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**GAUTENG DEPARTMENT OF EDUCATION
GAUTENGSE DEPARTEMENT VAN ONDERWYS
PREPARATORY EXAMINATION
VOORBEREIDENDE EKSAMEN
2020**

**MARKING GUIDELINES
NASIENRIGLYNE**

10842

**PHYSICAL SCIENCES: CHEMISTRY
FISIESE WETENSKAPPE: CHEMIE**

PAPER/VRAESTEL 2

12 pages/bladsye

P.T.O.

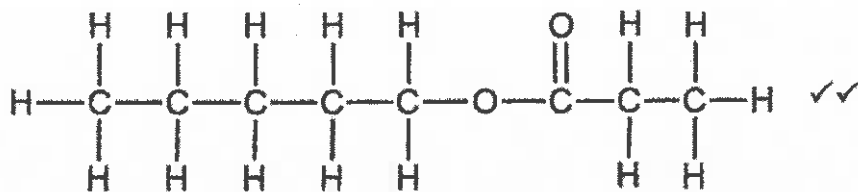
QUESTION/VRAAG 1

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

[20]**QUESTION/VRAAG 2**

- | | | |
|-------|---|-----|
| 2.1.1 | A or/of C ✓ | (1) |
| 2.1.2 | B ✓ | (1) |
| 2.1.3 | F ✓ | (1) |
| 2.1.4 | D ✓ | (1) |
| 2.2.1 | 4,5-dimethyl ✓ hex-2-ene ✓ / 4,5-dimetieselheks-2-een | |
| | <u>Marking criteria 2.2.1-2.2.3/Nasienriglyne:</u> | |
| | Only functional group correct/Slegs funksionele groep korrek: Max/Maks: $\frac{1}{2}$ | |
| | Whole structure correct/Hele struktuur korrek: $\frac{2}{2}$ | (2) |
| 2.2.2 | 2,3-dibromo-5-methyl ✓ heptane ✓ | |
| | 2,3-dibromo-5-metieselheptaan | (2) |
| 2.2.3 | 4-methyl ✓ pent-2-yne ✓ | |
| | 4-metieselpent-2-yn | (2) |

2.3.1



(2)

Marking criteria/Nasienriglyne

- Only functional group correct/Slegs funksionele groep korrek:

Max/Maks: $\frac{1}{2}$

- Whole structure correct:/hele struktuur korrek $\frac{2}{2}$

2.3.2 Propanoic acid ✓✓

Propanoësuur

(1)

2.3.3 Sulphuric acid/H₂SO₄ ✓Swawelsuur/ H₂SO₄

(1)

[14]**QUESTION/VRAAG 3**

3.1 The temperature at which the solid and liquid phase are at equilibrium ✓✓

Die temperatuur waarby die vaste stof en die vloeistof fase in ewewig is. ✓✓

(2)

3.2 C ✓ It has a lower vapour pressure ✓

✱ C ✓ Dit het 'n dampdruk ^{laer.} ✓ ₁ smeltpunt

(2)

3.3.1 Organic compounds with the same molecular formula, but different structural formulae. ✓✓

2 or zero

Organiese verbindings met dieselfde molekulêre formule, maar verskillende struktuurformules. ✓✓

2 of nul

(2)

- 3.3.2 Compound B heptane is less branched/has a longer chain/less compact/less spherical/has a larger surface area. ✓

Stronger intermolecular forces/Van der Waals forces/dispersion forces/London forces/Induced dipole- induced dipole forces. ✓
More energy needed to overcome intermolecular forces ✓

OR

Compound A/2-methylhexane is more branched/more compact/more spherical/has shorter chain/has a smaller surface area. ✓
It has weaker intermolecular forces/Van der Waals forces/dispersion forces/London forces/Induced dipole- induced dipole forces. ✓
Less energy needed to overcome intermolecular forces. ✓

Verbinding B, heptaan, is minder vertak/het 'n langer ketting/minder kompak/minder sferies/ het 'n groter oppervlak area. ✓

Sterker intermolekulêre kragte/Van der Waals kragte/dispersiekragte/Londonkragte/geïnduseerde kragte. ✓
Meer energie benodig om intermolekulêre kragte te oorkom. ✓

OF

Verbinding A/2-metielheksaan is meer vertak/meer kompak/meer sferies/het 'n korter kettinglengte/het 'n kleiner oppervlak area. ✓
Dit het 'n swakker intermolekulêre krag/Van der Waals kragte/dispersiekragte/Londonkragte/geïnduseerde dipoolkragte. ✓
Minder energie word benodig om die intermolekulêre kragte te oorkom. ✓

