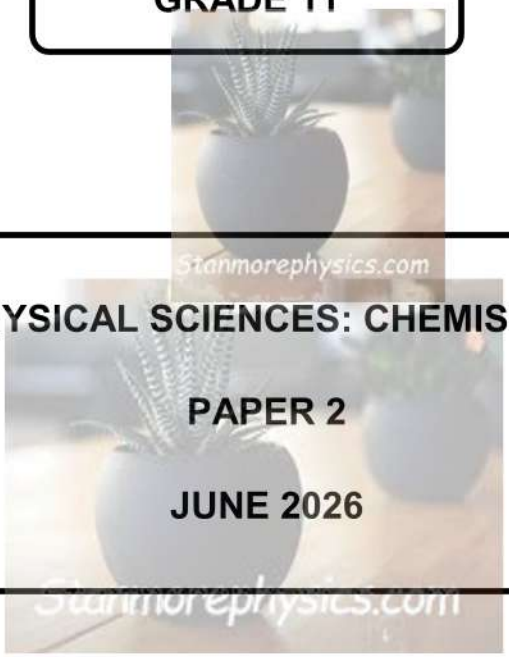
Northern Cape Department of Education

CURRICULUM PROVINCIAL QUESTION PAPER

GRADE 11



PHYSICAL SCIENCES: CHEMISTRY

PAPER 2

JUNE 2026

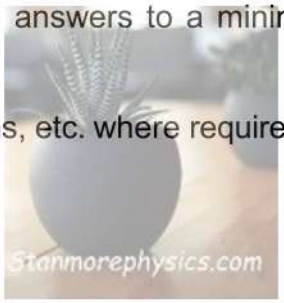
MARKS: 100

TIME: 2 hours

This question paper consists of 9 pages and 2 data sheets.

INSTRUCTIONS AND INFORMATION

1. Write your name and surname 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. Number the answers correctly according to the numbering system used in this question paper.
4. Leave one line between two subquestions, e.g. 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 where required.
10. Give brief motivations, discussions, etc. where required.
11. Write neatly and legibly.



QUESTION 1

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. 1.11 E.

1.1 Which ONE of the following bonds will have the highest bond energy?

A H – H

B C – H

C C = C

D C ≡ C (2)

1.2 Consider the following compounds and their respective boiling points.

COMPOUNDS	BOILING POINT (°C)
He	-268,9
HBr	-66
HF	19,5

The correct arrangement for the decreasing strength of the intermolecular forces of the given compounds is …

A HF, He, HBr.

B HBr, He, HF.

C HF, HBr, He.

D He, HBr, HF. (2)

1.3 The tendency of an atom to attract the bonding pair of electrons is known as..

A electron affinity.

B electronegativity.

C Polarity.

D activation energy. (2)

1.4 The type of bond formed between a H^+ ion and H_2O is called a/an …

A hydrogen bond.

B ionic bond.

C covalent bond.

D dative covalent bond. (2)

1.5 The shape of the molecule in which the central atom is surrounded by two lone pairs and two bonding pairs is …

A bent.

B trigonal planar.

C tetrahedral.

D linear. (2)

1.6 Hydrogen bonds and London forces (induced dipole forces) have a common characteristic because they …

A are both stronger than chemical bonds.

B are both intermolecular forces.

C both occur between non-polar molecules.

D both occur between polar molecules. (2)

1.7 Which ONE of the following has polar covalent bonds, but only has London forces between its molecules?

A NH_3

B HBr

C CO_2

D H_2S (2)

1.8 Bond length is the average distance between the …

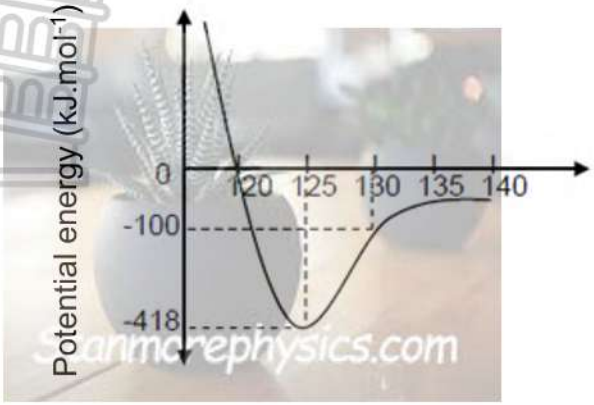
A nuclei of two bonded atoms.

