education

Department: Education
REPUBLIC OF SOUTH AFRICA

NATIONAL
SENIOR CERTIFICATE

GRADE/*GRAAD* 12

MARKS/*PUNTE*: 150

This memorandum consists of 17 pages.
Hierdie memorandum bestaan uit 17 bladsye.

Learning Outcomes and Assessment Standards *Leeruitkomste en Assesseringstandaarde*		
LO1/*LU1*	**LO2/*LU2***	**LO3/*LU3***
AS12.1.1: Design, plan and conduct a scientific inquiry to collect data systematically with regard to accuracy, reliability and the need to control variables. *Ontwerp, beplan en voer 'n wetenskaplike ondersoek uit om data te versamel ten opsigte van akkuraatheid, betroubaarheid en die kontroleer van veranderlikes.* **AS12.1.2:** Seek patterns and trends, represent them in different forms, explain the trends, use scientific reasoning to draw and evaluate conclusions, and formulate generalisations. *Soek patrone en tendense, stel dit in verskillende vorms voor, verduidelik die tendense, gebruik wetenskaplike beredenering om gevolgtrekkings te maak en te evalueer, en formuleer veralgemenings.* **AS12.1.3:** Select and use appropriate problem-solving strategies to solve (unseen) problems. *Kies en gebruik geskikte probleem-oplossingstrategieë om (ongesiene) probleme op te los.* **AS12.1.4:** Communicate and defend scientific arguments with clarity and precision. *Kommunikeer en verdedig wetenskaplike argumente duidelik en presies.*	**AS12.2.1:** Define, discuss and explain prescribed scientific knowledge. *Definieer, bespreek en verduidelik voorgeskrewe wetenskaplike kennis.* **AS12.2.2:** Express and explain prescribed scientific principles, theories, models and laws by indicating the relationship between different facts and concepts in the candidate's own words. *Verduidelik en druk voorgeskrewe wetenskaplike beginsels, teorieë, modelle en wette uit deur die verwantskap tussen verskillende feite en konsepte in die kandidaat se eie woorde aan te dui.* **AS12.2.3:** Apply scientific knowledge in everyday-life contexts. *Pas wetenskaplike kennis in kontekste van die alledaagse lewe toe.*	**AS12.3.2:** 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. *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.* **AS12.3.3:** 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. *Evalueer die impak van wetenskaplike en tegnologiese navorsing en dui die bydrae tot bestuur, benutting en ontwikkeling van bronne aan om volhoubaarheid kontinentaal en globaal te verseker.*

GENERAL GUIDELINES/*ALGEMENE RIGLYNE*

1.   CALCULATIONS/*BEREKENINGE*

1.1   Marks will be awarded for: correct formula, correct substitution, correct answer with unit.
Punte sal toegeken word vir: korrekte formule, korrekte substitusie, korrekte antwoord met eenheid.

1.2   No marks will be awarded if an incorrect or inappropriate formula is used, even though there may be relevant symbols and applicable substitutions.
Geen punte sal toegeken word waar 'n verkeerde of ontoepaslike formule gebruik word nie, selfs al is daar relevante simbole en relevante substitusies.

1.3   When an error is made during **substitution into a correct formula**, a mark will be awarded for the correct formula and for the correct substitutions, but **no further marks** will be given.
*Wanneer 'n fout gedurende **substitusie in 'n korrekte formule** begaan word, sal 'n punt vir die korrekte formule en vir korrekte substitusies toegeken word, maar **geen verdere punte** sal toegeken word nie.*

1.4   If no formula is given, but all substitutions are correct, a candidate will forfeit one mark.
Indien geen formule gegee is nie, maar al die substitusies korrek is, verloor die kandidaat een punt.

1.5   Marks can only be allocated for substitutions when values are substituted into formulae and not when listed before a calculation starts.
Punte kan slegs toegeken word vir substitusies wanneer waardes in 'n formule vervang is en nie vir waardes wat voor 'n berekening gelys is nie.

1.6   All calculations, when not specified in the question, must be done to two decimal places.
Alle berekenings, wanneer dit nie in die vraag gespesifiseer word nie, moet tot twee desimale plekke gedoen word.

2.   DEFINITIONS/*DEFINISIES*

Two marks will be awarded for a correct definition. No marks will be awarded for an incorrect or partially correct definition.
Twee punte sal vir 'n korrekte definisie toegeken word. Geen punte sal vir 'n verkeerde of gedeeltelik korrekte definisie toegeken word nie.

