LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

NATIONAL
SENIOR CERTIFICATE

GRADE 11

PHYSICAL SCIENCES: CHEMISTRY (P2)
JUNE 2025

MARKS: 100

TIME : 2 Hours

This question paper consists of 13 pages including this cover page and 3 data sheets.

INSTRUCTIONS AND INFORMATION

1. Write your NAME in the appropriate space on the ANSWER BOOK.

2. This question paper consists of 5 questions. Answer ALL the questions.

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. Show ALL formulae and substitutions in ALL calculations.

8. Round off your FINAL numerical answers to **TWO** decimal places.

9. Diagrams are NOT necessarily drawn to scale.

10. 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. Write only the letter (A – D) next to the number (1.1 – 1.10) in the ANSWER BOOK. Eg. 1.11 A

1.1 The type of particle which results from covalent bonding of atom is called

A an isotope.

B an atom.

C an ion.

D a molecule. (2)

1.2 The bonding in the H_2O molecule is described as polar covalent because

A the shared electrons are closer to the oxygen atom than the hydrogen atom.

B the shared electrons are closer to the hydrogen atom than the oxygen atom.

C electrons are transferred from hydrogen atoms to oxygen atoms.

D there is a large electronegativity difference between the two atoms. (2)

1.3 The $CC\ell_4$ molecule is considered to be non-polar because

A the shape of the molecule is linear.

B the molecule is symmetrical.

C the electronegativity difference is very small.

D the molecule is asymmetrical. (2)

1.4 Which ONE of the following contains ionic bonds?

A $NaC\ell$

B OF_2

C $CH_3C\ell$

D H_2O (2)

1.5 Bond length is the average distance between the…

A molecules of the same substance.

B nuclei of two bonded atoms.

C electrons in two bonded atoms.

D orbitals of two bonded atoms. (2)

1.6 Which ONE of the following statements represents the best explanation for the term 'electronegativity'?

A a measure of the tendency of an atom to attract a bonding pair of electrons.

B a measure of the tendency of an atom to attract an electron.

C a measure of the strength of a covalent bond.

D a measure of the strength of an ionic bond. (2)

1.7 Sodium chloride ($NaC\ell$) is a solid which is soluble in water. Which ONE of the following describes the intermolecular forces that exist between sodium chloride and water in solution?

A Induced dipole-dipole.

B Ion-induced dipole.

C Dipole-dipole.

D Ion-dipole. (2)

1.8 Consider the structure of hexane

$$H-\underset{H}{\overset{H}{C}}-\underset{H}{\overset{H}{C}}-\underset{H}{\overset{H}{C}}-\underset{H}{\overset{H}{C}}-\underset{H}{\overset{H}{C}}-\underset{H}{\overset{H}{C}}-H$$

A molecule of hexane is considered to be non-polar. Which ONE of the following statements best describes the reason why hexane is non-polar?

A Hexane contains only single bonds between atoms.

B The electronegativity difference between C and H atoms is so small as to be considered non-polar.

C Hexane is a linear molecule, hence is symmetrical.

D The charge distribution of electrons within the hexane molecule is symmetrical. (2)

1.9 Hydrogen bonds and London forces (induced dipole forces) have a common characteristic in that they …

A are both stronger than chemical bonds.

B both occur between non-polar molecules.

C both occur between polar molecules.

D are both intermolecular forces. (2)

1.10 Hydrogen bonding is a type of intermolecular force that can exist between the molecules of certain compounds. Which ONE of the statements below best describes the condition under which hydrogen bonding is most likely to occur? It occurs between:

A A small molecule which contains hydrogen atoms.

B Molecules in which hydrogen is bonded to small atoms with high electronegativity.

C Large molecules which contain both hydrogen and oxygen atoms.

D Molecules in which hydrogen is bonded to small atoms with low electronegativity. (2)

[20]

QUESTION 2 (Start on a new page)

Molecules such as $\mathbf{CO_2}$ and $\mathbf{H_2O}$ are formed through covalent bonding.

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

2.2 ONE of the above molecules has lone pairs of electrons on the central atom.

2.2.1 Explain what is meant by a lone pair. (2)

2.2.2 Draw the Lewis structure for this molecule (2)

2.2.3 Identify the central atom in this molecule. (2)

2.2.4 How many lone pairs of electrons are present in this molecule (1)

2.2.5 What is the molecular shape of this molecule. (2)

2.3 $\mathbf{H_2O}$ can form a dative covalent bond to form $\mathbf{H_3O^+}$.