B molecules of the same substance.

C electrons in two bonded atoms.

D orbitals of two bonded atoms. (2)

1.9 The graph below shows how the potential energy varies with the distance between the nuclei of two nitrogen atoms when a triple bond between the N_2 atoms are formed.



Choose from the table the bond length and bond energy for N_2.

	BOND LENGTH (pm)	BOND ENERGY ($kJ \cdot mol^{-1}$)
A	120	0
B	125	518
C	125	418
D	130	-100

(2)

1.10 NH_3 gas is very soluble in water because …

A both are covalent substances

B both are ionic substances

C one substance is ionic while the one contains polar bonds

D both are polar molecules (2)

[20]

QUESTION 2

Consider the following compounds:

I_2	$HOC\ell$	NH_3	H_2S	KBr

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

2.2 Write down the formula of the compounds from the given list that:

2.2.1 is non polar (1)

2.2.2 forms a bond as a result of transferring electrons (1)

2.2.3 has one lone pair of electrons (1)

2.2.4 has a pure covalent bond (1)

2.3 Draw the Lewis structure of the following compounds:

2.3.1 $HOC\ell$ (2)

2.3.2 H_2S (2)

2.4 The ammonium ion (NH_4^+) is formed from ammonia (NH_3)

2.4.1 Identify the bond responsible for the formation of NH_4^+. (1)

2.4.2 Give TWO conditions necessary for the formation of the bond in 2.4.1. (2)

2.4.3 Use the Lewis structure to show the formation of NH_4^+ from NH_3. (4)

2.5 Write down the shape of:

2.5.1 $HOC\ell$ molecule (1)

2.5.2 NH_3 molecule (1)

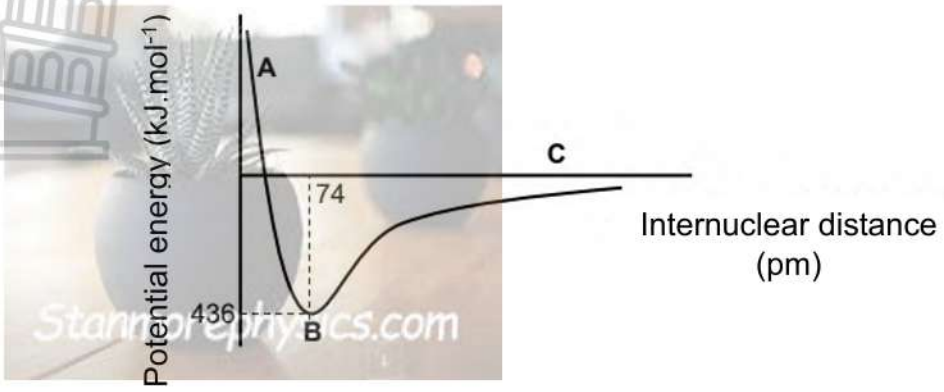
2.6 Will I_2 be soluble in $CC\ell 4$? Write YES or NO only. (1)

2.7 Explain the answer to QUESTION 2.6 by referring to the polarity and intermolecular forces involved in the compounds. (3)

[23]

QUESTION 3

The graph below shows the relationship between potential energy and the internuclear distance between two hydrogen atoms.



3.1 Define the following terms:

3.1.1 Chemical bond (2)

3.1.2 Bond energy (2)

3.2 At which point (A, B or C) is the H_2 molecule formed? (1)

3.3 3.3.1 By referring to the graph, write down, with units, (a) the bond length and (b) bond energy of the H_2 molecule. (2)

3.3.2 What happens to the potential energy of the atoms if they move too close to each other? Explain your answer. (3)

3.4 Write down TWO factors that can influence bond length. (2)

3.5 Consider the following table:

BOND LENGTH	BOND ENERGY ($kj \cdot mol^{-1}$)
C – C	346
C = C	610
C ≡ C	835

3.5.1 What is the relationship between bond energy and bond order? (2)

3.5.2 Which ONE of the bonds shown in the table above will have the shortest bond length? (1)

3.5.3 Explain your answer to QUESTION 3.5.2. (2)

3.6 How would the bond length of the CH bond compare to that of the CN bond? Write only LONGER THAN, SHORTER THAN or EQUAL TO. (1)

3.7 Explain your answer to QUESTION 3.6. (2)

[20]

QUESTION 4

Learners investigate the boiling points of the compounds listed in the table below.

