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 CH_2 group. ✓✓
'n Reeks organiese verindings met dieselfde algmene formule OF waarvan die lede verskilmet 'n CH_2 groep. (2)

2.2.1 **U** ✓ (1)

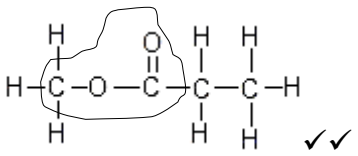
2.2.2 **S** ✓ (1)

2.2.3 **P** ✓ (1)

2.2.4 **Q** and **S**✓✓ (2)

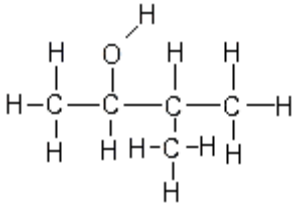
2.3.1 ✓ ✓ ✓
3,4-dibromo-2,2-dimethylpentane */ 3,4-dibromo-2,2-dimetielpentaan* (3)

2.3.2 ✓ ✓
Heksan-3-one / *Heksan-3-oon* (2)

2.4.1  ✓✓

1 mark for functional group
1 mark for whole structure

(2)

2.4.2 

1 mark for functional group 1 mark for whole structure

✓✓ (2)

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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]

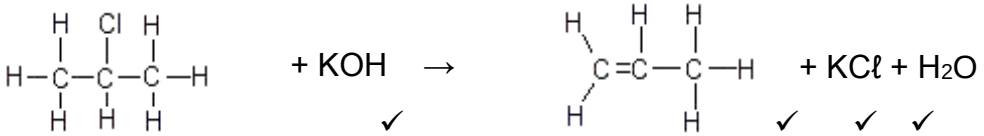
QUESTION 4

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-chloropropaan* (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)

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QUESTION 5

5.1 Rate of reaction / Time ✓ *Reaksietempo / Tyd* (1)

5.2 Temperature ✓ / *Temperatuur* (1)

5.3 Rate = $\frac{\Delta V}{\Delta t}$ ✓

= $\frac{0,06-0}{30-0}$ ✓

= 2 X 10^{-3} $dm^3 \cdot s^{-1}$ ✓ (3)

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

5.4 LOWER THAN ✓ / LAER AS (1)

5.5 The small pieces of magnesium has a <u>greater surface area</u> 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)

5.6 $Mg + 2HC\ell \rightarrow MgC\ell_2 + H_2$

25 g ↓

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

$= \frac{25}{24}$ ✓

= 1,04 mole ✓

n = c X V

= 0,1 X 0,1

= 0,01 mole ✓

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 ⟵ 0,01 mole ✓ (ratio)

1,04 – 0,005 = 1,035 mole ✓

m = n X M = 1,035 X 24 = 24,84 g ✓ (6)

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QUESTION 6

6.1 HOMOGENEOUS ✓ */ HOMOGEEN* (1)

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

6.3
- $n = \frac{m}{M}$ ✓$= \frac{138,6}{154}$ = 0,9 ✓
- Ratio : 1:3:1:1 ✓
- Calculation of mole at equilibrium ✓
- Divide by 2 ✓
- Correct K_c equation✓
- Correct substitution in Kc equation ✓
- Answer = 4,92✓ (8)

	CS_2	$3C\ell_2$	$S_2C\ell_2$	$CC\ell_4$
Mole initial	1,2	4	0	0
Mole react/form	-0,9	-2,7	+0,9	+0,9
Mole equillibrium	0,3	1,3	0,9	0,9
[ ]	0,15	0,65	0,45	0,45

$K_c = \frac{[S_2C\ell_2][CC\ell_4]}{[CS_2][C\ell_2]^3}$

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

= 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 $S_2C\ell_2$ is increased, the system will according to Le Chatelier act in such a way to decrease the concentration of $S_2C\ell_2$. ✓
The reverse reaction will be favoured. ✓
The amount of reactants will increase. ✓
As die konsentrasie an die $S_2C\ell_2$ 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. ✓
Dlt dissosieer volledig in water en vorm 'n hoë konsentrasie OH^- ione. (2)

7.2 $[H_3O^+] = 0,4 \text{ mol·dm}^{-3}$

$pH = -\log [H_3O^+]$ ✓
$= -\log (0,4)$ ✓
$= 0,4$ ✓ (3)

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

7.4.1 BASIC ✓ (1)

7.4.2 $CO_3^{2-} + H_2O \rightleftharpoons HCO_3^- + OH^-$ ✓ ✓ (2)

7.5 $Na_2CO_3 \rightarrow CO_2$

Marking Rule
- *Formula* $n = \frac{V}{V_m}$
- *Substitute 22,4 $dm^3.mol^{-1}$*
- *Ratio: 1:1*
- *Subtitute 106 $g.mol^{-1}$*
- *Final answer*

OPTION 1

4,48 dm^3

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

= 0,2 mole ✓ (ratio)

m = n X M
= 0,2 X 106 ✓
= 21,2 g
0,2 mole

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

OPTION 2

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

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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 $Fe^{3+} + 3\ e^- \rightarrow Fe$ ✓✓ (2)

8.3.2 $Ti(s) \mid Ti^{3+}(aq) \parallel Fe^{3+}(aq) \mid Fe(s)$ ✓ ✓ ✓
OR
$Ti \mid Ti^{3+} \parallel Fe^{3+} \mid Fe$ (3)

8.4 $E^\circ_{cell} = E^\circ_{reduction} - E^\circ_{oxidation}$ ✓
1,57 ✓ = -0,06 - $E^\circ_{oxidation}$ ✓
$E^\circ_{oxidation}$ = -1,63 V ✓ (4)

8.5 0 (V) ✓ (1)

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QUESTION 9

9.1 The process ✓where electrical energy is converted to chemical energy. ✓ (2)
Die proses waar elektriese energie omgeskakel word in chemiese energie.

9.2.1 $Ag \rightarrow Ag^+ + e^-$ ✓✓ (2)

9.2.2 $Ag + Ag^+ \rightarrow Ag + Ag^+$ ✓✓ (2)

9.3 Directly proportional ✓ / *Direk eweredig* (1)

9.4.1 Q ✓ (1)

9.4.2 Equal to 17 g ✓ (1)

9.4.3 $n = \frac{m}{M} = \frac{17}{108}$ ✓ = 0,157 mole ✓ (2)

9.4.4 Number of e^- = 0,157 X 6,02 X 10^{23} ✓ = 9,45 X 10^{22} ✓ (2)

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QUESTION 10

10.1.1 Fe / FeO ✓ (1)

10.1.2 NH_4NO_3 ✓ (1)

10.1.3 $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$ ✓ ✓ ✓ (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

$\frac{3}{21}$ ✓X 51 = 7,29% K

$\frac{7,29}{100}$ X 20 ✓= 1,45 kg ✓ (3)

OPTION 2

$\frac{\mathbf{51}}{\mathbf{100}}$ X 20✓ = 10,2 kg

$\frac{3}{21}$ ✓X 10,2 = 1,46 kg✓

[10]

TOTAL 150