MARKING GUIDELINES

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SACAI

SOUTH AFRICAN COMPREHENSIVE ASSESSMENT INSTITUTE

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QUESTION 1

1.1 C ✓✓ (2)

1.2 A ✓✓ (2)

1.3 B ✓✓ (2)

1.4 D ✓✓ (2)

1.5 B ✓✓ (2)

1.6 D ✓✓ (2)

1.7 B ✓✓ (2)

1.8 C ✓✓ (2)

1.9 D ✓✓ (2)

1.10 C ✓✓ (2)

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QUESTION 2

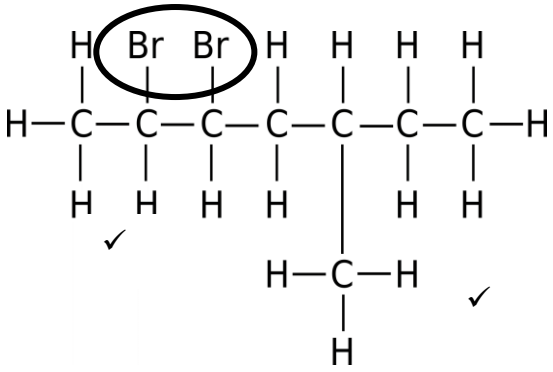
2.1 A series of organic compounds ✓that can be described by the same general formula. ✓ *'n Reeks organiese verbindings ✓wat deur dieselfde algemene formule beskryf word.*
OR/OF
A series of organic compounds✓ in which one member differs from the next with a CH_2 group. ✓ *'n Reeks organiese verbindings✓waarvan een lid van die ander verskil met 'n CH_2 groep.* (2)

2.2.1 A ✓ (1)

2.2.2 C ✓ (1)

2.3 2.3.1 2-methyl✓pent-1✓-ene✓/ *2-metiel ✓pent-1 ✓-een ✓*
OR/OF 2-methyl-1-pentene / 2-metiel-1-penteen (3)

2.3.2



MARKING GUIDELINES:
✓Br on C2 and C3 AND methyl on C5
✓Correct structure

NASIENRIGLYNE:
✓Br on C2 and C3 EN metiel op C5
✓ Korrekte struktuur

(2)

2.4. 2.4.1 Organic molecules with the same molecular formula, ✓but different positions of the side chain / substituents / functional groups on the parent chain. ✓
[If any one of the underlined key phrases are omitted or stated in the incorrect context, deduct one mark.]
Organiese molekules met dieselfde molekulêre formule ✓, maar verskillende posisies van die syketting / substituente / funksionele groepe op die stamketting. ✓ (2)

2.4.2 pentan-2-ol ✓✓ **OR/OF** pentan-3-ol ✓✓ (2)

2.5 2.5.1 Propanal ✓✓ *Propanaal ✓✓* (2)

2.5.2 Propanone/Propan-2-one✓✓ (coe from 2.5.1)
Propanoon **OF** *propan-2-oon* (2)

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QUESTION 3

3.1 3.1.1 Alkanes ✓ / *Alkane* (1)

3.1.2 Saturated ✓ / *Versadig* (1)

3.1.3 Gas ✓ (1)

3.1.4 68,7 (ºC) (1)

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

3.3 3.3.1 CH_3CH_2COOH✓ (Not O_2)

OR/OF

CH_3CH_2COH✓ (1)

3.3.2 For a <u>fair test</u> ✓✓/<u>molar masses affect boiling points</u> / <u>only one independent variable</u> ✓✓
Vir 'n geldige ondersoek ✓✓/ beïnvloed molêre massa kookpunt ✓✓/ Slegs een veranderlikes ✓✓ (2)