(3)

- 3.4 Both compounds C and D have hydrogen bonding between molecules. ✓ Compound C has one site for hydrogen bonding whilst compound D has two sites for hydrogen bonding ✓

OR

Compound C has less sites for hydrogen bonding/weaker hydrogen bonding than compound D.
More energy needed to overcome intermolecular forces in compound D/less energy needed to overcome intermolecular forces in compound E. ✓

Beide verbindings C en D het waterstofbindings tussen die molekule. ✓
Verbinding C het een plek vir waterstofbinding terwyl verbinding D twee plekke het vir waterstofbinding. ✓

OF

Verbinding C het minder plekke vir waterstofbinding/swakker waterstofbinding as verbinding D.
Meer energie word benodig om die intermolekulêre kragte te oorkom in verbinding D/minder energie word benodig om die intermolekulêre kragte in verbinding E te oorkom. ✓

(3)
 [12]

QUESTION/VRAAG 4

- 4.1.1 It contains a double bond/C=C between two carbon atoms in its hydrocarbon chain/All carbon atoms not bonded to the maximum number of atoms/four atoms✓

Daar is dubbelbindings/C=C tussen twee koolstofatome in die koolwaterstof ketting/Alle koolstofatome is nie gebind aan die maksimum aantal atome/vier atome nie. ✓

(1)

- 4.1.2 (a) Addition/Bromination ✓
Addisie/Broominasie

(1)

- (b) Substitution ✓
Substitusie

(1)

- 4.1.3 Heat/sunlight/ultraviolet light ✓
Hitte/sonlig/ultraviolet lig

(1)

- 4.1.4 Butane✓/butaan

(1)

- 4.1.5 Hydrogen bromide/HBr✓

Waterstofbromied/ HBr

(1)

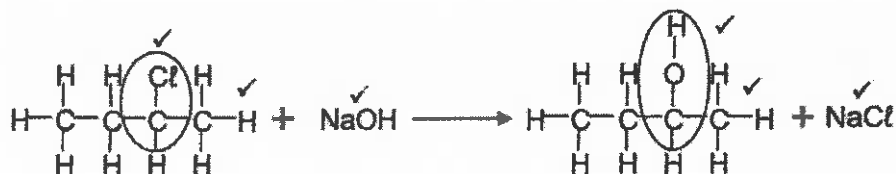
- 4.2.1 Elimination✓
Eliminasie

(1)

- 4.2.2 But✓-2-ene✓
But-2-een

(2)

- 4.2.3



(6)

[15]

QUESTION/VRAAG 5

5.1 Carbon dioxide/CO₂ ✓*Koolstofdioksied/CO₂* (1)

5.2.1 The decrease in concentration of hydrochloric acid per unit time. ✓✓

Die afname in konsentrasie van waterstofchloried per eenheid tyd. ✓✓ (2)

5.2.2 Concentration (of the acid) ✓

Konsentrasie (van die suur) ✓ (1)

5.2.3 For a fair test/comparison ✓

Vir 'n regverdige toets/of vergelyking ✓ (1)

- 5.3.1
- Higher acid concentration in experiment 2 means more particles/molecules per unit volume ✓
 - More particles have kinetic energy equal to or greater than activation energy/More particles have enough kinetic energy ✓
 - More effective collisions per unit time/frequency of effective collisions increases
 - Rate of effective collisions increases. ✓

Hoër konsentrasie suur in eksperiment 2 beteken meer deeltjies/molekule per eenheid volume ✓
Meer deeltjies het kinetiese energie gelyk of groter as die aktiveringsenergie/Meer deeltjies het genoeg kinetiese energie. ✓
Meer effektiewe botsings per eenheid tyd/frekwensie van effektiewe botsings verhoog.
Tempo van effektiewe botsings verhoog. ✓ (4)

