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# basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

SENIOR CERTIFICATE/SENIOR SERTIFIKAAT
NATIONAL SENIOR CERTIFICATE/
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GRADE/GRAAD 12

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

**NOVEMBER 2020** 

MARKING GUIDELINES/NASIENRIGLYNE

MARKS/PUNTE: 150

These marking guidelines consist of 17 pages./
Hierdie nasienriglyne bestaan uit 17 bladsye.

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Physical Sciences/P2/*Fisiese Wetenskappe*/V2 2 DBE/November 2020 SC/NSC/*SS/NSS* – Marking Guidelines/*Nasienriglyne* 

# **QUESTION 1/VRAAG 1**

1.1	C✓✓	(2)
1.2	D ✓✓	(2)
1.3	C✓✓	(2)
1.4	B✓✓	(2)
1.5	D ✓✓	(2)
1.6	B✓✓	(2)
1.7	B✓✓	(2)
1.8	C✓✓	(2)
1.9	A✓✓	(2)
1.10	C✓✓	(2) <b>[20]</b>

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(1)

(2)

(3)

(2)

## **QUESTION 2/VRAAG 2**

2.1.1 Ketones/*Ketone* ✓

2.1.2 Pentanal/Pentanaal ✓ ✓

# ACCEPT/AANVAAR

2,2-dimethylpropanal/2,2-dimethylpropanaal 2-methylbutanal/2-metielbutanaal 3-methylbutanal/3-metielbutanaal

#### Marking criteria/Nasienriglyne

- Correct functional group,i.e. al / Korrekte funksionele groep d.i. al √
- Whole name correct/Hele
   naam korrek √

2.2.1 5 – bromo-2,3 – dimethylhexane/5 – bromo-2,3 – dimetielheksaan

# Marking criteria/Nasienriglyne:

- Correct stem i.e. <u>hexane</u>./Korrekte stam d.i. <u>heksaan</u>. ✓
- All substituents (bromo and dimethyl) correctly identified./Alle substituente (bromo en dimetiel) korrek geïdentifiseer. ✓
- IUPAC name completely correct including numbering, sequence, hyphens and commas./IUPAC-naam heeltemal korrek insluitende volgorde, koppeltekens en kommas. ✓

2.2.2

## Marking criteria/Nasienriglyne

- Whole structure correct/Hele struktuur
   korrek: 2/2
- Only functional group correct:/Slegs
   funksionele groep korrek: Max/Maks.: 1/2

#### IF/INDIEN

More than one functional group/Meer as een funksionele groep 0/2

IF/INDIEN

Molecular formula/Molekulêre formule  $\frac{0}{2}$ 

Condensed structural formula / Gekondenseerde struktuurformule  $\frac{1}{2}$ 

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2.3.1 The C atom bonded to the hydroxyl group is bonded to only one other C-atom.  $\checkmark\checkmark$  (2 or 0)

Die C-atoom wat aan die hidroksielgroep gebind is, is aan slegs een ander C-atoom gebind. (2 or 0)

#### OR/OF

The hydroxyl group/-OH/ is bonded to a C atom which is bonded to two hydrogens atoms. (2 or 0)

Die hidroksielgroep/funksionele groep is gebind aan 'n C-atoom wat aan twee waterstofatome gebind is. (2 of 0)

#### OR/OF

The hydroxyl group/functional group/-OH is bonded to: a primary C atom / the first C atom (2 or 0)

Die hidroksielgroep/funksionele groep/-OH aan
'n primêre C-atoom gebind / die eerste C-atoom gebind (2 of 0)

#### OR/OF

The functional group (— C - OH) is bonded to only one other C-atom.

| Die funksionele groep (— C – OH) is aan slegs een ander C-atoom gebind.

| (2)

2.3.2 Esterification/condensation √

Verestering/esterifikasie/kondensasie (1)

2.3.3 <u>Butanoic acid</u>/<u>Butanoësuur</u> √ (1) [12]

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(2)

(3)

## **QUESTION 3/VRAAG 3**

## 3.1 Marking criteria/Nasienriglyne

If any one of the underlined key phrases in the **correct context** is omitted, deduct 1 mark./Indien enige van die onderstreepte frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.

The <u>temperature</u> at which the <u>vapour pressure equals atmospheric (external)</u> <u>pressure</u>.  $\checkmark\checkmark$ 

Die <u>temperatuur</u> waar die <u>dampdruk gelyk is aan atmosferie</u>se (eksterne) druk.