3.   UNITS/*EENHEDE*

3.1   Candidates will only be penalised once for the repeated use of an incorrect unit **within a question or subquestion**.
*Kandidate sal slegs een keer gepenaliseer word vir die herhaaldelike gebruik van 'n verkeerde eenheid **in 'n vraag of subvraag**.*

3.2   Units are only required in the final answer to a calculation.
Eenhede word slegs in die finale antwoord tot 'n vraag verlang.

3.3   Marks are only awarded for an answer, and not for a unit.   Candidates will therefore forfeit the mark allocated for the answer in each of the following situations:
- Correct answer + wrong unit
- Wrong answer + correct unit
- Correct answer + no unit

Punte word slegs vir 'n antwoord en nie vir 'n eenheid toegeken nie. Kandidate sal derhalwe die punt vir die antwoord in die volgende gevalle verbeur:
- *Korrekte antwoord + verkeerde eenheid*
- *Verkeerde antwoord + korrekte eenheid*
- *Korrekte antwoord + geen eenheid*

3.4   Separate compound units with a multiplication dot, not a full stop, for example, $mol \cdot dm^{-3}$. For marking purposes $mol.dm^{-3}$ (or mol/dm^3) will also be accepted.
Skei saamgestelde eenhede met 'n vermenigvuldigpunt en nie met 'n punt nie, byvoorbeeld, $mol \cdot dm^{-3}$*.   Vir nasiendoeleindes sal* $mol.dm^{-3}$ *(of* mol/dm^3*) ook aanvaar word.*

## 4.   GENERAL/*ALGEMEEN*

4.1   If one answer or calculation is required, but two given by the candidate, only the first one will be marked, irrespective of which one is correct. If two answers are required, only the first two will be marked, etc.
Indien een antwoord of berekening verlang word, maar twee word deur die kandidaat gegee, sal slegs die eerste een nagesien word, ongeag watter een korrek is. Indien twee antwoorde verlang word, sal slegs die eerste twee nagesien word, ens.

4.2   When a chemical **FORMULA** is asked, and the **NAME** is given as answer, only one of the two marks will be awarded. The same rule applies when the **NAME** is asked and the **FORMULA** is given.
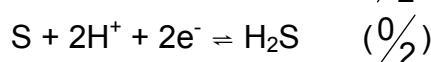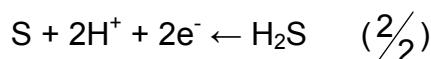*Wanneer 'n chemiese* **FORMULE** *gevra word en die* **NAAM** *word as antwoord gegee, sal slegs een van die twee punte toegeken word. Dieselfde reël geld wanneer die* **NAAM** *gevra word en die* **FORMULE** *gegee word.*

4.3   When redox half-reactions are to be written, the correct arrow should be used. If the equation

$$H_2S \rightarrow S + 2 H^+ + 2e^-   (^2/_2)$$
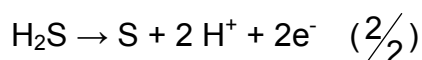
is the correct answer, the following marks will be given:
Wanneer redokshalfreaksies geskryf moet word, moet die korrekte pyltjie gebruik word. Indien die vergelyking hierbo die korrekte antwoord is, sal die volgende punte toegeken word:

$$H_2S \rightleftharpoons S + 2 H^+ + 2e^-   (^1/_2)$$

$$H_2S \leftarrow S + 2 H^+ + 2e^-   (^0/_2)$$

$$S + 2H^+ + 2e^- \leftarrow H_2S   (^2/_2)$$

$$S + 2H^+ + 2e^- \rightleftharpoons H_2S   (^0/_2)$$
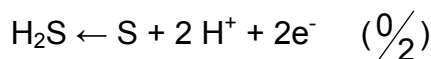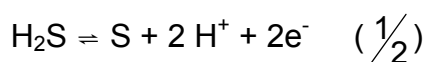
4.4   When candidates are required to give an explanation involving the relative strength of oxidising and reducing agents, the following is unacceptable:
- Stating the position of a substance on table 4 only (e.g. Cu is above Mg).
- Using relative reactivity only (e.g. Mg is more reactive than Cu).
- The correct answer would for instance be: Mg is a stronger reducing agent than Cu, and therefore Mg will be able to reduce Cu^{2+} ions to Cu. The answer can also be given in terms of the relative strength as electron acceptors and donors.

     Wanneer kandidate 'n verduideliking moet gee oor die relatiewe sterkte van oksideer- en reduseermiddels, is die volgende onaanvaarbaar:
- *Meld slegs die posisie van 'n stof op tabel 4 (bv. Cu is bo Mg).*
- *Gebruik slegs relatiewe reaktiwiteit (bv. Mg is meer reaktief as Cu).*
- *Die korrekte antwoord sal byvoorbeeld wees: Mg is 'n sterker reduseermiddel as Cu en derhalwe sal Mg in staat wees om Cu^{2+}-ione na Cu te reduseer. Die antwoord kan ook in terme van die relatiewe sterkte van elektronakseptors of -donors gegee word.*

4.5   One mark will be forfeited when the charge of an ion is omitted per equation.
     Een punt sal verbeur word wanneer die lading van 'n ioon per vraag weggelaat is.

