Province of the
EASTERN CAPE
EDUCATION



GRADE 10



PHYSICAL SCIENCES (P2)

OCTOBER 2022

MARKS: 100

TIME: 2 HOURS

This question paper consists of 13 pages, including 2 data sheets

INSTRUCTIONS AND INFORMATION

1. Write your FULL NAME and SURNAME on the ANSWER SCRIPT.
2. The question paper consists of 8 questions. Answer ALL the questions in the ANSWER SCRIPT.
3. Start EACH question on a new page in the ANSWER SCRIPT.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave ONE-line open between two sub-questions 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 explanations, motivations, et cetera where required.
12. Write neatly and legibly.

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QUESTION 1 MULTIPLE CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A-D) next to the question numbers (1.1 to 1.7) in the ANSWER BOOK, e.g. 1.11 E. Each question has only ONE correct answer.

1.1 Which one of the following is a mixture?

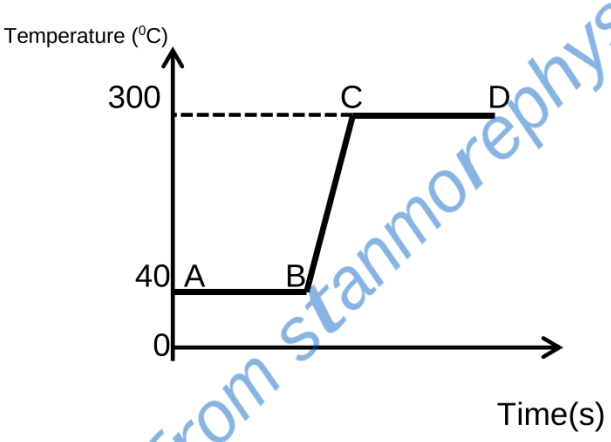
A Diamond

B Distilled water

C Vinegar

D. Sodium chloride (2)

1.2 The heating curve (not drawn to scale) of a compound is shown below.



What would be the physical state of the substance at 100^{0}C ?

A. Solid

B. Liquid

C. Gas

D. Solid to liquid (2)

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1.3 When atom **X** of an element in Group17 (VII) ionises to become $\mathbf{X}^-$ the...

A mass number of X increases.

B atomic number of X decreases

C number of electrons decreases

D number of electrons increases (2)

1.4 The molecular formula of a certain carbon compound is $C_4H_{10}O_2$.
Which one of the following can be the empirical formula of this compound?

A C_2H_6O

B $C_2H_4O_2$

C C_2H_5O

D $C_2H_6O_2$

(2)

1.5 Which one of the following elements has the highest ionisation energy?

A Potassium

B Lithium

C Caesium

D Sodium (2)

1.6 Which one of the following statements is correct? 1 mole is equal to...

i) 44 g of CO_2

ii) 32 g of O_2

iii) 14g of N_2

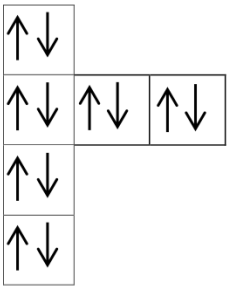
A. i and iii

B. i and ii

C iii

D i,ii and iii (2)

