Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE/*GRAAD* 12

SEPTEMBER 2015

PHYSICAL SCIENCES P2
FISIESE WETENSKAPPE V2
MEMORANDUM

MARKS/PUNTE: **150**

This memorandum consists of 14 pages./
Hierdie memorandum bestaan uit 14 bladsye.

QUESTION/*VRAAG 1*

1.1 B ✓✓

1.2 C ✓✓

1.3 C ✓✓

1.4 B ✓✓

1.5 B ✓✓

1.6 A ✓✓

1.7 C ✓✓

1.8 B ✓✓

1.9 B ✓✓

1.10 D ✓✓ (10 x 2) (20)

QUESTION 2/*VRAAG 2*

2.1 2.1.1 A and/*en* G ✓ (1)

2.1.2 E ✓ (1)

2.1.3 B ✓ (1)

CORRECT IUPAC NAME, BUT ONE OR MORE OF THE FOLLOWING ERRORS:
OMITTING HYPHENS AND/OR COMMAS; INCLUDING EXTRA HYPHENS AND /OR SPACES
MAX/*MAKS* ½
KORREKTE IUPAC-NAAM MAAR EEN OF MEER VD VOLGENDE FOUTE GEMAAK:
WEGLATING VAN KOPPELTEKENS EN/OF KOMMAS; INSLUITING VAN EKSTRA SPASIES EN/OF KOPPELTEKENS

2.2 2.2.1 ✓ ✓
2-methylbut-2-ene ACCEPT 2-methyl-2-butene
2-metielbut-2-een *AANVAAR 2-metiel-2-buteen* (2)

2.2.2 haloalkane ✓/alkyl halide
haloalkaan/alkielhalied (1)

-1 FOR STRUCTURAL FORMULA //
-1 VIR STRUKTUUR FORMULE

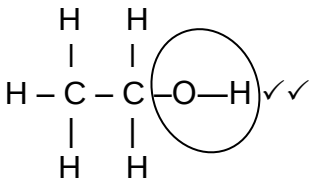
2.2.3 $2C_2H_2 + 5O_2$ ✓ → $4CO_2 + 2H_2O$ ✓ ✓balancing/*balansering*

Notes/*Aantekeninge:*
• Reactants ✓ Products ✓ Balancing: ✓
Reaktanse *Produkte* *Balansering*
• Ignore double arrows. / *Ignoreer dubbelpyle.*
• Marking rule 6.3.10. / *Nasienreël 6.3.10.* (3)

2.3 2.3.1 ✓ ✓
ethyl methanoate
etielmetanoaat

CORRECT IUPAC NAME, BUT ONE OR MORE OF THE FOLLOWING ERRORS: OMITTING HYPHENS AND/OR COMMAS; INCLUDING EXTRA HYPHENS AND/OR SPACES **MAX/*MAKS* ½**
KORREKTE IUPAC-NAAM MAAR EEN OF MEER VD VOLGENDE FOUTE GEMAAK: WEGLATING VAN KOPPELTEKENS EN/OF KOMMAS; INSLUITING VAN EKSTRA SPASIES EN/OF KOPPELTEKENS (2)

2.3.2



-1 FOR CONDENSED STRUCTURAL FORMULA //
-1 VIR GEKONDENSEERDE STRUKTUUR FORMULE

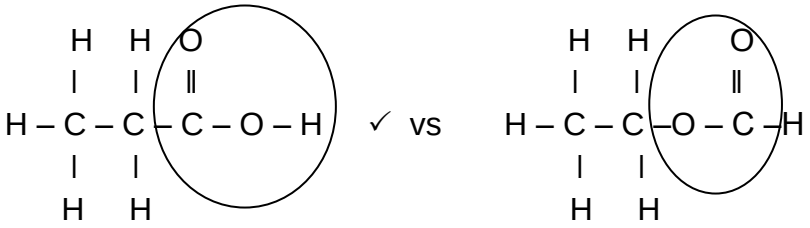
✓FUNCTIONALGROUP/
FUNKSIONELE GROEP
✓REST OF STRUCTURE/
RES VAN STRUKTUUR KORREK

(2)

2.3.3 methanoic acid ✓
metanoësuur (1)

2.4 Same molecular formula ✓ $C_5H_{10}O_2$ ✓ **OR/*OF*** $C_5O_2H_{10}$
Dieselfde molekulêre formule

Different structure ✓/functional group
Verskillende struktuur/funksionele group



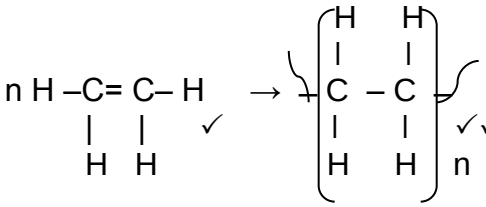
(4)
[18]

