KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES P2

COMMON TEST

JUNE 2023

MARKS: 75

DURATION: 1,5 hours

This question paper consists of 9 pages and a periodic table.

INSTRUCTIONS AND INFORMATION

1. This question paper consists of SIX questions. Answer ALL the questions in the ANSWER BOOK.
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 a minimum of TWO decimal places.
10. Give brief motivations, discussions et cetera where required.
11. 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 (1.1–1.5) in the ANSWER BOOK, for example 1.11 E.

1.1 Which of the following combinations have the same number of electrons?

A H and H^+
B O and O^{2-}
C S^{2-} and Ar
D Li^+ and Cl^-

(2)

1.2 Which one of the following describes the energy released when an atom accepts electrons?

A Electronegativity
B Ionisation energy
C Electron Affinity
D Ionic Bond

(2)

1.3 Which of the following is an example of a chemical change?

A Dissolving table salt in water
B Rusting of iron
C Sublimation of dry ice
D Filtration of sand and water mixture

(2)

1.4 Consider the unbalanced chemical equation below:
$(NH_4)_3PO_4 + Pb(NO_3)_4 \rightarrow Pb_3(PO_4)_4 + NH_4NO_3$
Which ONE of the sets of coefficients will balance the equation?

A 1, 3, 1, 3
B 4, 3, 1, 12
C 2, 1, 6, 6
D 2, 3, 2, 6

(2)

1.5 Which is the correct chemical formula for magnesium nitrite?

A $Mg(NO_2)_2$
B $Mg(NO_3)_2$
C $MgNO_2$
D Mg_2NO_3

(2)
[10]

QUESTION 2 (Start on a new page.)

2.1 Define the term *pure substance*. (2)

2.2 Indicate whether the following are MIXTURES or PURE SUBSTANCES.

2.2.1 Air (1)

2.2.2 Carbon Dioxide (1)

2.2.3 Brass (1)

2.3 Refer to table below to answer the questions that follow.

Substance	**A**	**B**	**C**	**D**	**E**
Element	Si	Cu	Ca	Ne	Cl_2

Write down the LETTER of the substance:

2.3.1 That is an alkali earth metal (1)

2.3.2 That experiences an increase in conductivity with an increase in temperature (1)

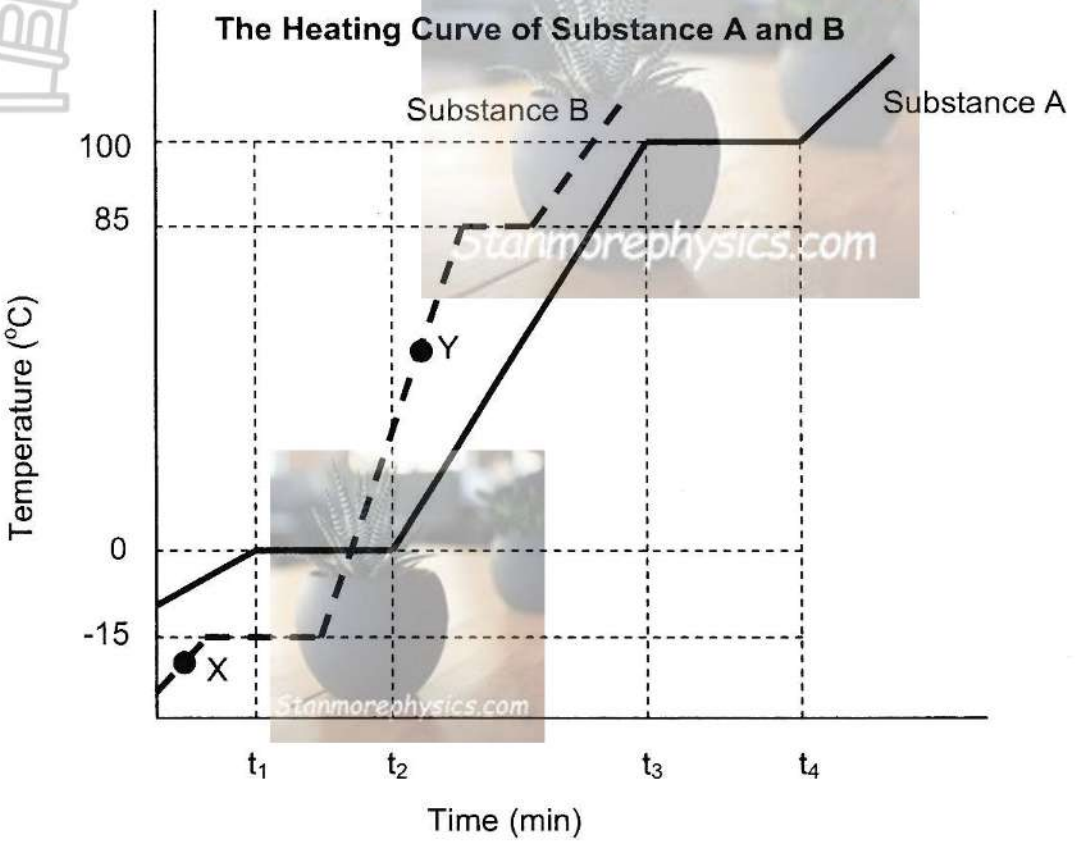
2.3.3 That is non-reactive (1)

