basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE/
*NASIONALE
SENIOR SERTIFIKAAT***

GRADE/*GRAAD* 10

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

NOVEMBER 2015

MEMORANDUM

MARKS/*PUNTE*: 150

**This memorandum consists of 10 pages.
*Hierdie memorandum bestaan uit 10 bladsye.***

QUESTION 1/*VRAAG 1*

1.1   A ✓✓   (2)

1.2   B ✓✓   (2)

1.3   A ✓✓   (2)

1.4   C ✓✓   (2)

1.5   D ✓✓   (2)

1.6   D ✓✓   (2)

1.7   B ✓✓   (2)

1.8   B ✓✓   (2)

1.9   B ✓✓   (2)

1.10   C ✓✓   (2)
                                                                                          [20]

QUESTION 2/*VRAAG 2*

2.1
2.1.1   ANY ONE:
        Copper/oxygen gas ✓
        ENIGE EEN:
        Koper/suurstofgas   (1)

2.1.2   ANY ONE:
        brass/salt solution/pure air ✓
        ENIGE EEN:
        Geelkoper/soutoplossing/suiwer lug   (1)

2.1.3   oxygen (gas)/*suurstof(gas)* ✓   (1)

2.1.4   ANY ONE:
        magnesium oxide/table salt/sugar ✓
        ENIGE EEN:
        magnesiumoksied/tafelsout/suiker   (1)

2.1.5   Sand ✓   (1)

2.2
2.2.1   (a)   Filtration/*Filtrering/filtrasie* ✓   (1)

        (b)   Evaporation/*Verdamping* ✓
                                                                                          (1)

        (c)   Sand ✓   (1)

        (d)   <u>Sugar solution/sugar and water</u> ✓
                Suikeroplossing/suiker en water   (1)

2.2.2   Physical (process)/*Fisiese (proses)* ✓
No new substances are formed./Water only changes phase./The chemical composition of the substance is not altered. ✓
Geen nuwe stowwe word gevorm nie./Water verander slegs van fase./Die chemiese samestelling van die stowwe verander nie.   (2)
[11]

QUESTION 3/*VRAAG 3*

3.1
3.1.1   The temperature ✓ at which the vapour pressure is equal to the external/atmospheric pressure. ✓
Die temperatuur waarby die dampdruk gelyk is aan die eksterne/atmosferiese druk.   (2)

3.1.2   (a)   D ✓   (1)

          (b)   B ✓   (1)

          (c)   C ✓   (1)

3.1.3   I ✓   (1)

3.2
3.2.1   Liquid/*Vloeistof* ✓   (1)

3.2.2   132 °C ✓   (1)

3.2.3   (a)   Increases/*Toeneem* ✓   (1)

          (b)   Remains the same/*Bly dieselfde* ✓   (1)

3.2.4   Heat <u>energy is used to break forces</u> between particles ✓
resulting in a <u>phase change</u> ✓
and <u>not to change the speed at which particles</u> move. ✓
Warmte <u>energie word gebruik om kragte te breek</u> tussen deeltjies wat
lei tot 'n <u>faseverandering</u>
en <u>nie tot verandering in die spoed waarteen deeltjies</u> beweeg nie.

OR/*OF*
Heat energy is used to <u>increase the potential energy</u> ✓ of the <u>particles</u> making them <u>move further apart</u> ✓ resulting in a <u>phase change</u>. ✓
Warmte energie word gebruik om die <u>potensiële energie</u> van die deeltjies te <u>verhoog</u> en veroorsaak dat hul <u>verder vanmekaar beweeg</u> en 'n <u>faseverandering</u> tot gevolg het.   (3)
[13]

QUESTION 4/*VRAAG 4*

4.1

4.1.1   The number of protons ✓ in the nucleus of an atom. ✓
         Die getal protone in die kern van 'n atoom.   (2)

4.1.2   Atoms of the same element having the same number of protons, ✓
         but different numbers of neutrons. ✓
         Atome van dieselfde element met dieselfde getal protone maar verskillende
         getalle neutrone.
         OR/*OR*
         Atoms (of the same element) with the same atomic number ✓ but different
         mass numbers. ✓
         Atome (van dieselfde element) met dieselfde atoomgetal, maar verskillende
         massagetalle.   (2)

4.2

4.2.1 $\underline{1s^2 2s^2 2p^6}$✓$\underline{3s^2 3p^5}$ ✓   (2)