2.3.1 Use the Lewis electron diagram for water molecule to explain the dative covalent bond. (6)

2.3.2 State TWO conditions for the formation of such a bond. (4)

[21]

QUESTION 3 (Start on a new page)

Hydrogen fluoride (HF) can be prepared by treating calcium fluoride (CaF_2) with an acid.

3.1 Define the term *electronegativity*. (2)

3.2 Use electronegativity differences to explain the difference in the type of bonding found in HF and CaF_2. (4)

3.3 Using a Lewis diagram, illustrate fully how bonding occurs in CaF_2 (4)

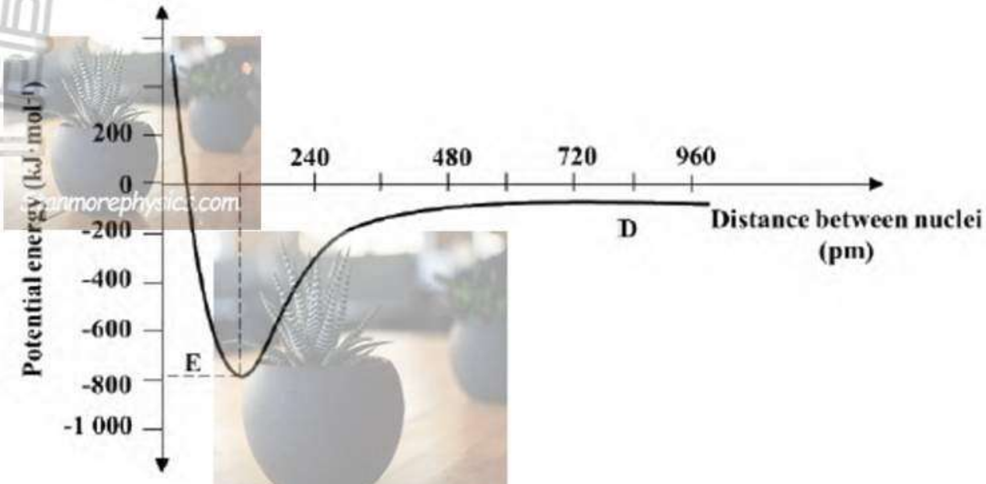
3.4 HF is described as a polar molecule. Explain what is meant by this term. (2)

3.5 HF is an example of a group of three molecules that exhibit what is known as hydrogen bonding. What TWO identifying characteristics are crucial in a molecule being able to exhibit hydrogen bonding. (2)

[14]

QUESTION 4 (Start on a new page)

The graph below shows the change in energy that takes place when an oxygen atom approaches a carbon atom during the formation of a **C=O** bond.



4.1 Define the term *bond length*. (2)

4.2 From the graph, write down the:

4.2.1 bond length, in pm, of the **C=O** bond. (2)

4.2.2 bond energy, in Kj.mol^{-1} needed to break the **C=O** bond. (2)

4.2.3 name the potential energy represented by **E**. (2)

4.3 How will the bond length of an **S=O** bond compares to that of the **C=O** bond? Write down EQUAL TO, SHORTER THAN or LONGER THAN. Give a reason for your answer. (2)

4.4 What can be said about the forces between the two atoms at point **D**? (2)

4.5 The table below shows the bond lengths and bond energies for different bonds between two carbon atoms.

	Bond	Length (pm)	Energy (kJ·mol^{-1})
A	C – C	154	348
B	C = C	134	614
C	C ≡ C	120	839

4.5.1 Describe the relationship between bond length and bond energy as shown in the above table? (2)

4.5.2 Which ONE of the bonds (**A, B** or **C**) will be the weakest? Explain (3)

[17]

QUESTION 5 (Start on a new page)

The boiling points of four compounds of hydrogen at standard pressure are given in the table below.