	COMPOUND	BOILING POINT (°C)
A	CH_4	-161,5
B	SiH_4	-111,8
C	GeH_4	-88,6
D	SnH_4	-52

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

4.2 Is this a fair investigation? Write only YES or NO.

Give a reason for the answer. (2)

4.3 Write down the phase of the above compounds at room temperature. (1)

4.4 Explain the trend observed in boiling points of the compounds in the table above by referring to the molecular mass, intermolecular forces, and energy involved. (3)

4.5 Which compound in the table above has the highest vapour pressure at a given temperature? Explain the answer by referring to the data in the table above. (2)

4.6 The boiling point of HF and HCℓ is compared.

	COMPOUND	BOILING POINT (°C)
E	HF	19,5
F	HCℓ	**X**

4.6.1 Will the value of **X** be HIGHER THAN, LOWER THAN or EQUAL TO 19,5 °C? (1)

4.6.2 Fully explain the answer to QUESTION 4.6.1. (4)

4.7 Consider the boiling points of the compounds in the table below.

SUBSTANCE	BOILING POINT (^{0}C)
H_2S	-66
NH_3	-33
H_2O	100

4.7.1 Which ONE of the substances in the table above has the weakest forces between its molecules? (1)

4.7.2 Name the type of intermolecular force found between NH_3 molecules. (1)

4.7.3 Explain the following statement:

Although the shape of the molecules of H_2S and H_2O is similar, there is a remarkable difference in their boiling points. (4)

[21]

QUESTION 5

Study the balanced chemical equation of the reaction between sodium carbonate (Na_2CO_3) and hydrochloric acid HCl and answer the questions that follow.

$$Na_2CO_3 + 2HCl \rightarrow 2NaCl + CO_2 + H_2O$$

5.1 Identify the type of reaction above. Choose from GAS FORMING or REDOX. (1)

5.2 In the reaction, 10,6 g of sodium carbonate reacts completely with excess hydrochloric acid.

Calculate the:

5.2.1 molar mass of sodium carbonate (2)

5.2.2 initial number of moles of sodium carbonate (3)

5.2.3 mass of CO_2 produced during this reaction (4)

5.2.4 Calculate the mass of sodium chloride produced if 4,87 dm^3 of carbon dioxide was produced at STP (6)

[16]

TOTAL: 100

DATA FOR PHYSICAL SCIENCES GRADE 11
PAPER 2 (CHEMISTRY)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 11
VRAESTEL 2 (CHEMIE)

TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTES*

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Standard pressure Standaarddruk	p^{θ}	$1{,}013 \times 10^{5}$ Pa
Molar gas volume at STP Molêre gasvolume by STD	V_m	$22{,}4\ dm^3 \cdot mol^{-1}$
Standard temperature Standaardtemperatuur	T^{θ}	273 K
Charge on electron *Lading op elektron*	e	$-1{,}6 \times 10^{-19}$ C
Avogadro's constant *Avogadro-konstante*	N_A	$6{,}02 \times 10^{23}\ mol^{-1}$

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

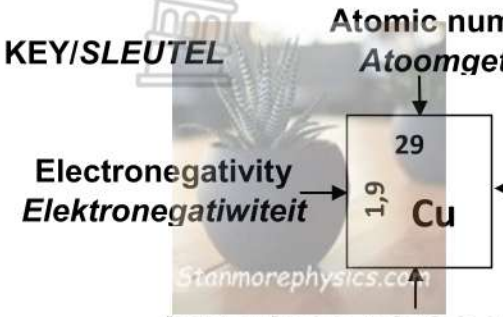
$n = \frac{m}{M}$	$n = \frac{N}{N_A}$
$c = \frac{n}{V}$ or/*of* $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$

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

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	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	La 139	1,6 Hf 179	Ta 181	W 184	Re 186	Os 190	Ir 192	Pt 195	Au 197	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	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*