4.2.2

OPTION 1/OPSIE 1:	**Marking criteria/*Nasienriglyne***
%Cℓ-35 = x and %Cℓ-37 = y x + y = 100 ✓…………………...………1 $35{,}5 = \dfrac{x(35) + y(37)}{100}$ ✓ …………….………2 1 in 2: $35{,}5 = \dfrac{x(35) + (100 - x)37}{100}$ 3550 = 35x + 3700 - 37x ∴ x = 75 ✓	• x + y = 100 **OR/OF** x = 100 – y **OR/OF** y = 100 – x ✓ • Expression to calculate average atomic mass of 100 atoms. ✓ *Uitdrukking om gemiddelde atoommassa van 100 atome te bereken.* • Final answer / *Finale antwoord*: 75

OPTION 2/OPSIE 2:
%Cℓ-35 = x ∴ %Cℓ-37 = 100 – x ✓ $\left(\dfrac{x}{100}\right)35 + \left(\dfrac{100 - x}{100}\right)37 = 35{,}5$ ✓   0,35x + 37 – 0,37x = 35,5   1,5 = 0,02x   x = 75 ✓

                                                                                               (3)

4.3

4.3.1   7 ✓   (1)
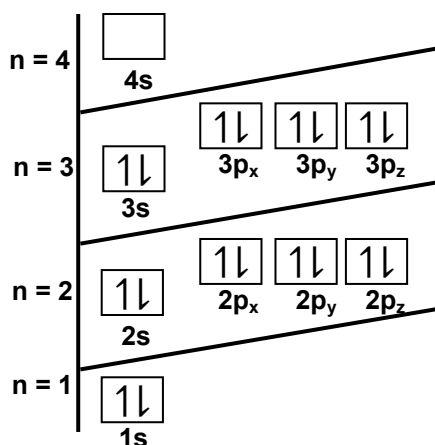
4.3.2   Covalent (bond)/*Kovalente (binding)* ✓   (1)

4.3.3   ✓✓   (2)

4.4

4.4.1

Marking criteria/*Nasienriglyne:*
• Main energy levels shown ✓ *Hoofenergievlakke aangedui* (1, 2, 3 etc.).
• Orbitals labelled as s or p. Ignore if 4ᵗʰ level and 4s not shown. ✓ *Orbitale genommer as s of p. Ignoreer as 4de vlak en 4s nie getoon word nie.*
• Nine electron pairs shown as arrows in opposite directions in blocks/circles. ✓ *Nege elektronpare getoon as pyltjies in teenoorgestelde rigtings in blokke of sirkels.*

(3)

4.4.2 Ca^{2+} ✓ & $C\ell^-$ ✓   (2)

[18]

QUESTION 5/*VRAAG 5*

5.1

5.1.1   The <u>ionisation energy</u> is the energy <u>needed/absorbed</u> to remove an electron, ✓ whilst <u>electron affinity</u> is energy <u>released</u> when an electron is taken in. ✓
Die <u>ionisasie energie</u> is die energie <u>benodig/geabsorbeer</u> om 'n elektron te verwyder, terwyl <u>elektronaffiniteit</u> die energie is wat <u>vrygestel</u> word wanneer 'n elektron opgeneem word.   (2)

5.1.2   <u>Increase</u> in effective <u>nuclear charge</u> from left to right in period. ✓
<u>Toename in</u> effektiewe <u>kernlading</u> van links na regs in 'n periode.

      OR/*OF*

<u>Decrease</u> in <u>atomic radius</u> from left to right in a period. ✓
<u>Afname</u> in <u>atoomradius</u> van links na regs in 'n periode.   (1)

5.1.3   Higher than/*Hoër as* ✓
Losing a second electron will result in an unstable electron structure for sodium, ✓ whilst losing a second electron will result in a stable/noble gas electron structure for magnesium. ✓
Verlies van 'n tweede elektron sal tot 'n onstabiele elektronstruktuur vir natrium lei, terwyl verlies van 'n tweede elektron tot 'n stabiele/edelgas elektronstruktuur vir magnesium sal lei.   (3)

5.1.4
$$n = \frac{m}{M}$$
$$= \frac{46}{23} \checkmark$$
$$= 2 \text{ mol}$$

Energy needed/*Energie benodig* = 2 x 496 ✓
                                            = 992 kJ ✓   (3)

5.1.5   Chlorine/*Chloor* ✓
Highest electron affinity/*Hoogste elektronaffiniteit* ✓

OR/*OF*
Releases the most energy./*Stel die meeste energie vry.*   (2)

5.2
5.2.1   (a)   E ✓   (1)
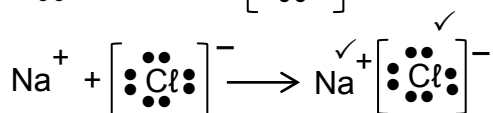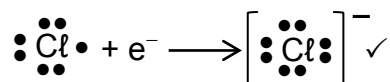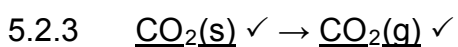
        (b)   C ✓   (1)

