pentaan/Heksaan*✓ (1)

3.3.3 London force/induced dipole force✓/*Londonkragte/geïnduseerde dipoolkragte*✓ (1)

3.3.4



✓✓ (2)

3.4 Increases✓/*Verhoog*✓ (1)

- **Structure:**
  The chain length/molecular mass increases from compound A to F✓
- **Intermolecular forces:**
  The strength of the London force increase ✓
- **Energy:**
  More energy needed to break the intermolecular forces from A to F✓
- ***Struktuur:***
  Die kettinglengte/molekulêre massa neem toe van verbinding A tot F✓
- ***Intermolekulêre kragte:***
  Die sterkte van die Londonkragte neem toe ✓
- ***Energie:***
  Meer energie word benodig om die intermolekulêrekragte van A na F te onderbreek. ✓ (4)

3.5 Higher than✓✓/*Hoër as*✓✓ (2)

[15]

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QUESTION 4/*VRAAG 4*:

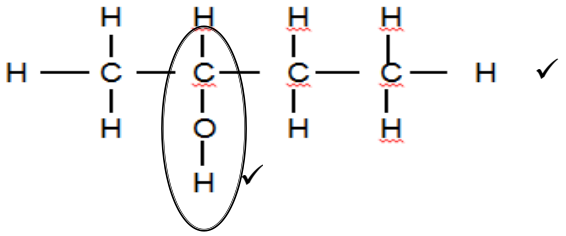
4.1

4.1.1 a) Hydration✓/*Hidrasie* ✓ (1)

b) Hydrohalogenation✓/*Hidrohalogenering* ✓ (1)

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4.1.2



(2)

Marking criteria:
• Four carbon atoms in longest chain✓
• Hydroxyl group on C_2✓
Nasienkriteria:
• *Vier koolstowwe in die langste ketting*✓
• *Hydroksielgroep op C_2*✓

4.1.3 2–chloro–2–methyl✓pentane✓/*2–chloro–2–metiel*✓*pentaan*✓ (2)

4.2

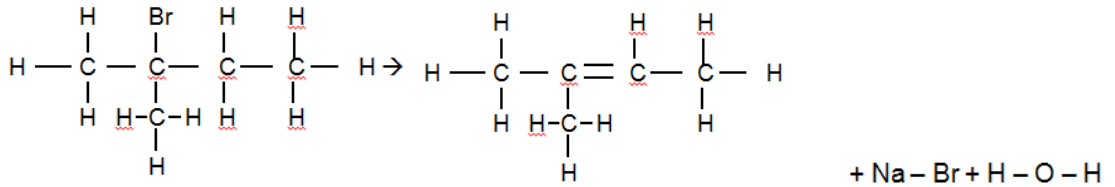
4.2.1 Substitution✓/*Substitusie*✓ (1)

4.2.2 NaOH/KOH/LiOH✓ (1)

4.2.3

Note:
• For QUESTIONS 4.2.3 & 4.3.2, penalise only once for the use of condensed formulae or molecular formulae
Aantekeninge:
• *Vir VRAE 4.2.3 & 4.3.2, penaliseer slegs een keer vir die gebruik van gekondenseerde of molekulêre formules*
Marking criteria:
• Correct structural formula for 2-bromo-2-methylbutane✓
• Correct structural formula for 2-methylbut-2-ene✓
• Correct functional group(double bond between carbon atoms) ✓for 2-methylbut-2-ene
• Correct formula for NaBr & H_2O✓
Nasienkriteria:
• *Korrekte struktuurformule vir 2-bromo-2-metielbutaan*✓
• *Korrekte struktuurformele vir 2-metielbut-2-een*✓
• *Korrekte funksionele groep(dubbelbinding tussen koolstofatome)* ✓*vir 2-metielbut-2-een*
• *Korrekte formule vir NaBr & H_2O* ✓

4.2.3



✓ ✓✓ ✓ (4)