Northern Cape Department of Education

CURRICULUM PROVINCIAL QUESTION PAPER/
KURRIKULUM PROVINSIALE VRAESTEL

GRADE/*GRAAD* 11

PHYSICAL SCIENCES: CHEMISTRY/
FISIESE WETENSKAPPE: CHEMIE

PAPER/*VRAESTEL* 2

JUNE/*JUNIE* 2026

MARKING GUIDELINES/*NASIENRIGLYNE*

MARKS/*PUNTE*: 100

These marking guidelines consist of 6 pages./
Hierdie nasienriglyne bestaan uit 6 bladsye.

QUESTION/*VRAAG* 1

1.1 D ✓✓ (2)

1.2 C ✓✓ (2)

1.3 B ✓✓ (2)

1.4 D ✓✓ (2)

1.5 A ✓✓ (2)

1.6 B ✓✓ (2)

1.7 C ✓✓ (2)

1.8 A ✓✓ (2)

1.9 C ✓✓ (2)

1.10 D ✓✓ (2)

[20]

QUESTION/*VRAAG 2*

2.1 The sharing of electrons between two atoms to form a molecule. ✓✓
Die deel van elektrone tussen twee atome om 'n molekuul te vorm. (2)

2.2.1 I_2 ✓ (1)

2.2.2 KBr ✓ (1)

2.2.3 NH_3 ✓ (1)

2.2.4 I_2 ✓ (1)

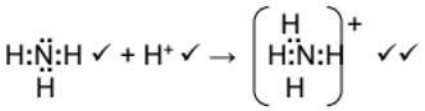
2.3.1  ✓✓ (2)

2.3.2  ✓✓ (2)

Marking criteria for 2.3.1 and 2.3.2
- ✓ central atom surrounded by 8 electrons
- ✓ Everything correct

2.4.1 Dative covalent bond/coordinate covalent bond ✓ (1)
Datief-kovalente binding

2.4.2 One atom must have an empty valence shell ✓ and the other atom must have a lone pair of electrons ✓
Een atoom moet 'n leë valensorbitaal besit en die ander atoom moet 'n enkelpaar elektrone besit. (2)

2.4.3  ✓✓ (4)

2.5.1 Bent/angular ✓ (1)
Hoekig

2.5.2 Trigonal pyramidal ✓ (1)
Trigonaal piramidaal

2.6 YES ✓
JA (1)

2.7 I_2 is a non-polar molecule and only has London forces between its molecules ✓
CCl_4 is a non-polar molecule and only has London forces.✓
Both compounds are non-polar and only have London forces, and like dissolves like✓

I_2 is 'n nie-polêre molekuul en besit slegs Londonkragte tussen die molekule.
CCl_4 is 'n nie-polêre molekuul en besit slegs Londonkragte tussen die molekule
Beide verbindings is nie-polêre molekule en besit slegs Londonkragte tussen die molekule en soort los op in soort. (3)

[23]

QUESTION/*VRAAG* 3

3.1.1 Mutual attraction between two atoms resulting from the simultaneous attraction between their nuclei and the outer electrons. ✓✓ **(2 or 0)**
Wedersydse aantrekkingskrag tussen twee atome as gevolg van die gelyktydige aantrekkingskrag tussen hulle kerne en die buitenste elektrone. (2)

3.1.2 The energy needed to break one mole of its molecules into separate atoms. ✓✓**(2 or 0)**
Die energie benodig om een mol van die molekule in afsonderlike atome op te breek. (2)

3.2 B ✓ (1)

3.3.1 Bond length = 74 pm ✓
Bond energy = 436 kJ.mol^{-1} ✓
Bindingslengte = 74 pm
Bindingsenergie = 436 kJ.mol^{-1} (2)

3.3.2 It increases ✓
As atoms become too close to each other, the forces of repulsion exceed the forces of attraction and the potential energy increases. ✓✓
Dit neem toe
Soos die atome te naby aanmekaar beweeg, neem die afstotingskragte in sterkte toe in vergelyking met die aantrekkingskragte en die potensiële energie styg. (3)

