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)

EXEMPLAR/*MODEL* 2014

MEMORANDUM

MARKS/*PUNTE*: 150

This memorandum consists of 10 pages.
Hierdie memorandum bestaan uit 10 bladsye.

QUESTION 1/*VRAAG 1*

1.1 B ✓✓ (2)

1.2 C ✓✓ (2)

1.3 A ✓✓ (2)

1.4 B ✓✓ (2)

1.5 C ✓✓ (2)

1.6 D ✓✓ (2)

1.7 C ✓✓ (2)

1.8 C ✓✓ (2)

1.9 C ✓✓ (2)

1.10 B ✓✓ (2)

[20]

QUESTION 2/*VRAAG 2*

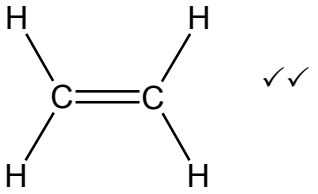
2.1

2.1.1 Alkynes / *Alkyne* ✓ (1)

2.1.2 Hydroxyl group / *Hidroksielgroep* ✓ (1)

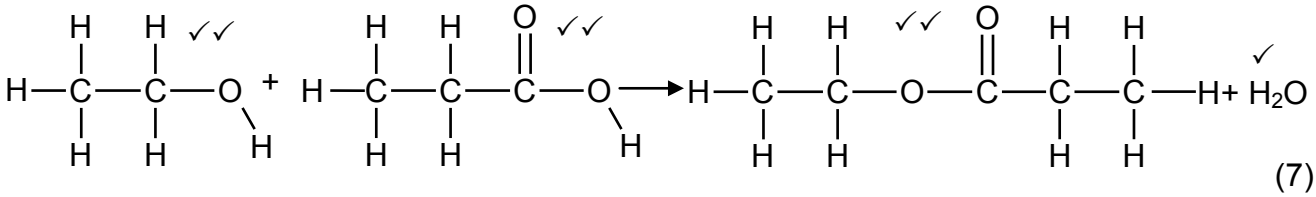
2.1.3 C ✓ (1)

2.1.4 2-methylpentan-3-one / *2-metielpentan-3-oon* ✓✓ (2)

2.1.5  ✓✓ (2)

2.1.6 $2C_4H_{10} + 13O_2$ ✓→ $8CO_2 + 10H_2O$ ✓ Bal. ✓ (3)

2.2 Same molecular formula, ✓
but different positions of the functional group. ✓
Dieselfde molekulêre formule,
maar verskillende posisies van die funksionele groep. (2)

2.3  (7)

[19]

QUESTION 3/*VRAAG 3*

3.1 Temperature ✓ at which the vapour pressure of the substance equals atmospheric pressure. ✓
Temperatuur waar die dampdruk van die stof gelyk is aan atmosferiese druk. (2)

3.2

3.2.1 Boiling point increases as the chain length / molecular mass increases. ✓
Kookpunt neem toe soos wat die kettinglengte / molekulêre massa toeneem.

OR/*OF*
Boiling point increases from methane to butane.
Kookpunt neem toe van metaan na butaan. (1)

3.2.2
- Chain length increases from methane to butane. ✓
  Kettinglengte neem toe van metaan na butaan.
- Strength of London forces / induced dipole forces increases from methane to butane. ✓
  Sterkte van Londonkragte / geïnduseerde dipoolkragte neem toe van metaan na butaan.
- More energy needed to overcome intermolecular forces in butane than in methane. ✓
  Meer energie benodig om intermolekulêre kragte in butaan as in metaan te oorkom. (3)

3.3 Between molecules of the alkanes are weak London forces or induced dipole forces. / *Tussen molekule van alkane is swak Londonkragte of geïnduseerde dipoolkragte.* ✓
Between alcohol molecules are, in addition to weak London forces or induced dipole forces, also strong hydrogen bonds. / *Tussen alkoholmolekule is sterk waterstofbindings bykomend by tot swak Londonkragte of geïnduseerde dipoolkragte.* ✓ (2)
[8]