- Increase in the number of C-atoms <u>increases molecular mass/size/chain</u> length/surface area. ✓
  - <u>Strength of the intermolecular forces increases/More sites for London forces.</u> ✓
  - More energy is needed to overcome/break intermolecular forces. ✓
  - Toename in aantal C-atome verhoog <u>molekulêre massa/molekulêre</u> grootte/kettinglengte/reaksie-oppervlak.
  - <u>Sterkte van die intermolekulêre kragte verhoog./Meer punte</u> vir Londonkragte.
  - Meer energie benodig om intermolekulêre kragte te oorkom/breek.

3.4.1 C ✓ (1)

3.4.2 B ✓

# Marking criteria/Nasienriglyne

- Compare strength of intermolecular forces of A, B and C. ✓
- $\bullet$  Compare boiling points/energy required to overcome intermolecular forces of alcohols/A and aldehydes/B.  $\checkmark$

#### OR

Alcohols have the highest boiling point.

 Compare boiling points/ energy required to overcome intermolecular force of aldehydes/B and alkanes/C .√

#### OR

Alkanes have the lowest boiling point.

- Vergelyk sterkte van intermolekulêre kragte van A, B en C. ✓
- Vergelyk kookpunte /energie benodig om intermolekulêre kragte van alkohole/A en aldehiede/B te oorkom. ✓

#### OF

Alkohole het die hoogste kookpunt.

 Vergelyk kookpunte /energie benodig om intermolekulêre kragte van aldehiede/B en alkane/C.√

#### OF

Alkane het die laagste kookpunt.

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Aldehydes/B have (in addition to London forces) dipole-dipole forces which are stronger than London forces, but weaker than hydrogen bonds. 

Therefore aldehydes/B have lower boiling points/require less energy to overcome intermolecular forces than alcohols/A, but higher boiling points / require more energy to overcome intermolecular forces than alkanes/C.

Aldehiede/B het (in toevoeging tot Londonkragte) dipool-dipoolkragte wat sterker is as Londonkragte, maar swakker is as waterstofbinding.

Dus het aldehiede/B laer kookpunte/benodig minder energie om intermolekulêre kragte te oorkom as alkohole/A, maar hoër kookpunte/benodig meer energie om intermolekulêre kragte te oorkom as alkane/C.

#### OR/OF

<u>Aldehydes/B</u> have stronger intermolecular forces than alkanes, but weaker intermolecular forces than alcohols/A. ✓

Therefore <u>aldehydes/B have higher boiling points/ more energy required to overcome intermolecular forces than alkanes/C, ✓ but lower boiling points/ less energy to overcome intermolecular forces than alcohols/A. ✓ the second intermolecular forces than alcohols/A.</u>

<u>Aldehiede/B</u> het <u>sterker intermolekulêre kragte as alkane/C</u>, maar <u>swakker</u> intermolekulêre kragte as alkohole/A.

Dus het <u>aldehiede/B laer kookpunte/ benodig minder energie om intermolekulêre kragte te oorkom as alkohole/A, maar hoër kookpunte/ benodig meer energie om intermolekulêre kragte te oorkom as alkane/C.</u>

3.5 Butanal ✓ ✓ Butanaal

#### Marking criteria/Nasienriglyne

- Correct stem, i.e. but/Korrekte stam d.i. but √
- Whole name correct/Hele naam korrek ✓

3.6 Pentan-1-ol ✓ ✓ **OR/***OF* 

1-pentanol ✓ ✓

(2) **[15]** 

(4)

(2)

#### **QUESTION 4/VRAAG 4**

## 4.1 Marking criteria/Nasienriglyne

- Addition reaction / reaction of alkene / reaction of C − C double bond /reaction of unsaturated hydrocarbon√
  - Addisie reaksie / reaksie van 'n alkeen / reaksie van C C dubbelbinding/reaksie van 'n onversadigde koolwaterstof.
- (Addition of) hydrogen halide/HX/ hydrogen and halide. ✓
   (Addisie van) waterstofhalied/HX/waterstof en halied.

The <u>addition</u> ✓ of a <u>hydrogen halide/HX</u> ✓ to an alkene. Die <u>addisie</u> van 'n <u>waterstofhalied/HX</u> aan 'n alkeen.

