



LIMPOPO

PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA



DEPARTMENT OF
EDUCATION

**NATIONAL
SENIOR CERTIFICATE**

GRADE 11

PHYSICAL SCIENCES: CHEMISTRY (P2)

JUNE 2026

MARKS: 100

TIME: 2 hours

This question paper consists of 09 pages and a periodic table.

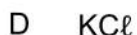
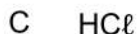
INSTRUCTIONS AND INFORMATION

1. Write your name and class in the appropriate spaces on the ANSWER BOOK.
2. This question paper consists of 5 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, e.g. QUESTION 2.1 and QUESTION 2.2.
6. You may use non-programmable calculator.
7. You may use appropriate mathematical instruments.
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. You are advised to use the attached DATA SHEET.
12. Write neatly and legibly

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

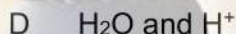
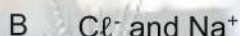
Various options are provided as possible answers to the following questions. Each question has only ONE correct answer. Choose the answer and write only the letter (A-D) next to the question numbers (1.1 to 1.10) in the ANSWER BOOK, e.g. 1.5 E.

1.1 Which ONE of the following compounds is the bonding ionic?



(2)

1.2 Which one of the following combinations will form a dative covalent bond?



(2)

1.3 Sodium chloride (NaCl) is a solid which is soluble in water. Which of the following describes the intermolecular forces that exist between sodium chloride and water in solution?

A Ion-dipole.

B Dipole-dipole.

C Ion-induced dipole.

D Induced dipole-dipole.

(2)

1.4 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)

1.5 The shape of a CH_4 molecule according to the VSEPR theory is:

- A. Linear
- B. Trigonal planar
- C. Tetrahedral
- D. Angular

(2)

1.6 What is the **bond order** of a Nitrogen molecule (N_2)

- A. 1
- B. 2
- C. 3
- D. 4



1.7 Which substance will have the highest viscosity at the same temperature?

- A. Hexane (C_6H_{14})
- B. Water (H_2O)
- C. Methanol (CH_3OH)
- D. Ethylene glycol ($\text{HOCH}_2\text{CH}_2\text{OH}$)

(2)

1.8 Which force explains why ionic solids dissolve readily in polar solvents like water?

- A. London dispersion
- B. Dipole - dipole
- C. Hydrogen bonding
- D. Ion - dipole

(2)

1.9 Which molecule can hydrogen – bond with itself (i.e, form H – bonds between identical molecules)?

- A. CH_3OH
- B. CH_4
- C. C_2H_6
- D. CO_2

(2)

1.10 For noble gases, what trend explains increasing boiling point down the group?

- A. Increasing polarity
B. Increasing molecular mass → stronger London dispersion
C. Increasing hydrogen bonding
D. Increasing ionic character

(2)

[20]

QUESTION 2 (Start on a new page.)

2.1 Define the term *covalent bond*.

(2)

Consider the following substances:

HCN (g) H₂O (ℓ) CH₄ NH₃(g) CO (g) CO₂ (g)

Answer the following questions based on the above substances.

2.2 Draw the Lewis diagram of the HCN molecule.

(2)

2.3 Write down the number of lone pairs in the central atom of a water molecule.

(1)

2.4 Write down the shapes of the following molecules:

2.4.1 CH₄

(2)

2.4.2 NH₃

(2)

2.5 NH₃ can form a dative covalent bond to form NH₄⁺.

2.5.1 Draw the Lewis structure NH₄⁺.

(2)

2.5.2 Explain how the ammonium ion (NH₄⁺) is formed using a dative covalent bond.

(4)

2.5.3 State TWO conditions for the formation of such a bond

(4)

[19]

Question 3 (Start on a new page.)

