



Education

KwaZulu-Natal Department of Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE**

GRADE 11

**PHYSICAL SCIENCES P2
(CHEMISTRY)**

COMMON TEST

MARCH 2018

MARKS: 50

TIME : 1 Hour

This question paper consists of 7 pages and 2 data sheets.

INSTRUCTIONS AND INFORMATION TO CANDIDATES

1. Write your name on the **ANSWER BOOK**.
4. Answer **ALL** the questions in the answer book.
5. You may use a non-programmable calculator.
6. You may use appropriate mathematical instruments.
7. Number the answers correctly according to the numbering system used in this question paper.
8. **YOU ARE ADVISED TO USE THE ATTACHED DATA SHEETS.**
9. Give brief motivations, discussions, et cetera where required.

SECTION A

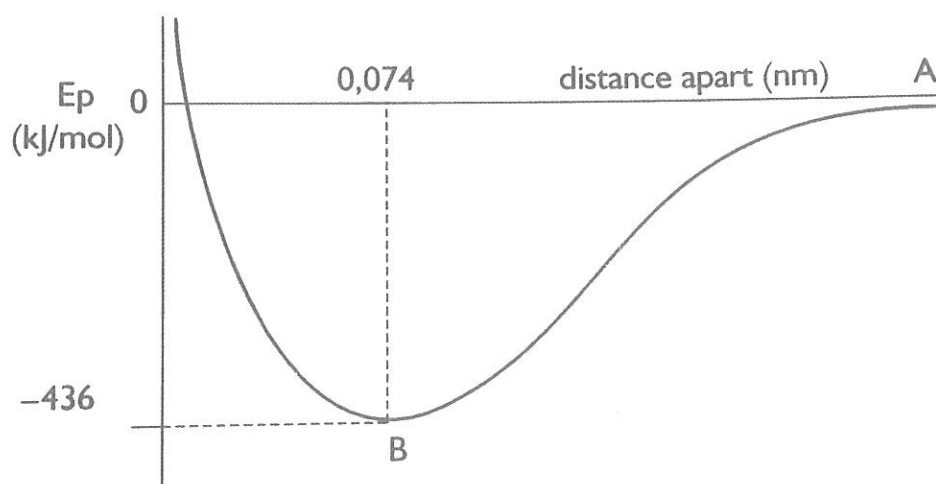
QUESTION 1: MULTIPLE- CHOICE QUESTIONS

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 number (1.1 – 1.4) in the ANSWER BOOK. Eg 1.5 A

1.1 Which one of the following statements concerning bond energy is **NOT TRUE**?

- A. Bond energy increases as bond length decreases
- B. Bond energy increases as atomic radius decreases
- C. The higher the bond energy, the stronger the bond
- D. Bond energy is smaller in multiple bonds than in single bonds (2)

1.2. The graph below shows the potential energy changes of a system of 2 hydrogen atoms as the distance between the 2 hydrogen nuclei changes.



Which of the following correctly represents the values for the bond energy and bond length respectively?

	Bond energy (kJ.mol ⁻¹)	Bond length (nm)
A.	0.074	-436
B.	-436	0.074
C.	7.40×10^{-11}	-436
D.	-436	7.40×10^{-11}

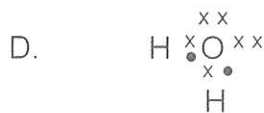
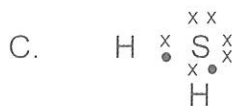
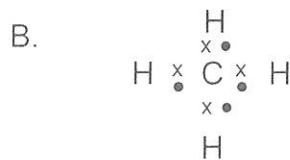
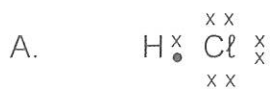
(2)

1.3 The shape of the PCl_5 molecule as predicted by the VSEPR theory is:

- A. Trigonal Bi-pyramidal
- B. Octahedral
- C. Trigonal planar
- D. Trigonal pyramidal

(2)

1.4 Which one of the following electron-dot structures represents a non-polar molecule?



(2)

TOTAL : SECTION A : [8]

SECTION B**INSTRUCTIONS AND INFORMATION**

1. Answer all questions.
2. Show the formulae and substitutions in ALL calculations.
3. Round off your numerical answers to a minimum of TWO decimal places.

