



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE
NASIONALE
SENIOR SERTIFIKAAT**

GRADE/GRAAD 12

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

NOVEMBER 2012

MEMORANDUM

MARKS/PUNTE: 150

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

SECTION A/AFDELING A

QUESTION 1/VRAAG 1

- 1.1 Ketones/*Ketone* ✓ (1)
- 1.2 Ethene/*Eteen* ✓ (1)
- 1.3 Activation (energy)/*Aktiverings(energie)* ✓ (1)
- 1.4 Catalyst/*katalistor* ✓ (1)
- 1.5 (saturated) sodium chloride solution ✓
(*versadigde*) *natriumchloried oplossing* (1)
- [5]**

QUESTION 2/VRAAG 2

- 2.1 B ✓✓ (2)
- 2.2 C ✓✓ (2)
- 2.3 A ✓✓ (2)
- 2.4 A ✓✓ (2)
- 2.5 D ✓✓ (2)
- 2.6 D ✓✓ (2)
- 2.7 B ✓✓ (2)
- 2.8 C ✓✓ (2)
- 2.9 D ✓✓ (2)
- 2.10 A ✓✓ (2)
- [20]**

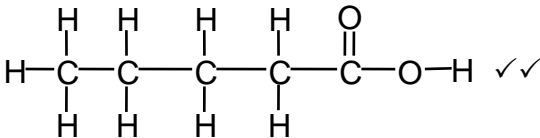
TOTAL SECTION A/TOTAAL AFDELING A: 25

SECTION B/AFDELING B

QUESTION 3/VRAAG 3

- 3.1
- 3.1.1 A ✓ (1)
- 3.1.2 D & F ✓✓ (2)
- 3.1.3 D ✓ (1)
- 3.1.4 E ✓ (1)
- 3.1.5 B ✓ (1)

- 3.2
- 3.2.1 2-methyl✓ but-1-ene ✓
2-metiel✓ but-1-een ✓ (2)

- 3.2.2
-  ✓✓ (2)

- 3.3
- 3.3.1 Pleasant odour ✓
Aangename geur (1)
- 3.3.2 Ethanol ✓✓
Etanol (2)
- 3.3.3 Ethyl propanoate ✓✓
Etielpropanoaat (2)

[15]

QUESTION 4/VRAAG 4

- 4.1
- 4.1.1 Fuels ✓
Brandstowwe ✓ (1)
- 4.1.2 C_nH_{2n+2} ✓ (1)
- 4.2
- 4.2.1 Boiling point/*Kookpunt* ✓ (1)
- 4.2.2 Chain length/Molecular size/Molecular mass ✓
Kettinglengte/Molekulêre grootte/Molekulêre massa (1)

4.2.3

Criteria for conclusion/ <i>Kriteria vir gevolgtrekking:</i>	Mark/Punt
Dependent and independent variables correctly identified. <i>Afhanklike en onafhanklike veranderlikes korrek geïdentifiseer.</i>	✓
Relationship between the independent and dependent variables correctly stated. <i>Verwantskap tussen die afhanklike en onafhanklike veranderlikes korrek genoem.</i>	✓

Examples/Voorbeelde:

- Boiling point increases with increase in chain length/molecular size/molecular mass.
Kookpunt neem toe met toename in kettinglengte/molekulêre grootte/molekulêre massa.
- Boiling point decreases with decrease in chain length/ molecular size/molecular mass.
Kookpunt neem af met afname in kettinglengte/molekulêre grootte/molekulêre massa.
- Boiling point is proportional to chain length/molecular size/molecular mass.
Kookpunt is eweredig aan kettinglengte/molekulêre grootte/molekulêre massa .

(2)

4.3 Pentane/*Pentaan* ✓

OR/OF

Hexane/*Heksaan* ✓

(1)

4.4 $C_3H_8 + 5O_2 \checkmark \rightarrow 3CO_2 + 4H_2O \checkmark$ bal ✓

(3)

4.5 Lower than ✓

- **Structure:**
Isomers have more branching/ more compact or spherical molecules / smaller surface areas over which the intermolecular forces act. ✓
- **Intermolecular forces:**
Weaker intermolecular forces/less intermolecular forces ✓
- **Energy:**
Less energy needed to overcome intermolecular forces. ✓

Kleiner as ✓

- **Struktuur:**
Isomere meer vertak/Molekule meer kompak of sferies./ Kleiner oppervlakte waaroor intermolekulêre kragte werk. ✓
- **Intermolekulêre kragte**
Swakker intermolekulêre kragte/ minder intermolekulêre kragte ✓
- **Energie:**
Die minder energie benodig om intermolekulêre kragte te oorkom. ✓

(4)

[14]

