KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 10

PHYSICAL SCIENCES P2

JUNE EXAMINATION

2025

MARKS: 75

DURATION: 1½ hours

This question paper consists of 9 pages and 1 data sheet.

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
1.6 E.

1.1 Which of the following are conserved in a chemical reaction?

A Atoms and molecules

B Mass and atoms

C Mass, atoms and molecules

D Mass and molecules (2)

1.2 Which ONE of the following is the name of group 2 elements in the periodic table?

A Alkali earth metals.

B Alkali metals.

C Halogens.

D Noble gases. (2)

1.3 Which ONE of the following has the largest atomic radius?

A Na

B Cl

C K

D Br (2)

1.4 What is the correct chemical formula for aluminium sulphite?

A Al_2SO_3

B Al_2SO_4

C $Al_2(SO_3)_3$

D $Al_2(SO_4)_3$ (2)

1.5 Consider the following statements regarding a substance in the solid state:

(i) Solids have a fixed shape.
(ii) Solids have a fixed volume.
(iii) The particles in a solid are not in motion.
(iv) A solid occupies the entire volume available.

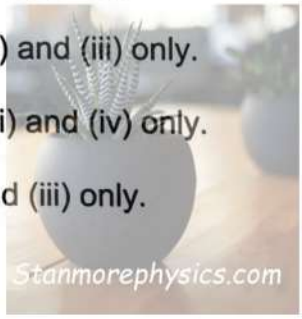
Which of the above statements is/are TRUE?

A (i) and (ii) only.

B (i), (ii) and (iii) only.

C (i), (iii) and (iv) only.

D (i) and (iii) only.



(2)
[5 x 2 = 10]

QUESTION 2 (Start on a new page.)

2.1 A learner adds 5 drops of red food colouring into a beaker filled with 100 ml cold water (see figure 1).
The entire solution turns red after 7 minutes as shown in figure 2.

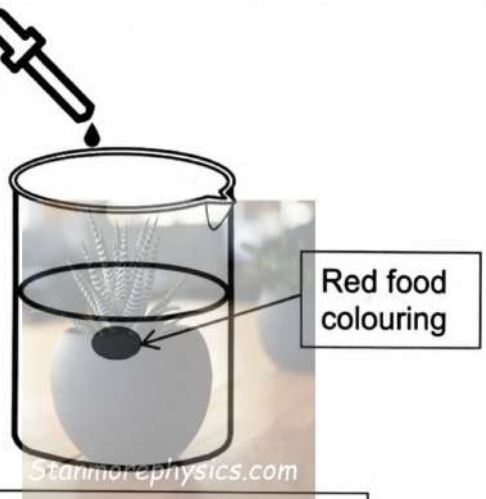


Figure 1: Red food colouring added to cold water

Figure 2: Solution after 7 minutes

2.1.1 Explain why the entire solution becomes red after a period of time. (2)

2.1.2 Is the solution in Figure 2 a MIXTURE or PURE SUBSTANCE? (1)

2.1.3 Is the process occurring above a PHYSICAL or CHEMICAL change? Provide a reason for the answer. (2)

2.1.4 5 drops of the same food colouring is now added to a beaker of 100 ml HOT water.
Use the kinetic molecular theory to explain why the time take for the entire solution to turn red is less than 7 minutes. (2)

2.2 Sodium carbonate reacts with hydrochloric acid as indicated in the unbalanced chemical equation below.

Sodium carbonate(s) + HCl(aq) → Sodium chloride(aq) + Carbon dioxide(g) + Water(l)

2.2.1 Write down a balanced chemical equation for the reaction, using chemical formulae. (4)

2.2.2 What does the **(aq)** in the reaction indicate? (1)

2.2.3 What visible change is noticed in the solution due to the formation of carbon dioxide?
Provide a reason for this observation. (2)

2.3 The reaction between $FeCl_3$ and sodium hydroxide is represented by the balanced chemical equation below:

$$FeCl_3 + 3NaOH \rightarrow Fe(OH)_3 + 3NaCl$$

2.3.1 Write down the chemical name of $FeCl_3$. (2)

2.3.2 Use the balanced chemical equation above to show that mass is conserved in a chemical reaction. (3)

[19]

QUESTION 3 (Start on a new page.)

