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) Sugar solution/sugar and water ✓
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/V*loeistof* ✓ (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 $\underline{1s^2}\,\underline{2s^2}\,\underline{2p^6}$ ✓ $\underline{3s^2}\,\underline{3p^5}$ ✓ (2)

4.2.2

<u>OPTION 1/OPSIE 1</u>:

%Cℓ-35 = x and %Cℓ-37 = y

x + y = 100 ✓……..……1

$35,5 = \frac{x(35) + y(37)}{100}$ ✓ ……..2

1 in 2:

$35,5 = \frac{x(35) + (100 - x)37}{100}$

3550 = 35x + 3700 - 37x

$\therefore$ x = 75 ✓

<u>OPTION 2/OPSIE 2</u>:

%Cℓ-35 = x $\therefore$ %Cℓ-37 = 100 – x ✓

$\left(\frac{x}{100}\right)35 + \left(\frac{100 - x}{100}\right)37 = 35,5$ ✓

0,35x + 37 – 0,37x = 35,5

1,5 = 0,02x

x = 75 ✓

<u>Marking criteria/*Nasienriglyne*</u>

- 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

(3)

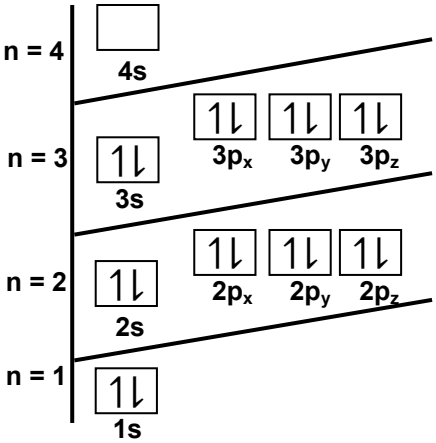
4.3

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)

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QUESTION 5/*VRAAG 5*

5.1

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

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

OR/*OF*

Decrease in atomic radius from left to right in a period. ✓
Afname in atoomradius 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 $n = \frac{m}{M}$
$= \frac{46}{23}$ ✓
$= 2$ mol

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

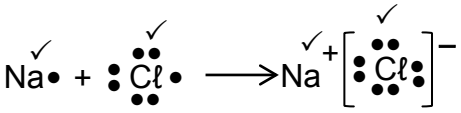
5.1.5 Chlorine/*Chloor* ✓
Highest electron affinity/*Hoogste elektronaffiniteit* ✓

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

5.2
5.2.1 (a) E ✓ (1)

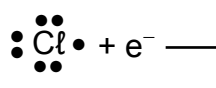
(b) C ✓ (1)

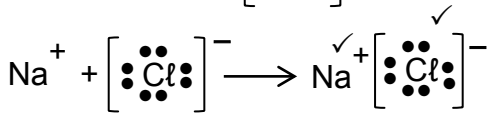
(c) A ✓ & D ✓ (2)

5.2.2 

OR/*OF*

$Na\bullet \longrightarrow Na^{+} + e^{-}$ ✓





(4)

5.2.3 $\underline{CO_2(s)}$ ✓ → $\underline{CO_2(g)}$ ✓ (2)
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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 $2Mg + O_2$ ✓→ $2MgO$ ✓ 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 Reaction in which a proton/hydrogen ion/H^+ is transferred from one reactant to another. ✓✓
Reaksie waarin 'n proton/waterstofioon/H^+ oorgedra word van een reaktans na 'n ander. (2)

7.2 18 cm^3 ✓ (1)

7.3

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

7.3.2 $\%CaCO_3 = \frac{0,1\checkmark}{0,25} \times 100 \checkmark$
$= 40\%$ ✓ (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.

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

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

Volume acid/*volume suur*:

$$c = \frac{n}{V} \checkmark$$
$$0,1 = \frac{2 \times 10^{-3}}{V} \checkmark$$
$V = 0,02$ dm^3 ✓ (5)

[13]

QUESTION 8/*VRAAG 8*

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

8.2

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

8.2.2 $(NH_4)_2CO_3(s)$ ✓→ $2NH_4^+(aq) + CO_3^{2-}(aq)$ ✓ 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 increase in ion concentration increases the conductivity. ✓
'n Toename in ioonkonsentrasie verhoog die geleidingsvermoë. (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. ✓

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

(3)
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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 –</u> 8 ✓= 2 dm^3
Volume of gas that remains/*Volume gas wat oorbly* = 2 <u>+ 16</u> ✓
= 18 dm^3 gas ✓ (4)

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

$= \frac{80}{2}$ ✓

$= 40$ mol ✓ (2)

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

= 298,67 dm^3 ✓ (2)

9.2 $m(O_2) = 239 - 207 = 32$ g ✓

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

$= \frac{207}{207}$ ✓

$= 1$ mol

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

$= \frac{32}{16}$ ✓

$= 2$ mol

n(Pb) : n(O)

1 : 2 ✓

∴ PbO_2 ✓ (5)

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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