Province of the
EASTERN CAPE
EDUCATION

OR TAMBO INLAND DISTRICT



GRADE 10



PHYSICAL SCIENCES P2

JUNE 2023

MARKS: 75

TIME: 1 HOUR 30 MINUTES

THIS QUESTION PAPER CONSISTS OF EIGHT PAGES INCLUDING THE COVER PAGE.

INSTRUCTIONS AND INFORMATION

1. This question paper consists of 6 questions. Answer ALL questions in the ANSWER booklet.
2. Start each question on a new page in the ANSWER BOOK.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Leave one line between two sub questions, for example between QUESTION 2.1 and QUESTION 2.2.
5. You may use a non-programmable calculator.
6. You may use appropriate mathematical instruments.
7. You are advised to use the attached data sheets.
8. Show all formulae and substitutions in ALL calculations.
9. Round off your final numerical answers to TWO decimal places unless stated otherwise by the question.
10. Give brief motivations, discussions et cetera where required.
11. Write neatly and legibly.

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QUESTION 1

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 – 1.5) in the ANSWER BOOK, for example 1.11 E.

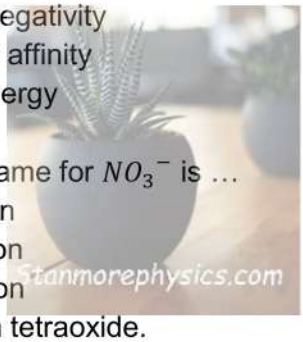
1.1 Substance consisting of one type of atom.

A. Element
B. Compound
C. Boiling point
D. Pure Substance

(2)

1.2 Which one of the following describes the ability of an atom to form a positive ion?

A. Ionisation energy
B. Electronegativity
C. Electron affinity
D. Bond energy (2)



1.3 The chemical name for NO_3^- is …

A. Nitrite ion
B. Nitride ion
C. Nitrate ion
D. Nitrogen tetraoxide. (2)

1.4 Which ONE of the following molecules will contain ionic bonds when chemical bonding occurs between the atoms?

A. HCl
B. O_2
C. Al_2O_3
D. CO_2

(2)

1.5 In a chemical change:

(i) The number of atoms is conserved.
(ii) The total mass is conserved.
(iii) No new substances are formed.
(iv) The number of molecules is conserved.

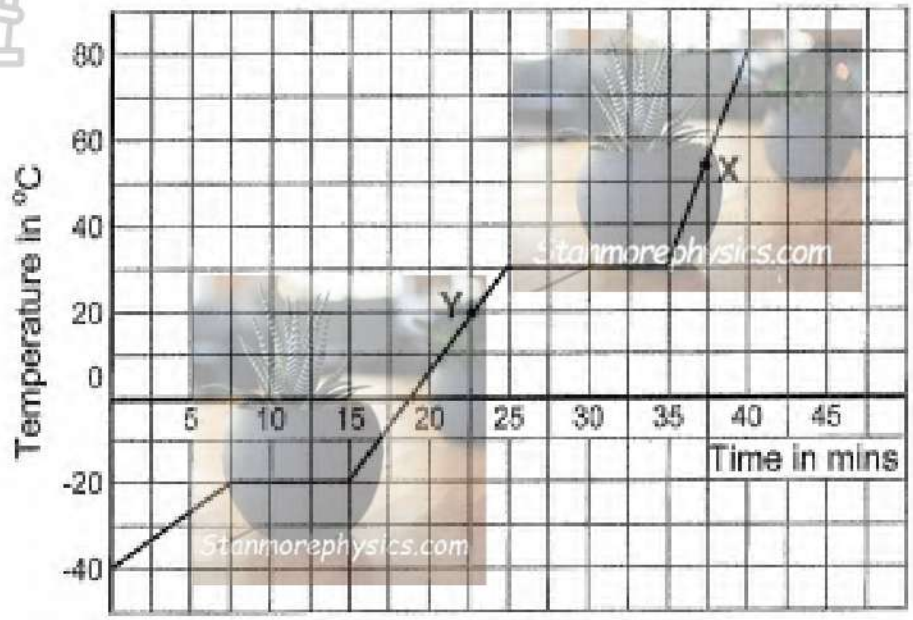
Which of the statements above that describe a chemical change is true?

A. (i); (ii) and (iii).
B. (i); (ii) and (iv).
C. (i) and (ii) only.
D. (iv) only. (2)

[10]

QUESTION 2

2.1 The graph below represents the heating curve of a pure substance at sea level.



2.1.1 Define melting point. (2)

2.1.2 What is the temperature at which the vapour pressure of the substance is equal to the atmospheric pressure? (2)

2.1.3 At which point, X or Y, are the molecules of this substance having the highest potential energy?
Explain your answer. (3)

2.1.4 Between which time interval(s) on the graph does the average kinetic energy of this substance remain constant? (2)

2.1.5 At $-20\ ℃$, there is no temperature change although heat is being added to the substance. Give an explanation for this observation. (3)

[12]

