



education

DEPARTMENT: EDUCATION
MPUMALANGA PROVINCE

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

**PHYSICAL SCIENCES: CHEMISTRY (P2)
MARKING GUIDELINES**

SEPTEMBER 2018

MARKS: 150

TIME: 3 hours

This marking guidelines consists of 9 pages

QUESTION 1

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

[20]**QUESTION 2**

- 2.1 A series of organic compounds that can be described by the same general formula OR in which one member differs from the next with a CH₂ group.
 ✓✓

'n Reeks organiese verindings met dieselfde algemene formule OF waarvan die lede verskilmet 'n CH₂ groep.

(2)

- 2.2.1 U ✓

(1)

- 2.2.2 S ✓

(1)

- 2.2.3 P ✓

(1)

- 2.2.4 Q and S ✓✓

(2)

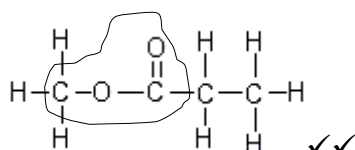
- 2.3.1 3,4-dibromo-2,2-dimethylpentane / 3,4-dibromo-2,2-dimetielpentaaan

(3)

- 2.3.2 Heksan-3-one / Heksan-3-oon

(2)

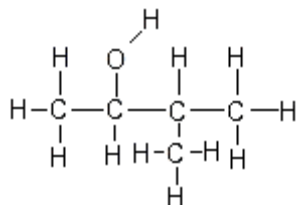
- 2.4.1



1 mark for functional group

1 mark for whole structure

(2)



✓✓

1 mark for functional group

1 mark for whole structure

(2)
[16]

QUESTION 3

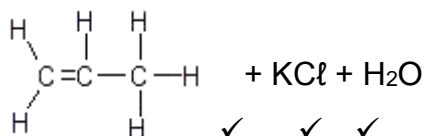
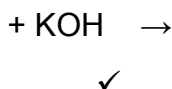
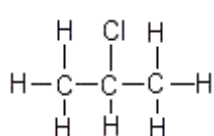
- 3.1 The temperature where the vapour pressure ✓ is equal to the atmospheric pressure. ✓
Die temperatuur waar die dampdruk gelyk is aan atmosferiese druk. (2)
- 3.2.1 Homologous series/ Functional group ✓ / *Homoloë reeks/ Funksionele groep* (1)
- 3.2.2 The number of C-atoms/ The length of the carbon chain ✓
Die aantal C-atome / Die lengte van die C-ketting (1)
- 3.3 A ✓ (1)
- 3.4.1 London forces ✓ / *Londonkragte* (1)
- 3.4.2 Dipole-dipole forces ✓ / *Dipool-dipoolkragte* (1)
- 3.5 A ✓
 Lower boiling point ✓ / *Laer kookpunt* (2)
- 3.6 Compound C: Alcohol-One site for hydrogen bonding ✓
 Compound D: Carboxylic acid- Two sites for hydrogen bonding ✓
 More energy needed to overcome the intermolecular forces of D. ✓
Verbinding C:Alkohol-Een plek vir waterstofbinding
Verbinding D: Karboksielsuur – Twee plekke vir waterstofbinding
Meer energie word benodig om die intermolekulêre kragte van D te oorkom. (3)
- 3.7 LOWER THAN. ✓ / *LAER AS* (1)

[13]

QUESTION 4

- 4.1.1 Substitution. ✓ / *Substitusie* (1)
- 4.1.2 Elimination / Dehydrohalogenation ✓/ *Eliminasie / Dehidrohalogenering* (1)
- 4.1.3 Addition / Hydrogenation ✓ / *Addisie / Hidrogenering* (1)
- 4.2.1 2-chloropropane ✓✓ / *2-chloropropan* (2)

4.2.2



(4)

- 4.3.1 An alcohol where the C-atom bonded to the –OH group, is bonded to two other C-atoms. ✓✓
'n Alkohol waar die C-atoom wat gebind is aan die –OH groep, aan twee ander C-atome gebind is. (2)
- 4.3.2 Propan-2-ol (2)

[13]**QUESTION 5**

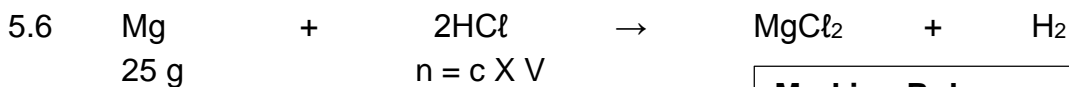
- 5.1 Rate of reaction / Time ✓ *Reaksietempo / Tyd* (1)
- 5.2 Temperature ✓ / *Temperatuur* (1)
- 5.3
$$\text{Rate} = \frac{\Delta V}{\Delta t} \checkmark$$

$$= \frac{0,06-0}{30-0} \checkmark$$

$$= 2 \times 10^{-3} \text{ dm}^3 \cdot \text{s}^{-1} \checkmark$$

$= \frac{60-0}{30-0} = 2 \text{ cm}^3 \cdot \text{s}^{-1} \quad \text{MAX: } \frac{2}{3}$