5.3.2 $n(\text{CaCO}_3) = m/M$

$$= 4/100 \checkmark = 0,04 \text{ mol}$$

$$n(\text{HCl}) : n(\text{CaCO}_3) = 2 : 1$$

$$n(\text{HCl}) = 2(0,04) \checkmark = 0,08 \text{ mol}$$

$$c(\text{HCl}) = n/V$$

$$0,4 = 0,08/V \checkmark$$

$$V = 0,2 \text{ dm}^3 = 200 \text{ cm}^3 \checkmark$$

Marking Criteria

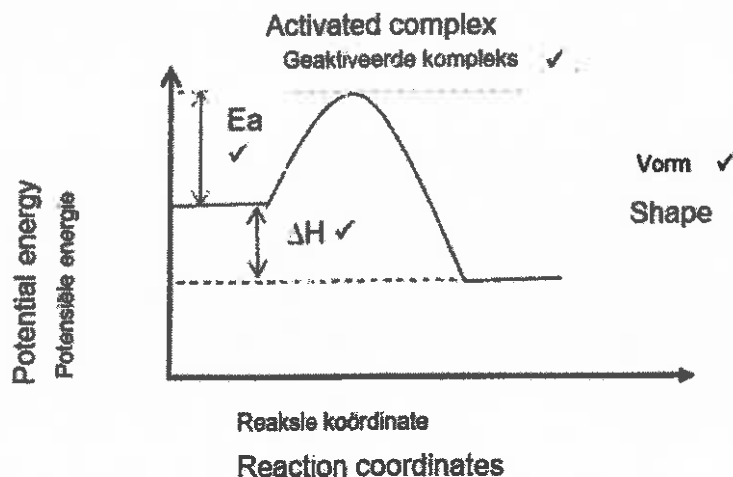
- Substituting 100 into formula m/M
- Using ratio 2:1
- Substituting the number of moles into formula $c = n/v$
- Final answer

Nasiennriglyne:

- Vervang 100 in formule m/M
- Gebruik verhouding 2:1
- Vervang getal mol in formule $c = n/V$
- Finale antwoord

(4)

5.4

(4)
[17]**QUESTION/VRAAG 6**

6.1 The reaction is reversible. ✓

Die reaksie is omkeerbaar. ✓

(1)

6.2 This reaction is in contact with a catalyst, and therefore is known as the contact process. ✓*Hierdie reaksie is in kontak met 'n katalisator en daarom staan dit bekend as die Kontakproses. ✓*

(1)

6.3

6.3.1 If the temperature is too low the reaction rate will be too slow for the yield to be enough. ✓✓*Indien die temperatuur te laag is sal die reaksietyempo te stadig wees vir die opbrengs om genoeg te wees. ✓✓*

(2)

6.3.2 A high temperature favours an endothermic reaction ✓

If the temperature is high the reverse reaction will be favoured ✓

Less product will be formed which is not favourable. ✓

*'n Hoë temperatuur bevoordeel die endotermiese reaksie. ✓**Indien die temperatuur hoog is word die terugwaartse reaksie bevoordeel. ✓**Minder produkte sal vorm en dit is nie voordelig nie. ✓*

(3)

6.4

Marking guideline/Nasienriglyne:

- Use the Ratio/Gebruik ratio ✓
- $n(\text{SO}_2)_{\text{eq/ewe}} = n(\text{SO}_2)_{\text{initial/begin}} - \Delta n(\text{SO}_2)$
 $n(\text{O}_2)_{\text{eq/ewe}} = x - \Delta n(\text{O}_2)$ } ✓
- Divide equilibrium moles by 200 dm³/Deel ewewigsmol deur 200 dm³ ✓
- Correct K_c expression (formulae in square brackets) ✓
 Korrekte K_c uitdrukking(formules in blokhakies)
- Substitution of values in expression/Vervanging van waardes in uitdrukking ✓
- Substitution of/Vervanging van 32 g·mol⁻¹ in m = nM ✓
- Final answer/Finale antwoord: 891,17g ✓
- Range/Gebied: 891,167 – 891,2

	SO ₂	O ₂	SO ₃	
Initial amount(moles) Aanvangs hoeveelheid	50	x	0	
Change in amount(moles) Verandering in hoeveelheid	22	11	22	Ratio ✓
Equilibrium amount(moles) Hoeveelheid	28	x – 11 ✓	22	
Equilibrium concentration(mol·dm ⁻³) Ewewigkonsentrasie(mol·dm ⁻³)	0,14	$\frac{(x-11)}{200}$	0,11	Divide by 200 dm ³ ✓

$$K_c = \frac{[\text{SO}_3]^2}{[\text{SO}_2]^2 [\text{O}_2]}$$

$$7,328 = \frac{(0,11)^2}{(0,14)^2 \left(\frac{x-11}{200}\right)}$$

$$x = 27,849 \text{ mol}$$

$$m = n \times M$$

$$= (27,849)(32) \checkmark$$

$$= 891,167 \text{ g} \checkmark$$

(7)

6.5 Forward ✓✓/ Voorwaarts

(2)
[16]

