basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

PHYSICAL SCIENCES: CHEMISTRY (P2)

NOVEMBER 2016

NATIONAL SENIOR CERTIFICATE

GRADE 10

MARKS: 150

TIME: 2 hours

This question paper consists of 12 pages and 2 data sheets.

INSTRUCTIONS AND INFORMATION

1. Write your name and class (for example 10A) in the appropriate spaces on the ANSWER BOOK.
2. This question paper consists of 10 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, for example 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 et cetera where required.
12. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Four 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 number (1.1–1.10) in the ANSWER BOOK, for example 1.11 E.

1.1 Which ONE of the following groups of elements are classified as halogens?

A Li, Na, K

B Ne, Ar, Kr

C F, Cℓ, Br

D Si, Ge, As (2)

1.2 According to the kinetic molecular theory the particles of a solid ...

A vibrate in their fixed positions and have a fixed shape.

B are free to move and are compressible.

C are free to move and have a fixed shape.

D vibrate in their fixed positions and are compressible. (2)

1.3 Which ONE of the following substances undergoes the process of sublimation?

A Water

B Wood

C Solid carbon dioxide

D Sodium chloride (2)

1.4 Which ONE of the molecules below contains the greatest number of atoms?

A N_2

B H_2O

C CH_4

D H_2SO_4 (2)

1.5 The chemical formula for sodium sulphate is ...

A $NaSO_4$

B $Na_2(SO_4)_2$

C Na_2SO_4

D $Na(SO_4)_2$ (2)

1.6 Which ONE of the following electron configurations represents an ion of an alkali metal?

A $1s^2$

B $1s^2\ 2s^2$

C $1s^2\ 2s^2\ 2p^5$

D $1s^2\ 2s^2\ 2p^6\ 3s^1$ (2)

1.7 Which ONE of the following groups of elements shows the correct trend of the atomic radii of elements?

A F > Cℓ > Br > I

B I > Br > Cℓ > F

C Li < Be < B < N

D Li > B > N > Be (2)

1.8 Consider the unbalanced chemical equation below.

$$P_4(s) + H_2(g) \rightarrow PH_3(g)$$

Which ONE of the sets of coefficients will balance the chemical equation?

A 4, 2, 3

B 1, 6, 4

C 1, 4, 4

D 2, 10, 8 (2)

1.9 During the formation of an ionic bond electrons are ...

A shared equally.

B shared unequally.

C transferred from a metal to a non-metal.

D transferred from a non-metal to a metal. (2)

1.10 The hydrosphere is best described as ...

A the layer of rock found above the earth's mantle.

B the hot liquid rock located in the earth's outer core.

C the very dense rock located in the earth's inner core.

D all the water below, on and above the surface of the earth. (2)

[20]

QUESTION 2 (Start on a new page.)

Most substances used in our daily lives are either pure substances or mixtures.

2.1 Define the term *pure substance*. (1)

2.2 Complete the table below. Write down only the answer next to the question number (2.2.1–2.2.4) in your ANSWER BOOK.

SUBSTANCE	ELEMENT/COMPOUND/MIXTURE	REASON
Diamond	**2.2.1**	**2.2.2**
Air	**2.2.3**	**2.2.4**

(4)