4.2.4 2–methylbutan–2–ol✓✓/*2-metielbutan-2-ol* ✓✓ (2)

4.3.1.(Concentrated)Sulphuric acid/H_2SO_4✓/*(gekonsentreerde)Swawelsuur/* H_2SO_4 ✓ (1)

4.3.2

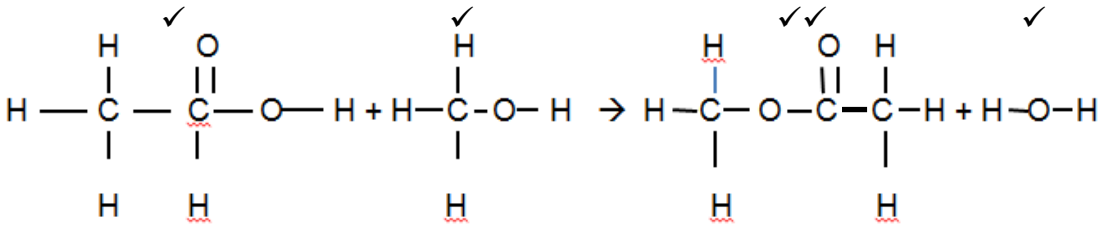
Marking criteria:

- Correct structural formula for ethanoic acid✓
- Correct structural formula for methanol✓
- Correct functional group (ester) ✓& correct structural formula methyl ethanoate✓
- Correct formula for H_2O✓

Nasiekriteria:

- *Korrekte struktuurformule vir etanoësuur*
- *Korrekte struktuurformule vir metanol*
- *Korrekte funksionele groep (ester)* ✓ *& korrekte struktuurformule metieletanoaat*
- *Korrekte formule vir* H_2O

4.3.2.



(5)
[20]

QUESTION 5/*VRAAG* 5:

5.1. **ANY ONE:**

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

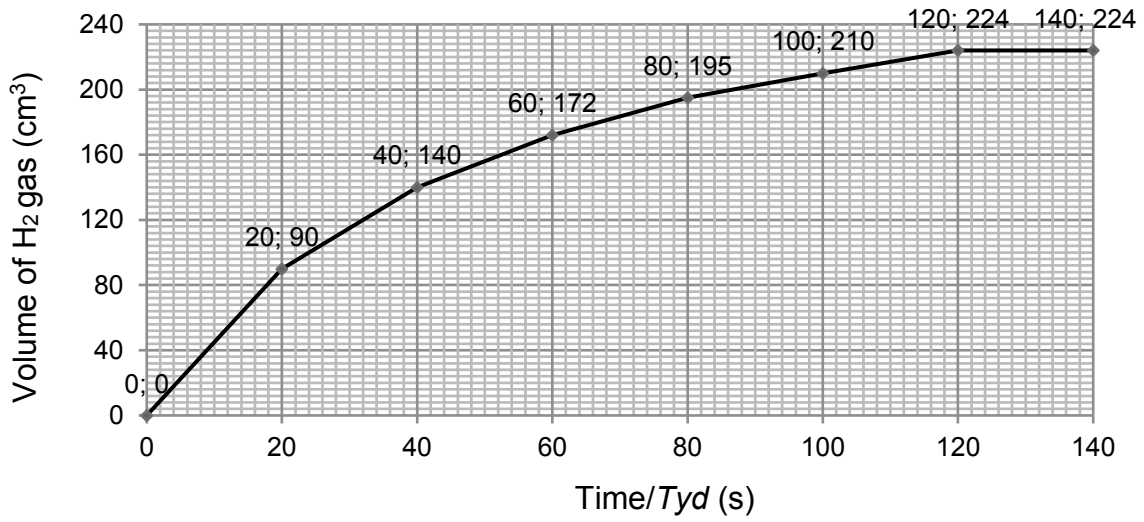
ENIGE EEN:

- *Verandering in konsentrasie ✓van produkte/reaktante per tydseenheid✓*
- *Verandering in hoeveelheidl/aantal mol/volume/massa ✓van die produkte/reaktante per tydseenheid ✓*
- *Hoeveelheidl/aantal mol/volume/massa produkte gevorm/reaktante opgebruik ✓per tydseenheid ✓*
- *Tempo van verandering in konsentrasie/aantal mol/hoeveelheid mol/volume/massa ✓✓(**2 or 0**)*

(2)

NOTE: Give the mark for per unit time only if in correct context of reaction rate. ***LET WEL:*** *Gee 'n punt vir per tydseenheid slegs as dit in die korrekte konteks vir reaksietempo gebruik is.*

5.2.



