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MARKING GUIDELINES

NASIENRIGLYNE

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

DATE / *DATUM*: JUNE 2024 **MARKS / *PUNTE*: 150**

QUESTION 1/*VRAAG 1*

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

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QUESTION 2/*VRAAG 2*

2.1 Saturated ✓

Versadig ✓ (1)

2.2.1 Haloalkanes / Alkyl Halides ✓

Haloalkane/ Alkielhaliede ✓ (1)

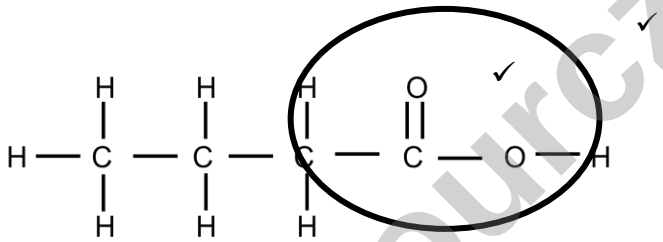
2.2.2 Carboxyl group✓

Karboksiel groep ✓ (1)

2.2.3 Ethanol✓
Ethanoic acid✓

Etanol ✓
Etanoësuur ✓ (2)

2.3.1



MARKING GUIDELINES:
Functional group
Correct structure

(2)

2.3.2 $CH_2(C\ell)CH(CH_3)CH_3$ ✓✓

OF

$CH_3CH(CH_3)CH_2C\ell$ ✓✓ (2)

2.3.3 $C_4H_8O_2$✓✓ (2)

2.4 Organic molecules with the <u>same molecular formula</u>, ✓but <u>different structural formulae</u>.✓

Organiese molekule met <u>dieselfde molekulêre formule</u> ✓, maar <u>verskillende struktuur formules</u> ✓ (2)

2.5.1 Positional isomers✓

Posisie isomere ✓ (1)

2.5.2 Functional isomers✓

Funksionele isomere ✓ (1)

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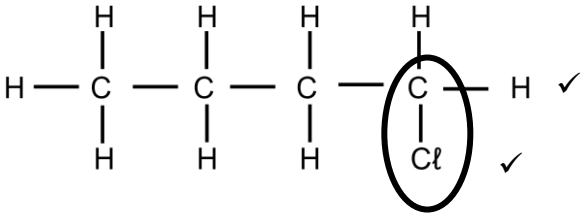
2.6



MARKING GUIDELINES:
✓ Functional group
✓ Correct structure

(2)

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QUESTION 3/*VRAAG 3*

3.1.1 Boiling point✓

Kookpunt ✓ (1)

3.1.2 The temperature ✓at which the vapour pressure of a substance equals atmospheric pressure.✓

Die temperatuur ✓ *waar die dampdruk van die stof gelyk is aan atmosferiese druk* ✓ (2)

3.1.3 A✓ (1)

3.1.4 Pent-2-ene is a non-polar alkene.
It has weak London forces between its molecules. ✓
Pentan-2-ol has stronger ✓hydrogen bonds✓ between its molecules.
More energy needed to overcome the forces in pentan-2-ol.✓

Pent-2-een is 'n nie-polêre alkeen
Daar is swak Londan kragte tussen die molekule ✓
Pentan-2-ol besit sterker✓ *waterstofbindings* ✓ *tussen die molekule*
Meer energie word benodig om intermolekulêre kragte in pentan-2-ol te oorkom ✓ (4)

3.2.1 2,2,4-trimethylpentane✓✓

2,2,4-trimetielpentaan ✓✓ (2)

3.2.2 Chain isomer✓

Ketting isomeer ✓ (1)

3.3.1 The pressure exerted by a vapour at equilibrium with its liquid in a closed system.✓ ✓

Die druk wat 'n ingeslote damp wat in ewewig met sy vloeistof is, uitoefen op die oppervlak van die vloeistof ✓✓ (2)

3.3.2 Pentan-1-ol ✓

Pentan-1-ol ✓ (1)

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3.3.3 The predominant intermolecular forces in 2,2-dimethylbutane are weak London forces.✓
Ethyl propanoate has dipole-dipole✓forces between its molecules.
More energy is needed to overcome the dipole-dipole forces✓in ethyl propanoate.
Therefore ethyl propanoate has a higher boiling point and a lower vapour pressure ✓than 2,2-dimethylbutane.