(2)

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4.2

$$H \longrightarrow H$$
 $H \longrightarrow H$ 

Marking criteria/Nasienriglyne

- Whole structure correct:

  Hele struktuur korrek:  $\frac{2}{2}$
- Only functional group correct/Slegs funksionele
   groep korrek: Max/Maks: 1/2

4.3.1 Cracking/Kraking ✓

4.3.2 C<sub>8</sub>H<sub>18</sub> ✓

4.4 <u>1,2-dibromo</u> ✓ <u>propane</u> ✓ 1,2-dibromopropaan/1,2-dibroompropaan

(2)

(2)

(1)

# Marking criteria for the alcohol/Nasienriglyne vir die alkohol

- Whole structure of alcohol correct/Hele struktuur van alkohol korrek:  $\frac{2}{2}$
- Only functional group correct/Slegs funksionele groep korrek:  $\frac{1}{2}$

#### Notes/Aantekeninge:

- If 1-chloropropane used as reactant, 2 marks for the primary alcohol.
   Indien 1-chloropropaan as reaktanse gebruik is, 2 punte vir die primêre alkohol.
- Condensed or semi-structural formula: Max. 4/5
   Gekondenseerde of semistruktuurformule: Maks. 4/5
- Molecular formula/Molekulêre formule: <sup>2</sup>/<sub>5</sub>
- Any additional reactants or products: Max. <sup>4</sup>/<sub>5</sub>
   Enige addisionele reaktanse of produkte: Maks. <sup>4</sup>/<sub>5</sub>
- If arrow in completely correct equation omitted: Max. 4/5
   Indien pyltjie in volledige korrekte vergelyking uitgelaat is: Maks. 4/5
- The product NaCl/KCl/HCl must be marked in conjunction with reactant NaOH/KOH/H<sub>2</sub>O.

  Die produk NaCl/KCl/HCl moet in samehang met die reaktans NaOH/KOH / H<sub>2</sub>O nagesien word.

4.5.2

- (Mild) heat/(Matige) hitte √
- <u>Dilute strong base/NaOH/LiOH/KOH</u> OR water/H<sub>2</sub>O \( \frac{Verdunde sterk basis/NaOH/LiOH/KOH} OF water/H<sub>2</sub>O

(2) **[15]** 

(5)

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#### **QUESTION 5/VRAAG 5**

- 5.1.1 (Reaction) rate/Reaksietempo ✓ (1)
- 5.1.2 Surface area/state of division /particle size √
  Reaksie-oppervlak/toestand van verdeeldheid/deeltjie grootte (1)
- 5.2.1 (Decreasing gradient indicates) rate of reaction is <u>decreasing</u>. √
   (Afnemende gradiënt dui aan dat) reaksietempo <u>afneem.</u>
- 5.2.2 (Gradient is zero, indicates) reaction rate is zero √
   (Gradiënt is nul, wat aandui dat) reaksietempo nul is.

5.3 ave rate/gem tempo = 
$$\frac{\Delta V}{\Delta t}$$
 =  $\frac{500^{\checkmark}(-0)}{60^{\checkmark}(-0)}$  = 8,33 (cm<sup>3</sup>·s<sup>-1</sup>)  $\checkmark$  (3)

- 5.4 Equal to/Gelyk aan √ (1)
- 5.5 Greater than/Groter as √

# **Experiment C/Eksperiment C:**

- Surface area of CaCO<sub>3</sub> powder is greater than that of CaCO<sub>3</sub> granules./
   More particles are exposed /More particles with correct orientation √
- More effective collisions per unit time/Higher frequency of effective collisions. ✓
- Increase in reaction rate.√
- Reaksieoppervlak van CaCO<sub>3</sub>-poeier is groter (as die van CaCO<sub>3</sub>-korrels /Meer deeltjies met korrekte oriëntasie.
- Meer effektiewe botsings per eenheid tyd./Hoër frekwensie van effektiewe botsings
- <u>Toename in reaksie tempo</u>

#### OR/OF

#### Experiment A/Eksperiment A:

- <u>Surface area of CaCO<sub>3</sub> granules is smaller/Fewer particles are exposed</u> (than that of powdered CaCO<sub>3</sub>). <u>Less particles with correct orientation</u> ✓
- <u>Less effective collisions per unit time</u>./<u>Lower frequency of effective</u> collisions. ✓
- Decrease in reaction rate.√.
- Reaksieoppervlak van CaCO<sub>3</sub> is kleiner/Minder deeltjies is blootgestel (as die van die verpoeierde CaCO<sub>3</sub>)./ Minder deeltjies met korrekte oriëntasie
- <u>Minder effektiewe botsings per eenheidtyd./Laer frekwensie van effektiewe botsings.</u>
- <u>Afname in reaksie tempo</u> (4)

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# 5.6 Marking criteria/Nasienriglyne:

• Divide volume by 25,7 in / Deel volume deur 25,7 in n =  $\frac{V}{V_M}$ .

