basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES: CHEMISTRY (P2)

NOVEMBER 2018

MARKS: 150

TIME: 2 hours

This question paper consists of 14 pages and 2 data sheets.

INSTRUCTIONS AND INFORMATION

1.　　　Write your name and class (e.g. 10A) in the appropriate spaces on the ANSWER BOOK.

2.　　　This question paper consists of TEN questions. Answer ALL the questions in the ANSWER BOOK.

3.　　　Start EACH question on a NEW page in the ANSWER BOOK.

4.　　　Number the answers correctly according to the numbering system used in this question paper.

5.　　　Leave ONE line between two subquestions, e.g. between QUESTION 2.1 and QUESTION 2.2.

6.　　　You may use a non-programmable calculator.

7.　　　You may use appropriate mathematical instruments.

8.　　　You are advised to use the attached DATA SHEETS.

9.　　　Show ALL formulae and substitutions in ALL calculations.

10.　　Round off your final numerical answers to a minimum of TWO decimal places.

11.　　Give brief motivations, discussions, etc. where required.

12.　　Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write only the letter (A–D) next to the question numbers (1.1 to 1.10) in the ANSWER BOOK, e.g. 1. 11 D.

1.1   Which ONE of the following substances is NOT a pure substance?

    A   Iron

    B   Sugar

    C   Steel

    D   Graphite   (2)

1.2   The CORRECT chemical formula for potassium nitrate is …

    A K_3N

    B PNO_3

    C KNO_3

    D K_2NO_3 (2)

1.3   Different isotopes of the same element have different …

    A   atomic numbers.

    B   numbers of neutrons.

    C   numbers of protons.

    D   numbers of electrons.   (2)

1.4   Which ONE of the following ionisation equations represents the second ionisation of magnesium?

    A $Mg(g) + energy \rightarrow Mg^+ + e^-$

    B $Mg^+(s) + energy \rightarrow Mg^{2+} + 2e^-$

    C $Mg^+(g) + energy \rightarrow Mg^{2+} + 2e^-$

    D $Mg(s) + energy \rightarrow Mg^+ + e^-$ (2)

1.5   Which PAIR of elements is most likely to have a similar arrangement of outer electrons and similar chemical behaviour?

    A   Boron and aluminium

    B   Helium and fluorine

    C   Carbon and nitrogen

    D   Chlorine and oxygen   (2)

1.6   Which ONE of the following statements is INCORRECT about the properties of a physical change?

    A   When a physical change occurs, the compounds may rearrange themselves, but the bonds in between the atoms will not break.

    B   Physical change in matter is reversible.

    C   Energy is absorbed when matter changes from a solid to a liquid.

    D   Molecules are not conserved during a physical change.   (2)

1.7   In the compound, H_2O, the ratio of the MASS of hydrogen to oxygen is always …

    A   1 : 2.

    B   2 : 1.

    C   1 : 8.

    D   1 : 16.   (2)

1.8   One mole of H_2SO_4 contains …

    A   7 atoms.

    B   1 molecule.

    C $6,02 \times 10^{23}$ molecules.

    D $42,14 \times 10^{23}$ molecules.   (2)

1.9   Which ONE of the following solutions will NOT form a precipitate if added to a
        solution of silver nitrate?

      A $NaCl(aq)$

      B $MgBr_2(aq)$

      C $KI(aq)$

      D $Mg(NO_3)_2(aq)$ (2)

1.10   The sphere in which minerals are found is known as …

      A   atmosphere.

      B   biosphere.

      C   lithosphere.

      D   stratosphere.   (2)
                                                                                               [20]

QUESTION 2 (Start on a new page.)

The diagram below shows three different substances, **P**, **Q** and **R**.

SUBSTANCE P	SUBSTANCE Q	SUBSTANCE R
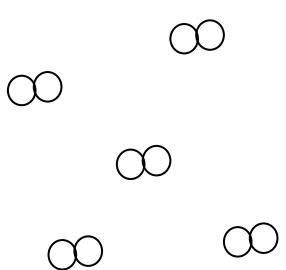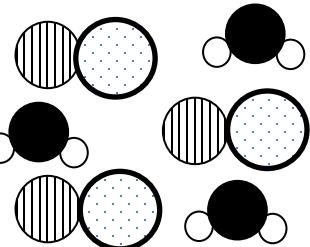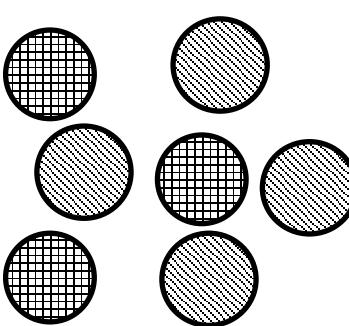
| KEY			
○	Hydrogen		Chlorine
●	Oxygen		Sulphur
	Sodium		Iron

2.1 Define the term *element*. (2)

Use the diagram and the key provided to answer the questions that follow.

2.2 Write down a LETTER that represents the following:

    2.2.1 Pure substance (1)

    2.2.2 Homogeneous mixture (1)

    2.2.3 Heterogeneous mixture (1)

2.3 Indicate whether the pure substance identified in QUESTION 2.2.1 is an element or a compound. (1)

2.4 Which physical method would you use to separate substance **Q** into its components? (1)

2.5 Write down the physical property upon which the separation techniques are based to separate the following substances into their individual components:

    2.5.1 **Q** (1)

    2.5.2 **R** (1)

[9]

QUESTION 3 (Start on a new page.)