2,2-dimetielbutaan besit swak London kragte ✓
Etielpropanoaat besit sterker dipool-dipool kragte ✓
Meer energie word benodig om die dipool-dipool kragte ✓ *in etielpropanoaat te oorkom*
Etielpropanoaat besit hoër kookpunt en dus 'n laer dampdruk as ✓ *2,2-dimetielbutaan* (4)

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QUESTION 4/*VRAAG 4*

4.1.1 Pt / Pd / Ni ✓ (1)

4.1.2 Butane ✓✓

Butaan ✓✓ (2)

4.1.3 $2\ C_4H_{10} + 13\ O_2$✓ $\rightarrow 8\ CO_2 + 10\ H_2O$✓ ✓

MARKING GUIDELINES:
✓ Reactants
✓ Products
✓ Balancing

(3)

4.2.1 Reaction I: Hydration✓
Reaction II: Hydrohalogenation✓

Reaksie I: Hidrogenering ✓
Reaksie II: Hidrohalogenering ✓ (2)

4.2.2 $C_6H_{13}Br$ ✓ (1)

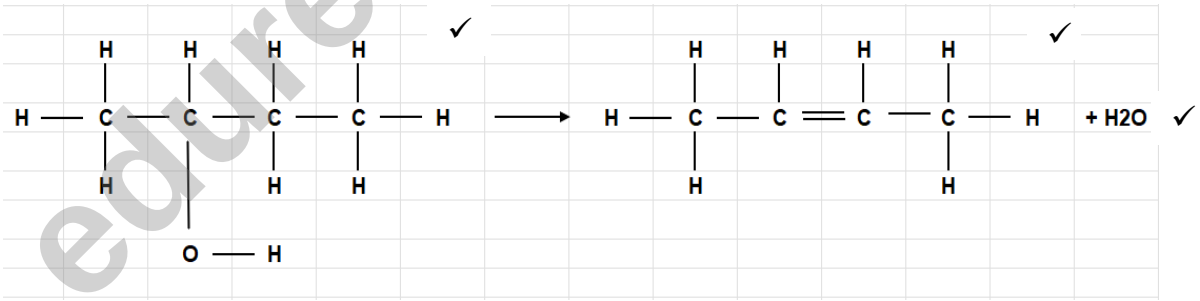
4.3.1 Elimination/Dehidration✓

Eliminasie/Dehedrasie ✓ (1)

4.3.2 Alkenes✓

Alkene ✓ (1)

4.3.3



MARKING GUIDELINES:
✓ Reactant
✓ Product (double bond at the right place
✓ H_2O

(3)

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QUESTION 5/*VRAAG 5*

5.1 $n = \frac{m}{M}$ ✓

$= \frac{12}{100}$ ✓

= 0,12 mol ✓ (3)

5.2 $n_{(CaCO3)}$ = 0,12 mol

$n_{(HC\ell)}$ = c x V

= 3 x 0,2 ✓

= 0,6 mol ✓

$CaCO_3$: $HC\ell$

1 : 2

0,12 : 0,24✓

0,24 < 0,6 $HC\ell$ is in excess/ *oormaat* ✓ (4)

5.3 4 minutes has a higher rate ✓than 8 minutes

4 minute het 'n hoër reaksietempo ✓ as 8 minute (1)

5.4 As the reaction proceeds, the concentration of the $HC\ell$ decreases. ✓

This means fewer particles per volume. ✓

Fewer effective collisions per unit time. ✓

Which results in a lower rate of reaction at 8 minutes

Soos reaksie verloop, neem die $HC\ell$ konsentrasie af ✓

Dit beteken minder deeltjies per volume ✓

Minder effektiewe botsings per tyds eenheid ✓

Dus 'n laer reaksie tempo by 8 minute (3)

5.5 3,25 g✓ (1)

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5.6 $n_{(CaCO3)}$ = 0,12 mol

$n_{(CO2)}$ = $n(CaCO_3)$ = 0,12 mol ✓

$m_{(CO2)}$ = m x M

= 0,12 x 44✓

= 5,28 g

% yield = $\frac{actual\ mass}{theoretical\ mass}$ x 100 ✓ (5)

= $\frac{3,25}{5,28}$ x 100✓

= 61,55 %✓

5.7.1 Steeper ✓

Steiler/ hoër gradient ✓ (1)

5.7.2 No change ✓

Geen verandering ✓ (1)

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QUESTION 6/*VRAAG 6*

6.1.1 A reaction is reversible when products can be converted✓back to reactants and vice versa.✓

'n Reaksie is omkeerbaar wanneer die produkte terug na reaktante omgeskakel kan word ✓ en vice versa. ✓ (2)