If no substitution step shown, award mark for answer: 0,0195 mol Indien geen vervanging stap getoon is nie, ken punt toe vit antwoord: 0,0195 mol

- Ratio/Verhouding: n(CO<sub>2</sub>) = n(CaCO<sub>3</sub>). √
- Substitute/Vervang 100 in  $n = \frac{m}{M}$  or in ratio / of in verhouding.  $\checkmark$
- Final answer/Finale antwoord: 1,95 g to/tot 2 g. ✓

# OPTION 1/OPSIE 1

$$n(CO_{2}) = \frac{V}{V_{m}} = \frac{0.5}{25.7}$$

$$= 0.0195 \text{ mol}$$

$$n(CaCO_{3}) = n(CO_{2}) = 0.0195 \text{ mol}$$

$$= 0.0195(100)$$

$$= 1.95 \text{ g}$$

# OPTION 2/OPSIE 2

25,7 dm³ ......1 mol 0,5 dm³ ......0,0195 mol ✓ 100 g ✓ .......1 mol x ......0,0195 mol ✓

$$x = m(CaCO_3) = 1,95 g$$

# OPTION 3/OPSIE 3

$$n(CO_2) = \frac{V}{V_m} = \frac{0.5}{25.7}$$

$$= 0.0195 \text{ mol}$$

$$0.0195 \text{ mol } CO_2 = 0.856 \text{ g } CO_2 \checkmark$$

$$m(CO_2) \text{ produced} : m(CaCO_3)$$

$$44 \text{ g} : 100 \text{ g} \checkmark$$

$$0.856 : x$$

$$x = 1.95 \text{ g} \checkmark CaCO_3$$

(4) [16]

## **QUESTION 6/VRAAG 6**

6.1 Products can be converted back to reactants. ✓ Produkte kan omgeskakel word na reaktanse.

#### OR/OF

Both forward and reverse reactions can take place. Beide voor-en terugwaartse reaksies kan plaasvind.

## OR/OF

A reaction which can take place in both directions. 'n Reaksie wat in beide rigtings kan plaasvind.

(1)

6.2.1 Remains the same/*Bly dieselfde* ✓

(1)

6.2.2 Increases/Toeneem ✓

(1)

- (When pressure is increased) the reaction that leads to the smaller amount of gas / side with less molecules/number of moles is favoured. ✓ (Wanneer die druk verhoog word,) word die reaksie wat tot die kleiner hoeveelheid gas /minder gas molekule/aantal mol lei, bevoordeel.
  - The reverse reaction is favoured. ✓
     Die terugwaartse reaksie word bevoordeel.

(2)

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#### 6.4 Endothermic/Endotermies ✓

- K<sub>c</sub> decreases with decrease in temperature. ✓
- Reverse reaction is favoured. / Concentration of reactants increases. / Concentration of products decreases./Yield decreases ✓
- Decrease in temperature favours an exothermic reaction. ✓
- K<sub>c</sub> neem af met afname in temperatuur.
- Terugwaartse reaksie word bevoordeel./Konsentrasie van reaktanse neem toe./Konsentrasie van produkte neem af./Opbrengs neem af
- Afname in temperatuur bevoordeel 'n eksotermiese reaksie.

#### OR/OF

- K<sub>c</sub> increases with increase in temperature. ✓
- Forward reaction is favoured. / Concentration of reactants decreases. / Concentration of products increases./Yield increases ✓
- Increase in temperature favours an endothermic reaction. ✓
- *K*<sub>c</sub> neem toename met toename in temperatuur.
- Voorwaartse reaksie word bevoordeel./Konsentrasie van produkte neem toe./Konsentrasie van reaktanse neem af./Opbrengs neem toe
- Toename in temperatuur bevoordeel 'n endotermiese reaksie