4.6   The error-carrying principle does not apply to chemical equations or half-reactions. For example, if a learner writes the wrong oxidation/reduction half-reaction in the subquestion and carries the answer to another subquestion (balancing of equations or calculation of E^{θ}_{cell}) then the learner is not credited for this substitution.
     Die foutdraende beginsel geld nie vir chemiese vergelykings of halfreaksies nie. Byvoorbeeld, indien 'n leerder die verkeerde oksidasie-/reduksiehalfreaksie vir die subvraag skryf en die antwoord na 'n ander subvraag oordra (balansering van vergelyking of berekening van E^{θ}_{sel}), word die leerder nie vir die substitusie gekrediteer nie.

4.7   In the structural formula of an organic molecule all hydrogen atoms must be shown. Marks will be deducted if hydrogen atoms are omitted.
     In die struktuurformules van 'n organiese molekuul moet alle waterstofatome getoon word. Punte sal afgetrek word vir die weglating van waterstofatome.

4.8   When a structural formula is asked, marks will be deducted if the learner writes the condensed formula.
     Wanneer 'n struktuurformule gevra word, sal punte afgetrek word indien die leerder die gekondenseerde formule neerskryf.

4.9   When an IUPAC name is asked and the candidate omits the hyphen (e.g. instead of 1-pentene the candidate writes 1 pentene), marks will be forfeited.
     Wanneer die IUPAC-naam gevra word en die koppelteken(s) in die naam word uitgelaat (bv. in plaas van 1-penteen skryf 'n kandidaat 1 penteen), sal punte verbeur word.

SECTION A/*AFDELING A*

QUESTION 1/*VRAAG 1*

1.1 Ketones/*Ketone* ✓ [12.2.1] (1)

1.2 Chemical equilibrium/*Chemiese ewewig* ✓

OR/*OF*
Dynamic equilibrium/*Dinamiese ewewig* [12.2.1] (1)

1.3 Reducing agent/*Reduseermiddel* ✓ (1)

OR/*OF*
Reductant/*Reduktant* [12.2.1]

1.4 Salt bridge/*Soutbrug* ✓ [12.2.1] (1)

1.5 Ampere-hour/*Ampère-uur* ✓ [12.2.1] (1)
[5]

QUESTION 2/*VRAAG 2*

2.1 … is an example of a (cyclo)alkane/… *is 'n voorbeeld van 'n (siklo-) alkaan* ✓✓

OR/*OF*
Benzene (or any alkyl substituted benzene) is an example …/
Benseen (of enige alkielgesubstitueerde benseen) is 'n voorbeeld … [12.2.3] (2)

2.2 … by providing a path of lower activation energy. ✓✓
…deur 'n pad van laer aktiveringsenergie te verskaf.

OR/*OF*
… lowering the (net) activation energy
... die (netto) aktiveringsenergie te verlaag [12.2.2] (2)

2.3 ... $K_c = [NH_3][HC\ell]$ ✓✓ [12.2.3] (2)

2.4 … carbon is <u>oxidised</u>/*koolstof is <u>geoksideer</u>* ... ✓✓

OR/*OF*
… <u>aluminium</u> is reduced at the <u>cathode</u>/<u>*aluminium*</u> *word by die <u>katode</u> gereduseer.* [12.2.2] (2)

2.5 … in the form of nitrates ... ✓✓
… in die vorm van nitrate ... [12.2.3] (2)
[10]

QUESTION 3/*VRAAG 3*

3.1　　A ✓✓　　　　　　　　　　　　　　　　　　　　　　　　[12.2.3]　(2)

3.2　　C ✓✓　　　　　　　　　　　　　　　　　　　　　　　　[12.2.3]　(2)

3.3　　A ✓✓　　　　　　　　　　　　　　　　　　　　　　　　[12.2.2]　(2)

3.4　　C ✓✓　　　　　　　　　　　　　　　　　　　　　　　　[12.2.3]　(2)

3.5　　C ✓✓　　　　　　　　　　　　　　　　　　　　　　　　[12.2.3]　(2)

[10]