Formula	Boiling point (°C)
CH_4	-164
NH_3	–33
H_2O	100
SiH_4	–112

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

5.2 Fully explain the difference in boiling points between CH_4 and:

5.2.1 NH_3 (3)

5.2.2 SiH_4 (3)

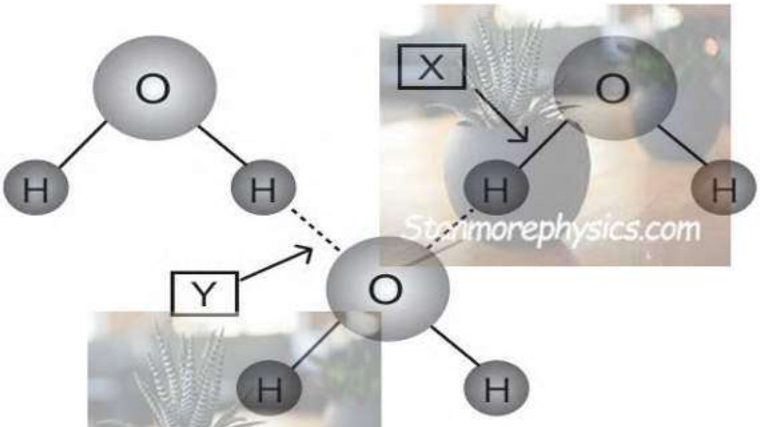
5.3 Explain why the boiling points of NH_3 and H_2O differ by referring to the electronegativity, the molecular shapes and the intermolecular forces in these substances. (4)

5.4 Select substances from the table above which are classified as either:

5.4.1 Non-polar molecules. (2)

5.4.2 Polar molecules. (2)

5.5 Consider the diagram below, showing an arrangements of water molecules in the liquid phase.



5.5.1 Explain the term *interatomic bond*. (2)

5.5.2 Name the specific type of interatomic bond represented by the letter **X** in the diagram. (2)

5.5.3 Define the term *intermolecular force*. (2)

5.5.4 Name the specific type of intermolecular force represented by the letter **Y** in the diagram. (2)

5.5.5 State TWO properties of the oxygen atom that make this type of intermolecular force **Y** possible (2)

5.5.6 What is the partial charge on the hydrogen atom in the water molecule. (2)

[28]

TOTAL MARKS: 100

TABLE 3: THE PERIODIC TABLE OF ELEMENTS/*TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE*

KEY/*SLEUTEL*

Atomic number
Atoomgetal

Electronegativity
Elektronegatiwiteit

29
1,9 Cu
63,5

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)
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

