



education

Department:
Education
PROVINCE OF KWAZULU-NATAL

**NATIONAL
SENIOR CERTIFICATE**

GRADE 11

PHYSICAL SCIENCE: CHEMISTRY (P2)

COMMON TEST

MARCH 2020

MARKS: 50

TIME: 1 hour

**This question paper consists of 5 pages and
2 data sheets.**

INSTRUCTIONS AND INFORMATION

1. Write your name on the **ANSWER BOOK**.
2. Answer **ALL** the questions in the ANSWER BOOK.
3. This question paper consists of **FOUR** questions.
4. You may use a non-programmable calculator.
5. Number the answers correctly according to the numbering system used in this question paper.
6. You are advised to use the attached **DATA SHEETS**.
7. Give brief motivations, discussions et cetera where required.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A-D) next to the question number (1.1 - 1.10) in the ANSWER BOOK, for example 1.5 D.

1.1 Which ONE of the following is a molecule with a multiple bond?

- A N_2
- B NH_3
- C OF_2
- D $HOCl$

(2)

1.2 The molecular formula of ethyne is C_2H_2 .

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

- A Trigonal planar.
- B Octahedral.
- C Linear.
- D Bent.

(2)

1.3 The table below indicates the boiling points of four liquids.

SUBSTANCE	BOILING POINT ($^{\circ}C$)
Water	100
Methylated spirits	78,5
Ethanol	78,37
Acetone	56

Which ONE of the above liquids has the lowest surface tension?

- A Water.
- B Methylated spirits.
- C Ethanol.
- D Acetone.

(2)

1.4 The predominant forces between the molecules in an ice crystal are called . . .

- A London forces.
- B Hydrogen bonding.
- C Induced dipole forces.
- D Polar covalent bonding.

(2)
[8]

QUESTION 2 (Start on a new page.)

The water molecule has the formula: H₂O.

- 2.1 Water forms a dative covalent bond with the hydrogen ion.
- 2.1.1 What is a dative covalent bond? (2)
- 2.1.2 State ONE requirement for the formation of a dative covalent bond. (1)
- 2.1.3 Draw the Lewis structure to show the bonding that takes place when the above dative covalent bond is formed. (2)
- 2.1.4 Name the ion that is formed from the above dative covalent bond. (1)
- 2.2 The water molecular is angular in shape. Explain this shape in terms of the VSEPR theory. (3)
- 2.3 The density of ice is less than the density of the liquid.
- 2.3.1 Explain the significance of the above for life on EARTH. (3)
- 2.3.2 Calculate the number of water molecules present in 1 dm³ of water if the mass of 1 cm³ of water is 1 g. (3)
- [15]**

QUESTION 3 (Start on a new page.)

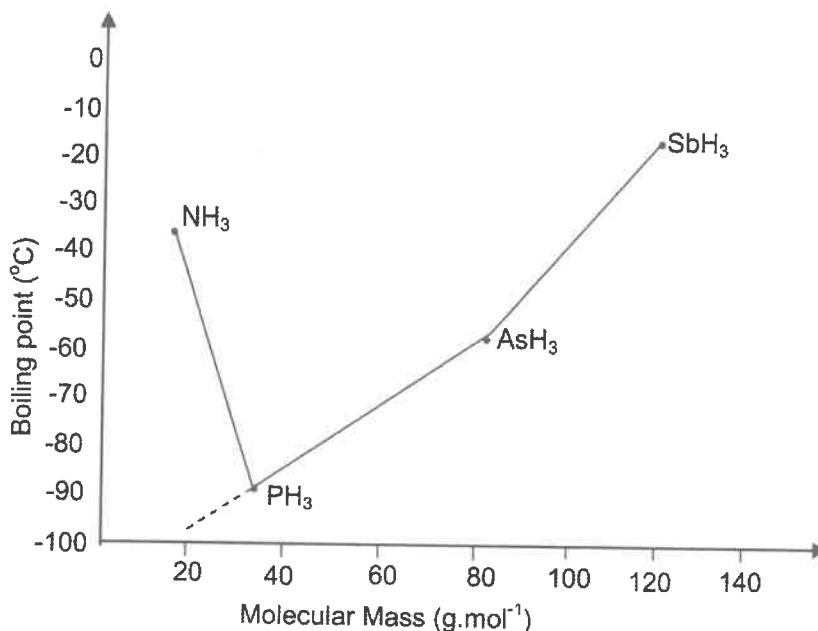
The bond length of the H – Br bond is 60 pm.
350 kJ.mol⁻¹ of energy is required to break the H – Br bond.

