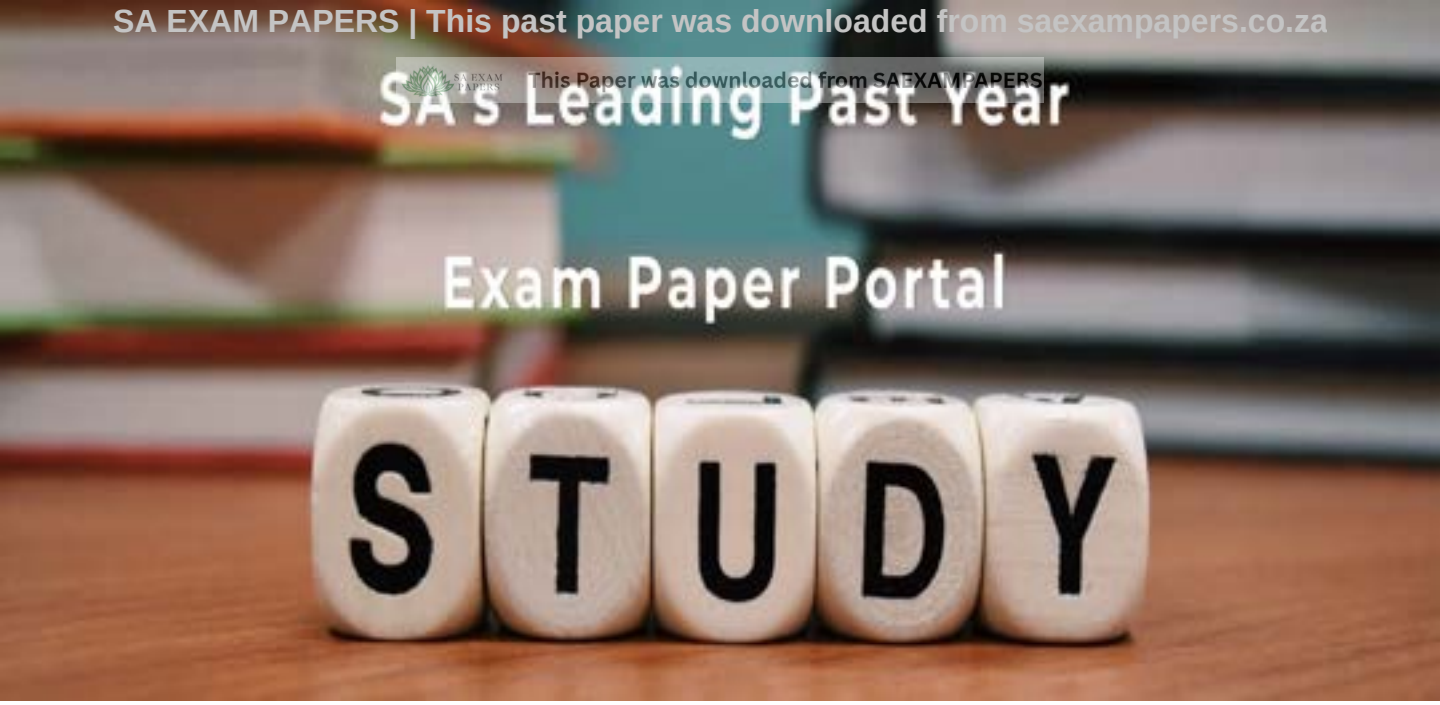


education

Department:
Education
North West Provincial Government
REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT
PROVINSIALE ASSESSERING

GRADE/*GRAAD* 12

PHYSICAL SCIENCES: CHEMISTRY (P2)
FISIESE WETENSKAPPE: CHEMIE (V2)
JUNE/*JUNIE* 2025
MARKING GUIDELINES
NASIENRIGLYNE

Marks/*Punte*: 150

These marking guidelines consists of 13 pages.
Hierdie nasienriglyne bestaan uit 13 bladsye.