2.3 Explain why pots and pans are made of metal but the handles are made of plastic or wood. (2)

2.4 Write down the chemical formulae of the following compounds:

2.4.1 Table salt (2)

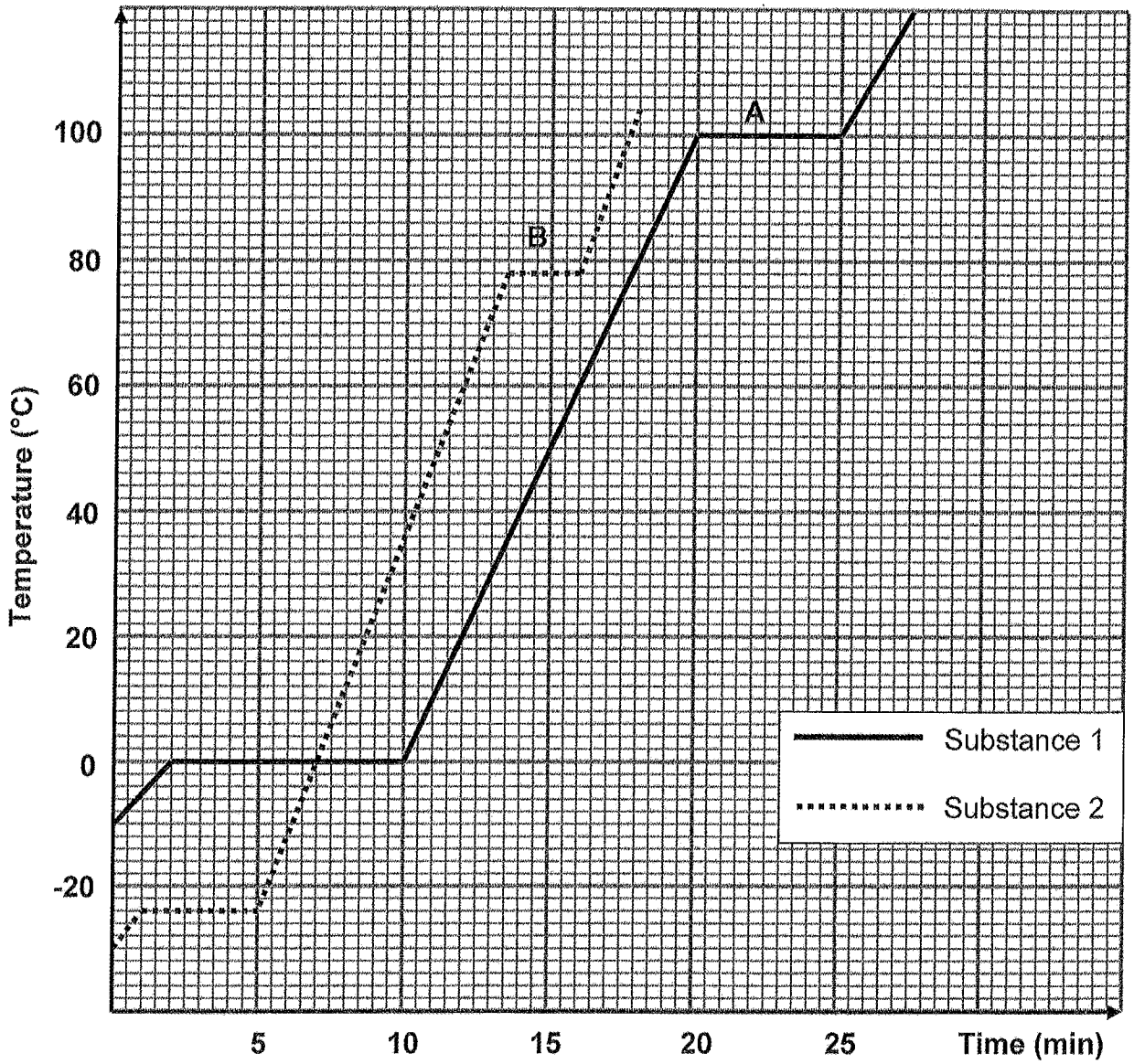
2.4.2 Calcium hydroxide (2)
[11]

QUESTION 3 (Start on a new page.)

Learners are investigating the effect of increasing temperature on two different substances (1 and 2) over a period of time.

Study the temperature versus time graphs below and answer the questions that follow.

The heating curves of substances 1 and 2



3.1 Write down the:

3.1.1 Dependent variable (1)

3.1.2 Independent variable (1)

3.2 Write down an investigative question for this investigation. (2)

3.3 In which phase is substance 1 at -10 °C? (1)

3.4 At what temperature does substance 2 melt? (1)

3.5 Define the term *boiling point*. (2)

3.6 State the phase change that takes place at **B**. (1)

Temperature remains constant at **B**.

3.7 Explain this phenomenon in terms of the spaces and the forces between the particles. (4)

3.8 Which substance on the graph has the weakest intermolecular force between the molecules in the liquid phase? Give a reason for the answer. (2)

3.9 Name the apparatus used to measure the average kinetic energy of the particles. (1)

3.10 How does the average kinetic energy of substance 1 compare to the average kinetic energy of substance 2 at 90 °C?

Write down LESS THAN, EQUAL TO or GREATER THAN and give a reason for the answer. (2)
[18]

QUESTION 4 (Start on a new page.)

Study the table of first and second ionisation energies and answer the questions that follow.