QUESTION 5/VRAAG 5

5.1

5.1.1 Haloalkanes /Haloalkane ✓ (1)

5.1.2



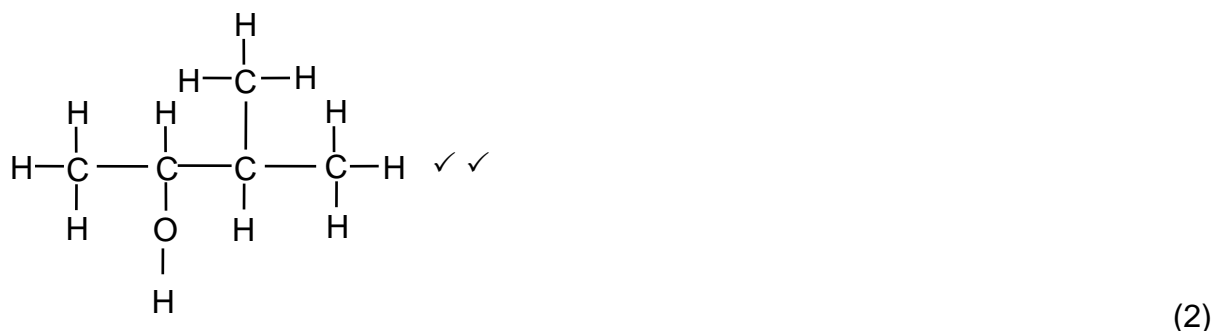
5.2

5.2.1 Substitution/Substitusie ✓

OR/OF

Hydrolysis/Hidrolise ✓ (1)

5.2.2



5.3

5.3.1 Heat strongly ✓
Verhit sterk (1)

5.3.2 Elimination/dehydrohalogenation/dehydrobromination ✓
Eliminasie/dehidrohalogenering/dehidrobrominering ✓ (1)

5.3.3



5.4 2-methylbut-2-ene ✓✓
2-metielbut-2-een (2)

[12]

QUESTION 6/VRAAG 6

- 6.1 Carbon dioxide ✓
Koolstofdioksied/koolsuurgas (1)
- 6.2
6.2.1 (6 ; 3,1) ✓ (1)
6.2.2 12 minutes/minute ✓ (1)
6.2.3 4 minutes/minute ✓ (1)
- 6.3 More particles per unit volume ✓
More effective collisions per unit time/second. ✓
Meer deeltjies per eenheids volume deeltjies.
Meer effektiewe botsings per eenheids tyd/sekonde. (2)
- 6.4
6.4.1 Increases/Vermeerder ✓ (1)
6.4.2 Remains the same/Bly dieselfde ✓ (1)
6.4.3 Decreases/Neem af ✓ (1)
- 6.5
 - Add a catalyst/Voeg 'n katalisator by ✓
 - Increase surface area of calcium carbonate./Use calcium carbonate powder./Crush calcium carbonate chips. ✓
Verhoog die oppervlakarea van kalsiumkarbonaat./Gebruik kalsiumkarbonaatpoeier./Maak die kalsiumkarbonaatstukkies fyn. (2)
- 6.6
$$n(\text{CO}_2) = \frac{m}{M} \checkmark$$
$$= \frac{4}{44} \checkmark$$
$$= 0,09 \text{ mol}$$
$$n(\text{CaCO}_3) = n(\text{CO}_2) = 0,09 \text{ mol}$$
$$m(\text{CaCO}_3) = nM$$
$$= (0,09) \checkmark (100) \checkmark$$
$$= 9 \text{ g} \checkmark$$
 (5)
[16]

QUESTION 7/VRAAG 7

7.1 The stage in a chemical reaction when the rate of forward reaction equals the rate of reverse reaction. ✓✓
Die stadium in 'n chemiese reaksie wanneer die tempo van die voorwaartse reaksie is gelyk aan die tempo van die terugwaartse reaksie. ✓✓

(2)

7.2 $n(\text{B})_{\text{reacted/gereageer}} = 6 - 4 = 2 \text{ mol}$ ✓
 $n(\text{C})_{\text{formed/gevorm}} = n(\text{B})_{\text{reacted/gereageer}} = 2 \text{ mol}$ ✓

$$c(\text{C}) = \frac{n}{V} = \frac{2}{5} \text{ ✓} = 0,4 \text{ mol}\cdot\text{dm}^{-3}$$

(3)

7.3 Increases ✓

- 3 mol/volumes (of gas) produces 2 mol/volumes (of gas). The reaction which produces the smaller number of moles/volume is favoured. ✓
- Forward reaction is favoured. ✓

Vermeerder ✓

- 3 mol/volumes (gas) produseer 2 mol/volumes (gas). Die reaksie wat die kleiner getal mol /volume vorm, word bevoordeel.
- Voorwaartse reaksie word bevoordeel.

(3)

7.4 **OPTION 1/OPSIE 1**

Use x as the total initial amount of B(g) that must be used.