The table below shows the melting and boiling points of three different substances.

Substance	Melting Point (°C)	Boiling Point (°C)
A	- 78	- 33
B	0	100
C	16	118

3.1 Define the term *melting point* in words. (2)

3.2 Write down the letter (A, B or C) of the substance which:

3.2.1 Is a gas at room temperature (25 °C) (1)

3.2.2 Is solid at 10 °C (1)

3.2.3 Represents water (1)

3.2.4 Has the strongest force between particles.
Give a reason for the answer. (2)

3.3 **Use the information in the table above** to sketch the heating curve of **Substance C**. (No time values are required on the x-axis)
Take the initial temperature as 10 °C and the final temperature as 120 °C on the y-axis.

Show the following values on the heating curve:

- The melting point.
- The boiling point.
- The initial and final temperatures. (5)

3.4 Explain why the temperature of a liquid decreases when evaporation takes place. (3)

[15]

QUESTION 4 (Start on a new page.)

The first ionization energies of Group 1 elements, in the periodic table, are shown in the table below.

Element	First ionization energy ($kJ.mol^{-1}$)
H	1312
Li	520
Na	496
K	419

4.1 Define the term *ionization energy* in words. (2)

4.2 Explain why the first ionization energy decreases from top to bottom in the group. (2)

4.3 Is the ionization energy of Oxygen GREATER THAN, LESS THAN or EQUAL TO 520 $kJ.mol^{-1}$?
Give a reason for the answer. (3)

4.4 Describe the trend in reactivity of group 1 elements, from top to bottom in the group.
Provide a reason for this trend using information from the table above. (3)

[10]

QUESTION 5 (Start on a new page.)

The electronic configuration of different elements is shown in the table below:

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

5.1 Write down the letter of the element which:

5.1.1 Has 3 valence electrons. (1)

5.1.2 Is non-reactive. (1)

5.1.3 Experiences an increase in conductivity with an increase in temperature. (1)

5.1.4 Forms an anion by gaining one electron. (1)

5.2 Element E is found in group 15 and period 3 of the periodic table.

5.2.1 Draw the Aufbau diagram for Element E. (2)

5.2.2 Fill in the table below **for the ion** that element E forms.
Write down only the letter (a – e) and the correct answer.

Formula	**Name**	**Number of protons**	**Number of electrons**	**Number of Neutrons**
(a)	(b)	(c)	(d)	(e)

(5)

[11]

QUESTION 6 (Start on a new page)

6.1 Potassium bonds with Oxygen to form Potassium oxide.

6.1.1 Identify the type of bond referred to above. (1)

6.1.2 Draw the Lewis dot diagram for potassium oxide. (3)

6.2 The only two stable isotopes of Potassium are listed below:

- Potassium – A: with 20 neutrons.
- Potassium – B: with 22 neutrons.

6.2.1 Calculate the atomic mass of:

(a) Potassium - A (1)

(b) Potassium - B (1)

The relative atomic mass of potassium is 39,13 AMU.

6.2.2 Determine the percentage abundance of Potassium – A. (4)

[10]

TOTAL: 75

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)	18 (VIII)
2,1 H 1																	2 He 4
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	92 Nb	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

KEY/*SLEUTEL*

Atomic number
Atoomgetal

Electronegativity
Elektronegatiwiteit

29 Cu 63,5 (1,9)

Symbol
Simbool

Approximate relative atomic mass
Benaderde relatiewe atoommassa

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GRADE 10

PHYSICAL SCIENCES P2

COMMON TEST
MARKING MEMORANDUM
JUNE 2025

MARKS: 75

DURATION: 1,5 hours

QUESTION 1:

1.1 B ✓✓ (2)
1.2 A ✓✓ (2)
1.3 C ✓✓ (2)
1.4 C ✓✓ (2)
1.5 A ✓✓ (2)
[10]

QUESTION 2

2.1

2.1.1 The food colouring moves from an area of higher concentration ✓ to an area of lower concentration. ✓

OR

The food colouring diffuses✓ in water✓. (2)

2.1.2 Mixture. ✓ (1)

2.1.3 Physical (change). ✓
No new substance is formed. ✓ (2)

2.1.4 At higher temperatures the particles have more kinetic energy OR at higher temperatures the particles move faster. ✓
This allows the food colouring to diffuse (or spread out) faster. ✓ (2)

2.2

2.2.1 $Na_2CO_3(s) + 2HCl(aq) \rightarrow 2NaCl(aq) + CO_2(g) + H_2O(l)$
Criteria:
Formula: Na_2CO_3 ✓
Formula: NaCl ✓
Formula: CO_2, H_2O ✓
Balancing ✓ (Note: Do not penalise if the phase is omitted) (4)

2.2.2 The solution is in an aqueous phase. ✓ (Accept: aqueous ✓) (1)

2.2.3 Bubbles are observed. ✓
Carbon dioxide is a gas OR A gas is formed. ✓ (2)

2.3

2.3.1 Iron (III) Chloride ✓✓ (Note: Iron Chloride ½) (2)

2.3.2 Mass of reactants = 56 + 35,5x3 + 3(23 + 16 + 1) ✓
= 282,5 $g.mol^{-1}$
Mass of products = 56 + 3(16 + 1) + 3(23 + 35,5)✓
= 282,5 $g.mol^{-1}$
Mass of reactants is equal to the mass of products. (Therefore mass is conserved.) ✓ (3)
[19]

QUESTION 3

3.1 The temperature at which a solid, given sufficient heat, becomes a liquid. ✓✓ (2)

3.2

3.2.1 A ✓ (1)

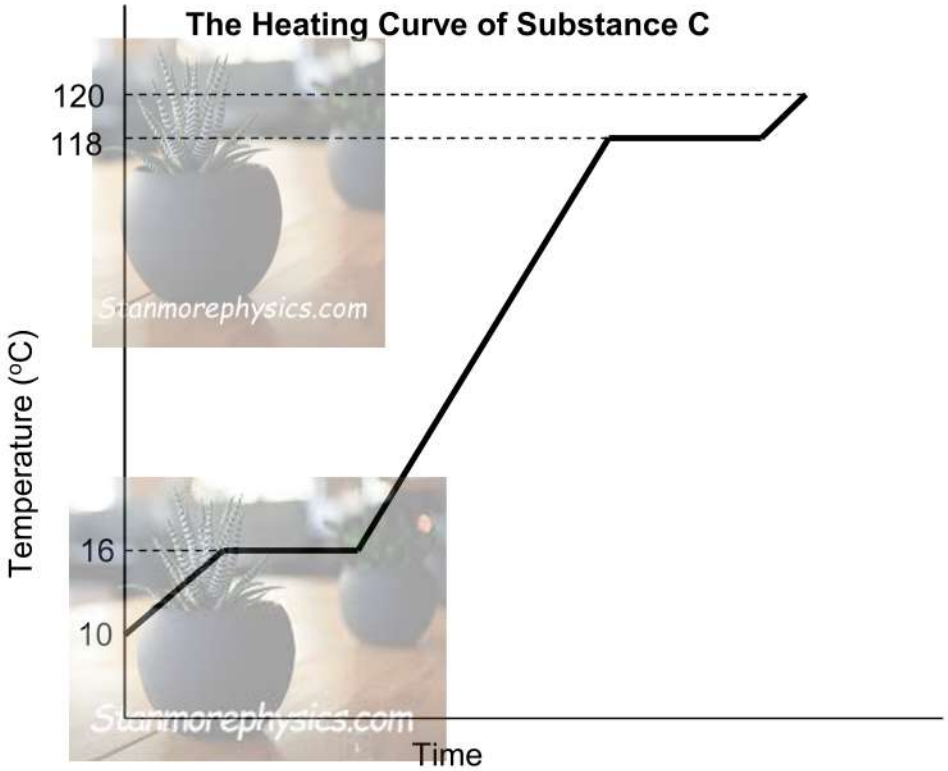
3.2.2 C ✓ (1)