QUESTION 3/*VRAAG 3*

3.1 3.1.1 Cracking ✓/*kraking* (1)

3.1.2 addition ✓(polymerisation)
addissie (polimerisasie) (1)

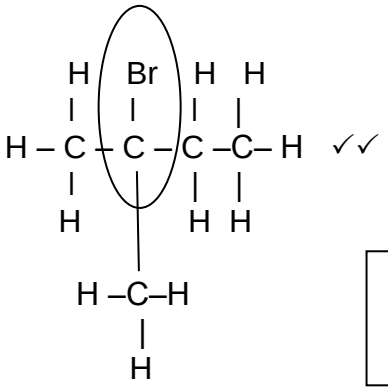
3.1.3



-1 FOR CONDENSED STRUCTURAL FORMULA //
-1 VIR GEKONDENSEERDE STRUKTUUR FORMULE

(3)

3.2 3.2.1



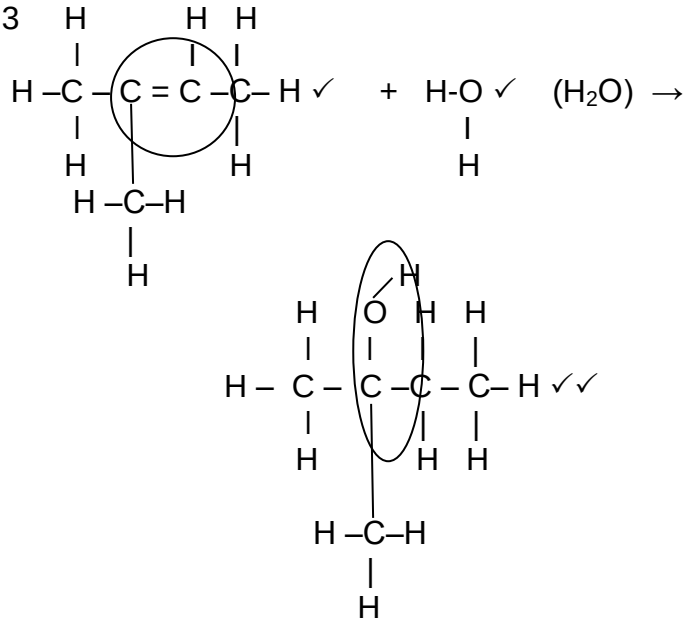
-1 FOR CONDENSED STRUCTURAL FORMULA
-1 VIR GEKONDENSEERDE STRUKTUUR FORMULE

✓FUNCTIONALGROUP/
FUNKSIONELE GROEP
✓REST OF STRUCTURE/
RES VAN STRUKTUUR KORREK

(2)

3.2.2 addition ✓/hydrobromination/hydrohalogenation
addissie/hidrobrominering/hidrohalogenering (1)

3.2.3



1 FOR CONDENSED STRUCTURAL FORMULA

-1 VIR GEKONDENSEERDE STRUKTUUR FORMULE

✓FUNCTIONALGROUP
FUNKSIONELE GROEP
✓REST OF STRUCTURE CORRECT
RES VAN STRUKTUUR KORREK

(4)

3.2.3 ✓ ✓

2-methylbutan-2-ol ACCEPT 2-methyl-2-butanol
2-metielbutan-*2-ol* *AANVAAR 2-metiel-2-butanol* (2)

3.2.4 substitution ✓ (hydrolysis)
substitusie (hidrolise) (1)

3.2.5
- use dilute potassium hydroxide ✓/aqueous potassium hydroxide NaOH/strong base OR water
- (mild) heat ✓

OR hot ethanolic dilute base

- *gebruik verdunde kaliumhidroksied/waterige kaliumhidroksied NaOH/sterk basis OF water*
- *(matige) hitte*

OF *warm etanoliese verdunde basis* (2)
[17]

QUESTION 4/*VRAAG 4*

4.1 The pressure exerted by a vapour at equilibrium ✓with its liquid ✓ in a closed system. ✓
Die druk uitgeoefen deur 'n damp in ewewig met sy vloeistof in 'n geslote sisteem. (3)

4.2 4.2.1
- Increased length of C chain ✓/molecular size or structure/ molecular mass/surface area
- Increased strength of InterMolecular Forces ✓/London forces/dispersion forces/van der Waal's forces
- More energy required ✓ to overcome IMF

