



# education

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Department:  
Education  
**REPUBLIC OF SOUTH AFRICA**

**NATIONAL  
SENIOR CERTIFICATE**

**GRADE/GRAAD 12**

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

**MEMORANDUM**

**NOVEMBER 2008**

**MARKS/PUNTE: 150**

**This memorandum consists of 18 pages.  
*Hierdie memorandum bestaan uit 18 bladsye.***

<b>Learning Outcomes and Assessment Standards</b> <b>Leeruitkomst en Assesseringstandaarde</b>		
LO 1/LU 1	LO 2/LU 2	LO 3/LU 3
<p><b>AS 12.1.1:</b> Design, plan and conduct a scientific inquiry to collect data systematically with regard to accuracy, reliability and the need to control variables.</p> <p><i>Ontwerp, beplan en voer 'n wetenskaplike ondersoek uit om data te versamel ten opsigte van akkuraatheid, betroubaarheid en die kontroleer van veranderlikes.</i></p> <p><b>AS 12.1.2:</b> Seek patterns and trends, represent them in different forms, explain the trends, use scientific reasoning to draw and evaluate conclusions, and formulate generalisations.</p> <p><i>Soek patrone en tendense, stel dit in verskillende vorms voor, verduidelik tendense, gebruik wetenskaplike beredenering om gevolgtrekkings te maak en te evalueer, en formuleer veralgemenings.</i></p> <p><b>AS 12.1.3:</b> Select and use appropriate problem-solving strategies to solve (unseen) problems.</p> <p><i>Kies en gebruik geskikte probleemoplossingstrategieë om (ongesiene) probleme op te los.</i></p> <p><b>AS 12.1.4:</b> Communicate and defend scientific arguments with clarity and precision.</p> <p><i>Kommunikeer en verdedig wetenskaplike argumente duidelik en presies.</i></p>	<p><b>AS 12.2.1:</b> Define, discuss and explain prescribed scientific knowledge.</p> <p><i>Definieer, bespreek en verduidelik voorgeskrewe wetenskaplike kennis.</i></p> <p><b>AS 12.2.2</b> Express and explain prescribed scientific principles, theories, models and laws by indicating the relationship between different facts and concepts in own words.</p> <p><i>Verduidelik en druk voorgeskrewe wetenskaplike beginsels, teorieë, modelle en wette uit deur die verwantskap tussen verskillende feite en konsepte in eie woorde aan te dui.</i></p> <p><b>AS 12.2.3:</b> Apply scientific knowledge in everyday life contexts.</p> <p><i>Pas wetenskaplike kennis in kontekste van die alledaagse lewe toe.</i></p>	<p><b>AS 12.3.2:</b> Research case studies and present ethical and moral arguments from different perspectives to indicate the impact (pros and cons) of different scientific and technological applications.</p> <p><i>Vors gevallestudies na en lewer etiese en morele argumente uit verskillende perspektiewe om die impak (voordele en nadele) van verskillende wetenskaplike en tegnologiese toepassings aan te dui.</i></p> <p><b>AS 12.3.3:</b> Evaluate the impact of scientific and technological research and indicate the contribution to the management, utilisation and development of resources to ensure sustainability continentally and globally.</p> <p><i>Evalueer die impak van wetenskaplike en tegnologiese navorsing en dui die bydrae tot bestuur, benutting en ontwikkeling van bronne om volhoubaarheid kontinentaal en globaal te verseker.</i></p>

## SECTION A/AFDELING A

### QUESTION 1/VRAAG 1

- 1.1 Endothermic / *Endotermies* ✓ [12.2.3] (1)
- 1.2 Dynamic / *Dinamiese* ✓  
(Chemical equilibrium: no marks / *Chemiese ewewig: geen punte*) [12.2.1] (1)
- 1.3 Oxidation / *Oksidasie* ✓ [12.2.1] (1)
- 1.4 Membrane (cell) / *Membraan(sel)* ✓  
**Accept/Aanvaar**  
Diaphragm (cell) / *Diafragma(sel)*  
mercury (cell) / *kwik(sel)*  
chlor alkali (cell) / *chlooralkalie(sel)* [12.2.1] (1)
- 1.5 Functional group / *Funksionele groep* ✓ [12.2.1] (1)  
**[5]**