3.2.3 B ✓ (1)

3.2.4 C ✓

It has the highest melting point/ boiling point/ melting and boiling points. ✓ (2)

3.3



Criteria:

Shape:

Temperature increase as time increase (except during phase change). ✓

Temperature constant during phase change. ✓

Values on y-axis:

Initial and final temperature : 10 and 120 °C ✓

Melting Point: 16 °C ✓

Boiling point: 118 °C ✓ (5)

3.4 Evaporation takes place (on the surface of a liquid) when the molecules with the highest kinetic energy are able to escape. ✓

The average kinetic energy of the liquid decreases. ✓

The temperature of a substance is the measure of the average kinetic energy of the particles. ✓ (3)

[15]

QUESTION 4

4.1 The energy needed per mole to remove an electron from an atom in the gaseous state. ✓✓ (2)

4.2 As you move down the group the atomic radius increases. ✓
The force of attraction between the nucleus and valence electrons decrease.✓ (2)

4.3 Greater than ✓
As you move from left to right across a period the effective nuclear charge increase OR the atomic radius decreases. ✓
The force of attraction between the nucleus and the outer orbital increases. ✓ (3)

4.4 The reactivity of group 1 elements increase from top to bottom. ✓
The ionization energy decrease from top to bottom in the group. ✓
Therefore it is easier to remove a valence electron. ✓ (3)

[10]

QUESTION 5

5.1

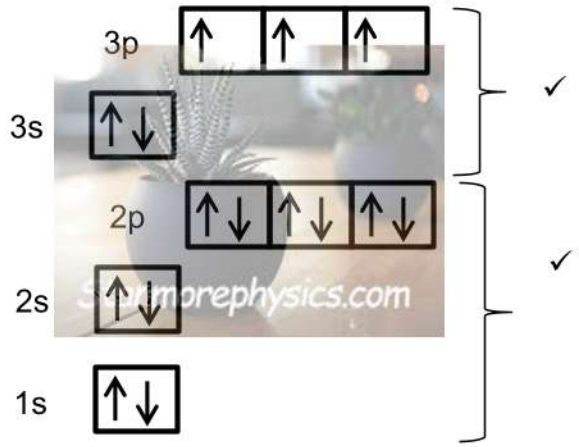
5.1.1 A ✓ (1)

5.1.2 C ✓ (1)

5.1.3 D ✓ (1)

5.1.4 B ✓ (1)

5.2.1



✓

✓

(2)

5.2.2 **POSITIVE MARKING FROM 5.2.1** (i.e. based on the chosen Element)
(a): P^{3-} /P^{-3} ✓
(b): Phosphide ion ✓
(c): 15 ✓
(d): 18 ✓
(e): 16 ✓ (5)

[11]

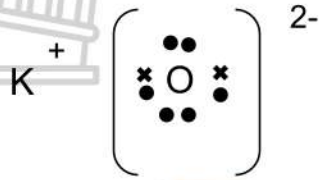
QUESTION 6

6.1

6.1.1 Ionic bond ✓ (1)

6.1.2 (3)

OPTION 1



✓✓

OPTION 2

✓✓

Note: Accept any alternative arrangement of bonded paired / lone-pairs

6.2.1

(a) Atomic mass of Potassium – A : 20 + 19 = 39 (AMU)✓ (1)

(b) Atomic mass of Potassium – B : 22 + 19 = 41 (AMU) ✓ (1)

6.2.2 **POSITIVE MARKING FROM 6.2.1**

Let the percentage abundance of Potassium – A be X

✓ ✓ ✓

$$39{,}13 = 39 \times \frac{X}{100} + 41\left(\frac{100 - X}{100}\right)$$

x = 93,5 % ✓ (4)

[10]

TOTAL: 75