#### (4)

# 6.5 CALCULATIONS USING NUMBER OF MOLES

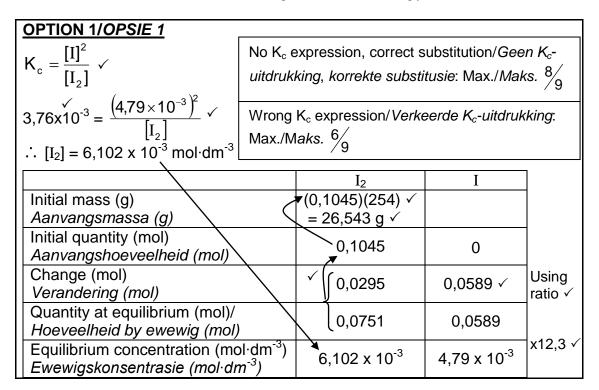
#### Mark allocation

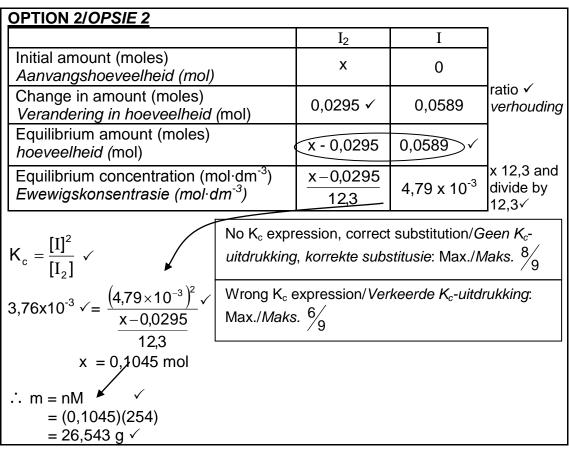
- Correct K<sub>c</sub> expression (<u>formulae in square brackets</u>). √
- Substitution of equilibrium concentrations into K<sub>c</sub> expression. ✓
- Substitution of K<sub>c</sub> value. ✓
- Multiply equilibrium concentrations of I₂ and I by 12,3 dm³. ✓ (OPTION 1)
- Multiply equilibrium concentrations of I by 12,3 dm³ and divide equilibrium mol of I₂ by 12,3 dm³. √(OPTION 2)
- Change in n(I) = n(I at equilibrium). √
- USING ratio/GEBRUIK verhouding: I₂: I = 1:2 √
- Initial n(I₂) = equilibrium n(I₂) + change in n(I₂). ✓
- Substitute 254 g⋅mol<sup>-1</sup> as molar mass for I<sub>2</sub>.√
- Final answer: (26 g 27,94 g). ✓

#### BEREKENINGE WAT AANTAL MOL GEBRUIK

#### Puntetoekenning:

- Korrekte K<sub>c</sub>-uitdrukking (<u>formules in vierkanthakies</u>).
- Vervanging van ewewigskonsentrasies in K<sub>c</sub>-uitdrukking.
- Vervanging van K<sub>c</sub>-waarde. ✓
- Vermenigvuldig ewewigskonsentrasies van I<sub>2</sub> en I met 12,3 dm³.(OPSIE 1)
   Vermenigvuldig ewewigskonsentrasies van I met 12,3 dm³ en deel ewewigsmol I<sub>2</sub> met 12,3 dm³(OPSIE 2)
- Verandering in n(I) = n(I by ewewig)
- GEBRUIK verhouding: I₂: I = 1:2 ✓
- Aanvanklike  $n(I_2)$  = ewewigs  $n(I_2)$  + verandering in  $n(I_2)$ .
- Vervang 254 g⋅mol<sup>1</sup> as molêre massa van I<sub>2</sub>.
- Finale antwoord: (26 g 27,94 g)





## **CALCULATIONS USING CONCENTRATION**

#### Mark allocation

- Correct K<sub>c</sub> expression (<u>formulae in square brackets</u>). √
- Substitution of equilibrium concentrations into K<sub>c</sub> expression. ✓
- Substitution of K<sub>c</sub> value √
- Change in n(I) = n(I at equilibrium). ✓
- **USING** ratio:  $I_2 : I = 1 : 2 \checkmark$
- Initial [I₂] = equilibrium [I₂] + change in [I₂]. √
- Divide by 12,3 dm<sup>3</sup>. ✓
- Substitute 254 g·mol<sup>-1</sup> as molar mass for I₂.√
- Final answer 26,543 g. ✓