QUESTION/*VRAAG* 1

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

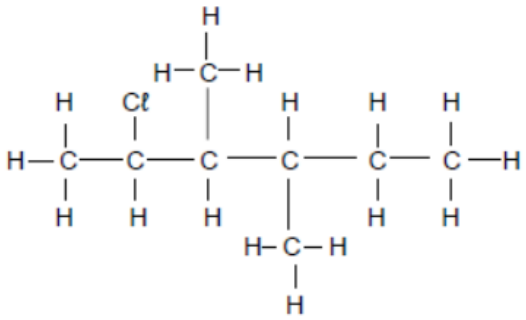
[20]

QUESTION/*VRAAG* 2

2.1 A chemical formula that indicates the element and numbers of each of the atoms in a molecule. ✓✓
'n Chemiese formule wat die element en die aantal atome van elk in 'n molekuul aandui. **(2 or 0)** (2)

2.2.1 $C_8H_{17}C\ell$ ✓ (1)

2.2.2



Marking Criteria/*Nasienkriteria*	**Allocation/ *toekenning***
Substituents correctly placed/*Vertakkings korrek geplaas*	✓
Six carbons on the parent chain./Ses koolstowwe in die hoofstam	✓
NOTE: Penalise when any hydrogen or bond is omitted. ***NOTA**: Penaliseer indien enige watersof of bindings weggelaat is*	

(2)

2.2.3 SECONDARY✓/SEKONDÊR
The carbon with(bonded to/attached to) the halogen/functional group is bonded/attached to two other carbon atoms.✓✓
Die koolstof met (gebind aan/geheg aan) die halogeen/funksionele groep is gebind/geheg aan twee ander koolstofatome (3)

2.3.1 Carboxyl (group) ✓/*Karboksiel (groep)* (1)

2.3.2 FUNCTIONAL ✓/*FUNKSIONEEL*
the organic compounds that have the same molecular formula✓ but different functional groups✓/belongs to different homologous series.
die organiese verbindings met dieselfde molekulêre formule, maar verskillende funksionele groepe/behoort aan verskillende homoloë reekse (3)

2.3.3 Methyl✓ ethanoate✓/*Metieletanoaat* (2)

2.4.1 2,2,4-trimethylpentane✓✓/*2,2,4–trimetielpentaan*

Criteria/*Kriteria*	**Allocation/ *Toekenning***
Correct stem (Pentane)/*Korrekte stam (Pentaan)*	✓
Substituent (trimethyl)/*Substituente (trimetiel)*	✓
IUPAC name completely correct including numbering, sequence, hyphens and commas./*IUPAC-naam heeltemal korrek insluitende nommering, volgorde, koppeltekens en kommas.*	✓

(3)

2.4.2 C_nH_{2n+2} ✓ (1)

2.4.3 $2C_8H_{18}$ ✓ + $25O_2 \rightarrow 16CO_2 + 18H_2O$ ✓ ✓balancing/*balansering* (3)
[21]

QUESTION/*VRAAG* 3

3.1.1 How does chain length affect the boiling point? ✓✓
OR
What is the relationship between chain length/molecular mass/number of carbon atoms and boiling point?

Hoe sal kettinglengte die kookpunt beïnvloed?
OF
Wat is die verhouding tussen kettinglengte/molekulêre massa/aantal koolstof atome en kookpunt? (2)

3.1.2 Straight chain alkanes/*Reguit keting alkane*✓

Accept/*Aanvaar*: Homologous series/Functional group/Alkanes/*Homoloë reeks/Funksionele groep/Alkane* (1)

3.2 Yes ✓/*Ja*
investigation has only one independent variable. ✓/Only chain length was varied/D*ie ondersoek het net een onafhanklike veranderlike.* /*Slegs kettinglengte was verander.* (2)

3.3 The pressure exerted by a vapour at equilibrium with its liquid in a closed system. ✓✓
Die druk uitgeoefen deur 'n damp in ewewig met sy vloeistof in 'n geslote sisteem. (2)

3.4 PENTANE✓/*PENTAAN*

- Pentane has a shorter chain length ✓ than hexane/*Pentaan het 'n korter ketting lengte as heksaan*
- Pentane has weaker intermolecular forces/London forces✓ than hexane/*Pentaan het swakker intermolekulêre kragte/Londonkragte as heksaan*
- Less energy is needed to overcome the intermolecular forces✓ between pentane molecules than between hexane molecules/*Minder energie is nodig om intermolekulêre kragte tussen pentaan te oorkom as tussen heksaan molekules.*

OR/*OF*

- Hexane has a longer chain length✓ than pentane/*Heksaan het 'n langer ketting lengte as pentaan*
- Hexane has stronger intermolecular forces/London forces✓ than pentane/*Heksaan het sterker intermolekulêre kragte/London kragte as pentaan*
- More energy is needed to overcome the intermolecular forces✓ between hexane molecules than between pentane molecules/*Meer energie is nodig om intermolekulêre kragte te oorkom tussen heksaan as tussen pentaan molekules.* (4)

