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**NATIONAL
SENIOR CERTIFICATE
NASIONALE
SENIOR SERTIFIKAAT**

GRADE/GRAAD 12

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

SEPTEMBER 2018

MEMORANDUM

MARKS/PUNTE: 150

**This memorandum consists of 11 pages.
*Hierdie memorandum bestaan uit 11 bladsye.***

QUESTION 1/VRAAG 1

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

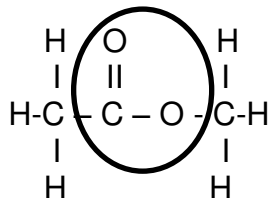
[20]

QUESTION 2/VRAAG 2

2.1.1 Carboxylic acids ✓ // *karboksielsure* ✓ (1)

2.1.2 Molecules with the same molecular formulae ✓ but different structural formula ✓
// *Organiese molekule met dieselfde molekulêre formule, ✓ maar verskillende struktuurformules.* ✓ (2)

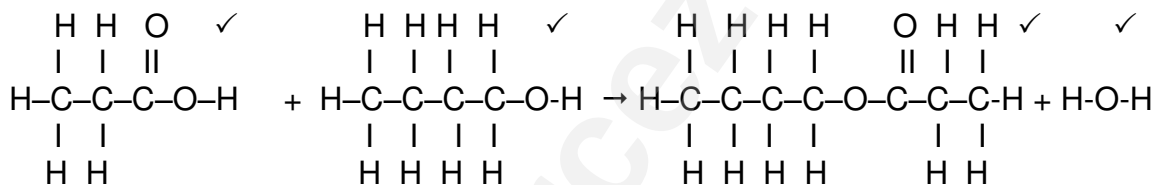
2.1.3

**Marking criteria/Nasienriglyne:**

- Whole structure correct/*Hele struktuur korrek.* $\frac{2}{2}$
- Functional group correct./*Funksionele groep korrek.* $\frac{1}{2}$

(2)

2.1.4



(4)

Notes/Aantekeninge:

- Condensed or semistructural formula: Max. $\frac{3}{4}$
Gekondenseerde of semistruktuurformule: Maks. $\frac{3}{4}$
- Molecular formula/*Molekulêre formule*: $\frac{1}{4}$
- Marking rule 3.9/*Nasienreël 3.9*
- Any additional reactants or products: Max. $\frac{3}{4}$
Enige addisionele reaktanse of produkte: Maks. $\frac{4}{4}$
- If arrow in equation omitted: Max. $\frac{3}{4}$
Indien pyltjie in vergelyking uitgelaat is: Maks. $\frac{3}{4}$

2.1.5 Butyl ✓ propanoate ✓ // *butiel* ✓ *propanoaat* ✓ (2)

2.2 2,4 – dimethyl ✓ pent-2-ene ✓ (2-pentene) // *2,4-dimetiel* ✓ *pent-2-ene* ✓ (2)
[13]

QUESTION 3/VRAAG 3

- 3.1 Temperature ✓ at which the vapour pressure of the substance equals atmospheric pressure. ✓
Die temperatuur ✓ waar die dampdruk van die stof gelyk is aan die atmosferiese druk. ✓ (2)
- 3.2.1 Liquid ✓ // vloeistof ✓ (1)
- 3.2.2 Boiling points increase (as chain length increases) ✓ // *Kookpunte neem toe (soos die kettinglengte toeneem) ✓* (1)
- 3.2.3 Lower. ✓ The isomer is branched/ rounder/ molecules further away from each other ✓ // *Laer. ✓ Die isomeer is vertak/ rond/ molekules verder van mekaar ✓* (2)
- 3.3 Alkanes have London forces between molecules, alcohols have hydrogen bonding forces ✓
 hydrogen bonding forces are stronger than London forces hydrogen bonding forces
 more energy is needed to overcome the intermolecular forces between alcohol molecules / break the hydrogen bonding forces hydrogen bonding forces and therefore the boiling point is higher
Tussen die alkane kom Londonkragte voor en tussen die alkohole waterstofbindings. ✓
Waterstofbindings is sterker as Londonkragte. ✓
Dit vereis dus meer energie om die waterstofbindings te breek ✓ en daarom is die kookpunt hoër. (3)
- 3.4.1 The pressure exerted by a vapour in equilibrium with its liquid ✓ in a closed system ✓
Die druk uitgeoefen deur 'n damp in ewewig met sy vloeistof ✓ in 'n geslote sisteem ✓