3.4 Bond order ✓
Atom size ✓
Bindingsorder
Atoomgrootte (2)

3.5.1 The higher the bond order, the higher the bond energy. ✓✓ **(2 or 0)**
Hoe hoër die bindingsorde, hoe hoër die bindingsenergie. (2)

3.5.2 C ≡ C ✓ (1)

3.5.3 - The higher the bond energy/bond order, the stronger the forces of attraction between the nuclei. ✓
- The nuclei come closer, resulting in a shorter bond length ✓
- Hoe hoër die bindingsenergie, hoe sterker is die aantrekkingskragte tussen die kerne.
- Die kerne kom nader en gevolglik is die bindingslengte korter. (2)

3.6 Shorter than ✓
Korter as (1)

3.7 H is a much smaller atom than N ✓✓
H is 'n heelwat kleiner atoom as N (2)
[20]

QUESTION/*VRAAG* 4

4.1 The temperature at which the vapour pressure of a substance equals the atmospheric pressure. ✓✓
Die temperatuur waarby die dampdruk van 'n verbinding gelyk is aan die atmosferiese druk. (2)

4.2 YES ✓
There is only one independent variable. ✓
JA
Daar is slegs een onafhanklike veranderlike. (2)

4.3 Gas ✓ (1)

4.4 - The molecular mass increases from A to D ✓
- The strength of the London forces/intermolecular forces increases with an increase in the molecular mass ✓
- More energy will be needed to overcome the intermolecular forces from A to D ✓
- *Die molekulêre massa neem toe van A na D.*
- *Sterkte van die Londonkragte neem toe soos die molekulêre massa toeneem*
- *Meer energie word benodig om intermolekulêre kragte te oorkom van A na D* (3)

4.5 Compound A ✓/CH4
It has the lowest boiling point ✓
Verbinding A/CH4
Dit het die laagste kookpunt (2)

4.6.1 Lower than ✓ *Laer as* (1)

4.6.2 - HF has hydrogen bonding between its molecules ✓
- HCl has dipole-dipole forces between its molecules ✓
- Hydrogen bonding is stronger than dipole-dipole forces ✓
- More energy is needed to overcome the intermolecular forces in HF than HCl✓
- *HF het waterstofbindings tussen die molekule.*
- *HCl het dipool dipool kragte tussen die molekule*
- *Waterstofbinding is sterker as dipool-dipool kragte*
- *Meer energie is nodig om intermolekulêre kragte van HF te oorkom as HCl* (4)

4.7.1 H_2S ✓ (1)

4.7.2 Hydrogen bonding ✓ *Waterstofbinding* (1)

4.7.3 Hydrogen bonding between H_2O molecules ✓ is stronger ✓ than the dipole-dipole forces between H_2S molecules ✓. More energy is needed to overcome the intermolecular forces in H_2O✓
Waterstofbindings tussen H_2O molekule is sterker as die dipool-dipool kragte tussen H_2S molecules. Meer energie is nodig om die intermolekulêre kragte te oorkom in H_2O (4)

[21]

QUESTION/*VRAAG* 5

5.1 Gas forming ✓ (1)
Gasvorming

5.2.1 $M(Na_2CO_3) = 2(23) + 12 + 3(16)$
$= 106\ g.mol^{-1}$ ✓✓ (2)

5.2.2 $n(Na_2CO_3) = \frac{m}{M}$ ✓

$= \frac{10,6}{106}$ ✓
$= 0,1\ mol$ ✓ (3)

5.2.3 $n(Na_2CO_3) : n(CO_2)$
1 : 1 ✓
Thus: $n(CO_2) = 0,1\ mol$

$n(CO_2) = \frac{m}{M}$ ✓

$0,1 = \frac{m}{44}$ ✓
$m = 4,4\ g$ ✓ (4)

5.2.4
$n(CO_2) = \frac{V_{CO_2}}{V_m}$ ✓
$= \frac{4,87}{22,4}$
$= 0,217mol$ ✓

$n(CO_2) : n(NaCl)$
1 : 2 ✓
$n(NaCl) = 0,434mol$

$n(NaCl) = \frac{m}{M}$ ✓

$0,434 = \frac{m}{58,5}$ ✓
$m = 25,16g$ ✓ (6)

[16]

TOTAL/*TOTAAL*: 100