2.4 Draw the Aufbau diagram for the substance referred to in QUESTION 2.3.3, and explain why this substance is non-reactive. (3)

[11]

QUESTION 3 (Start on a new page.)

3.1 The heating curves for 2 different substances, A and B, are drawn on the same set of axes in the graph below. The graph is not drawn to scale.



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

3.1.2 Write down the boiling point of substance B. (1)

3.1.3 At which point, X or Y, are the particles closer together in substance B. Explain fully. (3)

3.1.4 Which substance, A or B, has stronger forces between the particles in their solid phase? Give a reason for the answer. (2)

3.1.5 It can be seen from the graph that the temperature of substance A remains constant from t_3 to t_4. Explain this observation. (4)

3.2 Use the Kinetic Molecular Theory to explain the rise of mercury in the thermometer, when the temperature increases. (3)

[15]

QUESTION 4 (Start on a new page.)

4.1 The table below provides a representation of the atomic radius of the elements in period 2 of the periodic table.

Group	1	2	13	14	15	16	17	18
Element	Li	Be	B	C	N	O	F	Ne
Atomic Size Representation								

4.1.1 Explain the trend in atomic radius from left to right across the period as shown in the table above. (4)

4.1.2 For elements in the same group, period 3 elements have a larger atomic radius that those in period 2. Give a reason for this observation. (2)

4.2 Bromine has 2 common isotopes, Br-79 and Br-81. The relative atomic mass of Bromine is 79.9 AMU.

4.2.1 Define the term *isotope*. (2)

4.2.2 Determine the percentage abundance of Br-79 and Br-81. (5)

4.2.3 Fill in the table below for Br-79. Write down only the letter (a-c) and the answer.

Number of protons	**Number of electrons**	**Number of neutrons**
a	b	c

(3)
[16]

QUESTION 5 (Start on a new page.)

5.1 The table below shows the electronic configuration of 6 elements.

ELEMENTS	ELECTRONIC CONFIGURATION
A	$1s^2\ 2s^2\ 2p^2$
B	$1s^2\ 2s^2\ 2p^6\ 3s^1$
C	$1s^2\ 2s^2\ 2p^6\ 3s^2$
D	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^5$
E	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$
F	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$

Write down the letter of the element which:

5.1.1 Has 4 valence electrons. (1)

5.1.2 Occurs as a diatomic substance. (1)

5.1.3 Is located in period 4 of the periodic table. (1)

5.1.4 Forms a cation by transferring an electron. (1)

5.2 Magnesium and bromine combine to form magnesium bromide.

5.2.1 Draw the Aufbau diagram for the magnesium ion (Mg^{2+}). (3)

5.2.2 Identify the type of bond that forms when magnesium and bromine combine. (1)

5.2.3 Use Lewis structures to show the formation of magnesium bromide. (4)

[12]

QUESTION 6 (Start on a new page)

Refer to the unbalanced chemical equations below and answer the questions that follow.