The vapour pressure versus temperature graph below was obtained for four unknown liquids (**A**, **B**, **C** and **D**). Atmospheric pressure is measured as 101,3 kPa.

Vapour pressure versus temperature
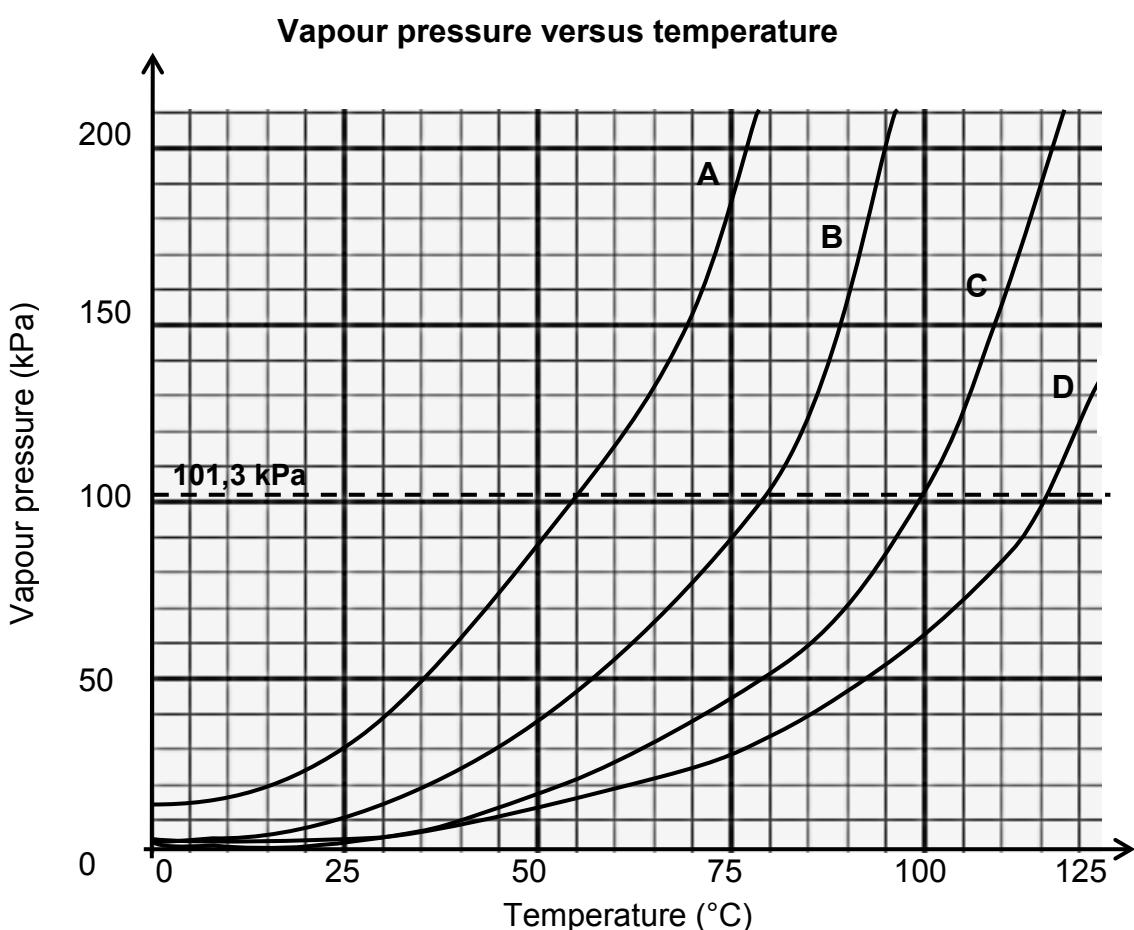
3.1 Define the term *boiling point*. (2)

Use the information given in the graph to answer the questions that follow.

3.2 Write down the:

    3.2.1 Boiling point of liquid **B** (1)

    3.2.2 Liquid which remains a liquid at 115 °C (1)

    3.2.3 Liquid that is most likely to be water (1)

3.3 State the PHASE CHANGE that takes place at the stage when the vapour pressure is equal to atmospheric pressure. (1)

3.4 What happens to the temperature of a liquid during a phase change? Write down only INCREASES, DECREASES or REMAINS THE SAME. (1)

3.5 Explain the answer to QUESTION 3.4. (2)

3.6 Which liquid (**A**, **B**, **C** or **D**) has the weakest intermolecular forces? Give a reason for the answer. (3)

3.7 What is the relationship between vapour pressure of the liquid and temperature? (2)

[14]

QUESTION 4 (Start on a new page.)

Study the table below and answer the questions that follow.

ELEMENT/ION	NUMBER OF PROTONS	NUMBER OF NEUTRONS	NUMBER OF ELECTRONS
P	11	12	11
Q	14	16	14
R	16	16	18

4.1   Define the term *atomic number.*   (2)

4.2   Write down the:

   4.2.1   Chemical symbol of element **Q** using the notation $^A_Z X$ (2)

   4.2.2   Element (**P**, **Q** or **R**) that is an alkali metal   (1)

   4.2.3   Chemical symbol of **R**   (2)

4.3   Element **P** reacts with oxygen to form the compound with the chemical formula P_2O.

   4.3.1   Predict the chemical formula that element Rb in the periodic table will form when it reacts with oxygen.   (2)

   4.3.2   Explain the answer to QUESTION 4.3.1.   (2)

4.4   What is the trend in ionisation energy as you move from element **P** to element **R**? Write down only INCREASES, DECREASES or REMAINS THE SAME. Explain the answer.   (4)

4.5   How many electrons does an ION of element **P** have? Draw the Aufbau diagram of this ion.   (3)

4.6   When orbitals of identical energy are available, electrons are placed in individual orbitals before they are paired. Give the name of this rule.   (1)

4.7   Element **Y** occurs as these isotopes in the following proportions:

   Y – 28(92,23%); **Y** – 29(4,68%); **Y** – 30(3,09%)

   Calculate the relative atomic mass of element **Y**.   (3)

   [22]

QUESTION 5 (Start on a new page.)