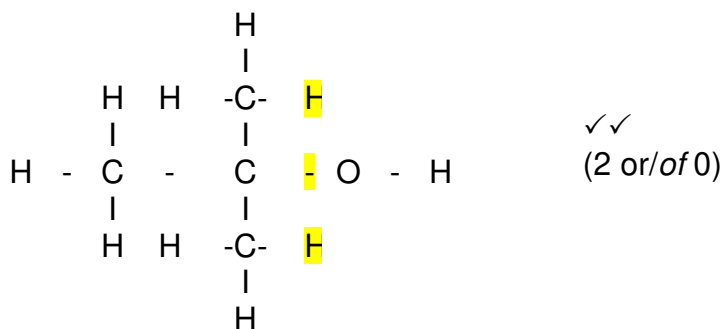
Note/aantekening:

Allocate mark for closed system only if first part of definition is correct.

Ken punt toe vir geslote sisteem slegs indien eerste deel van definisie korrek is.

- 3.4.2 Lower ✓ // Laer ✓ (1)

3.5



(2)

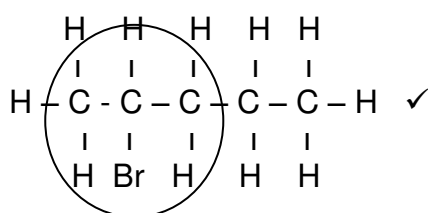
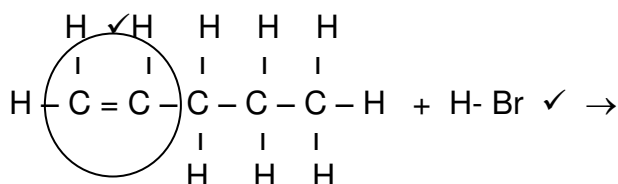
[14]

QUESTION 4/VRAAG 4

4.1.1 The solution decolourises/ loses its colour ✓ // *Die broomwater ont kleur* ✓ (1)

4.1.2 Halogenation ✓ // *Halogenering / halogenasie* ✓ (1)

4.2.1



(3)

4.2.2 2-bromo ✓ pentane // *2-bromo* ✓ *pentaan* ✓ (2)

4.2.3 Concentrated ✓ NaOH/strong base ✓ and high temperature/strong heat ✓
Gekonsentreerde ✓ *NaOH/KOH/sterk basis,* ✓ *en hoë temperatuur /sterk verhit* ✓ (3)

4.3 H_2SO_4 / H_3PO_4 ✓ (1)

4.4.1 Hydrogen ✓ // *Waterstof* ✓ (1)

4.4.2 $2\text{C}_4\text{H}_{10} + 13\text{O}_2 \checkmark \rightarrow 8\text{CO}_2 + 10\text{H}_2\text{O} \checkmark$ (bal ✓) (3)

4.4.3 Exothermic ✓ // *eksotermies* ✓ (1)

[16]

QUESTION 5/VRAAG 5

- 5.1.1 Homogeneous (reaction) ✓//Homogene (reaksie)✓ (1)
- 5.1.2 Heat of reaction / enthalpy difference / energy difference between products and reactants/ energy $\text{products} - \text{energy}_{\text{reactants}}$ ✓ Reaksiewarmte/energieverandering tussen reaktamore partieleste en produkte ✓ (1)
- 5.1.3 Iron/iron oxide ✓/Yster / Ysteroksied✓ (1)
- 5.2 Increase in concentration of N_2 means more particles/molecules per unit volume✓
More particles have enough kinetic energy/ energy equal or greater than activation energy✓
Number of effective collisions per unit time increases✓
Verhoging in konsentrasie van N_2 beteken meer deeltjies per eenheidvolume. ✓
Meer deeltjies het voldoende/genoeg kinetiese energie✓
Die aantal effektiewe botsings per tydseenheid neem dus toe/ frekwensie van effektiewe botsings neem toe. ✓ (3)
- 5.3.1 B.✓
 When temperature is increased✓, according to Le Chatelier the endothermic reaction will be favoured✓, thus the reverse reaction✓ Yield of ammonia decreases
 Die voorwaartse reaksie is eksotermies ✓ en volgens Le Chatelier sal 'n temperatuurverhoging teengewerk word deur die endotemiese reaksie bevoordeel✓ wat in hierdie geval die terugwaartse reaksie is.✓ Opbrengs ammoniak verminder dus. (4)
- 5.3.2 A ✓✓ (2)
- 5.3.3 C.✓✓ (2)
- [14]**