3.1 CO and CO₂ are molecules having only C-O bonds, and they are both linear in shape.

3.1.1 Define the term *electronegativity*. (2)

3.1.2 Calculate the difference in electronegativity (ΔEN) for the C-O bond. (2)

3.1.3 Explain why CO is a POLAR molecule, while CO₂ is a NON-POLAR molecule. (4)

3.2 On the Pauling scale the electronegativities of nitrogen and oxygen are respectively 3.0 and 3.5

3.2.1 What is meant by the Pauling electronegativity scale and why is the Pauling scale so useful? (2)

3.2.2 Why is oxygen more electronegative than nitrogen? (2)

3.3 By thinking about where the following atoms are in the Periodic Table, sort them into order of *increasing* electronegativity: stanmorephysics.com

Aluminium, Barium, Boron, Caesium, Calcium, Carbon, Fluorine (2)

3.4 Study the compounds below and answer the following questions:

Cl₂, CsCl, MgCl₂, NaCl, PCl₃, SCl₂

3.4.1 Which of these substances has non-polar bonds? Explain your reasoning. (2)

3.4.2 Which of these substances is the most ionic? Explain your reasoning. (2)

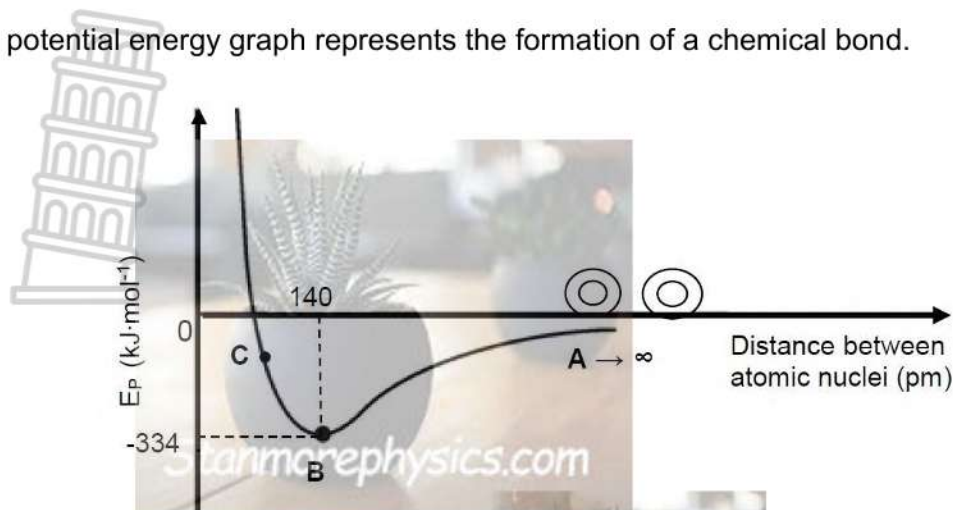
3.4.3 Which substance has polar covalent bonds. Explain your reasoning. (2)

3.5 Using the compounds CHCl₃ and CCl₄ as examples, explain the difference between a polar bond and a polar compound (4)

[24]

QUESTION 4 (Start on a new page.)

The potential energy graph represents the formation of a chemical bond.



- 4.1 Explain why the potential energy of the system decreases as shown in the graph. (2)
- 4.2 At what point, **A** or **B**: (2)
- 4.2.1 Are the atoms the furthest apart?
Give a reason for the answer by referring to the potential energy. (2)
- 4.2.2 Is the molecule formed?
Give a reason for the answer (2)
- 4.3 From the above graph, write down the VALUE and UNIT of the: (2)
- 4.3.1 The bond length (2)
- 4.3.2 Bonding energy. (2)
- 4.4 Explain the change from point **B** to point **C** on the graph. (2)
- [12]**

