education

Department:
Education
PROVINCE OF KWAZULU-NATAL

NATIONAL SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES: CHEMISTRY (P2)

COMMON TEST

MARCH 2019

MARKS : 50

TIME : 1 HOUR

This question paper consists of 6 pages and 2 data sheets.

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INSTRUCTIONS AND INFORMATION TO CANDIDATES

1. Write your name and other information in the appropriate spaces on the ANSWER BOOK.
2. The question paper consists of FOUR questions. Answer ALL the 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 sub-questions, for example between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable pocket 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 where applicable.
11. Give brief motivations, discussions, et cetera where required.
12. Write neatly and legibly.

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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. – 1.4) in the ANSWER BOOK, for example 1.5 D.

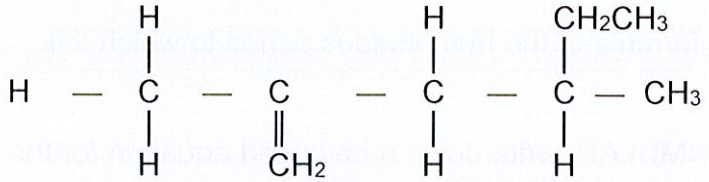
1.1 Which ONE of the following compounds represented below is an aldehyde?

A CH_3COOH
B CH_3COCH_3
C CH_3CH_2CHO
D $CH_3CH(OH)CH_3$ (2)

1.2 Boiling point is the . . .

A temperature at which a liquid becomes a gas and is also called vapourisation point.
B temperature at which a gas becomes a liquid and is also called condensation point
C temperature at which a solid becomes a gas and is also called sublimation point
D temperature at which the vapour pressure of a substance equals the atmospheric pressure. (2)

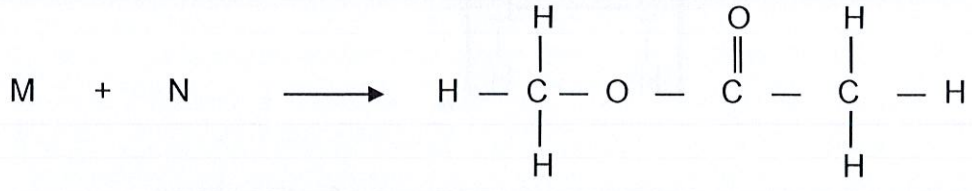
1.3 The structural formula of an organic compound is given below:



The correct IUPAC name for the above compound is . . .

A 2,4 – dimethylhex – 1 – ene.
B 3,5 – dimethylhex – 5 – ene.
C 4 – ethyl – 2 – methylpent – 1 – ene.
D 2 – ethyl – 4 – methylpent – 4 – ene. (2)

1.4 What are the reactants M and N in the following acid-catalysed reaction?

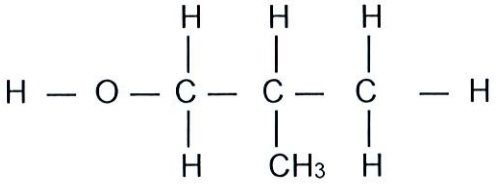


A Methanoic acid and ethanol.
B Ethanoic acid and methanol.
C Methanoic acid and methanol.
D Ethanoic acid and propan – 2 – ol. (2)

[8]

QUESTION 2 (Start on a new page.)

2.1 Consider the following compound:

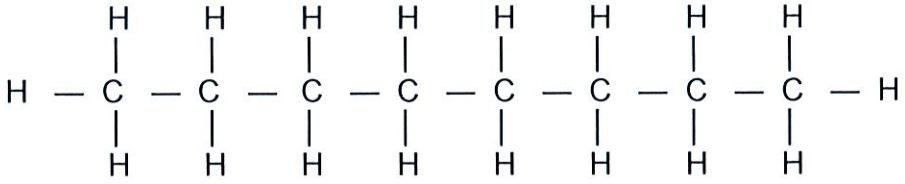


2.1.1 Name the functional group of the above compound. (1)

2.1.2 Write down the IUPAC name of the above compound. (2)

2.1.3 Write down a structural formula of an isomer of the above compound. (2)

2.2 Consider the following organic compound:

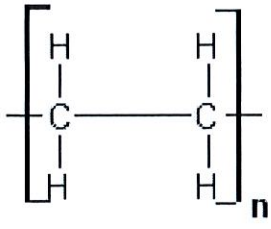


2.2.1 Write down the general formula of the homologous series to which this compound belongs. (2)

2.2.2 Using MOLECULAR FORMULAE, write down a balanced equation for the reaction of the above compound with excess oxygen. (3)

2.3 A chemical analysis of a compound, $C_nH_{2n}O_2$, shows that it is made up of 12,5 % oxygen by mass . Calculate the percentage carbon in the compound. (5)

2.4 Polymers are organic compounds with a wide range of applications. The following compound represents a polymer formed as a result of addition polymerization:



2.4.1 Write down the structural formula of a monomer for the above. (2)

2.4.2 Write down the IUPAC name of the above polymer. (2)
[19]

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QUESTION 3 (Start on a new page.)