TABLE 4A: STANDARD REDUCTION POTENTIALS
TABEL 4A: STANDAARD-REDUKSIEPOTENSIALE

Half-reactions/*Halfreaksies*			E^θ (V)
$F_2(g) + 2e^-$	$\rightleftharpoons$	$2F^-$	+ 2,87
$Co^{3+} + e^-$	$\rightleftharpoons$	Co^{2+}	+ 1,81
$H_2O_2 + 2H^+ +2e^-$	$\rightleftharpoons$	$2H_2O$	+1,77
$MnO_4^- + 8H^+ + 5e^-$	$\rightleftharpoons$	$Mn^{2+} + 4H_2O$	+ 1,51
$C\ell_2(g) + 2e^-$	$\rightleftharpoons$	$2C\ell^-$	+ 1,36
$Cr_2O_7^{2-} + 14H^+ + 6e^-$	$\rightleftharpoons$	$2Cr^{3+} + 7H_2O$	+ 1,33
$O_2(g) + 4H^+ + 4e^-$	$\rightleftharpoons$	$2H_2O$	+ 1,23
$MnO_2 + 4H^+ + 2e^-$	$\rightleftharpoons$	$Mn^{2+} + 2H_2O$	+ 1,23
$Pt^{2+} + 2e^-$	$\rightleftharpoons$	Pt	+ 1,20
$Br_2(\ell) + 2e^-$	$\rightleftharpoons$	$2Br^-$	+ 1,07
$NO_3^- + 4H^+ + 3e^-$	$\rightleftharpoons$	$NO(g) + 2H_2O$	+ 0,96
$Hg^{2+} + 2e^-$	$\rightleftharpoons$	$Hg(\ell)$	+ 0,85
$Ag^+ + e^-$	$\rightleftharpoons$	Ag	+ 0,80
$NO_3^- + 2H^+ + e^-$	$\rightleftharpoons$	$NO_2(g) + H_2O$	+ 0,80
$Fe^{3+} + e^-$	$\rightleftharpoons$	Fe^{2+}	+ 0,77
$O_2(g) + 2H^+ + 2e^-$	$\rightleftharpoons$	H_2O_2	+ 0,68
$I_2 + 2e^-$	$\rightleftharpoons$	$2I^-$	+ 0,54
$Cu^+ + e^-$	$\rightleftharpoons$	Cu	+ 0,52
$SO_2 + 4H^+ + 4e^-$	$\rightleftharpoons$	$S + 2H_2O$	+ 0,45
$2H_2O + O_2 + 4e^-$	$\rightleftharpoons$	$4OH^-$	+ 0,40
$Cu^{2+} + 2e^-$	$\rightleftharpoons$	Cu	+ 0,34
$SO_4^{2-} + 4H^+ + 2e^-$	$\rightleftharpoons$	$SO_2(g) + 2H_2O$	+ 0,17
$Cu^{2+} + e^-$	$\rightleftharpoons$	Cu^+	+ 0,16
$Sn^{4+} + 2e^-$	$\rightleftharpoons$	Sn^{2+}	+ 0,15
$S + 2H^+ + 2e^-$	$\rightleftharpoons$	$H_2S(g)$	+ 0,14
$2H^+ + 2e^-$	$\rightleftharpoons$	**$H_2(g)$**	**0,00**
$Fe^{3+} + 3e^-$	$\rightleftharpoons$	Fe	− 0,06
$Pb^{2+} + 2e^-$	$\rightleftharpoons$	Pb	− 0,13
$Sn^{2+} + 2e^-$	$\rightleftharpoons$	Sn	− 0,14
$Ni^{2+} + 2e^-$	$\rightleftharpoons$	Ni	− 0,27
$Co^{2+} + 2e^-$	$\rightleftharpoons$	Co	− 0,28
$Cd^{2+} + 2e^-$	$\rightleftharpoons$	Cd	− 0,40
$Cr^{3+} + e^-$	$\rightleftharpoons$	Cr^{2+}	− 0,41
$Fe^{2+} + 2e^-$	$\rightleftharpoons$	Fe	− 0,44
$Cr^{3+} + 3e^-$	$\rightleftharpoons$	Cr	− 0,74
$Zn^{2+} + 2e^-$	$\rightleftharpoons$	Zn	− 0,76
$2H_2O + 2e^-$	$\rightleftharpoons$	$H_2(g) + 2OH^-$	− 0,83
$Cr^{2+} + 2e^-$	$\rightleftharpoons$	Cr	− 0,91
$Mn^{2+} + 2e^-$	$\rightleftharpoons$	Mn	− 1,18
$A\ell^{3+} + 3e^-$	$\rightleftharpoons$	$A\ell$	− 1,66
$Mg^{2+} + 2e^-$	$\rightleftharpoons$	Mg	− 2,36
$Na^+ + e^-$	$\rightleftharpoons$	Na	− 2,71
$Ca^{2+} + 2e^-$	$\rightleftharpoons$	Ca	− 2,87
$Sr^{2+} + 2e^-$	$\rightleftharpoons$	Sr	− 2,89
$Ba^{2+} + 2e^-$	$\rightleftharpoons$	Ba	− 2,90
$Cs^+ + e^-$	$\rightleftharpoons$	Cs	- 2,92
$K^+ + e^-$	$\rightleftharpoons$	K	− 2,93
$Li^+ + e^-$	$\rightleftharpoons$	Li	− 3,05

