education

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REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT
PROVINSIALE ASSESSERING

GRADE/*GRAAD* 12

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

JUNE/*JUNIE* 2026

MARKING GUIDELINES/*NASIENRIGLYNE*

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Marks/*Punte*: 150

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

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QUESTION/*VRAAG* 1

1.1 D ✓✓ (2)

1.2 B ✓✓ (2)

1.3 C ✓✓ (2)

1.4 D ✓✓ (2)

1.5 A✓✓ (2)

1.6 C ✓✓ (2)

1.7 C ✓✓ (2)

1.8 D ✓✓ (2)

1.9 C ✓✓ (2)

1.10 D ✓✓ (2)
[20]

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QUESTION/*VRAAG* 2

2.1 Molecules containing carbon atoms./
Molekules wat koolstofatome bevat ✓✓ ***(2 or/of 0)*** (2)

2.2.1 27,5 % ✓ (1)

2.2.2 $n = \frac{m}{M}$ ✓

$n(C) = \frac{62,1}{12}$
$= 5,175$ mol

$n(H) = \frac{10,1}{1}$
$= 10,1$ mol ✓

$n(O) = \frac{27,1}{16}$
$= 1,71875$ mol

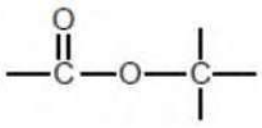
Ratio/*Verhouding*: C : H : O
3 : 6 : 1

Empirical formula/ *Empiriese formule*: C_3H_6O ✓

n (integer/*heelgetal*) $= \frac{116}{58}$ ✓
$= 2$

Molecular formula/*Molekulêre formule*: $C_6H_{12}O_2$ ✓ (5)

2.2.3



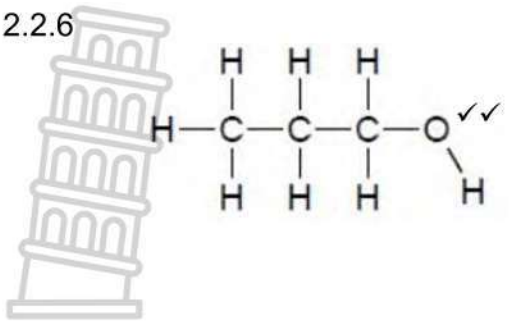
✓✓ (2)

2.2.4 Propyl propanoate/*Propielpropanoaat* ✓✓ (2)

2.2.5 H_2O ✓ (1)

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2.2.6



Marking criteria:
• Functional group correct.✓
• Whole structural formula correct.✓
NOTE: Penalise when hydrogen or bond is omitted
Nasienkriteria:
• Funksionele groep korrek. ✓
• Hele struktuurformule korrek.✓
NOTA: *Penaliseer indien enige waterstowwe of bindings gemis is* (2)

2.3.1 A bond or an atom or a group of atoms that determine(s) the physical or chemical properties of a group of organic compounds.✓✓
'n Binding of 'n atoom of 'n groep atome wat die fisiese en chemiese eienskappe van 'n groep organiese verbindings bepaal. **(2 or/*of* 0)** (2)

2.3.2 A ✓double bond or multiple bond between carbon/C atoms. ✓✓
A een of meer meervoudige bindings tussen C-atome in hul koolwaterstofkettings (3)

2.3.3 3-ethyl-2,4-dimethylhex-3-ene/*3-etiel-2,4-dimetielheks-3-een*. ✓✓✓

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

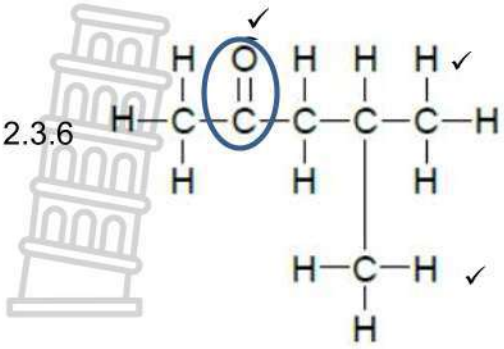
(3)

2.3.4 C_nH_{2n} ✓ (1)

2.3.5 Carbonyl (group)/*Karboniel (groep)* ✓ (1)

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2.3.6



Marking criteria	**Nasien *kriteria***
• Carbonyl group on the 2nd C-atom. ✓ • Five C-atoms in the parent chain.✓ • Whole structure correct.✓ NOTE: Penalise when a hydrogen or a bond is ommitted	• Karboniel groep op die 2de C-atoom. • *Vyf koolstowwe in die hoofstam* • *Hele struktuur korrek* *LET WEL: Penaliseer indien enige waterstowwe of bindings gemis is*