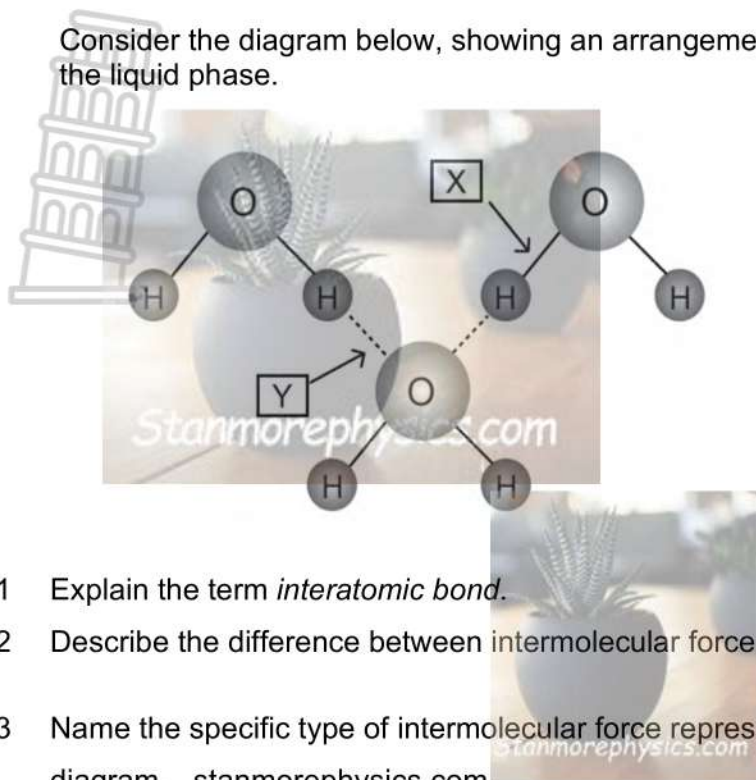
QUESTION 5 (Start on a new page.)

Consider the following substances with their formulae and appropriate boiling points at room temperature:

Name	Formula	Boiling point (°C)
Iodine	I ₂	184
Water	H ₂ O	100
Ethanol	CH ₃ CH ₃ OH	78
Bromine	Br ₂	59
Hydrogen bromide	HBr	-67

- 5.1 Define the term *boiling point*. (2)
- 5.2 Explain the difference in boiling points between the following substances by referring to the relevant intermolecular forces and their influence:
- 5.2.1 H₂O and HBr (4)
- 5.2.2 Iodine and bromine (4)
- 5.3 Can ethanol dissolve in water? Choose YES or NO. (1)
- 5.4 Explain your answer in QUESTION 5.3 by referring to the intermolecular forces. (3)
- 5.5 Hydrogen bromide has the highest vapour pressure of the substances in the table.
- 5.5.1 Define the term *vapour pressure*. (2)
- 5.5.2 Briefly explain why its vapour pressure is the highest. (2)

- 5.6 Consider the diagram below, showing an arrangement of water molecules in the liquid phase.



- 5.6.1 Explain the term *interatomic bond*. (2)
- 5.6.2 Describe the difference between intermolecular forces and interatomic forces. (2)
- 5.6.3 Name the specific type of intermolecular force represented by the letter Y in the diagram. (1)
- 5.6.4 What is the partial charge on the hydrogen atom in the water molecule. (2)

[25]

TOTAL: 100

NSC
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)
1 H 1																	2 He 4
3 Li 7	4 Be 9											5 B 11	6 C 12	7 N 14	8 O 16	9 F 19	10 Ne 20
11 Na 23	12 Mg 24											13 Al 27	14 Si 28	15 P 31	16 S 32	17 Cl 35,5	18 Ar 40
19 K 39	20 Ca 40	21 Sc 45	22 Ti 48	23 V 51	24 Cr 52	25 Mn 55	26 Fe 56	27 Co 59	28 Ni 59	29 Cu 63,5	30 Zn 65	31 Ga 70	32 Ge 73	33 As 75	34 Se 79	35 Br 80	36 Kr 84
37 Rb 86	38 Sr 88	39 Y 89	40 Zr 91	41 Nb 92	42 Mo 96	43 Tc 96	44 Ru 101	45 Rh 103	46 Pd 106	47 Ag 108	48 Cd 112	49 In 115	50 Sn 119	51 Sb 122	52 Te 128	53 I 127	54 Xe 131
55 Cs 133	56 Ba 137	57 La 139	72 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 Tl 204	82 Pb 207	83 Bi 209	84 Po 209	85 At 210	86 Rn 222
87 Fr 223	88 Ra 226	89 Ac															
58 Ce 140	59 Pr 141	60 Nd 144	61 Pm 145	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 231	92 U 238	93 Np 237	94 Pu 244	95 Am 243	96 Cm 247	97 Bk 247	98 Cf 251	99 Es 252	100 Fm 257	101 Md 258	102 No 259	103 Lr 262				