Marking criteria/*Nasiekriteria*:	**Marks/*Punte***
Plotting all the points correctly *Alle punte korrek geplot*	✓✓
Shape *Vorm van die grafiek*	✓✓
NOTE If four points plotted correctly give one mark. ***Aantekening*** *Indien vier punte korrek geplot is, gee een punt.*	

(4)

5.3 Rate of reaction $= \frac{\Delta v}{\Delta t} = \frac{202-156✓}{90-50✓} = 1,15\ cm^3.s^{-1}$ ✓ (3)

5.4. Reactants are used up/concentration of HCl decreased ✓
Reaktante is opgebruik/konsentrasie van HCl het afgeneem ✓ (1)

5.5

Marking criteria:
- Substituting 24 $g.mol^{-1}$✓ & 2 $g.mol^{-1}$✓ in the correct formula
- Using the ratios Mg : H_2 = 1 : 1✓
- Final answer✓

Nasienkriteria:
- *Vervang 24 $g·mol^{-1}$ ✓ & 2 $g·mol^{-1}$ in die korrekte formule*
- *Gebruik die verhouding vir Mg : H_2 = 1:1*
- *Finale antwoord*

5.5.1 $n\ (Mg) = \frac{m}{M}$

$n\ (Mg) = \frac{0,24}{24✓} = 0,01$ mol

Mg : H_2 = 1 : 1; $n\ (H_2)$ = 0,01 mol✓

$n\ (H_2) = \frac{m}{M}$

$0,01 = \frac{m}{2}✓$ m = 0,02 g✓ (4)

5.5.2 Increase/*Toeneem*✓ (1)
[15]

QUESTION 6/*VRAAG 6*:

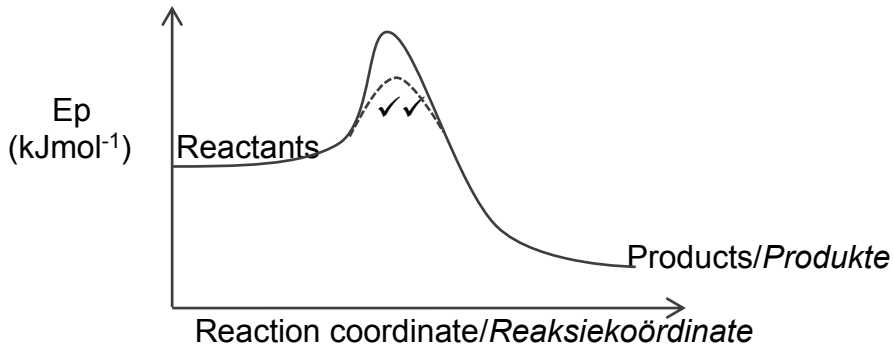
6.1

6.1.1 Minimum energy needed for a reaction to take place✓✓
Minimum energie benodig vir 'n reaksie om plaas te vind ✓✓ (2)

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6.1.2 $E_a = 480 - 120, = 360(kJ \cdot mol^{-1})$ ✓ (1)

6.1.3



(2)

6.2.1 S ✓ (1)

6.2.2
- An increase temperature increases average kinetic energy of the particles✓
- More effective collision per unit time✓
- Rate of reaction will increase✓
- *'n Toename in temperatuur verhoog die gemiddelde kinetiese energie van die deeltjies*✓
- *Meer effektiewe botsings per tydseenheid*✓
- *Reaksietempo sal toeneem*✓