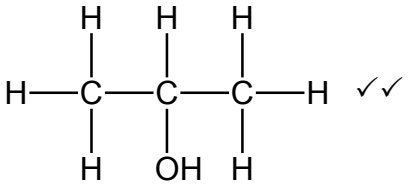
QUESTION 4/*VRAAG 4*

4.1 Alkenes / *Alkene* ✓ (1)

4.2

4.2.1 Addition / Hydrohalogenation / Hydrochlorination ✓
Addisie / Hidrohalogeneging / Hidrochloronering (1)

4.2.2



✓✓

Propan-2-ol ✓ (3)

4.2.3 Elimination / Dehydration ✓
Eliminasie / Dehidrasie (1)

4.2.4 Catalyst / *Katalisator* ✓ (1)

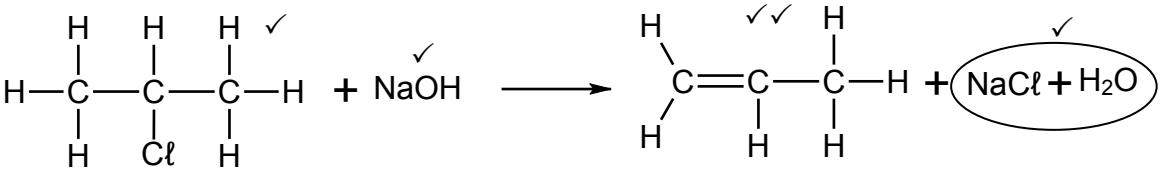
4.3

4.3.1 Sodium hydroxide / Potassium hydroxide ✓
Natriumhidroksied / Kaliumhidroksied (1)

4.3.2 Dissolve base in ethanol. / Concentrated (strong) base) ✓
Heat strongly. ✓

Los basis op in etanol. / Gekonsentreerde (sterk) basis
Verhit sterk. (2)

4.3.3



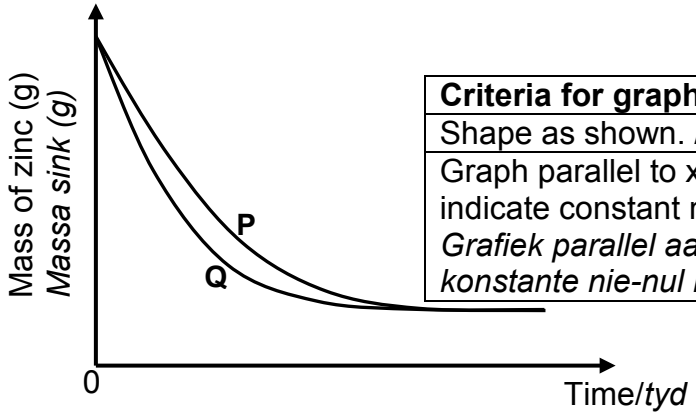
(5)
[15]

QUESTION 5/*VRAAG 5*

5.1 Hydrochloric acid / HCℓ / *Soutsuur* ✓ (1)

5.2 Hydrogen gas escapes from the flask. ✓
Waterstofgas ontsnap uit die fles. (1)

5.3



Criteria for graph P: / *Riglyne vir grafiek P:*	
Shape as shown. / *Vorm soos aangetoon*.	✓
Graph parallel to x-axis after a certain time to indicate constant non-zero mass of zinc. *Grafiek parallel aan x-as na 'n sekere tyd om konstante nie-nul massa van sink aan te dui.*	✓

(2)

5.4

Criteria for graph Q / *Riglyne vir grafiek Q*:	
Steeper gradient than Graph **P**. / Steiler gradiënt as Grafiek **P**.	✓
Joins parallel section of Graph **P** after a shorter time. *Verbind met die parallelle deel van Grafiek **P** na 'n korter tyd.*	

(1)

5.5 At a higher temperature:
- More molecules have sufficient kinetic energy / kinetic energy equal to or greater than the activation energy. ✓
- More effective collisions per unit time / second. ✓