TOTAL SECTION A/*TOTAAL AFDELING A:***　　25**

SECTION B/*AFDELING B*

QUESTION 4/*VRAAG 4*

4.1　　Dichlorodifluoromethane ✓✓
　　　　Dichloordifluoormetaan/dichlorodifluorometaan　　　　　　[12.2.3]　(2)

4.2　　Low boiling point ✓
　　　　Lae kookpunt

　　　　OR/*OF*
　　　　High volatility/high vapour pressure ✓
　　　　Hoë vlugtigheid/hoë dampdruk　　　　　　　　　　　　[12.2.2]　(1)

4.3.1　Damages the ozone layer ✓
　　　　Vernietig/beskadig die osoonlaag　　　　　　　　　　[12.3.3]　(1)

4.3.2　Increase in (dangerous) UV rays that reaches earth ✓
　　　　Toename in (gevaarlike) UV-strale wat aarde bereik

　　　　Higher occurrence of skin cancer/cataracts ✓
　　　　Hoër voorkoms van velkanker/katarakke　　　　　　　　[12.3.2]　(2)

4.4

$$CH_3CH_3 + Cl_2 \;✓ \rightarrow CH_3CH_2Cl + HCl \;✓ \quad \text{bal} \;✓$$

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　[12.2.3]　(3)

4.5　　Heat/*hitte* ✓

　　　　OR/*OF*
　　　　Ultraviolet light/*Ultravioletlig*

　　　　OR/*OF*
　　　　Sunlight/*sonlig*　　　　　　　　　　　　　　　　　　[12.2.1]　(1)

4.6

H—C—C—C—C—H ✓✓

(with H atoms shown above and below each carbon)
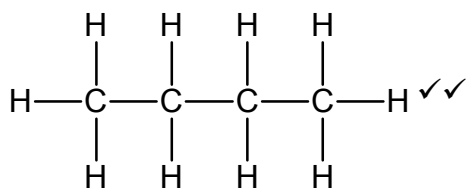
| Butane/*butaan* ½ | Molecular formula: $\frac{0}{2}$ |
| | *Molekulêre formule*: $\frac{0}{2}$ |

All bonds shown, one or more H-atoms omitted: - 1
Alle bindinge getoon, een of meer H-atome uitgelaat: -1

Condensed/semi-structural formula or mixture of both: -1
Gekondenseerde of semi-struktuurformule of mengsel van beide: -1
e.g./*bv.* $CH_3CH_2CH_2CH_3$

[12.2.3] (2)

4.7 No harm to the ozone layer/*Geen skade aan osoonlaag* ✓
Less potent greenhouse gas – contributes less to global warming ✓
Minder sterk kweekhuisgas – dra minder by tot aardverwarming [12.3.3] (2)

[14]

QUESTION 5/*VRAAG 5*

5.1 Saturated/*Versadig* ✓

Contains only carbon-carbon single bonds/*Bevat slegs koolstof-koolstof enkelbindings* ✓

OR/*OF*
No carbon-carbon double or triple bonds/*Geen koolstof-koolstof dubbel- of trippelbindings nie*

OR/*OF*
Each carbon bonded to four other atoms/*Elke koolstof aan vier ander atome gebind* [12.2.3] (2)

5.2 Aldehydes/*Aldehiede* ✓ [12.2.3] (1)

5.3.1 Ethanal/*Etanaal* ✓ [12.2.3] (1)

5.3.2 Ethanamine/*Etaanamien* ✓

Accept/*Aanvaar*:
Ethylamine/*etielamien* [12.2.3] (1)

5.4
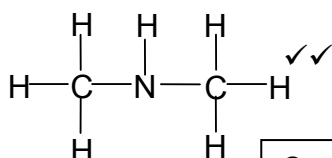
H—C—N—C—H ✓✓

(with H atoms shown above and below)

All bonds shown, one or more H-atoms omitted: -1
Alle bindinge getoon, een of meer H-atome uitgelaat: -1

Condensed/semi-structural formula or mixture of both: -1
Gekondenseerde of semi-struktuurformule of mengsel van beide: -1

[12.2.3] (2)

5.5   Relative molecular mass/molecular size ✓
         Relatiewe molekulêre massa/molekuulgrootte   [12.1.2]   (1)

5.6.1   Boiling point ✓
         Kookpunt   [12.1.2]   (1)

5.6.2   Type of organic compound/type of homologous series/type of functional group ✓
         Tipe organiese verbinding/tipe homoloë reeks/tipe funksionele groep   [12.1.2]   (1)