3.5.1 Butan-1-ol ✓ (1)

3.5.2
- Butan-1-ol has ONE site of hydrogen bonds ✓and Butanoic acid has TWO sites of hydrogen bonds.✓/*Butan-1-ol het een plek vir waterstofbindings en Butanoësuur het TWEE plekke vir waterstofbindings.*
- Butan-1-ol has weaker intermolecular forces ✓ than Butanoic acid./*Butan-1-ol het swakker intermolekulêre kragte as Butanoësuur.*

OR/*OF*

- Butanoic acid has stronger intermolecular forces than butan-1-ol/ *Butanoësuur het sterker intermolekulêre kragte as butan-1-ol.*

(3)
[15]

QUESTION/*VRAAG* 4

4.1.1 Addition/hydration ✓/*Addisie/hidrasie* (1)

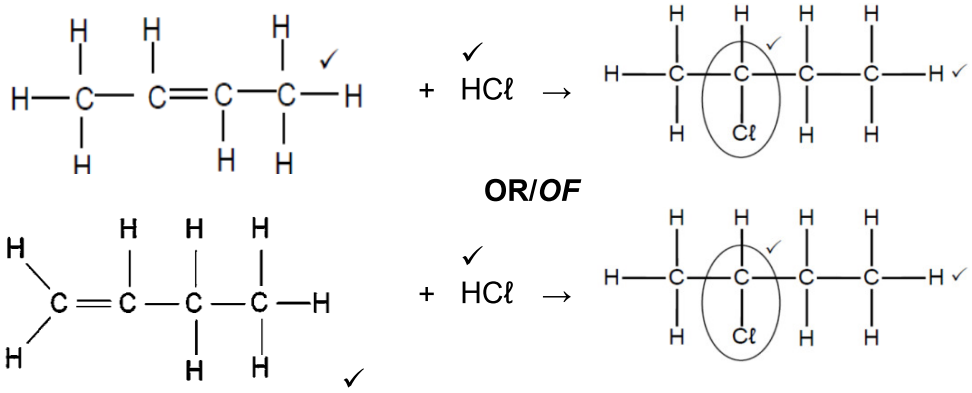
4.1.2 Substitution/hydrolysis ✓/*Substitusie/hidrolise* (1)

4.1.3 Elimination/dehydrohalogenation✓/*Eliminasie/dehidrohalogenering* (1)

4.2 Primary ✓P*rimêr* **Accept/*Aanvaar:***
Secondary/S*ekondêr* (1)

4.3 Elimination/removal of water from an alcohol ✓/
Eliminasie/ekstraksie van water uit 'n alkohol. (1)

4.4



(4)

4.5.1 H_2SO_4 ✓ (1)

4.5.2 $CH_3CH_2CH_2CH_2OH$ ✓ + CH_3CH_2COOH ✓→
$CH_3CH_2CH_2CH_2OOCCH_2CH_3$ ✓✓+ H_2O ✓ (5)

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

4.6 • Concentrated strong base/ (NaOH/KOH/LiOH)✓/*Gekonsentreerde sterk basis*
• Strong/More Heat ✓/*Sterk/meer hitte* (2)

4.7.1 Ni/Nickel/*Nikkel* or/of Pd/Palladium ✓ (1)

4.7.2 C_4H_{10} ✓ (1)
[21]

QUESTION/*VRAAG* 5

5.1.1 Activated complex ✓/*Geaktiveerde kompleks* (1)

5.1.2 $\Delta H = 173,2 - 182,8 = -9,6$ (kJ) ✓ (1)

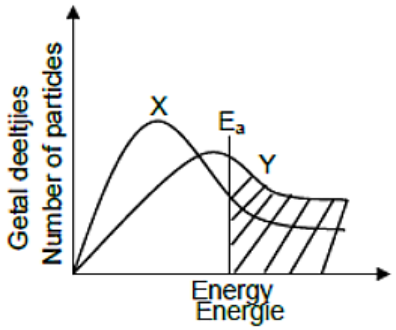
5.1.3 EXOTHERMIC✓/*EKSOTERMIES*
$\Delta H < 0$✓

OR/OF

Enthalpy of products is less than that of reactants/E*ntalpie van die produkte is minder as die van die reaktante* (2)