Gebruik x as die totale aanvanklike hoeveelheid B(g) wat gebruik moet word.

	A	B	C
Initial quantity (mol) <i>Aanvangshoeveelheid (mol)</i>	3	x	0
Change (mol) <i>Verandering (mol)</i>	-2	-4	+4
Quantity at equilibrium (mol)/ <i>Hoeveelheid by ewewig (mol)</i>	1	x - 4 ✓	4 ✓
Equilibrium concentration (mol·dm ⁻³) <i>Ewewigskonsentrasie (mol·dm⁻³)</i>	$\frac{1}{5} = 0,2$	$\frac{x - 4}{5}$	0,8

ratio ✓
verhouding

$$K_c = \frac{[\text{C}]^2}{[\text{A}][\text{B}]^2} \text{ ✓}$$

$$\therefore 0,625 \text{ ✓} = \frac{(0,8)^2}{(0,2)\left(\frac{x-4}{5}\right)^2} \text{ ✓}$$

$$\therefore x = 15,3 \text{ mol}$$

$$\therefore n(\text{B})_{\text{added}} = 15,3 - 6 \text{ ✓} = 9,3 \text{ (mol) ✓}$$

Divide by/gedeel deur 5 ✓

No K_c expression, correct substitution/Geen K_c -uitdrukking, korrekte substitusie: Max./Maks. $\frac{8}{9}$

Wrong K_c expression/Verkeerde K_c -uitdrukking: Max./Maks. $\frac{6}{9}$

OPTION 2/OPSIE 2

Use x as amount to be added to the amount of B(g) present initially i.e. 6 mol of B(g).

Gebruik x as die hoeveelheid wat by die hoeveelheid van B(g) wat aanvanklik teenwoordig was gevoeg moet word d.i. 6 mol B(g).

	A	B	C
Initial quantity (mol) Aanvangshoeveelheid (mol)	3	x + 6 ✓	0
Change (mol) Verandering (mol)	-2	-4	+4
Quantity at equilibrium (mol)/ Hoeveelheid by ewewig (mol)	1	x + 2 ✓	4 ✓
Equilibrium concentration (mol·dm ⁻³) Ewewigskonsentrasie (mol·dm ⁻³)	$\frac{1}{5} = 0,2$	$\frac{x+2}{5}$	0,8

ratio ✓
verhouding

$$K_C = \frac{[C]^2}{[A][B]^2} \checkmark$$

$$\therefore 0,625 \checkmark = \frac{(0,8)^2}{(0,2)\left(\frac{x+2}{5}\right)^2} \checkmark$$

$$\therefore x = 9,31 \text{ (mol)} \checkmark$$

Divide by/gedeel deur 5

OPTION 3/OPSIE 3

Use x as amount to be added to the amount of B(g) present after first equilibrium was established i.e. 4 mol of B(g).

Gebruik x as die hoeveelheid wat by die hoeveelheid van B(g) wat teenwoordig is nadat die eerste ewewig ingestel is, gevoeg moet word d.i. 4 mol B(g).

	A	B	C
Initial quantity (mol) Aanvangshoeveelheid (mol)	2	x + 4 ✓	2
Change (mol) Verandering (mol)	-1	-2	+2
Quantity at equilibrium (mol)/ Hoeveelheid by ewewig (mol)	1	x + 2 ✓	4 ✓
Equilibrium concentration (mol·dm ⁻³) Ewewigskonsentrasie (mol·dm ⁻³)	$\frac{1}{5} = 0,2$	$\frac{x+2}{5}$	0,8

ratio ✓
verhouding

$$K_C = \frac{[C]^2}{[A][B]^2} \checkmark$$

$$\therefore 0,625 \checkmark = \frac{(0,8)^2}{(0,2)\left(\frac{x+2}{5}\right)^2} \checkmark$$

$$\therefore x = 9,31 \text{ (mol)} \checkmark$$

Divide by /gedeel deur 5 ✓

(9)
[17]

QUESTION 8/VRAAG 8

- 8.1
- 8.1.1 Increases ✓
The reaction is exothermic./Energy (or heat) is released $\Delta H < 0$. ✓
Vermeerder
Die reaksie is eksotermies./Energie (of hitte) word vrygestel/ $\Delta H < 0$. (2)
- 8.1.2 Aluminium is a strong reducing agent/stronger reducing agent ✓ than copper and will reduce the copper(II) ions to copper. ✓
Aluminium is 'n sterk reduseermiddel / sterker reduseermiddel ✓ as koper en sal die koper(II)-ione reduseer na koper. ✓ (2)
- 8.1.3 $2\text{Al}(s) + 3\text{Cu}^{2+}(\text{aq}) \rightarrow 2\text{Al}^{3+}(\text{aq}) + 3\text{Cu}(s)$ ✓ bal. ✓ (3)
- 8.2
- 8.2.1 Al/Aluminium ✓ (1)
- 8.2.2 $\text{Al}(s) | \text{Al}^{3+}(1 \text{ mol}\cdot\text{dm}^{-3}) || \text{Cu}^{2+}(1 \text{ mol}\cdot\text{dm}^{-3}) | \text{Cu}(s)$ (3)
- 8.2.3 $E^{\circ}_{\text{cell}} = E^{\circ}_{\text{cathode}} - E^{\circ}_{\text{anode}}$ ✓
 $= 0,34 - (-1,66)$ ✓
 $E^{\circ}_{\text{cell}} = 2,00\text{V}$ ✓ (4)
- 8.2.4 0 (V)/zero/nul ✓
The circuit is open. ✓
Die stroombaan is oop (2)
- [17]**