### QUESTION 2/VRAAG 2

- 2.1 D ✓ [12.2.1] (1)
- 2.2 F ✓ [12.2.1] (1)
- 2.3 J ✓ [12.2.1] (1)
- 2.4 A ✓ [12.2.1] (1)
- 2.5 I ✓ [12.2.1] (1)  
**[5]**

### QUESTION 3/VRAAG 3

- 3.1 True / *Waar* ✓✓ [12.2.1] (2)
- 3.2 True / *Waar* ✓✓ [12.1.2] (2)
- 3.3 False / *Onwaar* ✓  
[A][B] > [C][D] ✓  
  
OR/OF  
[C][D] < [A][B]  
  
OR/OF  
...  $K_c > 1$ , ... [12.2.3] (2)
- 3.4 True / *Waar* ✓✓ [12.2.3] (2)
- 3.5 False / *Onwaar* ✓  
... an increase in the rate of the reaction ✓ / ... 'n verhoging in reaksietempo  
OR/OF  
... an increase in the rate of production of products / ... 'n verhoging in die tempo waarteen produkte vorm  
OR/OF  
... higher concentration per second / ... hoër konsentrasie per sekonde  
OR/OF  
Pt decreases the activation energy / Pt verlaag die aktiveringsenergie [12.2.3]  
OR/OF  
Does not ensure a high concentration of products / Verseker nie 'n hoë konsentrasie van produkte nie (2)
- [10]**

### QUESTION 4/VRAAG 4

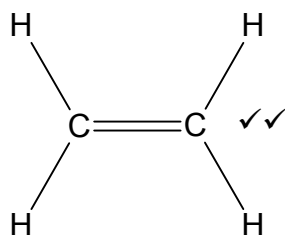
- 4.1 B ✓✓✓ [12.2.3] (3)
- 4.2 D ✓✓✓ [12.2.2] (3)
- 4.3 C ✓✓✓ [12.2.2] (3)
- 4.4 C ✓✓✓ [12.1.2] (3)
- 4.5 D ✓✓✓ [12.1.2] (3)
- [15]**

**TOTAL SECTION A: 35**  
**TOTAAL AFDELING A: 35**

**SECTION B/AFDELING B**

**QUESTION 5/VRAAG 5**

5.1



[12.2.3] (2)

5.2

The ethene liberated by the banana ages the cabbage and lettuce. ✓ ✓  
*Die eteen wat deur die piesang vrygestel is, verouder die kool en die blaarslaai.*

[12.3.2] (2)

5.3

$C_nH_{2n}$  ✓

[12.2.1] (1)

5.4

A: substitution (halogenation/bromination) / *substitusie (halogenering / brominerings)* ✓

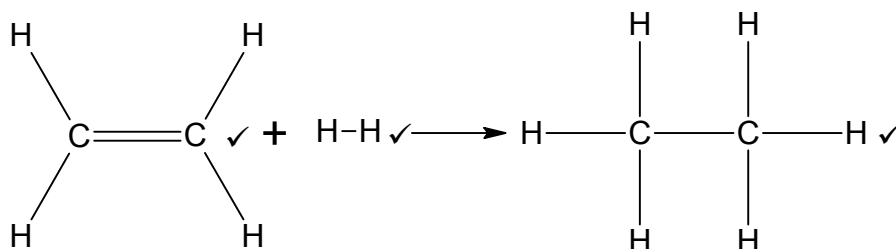
B: addition (hydrogenation) / *addisie (hidrogenering)* ✓

D: addition (hydration) / *addisie (hidrasie/hidrering)* ✓

H: substitution/ *substitusie* ✓

[12.1.2] (4)

5.5



[12.2.3] (3)

5.6

HBr ✓✓

(Hydrogen bromide – one mark / *Waterstofbromied – een punt*)

[12.1.2] (2)

5.7.1

*E: concentrated / gekonsentreerd* ✓

*G: dilute / verdund* ✓

OR/OF

Base is more concentrated in reaction E than in reaction G or base is less concentrated in reaction G than in reaction E ✓✓

*Basis is meer gekonsentreerd in reaksie E as in reaksie G of basis is minder gekonsentreerd in reaksie G as in reaksie E*

OR/OF

Base in reaction E is dissolved in ethanol (no water added) ✓✓

*Basis in reaksie E is in etanol opgelos (geen water nie)*

[12.1.2]

[12.2.3] (2)

5.7.2

Dehydrohalogenation/*Dehidrohalogenering* ✓

[12.1.2]

(1)

**[17]**

## QUESTION 6/VRAAG 6

### 6.1.1 Investigative question / *Ondersoekende vraag*:

Which one of the two compounds (X and Y) is saturated / unsaturated?