Study the physical and chemical processes below and answer the questions that follow.

X: $H_2O(s) \rightarrow H_2O(g)$

Y: $CaCO_3(s) \underset{\Delta}{\rightarrow} CaO(s) + CO_2(g)$

Z: Iron + Oxygen $\rightarrow$ Iron(III) oxide
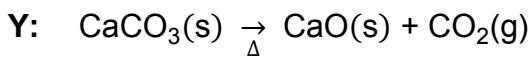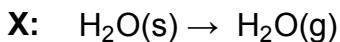
5.1   Define the term *physical change.*   (2)

5.2   Write down the LETTER of the process that represents the following:

    5.2.1   Physical change   (1)

    5.2.2   Decomposition reaction   (1)

5.3   Give the name of the physical change stated in QUESTION 5.2.1.   (1)

5.4   State TWO properties of a reaction that indicate that a chemical change has taken place.   (2)

5.5   For process **Z**, write down:

    5.5.1   What the symbol Δ represents   (1)

    5.5.2   A BALANCED CHEMICAL EQUATION (Show the phases of ALL reactants and products.)   (4)

5.6   A 20 g sample of $CaCO_3(s)$ in process **Y** decomposes to form 11,2 g of CaO. In a second sample, 30 g decomposes to form x g of CO_2.

    5.6.1   State the *law of constant composition*.   (2)

    5.6.2   Use the law in QUESTION 5.6.1 to calculate mass x of the CO_2 formed.   (4)

                                       [18]

QUESTION 6 (Start on a new page.)

Study the diagram below showing structures of two different substances (**A** and **B**) and answer the questions that follow.

SUBSTANCE A	SUBSTANCE B
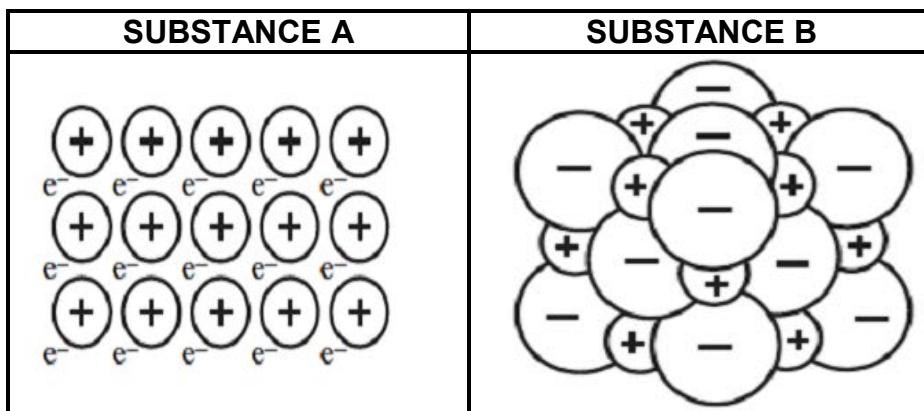
6.1   Choose the substance (**A** or **B**) that describes the following:

     6.1.1   Metallic structure   (1)

     6.1.2   Structure of magnesium chloride   (1)

6.2   Explain how the type of bond in substance **A** forms.   (2)

6.3   Name the type of bond that exists in substance **B**.   (1)

6.4   Magnesium and chlorine react to form compound magnesium chloride.

     6.4.1   Define the term *compound.*   (2)

     6.4.2   Write down the NAME of the group to which magnesium belongs.   (1)

     6.4.3   Write down the valency of a chlorine atom.   (1)

     6.4.4   Use the Lewis dot diagram to show the formation of magnesium chloride.   (3)

[12]

QUESTION 7 (Start on a new page.)

A group of learners prepare a 0,25 mol·dm^{-3} solution of sodium carbonate by dissolving a 14,2 g sample of hydrated sodium carbonate (Na_2CO_3·xH_2O) in 200 cm^3 of water.

7.1   Explain the meaning of the term *hydrated*.   (1)

7.2   Write down a BALANCED CHEMICAL EQUATION to show how sodium carbonate dissociates in water.   (2)

7.3   Learners then take 10 cm^3 of the prepared solution and allow it to react completely with 5 cm^3 of dilute hydrochloric acid, according the following balanced chemical equation:

$$Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$$
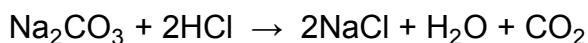
   7.3.1   Define the term *a mole of a substance.*   (2)

   7.3.2   What type of chemical reaction is represented by the chemical equation above?   (1)

   7.3.3   Calculate the number of moles of hydrochloric acid in 5 cm^3 of hydrochloric acid if its concentration is 1 mol·dm^{-3}.   (3)

7.4   Calculate the mass of sodium chloride formed in the reaction in QUESTION 7.3.   (5)
                                                                                          [14]

QUESTION 8 (Start on a new page.)

Learners investigate how the type of substance affects electrical conductivity of the substance. They conduct three experiments using three different substances under the same conditions, as shown in the table below.