	FIRST IONISATION ENERGY ($kJ.mol^{-1}$)	SECOND IONISATION ENERGY ($kJ.mol^{-1}$)
Li	520	7 297
Be	899	1 757
B	801	2 427
C	1 086	2 352
N	1 402	2 854
O	1 214	3 391
F	1 681	3 381
Ne	2 080	3 964

4.1 Define the term *ionisation energy*. (2)

4.2 Use the information in the table to explain why:

4.2.1 Metals form cations easily (2)

4.2.2 Non-metals form anions easily (2)

4.3 Explain why the second ionisation energy of lithium is higher than its first ionisation energy. (2)
[8]

QUESTION 5 (Start on a new page.)

5.1 Define the term *isotope*. (2)

5.2 Study the unknown elements **A** to **E** below.

A	B	C	D	E
$^{19}_{9}X$	$^{19}_{10}X$	$^{20}_{9}X$	$^{21}_{11}X$	$^{19}_{8}X$

5.2.1 Which of the elements above are isotopes of each other? (1)

5.2.2 Write down the name of this isotope. (1)

5.3 Calculate the relative atomic mass of copper by using the following isotopes of copper:

Copper isotopes: ^{63}Cu - 69% and ^{65}Cu - 31% (4)

5.4 Complete the table below. Write only the answer next to the question number (5.4.1–5.4.5).

ELEMENT	MASS NUMBER	ATOMIC NUMBER	NUMBER OF PROTONS	NUMBER OF NEUTRONS	NUMBER OF ELECTRONS
Fluoride ion	**5.4.1**	9	9	**5.4.2**	10
5.4.3	25	**5.4.4**	12	**5.4.5**	12

(5)

Ammonia (NH_3) is manufactured using an industrial process, known as the Haber process. It is used in the production of inorganic fertilisers, such as ammonium sulphate.

5.5 Write down the chemical formula for ammonium sulphate. (1)

5.6 Name the type of bond between the atoms in the ammonia molecule. Give a reason for the answer. (2)

5.7 Draw the Aufbau diagram (orbital box diagram) for nitrogen. (2)

5.8 How many valence electrons does nitrogen have? (1)

5.9 Draw the Lewis dot diagram for the ammonia molecule. (2)

[21]

QUESTION 6 (Start on a new page.)

The unbalanced chemical equation (i) and the word equation (ii) for two chemical reactions are shown below.

(i) $C\ell_2(g) + H_2(g) \rightarrow HC\ell(g)$

(ii) aluminium carbonate → aluminium oxide + carbon dioxide

6.1 Which ONE of the reactions, (i) or (ii), is:

6.1.1 A decomposition reaction (1)

6.1.2 A synthesis reaction (1)

6.2 What does the (g) in reaction (i) represent? (1)

6.3 Write down the chemical formulae for the following:

6.3.1 Aluminium carbonate (2)

6.3.2 Aluminium oxide (2)

6.4 Write a balanced chemical equation for equation (i). (2)

6.5 Use the balanced equation in QUESTION 6.4 to show that mass is conserved in a chemical reaction. (3)

6.6 Calculate the percentage composition of hydrogen chloride. (3)
[15]

QUESTION 7 (Start on a new page.)

Potassium chloride dissociates in water to form an electrolyte.

7.1 Define the term *electrolyte*. (2)

7.2 Use a chemical equation to show how potassium chloride dissociates in water. (3)

7.3 If 2 mol of potassium ions form during the process used in QUESTION 7.2, how many moles of the metal salt dissolved? (2)

7.4 Calculate the percentage potassium in potassium chloride. (2)

7.5 How will an increase in the concentration of potassium chloride affect the conductivity of the electrolyte?

Write down only INCREASE, DECREASE or REMAIN THE SAME. (1)

7.6 Give a reason for the answer to QUESTION 7.5. (2)
[12]

QUESTION 8 (Start on a new page.)

8.1 The empirical formula of a certain compound is to be determined. On analysis of a sample of the compound it was found to contain 40% C, 6,6% H and 53,3% O.

8.1.1 Define the term *empirical formula.* (2)

8.1.2 Determine the empirical formula of the compound. Show ALL calculations. (5)

8.1.3 If the molecular mass of the compound is 60 $g \cdot mol^{-1}$, calculate the molecular formula of the compound. (3)

8.2 The molar mass of hydrated sodium carbonate is found to be 268 $g \cdot mol^{-1}$. The formula of the hydrated sodium carbonate is $Na_2CO_3.xH_2O$.