- *Toename in lengte van C-ketting/molekulêre grootte of struktuur/ molekulêre massa/oppervlak area*
- *Toename in sterkte van InterMolekulêre Kragte/London kragte/dispersie kragte/van der Waalskragte*
- *Meer energie benodig om IMK te oorkom* (3)

4.2.2 Butane ✓ (1)

4.3 4.3.1 LOWER/*LAER* ✓ (1)

4.3.2 Stronger ✓ hydrogen bonds ✓ between ethanol molecules

OR

London forces between ethane molecules are weaker than hydrogen bonds between ethanol molecules

Sterker waterstofbindings tussen etanol molekules

OF

Londonkragte tussen etaan molekules swakker as waterstofbindings tussen etanol molekules (2)
[10]

QUESTION 5/*VRAAG 5*

5.1 5.1.1 (a) rate of reaction/*reaksietempo* (1)

(b) concentration/*konsentrasie* ✓ (1)

5.1.2 As concentration of $Na_2S_2O_{3\,(aq)}$ increases ✓ (decreases), the time decreases ✓ (increase)/rate of rxn decreases (increases).

Soos die konsentrasie van $Na_2S_2O_{3\,(aq)}$ toeneem (afneem), neem die tydsduur af (toe)/reaksietempo neem af (toe). (2)

5.1.3
- 1mol $Na_2S_2O_3$ reacts with/*reageer met* 2 mol HCl ✓
- From/*Vanuit* : n= cV

  $(0,5)(V_{Na_2S_2O_3}) = (0,5)(V_{HCl})$

  $n_{Na_2S_2O_3} = n_{HCl}$ ✓
- HCl ✓ will therefore be the limiting reagent as we need twice the amount of HCl to react.
- *HCl is die beperkende reaktant omdat ons twee maal die hoeveelheid HCl benodig.* (2)

5.2 5.2.1 Experiment **6** ✓ highest temperature ✓
*Eksperiment **6** hoogste temperatuur* (3)

5.2.2 If the temperature of the reaction mixture increases:

- Average kinetic ✓energy higher
- More particles have sufficient kinetic energy ✓ to collide effectively
- The number of effective collisions per unit time/second increases ✓
  The time lapse will decrease
  Rate of reaction increases

As die temperatuur van die reaksiemensel toeneem:

- *Gemiddelde kinetiese energie hoër*
- *Deeltjies het nou voldoende kinetiese energie om effektief te bots*
- *Die aantal effektiewe botsings per tydseenheid/sekonde neem toe*
  Die tydsverloop neem af
  Die reaksietempo neem toe (3)

[12]

QUESTION 6/*VRAAG 6*

6.1 6.1.1 yellow to orange ✓
geel na oranje (1)

6.1.2 $Cr_2O_7^{2-}$ ✓ **OR/OF** dichromate ions/*dichromaat-ione* (1)

6.1.3 Exothermic ✓
Eksotermies (1)

Negative marking QUESTION 6.1.4 to QUESTION 6.1.5/Merk negatief

6.1.4
- Increase in temperature favours endothermic reaction ✓
- The reverse reaction is favoured ✓
- The reverse reaction is endothermic ✓
  (forward) reaction is exothermic

- *Verhoging in temperatuur bevoordeel die endotermiese reaksie*
- *Die terugwaartse reaksie word bevoordeel*
- *Die terugwaartsewaartsereaksie is endotermies*
  Die (voorwaartse) reaksie is exotermies (3)

6.2 6.2.1 H_2 + I_2 ⇌ 2HI

Initial quantity (mol) Aanvangshoeveelheid (mol)	5	5	0	
Change (mol) Verandering (mol)	x ✓	x	2x ✓	✓ Ratio/*Verhouding*
Quantity at equilibrium (mol) Hoeveelheid by ewewig (mol)	5-x	5-x	2x	
Equilibrium concentration(mol·dm^{-3}) Ewewigskonsentrasie (mol·dm^{-3})	$\frac{5-x}{2}$	$\frac{5-x}{2}$	x	✓ Dividing by 2 *Deel deur 2*

$$K_c = \frac{[HI]^2}{[H_2][I_2]} \checkmark$$

$$0{,}36 \checkmark = \frac{(x)^2}{\left(\frac{5-x}{2}\right)\left(\frac{5-x}{2}\right)} \checkmark$$