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

MARKING GUIDELINES/NASIENRIGLYNE

JUNE 2026/JUNIE 2026

Stanmorephysics.com

MARKS/PUNTE: 100

This marking guideline consists of 8 pages/Hierdie nasienriglyne bestaan uit 8 bladsye

QUESTION 1/VRAAG 1

- 1.1 D ✓✓ (2)
- 1.2 D ✓✓ (2)
- 1.3 A ✓✓ (2)
- 1.4 D ✓✓ (2)
- 1.5 C ✓✓ (2)
- 1.6 C ✓✓ (2)
- 1.7 D ✓✓ (2)
- 1.8 D ✓✓ (2)
- 1.9 A ✓✓ (2)
- 1.10 B ✓✓ (2)

[20]**QUESTION 2/VRAAG 2**

- 2.1 Sharing of electrons between two atoms to form a molecule/shared pair of electrons ✓✓/ *Deling van elektrone tussen twee atome om 'n molekule/gedeelde elektronpaar te vorm.* (2)

- 2.2 $\text{H} \times \text{C} \begin{smallmatrix} \times \\ \times \end{smallmatrix} \text{N} \begin{smallmatrix} \times \\ \times \end{smallmatrix}$ ✓✓ (2)

Marking Criteria/Nasienriglyne

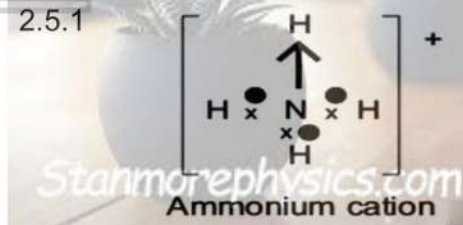
Criteria/Kriteria	Marks/Punte
Correct sharing of electrons between Hydrogen (H) and Carbon (C) to form a single covalent bond./ <i>Korrekte deling van elektrone tussen waterstof (H) en koolstof (C) om 'n enkele kovalente binding te vorm</i>	1
Correct sharing of electrons between Carbon (C) and Nitrogen (N) to form a triple covalent bond, AND showing the lone pair on the Nitrogen atom, ensuring both C and N achieve a stable octet (8 valence electrons)./ <i>Korrekte deling van elektrone tussen Koolstof (C) en Stikstof (N) om 'n drievoudige kovalente binding te vorm, EN wat die alleenpaar op die stikstofatoom toon, wat verseker dat beide C en N 'n stabiele oktet (8 valenselektrone) bereik.</i>	1

2.3 Two (2) ✓/Twee (2) (1)

2.4 2.4.1 Tetrahedral ✓/Tetraëdries (2)

2.4.2 (Trigonal) Pyramidal ✓/(Trigonaal) Piramidaal (2)

2.5 2.5.1

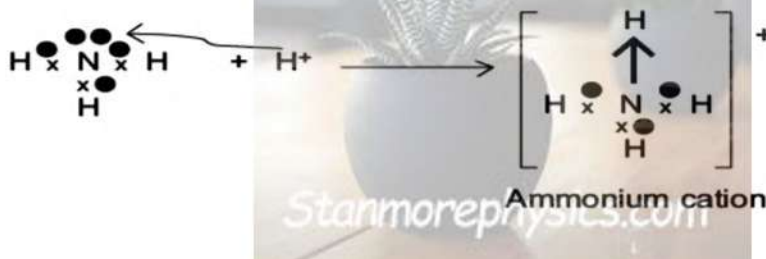


Marking criteria/nasienriglyne:

Criteria/Kriteria:	Marks/Punte
Showing three standard shared electron pairs (each consisting of one dot and one cross between the central Nitrogen (N) atom and three Hydrogen (H) atoms./ Toon drie standaard gedeelde elektronpare (elk bestaande uit een kolletjie en een kruising tussen die sentrale stikstofatoom (N) en drie waterstofatome (H)).	1
Correctly identifying the dative covalent bond—indicated either by the arrow pointing from Nitrogen's lone pair to the fourth Hydrogen (H ⁺ ion), AND enclosing the entire structure in square brackets with a positive sign (+) outside to indicate the overall charge/Die korrekte identifisering van die datief kovalente binding—aangedui deur die pyl wat van stikstof se alleenpaar na die vierde waterstof (H ⁺) ioon wys, EN die hele struktuur tussen vierkantige hakies met 'n positiewe teken (+) buite omsluit om die algehele lading aan te dui.	1

(2)

2.5.2



- Nitrogen in NH₃ has a lone pair of electrons. ✓/ Stikstof in NH₃ het 'n alleenstaande elektronpaar
- H⁺ has no electrons. ✓/ H⁺ het geen elektrone nie



2.5.3

- Nitrogen donates its lone pair to H^+ . ✓/ *Stikstof skenk sy alleenpaar aan H^+ .*
- A dative covalent bond forms to produce NH_4^+ . ✓/ *'n Datief kovalente binding vorm om NH_4^+ te produseer.*

(4)

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 alleenstaande elektronpaar hê*

(4)

[19]

QUESTION 3/VRAAG 3

3.1

3.1.1 Measure of the tendency of an atom in a molecule to attract bonding electrons/shared pairs of electrons. ✓✓/ *Maatstaf van die neiging van 'n atoom in 'n molekule om bindingselektrone/gedeelde elektronpare aan te trek.*

(2)

3.1.2 $\Delta EN_{C-O} = 3,5 - 2,5$ ✓
 $= 1,0$ ✓

(2)

3.1.3 CO is linear with O being more electronegative than C, ✓ therefore the O end of the molecule will be slightly negative/The charge distribution in CO is asymmetrical ✓ and thus it is a polar molecule.

CO₂ is also linear with the central C atom such that there is an O atom on either side. ✓ The two O ends will be slightly negative and the central C atom will be slightly positive/The charge distribution is symmetrical ✓ and thus the molecule is non-polar. /

CO is lineêr met O wat meer elektronegatief is as C, daarom sal die O-punt van die molekule effens negatief wees/Die ladingsverspreiding in CO is asimmetries en dus is dit 'n polêre molekule.

CO₂ is ook lineêr met die sentrale C-atoom sodat daar 'n O-atoom aan weerskante is. Die twee O-punte sal effens negatief wees en die sentrale C-atoom sal effens positief wees/Die ladingsverspreiding is simmetries en dus is die molekule nie-polêr.

(4)

3.2.1 The Pauling electronegativity scale is a scale between 0 and 4,0 which compares the electronegativity differences between atoms within a chemical bond. It is useful to see the degree of polarity within a covalent bond which can then give us an idea of the degree of polarity of the molecule. ✓✓ /

Die Pauling-elektronegatiwiteitskaal is 'n skaal tussen 0 en 4,0 wat die elektronegatiwiteitsverskille tussen atome binne 'n chemiese binding vergelyk. Dit is nuttig om die graad van polariteit binne 'n kovalente binding te sien, wat ons dan 'n idee kan gee van die graad van polariteit van die molekule.

