



**education**

Department of  
Education  
FREE STATE PROVINCE

**PREPARATORY EXAMINATION  
VOORBEREIDENDE EKSAMEN**

**GRADE/GRAAD 12**

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

**SEPTEMBER 2018**

**MARKS/PUNTE: 150**

**MEMORANDUM**

**This memorandum consists of 15 pages.  
*Hierdie memorandum bestaan uit 15 bladsye.***

### QUESTION 1/VRAAG 1

- 1.1 C ✓✓ (2)
- 1.2 A ✓✓ (2)
- 1.3 D ✓✓ (2)
- 1.4 D ✓✓ (2)
- 1.5 A ✓✓ (2)
- 1.6 C ✓✓ (2)
- 1.7 D ✓✓ (2)
- 1.8 B ✓✓ (2)
- 1.9 B ✓✓ (2)
- 1.10 D ✓✓ (2)
- [20]**

### QUESTION 2/VRAAG 2

- 2.1.1 A ✓ (1)
- 2.1.2 ANY TWO/ENIGE TWEE ✓  
B  
C  
D (1)
- 2.2
- 2.2.1 Compounds with the same molecular formula ✓ but different types of chains. ✓  
*Verbindings met dieselfde molekulêre formule, maar verskillende soort kettings.* (2)
- 2.2.2
- ```
      H   H   H ✓✓
      |   |   |
H - C - C - C - H
      |   |   |
      H   |   H
          C
          |
          H
```

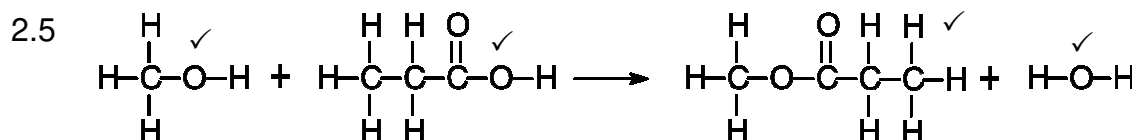
**IF/INDIEN:**

  - H atom omitted/H-atoom uitgelaat: - 1
  - Condensed structure/Gekondenseerde struktuur: -1
- (2)
- 2.3 H<sub>2</sub> ✓ (1)

2.4

2.4.1 Butanal/Butanaal ✓ (1)

2.4.2 3-methylbut-1-yne ✓/3-methyl-1-butyne  
 3-metielbut-1-yn/3-metiel-1-butyn (2)

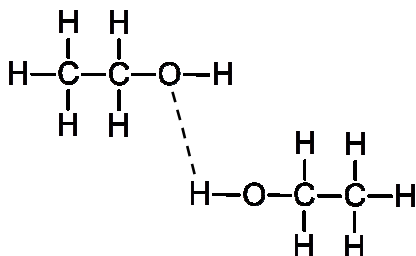


**Marking guidelines/Nasienriglyne**

- Ignore/Ignoreer ⇌
- Accept H<sub>2</sub>O if condensed./Aanvaar H<sub>2</sub>O as gekondenseerd.
- Any additional reactants and/or products/Enige addisionele reaktanse en/of produkte: Max./Maks. 3/4
- Accept coefficients that are multiples.  
Aanvaar koëffisiënte wat veelvoude is.
- Incorrect balancing/Verkeerde balansering: Max./Maks. 3/4
- Condensed formulae/Gekondenseerde formules: Max./Maks. 3/4
- Molecular formulae/Molekulêre formules: Max./Maks. 1/4

(4)

2.6



**Marking criteria/Nasienriglyne:**

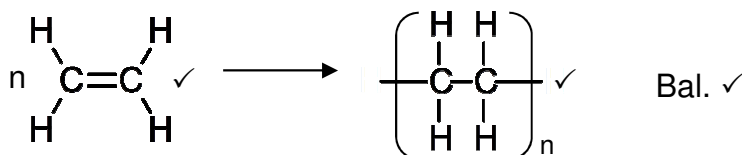
- At least one structural formula of ethanol as shown. ✓  
Ten minste een struktuurformule van etanol soos aangetoon.
- Dotted line drawn from O-atom of one molecule to H-atom bonded to an O-atom in the second molecule (H-atom should be between two O-atoms). ✓  
Stippellyn getrek vanaf O-atoom op een molekule na 'n H-atoom gebind aan 'n O-atoom in die tweede molekule (H-atoom moet tussen twee O-atome wees).

