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 2016

MEMORANDUM

MARKS/*PUNTE*: 150

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

QUESTION 1/*VRAAG 1*

1.1	C ✓✓	(2)
1.2	A ✓✓	(2)
1.3	C ✓✓	(2)
1.4	D ✓✓	(2)
1.5	C ✓✓	(2)
1.6	A ✓✓	(2)
1.7	B ✓✓	(2)
1.8	B ✓✓	(2)
1.9	C ✓✓	(2)
1.10	D ✓✓	(2)
		[20]

QUESTION 2/*VRAAG 2*

2.1 A pure substance is a substance that cannot be separated into simpler components by physical methods. ✓
'n Suiwer stof is 'n stof wat nie deur fisiese metodes in eenvoudiger komponente opgebreek kan word nie (1)

2.2
2.2.1	Element ✓	(1)
2.2.2	Consist of only one type of atom.✓ *Bestaan uit net een tipe atoom*	(1)
2.2.3	Mixtures ✓/*Mengsel*	(1)
2.2.4	It is a combination of many gases. ✓ *Dit is 'n kombinasie van baie gasse*	(1)

2.3 Pots and pans are made of metal because, metal is a good <u>conductor</u> that allows heat to be transferred so that the food can cook✓. The handles are <u>insulators</u> so that you do not burn your hands when you pick up a hot pot✓.
Potte en panne word van metaal gemaak, omdat metaal 'n goeie <u>geleier</u> van hitte is wat toelaat dat hitte oorgedra word, sodat die kos kan gaar word. Die handvatsels is <u>isolators</u> sodat jou hande nie brand as jy 'n warm pot optel nie. (2)

2.4
2.4.1	$NaC\ell$ ✓✓	(2)
2.4.2	$Ca(OH)_2$ ✓✓	(2)
		[11]

QUESTION 3/*VRAAG 3*

3.1 3.1.1 Temperature ✓/*Temperatuur* (1)

3.1.2 Time ✓ Also accept phase change
Tyd. Aanvaar ook faseverandering (1)

3.2 What is the relationship between an increase in temperature over a period of time and phase change? ✓✓
Wat is die verwantskap tussen 'n toename in temperatuur vir 'n tydperk en faseverandering?
NOTE: The dependent and independent variable must be mentioned.
The relationship between the variables must be identified.
LET WEL: Die onafhanklike en afhanklike veranderlike moet genoem word.
Die verwantskap tussen die veranderlikes moet ook genoem word. (2)

3.3 Solid ✓/*Vaste stof* (1)

3.4 -24 °C ✓ (1)

3.5 Boiling point is the temperature of a liquid at which its vapour pressure is equal to the external (atmospheric) pressure. ✓✓
Kookpunt is die temperatuur van 'n vloeistof waar sy dampdruk gelyk is aan die eksterne (atmosferiese) druk. (2)

3.6 Liquid changes to gas. ✓/*Vloeistof na gas* (1)

3.7 The energy is used to break the forces between the particles✓, resulting in a phase change✓, the kinetic energy of the particles remains the same✓, particles move further away from each other (increase in potential energy)✓.
Die energie word gebruik om die kragte tussen die deeltjies te oorkom✓ en sodoende vind 'n faseverandering plaas.✓ Die deeltjies beweeg verder uit mekaar uit, dus neem die potensiële energie toe.✓Die kinetiese energie bly dieselfde want temperatuur bly konstant. (4)

3.8 Substance 2✓,
Substance 2 has a lower melting and/or boiling point than substance 1 ✓
Stof 2
Stof 2 het 'n laer smelt- en/of kookpunt as stof 1 (2)

3.9 Thermometer ✓/*Termometer* (1)

3.10 Equal to✓ Substance 1 and 2 are at the same temperature. Therefore they will have the same average kinetic energy.✓
Gelyk aan. Stof 1 en 2 is by dieselfde temperatuur. Dus sal hulle oor dieselfde gemiddelde kinetiese energie beskik. (2)

[18]

QUESTION 4/*VRAAG 4*

4.1 Ionisation energy is the energy needed to remove an electron from (one mole) of an atom in a gaseous phase. ✓✓
Ionisasie-energie is die energie benodig om 'n elektron uit (een mol) van 'n atoom in 'n gasfase te verwyder. (2)

4.2 4.2.1 Metals have lower first ionisation energy than non-metals✓, therefore metals would rather lose electrons to form a positive ion (cation).✓
Metale het laer eerste ionisasie-energie as nie-metale, daarom sal metale eerder elektrone verloor om 'n positiewe ioon (katioon) te vorm. (2)

4.2.2 Non-metals have higher first ionisation energy than metals✓, therefore non-metals would rather gain electrons to form the negative ions (anions).✓
Nie-metale het hoër eerste ionisasie-energie as metale, daarom sal nie-metale eerder elektrone opneem om die negatiewe ione (anione) te vorm. (2)