QUESTION 2

An experiment is carried out to determine whether potassium nitrate and iodine crystals are soluble in each of the three solvents, water, ethanol and xylene. The results recorded in the table below are incomplete.

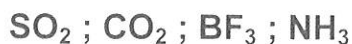
Crystal	Water	Ethanol	Xylene
Potassium nitrate	A		B
Iodine		Soluble	C

- 2.1. Refer to the table above. Write down the letters A, B, and C and next to each letter indicate whether the crystals are **SOLUBLE** or **INSOLUBLE** in the solvents. (3)
- 2.2. By referring to types and the strength of intermolecular forces, explain why iodine crystals are soluble in ethanol. (3)
- 2.3. A learner wishes to prepare a solution of Iodine-water. Instead of adding iodine to water, he first adds the iodine to the ethanol and then adds this mixture to water. Fully explain the reasoning behind this approach. (3)

[9]

QUESTION 3

Consider the following molecules and answer the questions.

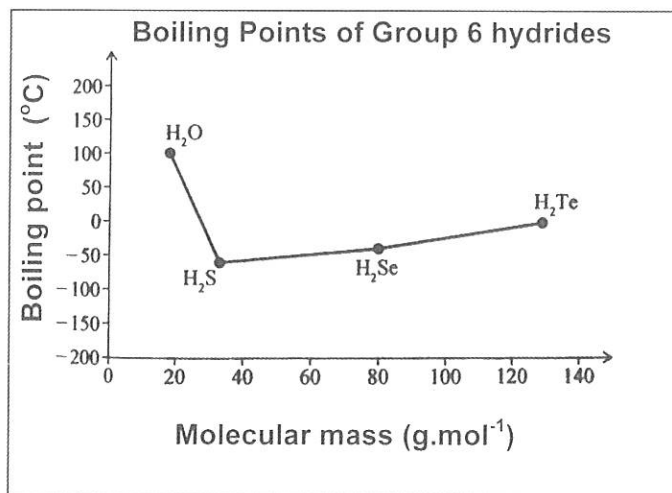


- 3.1. Draw the Lewis structure for the SO₂ molecule. (2)
- 3.2. BF₃ and NH₃ both contain 3 bonds around the central atom. The BF₃ molecule is non-polar while the NH₃ molecule is polar. Account for this difference between the two compounds using the VSEPR theory. (4)
- 3.3. Determine with the aid of a calculation, whether the C – O bond in the CO₂ molecule is POLAR or NON-POLAR. (2)
- 3.4. The boiling point of SO₂ is -10 °C and that of CO₂ is - 78 °C. Explain why the boiling point of SO₂ is higher than that of CO₂ by referring to the types of intermolecular forces and energy. (4)
- 3.5. NH₃ forms a dative covalent bond with the H⁺ ion to form NH₄⁺.
- 3.5.1. What is a dative covalent bond? (2)
- 3.5.2. Use Lewis dot structures to show the bonding in the NH₄⁺ ion. (2)
- 3.5.3 Write down the FORMULA of another compound that has a molecular shape similar to the NH₄⁺ ion (1)

[17]

QUESTION 4

The graph below shows the boiling points and molar masses of the hydrides of group 6.



