GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PROVINCIAL EXAMINATION
JUNE 2024

GRADE 11

PHYSICAL SCIENCES: CHEMISTRY

PAPER 2

TIME: 1 hour

MARKS: 50

6 pages + 2 data sheets

INSTRUCTIONS AND INFORMATION:

1. Write your name in the appropriate space on the ANSWER BOOK.
2. This question paper consists of FOUR questions. Answer ALL 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 subquestions, e.g. 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 SHEETS.
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, et cetera where required.
12. 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 question numbers (1.1 – 1.4) in the ANSWER BOOK, e.g. 1.5 A.

1.1 A dative covalent bond forms when…

A water decomposes.
B ionic compounds dissociate in water.
C hydronium ions are produced.
D hydroxide ions are produced. (2)

1.2 The factor that does NOT affect bond length between two atoms is:

A The size of the atoms.
B The difference in electronegativity between the atoms.
C The number of bonds between the atoms.
D The valences of the atoms. (2)

1.3 Identify the intermolecular force that must be overcome to convert the following substance from a liquid to a gas: CH_3OH

A London Forces
B Dipole-dipole forces
C Hydrogen bonds
D Ionic bonds (2)

1.4 Which of the following groups of substances have the same intermolecular forces present?

A NH_3, $CH_3C\ell$
B CH_4, CO_2
C H_2O, CO
D $HC\ell$, H_2O (2)

[8]

QUESTION 2 (Start on a new page.)

2.1 Ammonia (NH_3) is a colourless, poisonous gas. It is synthesized by the Haber-Bosch process, in which nitrogen gas and hydrogen gas are reacted at high temperature and pressure. Ammonia has a lone pair.

2.1.1 Define the term *lone pair*. (2)

2.1.2 Name and explain the type of chemical bond between nitrogen and hydrogen. (3)

2.1.3 Draw the Lewis structure for the ammonia molecule. (2)

2.1.4 Name the shape of the ammonia molecule. (2)

2.2 Ammonia reacts with a hydrogen ion to form NH_4^+.

2.2.1 How many electrons surround the central atom in NH_4^+? (2)

2.2.2 Name the type of bond between ammonia and hydrogen ions in NH_4^+. (2)

2.3 Phosphine (PH_3) and Ammonia (NH_3) are molecules that have the same shape. Explain why the boiling point of PH_3 is less than that of NH_3. (3)

[16]

QUESTION 3 (Start on a new page.)

The diagram below represents the bonding that takes place in a molecule.



The electronegativity difference between element **X** and oxygen is 1,0.

3.1 Define the term *electronegativity*. (2)

3.2 To which group in the periodic table does element **X** belong? Give a reason for your answer. (2)

3.3 Identify element **X**. (1)

3.4 Is the molecule **X**O_2 polar or non-polar? Explain your answer fully.
Use the table below to answer the questions that follow.

BOND	BOND ENERGY (k.J.mol-1)	BOND LENGTH
O – H	463	96
N – H	389	100,8
C – C	348	154

(2)

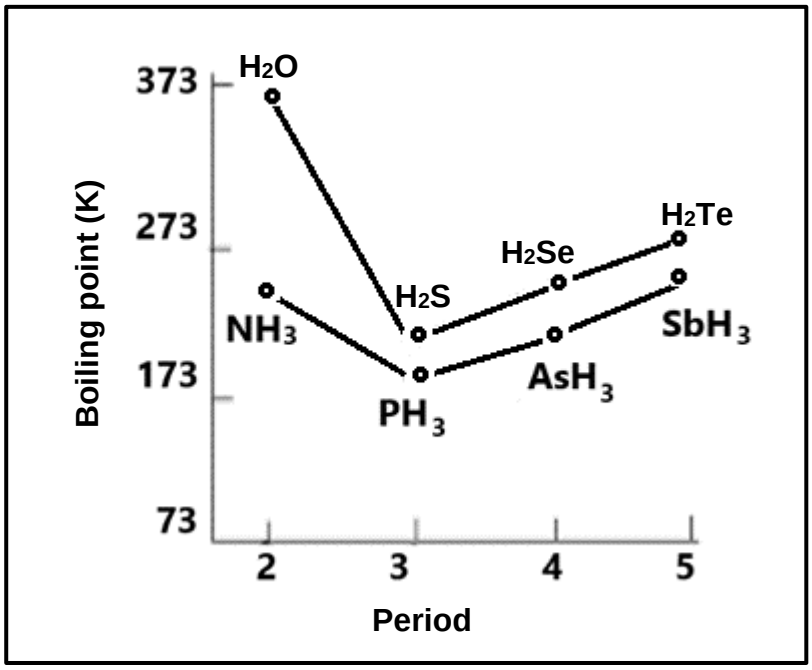
3.5 Define the term *bond energy*. (2)

3.6 From the data provided, what is the relationship between bond length and bond energy? (2)

[11]

QUESTION 4 (Start on a new page.)

The graph below shows the boiling points of different substances from groups 15 and 16 on the periodic table.



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

4.2 Explain, in terms of the strengths of intermolecular forces, why the boiling points of H_2O and NH_3 are much higher than those of the rest of group 15 and 16. (3)

4.3 The boiling points increase from H_2S to H_2Te.

4.3.1 Identify the strongest type of intermolecular forces present. (1)

4.3.2 Explain the trend that can be seen in their boiling points. (2)

4.3.3 Give the formula of one of the above mentioned compounds that will be a liquid at 0 °C? (1)

4.4 In the laboratory you are provided with the following chemicals:

$C\ell_2$, SO_2 and NaBr

4.4.1 Identify the intermolecular forces in each of the above compounds. (3)

4.4.2 Which ONE of the above chemicals will have the highest vapour pressure? Explain the answer. (3)

[15]

TOTAL: 50

END

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*
Avogadro's constant *Avogadro se konstante*	N_A	$6{,}02 \times 10^{23}\ mol^{-1}$
Molar gas constant *Molêre gaskonstante*	R	$8{,}31\ J{\cdot}K^{-1}{\cdot}mol^{-1}$
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

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

$\frac{p_1V_1}{T_1}=\frac{p_2V_2}{T_2}$	$pV=nRT$
$n=\frac{m}{M}$	$n=\frac{N}{N_A}$
$n=\frac{V}{V_m}$	$c=\frac{n}{V}$ OR/*OF* $c=\frac{m}{MV}$

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																	**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	**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	**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	**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	**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**	**Rn**
0,7 **Fr**	0,9 **Ra** 226	**Ac**															

Ce 140	**Pr** 141	**Nd** 144	**Pm**	**Sm** 150	**Eu** 152	**Gd** 157	**Tb** 159	**Dy** 163	**Ho** 165	**Er** 167	**Tm** 169	**Yb** 173	**Lu** 175
Th 232	**Pa**	**U** 238	**Np**	**Pu**	**Am**	**Cm**	**Bk**	**Cf**	**Es**	**Fm**	**Md**	**No**	**Lr**

KEY/*SLEUTEL*