(2)

2.7

2.7.1 Addition polymerisation/Addisiëpolimerisasie ✓ (1)

2.7.2



**Marking guidelines/Nasienriglyne**

- Ignore/Ignoreer ⇌
- Any additional reactants and/or products/*Enige addisionele reaktanse en/of produkte:* Max./Maks. 2/3
- Incorrect balancing/*Verkeerde balansering:* Max./Maks. 2/3
- Condensed formulae/*Gekondenseerde formules:* Max./Maks. 2/3
- Molecular formulae/*Molekulêre formules:* 0/3

(3)  
[20]

**QUESTION 3/VRAAG 3**

3.1 Haloalkanes/Alkyl halides/*Haloalkane/Alkielhaliede* ✓ (1)

3.2

3.2.1 London forces/dispersion forces/induced dipole forces ✓  
*Londonkragte/dispersiekragte/geïnduseerde dipoolkragte* (1)

3.2.2 **Structure/Struktuur:**

Compound B has a longer chain length/larger molecular size/molecular structure/molecular mass/surface area than compound A. ✓

Verbinding B het 'n langer kettinglengte/groter molekulêre grootte/molekulêre struktuur/molekulêre massa/oppervlak as verbinding A.

**Intermolecular forces/Intermolekulêre kragte:**

Stronger intermolecular forces/induced dipole forces/London forces/dispersion forces/Van der Waals forces. ✓

Sterker intermolekulêre kragte/geïnduseerde dipoolkragte/Londonkragte/dispersiekragte/Van der Waalskragte.

**Energy/Energie:**

More energy needed to overcome/break intermolecular forces. ✓

Meer energie benodig om intermolekulêre kragte te oorkom/breek.

OR/OF

**Structure/Struktuur:**

Compound A has a shorter chain length/smaller molecular size/molecular structure/molecular mass/surface area than compound B.

Verbinding A het 'n korter kettinglengte/kleiner molekulêre grootte/molekulêre struktuur/molekulêre massa/oppervlak as verbinding B.

**Intermolecular forces/Intermolekulêre kragte:**

Weaker intermolecular forces/induced dipole forces/London forces/dispersion forces/Van der Waals forces.

Swakker intermolekulêre kragte/geïnduseerde dipoolkragte/Londonkragte/dispersiekragte/Van der Waalskragte.

**Energy/Energie:**

Less energy needed to overcome/break intermolecular forces.

Minder energie benodig om intermolekulêre kragte te oorkom/breek. (3)

3.3 Positional (isomers)/Posisie(-isomere) ✓ (1)

3.4.1 69 °C ✓ (1)

3.4.2

• **Compare compound D to compound B:**

**Vergelyk verbinding D met verbinding B:**

Compound D is more branched/more compact/has a smaller surface area than compound B. ✓

Verbinding D is meer vertak/meer kompak/het 'n kleiner oppervlak as verbinding B.

• **Compare compound D to compound E:**

**Vergelyk verbinding D met verbinding E:**

Compound D is less branched/has a longer chain length/larger surface area than compound E. ✓

Verbinding D is minder vertak/het 'n langer kettinglengte/het 'n groter oppervlak as verbinding E.

• **Intermolecular forces in compound D are weaker than in compound B and stronger than in compound E. ✓**

Intermolekulêre kragte in verbinding D is swakker as in verbinding B en sterker as in verbinding E.

• **Less energy is needed to overcome/break intermolecular forces in compound D than in compound B and more energy is needed to overcome/break intermolecular forces in compound D than in compound E. ✓**

Minder energie benodig om intermolekulêre kragte in verbinding D te oorkom/breek as in verbinding B en meer energie benodig om intermolekulêre kragte in verbinding D te oorkom/breek as in verbinding E.

(4)  
[11]

**QUESTION 4/VRAAG 4**

4.1  
 4.1.1 Z ✓ (1)

4.1.2 X ✓ (1)

4.1.3 V ✓ (1)

4.1.4 Y ✓ (1)

4.2

4.2.1 Propan-2-ol/2-propanol ✓ (1)

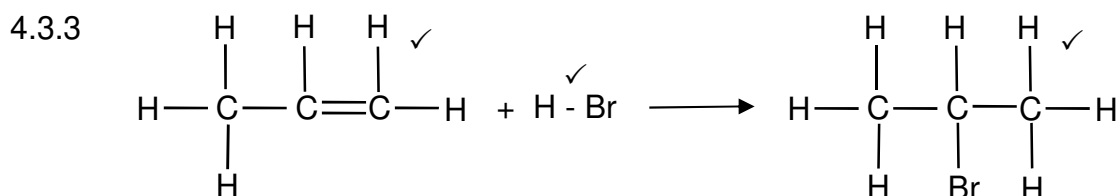
4.2.2 Propane/propan ✓ (1)

4.3

4.3.1 Both reactions take place in the presence of a strong base/NaOH/  
 KOH/LiOH. ✓  
*Beide reaksies vind plaas in teenwoordigheid van 'n sterk basis*/NaOH/  
 KOH/LiOH. (1)

4.3.2 Y: concentrated base/ethanolic base & Z: dilute base/base in water/water ✓  
*Y: gekonsentreerde basis/etanoliëse basis & Z: verdunde basis/basis in water/water*

Y: heat (strongly)/high temperature & Z: mild heat ✓  
*Y: verhit (sterk)/hoë temperatuur & Z: matige hitte* (2)



