LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES: CHEMISTRY (P2)

JUNE 2026

MARKS: 100

DURATION: 2 HOURS

This question paper consists of 12 pages including cover page and 2 data sheets

INSTRUCTIONS AND INFORMATION

1. Write your name on the answer book provided.
2. This question paper consists of 7 questions. Answer ALL the questions in the ANSWER BOOK.
3. Show ALL formulae and substitutions in ALL calculations.
4. Round off your FINAL numerical answers to MINIMUM of TWO decimal places.
5. Give brief motivations, discussions, et cetera where required.
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. Number the answers correctly according to the numbering system used in this question paper.
10. Write neatly and legibly.

QUESTION 1

Four possible options are provided as answers to the following questions. Each question has only ONE correct answer. Choose the correct answer and write ONLY a letter next to the appropriate question number (1.1 − 1.8) on the ANSWER SHEET. E.g. 1.9 D

1.1 Which one of the following is NOT a physical property of material?

A. Ductile

B. Density

C. Brittle

D. Kelvin (2)

1.2 Mixture of metals are:

A. Ampholytes

B. Anions

C. Anode

D. Alloys (2)

1.3 Brownian motion refers to …

A. The movement of atoms or molecules from an area of higher concentration to an area of lower concentration.

B. The random movement of microscopic particles suspended in a liquid or gas, caused by collisions between these particles and the molecules of the liquid or gas. stanmorephysics.com

C. The movement of atoms or molecules from an area of lower concentration to an area of higher concentration.

D. The random movement of microscopic particles in any direction suspended in a solid, caused by collisions between these particles and the molecules. (2)

1.4 Theory that describes a solid, a liquid, and a gas in terms of particles of matter, consisting of small particles that are in constant motion with forces of attraction between the particles that collide and exert pressure, is well known to be…

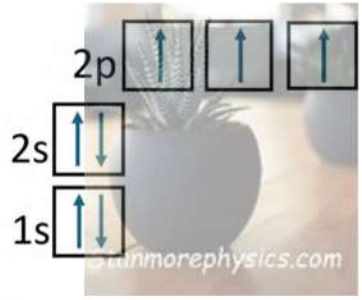
A. Lowry-Bronsted theory

B. Lewis's theory

C. Kinetic theory

D. Kinetic molecular theory (2)

1.5 The Aufbau diagram of element **X** is written as



Element **X** is likely to be

A. Oxygen

B. Sodium

C. Nickel

D. Nitrogen (2)

1.6 The correct chemical formula for magnesium carbonate is

A. $MgCO_3$

B. $MgCO_2$

C. $MgCO_4$

D. $Mg(CO_3)_2$ (2)

1.7 Which one of the following, is a metal and good thermal conductor but poor electrical conductor?

A. Copper

B. Hydrogen

C. Aluminium

D. Tin (2)

1.8 A substance that undergoes a _____ change, as a change in which no new substances are formed, mass number of atoms and molecules are conserved.

A. chemical

B. physical

C. decomposition

D. synthesis (2)

[16]

QUESTION 2 (Start on a new page)

2.1 Define the term *malleable*. (2)

2.2 A learner mixes sand and salt together.

Describe how the learner can separate the two substances (write them in bullet form and the steps in the correct order). (3)

2.3 Two samples are given to a scientist:

Sample A: melts at exactly 0°C

Sample B: melts between 0°C and 5°C

2.3.1 Which sample is most likely a pure substance? (1)

2.3.2 Explain your answer in 2.3.1 (2)

2.3.3 Explain why mixtures melts over a range of temperatures? (2)

2.4 A company wants to choose a material for making electrical wires. They can choose from the following

Glass	Copper	Aluminium	Plastic

2.4.1 Which material will be the best choice? (1)

2.4.2 Give two reasons based on physical properties (2)

[13]

QUESTION 3 (Start on a new page)

The graph of phase changes of an unknown pure substance is represented below.

