Province of the
EASTERN CAPE
EDUCATION

NASIONALE SENIOR SERTIFIKAAT

GRADE 12

SEPTEMBER 2010

PHYSICAL SCIENCES – PAPER 2
FISIESE WETENSKAPPE – VRAESTEL 2

MEMORANDUM

PUNTE: 150

TYD: 3 hours / uur

This memorandum consists of 12 pages.
Hierdie memorandum bestaan uit 12 bladsye.

SECTION A / *AFDELING A*

QUESTION 1: ONE-WORD ITEMS
VRAAG 1: EEN-WOORD ITEMS

1.1	Carboxylic acid ✓ / *Karboksielsuur*	[12.2.1]	(1)
1.2	Cathode ✓ / *Katode*	[12.2.1]	(1)
1.3	Ostwald's process✓ / *Ostwald proses*	[12.2.1]	(1)
1.4	Temperature ✓ / *Temperatuur*	[12.2.1]	(1)
1.5	Oxidising agent ✓ / oxidant / *Oksideermiddel / oksidant*	[12.2.1]	(1)
			[5]

QUESTION 2: MULTIPLE-CHOICE QUESTIONS
VRAAG 2: MEERVOUDIGEKEUSE-VRAE

2.1	B ✓✓	[12.2.3]	(2)
2.2	C ✓✓	[12.2.3]	(2)
2.3	C ✓✓	[12.2.3]	(2)
2.4	B ✓✓	[12.2.3]	(2)
2.5	A ✓✓	[12.2.3]	(2)
2.6	C✓✓	[12.2.3]	(2)
2.7	A✓✓	[12.2.3]	(2)
2.8	B✓✓	[12.2.3]	(2)
2.9	D✓✓	[12.2.3]	(2)
2.10	C✓✓	[12.2.3]	(2)
			[10]

TOTAL SECTION A: 25
TOTAAL AFDELING A: 25

SECTION B / *AFDELING B*

QUESTION 3 / *VRAAG 3*

3.1 Organic compounds with the same molecular formula but with different structural formula. ✓✓ [12.2.1]

Organiese verbindings met dieselfde molekulêre formule maar verskillende struktuurformules. (2)

3.2 **Condensed Structural formula / *Gekondenseerde struktuurformule***

3.2.1 4.2.1 $CH_3 – CH_2 – COOCH_3$ ✓OR $CH_3–COO – CH_2 – CH_3$ OR $CH_3 – CH_2 – CH_2OOCH$ [12.2.3]

IUPAC name / *IUPAC naam* (2)

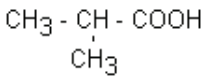
3.2.2 ethyl ethanoate ✓ OR methyl propanoate OR propyl methanoate [12.2.3]
Etiel etanoaat ✓ OF metiel propanoaat OF propiel metanoaat

Homologous series / *Homoloë reeks* (1)

3.2.3 ester ✓ [12.2.3]

Condensed Structural formula / *Gekondenseerde struktuurformule* (1)

3.2.4 $CH_3 – CH_2 – CH_2 – COOH$ ✓✓ OR [12.2.3]



IUPAC name *IUPAC naam* (2)

3.2.5 butanoic acid ✓ OR 2-methyl propanoic acid
butanoësuur *OF* *2-metiel propanoësuur* [12.2.3]

Homologous series / *Homoloë reeks* (1)

3.2.6 carboxylic acid ✓ / *karboksielsuur* [12.2.3] (1)

3.3 Hydrogen bonding takes place between molecules of carboxylic acids. ✓
The facility of acids to form two hydrogen bonds✓ per molecule makes their boiling points higher than those of the corresponding alcohols which is able to form only one hydrogen bond per molecule. ✓ [12.2.3]

Waterstofbinding vind plaas tussen molekules van karboksielsure. ✓
Die vermoë van sure om twee waterstofbindings ✓per molekuul te vorm lei daartoe dat hul kookpunte hoër is as die ooreenstemmende alkohole wat slegs een waterstofbinding per molekuul vorm. ✓ (3)

[13]

QUESTION 4 / *VRAAG 4*

4.1 Haloalkanes ✓
haloalkane [12.2.1] (1)

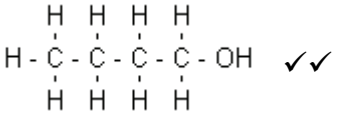
4.2 *gekon. KOH in etanol*
con.KOH in ethanol
✓ ✓
$CH_3 – CH_2 – CH_2 – CH_2 – Br \rightarrow CH_3 – CH_2 – CH = CH_2 + KBr + H_2O$
refluxed / terugvloei
[12.2.3] (2)

