education

MPUMALANGA PROVINCE

REPUBLIC OF SOUTH AFRICA

FURTHER EDUCATION AND TRAINING

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GRADE 11

PHYSICAL SCIENCES: CHEMISTRY

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PAPER 2

JUNE 2025

MARKS: 50

TIME: 1 hour

This question paper consists of 7 pages and 1 data sheet

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INSTRUCTIONS AND INFORMATION

1. Write your name in the appropriate space on the ANSWER BOOK.
2. This question paper consists of FIVE questions. Answer ALL the questions in the ANSWER BOOK.
3. Start EACH Question on a NEW page in the ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave one line 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 SHEET.
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, etc, where required.
12. Write neatly and legibly.

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QUESTION 1: MULTIPLE CHIOICE QUESTIONS

Various 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 to 1.3) in the ANSWER BOOK, eg. 1.4E

1.1 Which ONE of the following compounds has the highest ionic character?

A $NaC\ell$

B $RbC\ell$

C $MgC\ell_2$

D $BaC\ell_2$



(2)

1.2 Three chemical bonds are given as; H—N, Cl—Cl and H—F.

Consider the following statements in regard to these bonds:

(i) All of three bonds are polar covalent

(ii) H— N is the most polar bond.

(iii) H—F is the most polar bond.

Which of the above statements are/ is TRUE?

A i and ii only

B i and iii only

C ii only

D iii only

(2)

1.3 In which ONE of the following will hydrogen bonding NOT occur between molecules?

A HF(s)

B $NH_3(s)$

C HBr(s)

D $H_2O(s)$

(2)

[6]

QUESTION 2

Two fluorine atoms, F(g), combine by a chemical bond to form a fluorine molecule, $F_2(g)$, as shown in the equation below.

$$F(g) + F(g) \rightarrow F_2(g)$$

2.1 Define the term *chemical bond*. (2)

2.2 How does the stability of the combined atoms, $F_2(g)$ compare to that of individual atoms, F(g)? Choose from LOWER, HIGHER or EQUAL TO. Write down a reason for the answer. (2)

2.3 Consider $F_2(g)$ molecule.

2.3.1 Draw a Lewis dot diagram of F_2. (2)

2.3.2 Write down the number of lone pairs of electrons in the molecule. (1)

2.4 Ammonium ion, $NH_4^+(aq)$, is formed by the reaction of ammonia, $NH_3(g)$, with hydrogen ion, $H^+(aq)$, according to the following equation:

$$NH_3(g) + H^+(aq) \rightarrow NH_4^+(aq)$$

2.4.1 Draw the Lewis dot diagrams to show how NH_4^+ is formed. (4)

2.4.2 Write down the name of the molecular shape of NH_3. (1)

[12]

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QUESTION 3

The bond lengths and bond energies of the chemical bonds are given in the table below.

CHEMICAL BOND	BOND LENGTH (nm)	BONG ENERGY ($Kj.mol^{-1}$)
H–H	74	432
H–C	109	413
C–O	143	358
C–C	154	347

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3.1 Define the term *bond energy* of the compound. (2)

3.2 Write down the:

3.2.1 Relationship between bond length and bond energy of the bonds. (1)

3.2.2 Explanation for the answer in QUESTION 3.2.1 (2)

3.3 Carbon dioxide molecule, CO_2, has polar covalent bonds, C=O, but the molecule is non polar.

Write down a reason why the:

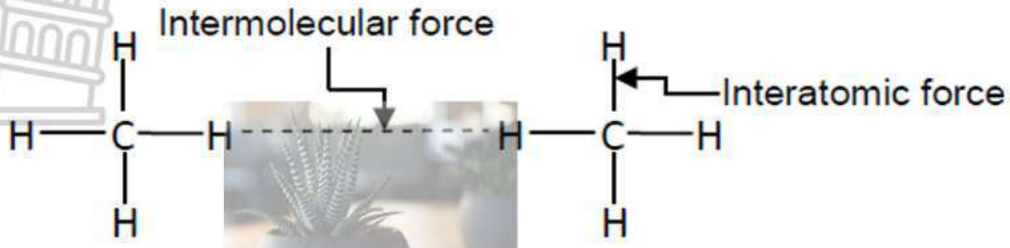
3.3.1 Bond energy of C=O bond is higher than that of C–O bond. (2)

3.3.2 C=O bonds are polar but CO_2 molecule is non polar. (3)

[10]

QUESTION 4

4.1 In the diagram below, two methane molecules, CH_4, are linked together by intermolecular force.



Refer to the diagram and write down the:

4.1.1 Type of intermolecular force between the two methane molecules. (1)

4.1.2 Type of interatomic force between carbon and hydrogen atoms. (1)

4.1.3 Which forces require more energy to separate, intermolecular forces or interatomic forces? (1)

4.2 Letters **A** to **F** represent six compounds used by grade 11 learners to investigate the relationship between molecular mass and boiling point. The results obtained are shown in the table below.