Calculate the number of moles of water of crystallisation (x) in the compound. (4)
[14]

QUESTION 9 (Start on a new page.)

The reaction between sodium and water is represented by the following balanced chemical equation:

$$2Na(s) + 2H_2O(\ell) \rightarrow 2NaOH(aq) + H_2(g)$$

During the reaction 10 g of sodium reacts with 2 dm^3 water to produce hydrogen gas at STP.

9.1 Write down the values of temperature and pressure at STP. (2)

9.2 Calculate the following:

9.2.1 Mass (in gram) of hydrogen gas produced (5)

9.2.2 Volume (in dm^3) of hydrogen gas produced at STP (3)

9.2.3 Mass (in gram) of NaOH produced (4)

9.2.4 Concentration of the sodium hydroxide solution (3)
[17]

QUESTION 10 (Start on a new page.)

Chlorides and sulphates are found in water. These ions may be identified by the *insoluble substances* they form in chemical reactions.

10.1 Write down the correct term for the following description:

The *insoluble substance* that forms when some solutions react (1)

10.2 Complete the following reactions by filling in the missing reactants/products, where applicable:

10.2.1 Test for sulphate ions:

Step I: $Na_2SO_4(aq) + \ldots \rightarrow BaSO_4(s) + NaC\ell(aq)$

Step II: $BaSO_4(s) + HNO_3(aq) \rightarrow \ldots$ (2)

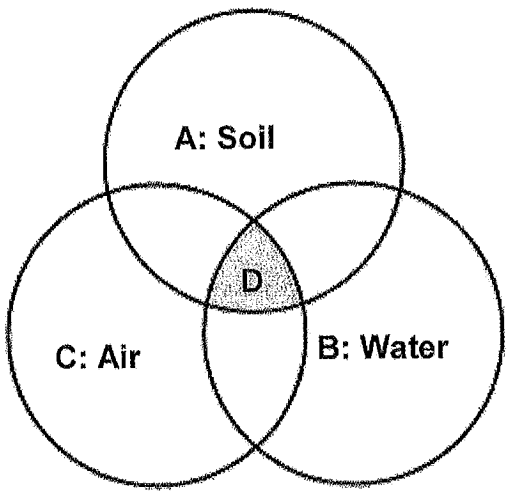
10.2.2 Test for chloride ions:

Step I: $KC\ell(aq) + \ldots \rightarrow AgC\ell(s) + KNO_3(aq)$

Step II: $AgC\ell(s) + \ldots \rightarrow$ no reaction (2)

10.2.3 What is the colour of the insoluble solid formed in step I of QUESTION 10.2.2? (1)

10.3 The diagram below represents components of the global system.



Which ONE of the symbols represents the:

10.3.1 Atmosphere (1)

10.3.2 Biosphere (1)

10.3.3 Lithosphere (1)

10.4 Name the THREE main processes involved in the transfer of water from one part of the water cycle to the next. (3)

10.5 Describe ONE way in which the demand for water is currently met. (2)
[14]

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*

$n = \frac{m}{M}$	$n = \frac{N}{N_A}$
$c = \frac{n}{V}$ OR $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$