1.7 Consider the Aufbau diagram of an element below.



The element is a/an…

A. halogen

B. noble gas

C. alkali metal

D. alkaline-earth metal.

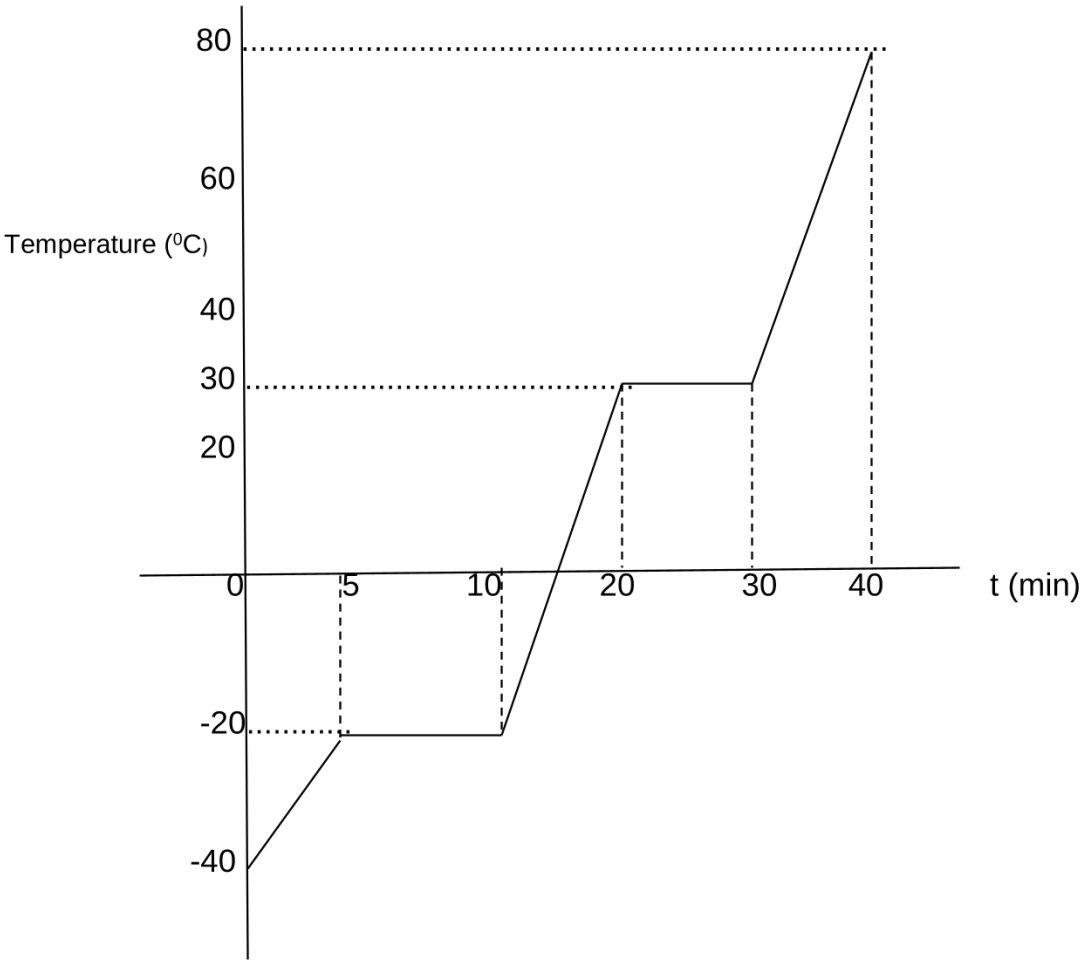
(2)

[14]



QUESTION 2

The graph below shows the heating curve of a pure substance under standard pressure.



2.1 Define the term temperature. (2)

2.2 What is the boiling point of this substance? (1)

2.3 During which time interval/s will the ...

2.3.1 forces of attraction between the particles be at their weakest? (1)

2.3.2 particles vibrate at their fixed positions (1)

2.3.3 average kinetic energy of the particles remains the same (2)

2.3.4 Give a reason for your answer ion 2.3.3 (2)

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QUESTION 3

3.1 An element X has two isotopes. The percentage abundance and atomic masses are given below.

	Percentage abundance	Atomic mass
Isotope -1	60.4%	69.5252
Isotope -2	39.6 %	70.9249

3.1.1. Define the term ***isotope***. (2)

3.1.2 Calculate the relative atomic mass of element X. (3)

3.1.3 Write down the symbol for element X (1)

3.2 The number of protons and electrons, the mass number and the atomic number of Aluminium (Al) and its ion Al^{3+} are shown in the table below.

Some of these values in the table have been omitted. Write down the letters **(a-e)** on the ANSWER BOOK and next to each letter the number omitted.

