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**NATIONAL
SENIOR CERTIFICATE/
NASIONALE
SENIOR SERTIFIKAAT**

GRADE/GRAAD 12

SEPTEMBER 2025

**TECHNICAL SCIENCES P2/TEGNIJSE WETENSKAPPE V2
MARKING GUIDELINE/ NASIENRIGLYN
(AMENDED)**

MARKS/PUNTE: 75

This marking guideline consists of 10 pages./
Hierdie nasienriglyn bestaan uit 10 bladsye.



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QUESTION/VRAAG 1

- 1.1 D ✓✓ (2)
- 1.2 B ✓✓ (2)
- 1.3 A ✓✓ (2)
- 1.4 B ✓✓ (2)
- 1.5 C ✓✓ (2)
- [10]**



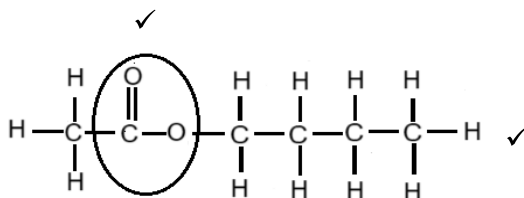
QUESTION/VRAAG 2

- 2.1 An atom or a group of atoms that determine the chemistry of a molecule. ✓✓
'n Atoom of 'n groep atome wat die chemie van 'n molekule bepaal.

OR/OF

An atom or a group of atoms that determine(s) the physical and chemical properties of a group of organic compounds.
'n Atoom of 'n groep atome wat die fisiese en chemiese eienskappe van 'n groep organiese verbindings bepaal. (2)

- 2.2 2.2.1 Formyl group/Formielgroep ✓
 (Accept: Carbonyl group at the end of chain.)
 (Aanvaar: Karbonielgroep aan die einde van die ketting.) (1)
- 2.2.2 Carboxyl group/Karboksielgroep ✓ (1)
- 2.3 2.3.1 D ✓ (1)
- 2.3.2 H ✓ (1)
- 2.3.3 G ✓ (1)
- 2.4 3-bromo-4-methyl ✓ hexane ✓
3-bromo-4-metielheksaan (2)
- 2.5 2.5.1

**MARKING CRITERIA/NASIENKRITERIA:**

- Correct functional group/ *Korrekte funksionele groep* ✓
- Whole structure correct/ *Hele struktuur korrek* ✓

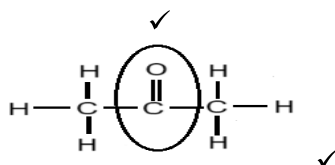
NOTE: If a bond or hydrogen is missing 1/2

LET WEL: As 'n binding of waterstof ontbreek 1/2

(2)



2.5.2

**MARKING CRITERIA/NASIENKRITERIA:**

- Correct functional group/ *Korrekte funksionele groep* ✓
- Whole structure correct/ *Hele struktuur korrek* ✓

NOTE: If a bond or hydrogen is missing 1/2**LET WEL: As 'n binding of waterstof ontbreek 1/2**(2)
[13]**QUESTION/VRAAG 3**

- 3.1 The temperature at which the solid and liquid phases of a substance are at equilibrium. ✓✓
Die temperatuur waarby die vaste-en vloeistoffases van 'n stof in ewewig is. (2)
- 3.2 Carboxylic acids/*Karboksielsure* ✓ (1)
- 3.3 Chain length/*Kettinglengte* ✓

OR/OF

- Number of carbon atoms/*Aantal koolstofatome*. (1)
- 3.4 Compound **P**/Ethanoic acid contain (London forces and) hydrogen bonds. ✓
 Compound **S**/Ethane contain only London forces/induced dipole forces/ dispersion forces ✓
 Hydrogen bonds/intermolecular forces in compound **P**/ Ethanoic acid are stronger than London forces/intermolecular forces/induced dipole forces/ dispersion forces in compound **S**/Ethane. ✓
 More energy is needed to overcome the intermolecular forces/bonds in compound **P**/Ethanoic acid than in compound **S**/Ethane ✓
- Verbinding **P**/Etanoësuur bevat (London-kragte en) waterstofbindings.*
*Verbinding **S**/Etaan bevat slegs London-kragte/geïnduseerde dipoolkragte/dispersiekragte*
*Waterstofbindings/intermolekulêre kragte in verbinding **P**/Etanoësuur is sterker as London-kragte/intermolekulêre kragte/geïnduseerde dipoolkragte/dispersiekragte in verbinding **S**/Etaan.*
*Meer energie word benodig om die intermolekulêre kragte/bindings in verbinding **P**/Etanoësuur te oorkom as in verbinding **S**/Etaan*



OR/OF

Compound **S**/Ethane contains only London forces/induced dipole forces/dispersion forces.