3.3.3 The <u>temperature</u> at which the <u>vapour pressure (</u>of a substance) <u>is equal to the atmospheric pressure</u>. ✓✓
[If any one of the underlined key phrases are omitted or stated in the incorrect context, deduct one mark.]
Die <u>temperatuur</u> waar die <u>dampdruk</u> (van die vloeistof) <u>gelyk is aan die atmosferiese druk</u> ✓✓ (2)

3.3.4
- <u>Propanoic acid</u> has <u>hydrogen bonding forces</u> and London forces. ✓
- <u>Pentane</u> has <u>London forces</u>.✓
- Hydrogen bonds are <u>stronger</u> ✓than London force.
- <u>More energy</u> is needed to <u>overcome the intermolecular forces</u> in <u>propanoic acid</u>✓ than in pentane.

- *<u>Propanoësuur besit beide waterstofbindings kragte</u> en London-kragte*✓
- *<u>Pentaan besit slegs London-kragte</u>*✓
- *Waterstofbindings-kragte is <u>sterker</u> as London-kragte*✓
- *<u>Meer energie</u> word benodig om <u>intermolekulêre kragte in propanoësuur te oorkom</u> as in pentaan* ✓ (4)

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QUESTION 4

4.1 Elimination / Dehydrohalogenation / *Eliminasie / Dehidrohalogenering* ✓ (1)

4.2 Hydrolysis / Substitution / *Hidrasie* / Substitusie ✓ (1)

4.3 B ✓ (1)

4.4 Addition Hydration / *Addisie / Hidrasie* ✓ (1)

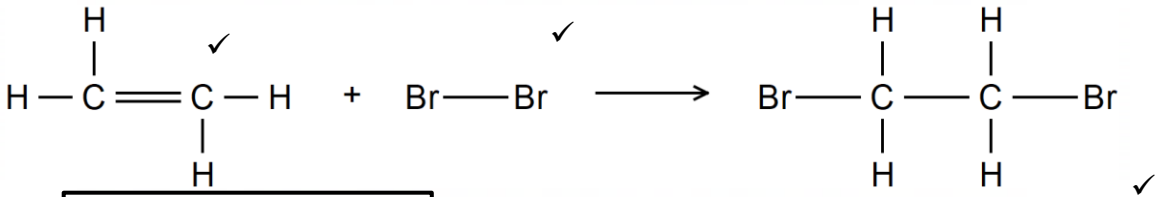
4.5 H_2O ✓ (1)

4.6 Ethyl ✓propanoate✓ / *Etiel ✓propanoaat* ✓ (2)

4.7 H_2SO_4/(concentrated) sulfuric acid/hydrogen sulphate.
H_2SO_4 (c) / (gekonsentreerde) swawelsuur / Waterstofsulfaat. (1)

4.8 Esterification/Condensation ✓
Estrifikasie / Kondensasie ✓ (1)

4.9



NASIENRIGLYNE:
✓ Eteen
✓Br_2 (met of sonder chemiese verbinding)
✓ 1,2-dibromoetaan

MARKING GUIDELINES:
✓Ethene
✓Br_2 (with or without bond)
✓1,2-dibromoethane

(3)

Marking guidelines 6.3.10:
When a chemical reaction is asked, marks are awarded for correct reactants, correct products and correct balancing. If only a reactant(s) followed by an arrow, or only a product(s) preceded by an arrow, is/are written, marks may be awarded for the reactant(s) or product(s). If only a reactant(s) or only a product(s) is/are written, without an arrow, no marks are awarded for the reactant(s) or product(s).