OR/*OF*

- A decrease temperature decreases the average kinetic energy of the particles✓
- Lesser effective collision per unit time✓
- Rate of reaction will decrease✓
- *'n Afname in temperatuur verlaag die gemiddelde kinetiese energie van die deeltjies*✓
- *Minder effektiewe botsings per tydseenheid*✓
- *Reaksietempo sal afneem*✓

(3)
[9]

QUESTION 7/*VRAAG* 7:

7.1.1 When the equilibrium in a closed system is disturbed, the system will re-instate a new equilibrium by favouring the reaction that will oppose the disturbance.✓✓*Wanneer die* ewewig in 'n geslote sisteem versteur word, sal die sisteem 'n nuwe ewewig instel, deur die reaksie wat die versteuring teenwerk te bevoordeel.✓✓(**2 or 0**) (2)

7.1.2

CALCULATIONS USING NUMBER OF MOLES
BEREKNENINGE WAT GETAL MOL GERBUIK

Marking criteria:

a) Calculating initial n(H_2S) substitute 34✓ in the formula n=n/M
b) Change in n (S_2) = equilibrium n(S_2) - initial n(S_2) ✓
c) Using ratio: H_2S : H_2 : S_2 = 2: 2: 1✓
d) Equilibrium n(H_2) = intial n(H_2) + change n(H_2)
Equilibrium n(H_2S) = intial n(H_2S) - change n(H_2S) ✓
e) Divide equilibrium amounts H_2S and H_2 and S_2 by 1,25 dm^3✓
f) Correct Kc expression in square brackets✓
g) Substitution of equilibrium concentrations into Kc expressions✓
h) Final answer. 0,24✓

Nasienkriteria:

a) Bereken die aanvanklike n(H_2S) vervang 34✓ in formule n=m/M
b) Verandering in n(S_2) = ewewig n(S_2) – aanvanklike n(S_2) ✓
c) Gebruik die verhouding: H_2S : H_2 : S_2 = 2: 2: 1✓
d) Ewewig n(H_2) = aanvanklik n(H_2) + verandering in n(H_2)
Ewewig n(H_2S) = aanvanklik n(H_2S) – verandering in n(H_2S) ✓
e) Deel ewewigswaardes van H_2S en H_2 en S_2 by 1,25 dm^3✓
f) Korrekte Kc uitdrukking in vierkantige hakkies✓
g) Substitusie van ewewiskonsentrasies in die Kc uitdrukking✓
h) Finale antwoord: 0,24✓

OPTION 1/OPSIE 1

mol	H_2S	H_2	S_2
Initial/ *Aanvanklik*	n= $\frac{3,4}{34}$✓ = 0,1	0	0
Change / *Verandering*	0.074	0,074	0,037✓ ratio✓
Equilibrium/ *Ewewig*	0,026	0,074✓	0,037
Concentration/ *Konsentrasie*	$\frac{0.026}{1,25}$= 0,0208	$\frac{0,074}{1,25}$= 0,0592	$\frac{0,037}{1,25}$ = 0,0296 divide by 1,25✓

$Kc = \frac{[H_2] \cdot [S_2]}{[H_2S]^2}$ ✓

$= \frac{(0,0592)^2 \times (0,0296)}{(0,0208)^2}$ ✓

= 0,24✓

CALCULATIONS USING CONCENTRATIONS
BEREKNENINGE WAT KONSENTRASIE GERBUIK

Marking criteria:

a) Calculating initial n(H_2S) substitute 34✓ in the formula n=m/M
b) Divide initial amounts H_2S by 1,25 dm^3✓
c) Change in c (S_2) = equilibrium c(S_2) - initial c(S_2) ✓
d) Using ratio: $H_2S : H_2 : S_2$ = 2:2:1✓
e) Equilibrium c(H_2) = intial c(H_2) + change c(H_2)
Equilibrium c(H_2S) = intial c(H_2S) - change c(H_2S) ✓
f) Correct Kc expression in square brackets✓
g) Substitution of equilibrium concentrations into Kc expressions✓
h) Final answer. 0,24✓