QUESTION 6/VRAAG 6

- 6.1.1 A catalyst is a chemical substance which increases the rate of a reaction ✓ without undergoing a permanent change itself ✓ //
’n Katalisator is ’n chemiese stof wat die tempo van ’n chemiese reaksie verhoog ✓ sonder om self ’n permanente verandering te ondergaan. ✓

OR/OF

A catalyst increases the rate of a reaction by providing an alternative route ✓ with lower activation energy. ✓ //
’n Katalisator verhoog die tempo van ’n reaksie deur ’n alternatiewe roete ✓ van laer aktiveringsenergie ✓ te verskaf. (2)

- 6.1.2 The reaction is exothermic ✓ and releases energy ✓ // Die reaksie is (2)
eksotermies ✓ en stel energie vry. ✓

- 6.1.3 When pressure is increased
 the reaction which produces less moles of gas / smaller volume of gas will be favoured ✓
 Thus forward reaction is favoured ✓ and more NO₂ is produced/formed ✓
 // As die druk verhoog
*sal die reaksie wat minder mol gas/kleiner volume gas produseer bevoordeel word ✓
 dus sal die voorwaartse reaksie bevoordeel word. ✓
 Meer NO₂ sal dus vorm. ✓* (3)

6.2.1

	NO ₂ (g)	+	NO(g)	⇌	N ₂ O(g)	+	O ₂ (g)
Initial mol <i>aanvanklike mol</i>	0,06		0,29		0,18		0,38 ✓
Used/formed <i>Verbruik/gevorm</i>	0,12-0,06 =0,06 ✓		0,06		0,06		0,06 ✓
Equilibrium (mol·dm ⁻³) <i>/Ewewig(mol·dm⁻³)</i>	0,12		0,35		0,12		0,32

Add// optel ✓

subtract// aftrek ✓

$$K_c = \frac{[\text{N}_2\text{O}][\text{O}_2]}{[\text{NO}_2][\text{NO}]} \checkmark = \frac{0,12 \times 0,32}{0,12 \times 0,35} \checkmark = 0,914 \checkmark$$

Marking criteria/nasienriglyne

- initial concentrations/ *aanvanklike konsentrasies neer* ✓
- Calculate concentration of NO₂ used (0,06)/ *Bereken konsentrasie van NO₂ wat gebruik is(0,06)* ✓
- Values of other reactants and products used or formed/ *Waardes van ander reaktante wat verbruik of gevorm is* ✓
- Equilibrium values for reactants/ *Ewewig waardes vir reaktante* ✓
- Equilibrium values for products/ *Ewewig waardes vir produkte* ✓
- Correct K_c expression/ *Korrekte K_c uitdrukking* ✓
- Substitution of concentration in correct K_c expression/ *Vervanging van konsentrasies in korrekte K_c-uitdrukking* ✓✓
- Correct final answer/ *Korrekte finale antwoord* ✓

(9)

6.2.2

Temperature is decreased // *Temperatuur is verlaag* ✓

(2)

[18]

QUESTION 7/VRAAG 7

7.1.1 Basic// *basies* ✓ (1)

7.1.2 $\text{pH} = -\log[\text{H}_3\text{O}^+]$ ✓
 $= -\log 10^{-8}$
 $= 8$ ✓ 2 marks for only answer / 2 punte vir slegs antwoord (2)

7.1.3 $\text{CO}_3^{2-} + \text{H}_2\text{O} \rightleftharpoons \text{HCO}_3^- + \text{OH}^-$ ✓ (2)

7.2.1 $n(\text{NaOH}) = cV = 0,2 \text{ mol} \cdot \text{dm}^{-3} \times 0,025 \text{ dm}^3 = 0,005 \text{ mol NaOH}$ ✓

$n(\text{HCl}) = cV = 0,15 \text{ mol} \cdot \text{dm}^{-3} \times 0,04 \text{ dm}^3 = 0,006 \text{ mol HCl}$ ✓

1 mol NaOH reacts with // *reageer met* 1 mol HCl ✓

$\therefore \text{Excess//oormaat HCl} = 0,006 - 0,005 = 0,001 \text{ mol}$ ✓ (7)

7.2.2 **Positive marking from 7.2.1// *positiewe nasien vanaf 7.2.1***

$$[\text{H}_3\text{O}^+] = \frac{n}{V} = \frac{0,001}{0,025+0,040} = 0,0154 \text{ mol} \cdot \text{dm}^{-3} \quad \checkmark$$

