LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF EDUCATION

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*

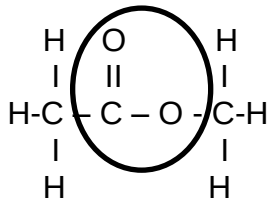
1.1	A ✓✓	(2)
1.2	A ✓✓	(2)
1.3	B ✓✓	(2)
1.4	D ✓✓	(2)
1.5	B ✓✓	(2)
1.6	D ✓✓	(2)
1.7	C ✓✓	(2)
1.8	A ✓✓	(2)
1.9	C ✓✓	(2)
1.10	C ✓✓	(2)
		[20]

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)

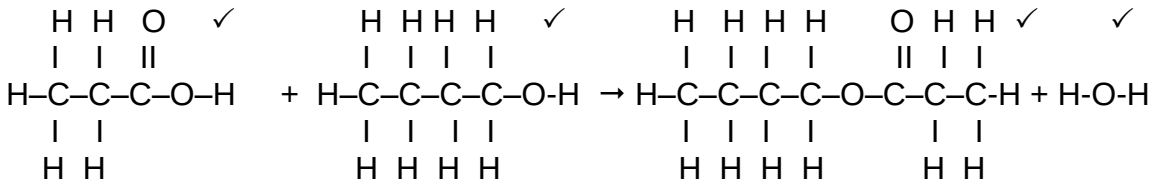
2.1.3



Marking criteria/*Nasienriglyne:*
- Whole structure correct/*Hele struktuur korrek.* 2/2
- Functional group correct./*Funksionele groep korrek.* 1/2

(2)

2.1.4



(4)

Notes/*Aantekeninge:*
- Condensed or semistructural formula: Max. 3/4
  Gekondenseerde of semistruktuurformule: *Maks.* 3/4
- Molecular formula/*Molekulêre formule*: 1/4
- Marking rule 3.9/*Nasienreël 3.9*
- Any additional reactants or products: Max. 3/4
  Enige addisionele reaktanse of produkte: Maks. 4/4
- If arrow in equation omitted: Max. 3/4
  Indien pyltjie in vergelyking uitgelaat is: *Maks.* 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-een*✓ (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/ ronder/ 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)

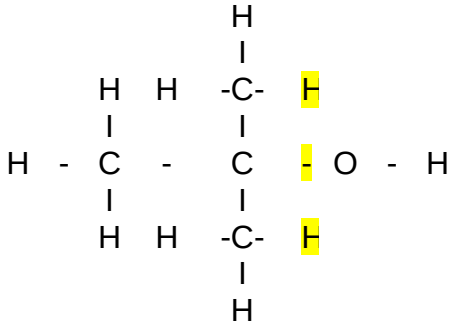
3.4.1 The pressure exerted by a vapour in equilibrium with its liquid✓ in a closed system✓
Die druk uitgeoefen deur 'n damp in ewewig met sy vloeistof ✓in 'n geslote sisteem✓

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*.

(2)

3.4.2 Lower ✓//Laer ✓ (1)

3.5



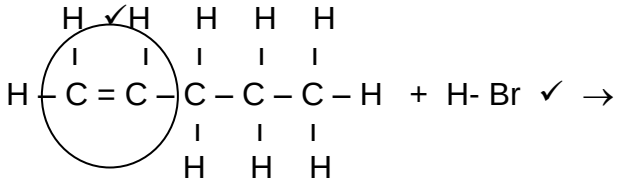
✓✓
(2 or/*of* 0)
(2)
[14]

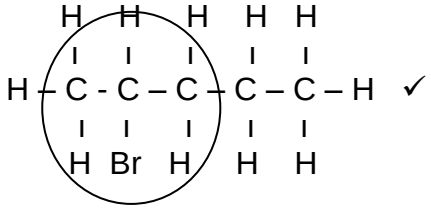
QUESTION 4/VRAAG 4

4.1.1 The solutionldecolourises/ loses its colour✓ //*Die broomwater ontkleur*✓ (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 ✓ (3)
Gekonsentreerde ✓NaOH/KOH/sterk basis,✓ en hoë temperatuur /sterk verhit✓

4.3 H_2SO_4 / H_3PO_4 ✓ (1)

4.4.1 Hydrogen ✓ //*Waterstof*✓ (1)

4.4.2 $2C_4H_{10} + 13O_2$ ✓→ $8CO_2 + 10H_2O$ ✓ (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 $_{products}$ – energy $_{reactants}$ ✓Reaksiewarmte/energieverandering tussen reaktamore particleste en produkte ✓ (1)

5.1.3 *Iron/iron oxide* ✓/Yster / Ysteroksied✓ (1)

5.2 Increase in concentration of N_2 means <u>more particles/molecules per unit volume</u>✓
<u>More particles have enough kinetic energy</u>/ energy equal or greater than activation energy✓
<u>Number of effective collisions per unit time increases</u>✓
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 eksotermies ✓en stel energie vry.✓* (2)