Compound **P**/Ethanoic acid contains (London forces and) hydrogen bonds.

London forces/intermolecular forces/ induced dipole forces/dispersion

forces in compound **S**/Ethane are weaker than hydrogen bonds

/intermolecular forces in compound **P**/ Ethanoic acid.

Less is energy needed to overcome the intermolecular forces/bonds

in compound **S**/ Ethane than in compound **P**/Ethanoic acid

*Verbinding **S**/Etaan bevat slegs London-kragte/geïnduseerde dipoolkragte/dispersiekragte.*

*Verbinding **P**/Etanoësuur bevat (London kragte en) waterstofbindings.*

London-kragte/intermolekulêre kragte/geïnduseerde dipoolkragte/

*dispersiekragte in verbinding **S**/Etaan is swakker as*

*waterstofbindings/intermolekulêre kragte in verbinding **P**/Etanoësuur.*

Minder energie word benodig om die intermolekulêre kragte/bindings in

*verbinding **S**/Etaan te oorkom as in verbinding **P**/Etanoësuur*

(4)

- 3.5 Compound **S**/Ethane
Verbinding **S**/Etaan ✓



Ethane has the lowest melting point/weakest intermolecular force. ✓

Etaan het die laagste smeltpunt/swakste intermolekulêre krag.

(2)

[10]

QUESTION/VRAAG 4

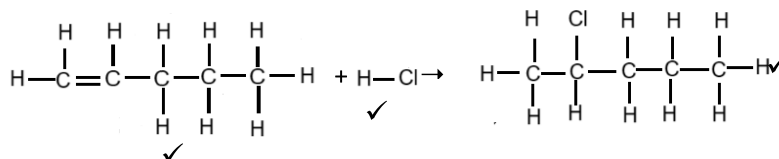
4.1 4.1.1 Addition/hydration ✓
Addisie/Hidrasie (1)

4.1.2 Substitution/ Hydrolysis (of haloalkanes) ✓
Substitusie/Hidrolise (van haloalkane) (1)

4.1.3 Addition/Hydrogenation ✓
Addisie/Hidrogenasie/Hidrogenering (1)

4.2. 4.2.1 No water must be present. ✓
Geen water moet teenwoordig wees nie.
(Accept : Anhydrous solution)
(Aanvaar: Anhidriese oplossing) (1)

4.2.2



MARKING CRITERIA/NASIENKRITERIA:

- 1 mark for each reactant /1 punt vir elke reaktant ✓
- 1 mark for the product /1 punt vir die produk ✓

(3)

4.3 4.3.1 Pentan ✓-2-ol ✓ Accept/Aanvaar: 2 - Pentanol (2)

4.3.2 $\text{H}_2\text{SO}_4/\text{H}_3\text{PO}_4$ ✓ (1)

4.4 $\text{C}_5\text{H}_{12} + 8\text{O}_2 \rightarrow 5\text{CO}_2 + 6\text{H}_2\text{O}$ ✓ (Balancing/Balansering) ✓

MARKING CRITERIA/NASIENKRITERIA:

- 1 mark for the reactants/1 punt vir die reaktante ✓
- 1 mark for the products/1 punt vir die produkte ✓
- 1 mark for balancing/1 punt vir balansering ✓

(3)

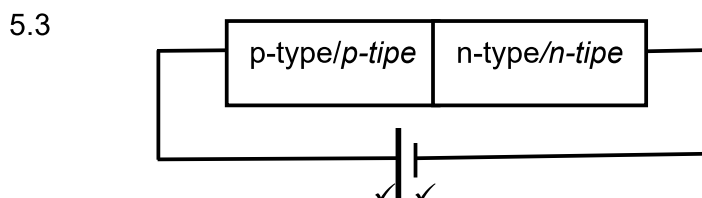
[13]



QUESTION/VRAAG 5

5.1 Doping ✓
Dotering/Doepatoevoeging (1)

5.2 N-type (semiconductor)/N-tipe (*halfgeleier*) ✓
 ⊖
 Doping silicon with a group 5 element, (such as phosphorus)
 will produce negative charge carriers(electrons) ✓
Dotering/Doepatoevoeging van silikon met 'n groep 5-element, (soos fosfor)
sal negatiewe ladingdraers (elektrone) produseer (2)

**MARKING CRITERIA/NASIENKRITERIA:**

- 1 mark for positive terminal of the cell/battery connected to the p-type semiconductor.
- 1 mark for negative terminal of the cell/battery connected to the n-type semiconductor.
- 1 punt vir positiewe terminaal van die sel/battery aan die p-tipe halfgeleier gekoppel.
- 1 punt vir negatiewe terminaal van die sel/battery aan die n-tipe halfgeleier gekoppel.