$\text{pH} = -\log[\text{H}_3\text{O}^+]$ ✓

$$= -\log(0,0154) = 1,812 \quad \checkmark$$

(5)
[17]

QUESTION 8/VRAAG 8

8.1.1 Temperature 25°C (298 K) ✓ // temperatuur 25°C; ✓ (298 K)
Pressure 101,3 kPa (1 atm) ✓ // druk 101,3 kPa (1 atm); ✓ (3)

8.1.2 Concentration 1 mol·dm⁻³ ✓ // konsentrasie 1 mol·dm⁻³ ✓
Fe/Fe²⁺ or/of Fe-half cell/halfsel or/of Fe(s) ✓✓ (2)

8.1.3 $\text{Fe} \rightarrow \text{Fe}^{2+} + 2\text{e}^-$ ✓✓ (2)

8.1.4 $\text{O}_2 + 4\text{H}^+ + 4\text{e}^- \rightarrow 2\text{H}_2\text{O}$ ✓✓ (2)

8.1.5 $\text{Fe(s)} / \text{Fe}^{2+}(\text{aq})$ ✓ // $\text{O}_2(\text{g}) / \text{H}_2\text{O(l)}$ ✓, Pt(s) ✓ (-1 if // not there) (3)

8.1.6 $E^\theta_{\text{cell/sel}} = E^\theta_{\text{cathode/katode}} - E^\theta_{\text{anode}}$
 $= 1,23 \checkmark - (-0,44) \checkmark$
 $= 1,67 \text{ V} \checkmark$

- Accept any other correct formula from the data sheet / Aanvaar enige ander korrekte formule vanaf gegewensblad.
- Any other formula using unconventional abbreviations, e.g. $E^\theta_{\text{cell}} = E^\theta_{\text{OA}} - E^\theta_{\text{RA}}$ followed by correct substitutions:/ Enige ander formule wat onkonvensionele afkortings gebruik bv. $E^\theta_{\text{sel}} = E^\theta_{\text{OM}} - E^\theta_{\text{RM}}$ gevolg deur regte vervangings:
 Max/maks 3/4

(4)

8.2 Mg is a stronger reducing agent than Fe ✓ Therefore Mg is more easily oxidised than iron ✓ and prevent that Fe is oxidized to Fe²⁺. ✓
Mg is 'n sterker reduseermiddel as Fe. ✓ Mg is daarom makliker geoksideer as yster ✓ en verhoed dat Fe na Fe²⁺ oksideer. ✓ (3)

[19]

QUESTION 9/VRAAG 9

9.1 P✓ (1)

9.2 $2\text{H}_2\text{O} + 2\text{e}^- \rightarrow \text{H}_2 + 2\text{OH}^-$ ✓✓ (2)

Notes/Aantekeninge

- Reactants ✓ Products ✓ Balancing ✓
Reaktanse Produkte Balansering
- Ignore double arrows./Ignoreer dubbele pyle.
Marking rule 6.3.10./Nasienreël 6.3.10.

9.3 Q na P ✓ (1)

9.4 Water / hydrogen ion ✓// *water/ waterstofioon* ✓ (1)

9.5 H_2 ✓ Cl_2 ✓ NaOH ✓ (any 2 // *enige 2*) (2)

[7]

QUESTION 10/VRAAG 10

10.1.1 Fractional distillation of liquid air ✓// *Fraksionele distillasie van vloeibare lug* ✓ (1)

10.1.2 Contact process✓ / *Kontakproses* ✓ (1)

10.1.3 $2\text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4$ ✓ (✓for/vir bal) (3)

10.2.1 Ratio ✓of nitrogen to phosphorous to potassium t✓ (2)

10.2.2 $\frac{3}{9} \times \frac{30}{100} \times 50 = 5 \text{ kg}$ ✓

OR/OF

% N: $\frac{3}{9} \times 30\% = 10\%$

Mass of nitrogen // *massa stikstof*: 10% van totale massa van 50 kg

$\therefore \frac{10}{100} \times 50 = 5 \text{ kg}$ ✓

(3)

10.2.3 % filler/ *vulsel* = $100 - 30 = 70\%$

$\frac{70}{100} \times 50 = 35 \text{ kg}$ ✓

OR/OF

Mass of fertilizer/*massa kunsmis* = $\frac{30}{100} \times 50 = 15$ ✓

Mass of filler/*massa vulsel* = $50 - 15 = 35 \text{ kg}$ ✓

(2)

[12]

TOTAL/TOTAAL: 150