$$x = [HI] = 1{,}15 \text{ mol·dm}^{-3} \checkmark$$

- **USING** ratio $n(H_2):n(I_2):n(HI) = x:x:2x$
  GEBRUIK *verhouding* $n(H_2):n(I_2):n(HI)=x:x:2x$
- Equilibrium $n(H_2)$ = initial $n(H_2)$-change $n(H_2)$
  Ewewig $n(H_2)$ = *aanvangs* $n(H_2)$- *verandering* $n(H_2)$
  Equilibrium $n(I_2)$ = initial $n(I_2)$-change $n(I_2)$
  Ewewig $n(I_2)$ = *aanvangs* $n(I_2)$- *verandering* $n(I_2)$
- Equilibrium n(HI) = initial n(HI)-change n(HI)
  Ewewig n(HI) = aanvangs n(HI)- verandering n(HI)
- Equilibrium moles divide by $2dm^3$
  Ewewigs mol gedeel deur $2dm^3$
- Correct K_c expression
  Korrekte K_c *uitdrukking*
- Substitute K_c value into K_c expression
  Substitueer K_c *waarde in* K_c *uitdrukking*
- Substitute concentrations into K_c expression
  Substitueer konsentrasies in K_c *uitdrukking in*
- Final answer/*Finale antwoord* 1,15 mol·dm^{-3} (8)

Refer to rule 1.4 / *Verwys na* reël *1.4*

6.2.2 INCREASED/*TOEGENEEM* ✓

Consider: $c = \frac{n}{V}$ ✓

Same number of molecules occupy smaller volume ✓

Beskou: $c = \frac{n}{V}$

Dieselfde aantal molekules beslaan 'n kleiner volume (3)

[17]

QUESTION 7/*VRAAG 7*

7.1 Point where indicator changes colour ✓✓
Punt waarby indicator van kleur verander (2)

7.2 M[KOH] = 39 + 16 + 1 = 56 g·mol^{-1}

$n = \frac{m}{M}$
$= \frac{0,28}{56}$ ✓
= 5 x 10^{-3} mol KOH

$n_a : n_b$ is 2:1
∴ 5 x 10^{-3} mol KOH reacts with/*reageer met* 2,5 x 10^{-3} mol H_2SO_4 ✓
$c = \frac{n}{V}$ ✓ = $\frac{2,5 \times 10^{-3}}{20 \times 10^{-3}}$ ✓= 0,125 mol·dm^{-3} ✓ (5)

7.3 7.3.1 acid-base ✓/protolysis/neutralisation
suur-basis/protolise/neutralisasie (1)

7.3.2 HNO_3 + NH_3 ✓ → NH_4NO_3 ✓ ✓balancing/*balansering* (3)

7.3.3 ACIDIC/*SUUR* ✓ (1)

7.3.4 $NH_4NO_3 + H_2O$ ✓→$NH_3 + H_3O^+ + NO_3^-$ ✓ ✓balancing/*balansering*
Presence of excess H_3O^+ ions ✓ makes solution acidic/
Teenwoordigheid van oormaat H_3O^+ veroorsaak dat oplossing suur is
Accept/*Aanvaar*
$NH_4^+ + H_2O$ ✓ → $NH_3 + H_3O^+$ ✓ ✓balancing/balansering
Presence of excess H_3O^+ ions ✓ makes solution acidic/
Teenwoordigheid van oormaat H_3O^+ veroorsaak dat oplossing suur is (4)
[16]

QUESTION 8/*VRAAG 8*

8.1 8.1.1
- solution/liquid/dissolved substance that conducts electricity ✓ through movement of ions ✓ ✓
- *'n oplossing/vloeistof/opgeloste stof wat elektrisiteit gelei deur die beweging van ione* (2)

8.1.2 H^+ ✓ Accept/*Aanvaar* H_2O/oxidation number of H decreases ✓ from +1 to 0 ✓
H^+ Anvaar H_2O/oksidasiegetal neem af vanaf +1 tot 0 (3)

8.1.3 $2\,C\ell^- \rightarrow C\ell_2(g) + 2e^-$ ✓
$2H_2O + 2e^- \rightarrow H_2 + 2OH^-$ ✓
$2C\ell^- + 2H_2O \rightarrow C\ell_2 + H_2 + 2OH^-$ ✓✓ or/of
$2NaC\ell + 2H_2O \rightarrow 2NaOH + C\ell_2 + H_2$ (4)

8.2 8.2.1 $Ni_{(s)}$ ✓ (1)