# BEREKENINGE WAT KONSENTRASIE GEBRUIK

## **Puntetoekenning**

- Korrekte K<sub>c</sub>-uitdrukking (<u>formules in vierkanthakies</u>).
- Vervanging van ewewigskonsentrasies in K<sub>c</sub>-uitdrukking.
- Vervanging van K<sub>c</sub>-waarde.
- Verandering in n(I) = n(I by ewewig).
- **GEBRUIK** verhouding  $I_2: I = 1:2$
- Aanvanklike  $[I_2]$  = ewewigs  $[I_2]$  + verandering in  $[I_2]$ .
- Deel deur 12,3 dm<sup>3</sup>. √
- Vervang 254 g⋅mol<sup>1</sup> as molêre massa van I<sub>2</sub>.
- Finale antwoord: 26,543 g

# OPTION 3/OPSIE 3

$$K_{c} = \frac{[I]^{2}}{[I_{2}]} \checkmark$$

$$3,76x10^{-3} \checkmark = \frac{(4,79 \times 10^{-3})^{2}}{[I_{2}]} \checkmark$$

$$[I_{2}] = 6,102 \times 10^{-3} \text{ mol·dm}^{-3}$$

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.  $\frac{6}{9}$ 

			_
	$I_2$	I	
Initial concentration (mol·dm <sup>-3</sup> )  Aanvangskonsentrasie (mol·dm <sup>-3</sup> )	₹8,497x10 <sup>-3</sup>	0	]
Change (mol·dm <sup>-3</sup> )  Verandering (mol·dm <sup>-3</sup> )	2,395x10 <sup>-3</sup>	4,79x10 <sup>-3</sup> ✓	Using ratio ✓
Equilibrium concentration (mol·dm <sup>-3</sup> ) Ewewigskonsentrasie (mol·dm <sup>-3</sup> )	6,102 x 10 <sup>-3</sup>	4,79 x 10 <sup>-3</sup>	
		·	

$$c = \frac{m}{MV}$$

$$8,497 \times 10^{-3} = \frac{m}{(254)^{\checkmark}(12,3)^{\checkmark}}$$

$$\therefore m = 26.546 \text{ g}^{\checkmark}$$

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#### **QUESTION 7/VRAAG 7**

7.1.1 (-) Weak/Swak ✓

Ionises/Dissociates incompletely/partially (in water) ✓ Ioniseer/Dissosieer/onvolledig/gedeeltelik (in water)

(2)

7.1.3 Greater than/Groter as √

(1)

7.1.4  $CH_3COO^{-}(aq) + H_2O(\ell) \checkmark \rightleftharpoons CH_3COOH(aq) + OH^{-}(aq) \checkmark$ 

OR/OF

 $CH_3COONa(aq) + H_2O(l) \checkmark \Rightarrow CH_3COOH(aq) + NaOH(aq) \checkmark$ 

Due to formation of hydroxide/OH⁻ / the solution is basic/alkaline /pH > 7. ✓ As gevolg van die vorming van hidroksied/OH⁻ is die oplossing basies/alkalies /pH > 7

(3)

# 7.2.1 Marking criteria/Nasienriglyne

- Substitute/vervang: 1 x 0,0145 **OR/OF** 1 x 14,5 in  $c = \frac{n}{V} / \frac{c_a \times V_a}{c_b \times V_b} = \frac{n_a}{n_b}$ .
- Use/Gebruik: n(CH<sub>3</sub>COOH): n(NaOH) = 1:1 √
- Final answer/Finale antwoord: 0,0145 mol √

# **OPTION 1/OPSIE 1**

n(NaOH)<sub>reacted</sub> = cV = 1(0,0145) ✓ = 0,0145 mol

 $n(CH_3COOH)_{diluted} = n(NaOH)$ = 0,0145mol  $\checkmark$ 

(3)

# 7.2.2 POSITIVE MARKING FROM 7.2.1./POSITEWE NASIEN VANAF VRAAG 7.2.1.

## Marking criteria/Nasienriglyne

- Calculate mass/Bereken massa CH<sub>3</sub>COOH in 25 cm<sup>3</sup> (1,13 g). ✓
- Formula/Formule:  $n = \frac{m}{M}$ .  $\checkmark$
- Substitute/Vervang: M = 60 g·mol<sup>-1</sup>. ✓
- n(CH<sub>3</sub>COOH)<sub>reacted/reageer</sub> = n<sub>initial/begin</sub> n<sub>unreacted/nie</sub> reageer ✓
- USE mol ratio/GEBRUIK molverhouding: n(CaCO₃): n(CH₃COOH) = 1: 2.√
- Substitution of/Vervanging van 100 g·mol<sup>-1</sup> in m = nM. √
- Calculate percentage/Bereken persentasie: 0,217/1,2 × 100 ✓
- Final answer/*Finale antwoord*: 18,08% √ (17,92 22,92)