QUESTION/VRAAG 7

7.1

7.1.1 Acid-base reaction/neutralisation/protolysis ✓

Suur-basis reaksie/ neutralisasie/protoliese ✓ (1)

7.1.2 Barium hydroxide ✓

Bariumhidroksied (1)

7.1.3 X- Burette ✓ Buret

(1)

7.1.4 A white precipitate in a yellow solution that gradually turns orange ✓✓*'n Wit neerslag in 'n geel oplossing wat geleidelik oranje word.* ✓✓ (2)

7.1.5 (a) ✓ Remains constant Barium Hydroxide is a strong base that will dissociate/ionise from the start

Bly konstant. Bariumhidroksied is 'n sterk basis wat sal dissosieer/ioniseer van die begin af. ✓

(b) Decrease ✓ Verminder

(c) Decrease ✓ Verminder

(3)

7.1.6 Marking guidelines/Nasiemriglyne

- Any formulae/*Enige formule:* ✓
- Division by Volume ✓/*deel deur volume*
- Use mole ratio ✓ *gebruik molverhouding*
- Use $M = 233 \text{ g} \cdot \text{mol}^{-1}$ in $m = nM$ ✓
- Answer = 1,165 g ✓

OPTION 1: OPSIE 1

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

$$\frac{c_a (30)}{(0,1)(50)} = \frac{1}{1}$$

$$c_a = 0,167 \text{ mol} \cdot \text{dm}^{-3}$$

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

$$0,167 = \frac{n}{0,03}$$

$$n = 0,005 \text{ mol}$$

OPTION 2: OPSIE 2

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

$$0,1 = \frac{n}{0,05}$$

$$n = 0,005 \text{ mol}$$

$$n(\text{BaSO}_4) = n(\text{Ba(OH)}_2) \quad \checkmark$$

$$= 0,005 \text{ mol}$$

$$m = n \times M$$

$$= (0,005)(233) \quad \checkmark$$

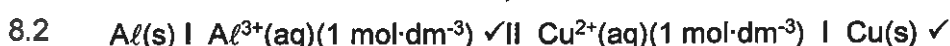
$$= 1,165 \text{ g} \quad \checkmark$$

(5)

7.2

**QUESTION/VRAAG 8**

8.1 A galvanic/voltaic cell✓
Galvaniese sel/voltaïese sel (1)

**Accept****Marking criteria: Nasienriglyne:**

- Oxidation ✓ Oksidasie
- Salt bridge ✓ soutbrug
- Reduction ✓ reduksie

(3)

8.3 Al to Cu✓



(1)

**Marking guidelines/Nasienriglyne**

- $\text{Al} \rightleftharpoons \text{Al}^{3+} + 3\text{e}^- \quad \frac{1}{2}$ $\text{Al}^{3+} + 3\text{e}^- \rightleftharpoons \text{Al} \quad \frac{0}{2}$
 - $\text{Al}^{3+} + 3\text{e}^- \leftarrow \text{Al} \quad \frac{2}{2}$ $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al} \quad \frac{0}{2}$
 - Ignore if charge omitted on electron. / Ignoreer indien lading weggelaat op elektron.
 - If charge (+) omitted on Al^{3+} / Indien lading (+) weggelaat op Al^{3+} :
Example/Voorbeeld: $\text{Al} \rightarrow \text{Al}^{3+} + 3\text{e}^- \checkmark$
- Max./Maks: $\frac{1}{2}$

8.5 $E^\ominus_{\text{cell}} = E^\ominus_{\text{reduction}} - E^\ominus_{\text{oxidation}} \checkmark$
 $= 0,34\checkmark - (-1,66) \checkmark$
 $= 2 \text{ V}\checkmark$

Notes

- Accept any other correct formula from the data sheet. / Aanvaar enige ander korrekte formule vanaf gegewensblad. (2)
- Any other formula using unconventional abbreviations, e.g. $E^\ominus_{\text{cell}} = E^\ominus_{\text{OA}} - E^\ominus_{\text{RA}}$ followed by correct substitutions. / Enige ander formule wat onkonvensionele afkortings gebruik bv. $E^\ominus_{\text{sel}} = \frac{3}{4}$ (4)
- $E^\ominus_{\text{OM}} - E^\ominus_{\text{RM}}$ gevolg deur korrekte vervangings. $\frac{3}{4}$

8.6

8.6.1 Decrease ✓ Verminder

(1)

8.6.2 **NEGATIVE MARKING FROM 8.6.1/NEGATIEWE NASIEN VANAF 8.6.1**

The concentration of Al^{+3} will increase. According to Le Chatelier the system needs to decrease the concentration. ✓