↑ Increasing oxidising ability/*Toenemende oksiderende vermoë*

↓ Increasing reducing ability/*Toenemende reduserende vermoë*

TABLE 4B: STANDARD REDUCTION POTENTIALS
TABEL 4B: STANDAARD-REDUKSIEPOTENSIALE

Half-reactions/*Halfreaksies*			E^{θ} (V)
$Li^+ + e^-$	⇌	Li	− 3,05
$K^+ + e^-$	⇌	K	− 2,93
$Cs^+ + e^-$	⇌	Cs	− 2,92
$Ba^{2+} + 2e^-$	⇌	Ba	− 2,90
$Sr^{2+} + 2e^-$	⇌	Sr	− 2,89
$Ca^{2+} + 2e^-$	⇌	Ca	− 2,87
$Na^+ + e^-$	⇌	Na	− 2,71
$Mg^{2+} + 2e^-$	⇌	Mg	− 2,36
$A\ell^{3+} + 3e^-$	⇌	$A\ell$	− 1,66
$Mn^{2+} + 2e^-$	⇌	Mn	− 1,18
$Cr^{2+} + 2e^-$	⇌	Cr	− 0,91
$2H_2O + 2e^-$	⇌	$H_2(g) + 2OH^-$	− 0,83
$Zn^{2+} + 2e^-$	⇌	Zn	− 0,76
$Cr^{3+} + 3e^-$	⇌	Cr	− 0,74
$Fe^{2+} + 2e^-$	⇌	Fe	− 0,44
$Cr^{3+} + e^-$	⇌	Cr^{2+}	− 0,41
$Cd^{2+} + 2e^-$	⇌	Cd	− 0,40
$Co^{2+} + 2e^-$	⇌	Co	− 0,28
$Ni^{2+} + 2e^-$	⇌	Ni	− 0,27
$Sn^{2+} + 2e^-$	⇌	Sn	− 0,14
$Pb^{2+} + 2e^-$	⇌	Pb	− 0,13
$Fe^{3+} + 3e^-$	⇌	Fe	− 0,06
$2H^+ + 2e^-$	⇌	**$H_2(g)$**	**0,00**
$S + 2H^+ + 2e^-$	⇌	$H_2S(g)$	+ 0,14
$Sn^{4+} + 2e^-$	⇌	Sn^{2+}	+ 0,15
$Cu^{2+} + e^-$	⇌	Cu^+	+ 0,16
$SO_4^{2-} + 4H^+ + 2e^-$	⇌	$SO_2(g) + 2H_2O$	+ 0,17
$Cu^{2+} + 2e^-$	⇌	Cu	+ 0,34
$2H_2O + O_2 + 4e^-$	⇌	$4OH^-$	+ 0,40
$SO_2 + 4H^+ + 4e^-$	⇌	$S + 2H_2O$	+ 0,45
$Cu^+ + e^-$	⇌	Cu	+ 0,52
$I_2 + 2e^-$	⇌	$2I^-$	+ 0,54
$O_2(g) + 2H^+ + 2e^-$	⇌	H_2O_2	+ 0,68
$Fe^{3+} + e^-$	⇌	Fe^{2+}	+ 0,77
$NO_3^- + 2H^+ + e^-$	⇌	$NO_2(g) + H_2O$	+ 0,80
$Ag^+ + e^-$	⇌	Ag	+ 0,80
$Hg^{2+} + 2e^-$	⇌	$Hg(\ell)$	+ 0,85
$NO_3^- + 4H^+ + 3e^-$	⇌	$NO(g) + 2H_2O$	+ 0,96
$Br_2(\ell) + 2e^-$	⇌	$2Br^-$	+ 1,07
$Pt^{2+} + 2e^-$	⇌	Pt	+ 1,20
$MnO_2 + 4H^+ + 2e^-$	⇌	$Mn^{2+} + 2H_2O$	+ 1,23
$O_2(g) + 4H^+ + 4e^-$	⇌	$2H_2O$	+ 1,23
$Cr_2O_7^{2-} + 14H^+ + 6e^-$	⇌	$2Cr^{3+} + 7H_2O$	+ 1,33
$C\ell_2(g) + 2e^-$	⇌	$2C\ell^-$	+ 1,36
$MnO_4^- + 8H^+ + 5e^-$	⇌	$Mn^{2+} + 4H_2O$	+ 1,51
$H_2O_2 + 2H^+ + 2e^-$	⇌	$2H_2O$	+1,77
$Co^{3+} + e^-$	⇌	Co^{2+}	+ 1,81
$F_2(g) + 2e^-$	⇌	$2F^-$	+ 2,87

Increasing oxidising ability/*Toenemende oksiderende vermoë* ↓

Increasing reducing ability/*Toenemende reduserende vermoë* ↑

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GRADE/*GRAAD* 11

PHYSICAL SCIENCES: CHEMISTRY (P2) / *FISIESE WETENSKAPPE: CHEMIE (V2)*

FINAL ERRATA MARKING GUIDELINE/FINALE ERRATA *NASIENRIGLYNE*

JUNE 2025/*JUNIE 2025*

MARKS/*PUNTE*: 100

This marking guideline consists of 8 pages including this cover page/*Hierdie nasienriglyne bestaan uit 8 bladsye, insluitend hierdie voorblad.*

QUESTION 1/*VRAAG* 1

1.1	**D**	✓✓
1.2	**A**	✓✓ **or/*of* D**
1.3	**B**	✓✓
1.4	**A**	✓✓
1.5	**B**	✓✓
1.6	**A**	✓✓
1.7	**D**	✓✓
1.8	**C**	✓✓ **or/*of* D**
1.9	**D**	✓✓
1.10	**B**	✓✓