✓✓

*Watter een van die verbindings (X en Y) is versadig / onversadig?*

OR/OF

Is X saturated?

*Is X versadig?*

*No marks if an aim or hypothesis is stated / Geen punte as stelling of hipotese gegee word*

[12.1.1] (2)

## TEST FOR SATURATION USING BROMINE/IODINE TOETS VIR VERSADIGING DEUR VAN BROOM/JODIUM GEBRUIK TE MAAK

### 6.1.2 Apparatus and chemicals/*Apparaat en chemikalieë*:

Bromine water(solution) / Br<sub>2</sub> or iodine (solution) / I<sub>2</sub> ✓

*Broomwater(oplossing)/ Br<sub>2</sub> of jodium / I<sub>2</sub>(oplossing)*

Test tubes / suitable containers / measuring cylinder / dropper ✓

*Proefbuis/geskikte houers/maatsilinder/drupper*

[12.1.1] (2)

### 6.1.3 Safety precautions/*Veiligheidsmaatreëls*:

- Protective clothing : Use gloves / Avoid contact with skin/ goggles *Gebruik handskoene/ vermy kontak met die vel / veiligheidsbrille* ✓
- Work in fume cupboard / mask(well ventilated room /outside) / Do not inhale ✓ *Werk in 'n dampkas/masker (goed geventileerde vertrek/werk buitekant) / Moenie inasem nie*
- No open flames/*Geen oop vlamme nie*

[12.1.1] (2)

### 6.1.4 Procedure / *Prosedure* (4 marks):

- Add bromine water / iodine solution (iodine) ✓
- to each of compounds X and Y in the test tubes ✓
- Compare / note / record/ observe ✓ the (rate of) colour change ✓ (decolourisation) for the two compounds.
- *Voeg broomwater/jodiumplossing (jodium)*
- *by elk van verbindings X en Y in die proefbuis*
- *Vergelyk / noteer/ skryf neer die (tempo van) kleurverandering (ontkleuring) vir die twee verbindings.*

[12.1.1] (4)

## BOILING POINT METHOD / KOOKPUNT METODE

### 6.1.2 Apparatus and chemicals/Apparaat en chemikalieë:

Any two / Enige twee

Water bath/Waterbad ✓

Heat source / Bron van hitte ✓

Retort stand /Retortstaander/Kolfstaander

Thermometer / Termometer

[12.1.1] (2)

### 6.1.3 Safety precautions/Veilighedsmaatreëls:

Any two / Enige twee

- Protective clothing : Use gloves / Avoid contact with skin/  
goggles *Gebruik handskoene/ vermy kontak met die vel /  
veiligheidsbrille ✓*
- Work in fume cupboard /mask(well ventilated room /outside) /  
Do not inhale✓ *Werk in 'n dampkas/masker (goed geventileerde  
vertrek/werk buitekant) /Moenie inasem nie*
- No open flames / Geen oop vlamme

[12.1.1] (2)

### 6.1.4 Procedure / Prosedure (4 marks):

- Set up the apparatus with the thermometer in the waterbath ✓  
*Stel die apparaat op met die termometer in die waterbad*
- Place the test tubes containing the liquids in the water bath ✓  
*Plaas die proefbuis wat die vloeistowwe bevat in die waterbad*
- Heat waterbath gently until the each liquid boils✓  
*Verhit die waterbad versigtig totdat elke vloeistof kook*
- Record/compare the temperature at which the solutions boil✓  
*Vergelyk/teken die temperatuur waarteen elke vloeistof kook op*

[12.1.1] (4)

## 6.2 SATURATION TEST / TOETS VIR VERSADIGING

The solution that shows a rapid colour change is unsaturated. ✓✓ / Die oplossing wat 'n kleurverandering toon, is onversadigd.

OR/OF

The solution that shows no or a slow rate of colour change (no reaction takes place) is saturated. ✓✓ / Die oplossing wat geen of stadige tempo van kleurverandering toon (geen reaksie vind plaas), is versadigd.