5.1.4 Decrease ✓/A*fneem* (1)

5.2.1



Marking Criteria/ *Nasienkriteria* of/*van* Y	**Allocation/ *toekenning***
Lower peak/*Laer piekwaarde*	✓
Peak shifted to the right/*Piek skuif na regs*	✓
More particles with sufficient kinetic energy/ *Meer deeltjies met genoegsame kinetiese energie*	✓

(3)

5.2.2 Higher than✓/G*roter as* (1)
[9]

QUESTION/*VRAAG* 6

6.1 **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/reaktanse per eenheid tyd.*
- *Verandering in hoeveelheid/getal mol/volume/massa van produkte/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)

6.2 3,0 (dm^3) ✓ (1)

6.3 Reaction rate/Reaksietempo $= \frac{\Delta V}{\Delta t}$

$= \frac{3,0-0}{20-0}$ ✓ ✓

$= 0,15\ dm^3 \cdot s^{-1}$ ✓ (3)

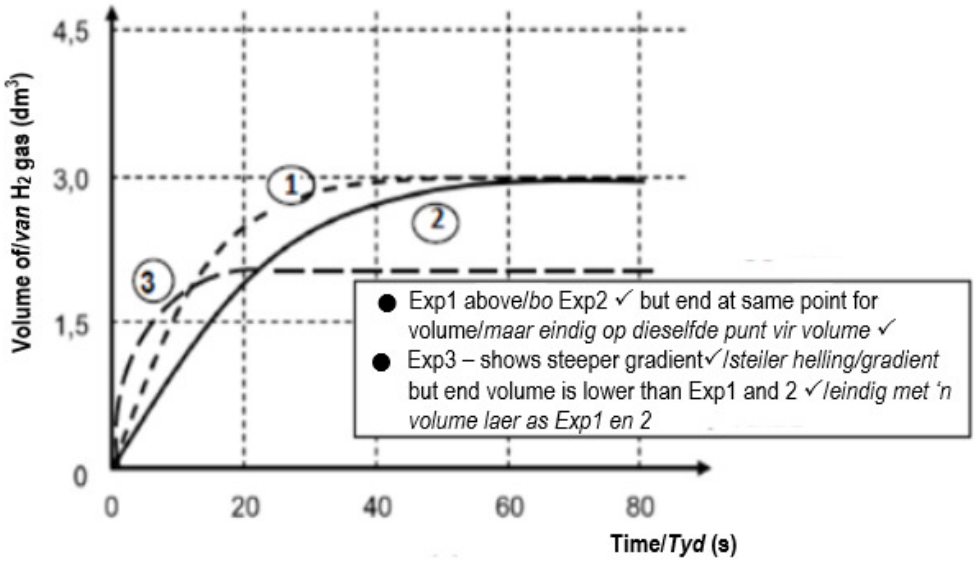
Note/*Nota*:
Penalize only ONCE if zero (0) is omitted at either the numerator or the denominator.
Penaliseer slegs EEN keer indien die nul (0) uitgelaat is by die noemer of teller.

6.4 Increases ✓/*Verhoog*

- Higher concentration will <u>increase the number of particles per unit volume</u>✓
- There will be <u>more particles with enough/sufficient kinetic energy</u> (E_k)✓ or <u>more particles with $E_k \geq E_A$ (Activation energy)</u>
- There will be <u>more effective collisions per unit time</u>✓ or the <u>frequency of effective collisions increases.</u>

- Hoër konsentrasie <u>verhoog die aantal deeltjies per volume-eenheid</u>
- Daar sal <u>meer deeltjies wees met genoeg/voldoende kinetiese energie (Ek)</u> of <u>meer deeltjies met $E_k \geq E_A$ (aktiveringsenergie)</u>
- Daar sal <u>meer effektiewe botsings per tydseenheid wees</u> of die <u>frekwensie van effektiewe botsings neem toe.</u> (4)

6.5



(4)
[14]

QUESTION/*VRAAG* 7

7.1.1 Increases ✓/*Vermeerder* (1)

7.1.2 Forward ✓/*Voorwaarts* (1)

7.1.3 **Marking criteria/*Nasienkriteria:***
If any one of the underlined key phrases in the **correct context** is omitted, deduct 1 mark./*Indien enige van die onderstreepte frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.*
The underlined phrases must be in the correct context. / *Die onderstreepte frases moet in die korrekte konteks wees.*