(2)

3.2.2 In both cases, the bonding electrons are in the 2-level and screened from the nucleus by the 1s electrons. But oxygen has 8 protons in the nucleus whereas nitrogen only has 7✓. A bonding pair will experience more attraction from the oxygen's nucleus than from nitrogen's, and so the electronegativity of oxygen is greater✓/

In beide gevalle is die bindingselektrone in die 2-vlak en word dit van die kern afgeskerm deur die 1s-elektrone. Maar suurstof het 8 protone in die kern, terwyl stikstof slegs 7 het. 'n Bindingspaar sal meer aantrekkingskrag van die suurstof se kern ervaar as van stikstof s'n, en dus is die elektronegatiwiteit van suurstof groter.

(2)

3.3 **Lowest** Caesium Barium, Calcium, Aluminium, Boron, Carbon, Fluorine **Biggest** ✓✓/ **Laagste** Sesium Barium, Kalsium, Aluminium, Boor, Koolstof, Fluoer **grootste**

(2)

3.4

3.4.1 Cl_2 will have non-polar bonds because the bond has identical atoms at each end. the electron pair will be on average held half-way between the two. There is no net pull one way or the other ✓✓ / Cl_2 sal nie-polêre bindings hê omdat die binding identiese atome aan elke kant het. Die elektronpaar sal gemiddeld halfpad tussen die twee gehou word. Daar is geen netto aantrekkingskrag in die een of ander rigting nie.

(2)

3.4.2 CsCl . Caesium has the lowest electronegativity of any of the atoms in the list joined to one or more chlorine atoms. ✓✓/ CsCl . Sesium het die laagste elektronegatiwiteit van enige van die atome in die lys wat aan een of meer chlooratome verbind is.

(2)

3.4.3 PCl_3 or SCl_2 are also polar covalent, because there isn't enough electronegativity difference here either to make it ionic ✓✓/ PCl_3 of SCl_2 is ook polêr kovalent, want daar is ook nie genoeg elektronegatiwiteitsverskil hier om dit ionies te maak nie.

(2)

3.5 A polar bond is one between two atoms of different electronegativity. An electron pair will be pulled towards the more electronegative atom making that slightly ✓✓. For example, in CCl_4 , all the bonds are polar because the chlorine is more electronegative than carbon. A polar molecule is one which has an overall charge separation – in the sense that one side or end of the molecule is slightly negative and the other slightly positive✓✓/

'n Polêre binding is een tussen twee atome van verskillende elektronegatiwiteit. 'n Elektronpaar sal na die meer elektronegatiewe atoom getrek word, wat dit effens

maak. Byvoorbeeld, in CCl_4 , is al die bindings polêr omdat die chloor meer elektronegatief is as koolstof. 'n Polêre molekule is een wat 'n algehele ladingskeiding het – in die sin dat een kant of punt van die molekule effens negatief is en die ander effens positief.

(4)

[24]

QUESTION 4/VRAAG 4

- 4.1 As the atoms approach each other/come close to each other, ✓ the forces of attraction between the nuclei and electron clouds become stronger. ✓/ Soos die atome mekaar nader/nader aan mekaar kom, word die aantrekkingskragte tussen die kerne en elektronwolke sterker.

(2)

4.2

- 4.2.1 A ✓

The potential energy is closest to zero/more positive. ✓/ Die potensiële energie is die naaste aan nul/meer positief

(2)

- 4.2.2 B. ✓

Lowest potential energy ✓/ Laagste potensiële energie

(2)

4.3

- 4.3.1 140 pm ✓✓

(2)

- 4.3.2 334 kJ. mol⁻¹ ✓✓

(2)

- 4.4 From B to C atoms move very close to each other and the forces of repulsion between the atomic nuclei increase. ✓/ Van B na C beweeg atome baie naby aan mekaar en die afstotingskragte tussen die atoomkerne neem toe.

The potential energy of the system of atoms increases. ✓/ Die potensiële energie van die atoomstelsel neem toe.