4.3 The second electron is removed from the energy level very close to the nucleus, therefore the force of attraction between the electron and the nucleus is stronger✓ hence more energy is needed to remove the second electron✓.
Die tweede elektron word verwyder van die energievlak wat naby aan die kern is, dus is die aantrekkingskrag tussen die elektron en die kern sterker. Daarom word meer energie benodig om die tweede elektron te verwyder. (2)
[8]

QUESTION 5/*VRAAG 5*

5.1 Isotopes are atoms of the same element having the same number of protons but different numbers of neutrons. ✓✓
Isotope is atome van dieselfde element wat dieselfde getal protone het, maar verskillende getalle neutrone. (2)

5.2 5.2.1 $^{19}_{9}X$ and/*en* $^{20}_{9}X$ ✓
OR/*OF*
A and/*en* C✓ (1)

5.2.2 Fluorine✓/*Fluoor* (1)

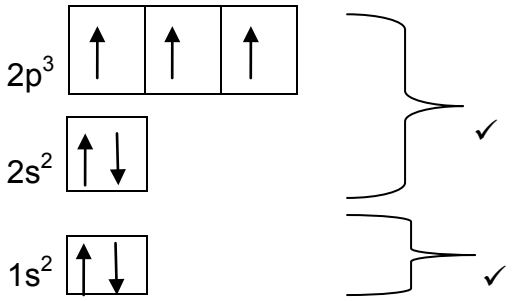
5.3
$$Ar(Cu) = \left(\frac{69}{100}\checkmark \times 63\right) + \left(\frac{31}{100}\checkmark \times 65\right)$$
$$= 63.62\checkmark$$ (4)

5.4 5.4.1 19 ✓
5.4.2 10 ✓
5.4.3 Mg isotope **OR** magnesium isotope✓
Mg-isotoop **OF** magnesium-isotoop✓
5.4.4 12 ✓
5.4.5 13 ✓ (5)

5.5 $(NH_4)_2SO_4$ ✓ (1)

5.6 Covalent bond✓. Electrons are shared✓ between the atoms of hydrogen and nitrogen.
Kovalente binding. Elektrone word gedeel tussen die atome van waterstof en stikstof. (2)

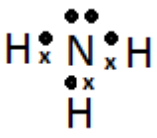
5.7



(2)

5.8 5 ✓ (1)

5.9



✓✓ (2)

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QUESTION 6/*VRAAG 6*

6.1 6.1.1 Reaction (ii) ✓/*Reaksie (ii)* (1)
6.1.2 Reaction (i) ✓/*Reaksie (i)* (1)

6.2 Gas phase ✓
Gasfase (1)

6.3 6.3.1 aluminium carbonate: $A\ell_2(CO_3)_3$ ✓✓
aluminiumkarbonaat: $A\ell_2(CO_3)_3$ (2)

6.3.2 aluminium oxide: $A\ell_2O_3$ ✓✓
aluminiumoksied: $A\ell_2O_3$ (2)

6.4 $C\ell_{2\ (g)} + H_{2\ (g)} \rightarrow 2HC\ell_{(g)}$ ✓✓ (2)

6.5 Reactants/*Reaktante*: M $(A\ell_2(CO_3)_3)$
= (2 x 27) + (3 x 12) + (9 x 16)
= 234 $g.mol^{-1}$ ✓

Products/Produkte: M $(A\ell_2O_3)$ + M $2(CO_2)$
=(2 x 27) + (3 x 16) + 2(12 + (2 x 16))
= 234 $g.mol^{-1}$ ✓

Thus the mass of the reactants = mass of the products ✓
Dus die massa van die reaktante = massa van die produkte. (3)

6.6 M(HCℓ) = 1 + 35,5
= 36,6 $g.mol^{-1}$ ✓

$$\%H = \frac{1}{36.5} \times 100$$
$$= 2,74\%$$ ✓

$$\%C\ell = \frac{35,5}{36,6} \times 100$$
= 97,26% ✓ (3)
[15]

QUESTION 7/*VRAAG 7*

7.1 An electrolyte is a solution that conducts electricity through the movement of ions. ✓✓
'n Elektroliet is 'n oplossing wat elektrisiteit gelei deur die beweging van ione. (2)

7.2 $KC\ell$ ✓ $\rightarrow$ K^+ ✓ + $C\ell^-$ ✓ (3)

7.3 $KC\ell : K^+$
1 : 1
Thus 2 mol of $KC\ell$ dissolves.✓✓
Dus 2 mol $KC\ell$ los op. (2)

7.4 $$\%K = \frac{39}{74,5} \times 100 \quad ✓$$
$$= 52,35\% \quad ✓$$ (2)

7.5 Increase ✓/*Toeneem* (1)

7.6 **NEGATIVE MARKING FROM QUESTION 7.5.**
NEGATIEWE NASIEN VAN VRAAG 7.5.
With an increase in concentration of the metal salt, potassium chloride, more ions are released ✓ into the solution. Thus more free ions are available to conduct electricity. ✓
Met 'n toename in die konsentrasie van die metaalsout, kaliumchloried, words meer ione in die oplossing vrygelaat. Dus is meer ione beskikbaar om elektrisiteit te gelei. (2)
[12]

