Education

KwaZulu-Natal Department of Education
REPUBLIC OF SOUTH AFRICA

PHYSICAL SCIENCE: CHEMISTRY (P2)

COMMON TEST

MARCH 2017

NATIONAL SENIOR CERTIFICATE

GRADE 11

MARKS: 50

TIME: 1 hour

This question paper consists of 6 pages and a periodic table.

INSTRUCTIONS AND INFORMATION

1. This question paper consists of FOUR questions. Answer ALL the questions in the ANSWER BOOK.
2. Number the answers correctly according to the numbering system used in this question paper.
3. Leave ONE line between two sub questions, for example between QUESTION 2.1 and QUESTION 2.2.
4. You may use a non-programmable calculator.
5. You may use appropriate mathematical instruments.
6. YOU ARE ADVISED TO USE THE ATTACHED DATA SHEET.
7. Show ALL formulae and substitutions in ALL calculations.
8. Round off your FINAL numerical answers to a minimum to TWO decimal places.
9. Give brief motivations, discussions, et cetera where required.
10. Write neatly and legibly.

QUESTION 1: MULTIPLE CHOICE

Four options are provided as possible answers to the following questions. Each question has only ONE correct answer. Write down only the letter (A – D) next to the question number (1.1 – 1.4) in the answer book, for example 1.1 D.

1.1 Which one of the following diatomic molecules is NOT possible to form?

A Cl_2
B He_2
C O_2
D N_2 (2)

1.2 The type of chemical bond between atoms whereby valence electrons move freely through the lattice structure is called a / an.....

A Ionic Bond
B Dipole-dipole
C Metallic Bond
D Dative covalent bond (2)

1.3. The shape of the PCl_5 molecule is...

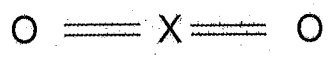
A Pentagonal
B Tetrahedral
C Trigonal planar
D Trigonal bipyramidal (2)

1.4 Hydrogen bonds and Van der Waals forces are similar in that both

A Are due to permanent dipoles.
B Are stronger than covalent bonds
C Are attractive forces between molecules
D Originate through the sharing of electrons between charges. (2)
[8]

QUESTION 2

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



The electronegativity difference between element **X** and oxygen is 1.0.