3.1 Write the correct suitable TITLE of the graph represented above? (1)

3.2 Define the term *melting point. stanmorephysics.com* (2)

3.3 Write the phase of this pure substance at 45°C (1)

3.4 At which pair of points (e.g. write **A-B** or **C-D** etc) are the following statement applicable?

3.4.1 The forces between the particles are strongest of them all. (1)

3.4.2 The spaces between the particles are largest of them all. (1)

3.4.3 The spaces between the particles remain constant. (1)

3.4.4 The particles are likely to vibrate at fixed position. (1)

South Africans experience winter in May - July, resulting in most fuel stations having a high demand of air pressure refilling on car tyres during this season.

3.5 Explain, using **kinetic molecular theory,** why cars experience flat tyres in winter. (4)

3.6 When someone sprays perfume in one corner of a room, the scent (smell) spreads throughout the entire room, allowing you to smell it far away.

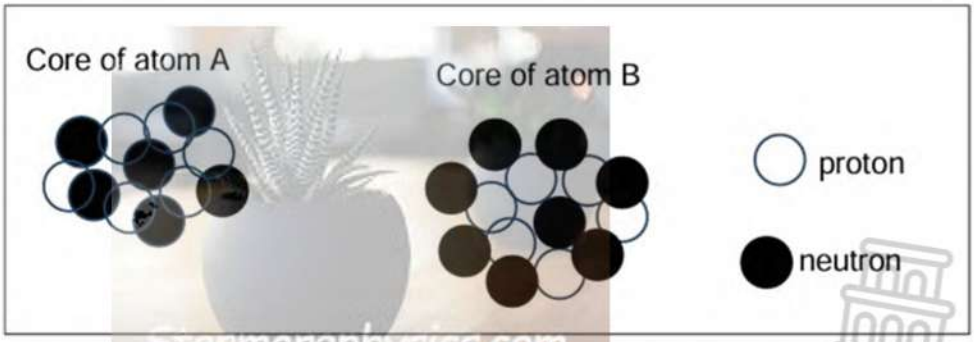
3.6.1 Is this effect due to Diffusion or Brownian motion? (1)

3.6.2 Explain your answer in 3.6.1 (2)

[15]

QUESTION 4 (Start on a new page)

The diagrams below show two neutral **atoms A and B**.



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

4.2 For **atom B** write down:

4.2.1 the atomic number (1)

4.2.2 the particles that contribute to the volume of an atom. (1)

4.2.3 the number of electrons (1)

4.2.4 the element as Metal, Metalloid or Non-Metal? (1)

4.2.5 the $^{A}_{Z}E$ notation (2)

4.3 For **atom A** write the following:

4.3.1 the sp-notation (2)

4.3.2 the Aufbau diagram (3)