	NUMBER OF PROTONS	**NUMBER OF ELECTRONS**	**MASS NUMBER**	**ATOMIC NUMBER**
Al	13	**(a)**	27	**(b)**
Al^{3+}	**(c)**	**(d)**	**(e)**	13

(5)

3.3 The sp notation of an unknown element **X** is shown below.

$$1s^2 2s^2 2p^6 3s^2 3p^6$$

For element **X**, write down the:

3.3.1 Number of valence electrons. (1)

3.3.2 Period where this element is found on the periodic table. (1)

3.3.3 Highest energy level in which electrons occur. (1)

3.3.4 Symbol (1)

3.4 Write down the type of bond that forms between Chlorine and Aluminium (1)

3.5 Draw the Aufbau diagram for Chloride ion (Cl^-). (3)

3.6 Draw Lewis dot diagram to show the bond formation between Aluminium and Chlorine (4)

[23]

QUESTION 4

4.1 A section of the periodic table is shown below.

H								He
Li	Be			C	N	O	F	Ne
Na	Mg		Al	Si			Cl	Ar
K	Ca	Transition metals						

Write down the **SYMBOL** as shown above, of the element that ..

4.1.1. is an alkaline earth metal in period 3 (1)

4.1.2 will form a anion with a charge of -2 (1)

4.1.3 has the smallest atomic radius (1)

4.1.4 has the highest electro negativity (1)

4.1.5 is a metalloid (1)

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4.2 The electron affinity of chlorine (Cl) is 349 kJ·mol^{-1}.

4.2.1 Define the term ***'electron affinity'***. (2)

4.2.2 The electron affinity of element Cl can be represented by the following incomplete equation:

Cl(g) + … → … + 400 kJ·mol^{-1}

Copy the equation above into the ANSWER BOOK and complete it by filling in the blank spaces. (2)

4.3 Atoms of Francium (Fr) have the lowest ***energy required to remove an electron from its atom to form positive ions.***

Write down ONE word or term for the underlined phrase. (1)

4.4 Write down the formula of the compound formed when:

4.4.1 Li combines with O (2)

4.4.2 Ca combines with F (2)

[14]

QUESTION 5

Consider the following reaction:

$4Cu_{(s)} + O_{2(g)} \longrightarrow 2Cu_2O_{(s)}$

5.1 Write down the chemical name of Cu_2O. (2)

5.2 Classify the above reaction as ***synthesis*** or ***decomposition*** reaction (1)

5.3 Using a calculation prove that the law of conservation of mass is valid for the above reaction. (3)

5.4 20g of Cu completely react with 250cm^3 of hydrochloric acid solution of unknown concentration according to the following balanced equation.

$Cu_{(s)} + 2HCl_{(aq)} \longrightarrow CuCl_{2(aq)} + H_{2(g)}$

5.4.1 Define the term concentration. (2)

5.4.2 Calculate the concentration of the hydrochloric acid solution. (6)

[14]

QUESTION 6

During a demonstration to show the difference between physical and chemical change, the following experiments are carried out:

Experiment 1: Iron filings are heated with sulphur

Experiment 2: Iron filings are mixed with sulphur powder



6.1 Which one of the above experiments is an example for a **chemical change? Experiment 1 or 2?** (1)

6.2 Give a reason for your answer in 6.1 (1)

6.3 Write down a balanced equation for the change in experiment 2. (3)

6.4 Name a method to reverse the change in experiment 2? (1)

[6]

QUESTION 7

The formation of sulphur trioxide (SO_3) is represented by the following balanced equation.

$$2\ SO_2\ (g) + O_2\ (g) \rightarrow 2SO_3\ (g)$$



7.1 Identify the element in the above equation (1)

7.2 Draw the Lewis dot diagram of the oxygen molecule (O_2). (2)

7.3 During the above reaction 10 g O_2 (oxygen) react completely with Sulphur dioxide (SO_2). Calculate the:

7.3.1 Number of moles of O_2 reacted (3)

7.3.2 Theoretical yield of SO_3 (g) (4)

7.3.3 Percentage yield if 40g of SO_3 is produced at the end of the reaction. (3)

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QUESTION 8

An inorganic compound has the following percentage composition.43.39% Sodium (Na), 11.32% Carbon (C) and 45.28% Oxygen(O)