4.10 Rapid colour change from brown to colourless ✓✓
Vinnige kleur verandering van oplossing van bruin na kleurloos. (2)

4.11 1,2-dibromo✓ethane ✓ / *1,2-dibromo ✓etaan* ✓ (2)

4.12 Combustion / Oxidation ✓ / *Verbranding / Oksidasie* ✓ (1)

4.13 $2\ C_2H_6 + 7\ O_2$ ✓→ $4\ CO_2 + 6\ H_2O$ ✓ (2)

NASIENRIGLYNE:
Heelgetal aantal mol van al die:
✓ Reaktante
✓ Produkte

MARKING GUIDELINES:
Whole number moles of all the:
✓reactants
✓products

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QUESTION 5

5.1 Change in concentration of reactants or products ✓per unit time. ✓
[If any one of the underlined key phrases are omitted or stated in the incorrect context, deduct one mark.]
Verandering in konsentrasie van reagense of produkte ✓per tydseenheid ✓ (2)

5.2 Concentration of $Na_2S_2O_3$ ✓ / *Konsentrasie van die* $Na_2S_2O_3$ ✓ / [$Na_2S_2O_3$] (1)

5.3
- More particles per unit volume ✓ **OR** More particles with E_k greater than E_a
- More effective collisions per unit time ✓
- Higher/faster rate of reaction. ✓

- *Meer deeltjies per volume eenheid* ✓ ***OF*** *Meer deeltjies met E_k groter as E_A*
- *Meer effektiewe botsings per tydseenheid* ✓
- *Hoër / vinniger tempo van die reaksie.* ✓ (3)

5.4.1 $n_{(Na2S2O3)} = cV$
$= 0,10 \times 0,025$ ✓
$= 0,0025$ mol
$n_{(HCℓ)} = cV$
$= 0,15 \times 0,005$ ✓
$= 0,00075$ mol

$HCℓ : Na_2S_2O_3$
2 : 1 ✓

MARKING GUIDELINES:
✓Substitution for n $Na_2S_2O_3$
✓Substitution for n HCℓ
✓Use of ratio
✓Conclusion

NASIENRIGLYNE:
✓ Substitusie van n $Na_2S_2O_3$
✓ Substitusie van n HCℓ
✓ Gebruik van verhouding
✓ Gevolgtrekking

0,0025 mol of $Na_2S_2O_3$ needs 0,005 mol of HCℓ /
Only 0,00075 mol of HCℓ available ✓
Therefore, HCℓ is limiting.

0,0025 mol $Na_2S_2O_3$ benodig 0,005 mol van HCℓ
Slegs 0,00075 mol van HCℓ beskikbaar ✓
Dus is HCℓ beperkend

OR/OF

(4)

$7,5 \times 10^{-4}$ mol HCℓ needs $3,75 \times 10^{-4}$ mol $Na_2S_2O_3$
More $Na_2S_2O_3$ available than required ✓
Therefore, HCℓ is limiting

$7,5 \times 10^{-4}$ mol HCℓ benodig $3,75 \times 10^{-4}$ mol $Na_2S_2O_3$
Meer $Na_2S_2O_3$ is beskikbaar as benodig ✓
Dus is HCℓ beperkend

5.4.2 coe 5.4.1
HCℓ : S
2 : 1
$0,00075 : 3,75 \times 10^{-4}$ ✓

$N = n.N_A$ ✓
$= 3,75 \times 10^{-4} \times 6,02 \times 10^{23}$ ✓
$= 2,26 \times 10^{20}$ S-atoms ✓

MARKING GUIDELINES:
✓use of ratio
✓formula
✓fubstitution
✓answer

NASIENRIGLYNE:
✓ Gebruik van verhouding
✓ Formule
✓ Substitusie
✓ Antwood

(4)

[14]

QUESTION 6

6.1 6.1.1 A reaction is reversible when products can be converted back to reactants. ✓
[If any one of the underlined key phrases are omitted or stated in the incorrect context, deduct one mark.]
'n Reaksie is omkeerbaar wanneer produkte terug na reaktante, (en omgekeerd), omgeskakel kan word. (1)

6.1.2 (Rate of) reverse reaction /
(*Reaksie tempo van) die terugwaartse reaksie* ✓ (1)