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

KEY/*SLEUTEL*

Atomic number / *Atoomgetal*

Electronegativity / *Elektronegatiwiteit* → 1,9 | 29 Cu 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)
2,1 / 1 / H / 1																	2 / He / 4
1,0 / 3 / Li / 7	1,5 / 4 / Be / 9											2.0 / 5 / B / 11	2.5 / 6 / C / 12	3,0 / 7 / N / 14	3.5 / 8 / O / 16	4.0 / 9 / F / 19	10 / Ne / 20
0,9 / 11 / Na / 23	1,2 / 12 / Mg / 24											1.5 / 13 / Aℓ / 27	1.8 / 14 / Si / 28	2.1 / 15 / P / 31	2.5 / 16 / S / 32	3.0 / 17 / Cℓ / 35,5	18 / Ar / 40
0,8 / 19 / K / 39	1,0 / 20 / Ca / 40	1,3 / 21 / Sc / 45	1,5 / 22 / Ti / 48	1,6 / 23 / V / 51	1,6 / 24 / Cr / 52	1,5 / 25 / Mn / 55	1,8 / 26 / Fe / 56	1,8 / 27 / Co / 59	1,8 / 28 / Ni / 59	1,9 / 29 / Cu / 63,5	1,6 / 30 / Zn / 65	1,6 / 31 / Ga / 70	1,8 / 32 / Ge / 73	2,0 / 33 / As / 75	2,4 / 34 / Se / 79	2,8 / 35 / Br / 80	36 / Kr / 84
0,8 / 37 / Rb / 86	1,0 / 38 / Sr / 88	1,2 / 39 / Y / 89	1,4 / 40 / Zr / 91	41 / Nb / 92	1,8 / 42 / Mo / 96	1,9 / 43 / Tc	2,2 / 44 / Ru / 101	2,2 / 45 / Rh / 103	2,2 / 46 / Pd / 106	1,9 / 47 / Ag / 108	1,7 / 48 / Cd / 112	1,7 / 49 / In / 115	1,8 / 50 / Sn / 119	1,9 / 51 / Sb / 122	2,1 / 52 / Te / 128	2,5 / 53 / I / 127	54 / Xe / 131
0,7 / 55 / Cs / 133	0,9 / 56 / Ba / 137	57 / La / 139	1,6 / 72 / Hf / 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	1,8 / 81 / Tℓ / 204	1,8 / 82 / Pb / 207	1,9 / 83 / Bi / 209	2,0 / 84 / Po	2,5 / 85 / At	86 / Rn
0,7 / 87 / Fr	0,9 / 88 / Ra / 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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NATIONAL
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GRADE/*GRAAD* 10

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

NOVEMBER 2016

MEMORANDUM

MARKS/*PUNTE*: 147

This memorandum consists of 12 pages.
Hierdie memorandum bestaan uit 12 bladsye.

15/11/2016

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. ✓
OR
A pure substance is made up of one (same) type of element or molecule. ✓
'n Suiwer stof is 'n stof wat nie deur fisiese metodes in eenvoudiger komponente opgebreek kan word nie.
OF
'n Suiwer stof bestaan slegs uit een (dieselfde) tipe element of molekule. (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 conductor ✓that allows heat to be transferred so that the food can cook. The handles are insulators (poor conductor of heat) ✓ 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 geleier van hitte is wat toelaat dat hitte oorgedra word, sodat die kos kan gaar word. Die handvatsels is isolators (swak geleiers van hitte) sodat jou hande nie brand as jy 'n warm pot optel nie. (2)

2.4 2.4.1 $NaCl$ ✓✓ (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/or phase change? ✓✓
Wat is die verwantskap tussen 'n toename in temperatuur vir 'n tydperk en/of faseverandering?
NOTE: ✓The dependent and independent variable must be mentioned.
✓The relationship between the variables must be identified.
The question should not be answered with a YES or NO.
LET WEL: Die onafhanklike en afhanklike veranderlike moet genoem word.
Die verwantskap tussen die veranderlikes moet ook genoem word.
Die vraag moet nie kan beantwoord word deur 'n JA of NEE antwoord nie. (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 kinetic energy of the particles remains the same✓, the energy is used to overcome/break/weaken the intermolecular forces (forces of attraction) between the particles✓, particles move further away from each other (increase in potential energy)✓ resulting in a phase change✓.
Die kinetiese energie bly dieselfde✓, die energie word gebruik om die intermolekulêre kragte (aantrekkingskragte) tussen die deeltjies te oorkom /breek/verswak ✓,die deeltjies beweeg verder uit mekaar uit, dus neem die potensiële energie toe.✓ en sodoende vind 'n faseverandering plaas.✓ (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. (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 (atomic radius decreases), therefore the force of attraction between the electron and the nucleus is stronger✓ hence more energy is needed to remove the second electron✓.
OR
When lithium loses its first electron, it attains a stable electron configuration✓, hence more energy is needed to remove the second electron✓.

Die tweede elektron word verwyder van die energievlak wat naby aan die kern is (atoomradius verminder), dus is die aantrekkingskrag tussen die elektron en die kern sterker. Daarom word meer energie benodig om die tweede elektron te verwyder.
OF
Wanneer litium die eerste elektron verloor, verkry dit 'n meer stabiele elektronkonfigurasie. 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. ✓✓
OR
Isotopes are atoms of the same element having the same atomic number but different atomic mass (mass number). ✓✓
Isotope is atome van dieselfde element wat dieselfde getal protone het, maar verskillende getalle neutrone.
OF
Isotope is atome van dieselfde element wat dieselfde atoomgetal het, maar verskillende atoommassas (massagetal) het. (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)