### BOILING POINT METHOD

The compound which has the higher boiling point is saturated ✓✓ / Die verbinding met die hoogste kookpunt is versadig

OR/OF

The compound with the lower boiling point is unsaturated ✓✓ / Die verbinding met die laer kookpunt is onversadig

[12.1.2]

(2)

## 6.3 Any one/Enigeen

1-pentene / pent-1-ene / 1-penteen / pent-1-ene ✓✓

OR/OF

2-pentene / pent-2-ene / 2-penteen / pent-2-ene

OR/OF

3-methyl-1-butene / 3-methylbut-1-ene

3-metiel-1-buteen / 3-metielbut-1-ene

OR/OF

2-methyl-1-butene / 2-methylbut-1-ene

2-metiel-1-buteen / 2-metielbut-1-ene

OR/OF

2-methyl-2-butene / 2-methylbut-2-ene

2-metiel-2-buteen / 2-metielbut-2-ene

[12.2.3]

(2)

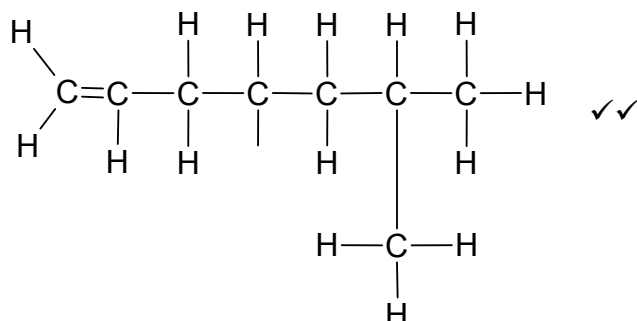
[14]



### QUESTION 7/VRAAG 7

7.1 Butanoic acid/*Butanoësuur* ✓ [12.2.1] (1)

7.2



[12.2.3] (2)

7.3 Amides / *amiede* ✓ [12.2.3] (1)

7.4 1-propanol / propan-1-ol / ethylmethylether ✓✓  
*1-propanol / propan-1-ol / etielmetieleter* [12.2.3] (2)

7.5 Amines are (weak) bases, ✓ lemon juice is an acid and therefore a neutralisation reaction ✓ takes place to mask the smell (odour).  
Amiene is (swak) basisse, suurlemoensap is suur en daarom sal 'n neutralisasiereaksie plaasvind om die reuk te verminder.

OR/OF

The base (amine) ✓ neutralises the acid ✓. *Die basis (amien) neutraliseer die suur.*

[12.3.2] (2)  
**[8]**

### QUESTION 8/VRAAG 8

- 8.1.1 Sufficient kinetic energy (molecules move fast enough ) of molecules A and B for the collisions ✓  
Molecules A and B must be correctly orientated ✓

Voldoende kinetiese energie (molekule beweeg vinnig genoeg) van molekule A en B vir die botsings  
Korrekte oriëntasie van die molekule A en B.

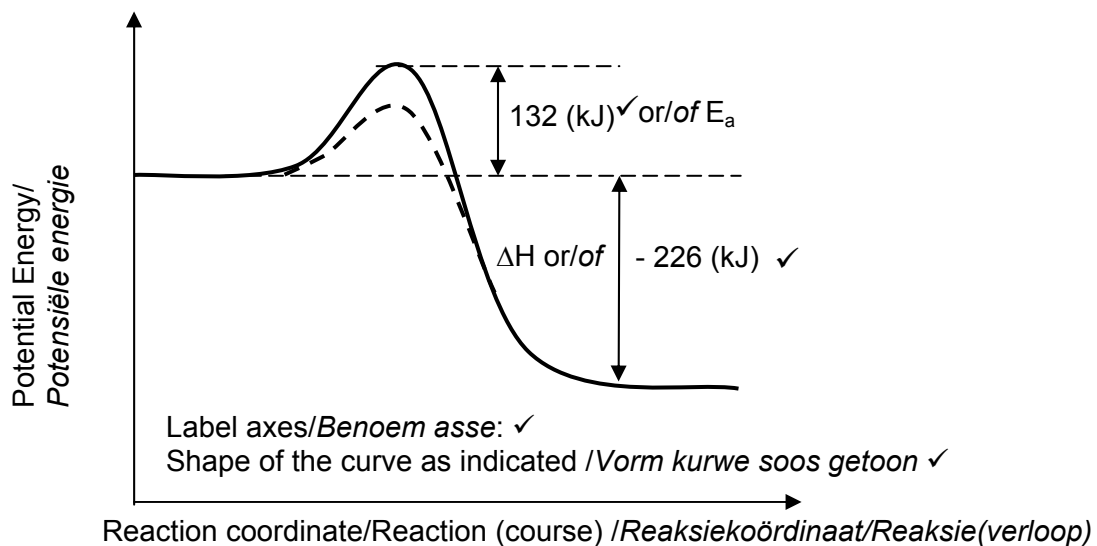
[12.2.1] (2)