6.1.3 False / *Vals* ✓ (1)

6.1.4 Decrease in temperature / *Afname in temperatuur* ✓ (1)

6.1.5
- Both reaction rates decrease/ ✓
- The reverse reaction decreases less than the forward reaction **OR** The forward reaction decreases more. ✓
- Reverse reaction is favoured. ✓
- Reverse reaction is the exothermic reaction. ✓

- Beide (voor- en terugwaartse) reaksietempo neem af ✓
- Die terugwaartse reaksie tempo neem minder af as die voorwaartse **OF** die voorwaartse reaksie tempo neem meer af ✓
- Die terugwaartse reaksie word bevoordeel ✓
- Die terugwaartse reaksie is eksotermies (temperatuur daling bevoordeel die eksotermiese reaksie) ✓ (4)

6.1.6 (a)

	HI	**H_2**	**I_2**
Initial moles (mol) *Aanvanklike mol*	x	0	0
Change in moles (mol) *Verandering in mol*	X – 0,04 ✓	$\frac{x-0,04}{2}$	$\frac{x-0,04}{2}$
Moles at equilibrium (mol) *Mol by ewewig*	0,04	$\frac{x-0,04}{2}$	$\frac{x-0,04}{2}$
Concentration (mol.dm^{-3}) *Konsentrasie*	0,02	$\frac{x-0,04}{4}$	$\frac{x-0,04}{4}$

✓Ratio/ *Verhouding*

✓Divide by 2/ *Deel met 2*

$K_c = \frac{[H_2][I_2]}{[HI]2}$ ✓

$0,02 = \frac{\left(\frac{X-0,04}{4}\right)\left(\frac{X-0,04}{4}\right)}{(0,02)(0,02)}$ ✓

X = 0,05

$[H_2] = \frac{X-0,04}{4}$

$[H_2] = \frac{(0,05-0,04)}{4}$

= 2,5 x 10^{-3} mol·dm^{-3} ✓

Range / Gebied : 2,5x10^{-4} – 3x10^{-4}

MARKING GUIDELINES:
✓Change of HI x – 0,04
✓Use of ratio
✓Divide by Volume
✓Kc expression
✓Substitution
✓Calculating $[H_2]$ (method mark)

NASIENRIGLYNE:
Verandering van HI X – 0,04
✓Gebruik van verhouding
✓Verdeel deur volume
✓Kc uitdrukking
✓Substitusie
✓Bereken $[H_2]$ (merk die metode)

(6)

OR/OF

	HI	**H_2**	**I_2**
Initial concentration *Aanvanklike konsentrasie*	y	0	0
Change in moles (mol) *Verandering in mol*	y – 0,02 ✓	$\frac{y-0,02}{2}$	$\frac{y-0,02}{2}$
Concentration (mol.dm^{-3}) *Konsentrasie*	0,02 ✓	$\frac{y-0,02}{2}$	$\frac{y-0,02}{2}$

✓Ratio/ *Verhouding*

$K_c = \frac{[H_2][I_2]}{[HI]2}$ ✓

$0,02 = \frac{\left(\frac{y-0,02}{2}\right)\left(\frac{y-0,02}{2}\right)}{(0,02)^2}$ ✓

y = 0,0257

$[H_2] = \frac{y-0,02}{2}$

$[H_2] = \frac{(0,0257-0,02)}{2}$

= 2,83 x 10^{-3} mol·dm^{-3} ✓

Range / Gebied : 2,5x10^{-4} – 3x10^{-4}

MARKING GUIDELINES:
✓Concentration of HI 0,02
✓ Change of initial concentration y-0,02
✓Use of ratio
✓Divide by Volume
✓Kc expression (max 5/6 if no expression)
✓Substitution
✓Calculating $[H_2]$ (method mark)
Wrong Kc expression: 3/6

NASIENRIGLYNE:
✓ Konsentrasie van HI (0,02)
✓ Verandering van aanvanklike HI y – 0,02
✓ Gebruik van verhouding
✓ Kc uitdrukking (maks 5/6 indien geen uitdrukking)
✓ Substitusie
✓ Bereken $[H_2]$ (merk die metode)
Foutiewe Kc uitdrukking: 3/6