**Marking guidelines/Nasiëriglyne**

- Ignore/Ignoreer ⇌
- Accept HBr if condensed./Aanvaar HBr as gekondenseerd.
- Any additional reactants and/or products/*Enige addisionele reaktanse en/of produkte:* Max./Maks. 2/3
- Accept coefficients that are multiples.  
*Aanvaar koëffisiënte wat veelvoude is.*
- Incorrect balancing/*Verkeerde balansering:* Max./Maks. 2/3
- Condensed formulae/*Gekondenseerde formules:* Max./Maks. 2/3
- Molecular formulae/*Molekulêre formules:* Max./Maks. 1/3

(3)  
**[12]**

### QUESTION 5/VRAAG 5

5.1

5.1.1

(a) Concentration (of  $\text{Na}_2\text{S}_2\text{O}_3$ )/Konsentrasie (van  $\text{Na}_2\text{S}_2\text{O}_3$ ) ✓ (1)

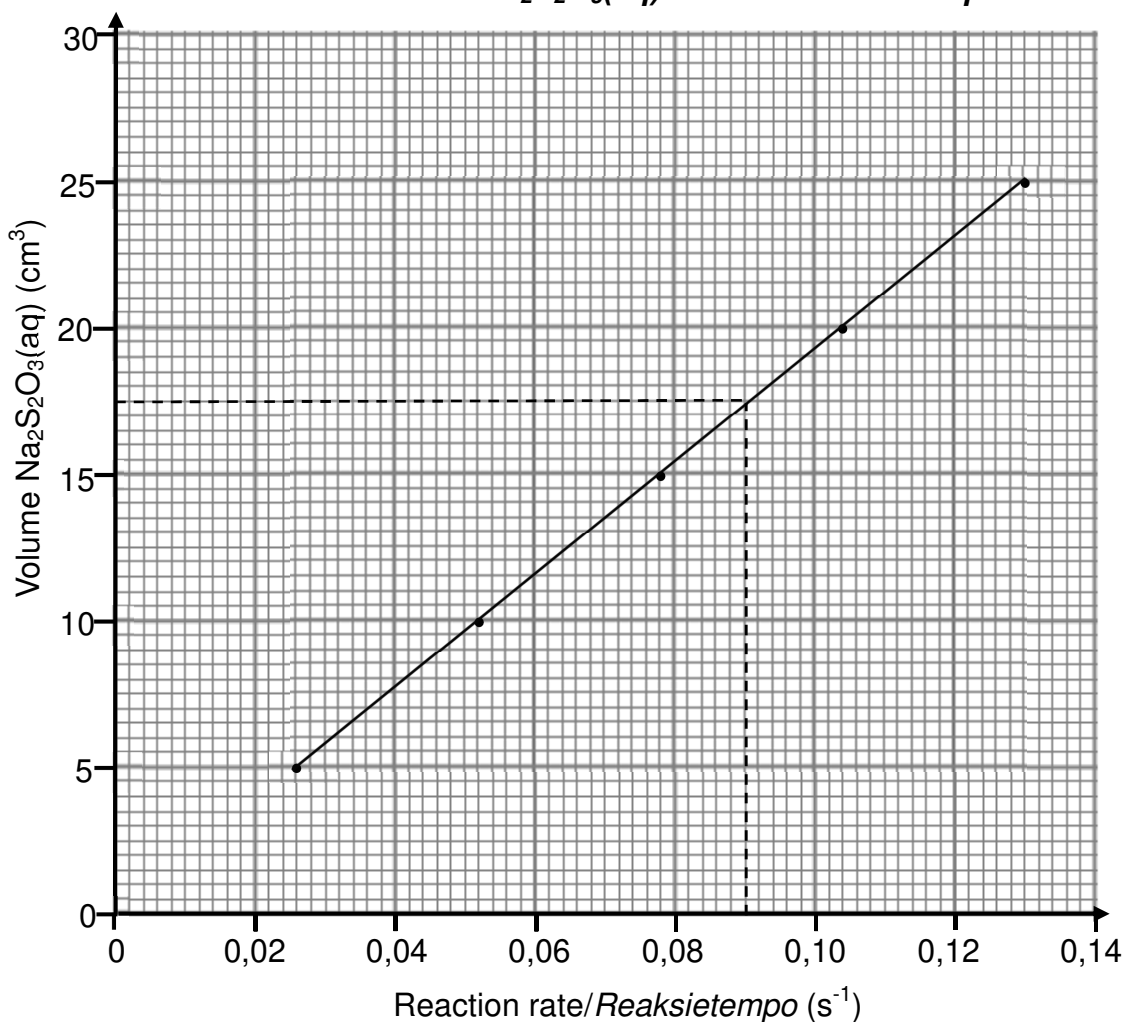
(b) To dilute (the  $\text{Na}_2\text{S}_2\text{O}_3$ )/Om  $\text{Na}_2\text{S}_2\text{O}_3$  te verdun. ✓