(3)
[28]

QUESTION/*VRAAG* 3

3.1 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 or/*of* 0)** (2)

3.2 B✓, Compound B has weaker intermolecular forces (than compound C).✓✓
Verbinding B het swakker intermolekulêre kragte (as verbinding C)
OR/*OF*
Compound C has stronger intermolecular forces (than compound B)
Verbinding C het sterker intermolekulêre kragte (as verbinding B) (3)

3.3 C/D✓ (1)

3.4 C – Butanal/*Butanaal* ✓✓
OR/*OF*
D – methyl propanoate/propyl methanoate/ethyl ethanoate.
metielpropanoaat/propielmetanoaat/etieletanoaat (2)

3.5 Forces between molecules in which hydrogen is covalently bonded to nitrogen, oxygen or fluorine. ✓✓
Kragte tussen molekule waarin waterstof kovalent gebind is aan stikstof, suurstof of fluoor **(2 or/*of* 0)** (2)

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3.6 D,

- compound D has two sites of hydrogen bonds ✓, compound A has one site of hydrogen bonds✓.
- compound D has stronger intermolecular forces/hydrogen bonds ✓than compound A/compound A has weaker intermolecular forces than compound D
- more energy is required to overcome the intermolecular forces✓ between molecules of compound D than between molecules of compound A/less energy is required to overcome intermolecular forces between molecules of compound A than compound D

- *verbinding D het twee plekke van waterstofbindings, verbinding A het een plek van waterstofbindings*
- *verbinding D het sterker intermolekulêre kragte/waterstofbindings as verbinding A/verbinding A het swakker intermolekulêre kragte as verbinding D*
- *meer energie is nodig om die intermolekulêre kragte tussen molekules van verbinding D te oorkom as tussen molekules van verbinding A/minder energie is nodig om intermolekulêre kragte tussen molekules van A te oorkom* (4)

3.7 Decreases/*Verlaag* ✓ (1)
[15]

QUESTION/*VRAAG* 4

4.1 The elimination of hydrogen and a halogen from a haloalkane. ✓✓
Die eliminasie van waterstof en 'n halogeen uit 'n haloalkaan **(2 or/*of* 0)** (2)

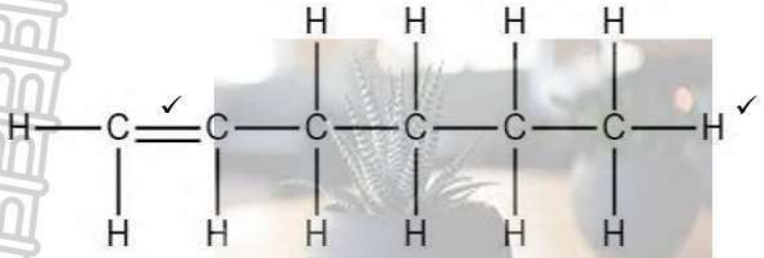
4.2 Step/*Stap* 1:

$$CH_3CH_2CH_2CH_2CHBrCH_3 \xrightarrow[\Delta]{NaOH(c)} \checkmark CH_3CH_2CH_2CH{=}CHCH_3 \checkmark\checkmark + H_2O\checkmark + NaBr\checkmark$$

Step/*Stap* 2: $CH_3CH_2CH_2CH{=}CHCH_3 + H_2\checkmark \rightarrow CH_3CH_2CH_2CH_2CH_2CH_3 \checkmark\checkmark$ (8)

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4.3



Criteria	***Kriteria***
• Correct functional group ✓	• *Korrekte funksionele groep*
• Six carbons on the parent chain✓ NOTE: Penalise when any hydrogen or bond is omitted	• *Ses koolstowwe in die hoofstam* *LET WEL: Penaliseer indien enige waterstowwe of bindings gemis is*

(2)

4.4.1 Ethane/*Etaan* ✓✓ (2)

4.4.2 Alkene/*Alkeen* ✓ (1)

4.4.3 C_6H_{12}✓ → $2C_2H_6 + C_2H_4$✓ ✓balancing/*balansering* (3)

4.4.4 Water ✓ and Carbon dioxide✓
Water en Koolstofdioksied (2)
[20]

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QUESTION/*VRAAG* 5

5.1 Hydrogen/*Waterstof* (gas). ✓ (1)

5.2 50s✓, volume of gas produced remained constant from 50s.✓✓
die volume gas geproduseer het konstant gebly vanaf 50s (3)