Nasienkriteria:

a) Bereken die aanvanklike n(H_2S) ✓vervang 34 in die formule n=m/M
b) Deel ewewigswaardes van H2S by 1,25 dm^3✓
c) Verandering in n(S_2) = ewewig n(S_2) – aanvanklike n(S_2) ✓
d) Gebruik die verhouding: $H_2S : H_2 : S_2$ = 2:2:1✓
e) Ewewig c(H_2) = aanvanklik c(H_2) + verandering in c(H_2)
Equilibrium c(H_2S) = intial c(H_2S) – verandering in c(H_2S) ✓
f) Korrekte Kc uitdrukking in vierkantige hakkies✓
g) Substitusie van ewewiskonsentrasies in die Kc uitdrukking✓
h) Finale antwoord: 0,24✓

OPTION 2/*OPSIE 2*

Concentration/*Konsentrasie*	H_2S	H_2	S_2
Initial/ *Aanvanklik*	n= $\frac{3,4}{34✓}$ = 0,1/1.25✓= 0,08	0	0
Change in concentrations *Verandering in konsentrasie*	0.0592	0,0592	0,0296✓ ratio✓
Equilibrium concentrations *Ewewigskonsentrasies*	0,0208	0,059✓	0,0296

$Kc = \frac{[H_2]^2 \cdot [S_2]}{[H_2S]^2}$ ✓

$= \frac{(0,0592)^2 \times (0,0296)}{(0,0208)^2}$ ✓

= 0,24✓



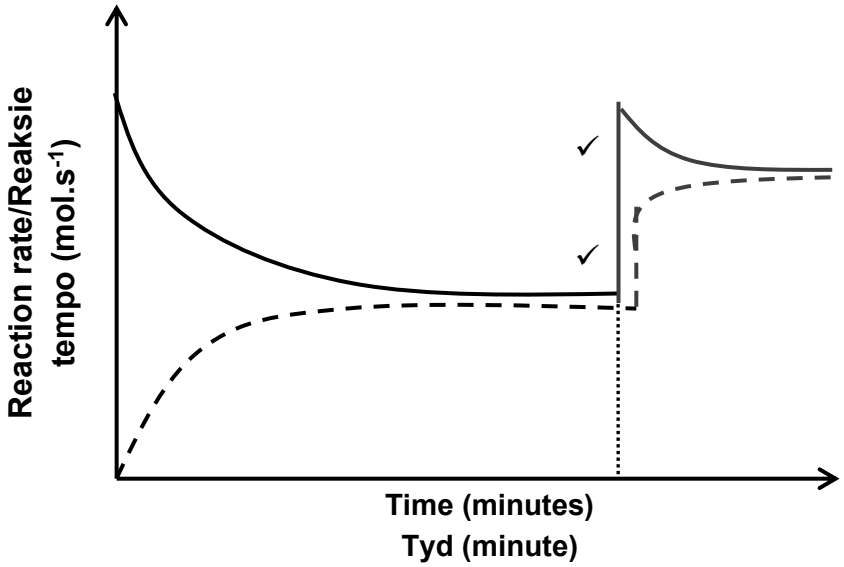
(8)

7.2

7.2.1 Endothermic✓/*Endotermies* ✓ (1)

7.2.2 Increase in temperature increases Kc value, and then the forward reaction is favoured✓. Increase in temperature favours endothermic reaction✓
'n Verhoging in temperatuur verhoog die Kc waarde, die voorwaartse reaksie is bevoordeel. ✓*'n Verhoging in temperatuur bevoordeel die endotermiese reaksie*✓ (2)

7.2.3



Marking criteria:
- Both lines are up✓
- Solid line is longer than dotted line✓

Nasienkriteria:
- *Beide lyne gaan op* ✓
- *Soliede lyn is langer as stippellyn* ✓