5.7   • Between alkane molecules/molecules of compound A/propane molecules are weak Van der Waals forces/intermolecular forces ✓
           Tussen alkaanmolekule/molekule van verbinding A/propaan-molekule is swak Van der Waals-kragte/intermolekulêre kragte
         • Between alcohol molecules/molecules of compound D/ethanol molecules are (weak Van der Waals forces as well as) strong hydrogen bonds ✓
           Tussen alkoholmolekule/molekule van verbinding D/etanolmolekule is (swak Van der Waals-kragte sowel as) sterk waterstofbindings
         • More energy needed to overcome intermolecular forces between alcohol molecules/ethanol molecules/molecules of compound D ✓
           Meer energie benodig om die intermolekulêre kragte tussen alkohol-molekule/etanolmolekule/molekule van verbinding D te oorkom

           OR/OF
           Less energy needed to overcome intermolecular forces between alkane molecules/<u>molecules of compound A/propane molecules</u> ✓
           Minder energie benodig om intermolekulêre kragte tussen alkaanmolekule/<u>molekule van verbinding A/propaanmolekule te oorkom</u>   [12.2.2]
                                                                     [12.1.2]   (3)

5.8   Compound C/*Verbinding* C✓
         Lower boiling point/weaker intermolecular forces ✓
         Laer kookpunt/swakker intermolekulêre kragte

                                                                     [12.1.2]   (2)
                                                                               [15]

QUESTION 6/*VRAAG 6*

6.1   Elimination/*eliminasie* ✓   [12.2.1]   (1)

6.2   Alkenes/*alkene* ✓   [12.2.3]   (1)

6.3   Addition/hydrohalogenation/hydrobromination ✓
       Addisie/hidrohalogenering/hidrobrominering   [12.2.3]   (1)

6.4
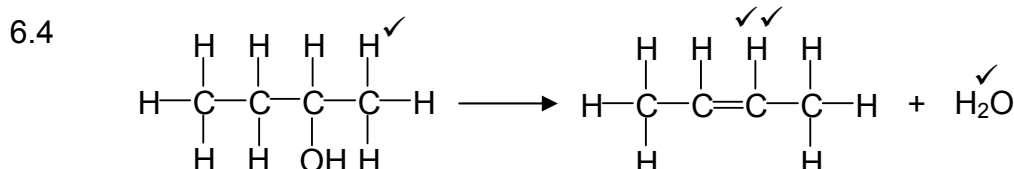
Condensed/semi-structural formulae or mixture of both: -1
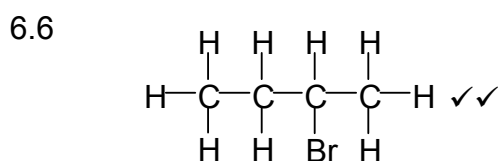*Gekondenseerde/semistruktuurformules of mengsel van beide: -1*

All bonds shown, one or more H-atoms omitted: -1 per structure
Alle bindinge getoon, een of meer H-atome uitgelaat: -1 per struktuur

Everything correct, wrong balancing: -1 *Alles korrek, verkeerde balansering: -1*	Any other reactants or products: -1 *Enige ander reaktante of produkte: -1*

                                                                          [12.2.3]   (4)

6.5   Q ✓
       The major product is the one in which the H-atom is removed from the
       least substituted C-atom (the C-atom with the least number of
       hydrogen atoms)/*Die hoofproduk is die een waarin die H-atoom
       verwyder word vanaf die minste gesubstitueerde C-atoom (die
       C-atoom wat die minste H-atome bevat)*✓   [12.2.3]   (2)

6.6

Condensed or semi-structural formula: -1
Gekondenseerde of semistruktuurformule: -1

All bonds shown, one or more H-atoms omitted: -1
Alle bindinge getoon, een of meer H-atome uitgelaat: -1

2-bromobutane ✓
2-broombutaan /2-bromobutaan

No hyphen in the name: -1 mark
Geen koppelteken in naam: -1 punt

                                                                          [12.2.3]   (3)

6.7   Substitution/*Substitusie* ✓   [12.2.3]   (1)

                                                                                      [13]

QUESTION 7/*VRAAG 7*

7.1 The change in concentration of reactants/products per unit time ✓✓
Die verandering in konsentrasie van reaktanse/produkte per eenheid tyd

> Only/*Slegs* $\frac{2}{2}$ or/*of* $\frac{0}{2}$

OR/*OF*
The rate of change of concentration of reactants/products
Die tempo van verandering in konsentrasie van reaktanse/produkte

OR/*OF*
The change in amount of reactants/products per unit time
Die verandering in hoeveelheid reaktanse/produkte per eenheid tyd [12.2.1] (2)

7.2 What is the relationship between reaction rate and surface area (of an antacid tablet)? ✓✓
Wat is die verwantskap tussen reaksietempo en oppervlakte (van 'n teensuurtablet)?