5.3 Dilute HCl contain a small amount (number of moles) of acid in proportion to the volume of water. ✓✓
Verdunde HCl bevat 'n klein hoeveelheid (aantal mol) suur in verhouding tot die volume water. **(2 or/*of* 0)** (2)

5.4 Zn ✓ (1)

5.5

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

ANY ONE:

- Change in concentration ✓ of reactants or products 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. ✓✓ **(2 or 0)**
- Rate of change in concentration/amount/number of moles/volume/ mass. ✓✓ **(2 or 0)**

ENIGE EEN:

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

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

$= \frac{(70 - 54)\ ✓}{(50 - 30)\ ✓}$

$= 0{,}8\ cm^3 \cdot s^{-1}$ ✓ (3)

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5.7
- Decrease in surface area provides <u>less surface</u> for collisions to occur✓
- <u>Less particles with sufficient kinetic energy/$E_K \geq E_A$</u>✓
- <u>Less effective collisions per unit time</u>✓/frequency of effective collisions decreases
- Reaction rate decreases✓
- *Afname in oppervlak gee <u>minder oppervlak</u> vir botsings om plaas te vind*
- *<u>Minder deeltjies met voldoende kinetiese energie/EK ≥ EA</u>*
- *<u>Minder effektiewe botsings per tydeenheid</u>/frekwensie van effektiewe botsings neem af*
- *Reaksietempo neem af* (4)

5.8 A substance that increases the rate of a chemical reaction without itself undergoing a permanent change.✓✓
'n Stof wat die tempo van 'n chemiese reaksie verhoog sonder om self 'n permanente verandering te ondergaan. **(2 or/*of* 0)** (2)

5.9 Remain the same/*Bly dieselfde*. ✓
A catalyst only increases the rate of reaction and does not affect the volume of the gas produced/ quantity of the products.✓✓
'n Katalisator verhoog slegs die reaksietempo maar affekteer nie die volume gas wat gevorm is/die hoeveelheid produk nie. (3)
[21]

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QUESTION/*VRAAG* 6

6.1.1 Number of (given) particles.✓
Aantal deeltjies (1)

6.1.2 Particles with sufficient kinetic energy✓/ particles with $E_k \geq E_A$
Deeltjies met genoegsame kinetiese energie/ deeltjies met $E_k \geq E_A$ (1)

6.1.3 Activation energy/*Aktiverings energie*. ✓ **Accept/*Aanvaar:*** E_A (1)

6.2 T_2✓, more particles with sufficient kinetic energy✓/
more particles with $E_K \geq E_A$
meer deeltjies met genoegsame kinetiese energie/
meer deeltjies met $E_k \geq E_A$ (2)

6.3 Shift to left/*Skuif na links*✓, catalyst decreases activation energy/*katalisator verlaag aktiverings energie.*✓ (2)

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6.4
- Increasing temperature, only increases the average speed/kinetic energy of particles✓
- Catalyst provides an alternative path of lower activation energy/ catalyst only increases the rate of reaction.✓
- Both increasing temperature and adding a catalyst have no effect on the number of particles✓ (area under the curve)
- *Temperatuur verhoging, verhoog net die gemiddelde spoed/kinetiese energie van deeltjies*
- *Katalisator bied 'n alternatiewe pad van laer aktiveringsenergie/katalisator verhoog net die reaksietempo.*
- *Beide die verhoging van die temperatuur en die byvoeging van 'n katalisator het geen effek op die aantal deeltjies (area onder die grafiek) nie*

(3)
[10]

QUESTION/*VRAAG* 7

7.1 Closed system✓ and reversible reaction.✓
Geslote sisteem en 'n omkeerbare reaksie (2)

7.2

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.*
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, stel die sisteem 'n nuwe ewewig in deur die reaksie wat die versteuring teenwerk, te bevoordeel. (2)

7.3.1 Endothermic✓, Heat energy is absorbed or used up. $\Delta H > 0$/ΔH is positive ✓
Endotermies, Warmte energie is geabsorbeer of op gebruik./$\Delta H > 0$/ΔH *is positief* (2)