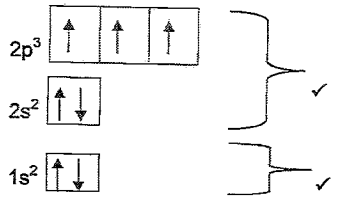
5.3
$$Ar(Cu) = \left(\frac{69}{100} \times 63\right) + \left(\frac{31}{100} \times 65\right)$$ ✓ ✓
$$= 63.62$$ ✓✓ (4)

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)

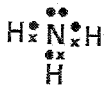
5.7



✓ ✓ (2)

5.8 5 ✓ (1)

5.9



✓✓ (2)
[21]

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 $C\ell_{2\,(g)} + H_{2\,(g)} \rightarrow 2HC\ell_{(g)}$ ✓Reactants/ Reagense ✓ Products/ Produkte (2)

6.5 Reactants/*Reaktante*: M ($C\ell_2$) + M (H_2)
= (2)(35,5) + (2)(1)
= 73 g.mol^{-1} ✓

Products/Produkte: M (2 $HC\ell$)
= (2)(1 + 35,5)
= 73 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($HC\ell$) = 1 + 35,5
= 36,5 (g.mol^{-1}) ✓

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

$$\%C\ell = \frac{35{,}5}{36{,}5} \times 100$$
$$= 97{,}26\%$$ ✓ (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 $KC\ell$ ✓ → 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 $\%K = \frac{39}{74,5} \times 100$ ✓
$= 52,35\%$ ✓ (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, word 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 = 3,33125 mol ✓	n = 3,3 mol ✓	n = 6,6 mol ✓

Thus/*Dus:*

O	: C	: H
3,33125	: 3,3	: 6,6
3,3	3,3	3,3 ✓
1	: 1	: 2

Emiprical formula/*Empiriese formule* = CH_2O✓
ACCEPT TABLE METHOD
AANVAAR TABEL METODE (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 $M(Na_2CO_3) = 106\ g{\cdot}mol^{-1}$ ✓

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

$n(H_2O) = \frac{162}{18}$ ✓
$= 9$ mol✓ (4)
[14]

QUESTION 9/*VRAAG 9*

9.1 Temperature/*Temperatuur*: 273 K or/*of* 0 °C ✓
Pressure/*Druk*: 1,013 x 10^5 Pa (101,3 kPa) or/*of* 1 atm ✓ (2)

9.2 9.2.1

MARK OPTION 1 AND 2 IF 10g Na IS USED. ***MERK OPSIE 1 EN 2 INDIEN 10g Na GEBRUIK IS.***	**MARK OPTION 3 IF 2dm³ WATER IS USED** ***MERK OPSIE 3 INDIEN 2dm³ WATER GEBRUIK IS.***
OPTION 1/*OPSIE 1*: $n(Na) = \frac{m}{M}$ ✓ $= \frac{10}{23}$ ✓ = 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 = 0,43 g ✓ H_2 produced/*gevorm* **OPTION 2/*OPSIE 2*:** 2 mol Na produces 1 mol H_2 ✓ (2)(23g) ✓ produces (1)(2g) ✓ 10g produces *x*✓ *x* = 0,43g✓	**OPTION 3/*OPSIE 3*:** 2 mol H_2O : 1 mol H_2 ✓ (2)(18) ✓ : 2 ✓ 2000 g : *x*✓ *x* = 111,11g ✓

(5)

9.2.2

POSITIVE MARKING FROM 9.2.1 ***POSITIEWE NASIEN VAN 9.2.1*** **MARK OPTION 1 AND 2 IF 10 g Na IS USED.** ***MERK OPSIE 1 EN 2 INDIEN 10g Na GEBRUIK IS.***
OPTION 1/*OPSIE1*: $n(H_2) = \frac{V}{V_m}$ ✓ $0,22 = \frac{V}{22,4}$ ✓ V = 4,93 dm³ ✓ Accept 4,82 dm³ **OPTION 2/*OPSIE 2*:** 1 mol : 22,4 dm³ ✓ 2g : 22,4 dm³✓ 0,43g : x x = 4, 82 dm³✓
MARK OPTION 3 IF 2dm³ WATER IS USED ***MERK OPSIE 3 INDIEN 2dm³ WATER GEBRUIK IS.*** **OPTION 3/*OPSIE 3*:** 1 mol : 22,4 dm³ ✓ 2g : 22,4 dm³✓ 111,11g : x x = 1244,43 dm³

(3)

9.2.3

POSITIVE MARKING FROM 9.2.1
POSITIEWE NASIEN VAN 9.2.1

MARK OPTION 1 AND 2 IF 10 g Na IS USED.
MERK OPSIE 1 EN 2 INDIEN 10g Na GEBRUIK IS.