(2)
[5]



QUESTION/VRAAG 6

6.1 An electrochemical cell that converts electrical energy to chemical energy. ✓✓
'n Elektrochemiese sel waarin elektriese energie na chemiese energie omgeskakel word. (2)

6.2 **X** ✓ (1)

6.3 6.3.1 CuCl_2 ✓ (1)

6.3.2 Chlorine/*Chloor*/ Cl_2 ✓ (1)

6.3.3 $2\text{Cl}^-_{(\text{aq})} \rightarrow \text{Cl}_{2(\text{g})} + 2\text{e}^-$ ✓✓

MARKING CRITERIA/NASIENKRITERIA:**NOTE/LET WEL:**

- Do not penalise if the phases are omitted.
Moenie penaliseer as die fases uitgelaat word nie
- Ignore if charge on electron is omitted.
Ignoreer as lading op elektron uitgelaat is.

(2)

6.3.4 Cu^{2+} ✓ (1)

6.4 Increase/*Toeneem* ✓

⊖

Reduction occurs at electrode X/cathode. ✓✓
Reduksie vind by elektrode X/katode plaas.

OR/OF

Cu^{2+} is reduced to Cu.
 Cu^{2+} word tot Cu gereduseer.

OR/OF

Electrode X is connected to the negative terminal of the battery.
Elektrode X is aan die negatiewe terminaal van die battery gekoppel.

(Accept : Electrode X gains electrons.)
 (Aanvaar: *Elektrode X ontvang elektrone.*)

OR/OF

(Accept: Cu is formed on electrode X that increases its mass.)
 (Aanvaar: *Cu is gevorm op elektrode X wat die massa vermeerder.*)

(3)

[11]

QUESTION/VRAAG 7

7.1 SPONTANEOUS/ SPONTAAN ✓

 $\Theta \curvearrowright$
EMF (E_{cell}^{θ}) is positive/EMK (E_{sel}^{θ}) is positief ✓**OR/OF**

No external power source is required/ Geen eksterne kragbron word benodig nie

OR/OF

Chemical energy is converted to electrical energy/ Chemiese energie word na elektriese energie omgeskakel

OR/OF

Exothermic reaction/ Eksotermiese reaksie

(2)

7.2 Concentration/Konsentrasie: $1 \text{ mol} \cdot \text{dm}^{-3}$ ✓Temperature/Temperatuur: 25°C ✓/298 K

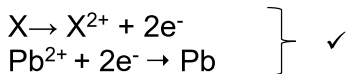
(2)

7.3 **OPTION/OPSIE 1**

$$E_{\text{cell/sel}}^{\theta} = E_{\text{cathode/katode}}^{\theta} - E_{\text{anode}}^{\theta} \checkmark$$

$$0,63 = -0,13 - E_{(\text{X})}^{\theta} \checkmark$$

$$E_{(\text{X})}^{\theta} = -0,76 \text{ V} \checkmark$$

X is Zinc/Sink (Zn) ✓**OPTION/OPSIE 2**

$$E_{(\text{X})}^{\theta} = -0,76 \text{ V} \checkmark$$

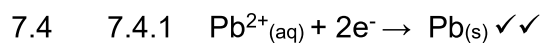
$$\left. \begin{array}{l} E_{\text{cathode/katode}}^{\theta} = -0,13 \text{ V} \\ E_{\text{cell/sel}}^{\theta} = 0,63 \text{ V} \end{array} \right\} \checkmark$$

X is Zinc/Sink (Zn) ✓**Marking guideline/Nasienriglyn**

- Accept any other correct formula from the data sheet.
Aanvaar enige ander korrekte formule uit die datablad.
- Penalise with one mark for using unconventional or incomplete formula.
Penaliseer met een punt vir die gebruik van onkonvensionele of onvolledige formule.

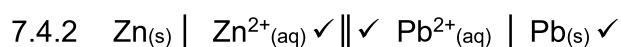
(4)



**MARKING CRITERIA/NASIENKRITERIA:****NOTE/LET WEL:**

- Do not penalise if the phases are omitted.
Moenie penaliseer as die fases uitgelaat word nie.
- Ignore if charge on electron is omitted.
Ignoreer as lading op elektron uitgelaat is.

(2)

**MARKING CRITERIA/NASIENKRITERIA:**

- Do not penalise if phases/concentrations are omitted.
Moenie penaliseer as fases/konsentrasies uitgelaat word nie.

(3)

[13]**TOTAL/TOTAAL: 75**