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.✓ (3)
Meer NO_2 sal dus vorm.✓

6.2.1

	$NO_2(g)$ +	$NO(g)$ ⇌	$N_2O(g)$ +	$O_2(g)$
Initial mol *aanvanklike mol*	0,06	0,29	0,18	0,38 ✓
Used/formed *Verbruik/gevorm*	0,12-0,06 =0,06 ✓	0,06	0,06	0,06 ✓
Equilibrium ($mol \cdot dm^{-3}$) /*Ewewig*($mol \cdot dm^{-3}$)	0,12	0,35	0,12	0,32

Add// *optel* ✓ subtract// *aftrek* ✓

$$K_c = \frac{[N_2O][O_2]}{[NO_2][NO]} \checkmark = \frac{0,12 \times 0,32}{0,12 \times 0,35} \checkmark \checkmark = 0,914 \checkmark$$

Marking criteria/nasienriglyne

a. initial concentrations/ *aanvanklike konsentrasies neer*✓
b. Calculate concentration of NO_2 used (0,06)/*Bereken konsentrasie van NO_2 wat gebruik is(0,06)*✓
c. Values of other reactants and products used or formed/ *Waardes van ander reaktante wat verbruik of gevorm is*✓
d. Equilibrium values for reactants/ *Ewewig waardes vir reaktante*✓
e. Equilibrium values for products/ *Ewewig waardes vir produkte*✓
f. Correct K_c expression/ *Korrekte K_c uitdrukking*✓
g. Substitution of concentration in correct K_c expression/ *Vervanging van konsentrasies in korrekte K_c-uitdrukking*✓✓
h. 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 $pH = -\log[H_3O^+]$ ✓
$= -\log 10^{-8}$
$= 8$ ✓ 2 marks for only answer / 2 punte vir slegs antwoord (2)

7.1.3 $CO_3^{2-} + H_2O$ ✓$\rightleftharpoons HCO_3^- + OH^-$ ✓ (2)

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

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

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

∴ Excess//*oormaat* HCl = 0,006 – 0,005 ✓= 0,001 mol ✓ (7)

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

$[H_3O^+] = \frac{n}{V}$✓$= \frac{0,001}{0,025+0,040}$ ✓$= 0,0154\ mol\cdot dm^{-3}$ ✓

$pH = -\log[H_3O^+]$ ✓

$= -\log(0,0154) = 1,812$ ✓ (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); ✓
Concentration 1mol·dm^{-3} ✓// konsentrasie 1mol·dm^{-3} ✓ (3)

8.1.2 Fe/Fe^{2+} or/*of* Fe-half cell/*halfsel* or/*of* Fe(s)✓✓ (2)

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

8.1.4 $O_2 + 4H^+ + 4e^- \rightarrow 2H_2O$ ✓✓ (2)

8.1.5 Fe(s) / Fe^{2+} (aq) ✓// O_2 (g) / H_2O (l)✓,Pt(s)✓ (-1 if // not there) (3)

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

- Accept any other correct formula from the data sheet / Aanvaar enige ander korrekte formule vanaf gegewensblad.
- Any other formula using unconventional abbreviations, e.g. $E^\theta_{cell} = E^\theta_{OA} - E^\theta_{RA}$ followed by correct substitutions:/ Enige ander formule wat onkonvensionele afkortings gebruik bv. $E^\theta_{sel} = E^\theta_{OM} - E^\theta_{RM}$ 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 Fe^{2+}. ✓
Mg is 'n sterker reduseermiddel as Fe.✓Mg is daarom makliker geoksideer as yster ✓en verhoed dat Fe na Fe^{2+} oksideer. ✓ (3)
[19]

QUESTION 9/VRAAG 9

9.1 P✓ (1)

9.2 $2H_2O + 2e^- \rightarrow H_2 + 2OH^-$ ✓✓ (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 / hygrogen 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 $2NH_3 + H_2SO_4$ ✓→ $(NH_4)_2SO_4$ ✓ (✓for/vir bal) (3)

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

10.2.2 $: \frac{3}{9}$ ✓x $\frac{30}{100}$ ✓x 50 = 5 kg✓
OR/*OF*
% N: $\frac{3}{9}$ x 30% ✓= 10%
Mass of nitogen // *massa stikstof*: 10% van totale massa van 50 kg

$\therefore : \frac{10}{100}$ x 50 ✓= 5 kg ✓ (3)

10.2.3 % filler/ *vulsel*= 100 – 30 = 70%

$\frac{70}{100}$ ✓x 50 = 35 kg✓
OR/OF
Mass of fertilizer/*massa kunsmis* = $\frac{30}{100}$ x 50 = 15✓
Mass of filler/*massa vulsel* = 50 – 15x = 35 kg✓x (2)
[12]

TOTAL/TOTAAL: 150