By 'n hoër temperatuur:
- *Meer molekule het voldoende kinetiese energie / kinetiese energie gelyk aan of groter as die aktiveringsenergie.*
- *Meer effektiewe botsings per eenheidstyd / sekond*. ✓

(2)

5.6 $c(HC\ell) = \frac{n}{V}$ ✓

$\therefore\ 0,2 = \frac{n}{0,1}$ ✓

$\therefore n(HC\ell) = 0,02$ mol

$n(Zn) = ½n(HC\ell) = 0,01$ mol ✓

m(Zn reacted / *gereageer*) = nM ✓
= (0,01)(65) ✓
= 0,65 g

Mass of Zn initially in flask / *Massa Zn aanvanklik in fles:*
0,65 + 0,12 = 0,77 g ✓

(6)
[13]

QUESTION 6/*VRAAG 6*

6.1 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 gelyk is aan die tempo van die terugwaarste reaksie. ✓✓ (2)

6.2

6.2.1 Higher than / *Hoër as* ✓ (1)

6.2.2 Equal to / *Gelyk aan* ✓ (1)

6.3

6.3.1 $NO_2(g)$ added / *bygevoeg* ✓ (1)

6.3.2 Decrease in pressure / *Afname in druk* ✓ (1)

6.4 Increases ✓
An increase in temperature favours the endothermic reaction. ✓
The forward reaction is endothermic. / The forward reaction is favoured. ✓
Verhoog
'n Toename in temperatuur bevoordeel die endotermiese reaksie.
Die voorwaartse reaksie is endotermies. / Die voorwaarste reaksie word bevoordeel. (3)

6.5

	N_2O_4	NO_2
Initial quantity (mol) *Aanvangshoeveelheid (mol)*	0,92	0
Change (mol) *Verandering (mol)*	0,19 ✓	0,38
Quantity at equilibrium (mol)/ *Hoeveelheid by ewewig (mol)*	0,73	0,38 ✓
Equilibrium concentration ($mol \cdot dm^{-3}$) *Ewewigskonsentrasie ($mol \cdot dm^{-3}$)*	$\frac{0,73}{2} = 0,37$	$\frac{0,38}{2} = 0,19$

ratio ✓
verhouding

$$K_C = \frac{[NO_2]^2}{[N_2O_4]} \checkmark$$
$$= \frac{(0,19)^2}{(0,37)} \checkmark$$
$$= 9,76 \times 10^{-2} \checkmark$$

Divide by / *gedeel deur* 2 ✓

No K_C expression, correct substitution /
Geen K_c-uitdrukking, korrekte substitusie:
Max. / *Maks.* $\frac{6}{7}$

Wrong K_C expression / *Verkeerde K_c-uitdrukking*: Max. / M*aks.* $\frac{4}{7}$

(7)
[16]

QUESTION 7/*VRAAG 7*

7.1 An acid forms hydronium ions / H_3O^+ ions when it dissolves in water. ✓
'n Suur vorm hidroniumione / H_3O^+-ione wanneer dit in water oplos. (2)

7.2 Incompletely / partially ionised ✓
Onvolledig / gedeeltelik geioniseer (1)

7.3 Solution of known concentration. / *Oplossing van bekende konsentrasie*. ✓ (1)

7.4 Burette / *Buret* ✓
Pipette / *Pipet* ✓ (2)

7.5

7.5.1

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$K_w = [H_3O^+][OH^-]$ $\therefore 1 \times 10^{-14} = [H_3O^+](0,5)$ ✓ $\therefore [H_3O^+] = 2 \times 10^{-14}$ mol·dm^{-3} pH = - log$[H_3O^+]$ ✓ = - log (2×10^{-14}) ✓ = 13,7 ✓	pOH = - log$[OH^-]$ ✓ = - log(0,5) ✓ = 0,3 pH = 14 – pOH ✓ = 14 – 0,3 = 13,7 ✓

(4)

7.5.2 n(NaOH) = cV ✓
= (0,5)(0,04) ✓
= 0,02 mol

n(CH_3COOH) = n(NaOH) = 0,02 mol ✓

m(CH_3COOH) = nM ✓
= (0,02)(60) ✓
= 1,2 g

% mass of / *massa van* $CH_3COOH = \frac{1,2}{20} \times 100$ ✓ = 6% ✓ (7)