EXPERIMENT	MASS OF SUBSTANCE (g)	TYPE OF SUBSTANCE	TEMPERATURE (°C)
1	2	Solution of $CaCl_2$	25
2	2	Solution of KCl	25
3	2	Solution of sugar	25

8.1 Define the term *electrolyte*. (2)

8.2 For the investigation, write down the:

    8.2.1 Investigative question (2)

    8.2.2 Dependent variable (1)

    8.2.3 Independent variable (1)

    8.2.4 Controlled variable (1)

8.3 For the investigation, predict with reasons the substance that will yield the following:

    8.3.1 The highest conductivity (2)

    8.3.2 Zero conductivity (2)

8.4 The substance tested in Experiment **3** was analysed. It was found to contain 40% carbon, 6,67% hydrogen and 53,33% oxygen.

    Determine the molecular formula if the molar mass is 180 g·mol^{-1}. (7)

    [18]

QUESTION 9 (Start on a new page.)

Two test tubes, **A** and **B**, both contain a sodium salt solution. After a small amount of barium chloride is added, the solution in both test tubes forms a white precipitate.

Barium chloride solution

Test tube **A**   Test tube **B**
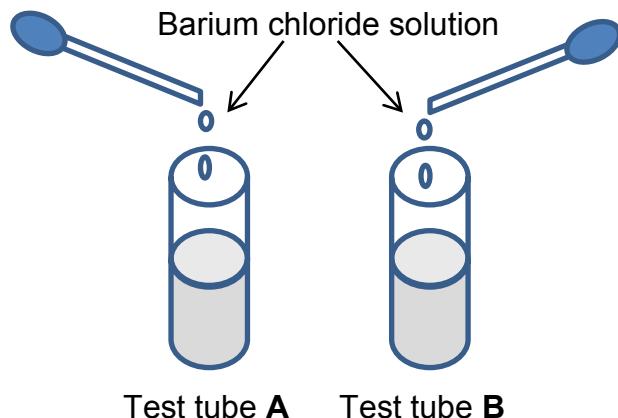
9.1   Write down the type of reaction that takes place in the test tubes.   (1)

9.2   A concentrated nitric acid solution is then added into each test tube to establish which one contains carbonate ions and which one contains sulphate ions.

Bubbles are formed in test tube **A**. There is no reaction in test tube **B**.

Test tube **A**   Test tube **B**
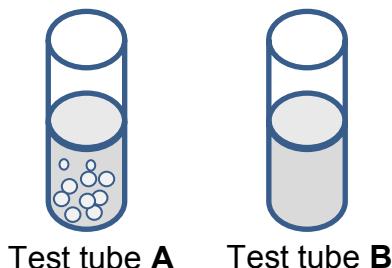
9.2.1   Identify which IONS (CARBONATE or SULPHATE) are present in test tube **B**.   (1)

9.2.2   Write down a BALANCED CHEMICAL EQUATION that represents the reaction between nitric acid and the precipitate formed in test tube **A**.   (3)

9.3   A solution of sodium carbonate was prepared by dissolving 5 g of the powder in 100 cm^3 of water. The solution reacted with a barium chloride solution, according to the following balanced chemical equation:

$$Na_2CO_3(aq) + BaCl_2(aq) \rightarrow BaCO_3(s) + 2NaCl(aq)$$
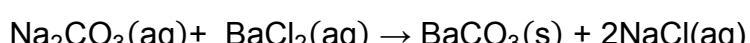
9.3.1   Calculate the mass of barium carbonate that should form in this reaction.   (5)

It was found that only 8,3 g precipitate formed.

9.3.2   Calculate the percentage yield.   (2)

[12]

QUESTION 10 (Start on a new page)

The diagram below shows how the hydrosphere is linked to the biosphere. Study the diagram and answer the questions that follow.
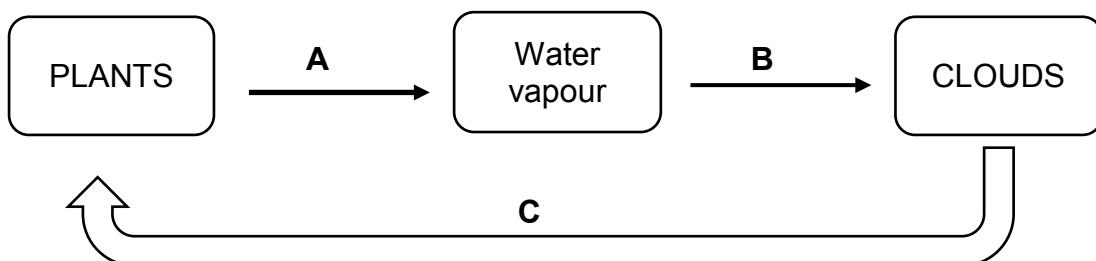
10.1　　Differentiate between the *hydrosphere* and *biosphere*.　　　　(2)

10.2　　Write down the name of process:

　　　　10.2.1　**A**　　　　　　　　　　　　　　　　　　　　　(1)

　　　　10.2.2　**B**　　　　　　　　　　　　　　　　　　　　　(1)

　　　　10.2.3　**C**　　　　　　　　　　　　　　　　　　　　　(1)

10.3　　Describe the energy changes during processes **A** and **B**. Write down only ENERGY GAINED or ENERGY LOST.　　　　(2)

10.4　　Describe the interaction between the hydrosphere and plants.　　　　(4)
　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　[11]