**OR/OF**

Decrease concentration (of  $\text{Na}_2\text{S}_2\text{O}_3$ .)  
Verminder konsentrasie (van  $\text{Na}_2\text{S}_2\text{O}_3$ .) (1)

5.1.2

**Graph of volume of  $\text{Na}_2\text{S}_2\text{O}_3(\text{aq})$  versus reaction rate**  
**Grafiek van volume  $\text{Na}_2\text{S}_2\text{O}_3(\text{aq})$  teenoor reaksietempo**



| <b>Marking criteria/Nasienriglyne</b>                               |   |
|---------------------------------------------------------------------|---|
| Any three points plotted correctly./Enige drie punte korrek gestip. | ✓ |
| All the points plotted correctly./Alle punte korrek gestip.         | ✓ |
| Best-fit line drawn./Beste paslyn getrek.                           | ✓ |

(3)

$$5.1.3 \frac{1}{\text{reaction time}} / \frac{1}{\text{reaksietyd}} = \frac{1}{11} = 0,09 \text{ (s}^{-1}\text{)} \checkmark$$

On graph: Dotted line starting from 0,09 s on x axis drawn to y axis as shown on graph.  $\checkmark$

Op grafiek: Stippellyn geteken vanaf 0,09 s op x-as na y-as soos getoon op grafiek.

Reading on y axis/Lesing op y-as: 17,5 cm<sup>3</sup>  $\checkmark$   
(Accept/Aanvaar: 17 – 18 cm<sup>3</sup>)

**Note/Let wel:** Award mark for answer only if 0,09 s used and dotted lines shown on graph./Ken punt vir antwoord slegs toe indien 0,09 s gebruik is en stippellyn op grafiek aangetoon is.

(3)

5.1.4 Higher than/Hoër as  $\checkmark$

(-)

**OPTION 1/OPSIE 1**

In experiment 1/In eksperiment 1:

- More (Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>) particles per unit volume.  $\checkmark$   
Meer (Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>)-deeltjies per eenheidsvolume.
- More effective collisions per unit time.  $\checkmark$   
Meer effektiewe botsings per eenheidstyd.

**OPTION 2/OPSIE 2**

In experiment 5/In eksperiment 5:

- Less (Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>) particles per unit volume.  
Minder (Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>)-deeltjies per eenheidsvolume.
- Less effective collisions per unit time  
Minder effektiewe botsings per eenheidstyd.

(3)

5.2

5.2.1 The minimum energy needed for a reaction to take place.  $\checkmark\checkmark$   
Die minimum energie benodig vir 'n reaksie om plaas te vind. (2)

5.2.2 (a) - 20 kJ·mol<sup>-1</sup>  $\checkmark$  (1)

(b) 185 kJ·mol<sup>-1</sup>  $\checkmark$  (1)

5.2.3 Reverse (reaction)/Terugwaartse (reaksie)  $\checkmark$  (1)

**[16]**



**QUESTION 6/VRAAG 6**

6.1 Reversible reaction/Omkeerbare reaksie ✓ (1)

6.2

**Marking criteria/Nasienriglyne:**

- Use  $M(\text{NH}_4\text{Cl}) = 53,5 \text{ g}\cdot\text{mol}^{-1}$  to calculate  $n(\text{NH}_4\text{Cl})$  ✓  
*Gebruik  $M(\text{NH}_4\text{Cl}) = 53,5 \text{ g}\cdot\text{mol}^{-1}$  om  $n(\text{NH}_4\text{Cl})$  te bereken.*
- $m(\text{NH}_4\text{Cl})_{\text{used/gebruik}} = m(\text{NH}_4\text{Cl})_{\text{initial/begin}} - m(\text{NH}_4\text{Cl})_{\text{equil/ewe}}$  ✓  
OR/OF  
 $n(\text{NH}_4\text{Cl})_{\text{used/gebruik}} = n(\text{NH}_4\text{Cl})_{\text{initial/begin}} - n(\text{NH}_4\text{Cl})_{\text{equil/ewe}}$
- **USING ratio/GEBRUIK verhouding:**  $\text{NH}_4\text{Cl} : \text{NH}_3 : \text{HCl} = 1 : 1 : 1$  ✓
- $n(\text{NH}_3)_{\text{equil/ewe}} = n(\text{NH}_3)_{\text{form/gevorm}}$  &  $n(\text{HCl})_{\text{equil/ewe}} = n(\text{HCl})_{\text{form/gevorm}}$  ✓
- Divide/Deel  $n(\text{NH}_3)_{\text{equil/ewe}}$  &  $n(\text{HCl})_{\text{equil/ewe}}$  by/deur  $0,5 \text{ dm}^3$  ✓
- Correct  $K_c$  expression/Korrekte  $K_c$ -uitdrukking ✓
- Substitution of concentrations into  $K_c$  expression. ✓  
*Vervang konsentrasies in  $K_c$ -uitdrukking.*
- Final answer/Finale antwoord: to/tot  $0,01$  ✓  
Range/Gebied:  $0,009,447 \times 10^{-3}$  to/tot  $0,01$