OPTION 1/*OPSIE 1*:

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

$n(NaOH) = \frac{m}{M}$ ✓

$0,43 = \frac{m}{(23+16+1)}$ ✓
m = 17,2 g ✓ of NaOH produced/*gevorm*

OPTION 2/*OPSIE 2*:

1 mol Na produces/*produseer* 1 mol NaOH ✓
23g produces/*produseer* 40g ✓
10g produces/*produseer* x✓
x = 17,39g✓

MARK OPTION 3 IF 2dm^3 WATER IS USED
MERK OPSIE 3 INDIEN 2dm^3 WATER GEBRUIK IS.

OPTION 3/*OPSIE 3*:

1 mol H_2O : 1 mol NaOH ✓
18g : 40g ✓
2000g : x✓
x = 4444,44g✓

(4)

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

$c = \frac{n}{V}$ ✓

$c = \frac{0,43}{2}$ ✓

c = 0,22 mol.dm^{-3} ✓

(3)
[14]

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*: 147

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TO: HEADS OF EXAMINATION SECTIONS
HEADS OF CURRICULUM SECTIONS

EXAMINATION INSTRUCTION NO 35 OF 2016

AMENDMENTS TO THE MARKING GUIDELINE OF THE 2016 COMMON EXAMINATION FOR GRADE 10: PHYSICAL SCIENCES P2

Error on both English and Afrikaans versions: Question 9.

1. An error was identified in sub question 9.2.4. Information required to calculate the concentration of NaOH was omitted.
2. This sub question which carried 3 marks must not be marked, and, these 3 marks must be excluded.
3. Consequently the total marks for the question paper must be reduced to 147 marks, then scaled up to 150 marks.
4. Refer to **Annexure A** that provides the conversion table that must be used to calculate the learner's total marks.
5. For further information please contact the Director: Examinations and Assessment, Ms P Ogunbanjo at 012 357 3909 or email: Ogunbanjo.p@dbe.gov.za

DR RR POLIAH
CHIEF DIRECTOR: NATIONAL ASSESSMENT AND PUBLIC EXAMINATIOS
DATE: 15-11-16.

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Annexure A: GRADE 10 PHYSICAL SCIENCES P2: ENGLISH AND AFRIKAANS VERSIONS- MARKS CONVERTED FROM 147 TO 150

Mark out of 147	Converted to 150	Mark out of 147	Converted to 150	Mark out of 147	Converted to 150	Mark out of 147	Converted to 150
1	1	45	46	89	91	133	136
2	2	46	47	90	92	134	137
3	3	47	48	91	93	135	138
4	4	48	49	92	94	136	139
5	5	49	50	93	95	137	140
6	6	50	51	94	96	138	141
7	7	51	52	95	97	139	142
8	8	52	53	96	98	140	143
9	9	53	54	97	99	141	144
10	10	54	55	98	100	142	145
11	11	55	56	99	101	143	146
12	12	56	57	100	102	144	147
13	13	57	58	101	103	145	148
14	14	58	59	102	104	146	149
15	15	59	60	103	105	147	150
16	16	60	61	104	106		
17	17	61	62	105	107		
18	18	62	63	106	108		
19	19	63	64	107	109		
20	20	64	65	108	110		
21	21	65	66	109	111		
22	22	66	67	110	112		
23	23	67	68	111	113		
24	24	68	69	112	114		
25	26	69	70	113	115		
26	27	70	71	114	116		
27	28	71	72	115	117		
28	29	72	73	116	118		
29	30	73	74	117	119		
30	31	74	76	118	120		
31	32	75	77	119	121		
32	33	76	78	120	122		
33	34	77	79	121	123		
34	35	78	80	122	124		
35	36	79	81	123	126		
36	37	80	82	124	127		
37	38	81	83	125	128		
38	39	82	84	126	129		
39	40	83	85	127	130		
40	41	84	86	128	131		
41	42	85	87	129	132		
42	43	86	88	130	133		
43	44	87	89	131	134		
44	45	88	90	132	135		

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