(2)

[12]

QUESTION 5/VRAAG 5

5.1 **Boiling point:** the temperature at which the vapour pressure of a substance equals the atmospheric pressure. ✓✓/ **Kookpunt:** die temperatuur waarby die dampdruk van 'n stof gelyk is aan die atmosferiese druk. (2)

5.2

5.2.1 In addition, London forces/dispersion forces/induced dipole forces HBr has dipole-dipole forces between the molecules. ✓

In addition, London forces/dispersion forces/induced dipole forces H_2O has hydrogen bonds between the molecules. ✓

The intermolecular forces of H_2O are stronger than those of HBr since hydrogen bonds are stronger than dipole-dipole forces. ✓

More energy is required to overcome the intermolecular forces in H_2O than in HBr. ✓/

Daarbenewens het Londense kragte/dispersiekragte/geïnduseerde dipoolkragte HBr dipool-dipoolkragte tussen die molekules.

Daarbenewens het Londense kragte/dispersiekragte/geïnduseerde dipoolkragte H_2O waterstofbindings tussen die molekules.

Die intermolekulêre kragte van H_2O is sterker as dié van HBr, aangesien waterstofbindings sterker is as dipool-dipoolkragte.

Meer energie word benodig om die intermolekulêre kragte in H_2O te oorkom as in HBr. (4)

5.2.2 Between the molecules of both iodine and bromine there are London forces/dispersion forces/induced dipole forces. ✓

The molecular mass of iodine is greater than that of bromine. ✓

The intermolecular forces of iodine are stronger than those of bromine. ✓

More energy is required to overcome the intermolecular forces in iodine than in bromine. ✓/

Tussen die molekules van beide jodium en broom is daar Londense kragte/dispersiekragte/geïnduseerde dipoolkragte.

Die molekulêre massa van jodium is groter as dié van broom.

Die intermolekulêre kragte van jodium is sterker as dié van broom.

Meer energie word benodig om die intermolekulêre kragte in jodium te oorkom as in broom. (4)

5.3 Yes ✓/Ja (1)

5.4 NEGATIVE MARKING FROM 5.3/ NEGATIEWE NASIEN VANAF 5.3

In addition, London forces/dispersion forces/induced dipole forces ✓ both ethanol and water have hydrogen bonds ✓ between the molecules and hence they have intermolecular forces of comparable strength. ✓/

Daarbenewens het Londense kragte/dispersiekrigte/geïnduseerde dipoolkrigte beide etanol en water waterstofbindings tussen die molekules en daarom het hulle intermolekulêre kragte van vergelykbare sterkte.

(3)

5.5

5.5.1 The pressure exerted by a vapour at equilibrium with its liquid in a closed system. ✓✓/ Die druk wat deur 'n damp in ewewig met sy vloeistof in 'n geslote sisteem uitgeoefen word.

(2)

5.5.2 The lower the boiling point, the higher the vapour pressure/hydrogen bromide has the lowest boiling point. ✓/ Hoe laer die kookpunt, hoe hoër die dampdruk/waterstofbromied het die laagste kookpunt.

(1)

5.6

5.6.1 Interatomic bond: a bond that exists within a molecule between the atoms in that molecule. ✓✓/ Interatomiese binding: 'n binding wat binne 'n molekule tussen die atome in daardie molekule bestaan.

(2)

5.6.2 Interatomic forces are forces that act **within** a molecule or compound and it is these forces that hold the atoms or ions together ✓. All of these are within the compounds and hence are called interatomic forces or chemical bonds. Intermolecular forces are the forces that exist between molecules e.g. in a compound, and particles e.g. ions in aqueous solutions ✓/ Interatomiese kragte is kragte wat binne 'n molekule of verbinding inwerk en dit is hierdie kragte wat die atome of ione bymekaar hou. Al hierdie is binne die verbindings en word dus interatomiese kragte of chemiese bindings genoem. Intermolekulêre kragte is die kragte wat bestaan tussen molekules, bv. in 'n verbinding, en deeltjies, bv. ione in waterige oplossings.

(2)

5.6.3 Hydrogen bonding intermolecular force. ✓/ Waterstofbinding intermolekulêre krag

(1)

5.6.4 δ^+ ✓✓

(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.)

(2)

[25]**TOTAL/TOTAAL: [100]**