**OPTION 1/OPSIE 1**

|                                                                               | NH <sub>4</sub> Cl(s)       | NH <sub>3</sub> (g) | HCl(g) |                              |
|-------------------------------------------------------------------------------|-----------------------------|---------------------|--------|------------------------------|
| Initial quantity (mol)<br><i>Aanvanklike hoeveelheid (mol)</i>                | $\frac{10,7}{53,5} = 0,2$ ✓ | 0                   | 0      |                              |
| Change (mol)<br><i>Verandering (mol)</i>                                      | 0,05 ✓                      | 0,05                | 0,05   | Ratio/<br>verhouding ✓       |
| Quantity at equilibrium (mol)<br><i>Hoeveelheid by ewewig (mol)</i>           | $\frac{8,1}{53,5} = 0,15$   | 0,05                | 0,05   | ✓                            |
| Equilibrium concentration<br><i>Ewewigskonsentrasie (mol·dm<sup>-3</sup>)</i> | -                           | 0,1                 | 0,1    | Divide by/Deel<br>deur 0,5 ✓ |

$$K_c = [\text{NH}_3][\text{HCl}] \checkmark$$

$$= (0,1)(0,1) \checkmark$$

$$= 0,01 \checkmark$$

No  $K_c$  expression, correct substitution/Geen  $K_c$ -uitdrukking, korrekte vervanging: Max./Maks. 7/8

Wrong  $K_c$  expression/Verkeerde  $K_c$ -uitdrukking: Max./Maks. 5/8

**IF/INDIEN:**  $[\text{NH}_4\text{Cl}] = 1$  in  $K_c = \frac{[\text{NH}_3][\text{HCl}]}{[\text{NH}_4\text{Cl}]}$

No mark for  $K_c$  expression, but continue marking substitution and answer.  
*Geen punt vir  $K_c$ -uitdrukking, maar sien substitusie en antwoord na.*

**OPTION 2/OPSIE 2:**

$$\Delta n(\text{NH}_4\text{Cl}) = 10,7 - 8,1 \checkmark = 2,6 \text{ g}$$

$$\Delta n(\text{NH}_4\text{Cl}) = \frac{2,6}{53,5\checkmark} = 0,05 \text{ mol}$$

$$\left. \begin{array}{l} \Delta n(\text{NH}_3) = \Delta n(\text{NH}_4\text{Cl}) = 0,05 \text{ mol} \\ \Delta n(\text{HCl}) = \Delta n(\text{NH}_4\text{Cl}) = 0,05 \text{ mol} \end{array} \right\} \checkmark$$

$$\left. \begin{array}{l} n(\text{NH}_3)_{\text{equi/ewe}} = n(\text{NH}_3)_{\text{initial/begin}} + \Delta n(\text{NH}_3) = 0,05 \text{ mol} \\ n(\text{HCl})_{\text{equi/ewe}} = \Delta n(\text{HCl})_{\text{initial/begin}} + \Delta n(\text{HCl}) = 0,05 \text{ mol} \end{array} \right\} \checkmark$$

$$\left. \begin{array}{l} [\text{NH}_3]_{\text{equi/ewe}} = \frac{0,05}{0,5\checkmark} = 0,1 \text{ mol} \\ [\text{HCl}]_{\text{equi/ewe}} = \frac{0,05}{0,5\checkmark} = 0,1 \text{ mol} \end{array} \right\} \checkmark \text{ Divide by/Deel deur } 0,5$$

$$\begin{aligned} K_c &= [\text{NH}_3][\text{HCl}] \checkmark \\ &= (0,1)(0,1) \checkmark \\ &= 0,01 \checkmark \end{aligned}$$

No  $K_c$  expression, correct substitution/Geen  $K_c$ -uitdrukking, korrekte vervanging: Max./Maks. 7/8

Wrong  $K_c$  expression/Verkeerde  $K_c$ -uitdrukking: Max./Maks. 5/8

**IF/INDIEN:**  $[\text{NH}_4\text{Cl}] = 1$  in  $K_c = \frac{[\text{NH}_3][\text{HCl}]}{[\text{NH}_4\text{Cl}]}$

No mark for  $K_c$  expression, but continue marking substitution and answer.  
Geen punt vir  $K_c$ -uitdrukking, maar sien substitusie en antwoord na.