　　　　　　　　　　　　　　　　　　　　　　　　TOTAL:　　**150**

DATA FOR PHYSICAL SCIENCES GRADE 10
PAPER 2 (CHEMISTRY)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 10
VRAESTEL 2 (CHEMIE)

TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES*

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Standard pressure *Standaarddruk*	p^{θ}	$1,013 \times 10^5$ Pa
Molar gas volume at STP *Molêre gasvolume by STD*	V_m	$22,4$ dm$^3 \cdot$mol^{-1}
Standard temperature *Standaardtemperatuur*	T^{θ}	273 K
Charge on electron *Lading op elektron*	e	$1,6 \times 10^{-19}$ C

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

$n = \dfrac{m}{M}$	$n = \dfrac{N}{N_A}$
$c = \dfrac{n}{V}$ OR/*OF* $c = \dfrac{m}{MV}$	$n = \dfrac{V}{V_m}$

TABLE 3: THE PERIODIC TABLE OF ELEMENTS/*TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE*

KEY/*SLEUTEL*

Atomic number
Atoomgetal

Electronegativity
Elektronegatiwiteit

29
Cu
1,9
63,5

Symbol
Simbool

Approximate relative atomic mass
Benaderde relatiewe atoommassa

1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)
1 **H** 2,1 1																	2 **He** 4
3 **Li** 1,0 7	4 **Be** 1,5 9											5 **B** 2,0 11	6 **C** 2,5 12	7 **N** 3,0 14	8 **O** 3,5 16	9 **F** 4,0 19	10 **Ne** 20
11 **Na** 0,9 23	12 **Mg** 1,2 24											13 **Aℓ** 1,5 27	14 **Si** 1,8 28	15 **P** 2,1 31	16 **S** 2,5 32	17 **Cℓ** 3,0 35,5	18 **Ar** 40
19 **K** 0,8 39	20 **Ca** 1,0 40	21 **Sc** 1,3 45	22 **Ti** 1,5 48	23 **V** 1,6 51	24 **Cr** 1,6 52	25 **Mn** 1,5 55	26 **Fe** 1,8 56	27 **Co** 1,8 59	28 **Ni** 1,8 59	29 **Cu** 1,9 63,5	30 **Zn** 1,6 65	31 **Ga** 1,6 70	32 **Ge** 1,8 73	33 **As** 2,0 75	34 **Se** 2,4 79	35 **Br** 2,8 80	36 **Kr** 84
37 **Rb** 0,8 86	38 **Sr** 1,0 88	39 **Y** 1,2 89	40 **Zr** 1,4 91	41 **Nb** 92	42 **Mo** 1,8 96	43 **Tc** 1,9	44 **Ru** 2,2 101	45 **Rh** 2,2 103	46 **Pd** 2,2 106	47 **Ag** 1,9 108	48 **Cd** 1,7 112	49 **In** 1,7 115	50 **Sn** 1,8 119	51 **Sb** 1,9 122	52 **Te** 2,1 128	53 **I** 2,5 127	54 **Xe** 131
55 **Cs** 0,7 133	56 **Ba** 0,9 137	57 **La** 139	72 **Hf** 1,6 179	73 **Ta** 181	74 **W** 184	75 **Re** 186	76 **Os** 190	77 **Ir** 192	78 **Pt** 195	79 **Au** 197	80 **Hg** 201	81 **Tℓ** 1,8 204	82 **Pb** 1,8 207	83 **Bi** 1,9 209	84 **Po** 2,0	85 **At** 2,5	86 **Rn**
87 **Fr** 0,7	88 **Ra** 0,9 226	89 **Ac**															

58 **Ce** 140	59 **Pr** 141	60 **Nd** 144	61 **Pm**	62 **Sm** 150	63 **Eu** 152	64 **Gd** 157	65 **Tb** 159	66 **Dy** 163	67 **Ho** 165	68 **Er** 167	69 **Tm** 169	70 **Yb** 173	71 **Lu** 175
90 **Th** 232	91 **Pa**	92 **U** 238	93 **Np**	94 **Pu**	95 **Am**	96 **Cm**	97 **Bk**	98 **Cf**	99 **Es**	100 **Fm**	101 **Md**	102 **No**	103 **Lr**

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REPUBLIC OF SOUTH AFRICA

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

GRADE/*GRAAD* 10

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

NOVEMBER 2018

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 150

These marking guidelines consist of 10 pages.
Hierdie nasienriglyne bestaan uit 10 bladsye.

NOTE/NOTA:* Ignore 1.4/ *Ignoreer 1.4 and
 Question 8.4 molecular formula not in CAPS */Vraag 8.4 molekulere
 formule nie in KABV
 MARKS/*PUNTE*: 141

QUESTION 1/*VRAAG 1*

1.1   C ✓✓   (2)

1.2   C ✓✓   (2)

1.3   B ✓✓   (2)

1.4   (Ignore this question/*Ignoreer hierdie vraag*)

1.5   A ✓✓   (2)

1.6   D ✓✓   (2)

1.7   C ✓✓   (2)

1.8   C ✓✓   (2)

1.9   D ✓✓   (2)

1.10   C ✓✓   (2)

[18]

QUESTION 2/*VRAAG 2*

2.1   A pure substance consisting of one type of atom. ✓✓/*'n Suiwer stof wat uit een tipe atoom bestaan.* (2)

2.2.1   P ✓   (1)

2.2.2   Q ✓

                                                                                       (1)

2.2.3   R ✓

                                                                                       (1)