2.1.1 Define the term *Electronegativity.* (2)

2.1.2 Which group in the periodic table does element **X** belong to? Give a reason. (2)

2.1.3 Identify element **X** by means of a calculation. (3)

2.1.4 Is the molecule XO_2 polar or non-polar? Explain fully. (3)

2.2 Consider the following substances and answer questions set:

CH_4	$MgC\ell_{2(s)}$	HF	$NaC\ell_{(aq)}$	H_3O^+

2.2.1 Which substance is ionic? (1)

2.2.2 Name the type of Van de Waals forces in NaCℓ.(aq) (1)

2.2.3. Which of the above substances is most likely to dissolve in chloroform? (1)

2.2.4. Identify the substance with a dative covalent bond. (1)

2.2.5 Which compound has London forces between its molecules? (1)

2.2.6. Identify the substance with the lowest melting point. (1)

2.7 Draw Lewis dot structures for the following:

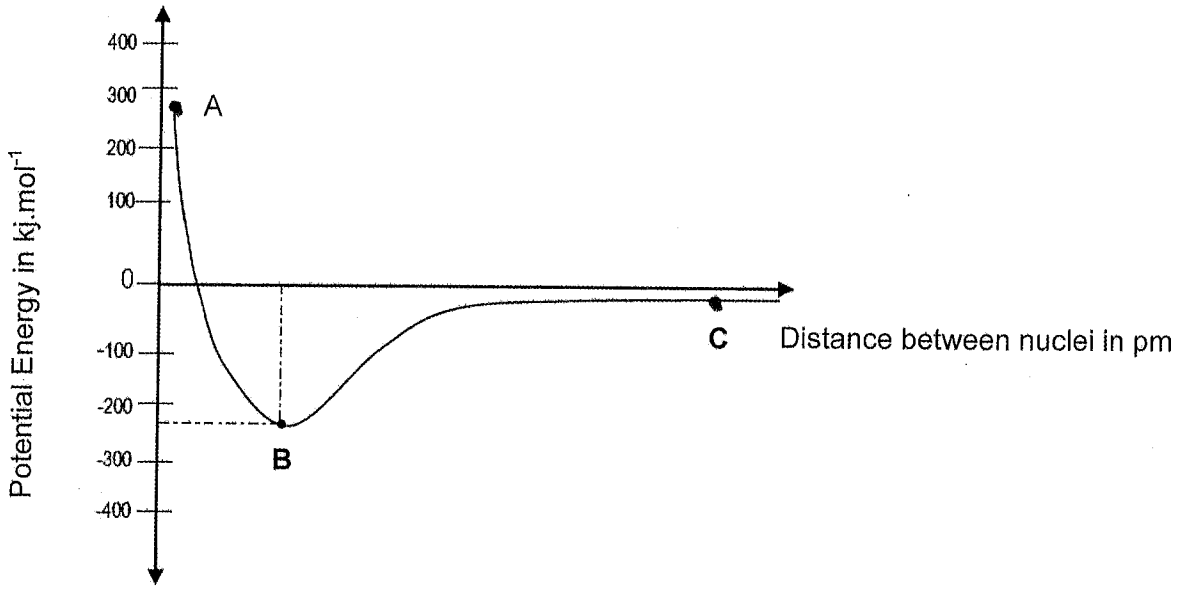
2.7.1 NH_3 (2)

2.7.2 HNO_3. (3)

[21]

QUESTION 3

The graph below shows the changes in potential energy that take place when a hydrogen (H) atom approaches a chlorine (Cℓ) atom.



3.1 Define *bond length.* (2)

3.2 From the graph, write down the:

3.2.1 Energy, in kJ·mol^{-1}, needed to break the H-Cl bond. (1)

3.2.2 Name of the potential energy at **B.** (1)

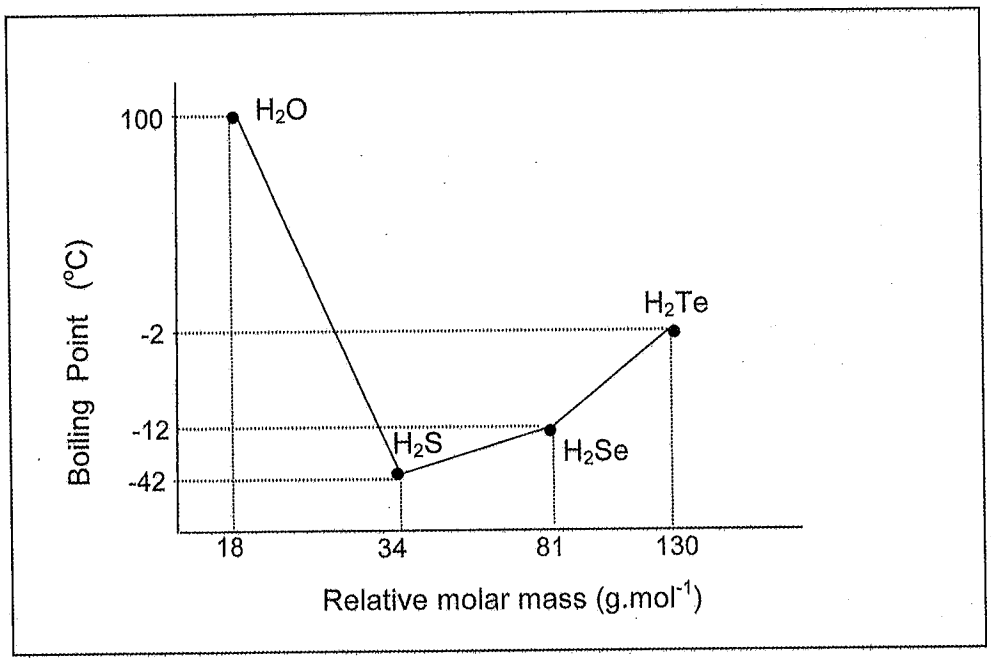
3.2.3 Explain why the potential energy decreases from **C** to **B**. (3)