[20]

QUESTION 2/*VRAAG* 2

2.1 Covalent bond is the sharing of electrons between two atoms to form a molecule. ✓✓ *Kovalente binding is die deling van elektrone tussen twee atome om 'n molekule te vorm* *(2 or 0)* (2)

2.2.1 Lone pair is a pair of electrons in the valence shell of an atom that is not shared with another atom. ✓✓/ *'n Alleenpaar is 'n paar elektrone in die valensskil/orbitaal van 'n atoom wat nie met 'n ander atoom gedeel word nie.* (2)

2.2.2

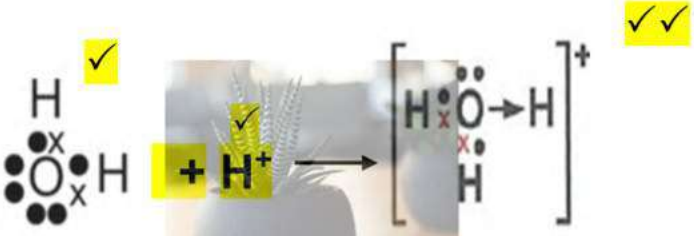
✓✓ (2)

2.2.3 Oxygen. ✓✓/O/*suurstof* (NOT O_2/*NIE* O_2 *NIE*) (2)

2.2.4 Two (2) lone pairs. ✓✓/*Twee (2) alleenpare* (2)

2.2.5 Angular molecular shape. ✓✓/bent /*Hoekige molekulêre vorm/gebuig* (2)

2.3.1 H_2O has two lone pairs of electrons. One of these lone pairs can be used to fill the empty outermost energy level of the H^+ ion. ✓ This now forms a dative covalent bond between H^2O and H^+ producing the H_3O^+ ion. ✓/*H_2O het twee alleenpaar elektrone. Een van hierdie alleenpare kan gebruik word om die leë buitenste energievlak van H^+ ione te vul. Hierdie vorm nou 'n datiewe kovalente binding tussen H_20 en H^+, wat H_3O^+ ione produseer.*



(6)

2.3.2 One atom must have an empty valence shell/ orbital. ✓✓/ *Een atoom moet 'n leë valensskil/orbitaal hê.*

The other atom must have a lone pair of electrons. ✓✓/ *Die ander atoom moet 'n alleenpaar elektrone hê.* (4)

[22]

QUESTION 3/*VRAAG 3*

3.1 The measure of the amount of attraction✓ an atom has on a shared pair of electrons. ✓/ *Die maatstaf van die hoeveelheid aantrekkingskrag wat 'n atoom op 'n gedeelde elektronpaar het.* (2)

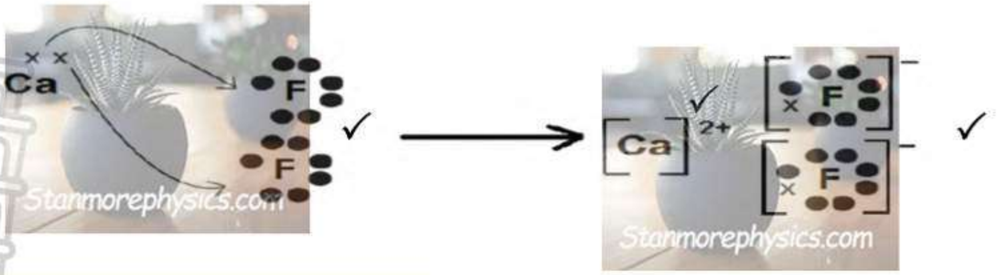
3.2 HF: Electronegativity difference =1,9✓/ *Elektronegatiwiteitsverskil =1,9*

CaF: Electronegativity difference = 3,0✓/*Elektronegatiwiteitsverskil = 3,0*

HF will be expected to be covalent✓ although it does have some ionic character due to the relatively large electronegativity difference. CaF_2 will be strongly ionic✓ due to a very high electronegativity./ *Daar sal verwag word dat HF kovalent sal wees, alhoewel dit wel 'n mate van ioniese eienskappe het as gevolg van die relatief groot elektronegatiwiteitsverskil. CaF_2 sal sterk ionies wees as gevolg van 'n baie hoë elektronegatiwiteit.*