EXPERIMENT	COMPOUND		MOLECULAR MASS ($g.mol^{-1}$)	BOILING POINT (°C)
I	A	CH_4	16	-164
	B	C_2H_6	30	-89
	C	C_3H_8	44	-42
	D	C_4H_{10}	58	-23
II	E	H_2O	18	100
	F	H_2S	34	-64

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

Consider experiment **I,** Write down the:

4.2.2 Independent variable. (1)

4.2.3 Conclusion that is drawn from the results obtained. (1)

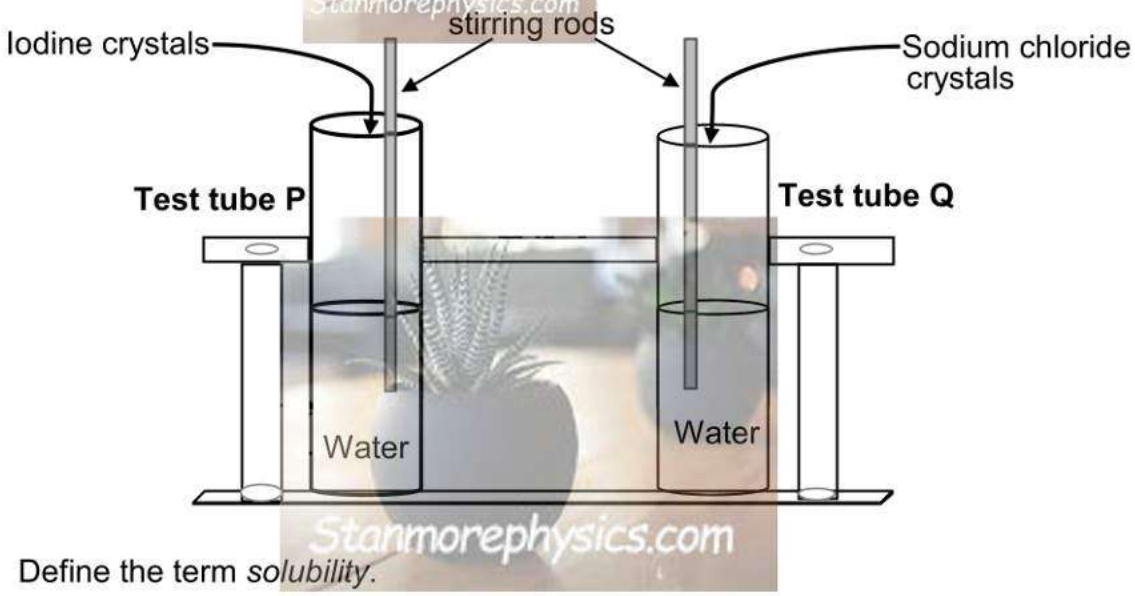
4.2.4 Explain the answer to QUESTION 4.2.3. (2)

A learner makes a conclusion based on the results obtained in experiment **II:**
The vapour pressure of compound **E** is lower than that of **F**.

4.2.5 Is the learner CORRECT or WRONG? Explain the answer. (4)
[13]

QUESTION 5

The effect of intermolecular forces on solubility of solutes is investigated using iodine, I_2, and sodium chloride crystals, NaCl. Equal amounts of each solute are placed in equal volumes of water at the same temperature of 22°C, as shown in the diagram below.
The mixture in each test tube is stirred with a stirring rod.



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5.1 Define the term *solubility*. (2)