- 8.1.2 Increase in temperature means:  
More molecules move fast enough or have sufficient  $E_k$ . ✓  
There are more effective collisions. ✓

Toename in temperatuur beteken:  
Meer molekule beweeg vinnig genoeg of het genoeg  $E_k$ . ✓  
Daar is meer effektiewe botsings. ✓

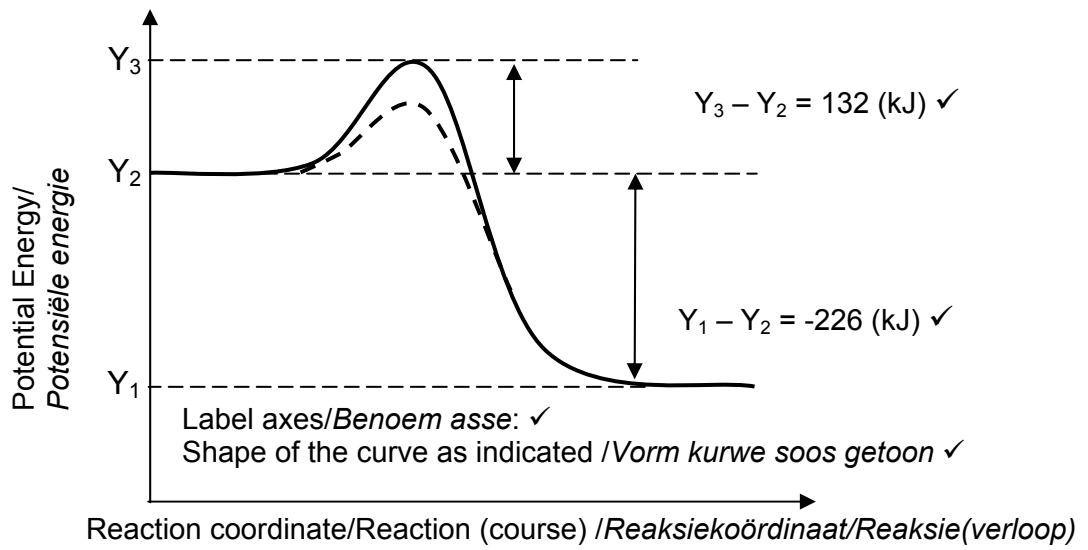
[12.2.2] (2)

- 8.2.1



If graph is endothermic .....only one mark for labelling of axes (1/4)  
As grafiek endotermies is .... slegs een punt vir benoeming van asse (1/4)

Any values of  $Y_1$ ,  $Y_2$  and  $Y_3$  that gives the correct answer  
*Enige waardes van  $Y_1$ ,  $Y_2$  en  $Y_3$  wat die korrekte antwoorde gee*



[12.1.2] (4)

8.2.2 See broken curve on graph  $\checkmark$   
*Verwys na gebroke kromme op grafiek*

[12.1.2] (1)  
**[9]**

## QUESTION 9/VRAAG 9

9.1 Any two/*Enige twee*:

Positive impact/*Positiewe impak*:

The process has led to/ *Die proses het gelei tot* :

- Creation of jobs / *Werkverskaffing*

Production of / *Produksie van* :

- Fertilisers to ensure enough food production / *Kunsmis om voldoende voedselproduksie te verseker*
- Plastics used to make containers, etc. / *Plastiek wat gebruik word om houers te maak, ens.*
- Coolants used in air conditioners, etc. / *Koelmiddels gebruik in lugreëling, ens.*
- Cleaning agents for household use etc. / *Skoonmaakmiddels vir huishoudelike gebruik, ens.*
- Explosives used in mining industry, etc. / *Plofstowwe vir gebruik in mynwese, ens.*
- Medicines to improve health / *Medisyne om gesondheid te verbeter*

Any two/*Enige twee*:

Negative impact/*Negatiewe impak*:

- Preparation of explosives – life risk / *Bereiding van plofstowwe - lewensrisiko*
- Air Pollution: increased amounts of nitrogen oxides is a health risk / *Lugbesoedeling : toenemende hoeveelhede stikstofoksiede is 'n gesondheidsrisiko*
- Water pollution e.g. excessive nitrates in water can cause blue baby syndrome/ *Warebesoedeling bv.oormaat nitrate in water kan bloubabasindroom veroorsaak*
- Eutrophication and its consequences e.g. dead zones/ *Eutrofisering en gevolge daarvan bv. dooie sones*

[12.3.2] (4)

9.2 (The system) is in equilibrium / amounts or concentration remains constant (the same) ✓ / *(Die sisteem) is in ewewig / hoeveelhede of konsentrasie bly konstant (dieselfde)*

[12.1.2] (1)

9.3 (The amount of ammonia) was increased / concentration was increased/ ammonia was added ✓ / *(Die hoeveelheid ammoniak) is vermeerder.*

[12.1.2] (1)

9.4 When the concentration of  $\text{NH}_3$  is increased, the reverse reaction is favoured ✓ because this reaction decreases the excess  $\text{NH}_3$  ✓. The result is an increase in the concentration of  $\text{H}_2$  and  $\text{N}_2$  / until a new equilibrium is established ✓

*Wanneer die konsentrasie van  $\text{NH}_3$  verhoog word, word die terugwaartse reaksie bevoordeel omdat hierdie reaksie die oormaat  $\text{NH}_3$  verminder. Die gevolg is dat die konsentrasie van  $\text{H}_2$  en  $\text{N}_2$  toeneem./totdat 'n nuwe ewewig bereik word.*

[12.1.2] (3)

9.5

	N <sub>2</sub>	H <sub>2</sub>	NH <sub>3</sub>
Molar ratio/Molverhouding	1	3	2
Initial quantity mol/ Aanvangshoeveelheid	1,5	2	0
Change (mol)/ Verandering (mol)	- 0,5✓	- 1,5✓	+ 1
Quantity at equilibrium (mol)/ Hoeveelheid by ewewig (mol)	1✓	0,5✓	1
Concentration (mol·dm <sup>-3</sup> ) Konsentrasie (mol·dm <sup>-3</sup> )	2	1	2

✓(divide by/deel deur 0,5)

$$K_c = \frac{[\text{NH}_3]^2}{[\text{N}_2][\text{H}_2]^3} \checkmark = \frac{(2)^2}{(2)(1)^3} \checkmark = 2 \checkmark \quad (+)$$

**OR/OF**

**Calculations using concentrations / Berekeninge deur gebruik van konsentrasie**

	N <sub>2</sub>	H <sub>2</sub>	NH <sub>3</sub>
Molar ratio/Molverhouding	1	3	2
Initial concentration (mol·dm <sup>-3</sup> ) Aanvangskonsentrasie (mol·dm <sup>-3</sup> )	3	4	0 ✓
Change in concentration (mol·dm <sup>-3</sup> ) Verandering in konsentrasie (mol·dm <sup>-3</sup> )	- 1✓	- 3✓	+ 2
Equilibrium concentration (mol·dm <sup>-3</sup> ) Ewewigskonsentrasie (mol·dm <sup>-3</sup> )	2✓	1✓	2

$$K_c = \frac{[\text{NH}_3]^2}{[\text{N}_2][\text{H}_2]^3} \checkmark = \frac{(2)^2}{(2)(1)^3} \checkmark = 2 \checkmark \quad (+)$$

[12.1.3] (8)

9.6.1  $K_c$  decreases/*neem af/verminder* ✓ [12.2.3] (1)

9.6.2 When the temperature is increased the reverse (endothermic) reaction is favoured✓, resulting in a lower concentration of products✓ (and a higher concentration of reactants)/denominator increases and numerator decreases

*Wanneer die temperatuur styg, word die terugwaartse (endotermiese) reaksie bevoordeel✓, wat tot 'n laer konsentrasie van produkte✓ (en 'n hoër konsentrasie reaktanse) /noemer vermeerder en teller verminder*