(i) $H_2O_{(l)} \rightarrow H_2O_{(g)}$

(ii) $FeBr_3 + H_2SO_4 \rightarrow Fe_2(SO_4)_3 + HBr$

6.1 Does equation (i) represent a physical or a chemical change? Give a reason for the answer. (2)

6.2 Write a balanced chemical equation for equation (ii). (2)

6.3 Use the balanced chemical equation in QUESTION 6.2 to show that mass is conserved in a chemical reaction. (3)

6.4 Write down the chemical formula for:

6.4.1 Potassium thiosulphate (2)

6.4.2 Magnesium hydroxide (2)
[11]

TOTAL: 75

TABLE 3: THE PERIODIC TABLE OF ELEMENTS

Atomic number
Atoomgetal

Electronegativity
Elektronegatiwiteit

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 He 4
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	10 Ne 20
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	18 Ar 40
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	36 Kr 84
0,8 Rb 86	1,0 Sr 88	1,2 Y 89	1,4 Zr 91	41 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	54 Xe 131
0,7 Cs 133	0,9 Ba 137	57 La 139	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	1,8 Tℓ 204	1,8 Pb 207	1,9 Bi 209	2,0 Po	2,5 At	86 Rn
0,7 Fr	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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MARKING GUIDELINE
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QUESTION 1: MULTIPLE-CHOICE QUESTIONS

1.1 C ✓✓ (2)

1.2 C ✓✓ (2)

1.3 B ✓✓ (2)

1.4 B ✓✓ (2)

1.5 A ✓✓ (2)

[10]

QUESTION 2

2.1 A substance that cannot be separated into simpler components ✓ by physical methods. ✓ (2)

2.2.1 Mixture ✓ (1)

2.2.2 Pure substance ✓ (1)

2.2.3 Mixture ✓ (1)

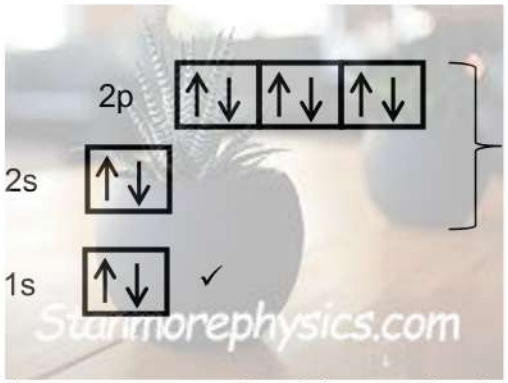
2.3

2.3.1 C ✓ (1)

2.3.2 A ✓ (1)

2.3.3 D ✓ (1)

2.4



✓

✓

The outer energy level is completely full ✓ (3)

[11]

QUESTION 3

3.1

3.1.1 The temperature of a liquid at which its vapour pressure equals the external (atmospheric) pressure. ✓✓ (2)

3.1.2 85°C ✓ (1)

3.1.3 Point X. ✓
Substance B is in the solid phase at Point X and a liquid phase at Point Y. ✓
Particles are closer in the solid phase than liquid. ✓ (3)

3.1.4 Substance A. ✓
Substance A has higher melting and boiling points. ✓ (2)

3.1.5 The average kinetic energy of the particles remains constant. ✓
Forces between particles weaken ✓ and the spaces between particles increase. ✓
The substance is changing phase liquid to gas. ✓ (4)

3.2 Temperature is a measure of the average kinetic energy of the particles in the substance. ✓
When the temperature increases, the particles move faster. ✓
The mercury will expand, resulting in an increase in temperature reading. ✓ (3)
[15]

QUESTION 4

4.1

4.1.1 As we move from left to right across a period, an additional valence electron is added to the outer orbital, and an additional proton is added to the nucleus. ✓✓
The force of attraction between the nucleus and outer orbital increases. ✓
The atomic radius will decrease. ✓ (4)

4.1.2 Period 3 elements have additional energy level ✓✓
OR
Period 3 elements have 3 energy levels whereas period 2 elements only have 2. ✓✓ (2)

4.2

4.2.1 Atoms of the same element having the same number of protons but different numbers of neutrons. ✓✓ (2)

4.2.2 Let the % of Br-79 be x
The % of Br-81 will be 100-x

✓ ✓ ✓

$$79.9 = 79 \times \frac{x}{100} + 81 \times \frac{100-x}{100}$$

x = 55

% Br-79 = 55 % ✓
% Br-81 = 45 % ✓ (5)

4.2.3 a = 35 ✓
b = 35 ✓
c = 44 ✓ (3)
[16]

QUESTION 5 (Start on a new page.)