(4)

3.3

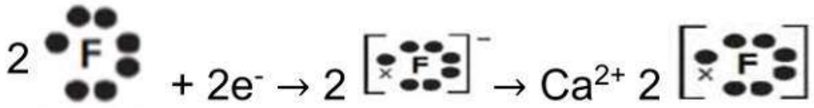


Marking Criteria/*Nasien kriteria*

	Marks/*punte*
xx **Ca**	✓ (Ca with two electrons/*Ca met 2 elektrone)*
.. .. **: F. . F:** **" "**	✓ (Each F with seven electrons/*elke F met sewe elektrone)*
[Ca]$^{2+}$	✓ (Ca with 2+/*Ca met 2+)*
.. .. **[: F .ˣ]$^-$ [.ˣ F:]$^-$** **" "**	✓ (Each F bonded to Ca electron/*Elke F aan 'n Ca elektron gebind)*

OR/*OF*

$\overset{x\,x}{Ca} \rightarrow Ca^{2+} + 2e^-$



(4)

3.4 HF has two distinct regions of charge on the molecule ✓✓

/HF het twee afsonderlike ladingsgebiede op die molekule.

(2)

3.5 The H atom in the molecule must be bonded to a small atom✓ of very high electronegativity✓/ *Die H-atoom in die molekule moet gebind wees aan 'n klein atoom met baie hoë elektronegatiwiteit.* (2)

[14]

QUESTION 4/*VRAAG 4*

4.1 Bond length is the average distance between the nuclei of two bonded atoms. ✓✓/ *Bindingslengte is die gemiddelde afstand tussen die kerne van twee gebonde atome* **(2 or/of 0)** (2)

4.2.1 120 pm ✓✓ (2)

4.2.2 (+ or -) 800 kJ mol^{-1} ✓✓ Accept range/*aanvaar reeks*: 790 – 800 (2)

4.2.3 Bond energy/ *Bindingsenergie* **(2 or/of 0)** (2)

4.3 LONGER THAN ✓ The sulphur atom is larger than the carbon atom ✓ therefore the bond length will be longer (the attraction between the two atoms will be less) / *LANGER AS. Die swaelatoom is groter as die koolstofatoom daarom sal die bindingslengte langer wees (die aantrekkingskrag tussen die twee atome sal minder wees)* (2)

4.4 At point D there is very little/weak (or no) force✓✓/ *By punt D is daar baie min/swak (of geen) krag.* (2)

4.5.1 The shorter the bond length the higher the bond energy. ✓✓/ *Hoe korter die bindingslengte, hoe hoër die bindingsenergie*

OR/OF

The longer the bond length the lower/less/smaller the bond energy.✓✓/ *Hoe langer die bindingslengte, hoe laer/minder/kleiner die bindingsenergie* (2)

4.5.2 A ✓.Need less energy✓ to overcome the single bond and there for weaker forces✓ /*A. Benodig minder energie om die enkelbinding te breek, daarom swakker kragte.*

OR/*OF*

A✓. Shorter bond length therefore less energy✓ to overcome the single bond and weaker force✓/*A. Korter bindingslengte, daarom minder energie omdie enkelbinding te breek en dus swakker kragte.*

(3)

[17]

QUESTION 5/*VRAAG 5*

5.1 The boiling point is the temperature at which the vapour pressure of a liquid is equal to the atmospheric pressure. ✓✓/ *Die kookpunt is die temperatuur waarby die dampdruk van 'n vloeistof gelyk is aan die atmosferiese druk*

(2 or 0) (2)

5.2.1 NH_3 has HYDROGEN BONDS between molecules and CH_4 LONDON FORCES between molecules✓/*NH_3 het waterstofbindings tussen molekules en CH_4 het Londonkragte tussen molekules*

Hydrogen bonds between molecules in NH_3 is stronger than the London forces in CH_4 ✓/*Waterstofbindings tussen molekules in NH_3 is sterker as Londonkragte in CH_4.*

More energy needed to overcome the stronger forces between NH_3 molecules therefore higher boiling point✓/*Meer energie is nodig om die sterker kragte in NH_3 te oorkom as die Londonkragte in CH_4.*

OR/*OF*

CH_4 London forces between molecules and Hydrogen bonds between NH_3 molecules. ✓/*CH_4 het Londonkragte tussen molekules en NH_3 het waterstofbindings tussen molekules*