        (c)   A ✓ & D ✓   (2)

5.2.2

OR/*OF*

                                                                            (4)
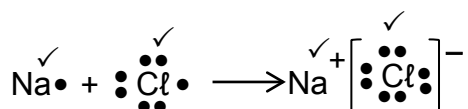
5.2.3 $\underline{CO_2(s)}$ ✓ → $\underline{CO_2(g)}$ ✓   (2)
[21]

QUESTION 6/*VRAAG 6*

6.1

6.1.1   Metallic (bond)/*Metaal (binding)* ✓   (1)

6.1.2   Ionic (bond)/*Ioniese (binding)* ✓   (1)

6.2   Chemical change/*Chemiese verandering* ✓
A new substance is produced. ✓
'n Nuwe stof word gevorm.   (2)

6.3 $2Mg + O_2$ ✓ $\rightarrow 2MgO$ ✓   Bal. ✓

> **Notes/*Aantekeninge***
> - Reactants ✓   Products ✓   Balancing ✓
>   *Reaktanse* ✓   *Produkte* ✓   *Balansering* ✓
> - Ignore/*Ignoreer* ⇌
> - Marking rule 3.10/*Nasienreël 3.10*
    (3)

6.4 $2Mg$ $+ O_2$ $\rightarrow 2MgO$
$2(24)$ ✓ $+ 2(16)$ ✓ $= 2(16 + 24)$ ✓
$80 = 80$ ✓

> **Marking criteria/*Nasienriglyne:***
> - M(reactant 1) correctly calculated. ✓
>   *M(reaktans 1) korrek bereken.*
> - M(reactant 2) correctly calculated. ✓
>   *M(reaktans 2) korrek bereken.*
> - M(product) correctly calculated. ✓
>   *M(produk) korrek bereken.*
> - M(reactants) = M(product) ✓
>   *M(reaktanse) = M(produkte)*
    (4)

[11]

QUESTION 7/*VRAAG 7*

7.1   <u>Reaction in which a proton/hydrogen ion/H^+ is transferred</u> from one reactant to another. ✓✓
<u>*Reaksie waarin 'n proton/waterstofioon/H^+ oorgedra word* van een reaktans na 'n ander.*</u>   (2)

7.2 $18 \ cm^3$ ✓   (1)

7.3

7.3.1   <u>Number of moles of solute</u> ✓ <u>per cubic decimetre/litre of solution</u>. ✓
Aantal mol opgeloste stof per kubieke desimeter/liter oplossing.   (2)

7.3.2 $\%CaCO_3 = \dfrac{0,1 ✓}{0,25} \times 100$ ✓
$= 40\%$ ✓   (3)

7.3.3 **POSITIVE MARKING FROM QUESTION 7.3.2 i.e. 0,1 g FROM GRAPH.**
POSITIEWE NASIEN VANAF VRAAG 7.3.2, m.a.w. 0,1 g VAN DIE GRAFIEK.

$$n(CaCO_3) = \frac{m}{M}$$
$$= \frac{0,1}{100} \checkmark$$
$$= 1 \times 10^{-3} \, mol$$

$n(HC\ell) = 2 \times n(CaCO_3) = 2 \times 10^{-3} \, mol$ ✓

Volume acid/*volume suur*:

$$c = \frac{n}{V} \checkmark$$

$$0,1 = \frac{2 \times 10^{-3}}{V} \checkmark$$

V = 0,02 dm³ ✓

(5)

[13]

QUESTION 8/*VRAAG 8*

8.1   Solution in which the <u>solvent is water</u>. ✓
        Oplossing waarin die <u>oplosmiddel water is</u>.   (1)

8.2
8.2.1   The <u>process in which solid ionic crystals are broken up into ions</u> ✓when <u>dissolved in water</u>. ✓
        Die <u>proses waarin vaste ioniese kristalle opgebreek word in ione</u> wanneer <u>opgelos word in water.</u>   (2)

8.2.2 $(NH_4)_2CO_3(s)$ ✓$\rightarrow$ $2NH_4^+(aq) + CO_3^{2-}(aq)$ ✓   bal. ✓   (3)

Notes/*Aantekeninge*		
• Reactants ✓	Products ✓	Balancing ✓
Reaktanse ✓	*Produkte* ✓	*Balansering* ✓
• Ignore/*Ignoreer* ⇌ and phases/*en fases.*		
• Marking rule 3.10/*Nasienreël 3.10*		

8.3
8.3.1   (a) Conductivity/Ammeter reading ✓
            Geleidingsvermoë/Ammeterlesing   (1)