5.1

5.1.1 A ✓ (1)

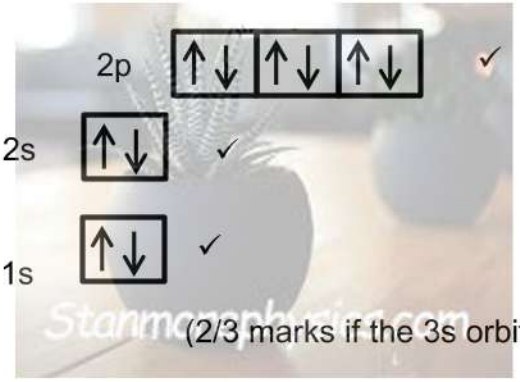
5.1.2 D ✓ (1)

5.1.3 F ✓ (1)

5.1.4 B ✓ (1)

5.2

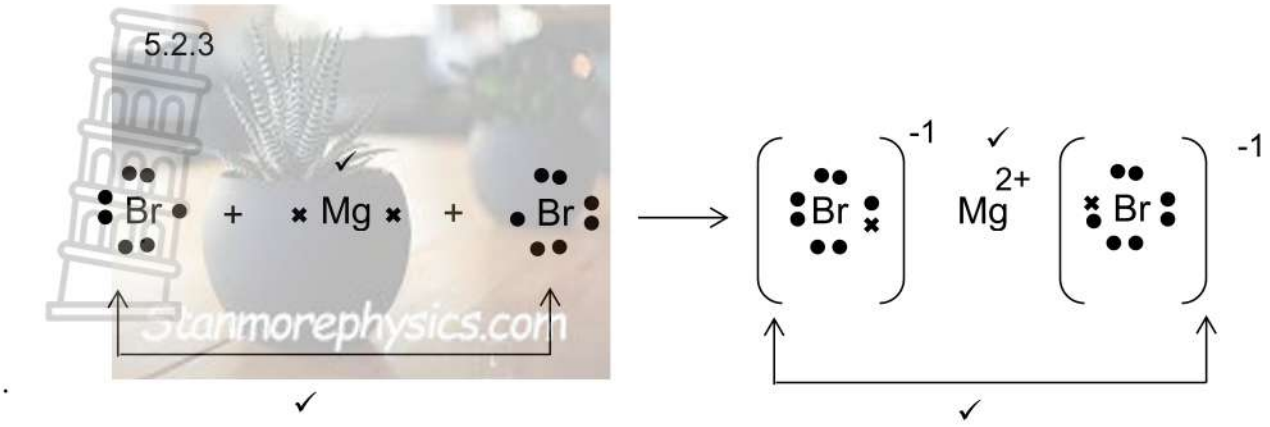
5.2.1 (3)



(2/3 marks if the 3s orbital is filled)

5.2.2 Ionic Bond ✓ (1)

5.2.3 (4)



✓ ✓ ✓ ✓

[12]

QUESTION 6

6.1 Physical Change. ✓
No new substance is formed. ✓ (2)

6.2 $2FeBr_3 + 3H_2SO_4 \rightarrow Fe_2(SO_4)_3 + 6HBr$ LHS ✓ RHS ✓ (2)

6.3 **POSITIVE MARKING FROM QUESTION 6.2**
Mass of Reactants = 2(56 + 3x80) + 3(2x1 + 32 + 4x16) ✓
= 886 g.mol^{-1}
Mass of Products = 56x2 + 3(32+ 4x16) + 6(1 + 80) ✓
= 886 g.mol^{-1}
Mass of reactants is equal to the mass of products. Therefore mass is conserved. ✓ (3)

6.4

6.4.1 $K_2S_2O_3$ ✓✓ (2)

6.4.2 $Mg(OH)_2$ ✓✓ (2)

[11]

TOTAL: 75