2.3   Element ✓   (1)

2.4   Evaporation ✓/*Verdamping*   (1)

2.5.1   Q: Boiling point ✓/*Kookpunt*   (1)

2.5.2   R: Magnetism ✓/*Magnetisme*   (1)

[9]

QUESTION 3/*VRAAG 3*

3.1   The temperature of the liquid at which the vapour pressure equals the external (atmospheric) pressure. ✓✓/*Die temperatuur van die vloeistof waarteen die dampdruk aan die eksterne (atmosferiese) druk gelyk is.*   (2)

3.2.1   80 °C ✓   (1)

3.2.2   D ✓   (1)

3.2.3   C ✓   (1)

3.3   Liquid changes to gas ✓/*Vloeistof verander na gas*   (1)

3.4   Remains the same. ✓/*Bly dieselfde*   (1)

3.5   Energy is used to overcome the intermolecular forces. ✓/*Energie word gebruik om die intermolekulêre kragte te oorkom.*
No energy available to increase the kinetic energy of the particles. ✓/*Geen energie beskikbaar om die kinetiese energie van die partikels te verhoog nie.*   (2)

3.6   A ✓
Lowest boiling point. ✓✓/*Laagste kookpunt*

   OR/*OF*

Highest vapour pressure at a specific temperature./*Hoogste dampdruk by 'n spesifieke temperatuur*   (3)

3.7   Vapour pressure increases with an increase in temperature. ✓✓/*Dampdruk verhoog wanneer temperatuur verhoog.*

   OR/*OF*

Vapour pressure is proportional to temperature. ✓✓/*Dampdruk is direk eweredig aan temperatuur.*   (2)

[14]

QUESTION 4/*VRAAG 4*

4.1   The <u>number of protons</u> in an atom of an element ✓✓/*Die aantal protone in 'n atoom van 'n element*   (2)

4.2.1 $^{30}_{14}$Si ✓✓ $^{28}_{14}$Si✓

• Identification of element (Si)/ *Identifiseer element (Si)*✓ • Correct mass number and atomic number (A and Z)/*Korrekte massagetal en atoomgetal (A en Z)*✓ • No mark for swopping of A and Z/*Geen punt indien A en Z omgeruil word*	(2)

4.2.2   P ✓ / Sodium / Na/ *Natrium*   (1)

4.2.3 S^{2-} ✓✓

• Identification of correct element (S)/*Identifiseer korrekte element (S)*✓ • Correct charge (2-)/*Korrekte lading (2-)*✓ • Incorrect identification of element/*Verkeerde element* (0/2)	(2)

4.3.1 Rb_2O ✓✓   (2)

4.3.2   Rb is in the same group as P / Na✓ /*Rb is in dieselfde groep as P/ Na*
         OR/OF Rb is in group 1/*Rb is in groep 1*
         ∴ has the same valency as P/ Na. ✓/ ∴ *het dieselfde valensie as P/ Na.*   (2)

4.4   Increases. ✓/*Neem toe*
         From P to R, the atomic radius gets smaller. ✓ **OR/OF** The outer electrons get closer to the nucleus.
         Van P na R raak die atomiese radius kleiner./Die buite-elektrone kom nader aan die kern.
         The attraction between the nucleus and the outer electron gets stronger ✓ ∴ more energy is needed to remove the electrons. ✓/*Die aantrekkingskrag tussen die kern en die buite-elektrone raak sterker* ∴ *meer energie is nodig om die elektrone te verwyder.*   (4)

4.5   10 (electrons) ✓
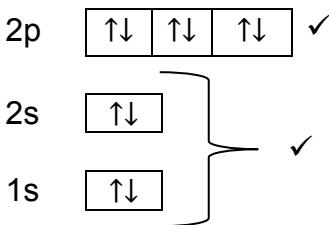
2p | ↑↓ | ↑↓ | ↑↓ | ✓

2s | ↑↓ |

1s | ↑↓ | ✓   (3)

4.6   Hund's rule ✓/*Hund se reël*   (1)

4.7   Relative atomic mass/*Relatiewe atoommassa*:

$$A_r = \frac{(28 \times 92{,}23 + 29 \times 4{,}68 + 30 \times 3{,}09)\checkmark}{100 \, \checkmark}$$

$$= 28{,}11 \, (u) \, \checkmark \tag{3}$$

[22]

QUESTION 5/*VRAAG 5*

5.1   A change in which no new substances are formed. $\checkmark\checkmark$/*'n Verandering waarin geen nuwe stowwe gevorm word nie.*

OR/*OF*

A change in which energy changes are small in relation to chemical changes. $\checkmark\checkmark$/*'n Verandering waarin energieveranderinge klein is in vergelyking met chemiese veranderinge.*

OR/*OF*

A change in which mass, number of atoms and molecules are being conserved. $\checkmark\checkmark$/*'n Verandering waarin massa, getal atome en molekule behoue bly.*   (2)

5.2.1   X $\checkmark$ (1)

5.2.2   Y $\checkmark$ (1)

5.3   Sublimation. $\checkmark$/*Sublimasie*   (1)

5.4   Colour change. $\checkmark$/*Kleurverandering*

Formation of gas $\checkmark$/*Vorming van gas*

Formation of a precipitate $\checkmark$/*Vorming van 'n neerslag*

Change in temperature $\checkmark$/*Verandering in temperatuur*   (Any two/*Enige twee*)   (2)

5.5.1   Heat. $\checkmark$/*Hitte*   (1)

5.5.2 $4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(s)$ (4)