- 4.1 Define *boiling point*. (2)
- 4.2 Explain why the boiling points increase from H₂S to H₂Te. (2)
- 4.3 The boiling point of water is much higher than that of the other hydrides. Explain fully why this is so. (3)
- 4.4 Which hydride will have the highest vapour pressure at -100°C? Give a reason. (2)
- 4.5 The density of ice is different to that of water. Explain how this is beneficial to life on earth. (3)
- 4.6 The density of water is 1g.mol⁻¹ at 25 °C. Calculate the number of water molecules in 0,5 dm³ of water. (4)

[16]
TOTAL : 50

TABLE 3: THE PERIODIC TABLE OF ELEMENTS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)	(XI)	(XII)	(XIII)	(XIV)	(XV)	(XVI)	(XVII)	(XVIII)
	1 2,1 H																	2 He
		3 1,0 Li	4 9 Be													8 3,5 O	9 4,0 F	10 20 Ne
		11 0,9 Na	12 24 Mg													16 2,5 S	17 3,0 Cl	18 40 Ar
	19 0,8 K	20 40 Ca	21 45 Sc	22 48 Ti	23 51 V	24 52 Cr	25 55 Mn	26 56 Fe	27 59 Co	28 59 Ni	29 63,5 Cu	30 65 Zn	31 70 Ga	32 73 Ge	33 75 As	34 79 Se	35 80 Br	36 84 Kr
	37 0,8 Rb	38 88 Sr	39 89 Y	40 91 Zr	41 92 Nb	42 96 Mo	43 96 Tc	44 101 Ru	45 103 Rh	46 106 Pd	47 108 Ag	48 112 Cd	49 115 In	50 119 Sn	51 122 Sb	52 128 Te	53 127 I	54 131 Xe
	55 0,7 Cs	56 137 Ba	57 139 La	72 179 Hf	73 181 Ta	74 184 W	75 186 Re	76 190 Os	77 192 Ir	78 195 Pt	79 197 Au	80 201 Hg	81 204 Tl	82 207 Pb	83 209 Bi	84 209 Po	85 209 At	86 209 Rn
	87 0,7 Fr	88 226 Ra	89 Ac															
				58 140 Ce	59 141 Pr	60 144 Nd	61 144 Pm	62 150 Sm	63 152 Eu	64 157 Gd	65 159 Tb	66 163 Dy	67 165 Ho	68 167 Er	69 169 Tm	70 173 Yb	71 175 Lu	
				90 232 Th	91 Pa	92 238 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr	

KEY/SLEUTEL

Atomic number
Atoomgetal

29
Cu
63,5

Electronegativity
Elektronegatiwiteit

Symbol
Simbool

Approximate relative atomic mass
Benaderde relatiewe atoommassa

CONSTANTSAVOGADRO CONSTANT 6.02×10^{23} **EQUATIONS**

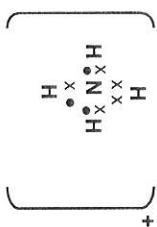
$$n = m/M$$

$$D = m/V$$

$$n = N/N_A$$

- 3.5.1 The bond formed when an empty valence shell of an atom shares a lone pair of electrons from another atom ✓✓ (2)

3.5.2



✓✓

(2)

3.5.3 CH₄ or CCl₄ ✓

(1)

[17]

QUESTION 4

- 4.1. The temperature at which the vapour pressure of a liquid is equal to atmospheric pressure. ✓✓ (2)
- 4.2. From H₂S to H₂Te, the molar mass increases, ✓ causing an increase in strength of Van der Waals forces ✓ More energy is needed to separate the molecules. (2)
- 4.3. Water has hydrogen bonding ✓ between molecules. The other hydrides have dipole- dipole forces ✓ between molecules. Hydrogen bonding is stronger than dipole-dipole forces. ✓ More energy needed to separate water molecules. (3)
- 4.4. H₂S ✓ Lowest B.P. ✓ (2)
- 4.5. Density of ice is less than density of water. ✓ Ice floats on water providing an insulating layer ✓ for aquatic life to exist. ✓ OR Water freezes from top down ✓ and captures heat ✓ allowing aquatic organisms to survive (3)
- 4.6. $D = m/V$
 $1 = m/0.5$
 $m = 500g$
 $n = m/M$ ✓
 $= 500/18$ ✓
 $= 27.78 \text{ mol}$
 $N = n \times N_A$
 $= 27.78 \times 6.02 \times 10^{23}$ ✓
 $= 1.67 \times 10^{25} \text{ molecules}$ ✓ (4)

TOTAL: 50 [16]