$$m(CH_{3}COOH) = \frac{4,52}{100} \times 25 \checkmark = 1,13 g$$

$$n(CH_{3}COOH)_{ini/aanv.} = \frac{m}{M} \checkmark$$

$$= \frac{1,13}{60} = 0,01883 \text{ mol}$$

$$n(CH_{3}COOH)_{rea} = 0,01883 \checkmark 0,0145 = 0,0043 \text{ mol}$$

$$n(CaCO_{3}) = \frac{1}{2}n(CH_{3}COOH)$$

$$= 0,5(0,0043) \checkmark$$

$$= 0,00217 \text{ mol}$$

$$m(CaCO_{3}) = nM \checkmark$$

$$= 0,00217(100) = 0,217 g$$
% CaCO<sub>3</sub> =  $\frac{0,217}{1,2} \times 100 \checkmark$ 

$$= 18,08 \% \checkmark$$

(8)

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## **QUESTION 8/VRAAG 8**

8.1 Provides path for movement of ions./Ensures(electrical)neutrality in the cell. ✓ Verskaf pad vir beweging van ione./Verseker (elektriese) neutraliteit in die sel.

(1)

8.2 (The electrode) where <u>oxidation</u> takes place/electrons are lost. ✓✓ (Die elektrode) waar oksidasie plaasvind/elektrone verloor word.

(2)

8.3 Mg/Magnesium ✓ (1)

 $2H^+ + 2e^- \rightarrow H_2 \checkmark \checkmark$ 8.4.1

# Marking criteria/Nasienriglyne

$$H_2 \leftarrow 2H^+ + 2e^- \qquad (\frac{2}{2})$$

$$(\frac{2}{2})$$

$$2H^+ + 2e^- = H_2 \qquad (\frac{1}{2})$$

$$H_2 = 2H^+ + 2e^- \qquad (0/2)$$

$$(\frac{0}{2})$$

$$2H^{+} + 2e \leftarrow H_{2} \qquad (0/2)$$

• Ignore if charge omitted on electron./Ignoreer indien lading weggelaat op elektron.

If charge (+) omitted on H<sup>+</sup>/Indien lading (+) weggelaat op H<sup>+</sup>:

Example/Voorbeeld:  $2H + 2e^{-} \rightarrow H_2 \checkmark$ 

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

8.4.2 Magnesium/Mg ✓

(2)(1)

#### 8.5 **OPTION 1/OPSIE 1**

$$E_{cell}^{\theta} = E_{reduction}^{\theta} - E_{oxidation}^{\theta}$$

$$= 0 \checkmark - (-2,36) \checkmark$$

$$E_{cell}^{\theta}=$$
 2,36  $V^{\checkmark}$ 

# Notes/Aantekeninge

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

# **OPTION 2/OPSIE 2**

$$\sqrt{2}H^+ 2e^- \rightarrow H_2$$

$$F^{\theta} = 0 V \checkmark$$

$$Mg(s) \rightarrow Mg^{2+}(aq) + 2e^{-}$$

$$E^{\theta} = +2,36 \text{ V } \checkmark$$

$$Mg(s) + 2H^{+}(aq) \rightarrow Mg^{2+}(aq) + H_{2}(g)$$
  $E^{\theta} = +2,36 \text{ V} \checkmark$ 

$$F^{\theta} = +2.36 \text{ V} \checkmark$$

H<sub>2</sub> is a stronger reducing agent ✓ than Cu ✓ and therefore Cu<sup>2+</sup>/Cu ions are 8.6 <u>reduced/H<sub>2</sub> is oxidised</u>  $\checkmark$  Electrons flow from H<sub>2</sub> to Cu.

> H<sub>2</sub> is 'n sterker reduseermiddel as Cu en dus word Cu<sup>2+</sup>/Cu-ione <u>gereduseer/H<sub>2</sub> is geoksideer</u>. Elektrone vloei vanaf H<sub>2</sub> na Cu.