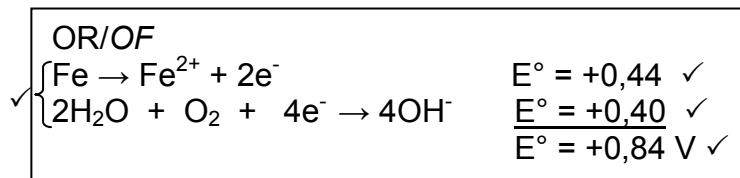
[12.1.4] (2)  
**[20]**

**QUESTION 10/VRAAG 10**

10.1.1  $Fe \rightarrow Fe^{2+} + 2e^-$  ✓✓ [12.2.3] (2)

10.1.2 Oxygen / *Suurstof* ✓ [12.2.3] (1)

10.1.3  $E^\circ_{cell/SEL} = E^\circ_{oxidising\ agent/oksideermiddel} - E^\circ_{reducing\ agent/reduseermiddel}$  ✓  
= 0,4 ✓ - (-0,44) ✓  
= 0,84 V ✓



Because  $E^\circ_{cell}$  is positive✓, the reaction is spontaneous  
*Omdat  $E^\circ_{sel}$  positief is, is die reaksie spontaan.*

[12.2.3] (5)

10.2.1 Mg is a stronger reducing agent (than Fe) ✓ / and will be oxidised (and not Fe)✓ / *Mg is 'n sterker reduseermiddel as Fe en sal geoksideer word (en nie Fe nie)*

OR/OF

Mg loses electrons more easily✓ than Fe and becomes oxidised✓  
*Mg verloor makliker as Fe elektrone en word geoksideer*

OR/OF

Fe is a weaker reducing agent (than Mg) ✓ and will not be oxidised ✓  
*Fe is 'n swakker reduseermiddel (as Mg) en sal nie geoksideer word nie.*

OR/OF

Fe will not lose its electrons easily compared to Mg✓ and will not be oxidised✓ / *Fe sal nie elektrone maklik verloor in vergelyking met Mg nie, en word dus nie geoksideer nie.*

[12.2.3] (2)

- 10.2.2 Electrolytes in the soil ✓✓ / Salts dissolved ✓ in the moist soil ✓  
*Sout opgelos in die klammigheid van die grond/elektroliete in die grond* [12.2.3 (2)
- 10.2.3 Mg is oxidised/becomes corroded /used up ✓  
*Mg is geoksideer/weggevreet /opgebruik* [12.2.3 (1)
- 10.2.4  $Mg \rightarrow Mg^{2+} + 2e^{-}$  ✓✓ [12.2.3 (2)
- 10.2.5 Any two/*Enige twee*:  
• Paint/*Verf* ✓  
• Electroplating/*Elektroplatering* ✓  
• Oil or waterproofing/*Olie of waterdigting*  
• Galvanising/*Galvanisering*  
• Plastic coating / *Plastiese bedekking* [12.3.3 (2)
- 10.2.6 Advantages/Voordele:  
Any one/*Enigeen*  
• Plastic is cheaper / *Plastiek is goedkoper* ✓  
• Does not rust / *Roes nie*
- Disadvantage/Nadeel:  
Any one/*Enigeen*  
• Not degradable / *Nie afbreekbaar nie* ✓  
• Not as strong as iron/*Nie so sterk soos yster nie* [12.3.3 (2)
- [19]

**QUESTION 11/VRAAG 11**

- 11.1 Electrical energy ✓ to chemical energy ✓  
*Elektriese energie na chemiese energie*
- Only electrical or chemical energy: no marks  
*Slegs elektries of chemiese energie: geen punte* [12.2.1] (2)
- 11.2 negative / *negatief* ✓ [12.2.3] (1)
- 11.3  $Al^{3+} + 3e^{-} \rightarrow Al$  ✓✓ [12.2.3] (2)
- 11.4 Carbon will burn in/react with  $O_2$  because of the high temperature ✓✓  
to form  $CO_2$  / *Koolstof verbrand in/reageer met  $O_2$  a.g.v. die hoë*  
*temperatuur om  $CO_2$  te vorm*  
OR/OF  
 $C(s) + O_2(g) \rightarrow CO_2(g)$
- OR/OF  
The carbon is oxidised according to the following half-reaction:  
*Die koolstof is oksideer as gevolg van die volgende halfreaksie:*  
 $C(s) + 2O^{2-}(g) \rightarrow CO_2(g) + 4e^{-}$  [12.2.3] (2)
- 11.5 Carbon burns away/used up/oxidised / loses  $e^{-}$  (and needs to be replenished) ✓✓  
*Koolstof brand weg/opgebruik/geoksideer/ verloor  $e^{-}$  (en moet aangevul word)* [12.2.3] (2)