Notes/*Aantekeninge*
• Reactants$\checkmark$; products$\checkmark$; phases$\checkmark$; balancing$\checkmark$ *Reaktanse/produkte/fases/balansering* Marking rule 6.3.10./*Nasienreël 6.3.10.*

5.6.1   States that, no matter how a chemical compound is prepared, it always contains <u>the same elements in the same proportion by mass</u>. $\checkmark\checkmark$/*Stel dit dat dit nie saak maak hoe 'n chemiese binding berei word nie; dit bevat <u>altyd dieselfde elemente in dieselfde verhouding by massa</u>.*   (2)

5.6.2 **OPTION 1/ *OPSIE 1*:**

Mass of CO_2 in the 1st sample/*Massa van CO_2 in die 1ste monster*
  = 20 – 11,2✓
  = 8,8 g

Proportion of CO_2 in the 1st sample/*Verhouding van CO_2 in die 1ste monster*
  = $\frac{8,8}{20}$ ✓

∴ Mass of CO_2 in the 2nd sample/*Massa van CO_2 in die 2de monster*
  = $\frac{8,8}{20}$ x 30 ✓

  = 13,2 g✓

(4)

OPTION 2/ *OPSIE 2*:	**OPTION 3/ *OPSIE 3*:**
100 g $CaCO_3$ → 44 g CO_2 ✓ 30 g $CaCO_3$ → x g CO_2 ✓ x = $\frac{30 \times 44}{100}$ ✓ x = 13,2 g✓	20 g $CaCO_3$ → 11,2 g CaO ✓ 30 g $CaCO_3$ → x g CaO ✓ x = 16, 83 g CaO ∴ Mass of CO_2 in the 2nd sample/ *Massa van CO_2 in die 2de monster* = 30 – 16, 83✓ = 13,2 g✓

[18]

QUESTION 6/*VRAAG 6*

6.1.1   A ✓ (1)

6.1.2   B ✓ (1)

6.2   It is formed when a pool of <u>delocalised electrons</u>✓ <u>surround the positive metal ion core.</u>✓/*Rooster metaal ione met wolk/poel gedelokaliseerde elektrone wat positiewe ioonkerne omring* (2)

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

6.4.1   A pure substance consisting of two or more different elements. ✓✓/*'n Suiwer stof wat uit twee of meer verskillende elemente bestaan.* (2)

6.4.2   Alkali earth ✓ (metals)/*Aardalkali (metale)* (1)

6.4.3   1 (one/*een*) ✓ (1)

6.4.4

(3)
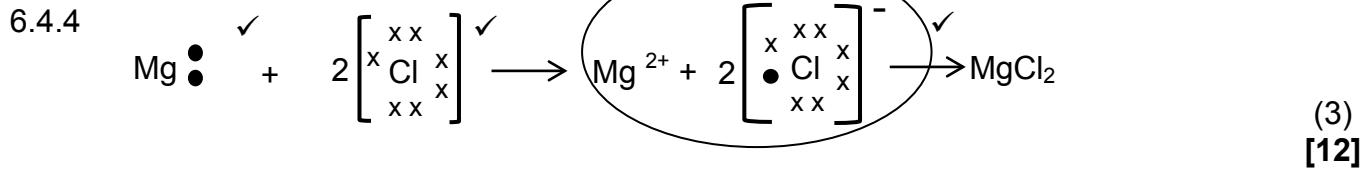
[12]

QUESTION 7/*VRAAG 7*

7.1 Hydrated: surrounded by water molecules✓/*Gehidrateer: omring deur water molekules* (1)

7.2 $Na_2CO_3(s) \rightarrow 2Na^+(aq) + CO_3^{2-}(aq)$
Products: ✓ Balancing: ✓/*Produkte:/Balansering:* (2)

7.3.1 The amount of a substance having the same number of particles as there are atoms in 12 g carbon-12. ✓✓/*Die hoeveelheid van 'n stof met dieselfde getal partikels as wat daar atome in 12 g koolstof-12 is.* (2)

7.3.2 Acid-base ✓/gas forming (reaction)/*Suur-basis/gasvormend (reaksie)* (1)

7.3.3
$$c\,(HCl) = \frac{n\,(HCl)}{V\,(HCl)} \checkmark$$

$$1 = \frac{n\,(HCl)}{0,005} \checkmark$$

$$n = 0,005 \text{ mol} \checkmark$$
(3)

7.4 **POSITIVE MARKING FROM 7.3.3/ *POSITIEWE NASIEN VANAF 7.3.3***

$n(NaCl) : n(HCl) = 1 : 1$

$$n(NaCl) = \frac{1}{1} \times 0,005 \checkmark$$

$$n(NaCl) = 0,005 \text{ mol}$$

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

$$0,005\checkmark = \frac{m}{58,5\checkmark} \checkmark$$

$$m = 0,29 \text{ g} \checkmark$$

Marking criteria/*Nasienriglyne*:
- **Using** ratio/***Gebruik** verhouding*✓
- Formula/*Formule* n = $\frac{m}{M}$ ✓
- Substituting of/ *Invervanging van* 0,005 mol✓ & 58,5 g·mol⁻¹ ✓in n = $\frac{m}{M}$
- Final answer/*Finale antwoord*: 0,29 g ✓

(5)
[14]

QUESTION 8/*VRAAG 8*

8.1 A <u>solution that conducts electricity</u>✓✓ (through the movement of ions). / *'n Oplossing wat elektrisiteit deur die beweging van ione gelei.*
NOTE/*LET WEL*: If learners refer to movement of electrons, a mark is forfeited/*Indien leerder verwys na beweging van elektrone, penaliseer met 1 punt.* (2)