QUESTION 9/VRAAG 9

9.1 Electrical energy to chemical energy. ✓
Elektriese energie na chemiese energie ✓ (1)

9.2 The polarity of the electrodes must remain constant during plating. ✓
Die polariteit van die elektrodes moet konstant bly tydens elektroplatering. (1)

9.3 Reduction/Reduksie ✓ (1)

9.4
9.4.1 $\text{Ag} \rightarrow \text{Ag}^+ + \text{e}^-$ ✓✓ (2)

9.4.2 Silver nitrate/Silwernitraat/ AgNO_3 ✓

OR/OF

Silver ethanoate/silver acetate/Silweretanoaat/silwerasetaat ✓
 $\text{CH}_3\text{COOAg}/\text{AgC}_2\text{H}_3\text{O}_2/\text{AgCH}_3\text{CO}_2$ (1)

9.5 Rate of oxidation is equal to the rate of reduction. ✓✓
Tempo van oksidasie is gelyk aan die tempo van reduksie. (2)

9.6 **Protection/Beskerming**
Protects it from rusting / corrosion./Beskerm dit teen roes/korrosie. ✓

OR/OF

Appearance/Voorkoms
Improve appearance of spoons. / Verbeter voorkoms van die lepels. (1)

9.7 Cost of electricity/ Koste van elektrisiteit. ✓
Cost of silver/ Koste van silwer ✓ (2)

[11]

QUESTION 10/VRAAG 10

10.1 Primary (cells)/Primêre (selle) ✓ (1)

10.2 (Equation/Vergelyking) 2 ✓
Reduction takes place (at the cathode)./Reduksie vind (by die katode) plaas. ✓ (2)

10.3 **ANY ONE/ENIGE EEN:**

- The cell reaction reaches equilibrium. ✓
Die selreaksie bereik ewewig. ✓
- The rates of the forward and reverse reactions become equal. ✓
Die tempo van die voorwaartse en terugwaartse reaksies is gelyk. ✓
- Substances reach their equilibrium concentrations. ✓
Stowwe bereik hul ewewigskonsentrasies. (1)

10.4

10.4.1 $W = qV$ ✓
 $\therefore 3 \times 10^4 = q(1,5)$ ✓
 $\therefore q = 2 \times 10^4$ (C)

Cell capacity/Selkapasiteit = $\frac{2 \times 10^4}{3600}$ ✓ = 5,56 A·h ✓ (4)

10.4.2

<u>OPTION 1 / OPSIE 1</u>	<u>OPTION 2 / OPSIE 2</u>
$q = I\Delta t$ ✓ $\therefore 2 \times 10^4 = I(20)(3600)$ ✓ $\therefore I = 0,28$ A ✓	$q = I\Delta t$ ✓ $\therefore 5,56 = I(20)$ ✓ $\therefore I = 0,28$ A ✓

(3)
[11]

QUESTION 11/VRAAG 11

11.1

11.1.1 Fractional distillation (of liquid air) ✓
Fraksionele distillasie (van vloeibare lug) ✓ (1)

11.1.2 $N_2 + 3H_2 \rightleftharpoons 2NH_3$ ✓ bal. ✓ (3)

11.1.3 Contact (process)/Kontak(proses) ✓ (1)

11.1.4 $H_2SO_4 + 2NH_3 \rightarrow (NH_4)_2SO_4$ ✓ bal. ✓ (3)

11.1.5 Neutralisation/Acid-base reaction ✓
Neutralisasie/Suur-basisreaksie ✓ (1)

11.2

11.2.1 Nitric acid/ HNO_3 / hydrogen nitrate /salpetersuur/ waterstofnitraat ✓ (1)

- 11.2.2
- Contains (a high percentage of) nitrogen/N/primary nutrient. ✓
Bevat ('n hoë persentasie) stikstof/N/primêre voedingstof. (2)
 - High solubility /Hoë oplosbaarheid ✓ [12]

TOTAL SECTION B/TOTAAL AFDELING B: 125
GRAND TOTAL/GROOTTOTAAL: 150