(3)
- 5.4 LOWER THAN ✓ / *LAER AS* (1)
- 5.5 The small pieces of magnesium has a greater surface area than the one piece. ✓
 More particles are exposed. ✓
 More effective collisions per second. ✓
 Higher reaction rate.
Die klein stukkies magnesium het 'n groterkontakoppervlakte.
Meer deeltjies is blootgestel.
Meer effektiewebotsings per sekonde.
Hoër reaksietempo. (3)



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

$= \frac{25}{24} \checkmark$

$= 1,04 \text{ mole } \checkmark$

$= 0,1 \times 0,1$

$= 0,01 \text{ mole } \checkmark$

Marking Rule

- Mol HCl
- Use of ratio 2:1
- Substitute 24 g.mol^{-1}
- 1,04 mol
- Subtraction:
initial mol - mol used
- Final answer

Range (24,8 -25)

0,005 mole \leftarrow 0,01 mole \checkmark (ratio)

$1,04 - 0,005 = 1,035 \text{ mole } \checkmark$

$m = n \times M = 1,035 \times 24 = 24,84 \text{ g } \checkmark$

(6)

[15]**QUESTION 6**

6.1 HOMOGENEOUS \checkmark / *HOMOGEEN* (1)

6.2 The reactants and products \checkmark are in the same phase. \checkmark (2)
Die reaktante en produkte is in dieselfde fase.

6.3

- $n = \frac{m}{M} \checkmark = \frac{138,6}{154} = 0,9 \checkmark$
- Ratio : 1:3:1:1 \checkmark
- Calculation of mole at equilibrium \checkmark
- Divide by 2 \checkmark
- Correct K_c equation \checkmark
- Correct substitution in K_c equation \checkmark
- Answer = 4,92 \checkmark (8)

	CS_2	3Cl_2	S_2Cl_2	CCl_4
Mole initial	1,2	4	0	0
Mole react/form	-0,9	-2,7	+0,9	+0,9
Mole equilibrium	0,3	1,3	0,9	0,9
[]	0,15	0,65	0,45	0,45

$$K_c = \frac{[\text{S}_2\text{Cl}_2][\text{CCl}_4]}{[\text{CS}_2][\text{Cl}_2]^3}$$

$$= \frac{(0,45)(0,45)}{(0,15)(0,65)^3}$$

$$= 4,92$$

- 6.4.1 *DECREASES* ✓ / *NEEM AF* (1)
- 6.4.2 *INCREASES* ✓ / *NEEM TOE* (1)
- 6.4.3 *REMAINS THE SAME* ✓ / *BLY DIESELFDE* (1)
- 6.5 If the concentration of S_2Cl_2 is increased, the system will according to Le Chatelier act in such a way to decrease the concentration of S_2Cl_2 . ✓
The reverse reaction will be favoured. ✓
The amount of reactants will increase. ✓
As die konsentrasie an die S_2Cl_2 verhoog word, sal die sisteem volgens Le Chatelier, sodanig reageer dat die konsentrasie weer sal verlaag.
Die terugwaartse reaksie word bevoordeel.
Die aantal mol reaktante sal toeneem. (3)
- 6.6 The pressure is decreased. ✓ / *Die druk word verlaag.* (1)
- 6.7 *INCREASE* ✓ / *TOENEEM* (1)
- 6.8 The rate of both forward and reverse reactions has increased. ✓ (1)
Die tempo van beide voorwaartse en terugwaartse reaskies het verhoog. **[20]**

QUESTION 7

7.1 It dissociates completely in water ✓ and produce a high concentration of OH⁻ ions. ✓
Dit dissosieer volledig in water en vorm 'n hoë konsentrasie OH⁻ ione. (2)

7.2 $[H_3O^+] = 0,4 \text{ mol}\cdot\text{dm}^{-3}$
 $\text{pH} = -\log [H_3O^+] \checkmark$
 $= -\log (0,4) \checkmark$
 $= 0,4 \checkmark$ (3)

7.3 $\text{pH} = 13$
 $[H_3O^+] = 10^{-13} \checkmark$
 $[H_3O^+][OH^-] = 1 \times 10^{-14} \checkmark$
 $[OH^-] = 10^{-1} \text{ mol}\cdot\text{dm}^{-3}$
 $[NaOH] = 0,1 \text{ mol}\cdot\text{dm}^{-3} \checkmark$ (3)