London forces between CH_4 molecules weaker than hydrogen bonds between NH_3. ✓/*London kragte tussen CH_4 molekules is swakker as waterstofbindings tussn NH_3.*

Less energy needed to overcome weaker forces between CH_4 molecules and therefore lower boiling point. ✓/*Minder energie is nodig om die swakker kragte tussen CH_4 molekules to oorkom en daarom het dit 'n laer kookpunt.*

(3)

5.2.2 The intermolecular dispersion forces in SiH_4 bigger than CH_4 ✓, SiH_4 requires larger energy ✓ to break these dispersion forces before the molecules can convert to vapor. ✓/ *Die intermolekulêre dispersiekragte in SiH_4 is groter as CH_4 , SiH_4 benodig groter energie om hierdie dispersiekragte te breek voordat die molekules na damp kan omskakel.*

OR/OF

Molecular mass/size of SiH_4 is greater than CH_4✓. London forces in SiH_4 is stronger than in CH_4. More energy is needed to overcome the intermolecular forces. Therefore the higher boiling point (Accept the inverse as well)/*Molekulêre massa/grootte van SiH_4 is groter as die van CH_4.*

Londonkragte in SiH_4 is sterker as in CH_4. Meer energie is nodig om die intermolekulêre kragte te oorkom, vandaar die hoër kookpunt. (Aanvaar die omgekeerde stelling ook). (3)

5.3 NH_3 and H_2O both have polar molecules with hydrogen bonds between them.✓ The electronegativity between N and H is 3,0 – 2,1 = 0,9 whereas the electronegativity difference between H and O is 3,5 – 2,1 = 1,4. ✓ The covelent bonds inside the water molecule are more polar than those in the NH_3 molecule. ✓ Water molecules have an angular shape, whereas NH_3 molecules are trigonal pyramidal. ✓ This allows each water molecules to form two hydrogen bonds with two other water molecules making the intermolecular forces in water. / *NH_3 en H_2O het albei polêre molekules met waterstofbindings tussen hulle. Die elektronegatiwiteit tussen N en H is 3,0 – 2,1 = 0,9, terwyl die elektronegatiwiteitsverskil tussen H en O 3,5 – 2,1 = 1,4 is. Die kovalente bindings binne die watermolekule is meer polêr as dié in die NH_3-molekule. Watermolekules het 'n hoekige vorm, terwyl NH_3-molekules trigonaal-piramidaal is. Dit laat elke watermolekule toe om twee waterstofbindings met twee ander watermolekules te vorm, wat die intermolekulêre kragte in water veroorsaak.* (4)

5.4.1 CH_4 ✓ and/*en* SiH_4 ✓ (2)

5.4.2 NH_3 ✓ and/*en* H_2O✓ (2)

5.5.1 A bond that exists within a molecule between the atoms in that molecule✓✓**Accept**: Forces between atoms/ *'n Binding wat binne 'n molekule tussen die atome in daardie molekule bestaan. Aanvaar: Kragte tussen atome* ***(2 or/of 0)*** (2)

5.5.2 Polar✓ covalent bond✓ (It will be polar due to the electronegativity difference between H and O) / *Polêr kovalente binding (Dit sal polêr wees as gevolg van die elektronegatiwiteitsverskil tussen H en O)* (2)

5.5.3 This is the force of attraction between molecules in a system✓✓/ *Dit is die aantrekkingskrag tussen molekules in 'n stelsel.* ***(2 or 0)*** (2)

5.5.4 Hydrogen bonding (intermolecular force). ✓✓/ *Waterstofbinding (intermolekulêre krag)* (2)

5.5.5 O is a very small atom in terms of its atomic size. ✓/ *O is 'n baie klein atoom in terme van sy atoomgrootte*

O has a very high electronegativity. ✓/ *O het 'n baie hoë electronegativities* (2)

5.5.6 δ^+✓/slightly positive/*ietwat positief*

(H will not have any electron near its nucleus as the high electronegativity of O will pull the shared electron pair away from the H atoms and towards itself, leaving the H atoms δ^+)/(*H sal geen elektron naby sy kern hê nie, aangesien die hoë elektronegatiwiteit van O die gedeelde elektronpaar weg van die H-atome en na homself sal trek, wat die H-atome δ^+) sal laat.)*

(1)

[27]

TOTAL/*TOTAAL:* 100