8.1 Define the term empirical formula. (2)

8.2 Determine the empirical formula of this compound. (5)

[7]

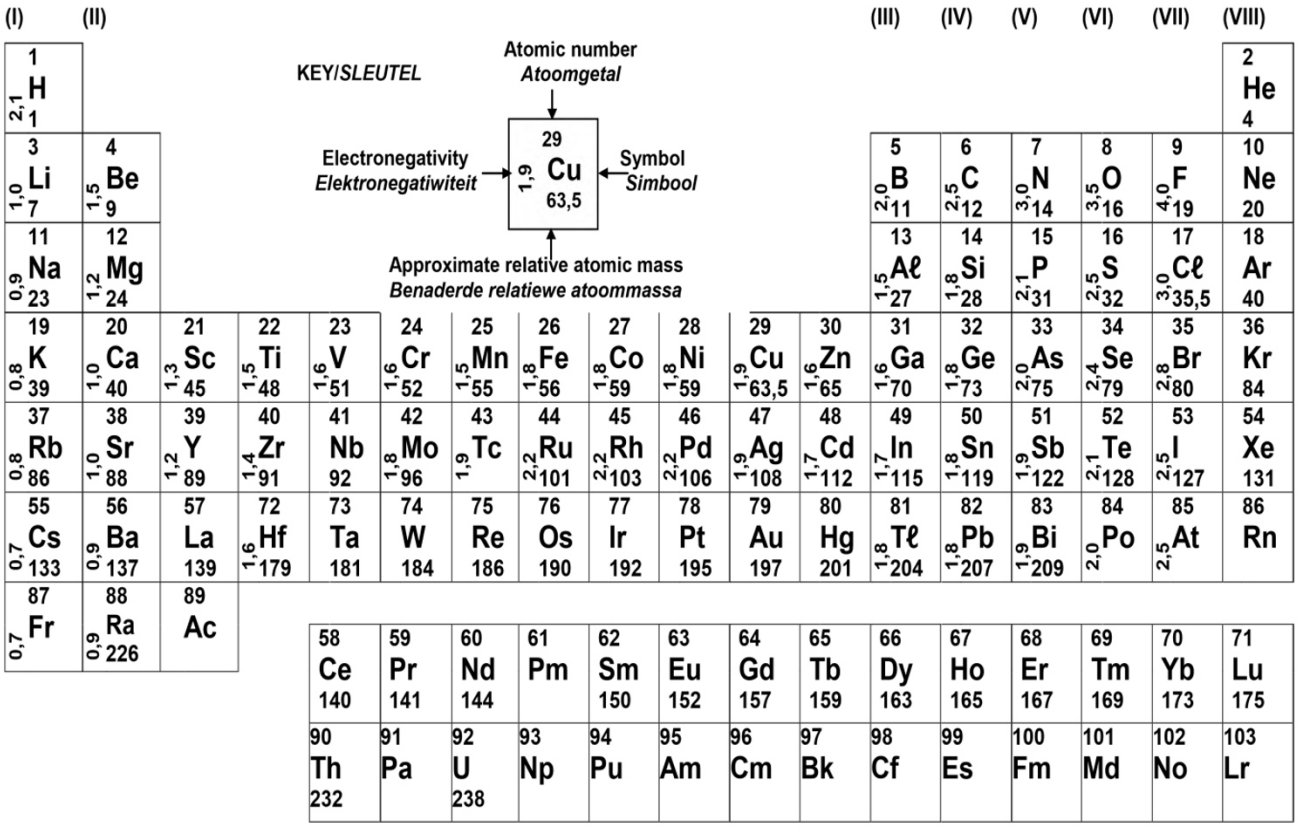
TOTAL:100

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/*of* $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$


(I)
(II)
(III)
(IV)
(V)
(VI)
(VII)
(VIII)
KEY/SLEUTEL
Atomic number
Atoomgetal
Electronegativity
Elektronegatiwiteit
Symbol
Simbool
29
Cu
1,9
63,5
Approximate relative atomic mass
Benaderde relatiewe atoommassa
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