4.4 Element X is found naturally in three forms, namely:

	32%	20%	48%
ISOTOPES	^{29}**X**	^{30}**X**	^{31}**X**

4.4.1 Define the term *isotope*. (2)

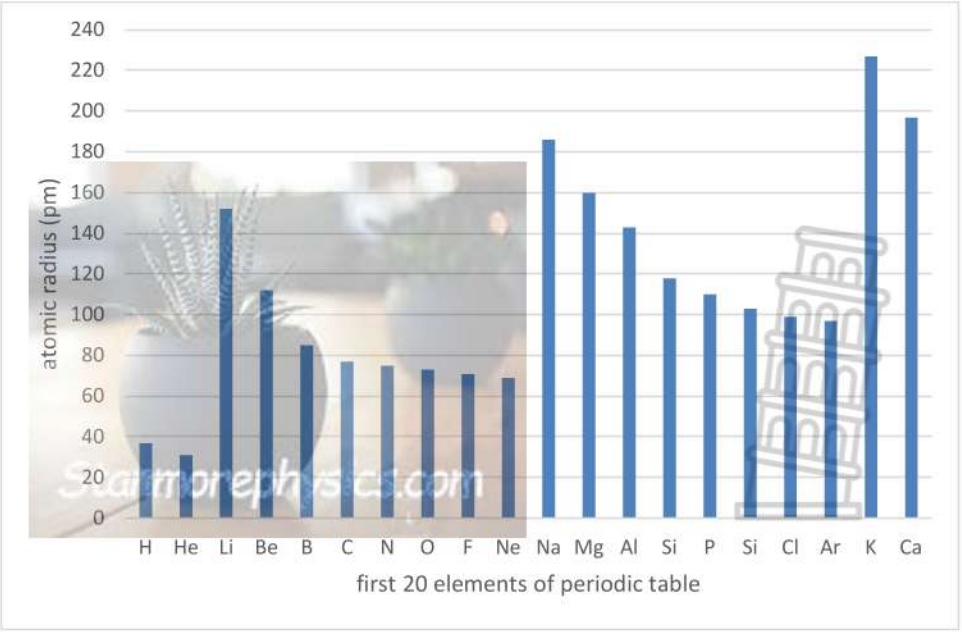
4.4.2 Determine the relative atomic mass of element **X** (3)

4.4.3 Write down the name of element **X**. (2)

[20]

QUESTION 5 (Start on a new page)

The graph below shows atomic radius of the first 20 elements on periodic table



5.1 Define *atomic radius.* (2)

5.2 Use the graph above to predict the atom radius of chlorine (1)

5.3 Explain why there is difference in atomic radius between Lithium (Li) and Fluorine (F). stanmorephysics.com (3)

5.4 Explain why there is difference in atomic radius between Sodium (Na) and Potassium (K). (3)

[9]

QUESTION 6 (Start on a new page)

6.1 NaCl has high thermal conductivity and can easily lower the freezing point of water, which prevents ice from forming.

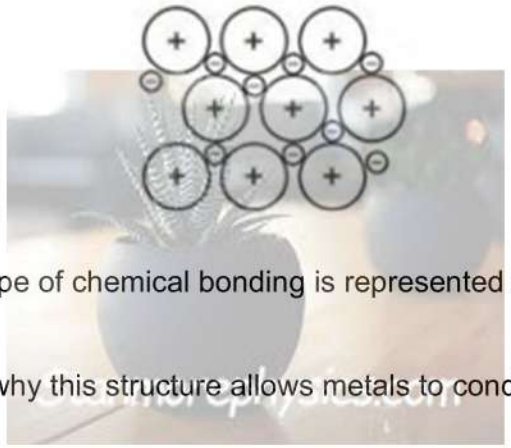
6.1.1 Give the chemical name of NaCl. (2)

6.1.2 Is the bond between Sodium and Chlorine covalent, ionic or metallic? (1)

6.1.3 Explain your answer in 6.1.2 (2)

6.1.4 Draw Lewis dot diagrams to show the formation of NaCl. (3)

6.2 Study the diagram below.



6.2.1 Which type of chemical bonding is represented by the diagram above. (1)

6.2.2 Explain why this structure allows metals to conduct electricity. (2)

[11]

QUESTION 7 (Start on a new page)

In the reaction below, Na_2CO_3 reacts with nitric acid solution according to the following UNBALANCED chemical equation:

$$Na_2CO_3(s) + HNO_3(aq) \rightarrow NaNO_3(s) + CO_2(g) + \mathbf{X}$$

7.1 Is the above reaction a CHEMICAL or PHYSICAL change? Explain (3)

7.2 Use the law of conservation of mass to calculate the mass of **X** in the above reaction. (5)

7.3 Write down the chemical formula for **X**. (1)

7.4 Write the balanced equation for the above equation showing ALL the molecular formulae. (2)

7.5 Write the NAME or FORMULA of the substance that causes effervescence in the above reaction. (1)

7.6 Suppose that 2000 cm^3 of CO_2 formed on the above reaction was subjected under STP:

Calculate number of moles of CO_2 formed. (4)

[16]