OR/*OF*
What is the relationship between the volume of $CO_2(g)$ formed per unit time and surface area (of an antacid tablet)?
Wat is die verwantskap tussen die volume $CO_2(g)$ gevorm per eenheid tyd en die oppervlakte (van 'n teensuurtablet)?

Criteria for investigative question/*Kriteria vir ondersoekende vraag*	Mark/*Punt*
Refers to relationship between dependent and independent variables *Verwys na verwantskap tussen afhanklike en onafhanklike veranderlikes*	✓
Is a question – not stated as an aim *Is 'n vraag – nie 'n doelstelling nie*	✓

[12.1.1] (2)

7.3 Concentration of acid/*Konsentrasie van suur* ✓
Mass of antacid/*Massa van teensuurmiddel* ✓
Temperature of acid/*Temperatuur van suur* ✓ [12.1.1] (3)

7.4   Any two pieces of apparatus with purpose/*Enige twee apparaatstukke met doel*:

- Thermometer/*Termometer* ✓
   Measure temperature/*meet temperatuur* ✓

- Pestle and mortar/any apparatus that can be used for grinding tablet✓
   Stamper en vysel/enige apparaat wat gebruik kan word om tablet te maal
   Grind antacid tablet to a powder/*Maal teensuurtablet tot poeier* ✓

- Triple beam/mass meter/*massameter*
   Measure the mass of the antacid/*Meet massa van die teensuurtablet*   [12.1.1]   (4)

7.5   (Gas) syringe ✓
        (Gas-) spuit   [12.1.1]   (1)

7.6
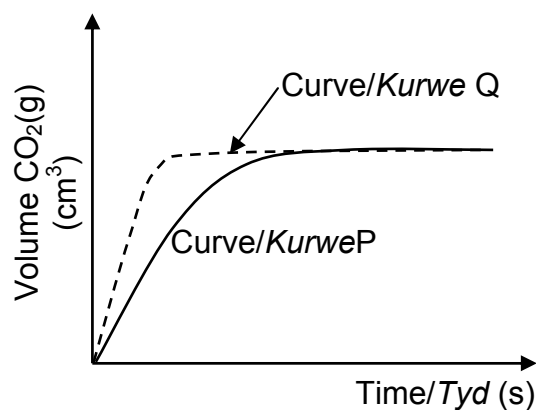
Criteria for sketch graph/*Kriteria vir sketsgrafiek*	Mark/*Punt*
Curve Q has a steeper slope than Curve P *Kurwe Q het 'n steiler helling as Kurwe P*	✓
Curve Q shows a constant volume in a shorter time than Curve P *Kurwe Q toon 'n konstante volume in 'n korter tyd as Kurwe P*	✓
Maximum volume the same for both graphs *Maksimum volume dieselfde vir beide grafieke*	✓

                                                                   [12.1.2]   (3)

7.7   Chewing tablet increases its surface area ✓ that results in a faster rate of reaction ✓
        Kou van tablet vergroot die oppervlakarea wat tot 'n vinniger reaksietempo lei   [12.2.3]   (2)
                                                                               [17]

QUESTION 8/*VRAAG 8*

8.1

$$[AB_3] = \frac{n}{V} = \frac{④}{2} = 2 \text{ mol·dm}^{-3}$$

$$[AB_2] = \frac{n}{V} = \frac{⑥}{2} = 3 \text{ mol·dm}^{-3}$$ Divide by 2/*Deel deur 2* ✓

$$[B_2] = \frac{n}{V} = \frac{③}{2} = 1,5 \text{ mol·dm}^{-3}$$

$(+)$

$$K_c = \frac{[AB_2]^2[B_2]}{[AB_3]^2} ✓ = \frac{(3)^2(1,5)}{(2)^2} ✓ = 3,38 ✓$$

No K_C expression, correct substitution/*Geen K_c-uitdrukking, korrekte substitusie:* Max./*Maks.* $\frac{5}{7}$

Wrong K_C expression/*Verkeerde K_c-uitdrukking*: Max/*maks.* $\frac{5}{7}$

[12.1.2]
[12.1.3]   (7)

8.2.1   Exothermic/*Eksotermies* ✓

$(-)$

An increase in temperature favours the reverse reaction ✓
(according to Le Chatelier), an increase in temperature favours the
reaction which decreases the temperature/endothermic reaction. ✓
*'n Toename in temperatuur bevoordeel die terugwaartse reaksie
(volgens Le Chatelier), 'n toename in temperatuur bevoordeel die
reaksie wat die temperatuur verlaag/endotermiese reaksie*   [12.1.2]   (3)