(8)

6.3 Endothermic/Endotermies  $\checkmark$



- Increase in temperature increases concentration of products/favours forward reaction.  $\checkmark$

*Toename in temperatuur verhoog die konsentrasie van die produkte/bevoordeel die voorwaartse reaksie.*

- Increase in temperature favours the endothermic reaction.  $\checkmark$

*Toename in temperatuur bevoordeel die endotermiese reaksie.*

(3)

6.4

6.4.1 Remains the same/Bly dieselfde  $\checkmark$

(1)

6.4.2 Increases/Verhoog  $\checkmark$

(1)

6.4.3 Remains the same/Bly dieselfde  $\checkmark$

(1)

**[15]**

### QUESTION 7/VRAAG 7

7.1

7.1.1 A dilute base contains a small amount/number of moles of base in proportion to the volume of water ✓ and a concentrated base contains a large amount/number of moles of base in proportion to the volume of water. ✓

*'n Verdunde basis bevat 'n klein hoeveelheid/aantal mol basis in verhouding tot die volume water en 'n gekonsentreerde basis bevat 'n groot hoeveelheid/aantal mol basis in verhouding tot die volume water.* (2)

7.1.2 Phosphoric acid (solution)/Fosforsuur(oplossing) ✓ (1)

7.1.3 (a) Increases/Toeneem ✓ (1)

(b) Increases/Toeneem ✓ (1)

7.2

7.2.1

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Marking criteria/Nasienriglyne:</b></p> <ul style="list-style-type: none"><li>• Formula/Formule: <math>\text{pH} = -\log [\text{H}_3\text{O}^+]</math> <b>OR/OF</b> <math>c = \frac{n}{v}</math> ✓</li><li>• Substitute/Vervang <math>\text{pH} = 2</math>. ✓</li><li>• Use mol ratio/Gebruik molverhouding: <math>n(\text{H}_3\text{PO}_4) : n(\text{H}_3\text{O}^+) = 1:3</math> ✓</li><li>• Substitute/Vervang <math>[\text{H}_3\text{PO}_4]</math> &amp; <math>0,5 \text{ dm}^3</math> in <math>n = cV</math>. ✓</li><li>• Final answer/Finale antwoord: <math>1,67 \times 10^{-3} \text{ mol}</math> / <math>1,665 \times 10^{-3} \text{ mol}</math> ✓</li></ul>         |
| <p><math>\text{pH} = -\log [\text{H}_3\text{O}^+]</math><br/><math>\therefore 2 \checkmark = -\log [\text{H}_3\text{O}^+]</math><br/><math>\therefore [\text{H}_3\text{O}^+] = 0,01 \text{ mol} \cdot \text{dm}^{-3}</math></p> <p><math>[\text{H}_3\text{PO}_4] = \frac{1}{3} [\text{H}_3\text{O}^+]</math><br/><math>= \frac{1}{3} \times 0,01 \checkmark</math><br/><math>= 3,33 \times 10^{-3} \text{ mol} \cdot \text{dm}^{-3}</math></p> <p><math>n(\text{H}_3\text{PO}_4)_{\text{ini/aanv}} = cV</math><br/><math>= (3,33 \times 10^{-3})(500 \times 10^{-3}) \checkmark</math><br/><math>= 1,67 \times 10^{-3} \text{ mol} \checkmark</math></p> <p>✓ Any one/Enige een</p> |

(5)

7.2.2 POSITIVE MARKING FROM QUESTION 7.2.1.  
 POSITIEWE NASIEN VANAF VRAAG 7.2.1.

**Marking criteria/Nasienriglyne:**

- Use  $M = 58 \text{ g}\cdot\text{mol}^{-1}$  to calculate  $n(\text{Mg}(\text{OH})_2)_{\text{reacted}}$  ✓  
 Gebruik  $M = 58 \text{ g}\cdot\text{mol}^{-1}$  om  $n(\text{Mg}(\text{OH})_2)_{\text{gereageer}}$  te bereken.
- Use mol ratio/Gebruik molverhouding:  $n(\text{H}_3\text{PO}_4) : n(\text{Mg}(\text{OH})_2) = 2:3$  ✓
- Subtraction/Aftrekking:  
 $n(\text{H}_3\text{PO}_4)_{\text{excess/oormaat}} = n(\text{H}_3\text{PO}_4)_{\text{initial/aanvanklik}} - n(\text{H}_3\text{PO}_4)_{\text{react/reageer}}$
- Use  $V_a = 14 \times 10^{-3} \text{ dm}^3/14 \text{ cm}^3$ . ✓  
 Gebruik  $V_a = 14 \times 10^{-3} \text{ dm}^3/14 \text{ cm}^3$ .
- Use mol ratio/Gebruik molverhouding:  $n(\text{H}_3\text{PO}_4) : n(\text{NaOH}) = 1:3$  ✓
- Use  $V_b = 25 \times 10^{-3} \text{ dm}^3/25 \text{ cm}^3$  to calculate  $[\text{NaOH}]$ . ✓  
 Gebruik  $V_b = 25 \times 10^{-3} \text{ dm}^3/25 \text{ cm}^3$  om  $[\text{NaOH}]$  te bereken.
- Final answer/Finale antwoord:  $9,58 \times 10^{-5} \text{ mol}\cdot\text{dm}^{-3}$  ✓  
 Range/Gebied:  $9,66 \times 10^{-4}$  to/tot  $9,76 \times 10^{-4} \text{ mol}\cdot\text{dm}^{-3}$