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

7.1.4
- Increase in temperature increases K_c ✓
- Increase in K_c indicates that the forward reaction has been favoured ✓
- Increase in temperature favours the endothermic reaction ✓
- Therefore the forward reaction is ENDOTHERMIC ✓

- *Toename in temperatuur verhoog K_c*
- *Toename in K_c dui aan dat die voorwaartse reaksie bevoordeel is*
- *Toename in temperatuur bevoordeel die endotermiese reaksie*
- *Daarom is die voorwaartse reaksie ENDOTERMIES* (4)

7.1.5 Add a catalyst ✓, increase pressure OR decrease volume.✓
Voeg 'n katalisator by, verhoog die druk OF verlaag die volume. (2)

7.2

	A_2 +	2B →	2AB
Initial/*Aanvangs (mol)*	x	2	0 ✓
Change/*Verandering*	-0,2	-0,4	0,4 ✓ ✓
Equilibrium/*Ewewig (mol)*	x – 0,2	1,6	0,4 ✓
[Equilibrium/*Ewewig*]	x – 0,2	1,6	0,4 ✓

RATIO/*VERHOUDING*

Addition for all 3
Optel van al 3

OR/*OF*

Conc only ✓
Slegs konsentrasie

	A_2 +	2B →	2AB
[Initial/*Aanvangs*] mol.dm^{-3}	x	2	0 ✓
Change/*Verandering*	-0,2	-0,4	0,4 ✓ ✓
[Equlibrium/*Ewewig*]	x – 0,2	1,6	0,4 ✓

RATIO
VERHOUDING

Addision of all 3
Addisie van al 3

$K_c = \frac{[AB]^2}{[A_2][B]^2}$ ✓

$= \frac{(0,4)^2}{(x - 0,2)(1,6)^2}$ ✓

$= 0,5$

$0,5[(x - 0,2)(1,6)^2] = (0,4)^2$

$\therefore 1,28x - 0,256 = 0,16$

$\therefore X = 0,325$ mol ✓

Marking criteria/*Nasien kriteria:*

- Initial mol/conc correctly indicated ✓
- Mol/conc of AB produced = 0,4 ✓
- Ratio applied correctly ✓
- Equilibrium mol: ✓ initial – used / initial + produced
- Equilibrium conc: ✓✓ initial – used / initial + produced
- Equilibrium mol ÷ 1 = eq conc ✓
- Correct K_C expression ✓
- Substitution of eq conc into K_C expression ✓
- Final answer ✓

- *Aanvanklike mol/kons korrek aangedui*
- *Mol/kons van AB geproduseer = 0,4*
- *Verhouding korrek toegepas*
- *Ewewigs mol: aanvanklik – gebruik / aanvanklike + geproduseer*
- *Ewewig kons: aanvanklik – gebruik / aanvanklike + geproduseer*
- *Ewewig mol ÷ 1 = ewewig kons*
- *Korrekte K_C-uitdrukking*
- *Vervanging van ewewig kons in K_C-uitdrukking*
- *Finale antwoord*

(8)
[18]

QUESTION/*VRAAG* 8

8.1.1 A standard solution is one whose concentration is precisely known ✓✓
'n Standaardoplossing is 'n oplossing waarvan die konsentrasie presies bekend is. (2)

8.1.2

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
$C_1V_1 = C_2V_2$ (0.63 x 0,05)✓ = C_2 x 1,0✓ C_2 = 0,0315 mol.dm^{-3}✓ ***(accept/aanvaar: 0,032* or/*of 0,03)***	n(NaOH) = c.V✓ = 0,63 x 0.05✓ = 0.0315 mol.dm^{-3}✓ ***(accept/aanvaar: 0,032* or/*of 0,03)***

(3)

8.1.3 **Positive marking from QUESTION 8.1.2/*Positiewe nasien van VRAAG* 8.1.2**

n(NaOH) = C V
= 0,0315 x 0,04 ✓
= 1,26 x 10^{-3} mol ✓

n(NaOH) = n($C_2H_2O_4$)
2 : 1

n($C_2H_2O_4$) = 6,3 x 10^{-4} mol ✓

m($C_2H_2O_4$) = n x M ✓
= 6,3 x 10^{-4} x 90 ✓
= 0,0567 g

$$\% \text{ purity} = \frac{0{,}0567}{0{,}25} \checkmark \times \frac{100}{1}$$
= 22,68 % ✓