(b)(Kc = 1/K_c =) $\frac{1}{0,02}$ = 50 ✓ (1)

6.2 6.2.1 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 ✓
[If any one of the underlined key phrases are omitted or stated in the incorrect context, deduct one mark.]
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)

6.2.2 (a) Remains the same / *Bly dieselfde* ✓ (1)

(b) Increases / *Verhoog* ✓ (1)

6.2.3 Decreases / *Verminder* ✓ (1)

6.2.4
- (Increase in pressure) favours the reaction with the least number of moles. ✓ (*Toename in druk) bevoordeel die reaksie met die minste aantal mol*
- Reverse reaction is favoured. ✓ *Terugwaartse reaksie bevoordeel* (2)

[22]

QUESTION 7

7.1 7.1.1 A solution with a known concentration. ✓✓
[If any one of the underlined key phrases are omitted or stated in the incorrect context, deduct one mark.]
'n Oplossing waarvan die konsentrasie bekend is (2)

7.1.2 $c = \frac{m}{MV}$ ✓

$0,22 = \frac{m}{(40)(0,5)}$ ✓ ✓

m = 4,4 g ✓

MARKING GUIDELINES:
✓Formula
✓Substitution
✓Conversion of volume (method mark)
✓Answer with unit

NASIENRIGLYNE:
✓ Formule
✓ Substitusie
✓ Omskakeling van volume
✓ Antwoord met eenheid

Alternative/*Alternatief*:

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

$0,22 = \frac{n}{0,5}$ ✓

n = 0,11 mol

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

$0,11 = \frac{m}{40}$ ✓

m = 4,4 g ✓

MARKING GUIDELINES: (Alternative)
✓ Both formula
✓ Substitution (including conversion)
✓ Substitution
✓ Answer with unit

NASIENRIGLYNE: (Alternatief)
✓ Beide formules
✓ Vervanging (insluitend omskakeling)
✓ Vervanging
✓ Antwoord met eenheid

(4)

7.2 7.2.1 A ✓ (1)

7.2.2 A ✓ (1)

7.2.3 C✓ (1)

7.3 7.3.1 $c = \frac{n}{V}$ ✓
= 0,8 x 0,05 ✓
= 0,04 mol of HCℓ ✓ (3)

7.3.2 $c_{NaOH} = \frac{n}{V}$
= 0,5 x 0,02 ✓
= 0,01 mol of NaOH

Therefore 0,01 mol of HCℓ neutralised (excess)/ *Dus 0,01 mol van HCℓ geneutraliseer (oormaat)*
n HCℓ that reacted with MgO
n HCℓ reageer met MgO = (0,04 – 0,01) ✓
= 0,03 mol of HCℓ ✓

OR/OF

$\frac{n_a}{n_b} = \frac{c_a V_a}{c_b V_B}$
$\frac{1}{1} = \frac{0,8 \times V_a}{0,5 \times 0,02}$ ✓
$V_a = 0,0125$ dm^3

HCℓ that reacted with MgO
HCℓ reageer met MgO = 0,05 – 0,0125 ✓
= 0,0375 dm^3

$n = cV$
n = 0,8 x 0,0375 ✓
= 0,03 mol

Mol ratio / *verhouding*:
MgO : HCℓ
1 : 2
0,015 : 0,03 ✓

n of MgO = $\frac{m}{M}$ (7)
= 0,015 x 40 ✓
= 0,6 g of MgO

% of MgO in tablet = $\frac{0,6}{0,96}$ x 100 ✓
= 62,5 % ✓

OR/OF

Assume 100% purity / Aanvaar 100% suiwerheid

n = $\frac{m}{M}$
= $\frac{0,96}{40}$ ✓
= 0,024 mol MgO

But, only 0,015 mol of MgO in tablet / *Maar slegs 0,015 mol van MgO in tablet:*
% of MgO in tablet = $\frac{0,015}{0,024}$ x 100✓
= 62,5% ✓