TOTAL: 100 MARKS

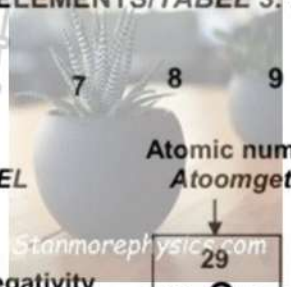
TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES*

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
Avogadro's constant *Avogadro-konstante*	N_A	$6{,}02 \times 10^{23}$ mol^{-1}

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*



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

PHYSICAL SCIENCES:CHEMISTRY (P2)/*FISIESE WETENSKAPPE: CHEMIE (V2)*
JUNE/*JUNIE* 2026
MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 100

This marking guideline consists of 7 pages/*Hierdie nasienriglyn bestaan uit 7 bladsye*

QUESTION 1/*VRAAG 1*

1.1 D ✓✓ (2)

1.2 D ✓✓ (2)

1.3 B ✓✓ (2)

1.4 D ✓✓ (2)

1.5 D ✓✓ (2)

1.6 A ✓✓ (2)

1.7 D ✓✓ (2)

1.8 B ✓✓ (2)

[16]

QUESTION 2/*VRAAG 2*

2.1 The ability of a material to be hammered or pressed into thin sheets without breaking or cracking. ✓✓ **(2 or zero)**/ *Potensiaal om in vorms gehamer of gedruk te word sonder om te breek of te kraak* (**2 of nul**) (2)

2.2

- **Step 1:** Add water to the mixture and stir to dissolve the salt. ✓/ ***Stap 1****: Voeg water by die mengsel en roer om die sout op te los*
- **Step 2:** Filter the mixture; sand remains on the filter paper (residue). ✓/ ***Stap 2****: Filtreer die mengsel; sand bly op die filterpapier (residu).*
  OR/*OF*
  Filtration (only: accept) ✓/ *Filtrering (slegs: aanvaar)*
- **Step 3:** Evaporate the water from the filtrate (salt water) to recover the salt. ✓/ **Stap 3**: *Verdamp die water uit die filtraat (soutwater) om die sout te herwin*
  OR/*OF*
  Evaporation (only: accept) ✓/ *Evaporation (only: accept)*

NOTE/*NOTA:*	-1 only if the steps are not in order/*-1 slegs indien die stappe nie in volgorde is nie*	✓✓2/3 total/*totaal*

(3)

2.3

2.3.1 Sample A✓/ *Voorbeeld A* (1)

2.3.2 Pure substances have a **fixed/sharp** melting point ✓✓/ *Suiwer stowwe het 'n vaste/skerp smeltpunt*

Or/*Of*
Pure substances consist of same type of atoms/ *Suiwer stowwe bestaan uit dieselfde tipe atome* (2)

2.3.3 Mixtures contain <u>different substances with different melting</u> <u>points</u>, causing them to melt gradually as temperature increases. ✓✓ / *Mengsels bevat verskillende stowwe met verskillende smeltpunte, wat veroorsaak dat hulle geleidelik smelt soos temperatuur styg.* (2)

2.4

2.4.1 Copper ✓/*Koper* (1)

2.4.2
- It is a good electrical conductor. ✓/ *Dit is 'n goeie elektriese geleier*
- Is ductile (can be drawn into wires). ✓/ *Is rekbaar (kan in drade getrek word).* (2)

[13]

QUESTION 3/*VRAAG 3*

3.1 Cooling curve of an unknown pure substance ✓/ *Verkoelingskurwe van 'n onbekende suiwer stof*

Or/*Of*

Accept: temperature vs time graph of unknown pure substance ✓/
***Aanvaar**: temperatuur teenoor tydgrafiek van onbekende suiwer stof* (1)

3.2 The temperature at which a solid, given sufficient heat, becomes a liquid. ✓✓ (2 or zero) / *Die temperatuur waarby 'n vaste stof, met voldoende hitte, 'n vloeistof word. (2 of nul)* (2)

