Bergvliet High School

GRADE 10

Physical Science Exam
Paper 2
November 2023

MARKS: 100
TIME: 2 hours
EXAMINER: T. Abrahams
MODERATOR/S: Z. Booysen, G. O'Connor, S. Van Harte

This question paper consists of 8 pages and data sheets.
Detach this sheet and attach it to the front of your answer sheets.

Name: _____ Teacher: Am, Bn, Vh, Oc

For official use only					
Question 1	Marker	Moderator	**Question 6**	Marker	Moderator
Question 2	Marker	Moderator	**Question 7**	Marker	Moderator
Question 3	Marker	Moderator	**Question 8**	Marker	Moderator
Question 4	Marker	Moderator	**Total**		
Question 5	Marker	Moderator	**Percentage**		
Signature	Marker		**Signature**	Moderator	

INSTRUCTIONS

1. Write your name in the appropriate space on the Cover Page and all pages of your ANSWER PAPER.
2. The question paper consists of 8 questions. Answer ALL the questions on the paper provided.
3. Start EACH question on a NEW page on the answer pages.
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

Four options are provided as possible answers to the following questions. Choose the answer and place a **X** on the letter (A–D) on the table below:

1.1.1	A	B	C	D
1.1.2	A	B	C	D
1.1.3	A	B	C	D
1.1.4	A	B	C	D
1.1.5	A	B	C	D
				/10

Question 1 Multiple choice questions

Four options are provided as possible answers to the following questions.
Choose the answer and place a **X** on the letter (A–D) on the table above:

1.1 Air can be classified as a/an …

A Element

B Compound

C Homogenous mixture

D Heterogenous mixture 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 What is the total number of protons and neutrons in the ion of calcium when calcium loses two electrons to form Ca^{2+}?

A 40
B 18
C 22
D 20 2

1.4 In a 20 g sample of molecules, which sample below has the greatest number of moles?

A NH_3

B N_2

C CO_2 2

D H_2

1.5 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

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Question 2 Start question on new page

The table below gives the temperature for bromine every 2 minute as bromine (starting at solid phase) was heated:

Time (min)	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32
Temperature (ºC)	-9	-7	-7	-7	-2	4	10	22	34	46	58	58	58	58	64	68	72

2.1 Define the term *boiling point.* 2

2.2 What is the boiling point of bromine? 1

2.3 At which phase is bromine at 10 minutes? 1

2.4 Which phase change occurs between 20 and 26 minutes? 1

2.5 Explain why the temperature remains constant between 2 and 6 minutes. 2

2.6 Between what time frames are the following true for the particles of bromine?

2.6.1 There are very large spaces between the particles. 1

2.6.2 The particles use the energy to completely break the intermolecular forces between them. 1

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Question 3 Start question on new page

Chlorine is a non-metallic element with an atomic number of 17 and can exist as isotopes.

3.1 Define the term :

3.1.1 Atomic number 2

3.1.2 Isotope 2

3.2 Natural chlorine consists of Cℓ-35 and Cℓ-37.

3.2.1 Write down the sp-notation for Cℓ-37. 2

3.2.2 The relative atomic mass of chlorine is 35,5. Calculate the percentage of Cℓ-35 in natural chlorine. 3

3.3 Chlorine gas ($C\ell_2$) consists of molecules.

Write down the :

3.3.1 Number of valence electrons in a chlorine atom 1

3.3.2 Type of bonding in chlorine molecule 1

3.3.3 Lewis structure for the chlorine molecule 2

3.4 Calcium reacts with chlorine to form calcium chloride

3.4.1 Draw the Aufbau diagram for a calcium ion 3

3.4.2 Write down the chemical symbols of the particles found in the calcium chloride crystal (lattice). 2

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Question 4 Start question on new page

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

	FIRST IONISATION ENERGY ($kJ.mol^{-1}$)	SECOND IONISATION ENERGY ($kJ.mol^{-1}$)
Li	520	7297
Be	899	1757
B	801	2427
C	1086	2352
N	1402	2854
O	1214	3391
F	1681	3381
Ne	2080	3964

4.1 Define the term *first ionization energy.* 2

4.2 Use information from 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

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Question 5 Start question on new page

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

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

Y: : $CaCO_3(s) \xrightarrow[\triangle]{} CaO(s) + CO_2(g)$

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

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

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

5.5 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.

5.5.1 State the law *of constant composition*. 2

5.5.2 Use the law in QUESTION 5.6.1 to calculate mass x of the CO_2 formed. 4

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Question 6 Start question on new page

6.1 Nitrogen and hydrogen react to form ammonia according to the following reaction:

$$N_2 + 3H_2 \rightarrow 2NH_3$$

6.1.1 Draw the Lewis structure of NH_3 3

6.1.2 How many valence electrons does nitrogen have? 1

6.2 What type of chemical bond exists between the nitrogen and hydrogen atoms? 2

6.3 Magnesium and chlorine react to form magnesium chloride according to the following reaction:

$$Mg + C\ell_2 \rightarrow MgC\ell_2$$

6.3.1 Represent the above reaction with Lewis notation. 3

6.3.2 Explain how the bond between magnesium and chlorine is formed. 3

6.4 What is the difference between the chemical bond in question 6.2 and 6.3.2? 2

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Question 7 Start question on new page

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.

7.1 Define the term *empirical formula.* 2

7.2 Determine the empirical formula of the compound. Show ALL calculations. 5

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

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Question 8 Start question on new page

Mikaeel and Ryan heated a 2.558g of hydrated sodium carbonate ($Na_2CO_3 \cdot xH_2O$) to drive off the water, resulting in 0.948g of anhydrous sodium carbonate. The mass of the water driven out was 1.61g.

8.1 Explain the meaning of the term *anhydrous.* 1

8.2 Calculate the number of moles of the anhydrous salt. 3

8.3 Mikaeel then took 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:

$$Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$$

8.3.1 Define the term a *mole of a substance* 2

8.3.2 What type of chemical reaction is represented by the chemical equation above? 1

8.3.3 Calculate the number of moles of hydrochloric acid in 5 cm^3 of hydrochloric acid, if its concentration is 1 $mol \cdot dm^{-3}$. 3

8.4 Calculate the mass of sodium chloride formed in the reaction in QUESTION 8.3. 5

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TABLE 1: PHYSICAL CONSTANTS

NAME/*NAAM*	**SYMBOL/*SIMBOOL***	**VALUE/*WAARDE***
Avogadro's constant *Avogadro-konstante*	N_A	$6{,}02 \times 10^{23}\ mol^{-1}$
Charge on electron *Lading op elektron*	e	$-1{,}6 \times 10^{-19}\ C$
Electron mass *Elektronmassa*	m_e	$9{,}11 \times 10^{-31}\ kg$
Molar gas volume at STP *Molêre gasvolume by STD*	V_m	$22{,}4\ dm^3 \cdot mol^{-1}$
Standard pressure *Standaarddruk*	p^e	$1{,}013 \times 10^5\ Pa$

TABLE 2: FORMULAE/TABEL 2: FORMULES

$n = \frac{m}{M}$	$c = \frac{n}{V}$ or/*of* $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$	$n = \frac{N}{N_A}$

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