7.4.1 BASIC ✓ (1)

7.4.2 $\text{CO}_3^{2-} + \text{H}_2\text{O} \rightleftharpoons \text{HCO}_3^- + \text{OH}^-$ (2)

7.5 $\text{Na}_2\text{CO}_3 \rightarrow \text{CO}_2$

Marking Rule

- Formula $n = \frac{V}{V_m}$
- Substitute $22,4 \text{ dm}^3\cdot\text{mol}^{-1}$
- Ratio: 1:1
- Substitute $106 \text{ g}\cdot\text{mol}^{-1}$
- Final answer

OPTION 1

$$m = n \times M$$

$$= 0,2 \times 106 \checkmark$$

$$= 21,2 \text{ g}$$

$$0,2 \text{ mole}$$

$$4,48 \text{ dm}^3$$

$$\downarrow$$

$$n = \frac{V}{V_m} \checkmark \quad \frac{4,48}{22,4} \checkmark$$

$$= 0,2 \text{ mole} \checkmark \quad (\text{ratio})$$

$$\% = \frac{21,2}{25} \times 100 = 84,8\% \checkmark$$
 (5)

OPTION 2

$$n = \frac{25}{106} = 0,236 \text{ mole} \quad \frac{0,2}{0,236} \times 100 = 84,75\%$$

QUESTION 8

- 8.1 Oxidation is an increase in oxidation number. ✓✓
Oksidasie is 'n toename in oksidasiegetal. (2)
- 8.2 Complete the circuit. ✓ / *Voltooi die stroombaan,*
Maintain electrical neutrality. ✓ / *Handhaaf elektriese eutraliteit.* (2)
- 8.3.1 $\text{Fe}^{3+} + 3 \text{e}^- \rightarrow \text{Fe}$ ✓✓
✓ ✓ ✓ (2)
- 8.3.2 $\text{Ti(s)} | \text{Ti}^{3+}(\text{aq}) || \text{Fe}^{3+}(\text{aq}) | \text{Fe(s)}$
OR
 $\text{Ti} | \text{Ti}^{3+} || \text{Fe}^{3+} | \text{Fe}$ (3)
- 8.4 $E^\circ_{\text{cell}} = E^\circ_{\text{reduction}} - E^\circ_{\text{oxidation}}$ ✓
 $1,57 \checkmark = -0,06 - E^\circ_{\text{oxidation}}$ ✓
 $E^\circ_{\text{oxidation}} = -1,63 \text{ V}$ ✓ (4)
- 8.5 0 (V) ✓ (1)

[14]**QUESTION 9**

- 9.1 The process ✓ where electrical energy is converted to chemical energy. ✓
Die proses waar elektriese energie omgeskakel word in chemiese energie. (2)
- 9.2.1 $\text{Ag} \rightarrow \text{Ag}^+ + \text{e}^-$ ✓✓ (2)
- 9.2.2 $\text{Ag} + \text{Ag}^+ \rightarrow \text{Ag} + \text{Ag}^+$ ✓✓ (2)
- 9.3 Directly proportional ✓ / *Direk eweredig* (1)
- 9.4.1 Q ✓ (1)
- 9.4.2 Equal to 17 g ✓ (1)
- 9.4.3 $n = \frac{m}{M} = \frac{17}{108} \checkmark = 0,157 \text{ mole}$ ✓ (2)
- 9.4.4 Number of $\text{e}^- = 0,157 \times 6,02 \times 10^{23} \checkmark = 9,45 \times 10^{22} \checkmark$ (2)

[13]

QUESTION 10

10.1.1 Fe / FeO ✓ (1)

10.1.2 NH₄NO₃ ✓ (1)

10.1.3 4NH₃ + 5O₂ → 4NO + 6H₂O ✓ (bal) (3)

10.2.1 X ✓ (1)

10.2.2 X has the highest percentage of potassium that is needed for the growth of fruit. ✓
X het die hoogste persentasie kalium wat nodig is vir die groei van vrugte. (1)

10.2.3 OPTION1

$$15+3+3 = 21$$

$$\frac{3}{21} \checkmark \times 51 = 7,29\% \text{ K}$$

$$\frac{7,29}{100} \times 20 \checkmark = 1,45 \text{ kg } \checkmark \quad (3)$$

OPTION 2

$$\frac{51}{100} \times 20 \checkmark = 10,2 \text{ kg}$$

$$\frac{3}{21} \checkmark \times 10,2 = 1,46 \text{ kg } \checkmark$$

TOTAL [10]
150