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7.3.2 **Marking guidelines/*Nasien riglyne***

- Calculate number of moles/*Bereken aantal mol* NH_4Cl ($\frac{64,2}{53,5}$) ✓

  OR/*OF* 1,2 moles/*mol*
- n.(equil/*ewewig.*) NH_3 = 0,80 ✓
- mole ratio/*mol verhouding*: n(NH_4Cl) : n(NH_3) : n(HCl) = 1:1:1 ✓
- Divide n(equil) of both/*Deel n(ewewig) van albei* NH_3 and/*en* HCl ✓
- Correct Kc expression/*korrekte K_c vergelyking* ✓
- Substitute 0,1 in the Kc expression/*Vervang 0,1 in die K_c vergelyking* ✓
- Substitute equilibrium concentrations in the Kc expression/*Vervang die ewewigs konsentrasie in die Kc vergelyking* ✓
- Final answer/*Finale antwoord* in dm^3 = 0,80 dm^3 ✓ (Range: 0,78 – 0.82)

$$n = \frac{m}{M}$$
$$= \frac{64,2}{53,5} \checkmark$$
$$= 1,2 \text{ mol}$$

	$NH_4C\ell$	NH_3	$HC\ell$
Ratio/*Verhouding*	1	1	1
Initial quantity (mol) *Begin mol*	1,2	0	0
Change (mol) *Verandering in mol*	0,80	0,80	0,80 ✓
Quantiy at equilibrium (mol) *Hoeveelheid by ewewig*	0,4	0,80✓	0,80
Equilibrium concentration ($mol \cdot dm^{-3}$) *Ewewigs konsentrasie*		$\frac{0,80}{V}$	$\frac{0,80}{V}$ ✓

$Kc = [NH_3][HC\ell]$ ✓

$1,0 \checkmark = (\frac{0,80}{V})(\frac{0,80}{V}) \checkmark$

$V = 0,80\ dm^3$ ✓ (8)

7.3.3 Decreases/*Afname* ✓ (1)

7.3.4
- Decrease in temperature favours exothermic reaction✓
- Reverse reaction is exothermic and is favoured✓
- Concentration/amount/moles of products increases✓
- *Afname in temperatuur bevoordeel eksotermiese reaksie*
- *Terugwaartse reaksie is eksotermies en word bevoordeel*
- *Konsentrasie/hoeveelheid/mol van produkte neem toe* (3)

[18]

QUESTION/*VRAAG* 8

8.1.1 Exothermic/*Eksotermies* ✓ (1)

8.1.2 **POSITIVE MARKING FROM QUESTION 8.1.1/**
POSITIEWE NASIEN VAN VRAAG 8.1.1

Reaction that releases heat/*Reaksie wat hitte vrystel*✓ (1)

8.1.3 Heat of reaction✓/*Reaksiewarmte*/ΔH, -60 kJ·mol^{-1} ✓ (2)

8.1.4 A substance that produces hydroxide ions (OH^-) in aqueous solution/water. ✓✓
*'n Stof wat hidroksiedione (OH^-) vorm wanneer dit in water oplos.***(2 or/*of* 0)** (2)

8.1.5 HCℓ✓ and/*en* $Cℓ^-$ ✓ /H_2O and/*en* H_3O^+ (2)

8.1.6 Increases/*Verhoog* ✓ (1)

8.1.7
- $[H_3O^+]$ increases, the reaction that decreases the $[H_3O^+]$ will be favoured ✓
- Reverse reaction is favoured.✓/ Concentration or amount of reactants increases
- *[H3O$^+$] neem toe, die reaksie wat die $[H_3O^+]$ verminder, word bevoordeel*
- *Terugwaartse reaksie word bevoordeel./Konsentrasie of hoeveelheid reaktante neem toe* (2)

8.1.8 $m(CaCO_3) = 8x\ 0,95$ ✓
$= 7,6\ g$

$n(CaCO_3) = \frac{m}{M}$ ✓
$= \frac{7,6}{100}$ ✓
$= 0,076\ mol$

$n(HC\ell) = 2 \times 0,076$ ✓
$= 0,152\ mol$

$c(HC\ell) = \frac{n}{V}$

$0,5$ ✓ $= \frac{0,152}{V}$ ✓

$V(HC\ell) = 0,304\ dm^3$
$\therefore\ V(HC\ell) = 304\ cm^3$ ✓

(7)
[18]

TOTAL/*TOTAAL*: 150

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