

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.

2

PHYSICAL SCIENCE – PAPER 2
FISIESE WETENSKAPPE – VRAESTEL 2

(SEPTEMBER 2010)

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 ✓ / oksidant / 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 ✓✓ A | [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.

3.2 Condensed Structural formula / Gekondenseerde struktuurformule

- 3.2.1 4.2.1 CH₃-CH₂-COOCH₃ ✓ OR CH₃-COO-CH₂-CH₃ OR CH₃-CH₂-CH₂-OOCH ✓ [12.2.3]

IUPAC name / IUPAC naam

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

Homologous series / Homoloë reeks

- 3.2.3 ester ✓ [12.2.3]

Condensed Structural formula / Gekondenseerde struktuurformule

- 3.2.4 CH₃-CH₂-CH₂-COOH ✓✓ OR CH₃-CH₂-COOH ✓ [12.2.3]

IUPAC name / IUPAC naam

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

Homologous series / Homoloë reeks

- 3.2.6 carboxylic acid ✓ / karboksiesuur [12.2.3] (1)

- 3.3 Hydrogen bonding takes place between molecules of carboxylic acids. ✓
The ability 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 karboksiesure. ✓
Die vermoë van sure om twee waterstofbindings per molekule te vorm lei daartoe dat hul kookpunte hoër is as die ooreenstemmende alkohole wat slegs een waterstofbinding per molekule vorm. ✓

(3)
[13]

QUESTION 4 / VRAAG 4

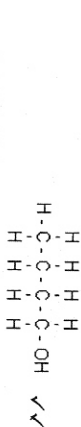
- 4.1 Haloalkanes ✓ Alkyl halides ✓ [12.2.1] (1)
haloalkane

- 4.2 CH₃-CH₂-CH₂-CH₂-Br ✓
gek. KOH in etanol
con. KOH in etanol
refluxed / terugvloei
if 4.2 wrong ✓
[12.2.3] (2)

- 4.3 Unsaturated ✓ 4.3 0
Onversadig ✓ 4.4. 0.
[12.2.1] (2)

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

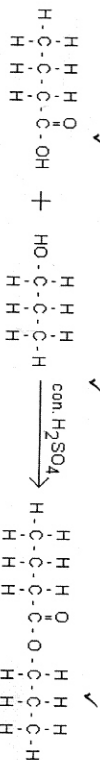
- 4.4 dehydrohalogenation. ✓✓
dehidrohalogenering [12.2.1] (2)



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

- 4.6 CH₃-CH₂-CH₂-CH₂-OH ✓✓ structure asked. [12.2.3] (2)

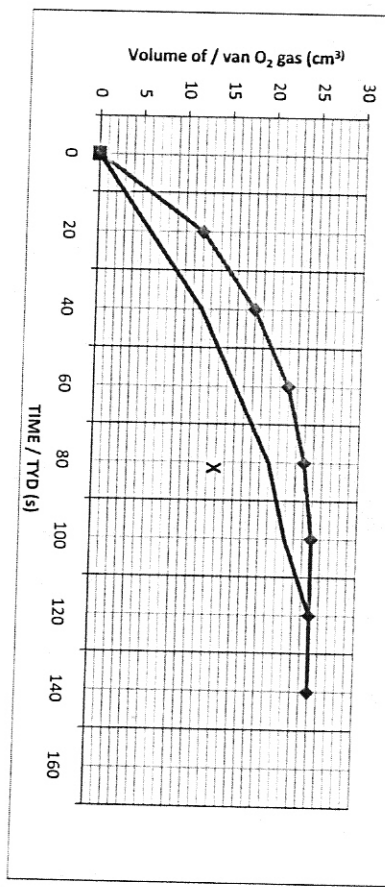
- 4.7 -COOH ✓✓ [12.2.1] (2)



[12.2.3] (3)
[19]

AXES
 SHAPE
 POINTS

Question 7.3 and 7.4 / Vraag 7.3 en 7.4



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

✓✓

[12.1.2] (2)

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

(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]

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 toename in temperatuur.
 OF

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.

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

- 8.3 Chemical equilibrium. ✓
Chemiese ewewig [12.1.2]

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.

OR/OF
Die aantal mol / hoeveelheid / konsentrasie van die reaktante en produkte bly dieselfde / konstant.