QUESTION 8/*VRAAG 8*

8.1 8.1.1 The empirical formula is the simplest whole number ratio of atoms in a compound. ✓✓
Die empiriese formule is die eenvoudigste heelgetalverhouding van atome in 'n verbinding. (2)

8.1.2 If 100 g of the compound is available then:
Indien 100 g van die verbinding beskikbaar is, dan is daar:

53,3 g O	40 g C	6,6 g H
$M(O) = 16\ g{\cdot}mol^{-1}$	$M(C) = 12\ g{\cdot}mol^{-1}$	$M(H) = 1\ g{\cdot}mol^{-1}$
$n = m/M$	$n = m/M$	$n = m/M$
$n = 53,3/16$	$n = 40/12$	$n = 6,6/1$
$n = 3,3125\ mol$ ✓	$n = 3,3\ mol$ ✓	$n = 6,6\ mol$ ✓

Thus/*Dus*:

O	:	C	:	H
3,3125	:	3,3	:	6,6
3,3		3,3		3,3 ✓
1	:	1	:	2

Emiprical formula/*Empiriese formule* = $C\ H_2\ O$✓ (5)

8.1.3 $M(CH_2O)$
$= 12 + 2(1) + 16$
$= 30\ g{\cdot}mol^{-1}$ ✓

$$\frac{\text{Formule mass/}\textit{Formulemassa}}{\text{Empirical mass/}\textit{Empiriese massa}} = \frac{60}{30} = 2\ ✓$$

Thus the *molecular formula*
Dus is die molekulêre formule $= (CH_2O) \times 2$
$= C_2H_4O_2$ ✓ (3)

8.2 $M\ (Na_2CO_3) = 106\ g{\cdot}mol^{-1}$ ✓

$M\ (x\ H_2O) = 268 - 106$
$= 162\ g{\cdot}mol^{-1}$ ✓

$$n(H_2O) = \frac{16}{18} \quad ✓$$
$$= 9\ mol ✓$$

(4)
[14]

QUESTION 9/*VRAAG 9*

9.1 Temperature/*Temperatuur*: 0 °C or/*of* 273 K ✓
Pressure/*Druk*: 101,3 kPa or/*of* 1 atm ✓ (2)

9.2 9.2.1

$$n(Na) = \frac{m}{M} \quad \checkmark$$

$$= \frac{10}{23} \quad \checkmark$$

= 0,43 mol Na

Na : H_2
2 : 1 ✓

Thus 0,22 mol H_2 produced ✓
Dus 0,22 mol H_2 word geproduseer.

$$n(H_2) = \frac{m}{M}$$

$$0,22 = \frac{m}{2}$$

m = 0,44 g H_2 produced/*gevorm* ✓ (5)

9.2.2 **POSITIVE MARKING FROM 9.2.1**
POSITIEWE NASIEN VAN 9.2.1

$$n(H_2) = \frac{V}{V_m} \checkmark$$

$$0,22 = \frac{V}{22,4} \quad \checkmark$$

V = 4,93 dm^3 ✓ (3)

9.2.3 **POSITIVE MARKING FROM 9.2.1**
POSITIEWE NASIEN VAN 9.2.1

n(Na) : n(NaOH)
2 : 2 ✓
Thus mol NaOH = 0,43 mol
Dus mol NaOH = 0,43 mol

$$n(NaOH) = \frac{m}{M} \quad \checkmark$$

$$0,43 = \frac{m}{(23+16+1)} \checkmark$$

m = 17,2 g of NaOH produced/*gevorm*✓ (4)

9.2.4 **POSITIVE MARKING FROM 9.2.3**
POSITIEWE NASIEN VAN 9.2.1

$c = \frac{n}{V}$ ✓

$c = \frac{0,43}{2}$ ✓

$c = 0,22\ mol.dm^{-3}$ ✓ (3)

[16]

QUESTION 10/*VRAAG 10*

10.1 Precipitate ✓/*Presipitaat/Neerslag* (1)

10.2 10.2.1 Step I: $BaCl_2$ ✓
Step II: no reaction ✓

Stap I: $BaCl_2$
Stap II: geen reaksie ✓ (2)

10.2.2 Step I: $AgNO_3$ ✓
Step II: HNO_3 ✓

Stap I: $AgNO_3$
Stap II: HNO_3 (2)

10.2.3 White ✓/*Wit* (1)

10.3 10.3.1 C ✓ (1)
10.3.2 D ✓ (1)
10.3.3 A ✓ (1)

10.4 Precipitation ✓/*Presipitasie (neerslag)*
Evaporation ✓/*Verdamping*
Condensation ✓/*Kondensasie* (3)

10.5 Building dams that store drinking water and water for household needs or agriculture.
Boreholes are used to tap ground water for use.
Any applicable answer. ✓✓

Bou damme vir drinkwater en huishoudelike gebruik of landbou.
Boorgate word gebruik om grondwater te gebruik.
Enige aanvaarbare antwoord. ✓✓ (2)

[14]

TOTAL/*TOTAAL*: 150