- 3.1 Define the term *bond length*. (2)
- 3.2 Draw a sketch graph (not to scale) in your answer book to show how potential energy changes as the distance between the nuclei changes when a hydrogen (H) atom approaches a bromine (Br) atom.
- Indicate the following values on the graph:
- (i) Bond length.
- (ii) Bond energy. (5)
- 3.3 How will the bond length of an H - Cl bond compare to that of the H – Br bond? Write down LONGER THAN, EQUAL TO or SHORTER THAN. (1)
- 3.4 Give a reason for the answer to question 3.3. (1)

[9]

QUESTION 4 (Start on a new page.)

The graph below shows the results obtained during an investigation to determine the boiling points of substances formed when hydrogen is bonded to atoms from group V of the periodic table.



- 4.1 Define *boiling point*. (2)
- 4.2 Write down an investigative question for this investigation. (2)
- 4.3 Consider PH₃, AsH₃ and SbH₃.
- 4.3.1 Name the type of van der Waals forces that exist between molecules of PH₃. Explain the answer by referring to the shape and polarity of the molecule. (3)
- 4.3.2 Which of the three substances has the highest vapour pressure? Give a reason for the answer. (2)
- 4.3.3. Fully explain why SbH₃ has a higher boiling point than AsH₃. (3)
- 4.4 It is expected that from the trend shown in the above graph, the boiling point of NH₃ should fall along the dotted line. Explain, with reference to the TYPE OF INTERMOLECULAR FORCES AND ENERGY, why the boiling point of NH₃ does not fall along the dotted line. (4)
- 4.5 The SAME INVESTIGATION is now conducted when the atmospheric pressure is LOWERED. What effect will this have on:
- 4.5.1 The vapour pressure of NH₃? (1)
- 4.5.2 The boiling point of NH₃? (1)
- (Choose from INCREASES, DECREASES or REMAINS THE SAME in each case):

[18]**TOTAL MARKS: 50**

**DATA FOR PHYSICAL SCIENCES GRADE 11
PAPER 2 (CHEMISTRY)**

**GEGEWENS VIR FISIESTE WETENSKAPPE GRAAD 11
VRAESTEL 2 (CHEMIE)**

TABLE 1: PHYSICAL CONSTANTS/TABEL 1: FISIESTE KONSTANTES

NAME/NAAM	SYMBOL/SIMBOOL	VALUE/WAARDE
Avogadro's constant <i>Avogadro-konstante</i>	N_A	$6,02 \times 10^{23} \text{ mol}^{-1}$
Molar gas constant <i>Molêre gaskonstante</i>	R	$8,31 \text{ J}\cdot\text{K}^{-1}\cdot\text{mol}^{-1}$
Standard pressure <i>Standaarddruk</i>	p^\ominus	$1,013 \times 10^5 \text{ Pa}$
Molar gas volume at STP <i>Molêre gasvolume by STD</i>	V_m	$22,4 \text{ dm}^3\cdot\text{mol}^{-1}$
Standard temperature <i>Standaardtemperatuur</i>	T^\ominus	273 K

TABLE 2: FORMULAE/TABEL 2: FORMULES

$\frac{p_1 V_1}{T_1} = \frac{p_2 V_2}{T_2}$	$pV = nRT$
$n = \frac{m}{M}$	$n = \frac{N}{N_A}$
$n = \frac{V}{V_m}$	$c = \frac{n}{V}$ OR/OF $c = \frac{m}{MV}$

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

KEY/SLEUTEL	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)		
	1 H 1												5 B 11	6 C 12	7 N 14	8 O 16	9 F 19	10 Ne 20	
		3 Li 7	4 Be 9										11 Na 23	12 Mg 24					
				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
				39 Y 89	40 Zr 91	41 Nb 92	42 Mo 96	43 Tc 98	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
				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 209	86 Rn 209
				89 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