4.3 Unsaturated ✓
Onversadig

Double bond between two carbon atoms. ✓✓ [12.2.1]
Dubbelbinding tussen twee koolstof atome (3)

4.4 dehydrohalogenation. ✓✓ [12.2.1]
dehidrohalogenering (2)

4.5

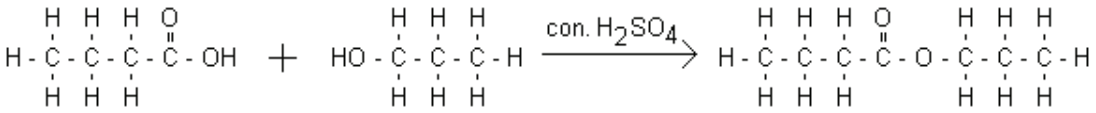


butanol-1 ✓✓ OR / OF butan-1-ol OR / OF 1-butanol [12.2.3] (4)

4.6 $CH_3 – CH_2 – CH_2 – CH_2 – OH$ ✓✓ [12.2.3] (2)

4.7 - COOH ✓✓ [12.2.1] (2)

4.8 ✓ ✓ ✓



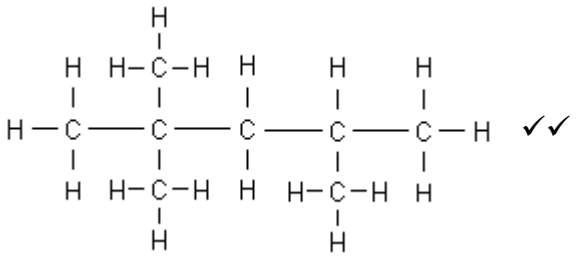
+ H_2O

[12.2.3] (3)
[19]

QUESTION 5 / *VRAAG 5*

5.1 The process by which (less volatile) larger hydrocarbons is converted to (more volatile) lower hydrocarbons ✓✓
Die proses waardeur (minder aktiewe) hoër koolwaterstowwe opgebreek word na (meer aktiewe) laer koolwaterstowwe. [12.1.1]
(2)

5.2



✓✓
(2)

5.3 Ethene / Ethylene. ✓✓ [12.2.1]
Eteen / Etileen (2)

5.4 $2\ C_4H_{10} + 13\ O_2 \rightarrow 8\ CO_2 + 10\ H_2O$ (bal)✓ [12.2.3] (3)
[9]

QUESTION 6 / *VRAAG 6*

6.1 Carbon dioxide✓, methane✓, nitrous oxide/ dinitrogen monoxide, chlorofluro carbons. (accept if formula is written) [12.3.1]
Koolstofdioksied, metaan, stikstofoksied, stikstofmonoksied, haloalkane (2)

6.2 Ethanol can be produced by the fermentation of starchy materials. ✓✓ [12.3.1]
Etanol kan vervaardig word deur die fermentasie van styselbevattende stowwe. (2)

6.3 $2\ NO + O_2 \rightarrow 2\ NO_2$ (bal) ✓ [12.2.3] (3)

6.4 Reduce the emission of $NO_{(g)}$ by regulating the use of automobiles. ✓
Fit automobiles with catalytic convertors. ✓ [12.3.2]

Verminder die emissies van NO(g) deur die gebruik van voertuie te reguleer. Voorsien voertuie met katalitiese omsetters. (2)

6.5 Shortness of breath, coughing, asthma, bronchitis, wheezing, pneumonia, lung cancer. (accept any two) ✓✓ [12.3.1]

Gejaagde asemhaling / Hoes / asma / brongitis / longkanker / long ontsteking (2)

6.6 6.6.1 Endothermic. ✓ [12.2.2]
Endotermies (1)

6.6.2 The minimum kinetic energy required for a reaction to take place. ✓✓ [12.2.1]
Die minimum kinetiese energie benodig vir die reaksie om plaas te vind. (2)

6.6.3 When temperature is increased the number of molecules with the minimum kinetic energy required for the reaction increases. ✓Thus the number of molecules that can overcome the activation energy increases. ✓
More molecules now move faster causing an increase in the frequency of number of effective collisions. ✓Hence the rate of formation of nitric oxide increases. [12.2.2]

Wanneer die temperatuur toeneem , neem die aantal molekules met die minimum kinetiese energie benodig ook toe. ✓ Die aantal molekules wat genoegsame energie het om die aktiveringsenergie te oorkom neem toe. ✓ Meer molekules beweeg nou vinniger sodat daar 'n toename is in die aantal effektiewe botsings. ✓ Dus neem die reaksietempo toe. (3)
[17]

QUESTION 7 / *VRAAG 7*

7.1 What is the effect of a catalyst on the rate of a chemical reaction? ✓✓ [12.1.1]

OR

How will the rate of a chemical reaction be affected by the addition of a catalyst?