        (b) Type of compound/Concentration of ions ✓
            Tipe verbinding/Konsentrasie van ione   (1)

8.3.2   An <u>increase in ion concentration increases the conductivity</u>. ✓
        'n <u>Toename in ioonkonsentrasie verhoog die geleidingsvermoë.</u>   (1)

8.3.3 $NaC\ell \rightarrow Na^+ + C\ell^-$ ✓
Forms <u>two ions</u> per mole of $NaC\ell$./*Vorm <u>twee ione</u> per mol* $NaC\ell$. ✓
$CaC\ell_2 \rightarrow Ca^{2+} + 2C\ell^-$ ✓
Forms <u>three ions</u> per mole of $CaC\ell_2$./*Vorm <u>drie ione</u> per mol* $CaC\ell_2$. ✓

OR/*OF*
<u>Concentration of ions in $CaC\ell_2$(aq) is higher than in $NaC\ell$(aq).</u> ✓✓
<u>*Konsentrasie van ione in $CaC\ell_2$(aq) is hoër as in $NaC\ell$(aq)*</u>.   (4)

8.4
8.4.1   Redox/*Redoks* ✓   (1)

8.4.2   Gas forming/*Gasvorming* ✓   (1)

8.4.3   Precipitation/*Presipitasie* ✓   (1)

8.5 $Cu + 4HNO_3$ ✓ $\rightarrow Cu(NO_3)_2 + 2H_2O + 2NO_2$ ✓   Bal. ✓

> **Notes/*Aantekeninge***
> - Reactants ✓   Products ✓   Balancing ✓
>   *Reaktanse* ✓   *Produkte* ✓   *Balansering* ✓
> - Ignore/*Ignoreer* ⇌
> - Marking rule 3.10/*Nasienreël 3.10*

                                                                                                                       (3)
                                                                                                                     [19]

QUESTION 9/*VRAAG 9*

9.1
9.1.1   One mole is the <u>amount of substance</u> ✓ having the <u>same number of particles
as there are atoms in 12 g carbon-12</u>. ✓
*Een mol is die <u>hoeveelheid stof</u> wat <u>dieselfde aantal deeltjies bevat as wat
daar atome is in 12 g koolstof-12.</u>*   (2)

9.1.2   0,67 mol/$\frac{2}{3}$ mol ✓
                                                                                                                       (1)

9.1.3 $V(N_2) : V(H_2) : V(NH_3) = 1 : 3 : 2$

$V(N_2$ reacted/*reageer*$) = \frac{1}{3}V(H_2)$

$= \frac{1}{3}(24)$ ✓
$= 8\ dm^3$

Volume N_2 remains/*oorbly* = <u>10 – 8</u> ✓ = 2 dm^3
Volume of gas that remains/*Volume gas wat oorbly* = 2 <u>+ 16</u> ✓
                                                                                    = $\overline{18\ dm^3}$ gas ✓   (4)

9.1.4 $n = \dfrac{m}{M}$

$= \dfrac{80}{2}$ ✓

$= 40 \text{ mol}$ ✓   (2)

9.1.5 $V(N_2) = \dfrac{1}{3} (40) \times 22,4$ ✓

$= 298,67 \text{ dm}^3$ ✓   (2)

9.2 $m(O_2) = 239 - 207 = 32 \text{ g}$ ✓

$n(Pb) = \dfrac{m}{M}$

$= \dfrac{207}{207}$ ✓

$= 1 \text{ mol}$

$n(O) = \dfrac{m}{M}$

$= \dfrac{32}{16}$ ✓

$= 2 \text{ mol}$

$n(Pb) : n(O)$

  1 : 2 ✓

∴ PbO_2 ✓   (5)

[16]

QUESTION 10/*VRAAG 10*

10.1   All the water of the earth./*Al die water van die aarde* ✓   (1)

10.2

10.2.1   Evaporation/*Verdamping* ✓   (1)

10.2.2   Condensation/*Kondensasie* ✓   (1)

10.2.3   Infiltration/percolation ✓
Infiltrering/Infiltrasie/perkolasie   (1)

10.2.4   Rain fall/Precipitation ✓
Reënval/Presipitasie/Neerslag   (1)

10.3   Increase in ground water levels./*Toename in grondwater vlakke.* ✓   (1)

10.4   ANY TWO/*ENIGE TWEE*:
Storage of water ✓/recreation areas ✓/job creation/irrigation of crops/ attraction of bird life/source of food
Stoor van water/ontspanningsareas/werkskepping/besproeiing van gewasse/ aantrekking van voëllewe/bron van voedsel   (2)

[8]

TOTAL/*TOTAAL*:   **150**