- 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-Chatelier's principle, the equilibrium will shift from the right to the left to cancel the effect due to the increase in temperature. ✓ Hence the [NH₃] decreases and the [N₂] and [H₂] increases. ✓ [12.1.2] (1)

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 skuf om die verhoging in temperatuur teen te werk. ✓ Dus sal die [NH₃] afneem en die [N₂] en [H₂] toeneem. ✓

- 8.4.2 Decreases ✓
Neem af [12.1.2] (3)

$$K_c = \frac{[\text{NH}_3]^2}{[\text{N}_2][\text{H}_2]^3} \quad \checkmark$$

$$6 = \frac{(0,48)^2}{[\text{N}_2](0,48)^3}$$

$$[\text{N}_2] = \frac{(0,48)^2}{6(0,48)^3}$$

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

(1)

Initial concentration of reactants / product (mol dm ⁻³)	N ₂	+	3 H ₂	⇌	2 NH ₃
Aanvanklike konsentrasies van reagents en produkte (mol dm ⁻³)	0,59 ✓		1,20 ✓	⇌	0
Concentration of reactants reacted / product formed (mol dm ⁻³)	0,24 ✓		0,72 ✓	⇌	0,48
Konsentrasie van reagents reageer en produkte gevorm. (mol dm ⁻³)					
Equilibrium concentration of reactants / product (mol dm ⁻³)	0,35		0,48	⇌	0,48
Ewewigskonsentrasies van reagents en produkte (mol dm ⁻³)					

$$[\text{N}_2] = \frac{n}{V}$$

$$0,59 = \frac{n}{5}$$

$$[\text{H}_2] = \frac{n}{V}$$

$$1,20 = \frac{n}{5}$$

Initial number of moles of H₂ = 1,20 x 5 = 6,0 moles ✓
Initial number of moles of N₂ = 0,59 x 5 = 2,95 moles ✓
Aanvanklike aantal mol H₂ = 1,20 x 5 = 6,0 mol
Aanvanklike aantal mol N₂ = 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. ✓
Pothoof vir ions
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 ✓ ✓
Elektrochemiese sel-1 [12.1.2] (2)

9.5 Al → Al³⁺ + 3e⁻ ✓ ✓ [12.2.2] (2)

9.6 Cu ✓

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

(3)

9.7 $E_{Cell}^0 = E_{Cathode}^0 - E_{Anode}^0$ ✓

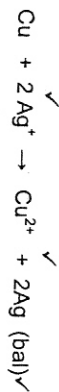
$= (-0,44) - (-1,66)$ ✓

$= 1,22 V$

[12.1.3]

(3)

9.8



[12.2.3]

(3)

QUESTION 10 / VRAAG 10

10.1 Membrane cell. ✓

Membraansel

[12.2.1]

(1)

10.2 Electrical energy is converted to chemical energy. ✓✓

Elektriese energie word omgesit na chemiese energie.

[12.2.1]

(2)

10.3 Anode. ✓

Anode

[12.2.1]

(1)



[12.2.1]

(2)

10.5 10.5.1 Sodium hydroxide. ✓

Natriumhidroksied

[12.2.1]

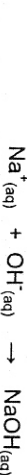
(1)

10.5.2 Na⁺ ✓

Na⁺

[12.2.1]

(1)



[12.2.1]

(2)

10.6

Hydrogen Waterstof	Chlorine Chlor	Sodiumhydroxide Natriumhidroksied
To manufacture ammonia. ✓ As fuel for rockets. For hydrogenation of fats and oil. In the production of H ₂ O ₂ for bleaching. To produce hydrochloric acid. (any one) Vervaardiging van ammoniak / Hidrogenering van vette en olies / Produkisie van H ₂ O ₂ vir bleikaksie / Produkisie 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) Produkisie van bleikmiddels Vervaardiging van plastiek PVC / Vervaardiging van klemdoders / Vervaardiging van verf en kleurstowwe (enige een)	To manufacture soaps and detergents. ✓ In the paper industry. / In the textile industry. / For the extraction of aluminium metal. / To produce other sodium salts. (any one) Vervaardiging van seep en reinigingsmiddels / Tekstielbedryf / Ekstraksie van aluminium metaal / Vervaardiging van natrium sout (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)

QUESTION 11 / VRAAG 11

11.1 Mass ratio of the elements Nitrogen(N), Phosphorous(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]

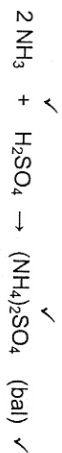
(1)

11.3 % Nitrogen / Stikstof = $3/10 \times 26$ ✓
 $= 7,8\%$ ✓

[12.3.2]

(2)

11.4 11.4.1 ✓



[12.3.3]

(3)

11.4.2 Eutrophication. ✓

Eutrofikasie

[12.3.3]

(1)

TOTAL SECTION B / TOTAAL AFDELING B: 125

GRAND TOTAL / GROOTTOTAAL: 150