(2)
[15]

QUESTION 8/*VRAAG 8*:

8.1 Weak acid ✓ It ionises incompletely/does not ionise completely in water✓ (to form a low concentration of H_3O^+)/
Swak suur✓ Dit ioniseer onvolledig/ioniseer nie volledig in water nie✓(om 'n lae konsentrasie H_3O^+ ione te vorm) (2)

8.2 $[H_3O^+] = [HCO_3^-] = 0,012$ mol.dm^{-3}✓
n = cV
= 0,012 x 0,5 ✓
n = 0.006 mol ✓ (3)

Marking Criteria:
- Ratio $[H_3O^+] = [HCO_3^-]$✓
- Substitution✓ on c = n/V
- Answer✓

Nasienriglyne:
- *Verhouding $[H_3O^+] = [HCO_3^-]$✓*
- *Substitusie✓ in c = n/V*
- *Antwoord✓*

8.3

8.3.1.

Marking criteria:
- Formula c = n/V✓
- Substitution✓
- Using ratio 1(OH^-) : 1(NaOH) correctly ✓

Nasienriglyne:
- *Formule c = n/V✓*
- *Substitusie✓*
- *Gebruik verhouding 1(OH^-) : 1(NaOH) korrek ✓*

$n_{(NaOH)}$ = cV✓
$n_{(NaOH)}$ = 0,25 x 0,75✓
= 0,1875 mol
Therefore n(OH^-) = 0,1875 mol ✓ (3)

8.3.2 **Positive marking from 8.2 & 8.3.1/ *Positiewe merk vanaf 8.2 & 8.3.1***

Marking criteria:
- Using ratio 1 (OH^-) : 1 (HCO_3^-) correctly✓(0,006 mol of acid neutralises 0,006 mol of base)
- n(OH^-) in excess 0,1875 - 0,006✓ = 0,1815mol
- Substitution ✓on c = n/v
- $[H_3O^+] = 10^{-14}/0,102$ ✓
- pH = -log $[H_3O^+]$ ✓
- Substitution on formula✓
- Final answer✓

Nasienriglyne:
- *Gebruik verhouding 1(OH^-) : 1(HCO_3^-) korrek ✓(0,006 mol suur neutraliseer 0,006 mol basis)*
- *n(OH^-) in oormaat 0,1875- 0,006✓ = 0,1815mol*
- *Substitusie ✓on c = n/v*
- *$[H_3O^+] = 10^{-14}/0,102$ ✓*
- *pH = -log $[H_3O^+]$ ✓*
- *Substitusie in formule✓*
- *Finale antwoord✓*

OPTION 1/*OPSIE 1*

0,006 mol of acid neutralises 0,006 mol of base ✓/*0,006 mol suur neutraliseer 0,006 mol basis* ✓
$n(OH^-)$ in excess/*in oormaat* 0,1875- 0,006✓= 0,1815 mol
$[OH^-] = n/V = 0,1815/(0,5+0,75)$ ✓
$= 0,1452 \text{ mol.dm}^{-3}$
$K_w = [H_3O^+][OH^-] = 1x10^{-14}$,
therefore/*dus* $[H_3O^+] = 10^{-14}/0,1452$ ✓
$= 6,89x10^{-14}$
$pH = -\log [H_3O^+]$ ✓
$pH = -\log(6,89x10^{-14})$✓
pH = 13,16✓

OPTION 2/*OPSIE 2*

0,006 mol of acid neutralises 0,006 mol of base ✓/*0,006 mol suur neutraliseer 0,006 mol basis* ✓
$n(OH^-)$ in excess/*oormaat* 0,1875 - 0,006✓ = 0,1815 mol
$[OH^-] = n/V = 0,1815/(0,5 + 0,75)$ ✓
$= 0,1452 \text{ mol.dm}^{-3}$
$pOH = -\log[OH^-]$✓
$= -\log(0,1452)$ ✓
= 0.84
pH = 14 - pOH
pH = 14 - 0,84✓
pH = 13,16✓ (7)