5.2 Write down the observation made in each test tube.
Choose from CRYSTALS ARE SOLUBLE or CRYSTALS ARE NOT SOLUBLE.

5.2.1 Test tube **P**. (1)

5.2.2 Test tube **Q.** Explain the answer. (4)

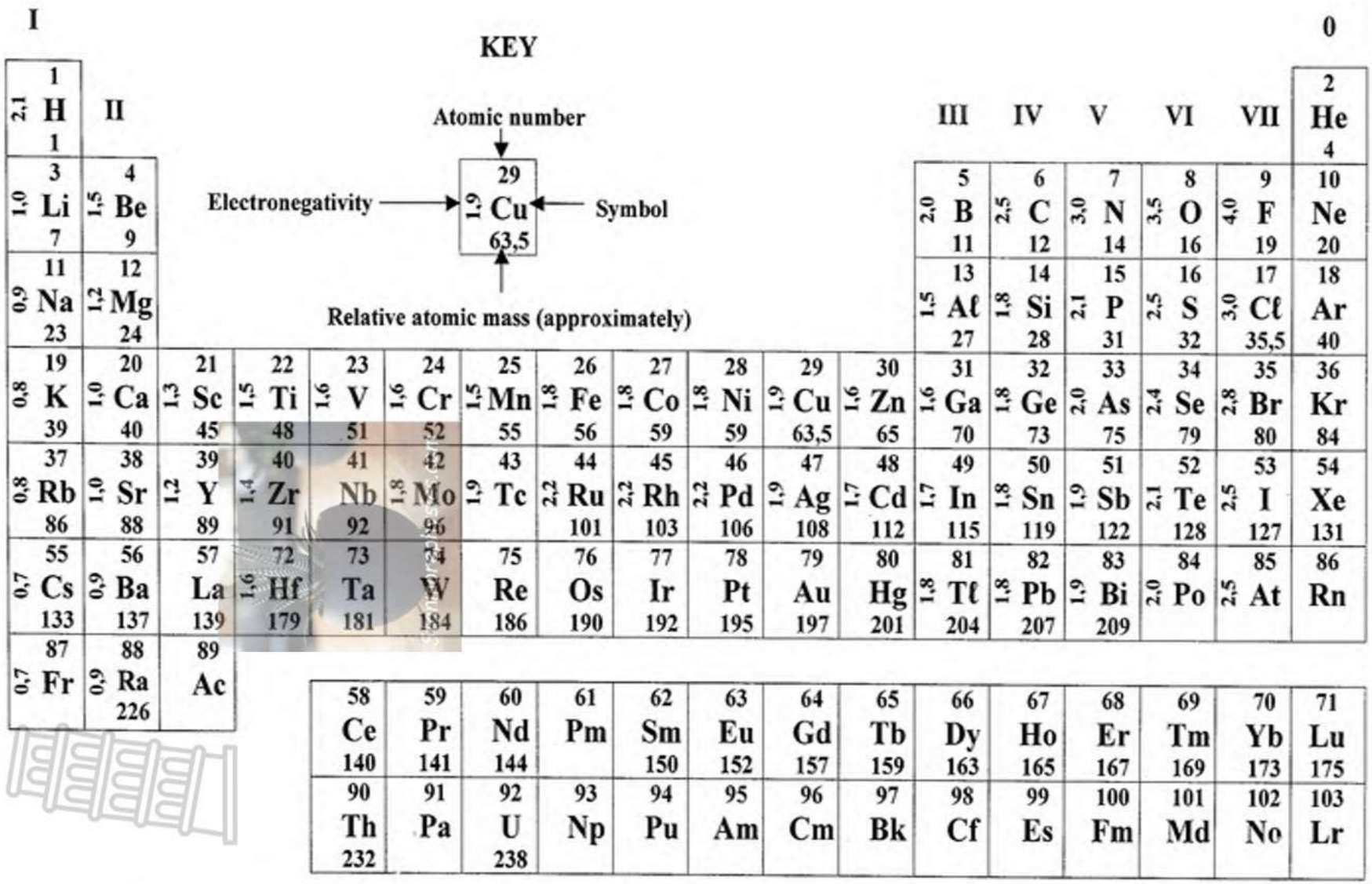
5.3 Write down the:

5.3.1 Type of intermolecular forces between iodine crystals. (1)

5.3.2 Conclusion made from observation in test tube **P**. (1)
[9]

TOTAL: 50

TABLE 3: THE PERIODIC TABLE OF ELEMENTS



I	II	III	IV	V	VI	VII	0
1 2,1 H 1							2 He 4
3 1,0 Li 7	4 1,5 Be 9	5 2,0 B 11	6 2,5 C 12	7 3,0 N 14	8 3,5 O 16	9 4,0 F 19	10 Ne 20
11 0,9 Na 23	12 1,2 Mg 24	13 1,5 Aℓ 27	14 1,8 Si 28	15 2,1 P 31	16 2,5 S 32	17 3,0 Cℓ 35,5	18 Ar 40
19 0,8 K 39	20 1,0 Ca 40	21 1,3 Sc 45	22 1,5 Ti 48	23 1,6 V 51	24 1,6 Cr 52	25 1,5 Mn 55	26 1,8 Fe 56	27 1,8 Co 59	28 1,8 Ni 59	29 1,9 Cu 63,5	30 1,6 Zn 65	31 1,6 Ga 70	32 1,8 Ge 73	33 2,0 As 75	34 2,4 Se 79	35 2,8 Br 80	36 Kr 84
37 0,8 Rb 86	38 1,0 Sr 88	39 1,2 Y 89	40 1,4 Zr 91	41 Nb 92	42 1,8 Mo 96	43 1,9 Tc	44 2,2 Ru 101	45 2,2 Rh 103	46 2,2 Pd 106	47 1,9 Ag 108	48 1,7 Cd 112	49 1,7 In 115	50 1,8 Sn 119	51 1,9 Sb 122	52 2,1 Te 128	53 2,5 I 127	54 Xe 131
55 0,7 Cs 133	56 0,9 Ba 137	57 La 139	72 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	81 1,8 Tℓ 204	82 1,8 Pb 207	83 1,9 Bi 209	84 2,0 Po	85 2,5 At	86 Rn
87 0,7 Fr	88 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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