8.2.2   Smaller than/*Kleiner as* ✓   [12.1.2]   (1)

8.3.1   Remains the same/*Bly dieselfde* ✓   [12.1.2]   (1)

8.3.2   Increases/N*eem toe* ✓

$(-)$

When the volume is decreased at constant temperature,
the pressure on the system increases ✓.
Stress on the system is relieved by decreasing pressure✓,
the reverse reaction (decrease in number of moles) is favoured✓.
*Wanneer die volume by konstante temperatuur afneem, verhoog die
druk op die sisteem.
Spanning op die sisteem word verlig deur verlaging in druk;
die terugwaartse reaksie (afname in aantal mol) word bevoordeel.*   [12.1.4]   (4)

[16]

QUESTION 9/*VRAAG 9*

9.1.1   P ✓   [12.1.2]   (1)

9.1.2   T ✓   [12.1.2]   (1)

9.2.1 $Ni^{2+}(aq)$ ✓   [12.2.3]   (1)

9.2.2   Q ✓
        $Ni^{2+} + 2e^- \rightarrow Ni$ ✓✓   [12.2.3]   (3)

9.2.3   For each mole of nickel oxidised at the anode ✓
        a mole of nickel is reduced at the cathode. ✓
        Vir elke mol nikkel by die anode geoksideer
        word 'n mol nikkel by die katode gereduseer   [12.2.3]   (2)

9.2.4   Protects iron from rusting ✓
        Beskerm yster teen roes   [12.3.3]   (1)

9.3.1   Chemical energy ✓ to electrical energy ✓
        Chemiese energie na elektriese energie   [12.2.3]   (2)

9.3.2 $A\ell + 3Ag^+$ ✓ $\rightarrow A\ell^{3+} + 3Ag$ ✓   Bal ✓   [12.2.3]   (3)

9.3.3 $E^{\theta}_{cell/sel} = E^{\theta}_{cathode/katode} - E^{\theta}_{anode}$ ✓

OR any other correct formula from data sheet/*OF*
enige ander korrekte formule vanaf gegewensblad

          = 0,80 ✓ – (- 1,66) ✓
          = 2,46 V ✓

OR/*OF*

✓ $A\ell \rightarrow A\ell^{3+} + 3e^-$ $E° = + 1,66$ ✓
     $Ag^+ + e^- \rightarrow Ag$ <u>$E° = + 0,80$</u> ✓
                       $E° = + 2,46$ V ✓

Any other formula using unconventional abbreviations, e.g.
$E°_{cell} = E°_{OA} - E°_{RA}$ followed by correct substitutions: $^3/_4$
Enige ander formule wat onkonvensionele afkortings gebruik, bv.
$E°_{sel} = E°_{OA} - E°_{RA}$, gevolg deur korrekte substitusies: $^3/_4$

                                                  [12.2.3]   (4)

9.3.4   Decreases/*Afneem* ✓   [12.2.3]   (1)

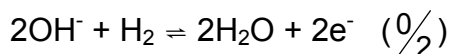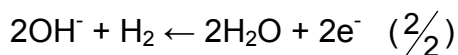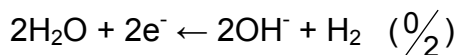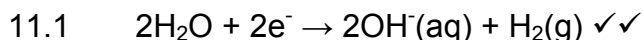9.3.5 $A\ell$ to Ag/*$A\ell$ na Ag* ✓   [12.2.3]   (1)

                                                          [20]

QUESTION 10/*VRAAG 10*

10.1 $N_2 + 3 H_2 \checkmark \rightarrow 2 NH_3 \checkmark$ bal $\checkmark$ [12.2.3]   (3)

10.2   Contact process/*Kontakproses*$\checkmark$ [12.2.1]   (1)

10.3 $2NH_3 + H_2SO_4 \checkmark \rightarrow (NH_4)_2SO_4 \checkmark$ bal $\checkmark$ [12.2.3]   (3)

10.4   Any TWO/*Enige TWEE*
- Leakage of the fertiliser into the water may lead to <u>eutrophication that can lead to a decrease in water quality</u>. $\checkmark$
  Uitlek van kunsmis in water mag lei tot <u>eutrofikasie</u> wat kan lei tot 'n <u>verlaging in waterkwaliteit</u>
- The leakage of fertiliser into their only source of drinking water may lead to <u>blue baby syndrome</u> when consumed. $\checkmark$
  Uitlekking van kunsmis in hul enigste bron van drinkwater mag lei tot <u>bloubabasindroom</u> wanneer dit ingeneem word
- The leakage of fertiliser into their only source of water can result in the <u>death of fish used as food</u>. $\checkmark$
  Uitlekking van kunsmis in hul enigste bron van water kan lei tot <u>vis wat vrek wat as kos gebruik word</u>
- <u>Source of drinking water</u>
  <u>*Bron van drinkwater*</u>   [12.3.3]   (2)