8.2.2 $Ni \rightarrow Ni^{2+} + 2e^-$ ✓✓

Marking guidelines/*Nasien riglyne*:
$Ni^{2+} + 2e^- \rightleftharpoons Ni$ $\frac{0}{2}$ $Ni \rightleftharpoons Ni^{2+} + 2e^-$ $\frac{1}{2}$
$Ni^{2+} + 2e^- \leftarrow Ni$ $\frac{2}{2}$ $Ni^{2+} + 2e^- \rightarrow Ni$ $\frac{0}{2}$

(2)

8.2.4 LOWER ✓/*LAER*

$E^{\theta}_{cell} = E^{\theta}_{cathode} - E^{\theta}_{anode}$ ✓

$= 1{,}36$ ✓ $- (0{,}34)$ ✓
$= 1{,}02$ V ✓

Accept any other correct formula from the data sheet.

Aanvaar enige ander korrekte formule vanaf gegewensblad.

(5)
[17]

QUESTION 9/*VRAAG 9*

9.1 n(Cu) = $\frac{1}{2}$ n(electrons/*elektrone)*
number of atoms = n x N_A
= (0,8 x 0,5) ✓ x 6.02 x 10^{23} ✓ ($Cu^{2+} + 2e^- \rightarrow Cu$)
= 2,408 x 10^{23} ✓ atoms/*atome* (3)

9.2

OPTION/*OPSIE* 1

$\frac{5}{5}$

n= $\frac{m}{M}$
m(Cu) = nM
= 0,4 x 63,5 ✓
= 25,4g ✓
% Cu = $\frac{25,4}{28}$ x 100 ✓
= 90,71% ✓
No/*Nee* ✓(% Cu < 99,99%)

OPTION/*OPSIE* 2

$\frac{4}{5}$

n(Cu) = $\frac{m}{M}$ = $\frac{28}{63,5}$ = 0.441mol
n(Cu) (pure) = $\frac{m}{M}$ = $\frac{0,8}{2}$ = 0.4mol ✓
% Cu = $\frac{0,4}{0,441}$ x 100 ✓
= 90,70% ✓
No/*Nee* ✓(% Cu < 99,99%)

OPTION 3

$\frac{4}{5}$

N_{cu} (impure) = $\frac{m}{M}$ N_A
= $\frac{28}{63,5}$ x 6,02
= 2,654 x 10^{23} (atoms/*atome*)
N_{cu} (pure) = $\frac{0,8}{2}$
= 2,41 x 10^{23} ✓(atoms/*atome*)
(% Cu = $\frac{2,41 \times 10^{23}}{2,65 \times 10^{23}}$ ✓
= 90,9% ✓
No/*Nee* ✓
(% Cu < 99,99%) (5)

9.3 Cu is a stronger reducing agent ✓ than Pt and Ag ✓and will be oxidised to Cu^{2+} ✓
Cu is 'n sterker reduseermiddel as Pt en Ag en sal geoksideer word na Cu^{2+}

OR/OF

Pt and Ag are weaker reducing agents than Cu and Cu will be oxidised to Cu^{2+}
Pt en Ag is swakker reduseermiddels as Cu en Cu sal geoksideer word na Cu^{2+} (3)
[11]

QUESTION 10/*VRAAG 10*

10.1 10.1.1 Haber ✓ (1)

10.1.2 $N_2 + 3H_2$ ✓ → $2NH_3$ ✓ ✓balancing/*balansering* (3)

10.1.3 Iron or iron oxides ✓
yster of ysteroksied (1)

10.2
- Eutrophication is the process by which an ecosystem becomes enriched with inorganic plant nutrients (P and N) ✓
- This results in excessive plant growth/algal bloom ✓
- Decaying plant material uses up oxygen supply ✓ in water
- Leading to death of other aquatic plants and animals ✓/dead zones

- *Eutrofikasie is die proses waartydens 'n ekosisteem verryk word met 'n oormaat anorganiese plant voedingstowwe (P en N)*
- *Dit veroorsaak 'n oormaat plantegroei/algebloei*
- *Verrottende plant- en dieremateriaal gebruik die beskikbare suurstof in die water op*
- *Wat lei tot dood van meer plante en diere/dooie sones* (4)

10.3 10.3.1 Ferteliser A ✓ (1)

10.3.2 Less nitrogen – prevents too much leaf growth at the cost of fruit ✓
Richer in potassium- good quality flowers/fruit ✓

Minder stikstof – voorkom oormaat blaargroei ten koste van vrugte
Ryk aan kalium – verseker goeie kwaliteit blomme/vrugte (2)
[12]

TOTAL/*TOTAAL*: 150