8.2.1 What is the relationship between a type of substance and its (electrical) conductivity? ✓✓/*Wat is die verwantskap tussen 'n tipe stof en sy (elektriese) geleidingsvermoë?*

OR/*OF*

How does a type of substance affect the (electrical) conductivity of a substance? ✓✓/*Hoe beïnvloed 'n tipe stof die (elektriese) geleidingsvermoë van 'n stof?*   (2)

Marking Criteria/Nasienriglyne:	
Dependent and independent variable correctly stated. *Afhanklike en onaafhanklike veranderlikes korrek genoem.*	✓
Ask a question about the relationship between the independent and dependent variables. *Vra 'n vraag oor die verwantskap tussen die onafhanklike en afhanklike veranderlikes.*	✓

8.2.2   Conductivity ✓/*Geleidingsvermoë*   (1)

8.2.3   Type of a substance ✓/*Tipe stof*   (1)

8.2.4   Mass OR Temperature ✓/*Massa OF Temperatuur*   (1)

8.3.1   A solution of $CaCl_2$ ✓/*'n Oplossing $CaCl_2$*
It is the strongest electrolyte ✓/*Dit is die sterkste elektroliet.*

   OR/*OF*

   It has the highest concentration of (chloride) ions ✓/*Dit het die grootste getal (chloried) ione.*   (2)

8.3.2   A solution of sugar ✓/*'n Oplossing van suiker*
It contains no free ions. ✓/*Dit bevat geen vrye ione nie.*   (2)

8.4   n(C):C(H):n(O)   [**ignore this question**]

$$\frac{m(C)}{M[C]} : \frac{m(H)}{M[H]} : \frac{m(O)}{M[O]}$$

Assume mass of 100 g of a sample/*Aanvaar massa van 100 g van 'n monster*

$$\frac{40}{12}✓ : \frac{6,67}{1}✓ : \frac{53,33}{16}✓$$

3,33 : 6,67 : 3,33

$$\frac{3,33}{3,33} : \frac{6,67}{3,33} : \frac{3,33}{3,33}$$

1 : 2 : 1✓

Empirical formula/*Empiriese formule*: CH_2O

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

Factor/*Faktor* $= \frac{180}{30} = 6$✓

∴ Molecular formula/*Molekulêre formule* is: $C_6H_{12}O_6$ ✓   (7)

[11]

QUESTION 9/*VRAAG 9*

9.1   Precipitation reaction ✓/*Presipitasiereaksie*   (1)

9.2.1   Sulphate ✓/*Sulfaat*   (1)

9.2.2 $BaCO_3 + 2HNO_3$ ✓ $\rightarrow Ba(NO_3)_2 + CO_2 + H_2O$✓
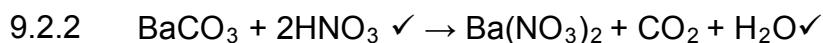
Reactants✓; products✓; balancing✓
Reaktanse/produkte/ balansering   (3)

9.3.1 $n(Na_2CO_3) = \dfrac{m}{M}$ ✓

$= \dfrac{5}{106}$ ✓

$= 0,047$ mol

$n(BaCO_3) : n(Na_2CO_3)$

$1 : 1$✓

$m(BaCO_3) = n \times M$

$= 0,047 \times 197$✓

$= 9,26$ g ✓   (Range/*Gebied*: 9,25 – 9,87)   (5)

> Marking criteria/*Nasienriglyne*:
> - Formula/*Formule* n = $\frac{m}{M}$ ✓
> - Substitution/*Invervanging* ✓
> - Using ratio/*Gebruik verhouding* ✓
> - Multipy by/*Vermenigvulding met* 197 g·mol^{-1} ✓in n = $\frac{m}{M}$
> - Final answer/*Finale antwoord*: 9,26 g ✓

9.3.2   **POSITIVE MARKING FROM 9.3.1/ *POSITIEWE NASIEN VANAF 9.3.1***

% yield/*opbrengs* $= \dfrac{\text{actual yield/\textit{werklike opbrengs}}}{\text{theoretical yield/\textit{teoretiese opbrengs}}} \times 100$

$= \dfrac{8,3}{9,26} \times 100$ ✓

$= 89,63\%$✓   (Range/*Gebied*: 84,26 – 89,64)   (2)

[12]

QUESTION 10/*VRAAG 10*

10.1   Hydrosphere: includes all water of the earth found as liquid water ✓
Hidrosfeer: sluit alle water van die aarde in wat as vloeibare water gevind word
Biosphere: includes all the living organisms. ✓/*Biosfeer: sluit alle lewende organismes in*   (2)

10.2.1   (A) Transpiration ✓/*Transpirasie*

10.2.2   (B) Condensation ✓/*Kondensasie*

10.2.3   (C) Precipitation ✓/*Presipitasie*   (3)

10.3   (A) Energy gained ✓/*Energie gewen*

          (B) Energy lost. ✓/*Energie verloor*   (2)

10.4   Roots of plants absorb water from the ground. ✓/*Plantwortels absorbeer water uit die grond.*
Plants release the water to the atmosphere by transpiration. ✓/*Plante stel water deur transpirasie aan die atmosfeer vry.*
The water condenses to form clouds. ✓/*Die water kondenseer om wolke te vorm.*
Then water falls back to the ground by precipitation. ✓/*Water val dan terug grond toe deur presipitasie.*   (4)
[11]

TOTAL/*TOTAAL*:   150/
FINAL TOTAL: 141