                                                                [9]

QUESTION 11/*VRAAG 11*

11.1 $2H_2O + 2e^- \rightarrow 2OH^-(aq) + H_2(g)$ ✓✓

$2H_2O + 2e^- \rightleftharpoons 2OH^- + H_2$ $(\frac{1}{2})$
$2H_2O + 2e^- \leftarrow 2OH^- + H_2$ $(\frac{0}{2})$
$2OH^- + H_2 \leftarrow 2H_2O + 2e^-$ $(\frac{2}{2})$
$2OH^- + H_2 \rightleftharpoons 2H_2O + 2e^-$ $(\frac{0}{2})$

[12.2.3]   (2)

11.2 $\boxed{2H_2O(\ell) + 2C\ell^-(aq)}^{✓} \rightarrow \boxed{2OH^-(aq) + H_2(g) + C\ell_2(g)}^{✓}$ bal ✓

[12.2.3]   (3)

11.3
- Allows the migration of positive ions from anode to cathode ✓
  Laat die migrasie van positiewe ione vanaf anode na katode toe
- Prevents mixing of products ✓
  Verhoed vermenging van produkte

[12.2.1]   (2)

11.4 H_2O is a stronger oxidising agent than Na^+ ✓ and will be reduced. ✓
H_2O is 'n sterker oksideermiddel as Na^+ en sal gereduseer word.

OR/*OF*
Na^+ is a weaker oxidising agent than H_2O ✓ and will not be reduced. ✓
Na^+ is 'n swakker oksideermiddel as H_2O en sal nie gereduseer word nie.

[12.2.3]   (2)

11.5   Any one/*Enige een:*
- Chlorine gas is poisonous – causes health problems/breathing complications
  Chloorgas is giftig – veroorsaak gesondheidsprobleme/ asemhalingskomplikasies ✓
- Chlorine gas is used to make drugs that can be dangerous when overdosing
  Chloorgas word gebruik om geneesmiddels/verdowingsmiddels te maak wat gevaarlik in 'n oordosis kan wees.
- Chlorine used as nerve gas.
  Chloorgas word as senugas gebruik.

[12.3.2]   (1)

[10]

QUESTION 12/*VRAAG 12*

12.1   Electrolyte is a paste/not a liquid ✓
        Elektroliet is 'n pasta/nie vloeistof nie   [12.1.2]   (1)

12.2   The acid in the <u>battery attacks (reacts with) the zinc</u> ✓, <u>causing it to corrode faster</u> ✓than the alkaline-based battery.
        Die suur in die <u>battery val (reageer met) die sink aan</u>, wat veroorsaak dat dit <u>gouer roes</u> as die alkaliesgebaseerde battery.   [12.2.3]   (2)

12.3.1 $w = VQ$ ✓
          $= (1,5)$ ✓$(1\ 000 \times 10^{-3} \times 60 \times 60)$ ✓
          $= 5\ 400$ J ✓ $(5,4 \times 10^{3}$ J$)$ [12.2.3]   (4)

12.3.2 $Q = I\Delta t$ ✓
          $1\ 000 \times 10^{-3} \times 60 \times 60 = I(20 \times 60 \times 60)$ ✓
          $\therefore I = 0,05$ A ✓

          OR/*OF*
          Battery capacity/*Batterykapasiteit* $= I\Delta t$ ✓
          $1\ 000 = I(20)$ ✓
          $\therefore I = 50$ mA ✓ $(5 \times 10^{-2}$ A$)$ [12.2.3]   (3)

> Accept/*Aanvaar*:
> $Q = I\Delta t$ ✓
> $1\ 000 = I(20)$ ✓
> $\therefore I = 50$ mA ✓ $(5 \times 10^{-2}$ A$)$

12.4   More primary batteries need to be manufactured as they cannot be re-used and <u>transportation/manufacturing leads to emission of greenhouse gases.</u> ✓
        Meer primêre batterye moet vervaardig word aangesien hulle nie hergebruik kan word nie en <u>vervoer/vervaardiging lei tot die vrystelling van kweekhuisgasse</u>

        OR/*OF*
        Rechargeable batteries can be re-used and less is manufactured/transported – less greenhouse gases emitted
        Herlaaibare batterye kan hergebruik word en minder word vervaardig/vervoer – minder kweekhuisgasse vrygestel   [12.3.3]   (1)

                                                         [11]

        TOTAL SECTION B/*TOTAAL AFDELING B*:   **125**

        GRAND TOTAL/*GROOTTOTAAL*:   **150**