Wat is die effek van 'n katalisator op die tempo van 'n chemiese reaksie?

OF

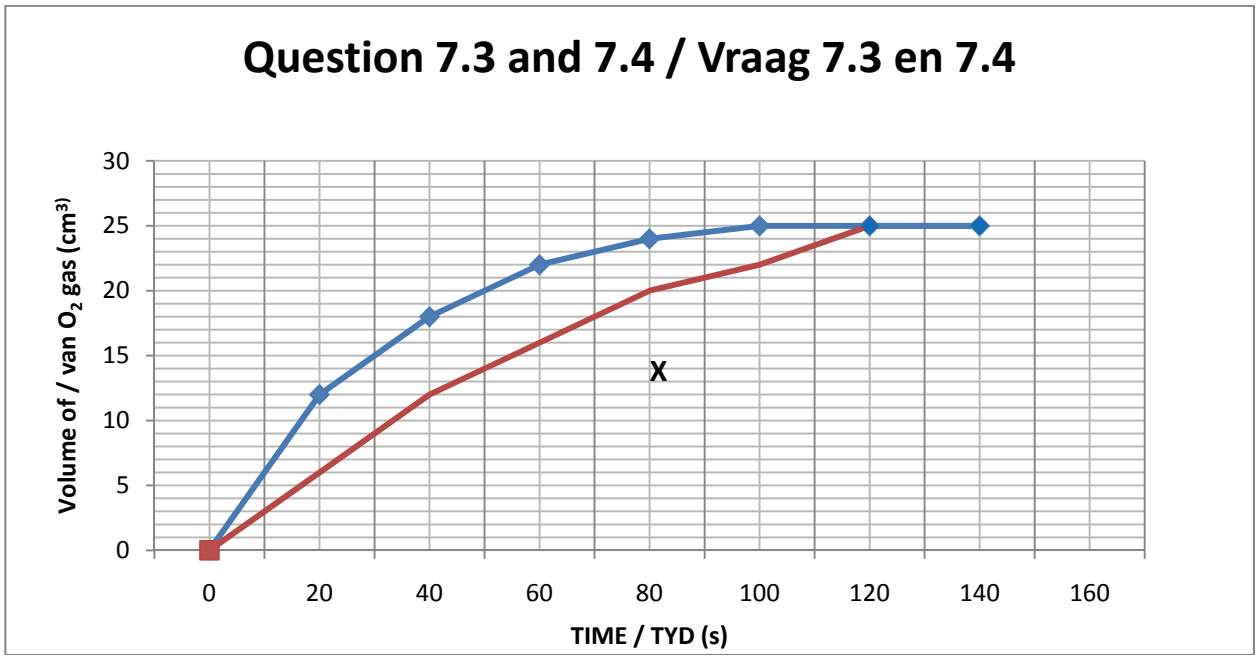
Hoe word die tempo van 'n chemiese reaksie affekteer deur die byvoeging van 'n katalisator ? (2)

7.2 Volume of oxygen gas formed. ✓ [12.1.1]
Volume van suurstofgas gevorm. (1)

7.3

CHECK LIST/ *KONTROLELYS*	
Criteria for graph / *Kriteria vir grafiek*	
1. Axes correctly labelled / *Asse korrek benoem*	✓
2. Shape of the graph / *Vorm van grafiek*	✓
3. Points plotted / *Plot van punte*	✓

[12.1.2] (3)



7.4 [12.1.2] (2)

Shape of graph **X** (must be below the first curve) *Vorm van grafiek X (moet onder eerste grafiek wees.)*	✓✓

7.5 The reactant is used up. ✓✓ / The reaction reached completion. [12.1.2]
Die reaktant is opgebruik. / Die reaksie is voltooi. (2)
[10]

QUESTION 8 / *VRAAG 8*

8.1 The equilibrium number of moles / amount / concentration of reactants and products increase with an increase in temperature. ✓ [12.1.1]

OR

The equilibrium number of moles / amount / concentration of reactants and products decrease with an increase in temperature.

OR

The equilibrium number of moles / amount / concentration of reactants and products increase with a decrease in temperature.

OR

The equilibrium number of moles / amount / concentration of reactants and products decrease with a decrease in temperature.

OR

The equilibrium number of moles / amount / concentration of reactants decrease and that of the product increases with an increase in temperature.