$$\begin{aligned}
 n(\text{Mg}(\text{OH})_2) &= \frac{m}{M} \\
 &= \frac{0,12}{58} \checkmark \\
 &= 2,07 \times 10^{-3} \text{ mol} \\
 n(\text{H}_3\text{PO}_4)_{\text{reacted/reageer}} &= \frac{2}{3}n(\text{Mg}(\text{OH})_2) \\
 &= \frac{2}{3}(2,07 \times 10^{-3}) \checkmark \\
 &= 1,38 \times 10^{-3} \text{ mol} \\
 n(\text{H}_3\text{PO}_4)_{\text{excess/oormaat}} &= 1,67 \times 10^{-3} - 1,38 \times 10^{-3} \checkmark \\
 &= 2,9 \times 10^{-4} \text{ mol} \\
 n(\text{H}_3\text{PO}_4)_{\text{excess/oormaat}} \text{ in } 14 \text{ cm}^3 &= 2,9 \times 10^{-4} \times \frac{14}{500} \checkmark \\
 &= 8,12 \times 10^{-6} \text{ mol} \\
 n(\text{NaOH}) &= 3n(\text{H}_3\text{PO}_4) \\
 &= 3(8,12 \times 10^{-6}) \checkmark \\
 &= 2,44 \times 10^{-5} \text{ mol} \\
 c_b &= \frac{n}{V} \\
 &= \frac{2,44 \times 10^{-5}}{25 \times 10^{-3}} \checkmark \\
 &= 9,76 \times 10^{-4} \text{ mol}\cdot\text{dm}^{-3} \checkmark
 \end{aligned}$$

(7)  
 [17]

**QUESTION 8/VRAAG 8**

8.1 Galvanic/Galvanies ✓ (1)

8.2 Ag ✓ (1)

8.3  $Zn \rightarrow Zn^{2+} + 2e^-$  ✓✓

**Marking guidelines/Nasienriglyne:**

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

(2)

8.4 Increases/Verhoog ✓ (1)

8.5

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

$$= \frac{2,16}{108} \checkmark$$

$$= 0,02 \text{ mol}$$

↙

$$n(\text{Zn}) = \frac{1}{2}n(\text{Ag})$$

$$= \frac{1}{2} \times 0,02 \checkmark$$

$$= 0,01 \text{ mol}$$

↙

$$n(\text{Zn}) = \frac{m}{M}$$

$$0,01 = \frac{m}{65} \checkmark$$

$$m = 0,65 \text{ g} \checkmark$$

(4)

8.6

8.6.1 Pressure/Druk:  $1,013 \times 10^5 \text{ Pa}/101,3 \text{ kPa}/1 \text{ atm}$  ✓ (1)

8.6.2  $Zn(s) | Zn^{2+}(aq) (1 \text{ mol}\cdot\text{dm}^{-3}) \checkmark || \checkmark H^+(aq) (1 \text{ mol}\cdot\text{dm}^{-3}) | H_2(g) | Pt(s) \checkmark$

**OR/OF**

$Zn(s) | Zn^{2+}(aq) \checkmark || \checkmark H^+(aq) | H_2(g) | Pt(s) \checkmark$

**OR/OF**

$Zn | Zn^{2+} \checkmark || \checkmark H^+ | H_2 | Pt \checkmark$

(3)

8.6.3

|                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>OPTION 1/OPSIE 1:</b></p> $E_{\text{cell}}^{\theta} = E_{\text{reduction}}^{\theta} - E_{\text{oxidation}}^{\theta} \checkmark$ $E_{\text{sel}}^{\theta} = E_{\text{reduksie}}^{\theta} - E_{\text{oksidasie}}^{\theta}$ $= 0 \checkmark - (-0,76) \checkmark$ $= 0,76 \text{ V} \checkmark$                                                   | <p><b>Notes/Aantekeninge</b></p> <ul style="list-style-type: none"> <li>Accept any other correct formula from the data sheet./Aanvaar enige ander korrekte formule vanaf gegewensblad.</li> <li>Any other formula using unconventional abbreviations, e.g. <math>E_{\text{cell}}^{\circ} = E_{\text{OA}}^{\circ} - E_{\text{RA}}^{\circ}</math> followed by correct substitutions:/Enige ander formule wat onkonvensionele afkortings gebruik bv. <math>E_{\text{sel}}^{\circ} = E_{\text{OM}}^{\circ} - E_{\text{RM}}^{\circ}</math> gevolg deur korrekte vervangings: 3/4</li> </ul> |
| <p><b>Option 2:</b></p> $\left. \begin{array}{l} 2\text{H}^{+} + 2\text{e}^{-} \rightarrow \text{H}_2 \\ \text{Zn} \rightarrow \text{Zn}^{2+} + 2\text{e}^{-} \end{array} \right\} \checkmark$ $E^{\circ} = 0,00 \text{ (V)} \checkmark$ $E^{\circ} = 0,76 \text{ (V)} \checkmark$ $\underline{E_{\text{cell}}^{\circ} = 0,76 \text{ V} \checkmark}$ |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

(4)  
[17]

### QUESTION 9/VRAAG 9

9.1 The process in which electrical energy is converted to chemical energy.  $\checkmark\checkmark$   
Die proses waarin elektriese energie omgeskakel word na chemiese energie.