QUESTION 3

3.1 Copper atoms exist naturally as $^{63}_{29}Cu$ and $^{65}_{29}Cu$.

3.1.1 What are such atoms called? (1)

3.1.2 Besides their masses, how else do these atoms differ? (1)

3.1.3 The relative atomic mass of copper is 63,5. Determine the percentage abundance of each of the copper atoms. (5)

3.2 Complete the table below. Write only the answer next to the question number (3.2.1 – 3.2.5).

ELEMENT	MASS NUMBER	ATOMIC NUMBER	NUMBER OF NEUTRONS	NUMBER OF ELECTRONS
Aluminium ion	3.2.1	13	3.2.2	3.2.3
3.2.4	30	3.2.5	16	15

(5)

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3.3 Write down:

3.3.1 the name of the compound: $KMnO_4$ (2)

3.3.2 the chemical formula for iron (III) chloride. (2)

[16]

QUESTION 4

Consider the following substances: $MgBr_2$; NH_3; Mn

4.1 Define a chemical bond. (2)

4.2 Write down a substance from the list above which has:

4.2.1 a covalent bond. (1)

4.2.2 An ionic bond (1)

4.3 Magnesium reacts with bromine to form magnesium bromide.

4.3.1 Using Lewis dot diagrams, show how magnesium reacts with bromine to form magnesium bromide. (3)

4.3.2 Draw the Aufbau (orbital box) diagram for the **magnesium ion**. (3)

[10]

QUESTION 5

The periodicity of elements on the periodic table is affected by some factors such as atomic radius, ionization energy, electron affinity and electronegativity.

5.1 Define atomic radius. (2)

5.2 What is the general trend in atomic radii as you move from left to right across the period? Write down INCREASES, DECREASES OR REMAINS THE SAME.
Give a reason for your answer. (3)

5.3 The table below represents the first ionisation energies of the first 10 elements on the periodic table.

Element	Ionisation energy ($kJ.mol^{-1}$)	Element	Ionisation energy ($kJ.mol^{-1}$)
H	1312	C	1086.5
He	2372	N	1402.3
Li	520.2	O	1313.9
Be	899.5	F	1681
B	800.6	Ne	2080.7

5.3.1 Define ionisation energy. (2)

5.3.2 Write down the group names to which the following elements belong in the periodic table. (4)
(I)H and Li
(II) Be
(III) He
(IV)Give the general name that is given to the following elements:(B,Si and Ge)

5.3.3 Copy and complete the following reaction:
$Li + 520.2\ kJ.mol^{-1} \longrightarrow ____ + ____$ (2)

5.3.4 Ionisation energy generally increases across the period and decreases down the group. However, the first ionisation energy of Boron is smaller than that of Beryllium. Explain why this happens(**Hint** :use the electron configuration of the two atoms). (3)

[16]

QUESTION 6

6.1 In the Haber process, **hydrogen reacts with nitrogen to produce ammonia.**

6.1.1 Define a chemical change. (2)

6.1.2 Write a balanced equation for the reaction that takes place during the Haber process. (3)

6.1.3 Use this reaction to prove the law of conservation of mass. (3)

6.1.4 Is this reaction a synthesis or a decomposition? (1)

6.2 Balance the following reaction: $C_2H_6 + O_2 \longrightarrow CO_2 + H_2O$ (2)

[11]

TOTAL [75]

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TABLE 3: THE PERIODIC TABLE OF ELEMENTS

1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)
2,1 **H** 1																
1,0 **Li** 7	1,5 **Be** 9											2,0 **B** 11	2,5 **C** 12	3,0 **N** 14	3,5 **O** 16	4,0 **F** 19
0,9 **Na** 23	1,2 **Mg** 24											1,5 **Aℓ** 27	1,8 **Si** 28	2,1 **P** 31	2,5 **S** 32	3,0 **Cℓ** 35,5
0,8 **K** 39	1,0 **Ca** 40	1,3 **Sc** 45	1,5 **Ti** 48	1,6 **V** 51	1,6 **Cr** 52	1,5 **Mn** 55	1,8 **Fe** 56	1,8 **Co** 59	1,8 **Ni** 59	1,9 **Cu** 63,5	1,6 **Zn** 65	1,6 **Ga** 70	1,8 **Ge** 73	2,0 **As** 75	2,4 **Se** 79	2,8 **Br** 80
0,8 **Rb** 86	1,0 **Sr** 88	1,2 **Y** 89	1,4 **Zr** 91	**Nb** 92	1,8 **Mo** 96	1,9 **Tc**	2,2 **Ru** 101	2,2 **Rh** 103	2,2 **Pd** 106	1,9 **Ag** 108	1,7 **Cd** 112	1,7 **In** 115	1,8 **Sn** 119	1,9 **Sb** 122	2,1 **Te** 128	2,5 **I** 127
0,7 **Cs** 133	0,9 **Ba** 137	**La** 139	1,6 **Hf** 179	**Ta** 181	**W** 184	**Re** 186	**Os** 190	**Ir** 192	**Pt** 195	**Au** 197	**Hg** 201	1,8 **Tℓ** 204	1,8 **Pb** 207	1,9 **Bi** 209	2,0 **Po**	2,5 **At**
0,7 **Fr**	0,9 **Ra** 226	**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
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**

KEY/*SLEUTEL*

Atomic number
Atoomgetal

Electronegativity
Elektronegatiwiteit

29 **Cu** 63,5

Symbol
Simbool

Approximate relative atomic mass
Benaderde relatiewe atoommassa

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