[19]

QUESTION 8

8.1 Chemical (energy) to electrical (energy) / *Chemiese (energie) na elektriese (energie)* ✓ (1)

8.2 Temperature = 25 ºC / 298 K✓
Concentration of Pb^{2+} ions = 1 mol·dm^{-3}✓ (Pressure not accepted)
Konsentrasie van die Pb^{2+} ione = 1 mol·dm^{-3} ✓ (Druk word nie aanvaar nie) (2)

8.3 Salt bridge / *Soutbrug* ✓ (1)

8.4 $E_{cell} = E_{cathode} – E_{anode}$ ✓
1,53 ✓= -0,13 ✓– E_{anode}
E_{anode} = -1,66 (V) ✓
Unknown metal is Aℓ ✓
Onbekende metaal is

MARKING GUIDELINES:
✓ Correct formula
✓✓ Substitution
✓ Answer
✓Metal correctly identified.

NASIENRIGLYNE:
✓ Korrekte formule
✓✓ Substitusie
✓ Antwoord
✓ Metaal korrek geïdentifiseer.

(5)

8.5 2 Aℓ (s) + 3 Pb^{2+} (aq) ✓→ 2 $Aℓ^{3+}$ (aq) + 3 Pb (s) ✓✓
2 X (s) + 3 Pb^{2+} (aq) ✓→ 2 X^{3+} (aq) +3 Pb (s)

(Accept if learner uses X)

NASIENRIGLYNE:
✓ reaktante
✓ produkte
✓ balanseer
Fases nie noodwendig

MARKING GUIDELINES:
✓ reactants
✓ products
✓ balanced
Phases not necessary

(3)

8.6 Decreases / *Verminder* ✓✓ (2)

[14]

QUESTION 9

9.1 A substance of which the aqueous solution contains ions **OR** A substance that dissolves in water to give a solution that conducts electricity. ✓✓
*'n Stof waarvan die oplossing in water ione bevat **OF** 'n Stof wat in water oplos om 'n oplossing te vorm wat elektrisiteit gelei. i.*✓✓ (2)

9.2 $Ni \rightarrow Ni^{2+} + 2e^-$ ✓✓

$Ni \rightleftharpoons Ni^{2+} + 2e^-$ (1/2)
$Ni \leftarrow Ni^{2+} + 2e^-$ (0/2)
$Ni^{2+} + 2e^- \leftarrow Ni$ (2/2)
$Ni^{2+} + 2e^- \rightleftharpoons Ni$ (0/2) (2)

9.3 Silver / *Silwer* (Ag) ✓and copper / *koper* (Cu) ✓ (2)

9.4 Ni^{2+} is a STRONGER OXIDISING agent ✓than magnesium ions (Mg^{2+}) ✓
Ni^{2+} is 'n STERKER OKSIDEERMIDDEL ✓as magnesium-ione (Mg^{2+}) ✓

OR/OF:

Magnesium ions (Mg^{2+}) ✓ is a WEAKER OXIDISING agents than Ni^{2+}. ✓
Magnesium-ione (Mg^{2+}) is 'n SWAKKER OKSIDEERMIDDEELS as Ni^{2+} (2)

9.5 **Nickel / *Nikkel*:**

$n = \frac{m}{M}$ ✓
$= \frac{0,055}{59}$ ✓
$= 9,32 \times 10^{-4}$ mol ✓ (3)

MARKING GUIDELINES:	**NASIENRIGLYNE:**
✓Formula	✓ Formule
✓Substitution	✓Substitusie
✓Correct answer with unit	✓Korrekte antwoord met eenheid

[11]

GRAND TOTAL: [150]