**OR/OF**

The use of electrical energy to produce a chemical change.

Die gebruik van elektriese energie om 'n chemiese verandering te weeg te bring. (2)

9.2 Oxidation/Oksidasie  $\checkmark$  (1)

9.3 A substance that loses electrons/donates electrons.  $\checkmark\checkmark$   
'n Stof wat elektrone verloor/skenk. (2)

9.4  $\text{Cl}^{-}$ /chloride (ion)/Chloried(ioon)  $\checkmark$   
Accept/Aanvaar:  $\text{NaCl}$ /sodium chloride/natriumchloried. (1)

9.5  $2\text{H}_2\text{O}(\ell) + 2\text{e}^{-} \rightarrow \text{H}_2(\text{g}) + 2\text{OH}^{-}(\text{aq}) \checkmark\checkmark$

**Marking guidelines/Nasienglyne:**

- $2\text{H}_2\text{O} + 2\text{e}^{-} \rightleftharpoons \text{H}_2 + 2\text{OH}^{-} \quad \frac{1}{2} \qquad \text{Zn}^{2+} + 2\text{e}^{-} \rightleftharpoons \text{Zn} \quad \frac{0}{2}$
- $\text{H}_2 + 2\text{OH}^{-} \leftarrow 2\text{H}_2\text{O} + 2\text{e}^{-} \quad \frac{2}{2} \qquad \text{H}_2 + 2\text{OH}^{-} \rightarrow 2\text{H}_2\text{O} + 2\text{e}^{-} \quad \frac{0}{2}$

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

• If charge (-) omitted on  $\text{OH}^{-}$ /Indien lading (-) weggelaat op  $\text{OH}^{-}$ :

Max./Maks:  $\frac{1}{2}$  Example/Voorbeeld:  $2\text{H}_2\text{O} + 2\text{e}^{-} \rightarrow \text{H}_2 + 2\text{OH}^{-}$

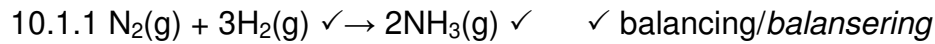
(2)

9.6 Carbon/C/koolstof/platinum/Pt  $\checkmark$  (1)

[9]

**QUESTION 10/VRAAG 10**

10.1



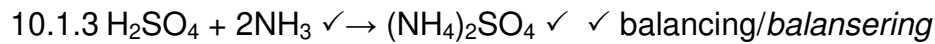
**Marking criteria/Nasienriglyne:**

- Reactants  $\checkmark$  Products  $\checkmark$  Balancing  $\checkmark$   
*Reaktanse Produkte Balansering*
- Ignore phases./Ignoreer fases.
- Ignore double arrows./Ignoreer dubbelpyle.
- Marking rule 6.3.10/Nasienreël 6.3.10.

(3)

10.1.2 Contact (process)/Kontak(proses)  $\checkmark$

(1)



**Marking criteria/Nasienriglyne:**

- Reactants  $\checkmark$  Products  $\checkmark$  Balancing  $\checkmark$   
*Reaktanse Produkte Balansering*
- Ignore phases./Ignoreer fases.
- Ignore double arrows./Ignoreer dubbelpyle.
- Marking rule 6.3.10/Nasienreël 6.3.10.

(3)

10.2

10.2.1 (Fertiliser) **S**  $\checkmark$

(1)

10.2.2 Higher N  $\checkmark$  for leaf production.  $\checkmark$   
Hoër N vir blaarproduksie.

(2)

10.2.3

| <b>OPTION 1/OPSIE 1:</b>                                                                                                                                                      | <b>OPTION 2/OPSIE 2:</b>                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $m(\text{fertiliser}) = \frac{30}{100} \times 2 \checkmark$<br>$= 0,6 \text{ kg}$<br>$\downarrow$<br>$m(\text{filler}) = 2 - 0,6 \checkmark$<br>$= 1,4 \text{ kg} \checkmark$ | $\% \text{ filler} = \frac{100 - 30}{100} \checkmark$<br>$= 70\%$<br>$\downarrow$<br>$m(\text{filler}) = \frac{70}{100} \times 2 \checkmark$<br>$= 1,4 \text{ kg} \checkmark$ |

(3)

[13]

**TOTAL/TOTAAL: 150**