The reverse reaction will be favoured. ✓

Therefore the reading will decrease. ✓

Die konsentrasie van Al^{+3} sal vermeerder. Volgens Le Chatelier sal die sisteem die konsentrasie moet verlaag. ✓

Die terugwaartse reaksie sal bevoordeel word. ✓

Dus sal die lesing verminder. ✓

(3)

8.7 Chemical energy to electrical energy ✓

Chemiese potensiële energie na elektriese energie. ✓

(1)

[16]

QUESTION/VRAAG 9

9.1 A ✓

(1)

9.2 $Cu^{2+} + 2e^- \rightarrow Cu$ ✓✓

(2)

✗ 9.3 Marking guidelines/Nasienriglyne

- Multiply $nx2$ or $mx2$ ✓ Vermenigvuldig $nx2$ of $mx2$
- $m_{deposit} = 31,75g$ ✓
- $m_{lost\ at\ anode} = (31,75 + 15,8)g$ ✓
- Answer/antwoord 66,77% ✓

$$n = \frac{m}{M}$$

$$(0,25 \times 2) = \frac{m}{63,5}$$

$$m = 31,75\ g$$

$$\%purity = \frac{m_{deposited}}{m_{lost\ at\ anode}} \times 100$$

$$= \frac{31,75}{(31,75 + 15,8)} \times 100$$

$$= 66,67\%$$

0,25 mol Cu formed in 1 800 s so in 3 600s ($2 \times 0,25$) mol formed
 0,25 mol Cu vorm in 1 800 s dus in 3 600 s ($2 \times 0,25$) mol gevorm

(4)

9.4.1 Electrolyte is a solution/liquid/dissolved substance that conducts electricity through the movement of ions (2 or 0)

Elektroliete is 'n oplossing/vloeistof/opgeloste stof wat elektrisiteit gelei deur die beweging van ione ✓✓ (2 of 0)

(2)

9.4.2 The rate of oxidation is equal to the rate of reduction. ✓

Die tempo waarteen oksidasie plaasvind is gelyk aan die tempo van reduksie. ✓

(1)

[10]

QUESTION/VRAAG 10

10.1

- 10.1.1 Nitrogen ✓ *stikstof*
 Phosphorus ✓ *fosfor*
 Potassium ✓ *kalium*

Accept/aanvaar

N : P : K (3)

- 10.1.2 Potassium/K ✓ (1)
Kalium/ K

- 10.1.3 Phosphates/P ✓ (1)
Fosfate/ P

- 10.1.4 Haber or/of Ostwald ✓ (1)

- 10.2 Eutrophication: The process by which an ecosystem eg. A river or dam, becomes enriched with inorganic nutrients ✓, especially phosphorus and nitrogen, resulting in excessive plant growth ✓

Eutrofikasie: Die proses waarby 'n ekosisteem bv. 'n rivier of dam, verryk word met anorganiese voedingstowwe ✓, veral fosfor en stikstof, wat 'n oorgroot toename in plantegroei tot gevolg het. ✓ (2)

✗ 10.3 Marking guidelines/Nasienriglyne

- $m(N) = \frac{4}{6} \times 36$ ✓
- Double up on Fertilizer B ✓ *verdubbel kunsmis B*
- Fertilizer A $m(N) = 24\text{kg}$, $m(P)=m(K) = 6\text{ kg}$ ✓
- Fertilizer B $m(N) = 19,09\text{kg}$, $m(P)=m(K) = 5,45\text{ kg}$ ✓
- Answer Fertilizer B ✓

Fertilizer A/kunsmis A

In 100kg 4.1.1(36)

$$\left. \begin{aligned} m(N) &= \frac{4}{6} \times 36 \\ &= 24\text{ kg} \quad \checkmark \\ m(P)=m(K) &= \frac{1}{6} \times 36 \\ &= 6\text{ kg} \end{aligned} \right\} \checkmark$$

✗ **Fertilizer B/kunsmis B**

In 50 kg 7.2.2(15)

∴ In 100kg 14.4.4(30) ✓

$$\left. \begin{aligned} m(N) &= \frac{14}{22} \times 30 \\ &= 19,09\text{ kg} \\ m(P)=m(K) &= \frac{14}{22} \times 30 \\ &= 5,45\text{ kg} \end{aligned} \right\} \checkmark$$

Therefore **Fertilizer B** will be the best ✓*Kunsmis B sal die beter een wees.*(5)
[13]**TOTAL/TOTAAL: 150**