6.1.2 $2\ NO\ (g) \rightarrow N_2\ (g) + O_2\ (g)$✓ (1)

6.1.3 The system in in (dynamic) chemical equilibrium.✓
The rate of reverse and forward reactions is equal. ✓

Die sisteem is in (dinamiese) chemiese ewewig ✓
Die tempo van die voorwaartse en terugwaartse reaksie is dieselfde ✓ (2)

6.1.4 Decreased.✓

Afneem ✓ (1)

6.1.5 Exothermic.✓

Eksotermies ✓ (1)

6.1.6 Rates of both forward and reverse reactions decrease.
Reverse reaction rate decreases more.✓
Rate of endothermic reaction will decrease more to absorb the energy.
Thus, the reverse reaction is endothermic.✓
Forward reaction was (increased) favoured by the decreases in temperature.

Die tempo van beide die voorwaatse en terugwaartse reaksies neem af
Die terugwaartse reaksie tempo neem meer af ✓
Die tempo van die endotermiese reaksie sal meer afneem omdat die energie te absorber (Volgens Le Chatelier se beginsel sal temperatuur verhoging die endotermiese reaksie bevoordeel)
Dus die terugwaartse reaksie is endotermies ✓
Die voorwaatse reaksie is bevoordeel deur die afname in temperatuur (2)

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6.1.7 Kc will increase. ✓

Since Kc = $\frac{[NO]^2}{[N_2][O_2]}$ and the forward reaction is favoured, it will cause an increase in [NO]✓, value of Kc will increase.

OR

Decrease in the $[N_2]$ and $[O_2]$ ✓, value of Kc will increase.

K_c sal toeneem ✓

Omdat Kc = $\frac{[NO]^2}{[N_2][O_2]}$ *is en die voorwaatse reaksie is bevoordeel sal [NO] toeneem en K_c sal toeneem* ✓

OF

Afname in die $[N_2]$ en $[O_2]$ en sal K_c sal toeneem ✓ (2)

6.1.8 Catalyst was added/ Pressure is increased.✓

Katalisator is bygevoeg / druk word verhoog ✓ (1)

6.1.9 *The rates of both the forward and reverse reactions increased* ✓✓

Die tempo van beide die voorwaartse en terugwaartse reaksie verhoog✓✓ (2)

6.2.1

	NO_2	NO	N_2O	O_2
Ratio	1	1	1	1
Initial concentration / Oorspronklike konsentrasie ($mol \cdot dm^{-3}$)	0,06	0,29	0,18	0,38
Change in concentrations/ Verandering in konsentrasie	**+ 0,06**	**+ 0,06**	**- 0,06**	**- 0,06**
Equilibrium concentration / Konsentrasie by ewewig	**0,12**	0,35	0,12	0,32

Kc = $\frac{[N_2O][O_2]}{[NO_2][NO]}$

$= \frac{(0,12)(0,32)}{(0,12)(0,35)}$

= 0,91

MARKING GUIDELINES:
✓Use of ratio
✓Concentrations of NO, N_2O and O_2 at equilibrium
✓Kc expression
✓Substitution of values
✓Answer (no unit)

(5)

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6.2.2 Reverse reaction✓

Terugwaartse reaksie ✓ (1)

6.2.3 [NO_2] increased from 0,06 mol·dm^{-3} to 0,12 mol·dm^{-3}.✓
NO_2 is the product of the reverse reaction.
OR
Kc value decreased.✓

[NO_2] neem toe van 0,06 mol.dm^{-3} na 0,12 mol·dm^{-3} ✓
NO_2 word deur die terugwaartse reaksie gevorm
OF
K_c waarde het afgeneem ✓ (1)

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QUESTION 7/*VRAAG 7*

7.1.1 An acid is a proton donor. ✓ ✓

'n Suur is 'n proton skenker ✓✓ (2)

7.1.2 H_3PO_4 can donate more than one proton (H^+-ion) per molecule.✓

H_3PO_4 kan meer as een proton (H^+-ioon) per molekuul skenk ✓ (1)

7.2.1

$c = \frac{m}{MV}$ ✓

$0,22 = \frac{m}{40x0,5}$ ✓

m = 4,4 g ✓ (3)