OR

The equilibrium number of moles / amount / concentration of reactants increase and that of the product decreases with an increase in temperature.

Die aantal mol / hoeveelheid / konsentrasie van die reaktante by ewewig neem toe en die produkte neem af met toename in temperatuur

OF

Die aantal mol / hoeveelheid / konsentrasie van die reaktante en produkte by ewewig neem af met toename in temperatuur.

OF

Die aantal mol / hoeveelheid / konsentrasie van die reaktante en produkte by ewewig neem toe met afname in temperatuur

OF

Die aantal mol / hoeveelheid / konsentrasie van die reaktante en produkte by ewewig neem af en die produkte neem af met afname in temperatuur

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Die aantal mol / hoeveelheid / konsentrasie van die reaktante by ewewig neem af en die produkte neem toe met toename in temperatuur

OF

Die aantal mol / hoeveelheid / konsentrasie van die reaktante by ewewig neem toe en die produkte neem af met toename in temperatuur (1)

8.2 By the fractional distillation of liquid air. ✓ [12.2.1]
Fraksionele distillasie van vloeibare lug. (1)

8.3 Chemical equilibrium. ✓ [12.1.2]
Chemiese ewewig

OR/OF

The rate of the forward reaction is equal to the reverse reaction.
Die tempo van die voorwaartse reaksie is gelyk aan die tempo van die terugwaartse reaksie.

OR/OF

The number of moles / amount / concentration of the reactants and products remains the same / constant.

OF

Die aantal mol / hoeveelheid / konsentrasie van die reaktante en produkte bly dieselfde / constant. (1)

8.4 8.4.1 In the given system the forward reaction is exothermic and the reverse reaction is endothermic. An increase in temperature increases the rate of both the forward and the reverse reaction. But the rate of the endothermic reaction is favoured more than the rate of the exothermic reaction. ✓ According to Le-Chatliers principle, the equilibrium will shift from the right to the left to cancel the effect due to the increase in temperature. ✓Hence the $[NH_3]$ decreases and the $[N_2]$ and $[H_2]$ increases. ✓ [12.1.2]

In die gegewe sisteem is die voorwaartse reaksie eksotermies en die terugwaartse reaksie endotermies. 'n Toename in temperatuur verhoog die tempo van beide die voorwaartse en terugwaartse reaksies. Maar die endotermiese reaksie se reaksietempo word meer bevoordeel as die eksotermiese reaksie. ✓ Volgens Le Chatelier se beginsel sal die ewewig van regs na links skuif om die verhoging in temperatuur teen te werk. ✓ Dus sal die $[NH_3]$ afneem en die $[N_2]$ en $[H_2]$ toeneem. ✓ (3)

8.4.2 Decreases ✓ [12.1.2]
Neem af (1)

8.5

$$K_c = \frac{[NH_3]^2}{[N_2]\ [H_2]^3} \checkmark$$

$$6 = \frac{(0,48)^2}{[N_2]\ (0,48)^3}$$

$$[N_2] = \frac{(0,48)^2}{6\ (0,48)^3}$$

$$= 0,35 \text{ mol.dm}^{-3} \checkmark$$

	N_2 +	$3\ H_2$ ⇌	$2\ NH_3$
Initial concentration of reactants / product ($mol.dm^{-3}$) *Aanvanklike konsentrasies van reagense en produkte ($mol.dm^{-3}$)*	0,59 ✓	1,20 ✓ ⇌	0
Concentration of reactants reacted / product formed ($mol.dm^{-3}$) *Konsentrasie van reagense reageer en produkte gevorm. ($mol.dm^{-3}$)*	0,24 ✓	0,72 ✓ ⇌	0,48
Equilibrium concentration of reactants / product ($mol.dm^{-3}$) *Ewewigskonsentrasies van reagense en produkte ($mol.dm^{-3}$)*	0,35	0,48 ⇌	0,48

$$[N_2] = \frac{n}{V} \qquad [H_2] = \frac{n}{V}$$

$$0,59 = \frac{n}{5} \qquad 1,20 = \frac{n}{5}$$

Initial number of moles of H_2 = 1,20 x 5 = 6,0 moles✓
Initial number of moles of N_2 = 0,59 x 5 = 2,95 moles✓
Aanvanklike aantal mol H_2 = 1,20 x 5 = 6,0 mol
Aanvanklike aantal mol N_2 =0,59 x 5 = 2,95 mol [12.1.3] (8)
[15]

QUESTION 9 / *VRAAG 9*

9.1 Temperature / *Temperatuur* = 25°C ✓/ 273 K
Concentration of electrolytes / *Konsentrasie van elektroliete* = 1 $mol.dm^{-3}$ ✓
[12.2.3] (2)