(7)

8.2.1

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
Kw = $[H_3O^+][OH^-]$ = 1 x 10^{-14} ✓	pOH = -log$[OH^-]$ ✓
1 x 10^{-14} = $[H_3O^+]$ (0,20)	= -log(0,2)
$[H_3O^+]$ = 5 x 10^{-14} ✓	= 0,70 ✓
pH = -log$[H_3O^+]$ ✓	pH + pOH = 14 ✓
= -log (5 x 10^{-14})	pH + 0,70 = 14
= 13,3 ✓	pH = 13,3 ✓

(4)

8.2.2 Is the point during titration where the indicator changes colour. ✓✓
OR the exact point of neutralization
Die punt tydens titrasie waar die indikator van kleur verander.
OF *die presiese punt van neutralisasie.* **(2 or/*of* 0)** (2)

8.2.3

OPTION/*OPSIE* 1

$\frac{CaVa}{CbVb} = \frac{na}{nb}$

$\frac{Ca \times 15 \checkmark}{(0,2)(30,25) \checkmark} = \frac{1}{1}$ ✓(ratio)

$Ca = 0,40 \text{ mol·dm}^{-3}$ ✓

- Substitution on LHS ✓✓/*Vervanging aan linkerkant*
- mol ratio on RHS ✓/*mol verhouding aan regterkant*
- Final answer ✓/*Finale antwoord*

OPTION/*OPSIE* 2

n (base) = cV
= 0,2 X 0,03025 ✓
= 0,00605 mol

n(base) : n(acid)
1:1 ✓

$C_a = n/V$
= 0,00605/0,015✓
= 0,40 mol·dm^{-3}✓

- Substitution of 0,2 X 0,03025 ✓/ *Vervanging van* 0,2 X 0,03025
- mol ratio ✓/*mol verhouding*
- Final answer ✓/*Finale antwoord*

(4)

8.2.4 **POSITIVE MARKING FROM QUESTION 8.2.3/*POSITIEWE NASIEN VAN VRAAG* 8.2.3**

OPTION/*OPSIE* 1

$M(CH_3COOH)$ = 2(12) + 4(1) + 2(16)
= 60 g·mol^{-1} ✓

$n(CH_3COOH)_{\text{diluted/verdun}}$ = C x V
= 0,40 x 0,25 ✓
= 0,1 mol

$m(CH_3COOH)_{\text{diluted/verdun}}$ = n x M
= 0,1 x 60
= 6,0 g

$\%CH_3COOH$ in vinegar/*asyn* = $\frac{6,0}{25}$✓x $\frac{100}{1}$✓

= 24,0 % ✓

- M of/*van* CH_3COOH ✓
- Substitution/*vervang* 0,40 x 0,25✓
- m of/*van* 25g in vinegar/*asyn* ✓
- Substitution/*vervang* of/*van* % ✓
- Final answer/*Finale antwoord* ✓

OPTION/*OPSIE* 2

$M(CH_3COOH) = 2(12) + 4(1) + 2(16)$
$= 60\ g \cdot mol^{-1}$ ✓

$m(CH_3COOH)_{diluted/verdun} = C \times V$
$= \underline{0,40 \times 60}$ ✓ x 0,25 ✓
$= 6,0\ g$

- M of/*van* CH_3COOH ✓
- Substitution/*vervang* 0,40 x 0,25 ✓
- m of/*van* 25g in vinegar/*asyn* ✓
- Substitution/*vervang* of/*van* % ✓
- Final answer/*Finale antwoord* ✓

% CH_3COOH in vinegar/*asyn* $= \frac{6,0}{25}$ ✓ x $\frac{100}{1}$ ✓

$= 24,0\ \%$ ✓ (5)

8.3.1 Reaction of a salt with water. ✓✓
Reaksie van 'n sout met water. **(2 or/*of* 0)** (2)

8.3.2 Increases ✓/*Toeneem*

$CH_3COO^- + H_2O \rightarrow CH_3COOH + OH^-$

OR/*OF*

$CH_3COONa + H_2O \rightarrow CH_3COOH + NaOH$

(*reactants ✓*/reaktante* , products✓*/produkte)
Note/Nota: It has to be a reaction/*dit moet 'n vergelyking wees.* (3)
[

TOTAL/*TOTAAL:* *150*