7.6 $CH_3COO^-(aq) + H_2O(\ell)$ ✓→ $CH_3COOH(aq) + OH^-(aq)$ ✓ Bal. ✓ (3)
[20]

QUESTION 8/*VRAAG 8*

8.1 $1\ mol\cdot dm^{-3}$ ✓ (1)

8.2 Iodine is not a conductor. / *Jodium is nie 'n geleier nie.* ✓ (1)

8.3 Graphite is a conductor. / *Grafiet is 'n geleier.*✓
Graphite is inert. / *Grafiet is onaktief/traag*. ✓ (2)

8.4

8.4.1 Permanganate ion / *Permanganaat-ioon* ✓ (1)

8.4.2 $2MnO_4^-(aq) + 16H^+(aq) + 10I^-(aq)$ ✓ $\rightarrow 2Mn^{2+}(aq) + 5I_2(s) + 8H_2O(\ell)$ ✓ bal. ✓ (3)

8.4.3 $C(s) \mid I^-(aq) \mid I_2(s) \parallel H^+(aq), MnO_4^-(aq), Mn^{2+}(aq) \mid C(s)$ (3)

8.5 $E^o_{cell} = E^o_{cathode} - E^o_{anode}$ ✓
$= 1,51$ ✓$- 0,54$ ✓
$E^o_{cell} = 0,97\ V$ ✓ (4)

8.6 Decreases / *Verlaag* ✓ (1)
[16]

QUESTION 9/*VRAAG 9*

9.1 A solution that conducts electricity through the movement of ions. ✓✓
'n Oplossing wat elektrisiteit gelei deur die beweging van ione. (2)

9.2 Bracelet / *Armband* ✓ (1)

9.3

9.3.1 Chromium / *Chroom* ✓ (1)

9.3.2 $Cr^{3+}(aq) + 3e^- \rightarrow Cr(s)$ ✓✓ (2)

9.4

$$n(Cr) = \frac{m}{M} \checkmark$$
$$= \frac{0,86}{52} \checkmark$$
$$= 0,0165\ mol$$

n(electrons / *elektrone*) = 3n(Cr) ✓ $= 4,96 \times 10^{-2}$ mol

$$n = \frac{N}{N_A} \checkmark$$
$$4,96 \times 10^{-2} = \frac{N}{6,02 \times 10^{23}}$$
$$\therefore N = 2,99 \times 10^{22} \checkmark$$ (6)
[12]

QUESTION 10/*VRAAG 10*

10.1 Contact process */ Kontakproses* ✓ (1)

10.2 Sulphur dioxide / SO_2 / S*waweldioksied* ✓ (1)

10.3

10.3.1 Vanadium pentoxide / Vanadium(V) oxide / V_2O_5 ✓
Vanadiumpentoksied / Vanadium(V)oksied / V_2O_5 (1)

10.3.2 $2SO_2(g) + O_2$ ✓ $\rightleftharpoons 2SO_3$ ✓ Bal. ✓ (3)

10.4

10.4.1 Oleum / Pyrosulphuric acid / $H_2S_2O_7$ ✓
Oleum / Piroswawelsuur / $H_2S_2O_7$ (1)

10.4.2 Reaction is highly exothermic and forms a mist. ✓
Die reaksie is hoog eksotermies en vorm 'n mis. (1)

10.5 Ammonium sulphate / $(NH_4)_2SO_4$ ✓
Ammoniumsulfaat / $(NH_4)_2SO_4$ (1)

10.6 Eutrophication leads to the destruction of aquatic life / dead zones. ✓
This results in less income due to selling of food / recreation areas. ✓
Eutrofikasie lei tot die afbreek van waterlewe / dooie sones.
Dit het minder inkomste deur die verkoop van voedsel / ontspanningsareas tot gevolg. (2)

[11]

GRAND TOTAL/*GROOTTOTAAL*: 150