3.3 Liquid ✓/*Vloeistof* (1)

3.4

3.4.1 E-F ✓ (1)

3.4.2 A-B ✓ (1)

3.4.3 C-D ✓ **Or/*Of*** E-F ✓ (1)

3.4.4 E-F ✓ (1)

3.5 **<u>According to the Kinetic Molecular Theory</u>**

- As temperature decreases in winter ✓
- The average kinetic energy of air particles decreases. ✓

- Particles move slower and collide with the tyre walls less frequently and with less force. ✓
- This leads to a decrease in internal pressure, making the tyre appear "flat." ✓

Vogens die Kinetiese Molekulêre Teorie:

- *Soos die temperatuur in die winter daal,*
- *neem die gemiddelde kinetiese energie van die lugdeeltjies af.*
- *Die deeltjies beweeg stadiger en bots minder gereeld en met minder krag teen die bandwande.*
- *Dit lei tot 'n afname in die interne druk, wat die band "pap" laat lyk.* (4)

3.6

3.6.1 Diffusion ✓/*Diffusie* (1)

3.6.2 High-energy perfume gas particles move from an area of **high concentration** (the corner) to **low concentration** (the rest of the room) until evenly spread. ✓✓/ *Hoë-energie parfuumgasdeeltjies beweeg van 'n area met **hoë konsentrasie** (die hoek) na **'n lae konsentrasie** (die res van die kamer) totdat dit eweredig versprei is.* (2)

[15]

QUESTION 4/*VRAAG 4*

4.1 The number of protons in an atom of an element. ✓✓ **(2 or zero)**/ *Die aantal protone in 'n atoom van 'n element. (2 of nul)*
Or/*Of*
The number of protons in the nucleus of an atom. ✓✓ **(2 or zero)**/ *Die aantal protone in die kern van 'n atoom. (2 of nul)* (2)

4.2

4.2.1 6 ✓ (1)

4.2.2 Electrons ✓/ *Elektrone* (1)

4.2.3 6 ✓ (1)

4.2.4 Non-metal ✓/ *Nie-metaal* (1)

4.2.5 $^{14}_{6}C$

Criteria/*Kriteria*	
A = 14 Z = 6	✓

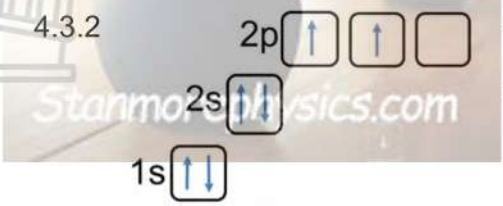
(2)

C (for carbon/*vir koolstof*)	✓
total/*totaal*	✓✓

4.3

4.3.1 $\underline{1s^2}$ ✓ $\underline{2s^2\ 2p^2}$ ✓ (2)

4.3.2



✓
✓
✓ (3)

4.4

4.4.1 Atoms of the same element having the same number of protons, but different numbers of neutrons. ✓✓ **(2 or zero)**/ *Atome van dieselfde element met dieselfde aantal protone, maar verskillende getalle neutrone. (2 of nul)* (2)

4.4.2 $RAM = \left(\frac{32}{100} \times 29\right)$ ✓ $+ \left(\frac{20}{100} \times 30\right) + \left(\frac{48}{100} \times 31\right)$ ✓

$RAM = 30.16\ amu$ ✓ (3)

4.4.3 Phosphorus ✓✓ (or P)/ *Fosfor (of P)* (2)

[20]

QUESTION 5/*VRAAG 5*

5.1 The distance from the nucleus to the outermost stable electron orbital. ✓✓ **(2 or zero)**/ *Die afstand van die kern na die buitenste stabiele elektronorbitaal. (**2 of nul**)* (2)

5.2 ACCEPT/*AANVAAR*: 98 pm – 100 pm ✓

No mark if SI-unit "pm" is omitted/*Geen punt indien SI-eenheid "pm" weggelaat word nie* (1)