11.6 Any two: ✓✓

**Ecological Impact**

- Loss of landscape due to the size of the chemical plant needed
- Disposal of red mud (iron(III) oxide formed during extraction of aluminium oxide from bauxite) into lagoons causing them to become unsightly

**Environmental Impact**

- Carbon dioxide from the burning of the anodes contributes to the (enhanced) greenhouse effect (air pollution /global warming)
- Carbon monoxide is poisonous
- fluorine (and fluorine compounds) lost from the cryolite during the electrolysis process is poisonous
- Alkali of red mud dams can drain into soil and contaminate groundwater
- Pollution caused by power generation (for electrolytic process) using coal-fired plants leads to acid rain/enhanced (greenhouse effect)
- Noise pollution

*Enige twee: ✓✓*

***Ekologiese impak***

- *Groot gebied vir chemiese aanleg benodig - verlies aan landskap*
- *Wegdoening van rooi modder (yster(III)oksied gevorm tydens die ekstraksie van aluminiumoksied vanaf bauxiet) ontsier strandmere*

***Omgewingsimpak***

- *Koolstofdiksied uit die verbranding van die anode dra by tot die kweekhuiseffek (lugbesoedeling / aardverwarming)*
- *Koolstofmonoksied is giftig*
- *fluor (en fluorprodukte); verlies van krioliet gedurende die elektrolise – proses is giftig*
- *Alkalieë van rooi modderdamme kan in grond sypel en grondwater kontamineer*
- *Besoedeling veroorsaak deur kragopwekking d.m.v. steenkoolaanlegte dra by tot suurreën/kweekhuiseffek*
- *Klankbesoedeling*

[12.3.3]

(2)  
[11]

**QUESTION 12/VRAAG 12**

- 12.1 Nitrogen-rich (and phosphorous) nutrients (fertilisers) get into water ✓  
This causes rapid growth of algae (algal bloom). ✓  
Depletion of oxygen: ✓ when algae die, their decomposition by bacteria removes oxygen from water  
Living organisms die ✓
- Stikstofryke (en fosforryke) voedingstowwe (kunsmisstowwe) beland in water*  
*Veroorsaak vinnige groei van alge (alge-opbloeiing).*  
*Uitputting van suurstof: Die bakteriese ontbinding van dooie alge verwyder suurstof vanuit water*  
*Lewende organismes sterf.* [12.3.3] (4)
- 12.2 Any two/*Enige twee*: ✓✓
- Over-application of fertilisers / *Ooraanwending van kunsmisstowwe*
  - Emissions from vehicles / *Emissies deur voertuie*
  - Factory emissions / *Emissies deur fabriek*
  - Sewage; waste disposal systems / *Riool; afvalverwyderingstelsels*
  - Stock farming / *Veeboerdery* [12.3.3] (2)
- 12.3.1 Catalytic oxidation of ammonia/*Katalitiese oksidasie van ammoniak* ✓ [12.3.3] (1)
- 12.3.2  $4\text{NH}_3 + 5\text{O}_2 \rightarrow 4\text{NO} + 6\text{H}_2\text{O}$  ✓ (✓bal) [12.3.3] (3)
- 12.3.3  $\text{NO}_2$  ✓✓ [12.3.3] (2)
- 12.3.4  $\text{NH}_3 + \text{HNO}_3 \rightarrow \text{NH}_4\text{NO}_3$  ✓ (✓bal)  
OR/OF  
 $\text{NH}_3 + \text{HNO}_3 \rightarrow \text{NH}_4^+ + \text{NO}_3^-$  ✓ (✓bal) [12.3.3] (3)
- 12.4 Any two ✓✓
- Control (reduce) the use of fertilisers / Use organic fertilisers / compost
  - Control (reduce) waste disposal
  - Control vehicle and factory emissions, etc.
- Enige twee*
- *Kontroleer (verminder) die gebruik van kunsmisstowwe/ Gebruik organiese kunsmisstowwe / kompos*
  - *Kontroleer (verminder) afvalwegdoening*
  - *Kontroleer voertuig- en fabriekemissies* [12.3.3] (2)

**TOTAL SECTION B:/TOTAAL AFDELING B: 115**  
**GRAND TOTAL:/GROOTTOTAAL: 150**