9.2 To complete the circuit. ✓
To maintain electric neutrality in the two half cells. ✓

Voltooi die stroombaan
Handhaaf elektrisiteit neutraliteit in die twee half-selle. [12.2.3] (2)

9.3 Ag^+✓ [12.2.1] (1)

9.4 Electrochemical cell-1 ✓✓ [12.1.2]
Elektrochemiese sel-1 (2)

9.5 $Al \rightarrow Al^{3+} + 3e^-$ ✓✓ [12.2.2] (2)

9.6 Cu ✓
Copper electrode loses electrons ✓✓ / Cu electrode undergoes oxidation /
$Cu \rightarrow Cu^{2+} + 2e^-$ [12.1.1]
Cu- elektrode verloor elektrone / Cu-elektrode word geoksideer. (3)

9.7 $E^0_{Cell} = E^0_{Cathode} - E^0_{Anode}$ ✓
✓ ✓
$= (-0,44) - (-1,66)$

$= 1,22$ V [12.1.3] (3)

9.8 ✓ ✓
$Cu + 2\,Ag^+ \rightarrow Cu^{2+} + 2Ag$ (bal)✓ [12.2.3] (3)
[18]

QUESTION 10 / *VRAAG 10*

10.1 Membrane cell. ✓ [12.2.1]
Membraansel (1)

10.2 Electrical energy is converted to chemical energy. ✓✓ [12.2.1]
Elektriese energie word omgesit na chemiese energie. (2)

10.3 Anode. ✓ [12.2.1]
Anode (1)

10.4 $2\,H_2O_{(l)} + 2e^- \rightarrow H_{2(g)} + OH^-_{(aq)}$ ✓✓ [12.2.1] (2)

10.5 10.5.1 Sodium hydroxide. ✓ [12.2.1]
Natriumhidroksied (1)
10.5.2 Na^+ ✓ [12.2.1] (1)
10.5.3 ✓ ✓
$Na^+_{(aq)} + OH^-_{(aq)} \rightarrow NaOH_{(aq)}$
[12.2.1] (2)

10.6

Hydrogen ***Waterstof***	**Chlorine** ***Chloor***	**Sodiumhydroxide** ***Natriumhidroksied***
To manufacture ammonia.✓ As fuel for rockets. For hydrogenation of fats and oil. In the production of H_2O_2 for bleaching. To produce hydrochloric acid. (any one) *Vervaardiging van ammoniak / Hidrogenering van vette en olies / Produksie van H_2O_2 vir bleikaksie / Produksie van soutsuur (enige een)*	To produce bleaching agents.✓/ To produce disinfectants. / To manufacture plastics like PVC. / To produce hydrochloric acid. / To manufacture pesticides. To manufacture paints and dyes. (any one) *Produksie van bleikmiddels Vervaardiging van plastiek PVC / Vervaardiging van kiemdoders / Vervaardiging van verf en kleurstowwe (enige een)*	To manufacture soaps and detergents.✓ In the paper industry. / In the textile industry. / For the extraction of aluminum metal. / To produce other sodium salts. (any one) *Vervaardiging van seep en reinigingsmiddels / Tekstielbedryf / Ekstraksie van aluminium metaal / Vervaardiging van natrium soute (enige een)*

[12.3.1] (3)

10.7 1. Lower operating costs. ✓ / Economically cheaper.
2. Environmentally friendly. ✓ / Less pollution compared to the other electrolytic cells.

1. Laer operasionele koste / Ekonomies goedkoper.
2. Omgewings vriendelik / Minder besoedeling in vergelyking met ander elektrochemiese selle. [12.3.3] (2)

[15]

QUESTION 11 / *VRAAG 11*

11.1 Mass ratio of the elements Nitrogen(N), Phospherous(P) and Potassium (K) in the fertilizer bag. ✓✓ [12.3.2]

Massa verhouding van elemente Stikstof (N), Fosfor (P) en Kalium(K) in die kunsmis sak. (2)

11.2 26% ✓ [12.3.2] (1)

11.3 % Nitrogen / *Stikstof* = 3/10 x 26 ✓
= 7,8% ✓ [12.3.2] (2)

11.4 11.4.1 ✓ ✓
$2\ NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$ (bal) ✓ (3)

11.4.2 Eutrophication. ✓ [12.3.3]
Eutrofikasie (1)

[9]

TOTAL SECTION B / *TOTAAL AFDELING B*: 125

GRAND TOTAL / *GROOTTOTAAL*: 150