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(4)

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## **QUESTION 9/VRAAG 9**

#### 9.1 **ANY ONE/ENIGE EEN:**

- The chemical process in which <u>electrical energy is converted to chemical energy</u>. ✓✓ (2 or 0)
- The use of electrical energy to produce a chemical change. (2 or 0)
- <u>Decomposition of an ionic compound</u> by means of <u>electrical energy</u>. **(2 or 0)**
- The process during which and <u>electric current passes through a solution/ionic liquid/molten ionic</u> compound. (2 or 0)
- Die chemiese proses waarin <u>elektriese energie omgeskakel word na chemiese energie</u>. (2 of 0)
- Die gebruik van <u>elektriese energie om 'n chemiese verandering te weeg</u> te bring. (2 of 0)
- <u>Ontbinding van 'n ioniese verbinding</u> met behulp van <u>elektriese energie</u>. **(2 of 0)**
- Die proses waardeur 'n <u>elektriese stroom deur 'n</u> <u>oplossing/ioniese</u>
   vloeistof/gesmelte ioniese verbinding beweeg. (2 of 0)
- 9.2 Battery/cell/ power source √

  Battery/sel/kragbron (1)
- 9.3 Silver nitrate/AgNO₃/ Silver ethanoate/CH₃COOAg / Silver fluoride /AgF/ Silver perchlorate AgCℓO₄. ✓ Silwernitraat/AgNO₃/ Silweretanoaat/CH₃COOAg / Silwerfloried / AgF / Silwerperchloraat / AgCℓO₄ (1)
- 9.4 C Remains the same/Bly dieselfde ✓

Rate of oxidation is equal to the rate of reduction. ✓

Tempo van oksidasie is gelyk aan die tempo van reduksie. (2)

9.5 Ag  $\rightarrow$  Ag<sup>+</sup> + e<sup>-</sup>  $\checkmark$   $\checkmark$ 

Notes/Aantekeninge
$$Ag^{+} + e^{-} \leftarrow Ag \quad (\frac{2}{2}) \qquad Ag \rightleftharpoons Ag^{+} + e^{-} \quad (\frac{1}{2})$$

$$Ag \leftarrow Ag^{+} + e^{-} \quad (\frac{0}{2}) \qquad Ag^{+} + e^{-} \rightleftharpoons Ag \quad (\frac{0}{2})$$

- Ignore if charge omitted on electron./Ignoreer indien lading weggelaat op elektron.
- If charge (+) omitted on Ag<sup>+</sup>/Indien lading (+) weggelaat op Ag<sup>+</sup>:

Example/Voorbeeld: Ag → Ag + e ✓

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#### **QUESTION 10/VRAAG 10**

10.1.1 (Liquid) Air/(Vloeibare)Lug ✓ (1)

10.1.2 Natural gas/methane/oil/coal/coke√

\*\*Aardgas/metaan/olie/steenkool/kooks\*\*

(1)

10.1.3 Iron/iron oxide/Fe/FeO ✓

Yster/ysteroksied/Fe/FeO (1)

10.1.4 NH<sub>3</sub>/Ammonia/*Ammoniak* ✓ (1)

10.1.5 Ostwald (process)/Ostwald(proses) ✓ (1)

10.1.6  $NH_3 + HNO_3 \checkmark \rightarrow NH_4NO_3 \checkmark$  Bal  $\checkmark$ 

#### Marking criteria/Nasienriglyne

- Reactants ✓ Products ✓ Balancing ✓
   Reaktanse Produkte Balansering
- Ignore double arrows./Ignoreer dubbelpyle.
- Marking rule 6.3.10./Nasienreël 6.3.10.

10.2.1 NPK ratio/Ratio of primary nutrients ✓ NPK-verhouding/Verhouding van primêre voedingstowwe (1)

10.2.2 **OPTION 1/OPSIE 1** 

$$\frac{4}{9} \times \frac{X}{100} \times 20 = 2,315 \text{ kg}$$

$$X = 26 \times (26,04)$$

**OPTION 2/OPSIE 2** 

m(P) = 2,315 kg

Mass of 1 part P =  $\frac{2,315}{4}$  = 0,57575

Mass of N = (0.57575)(2) = 1.1575 kg Mass of K = (0.57575)(3) = 1.73625 kg

Total mass of fertiliser:

1,1575 + 2,315 + 1,73625 = 5,20875 kg

$$X = \frac{5,20875}{20} \times 100 = 26,04 \checkmark$$

TOTAL/TOTAAL: 150

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