7.2.2

$\frac{n_a}{n_b} = \frac{c_a V_a}{c_b V_b}$ ✓

$\frac{1}{3}$ ✓$= \frac{c_a \, x \, 20}{0,22 \, x \, 15}$ ✓✓

c_a = 0,055 mol·dm^{-3} ✓

OR

n_b = c.V ✓

= 0,22 x 0,015 ✓

= 3,3 x10^{-3} (0,0033) mol

n_b : n_a

3 : 1 ✓

3,3 x10^{-3} : 1,1x10^{-3} (0,0011)

$c_a = \frac{n}{V}$

$= \frac{1,1x10^{-3}}{0,020}$ ✓

= 0,055 mol·dm^{-3} ✓ (5)

MARKING GUIDELINES:
- ✓ Formula
- ✓ Ratio
- ✓✓ Substitution
- ✓ Answer with unit

MARKING GUIDELINES:
- ✓ Any Formula
- ✓ substitution
- ✓ Ratio
- ✓ Substitution
- ✓ Answer with unit

(5)

7.2.3 Greater than 7. ✓

Groter as 7 ✓ (1)

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7.2.4 NaOH is a strong base and H_3PO_4 is a weak acid.✓
PO_4^{3-} will react with water to produce OH^{-1} ions.
$PO_4^{3-} + 3H_2O \rightleftharpoons H_3PO_4 + 3OH^-$✓
Excess OH^- in solution results in a basic solution.✓
Indicator that changes colour in basic range (phenolphthalein) required.

NaOH is 'n sterk basis en H_3PO_4 is 'n swak suur ✓
PO_4^{3-} sal met water reageer om OH^{-1}-ione te vorm
$PO_4^{3-} + 3H_2O \rightleftharpoons H_3PO_4 + 3OH^-$✓
Dit is 'n basiese oplossing omdat daar 'n oormaat OH^{-1}-ione in die oplossing is✓
'n Indikator wat kleur verander in die pH- gebied(basiese gebied) word benodig (3)

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QUESTION 8/*VRAAG 8*

8.1 Chemical energy is converted in electrical energy.✓ ✓

Chemiese energie word omgeskakel in elektriese energie ✓✓ (2)

8.2 1 mol·dm^{-3}✓ (1)

8.3 A substance of which the aqueous solution contains ions.✓ ✓
OR
A substance that dissolves in water to give a solution that conducts electricity.✓✓

'n Stof wat in 'n waterige oplossing ione besit ✓✓
OF
'n Stof wat oplosbaar is in water en 'n oplossing vorm wat elektrisiteit gelei ✓✓ (2)

8.4 Co / cobalt✓

Co / kobalt ✓ (1)

8.5 $C\ell_2 + 2e^- \rightarrow 2\ C\ell^-$✓✓ (2)

8.6 Co (s)|Co^{2+} (aq) || ✓$C\ell_2$ (g) | $C\ell^-$ (aq)✓, Pt (s) ✓at 25 ºC

MARKING GUIDELINES:
✓ Anode up to saltbridge
✓ Cathode
✓ Pt

(3)

8.7 $E^{\theta}_{cell} = E^{\theta}_{cathode} - E^{\theta}_{anode}$✓
$= 1{,}36$ ✓ $- (-0{,}28)$✓
$= 1{,}64$ V✓

MARKING GUIDELINES:
✓ Formula
✓ Substitution
✓ Answer with unit

(4)

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8.8 Suggestion is not correct ✓

$C\ell_2 + Co \rightarrow 2\ C\ell^- + Co^{2+}$

Increasing $[Co^{2+}]$ will favour the reverse reaction✓decreasing the emf.✓

Die voorstel is nie korrek nie ✓

$C\ell_2 + Co \rightarrow 2\ C\ell^- + Co^{2+}$

'n Toename in die $[Co^{2+}]$ sal die terugwaartse reaksie bevoordeel ✓ *en die emk sal afneem* ✓ (3)

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QUESTION 9/*VRAAG 9*

9.1 Chromium (Cr)✓

Chroom (Cr) ✓ (1)

9.2 Cr^{3+} is a much stronger oxidising✓ agent than water. ✓
Cr^{3+} will be reduced at the cathode/key✓

Cr^{3+} is 'n sterker oksideermiddel✓ as water ✓
Cr^{3+} sal gereduseer word by die katode/sleutel ✓ (3)

9.3 Cr: electrons/ elektrone
1 :3
0,073 : 0.22✓

M(Cr) = n x M✓
= 0,073 x 52✓
= 3,796 g✓ (4)

MARKING GUIDELINES:
✓ Use of ratio
✓ Formula
✓ Substitution
✓ Answer with unit

[8]

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