[15]

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QUESTION 9/*VRAAG 9*:

9.1 Substance which accepts electron/ electron acceptors✓✓/ *Stof wat elektrone opneem/ontvang*✓✓ (2)

9.2 $X^{2+} + 2e^- \rightarrow X$✓✓ (2)

9.3 $E^{\ominus}_{cell} = E^{\ominus}_{reduction} - E^{\ominus}_{oxidation}$✓
0,47✓ = $E^{\ominus}_{cathode}$ – (-0.13) ✓
$E^{\ominus}_{cathode}$ = 0,34 v✓
Metal/*Metaal* **X** = Cu/Copper✓/ Koper✓ (5)

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NOTE:
- Accept any other correct formula from the data sheet.
- Any other formula using unconventional abbreviations, e.g. $E^{\ominus}_{cell} = E^{\ominus}_{OA} - E^{\ominus}_{RA}$ followed by correct substitutions: ¾

LET WEL:
- *Aanvaar enige ander korrekte formule vanaf gegewensblad.*
- *Any other formula using unconventional abbreviations, e.g. $E^{\ominus}_{cell} = E^{\ominus}_{OA} - E^{\ominus}_{RA}$ followed by correct substitutions: ¾*

9.4 Pb(s)lPb^{2+}(aq)✓ ll✓ Cu^{2+}(aq)lCu (s)✓ (3)

Marking criteria/*Nasienriglyne*:
- Oxidation/*Oksidasie* ✓ Double line/*Dubbellyn*(ll)✓ Reduction/*Reduksie*✓
- Ignore the phases/*Ignoreer fases*

9.5 Less than 0.47 V✓/*Minder as 0.47 V*✓
As the reaction proceeds/*Soos die reaksie voortgaan*
- [Pb^{2+}] increases and [Cu^{2+}] decreases✓/*[Pb^{2+}] verhoog en [Cu^{2+}] verlaag*✓
- reverse reaction is favoured✓/*terugwaartse reaksie is bevoordeel*✓ (3)

[15]

QUESTION 10/*VRAAG 10*:

10.1 **ANY ONE: (2 or 0)**

- Process in which <u>electrical energy is converted to chemical energy</u>✓✓
- Process in which <u>electric current flows through an electrolyte</u>✓✓

***ENIGE EEN*: (2 or 0)**

- *Proses waar <u>elektriese stroom deur 'n elektroliet vloei</u>*✓✓
- *Proses waar <u>elektriese energie omgeskakel word in chemiese energie</u>*✓✓ (2)

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10.2 Copper Sulphate/$CuSO_4$✓ **Accept** : Copper ions/Cu^{2+}
Kopersulfaat/ $CuSO_4$✓***Aanvaar:*** *Koperione/Cu^{2+}* (1)

10.3 Cathode/*Katode*✓

$Cu^{2+} + 2e^- \rightarrow Cu$✓✓ (3)

10.4 <u>Ag(s) is a weaker reducing agent</u> ✓<u>than Cu(s)</u> ✓and will therefore <u>not</u> be able to <u>reduce cu^{2+}(aq) to Cu(s)</u> ✓/*<u>Ag(s) is 'n swakker reduseermiddel</u>*✓ *<u>as Cu(s)</u>* ✓ *en sal dus <u>nie Cu^{2+} na Cu reduseer nie</u>*.✓

OR/*OF*

<u>Cu(s) is a stronger reducing agent</u> ✓<u>than Ag(s)</u> ✓and will therefore not be able to <u>reduce cu^{2+}(aq) to Cu(s)</u> ✓/ *<u>Cu(s) is 'n sterker reduseermiddel</u>* ✓ *<u>as Ag(s)</u>* ✓ *en sal dus <u>nie Cu^{2+} na Cu reduseer nie</u>*.✓ (3)

[9]

TOTAL/*TOTAAL*: 150

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