5.3
- Both are in the same period on Periodic Table, and they have the same number of energy levels which is 2. ✓/ *Beide is in dieselfde periode op die Periodieke Tabel, en hulle het dieselfde aantal energievlakke, naamlik 2.*
- Fluorine has more protons (higher nuclear charge) than Lithium at the same energy level. ✓/ *Fluor het meer protone (hoër kernlading) as litium teen dieselfde energievlak.*

- This exerts a stronger pull on the electrons, making the radius smaller. ✓/ *Dit oefen 'n sterker aantrekkingskrag op die elektrone uit, wat die radius kleiner maak.* (3)

5.4
- Both are in the same Group on Periodic Table. ✓/ *Beide is in dieselfde groep op die periodieke tabel.*
- But Potassium has an extra electron shell (energy level) compared to Sodium. ✓/ *Maar kalium het 'n ekstra elektronskil (energievlak) in vergelyking met natrium.*
- Which increases the distance from the nucleus to the outer electrons. ✓/ *Wat die afstand van die kern na die buitenste elektrone vergroot.* (3)

[9]

QUESTION 6/*VRAAG 6*

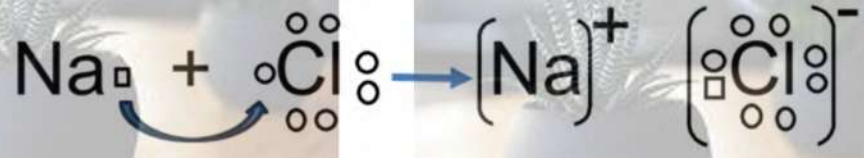
6.1

6.1.1 Sodium Chloride. ✓✓/ *Natriumchloried* (2)

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

6.1.3 It occurs between a metal (Na) and a non-metal (Cl) ✓ involving the transfer of electrons. ✓/ *Dit vind plaas tussen 'n metaal (Na) en 'n nie-metaal (Cl) wat die oordrag van elektrone behels.* (2)

6.1.4



Reactants/ *Reaktante*	Products/ *Produkte*	Ion atoms/ *Ioonatome*
✓	✓	✓
	total/ *totaal*	✓ ✓ ✓

(3)

6.2

6.2.1 Ionic bonding ✓/ *Ioniese binding* (1)

6.2.2
- It consists of a lattice of positive metal ions surrounded by a sea of delocalized electrons ✓/ *Dit bestaan uit 'n rooster van positiewe metaalione omring deur 'n see van gedelokaliseerde elektrone.*
- Which are free to move and carry charge. ✓/ *Wat vry is om te beweeg en lading te dra* (2)

[11]

QUESTION 7/*VRAAG 7*

7.1 Chemical change ✓/ *Chemiese verandering*

- New chemical substances are formed ✓/ *Nuwe chemiese stowwe word gevorm*
- Mass and atoms are conserved, but the number of molecules is not ✓/ *Massa en atome bly behoue, maar die aantal molekules nie* (3)

7.2 Total mass of reactants = Total mass of products./ *Totale massa van reaktante = Totale massa van produkte*

$Mr(Na_2CO_3) + Mr(HNO_3) = Mr(NaNO_3) + Mr(CO_2) + Mr(X)$

108 ✓ + 126 ✓= 170 + 44 ✓+ Mr(X)

$Mr(X) = 18\ g.mol^{-1}$ ✓ (5)

7.3 H_2O (1)

7.4 (2)

$\underline{Na_2CO_3(s) + 2HNO_3(aq) \rightarrow 2NaNO_3(s) + CO_2(g) + H_2O}$ ✓

7.5 CO_2 **OR** Carbon dioxide/ ***OF*** *Koolstofdioksied* (1)

7.6

$V = 2000\ cm^3 = 2\ dm^3$ ✓

$n = V$ ✓

$n = \frac{2}{22,4}$ ✓

$n = 0,089\ mol$ ✓ (4)

[16]

TOTAL/*TOTAAL*: 100