3.2.4. At which point (**A**, **B** or **C**) are the repulsive forces the greatest? (1)

3.3 Which molecule has a greater bond length, HCℓ or HF?
Give a reason for the answer. (2)
[10]

QUESTION 4

4. Study the following graph of the boiling points of the hydrides of the group VI elements:



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

4.2 Explain, why the boiling point increase from H_2S to H_2Te? (3)

4.3 It is observed that boiling point of water does not follow the same trend as that of the other hydrides.
FULLY explain this deviation. (4)

4.4. Which hydride has the highest vapour pressure?
Give a reason. (2)
[11]

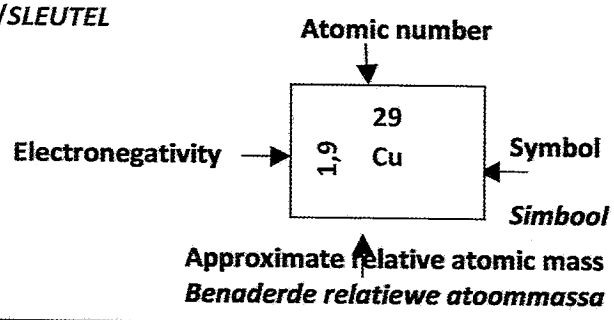
TOTAL MARKS: [50]

THE PERIODIC TABLE OF ELEMENTS

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 He 4
2,1 H 1																	
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	Po	2,5 At	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*



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SECTION A

QUESTION 1

1.1 B ✓✓ (2)

1.2 C ✓✓ (2)

1.3 D ✓✓ (2)

1.4 C ✓✓ (2)
[8]

QUESTION 2

2.1.1 **Electronegativity** as a measure of the tendency of an atom in a molecule to attract a bonding pair of electrons. ✓✓ (2)

2.1.2 Group IV✓, it is able to form 4 bonding pairs✓ with no lone pairs or has a valency of four (2)

2.1.3 $\Delta EN = EN_O - EN_x$
$1.0 = 3.5 - EN_x$ ✓
$EN_x = 2.5$✓
Therefore X is there Carbon atom✓. (3)

2.1.4. Non-polar,✓ the bonds between C and O atoms are polar✓ but the molecule symmetrical shaped ✓/ even distribution of electrons around molecule. ✓ (3)

2.2.

2.2.1. $MgCl_2$✓ / NaCl ✓ (1)

2.2.2. Ion-dipole ✓ (1)

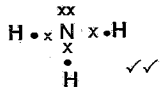
2.2.3. CH_4✓ (1)

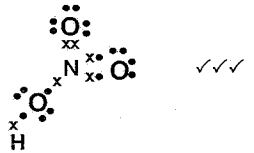
2.2.4. H_3O^+✓ (1)

2.2.5 CH_4✓ (1)

2.2.6 CH_4✓ (1)

2.7.

2.7.1  ✓✓ (2)

2.7.2  ✓✓✓

(3)
[21]

QUESTION 3

3.1 Average distance between the nuclei of two bonded atoms✓✓ (2 or 0) (2)

3.2.1. Accept from 220 - 240 kJ.mol^{-1}✓ (1)

3.2.2. Bond energy✓ (1)

3.2.3 As the distance between nuclei decrease✓the attractive forces increases ✓ more energy is required to pull the two atoms apart. ✓ (3)

3.2.4 Repulsive forces✓ (1)

3.3 HCℓ . ✓

F is a smaller atom than Cℓ✓ or F more electronegative than Cℓ ✓ (2)
[10]

QUESTION 4

4.1. The temperature at which vapour pressure of a substance is equal to the atmospheric pressure✓✓ (2 or 0) (2)

4.2 The molar mass increases✓. Strength of the Van Der Waals forces increases .✓ More energy needed to separate the molecules.✓ (3)

4.3. Water has hydrogen bonds ✓ between molecules whereas the other hydrides have London forces only.✓Hydrogen bonds are stronger than London forces. ✓ Hence more energy needed to separate the water molecules. ✓ (4)

4.4. H_2S✓, Has the lowest boiling point✓ (2)
[11]

TOTAL MARKS: [50]