An experiment was conducted to determine the boiling points of three(3) organic compounds, P, Q and R, from DIFFERENT HOMOLOGOUS SERIES under the same conditions.The following data was obtained:

COMPOUND	BOILING POINT/^{0}C
P	103
Q	137
R	163

3.1 Define the term homologous series. (2)

3.2 Formulate an investigative question for this experiment. (2)

3.3 Which ONE of the compounds P, Q or R has the highest vapour pressure? Refer to the data in the table to give a reason for the answer. (2)

3.4 The three organic compounds used in the experiment are $CH_3(CH_2)_3CH_2OH$, $CH_3(CH_2)_2COOH$ and $CH_3(CH_2)_3CHO$, in no specific order.

3.4.1 Which ONE of these compounds is represented by letter R? (1)

3.4.2 Explain the answer to question 3.4.1 by referring to intermolecular forces and energy. (4)

3.5 How will the boiling point of pentane – 1,2 – diol compare to the boiling point of $CH_3(CH_2)_3CH_2OH$? (Choose from GREATER THAN, LESS THAN or EQUAL TO) (1)

[12]

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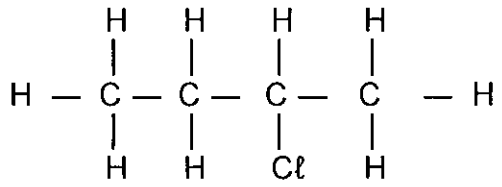
QUESTION 4 (Start on a new page.)

Three reactions of organic compounds are shown below:

I: $CH_3CH_2CHBrCH_3 \longrightarrow X + NaBr$

II: $H_2SO_4(conc.) + X \xrightarrow{heat} CH_3CHCHCH_3 + Y$

III: $Z + HC\ell \longrightarrow$



4.1 Compound X represents an alcohol.

4.1.1 Name the type of reaction represented by reaction **I**. (1)

4.1.2 List any TWO reaction conditions that must be satisfied for reaction **I** to take place. (2)

4.1.3 Write down the IUPAC name for compound X. (2)

4.2 Reaction **II** is an elimination reaction.

4.2.1 Name the type of elimination reaction represented by reaction **II**. (1)

4.2.2 Name the inorganic product Y. (1)

4.2.3 Is the organic product of this reaction a MAJOR or MINOR product? (1)

4.3 In reaction **III**, an ALKENE Z is mixed with $HC\ell$.

4.3.1 Name this type of reaction. (1)

4.3.2 Explain why water must NOT be present in the reaction vessel. (2)

[12]

TOTAL MARKS: 50

DATA FOR PHYSICAL SCIENCES GRADE 12
PAPER 2 (CHEMISTRY)

GEGEWENS VIR FISIESE WETENSKAPPE GRAAD 12
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* $c = \frac{m}{MV}$	$n = \frac{V}{V_m}$
$\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b}$	$pH = -\log[H_3O^+]$
$K_w = [H_3O^+][OH^-] = 1 \times 10^{-14}$ at/*by* 298 K	
$E^\theta_{cell} = E^\theta_{cathode} - E^\theta_{anode}$ / $E^\theta_{sel} = E^\theta_{katode} - E^\theta_{anode}$ or/*of* $E^\theta_{cell} = E^\theta_{reduction} - E^\theta_{oxidation}$ / $E^\theta_{sel} = E^\theta_{reduksie} - E^\theta_{oksidasie}$ or/*of* $E^\theta_{cell} = E^\theta_{oxidising\ agent} - E^\theta_{reducing\ agent}$ / $E^\theta_{sel} = E^\theta_{oksideermiddel} - E^\theta_{reduseermiddel}$	

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

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)
1 H 1 2,1																	2 He 4
3 Li 7 1,0	4 Be 9 1,5											5 B 11 2,0	6 C 12 2,5	7 N 14 3,0	8 O 16 3,5	9 F 19 4,0	10 Ne 20
11 Na 23 0,9	12 Mg 24 1,2											13 Aℓ 27 1,5	14 Si 28 1,8	15 P 31 2,1	16 S 32 2,5	17 Cℓ 35,5 3,0	18 Ar 40
19 K 39 0,8	20 Ca 40 1,0	21 Sc 45 1,3	22 Ti 48 1,5	23 V 51 1,6	24 Cr 52 1,6	25 Mn 55 1,5	26 Fe 56 1,8	27 Co 59 1,8	28 Ni 59 1,8	29 Cu 63,5 1,9	30 Zn 65 1,6	31 Ga 70 1,6	32 Ge 73 1,8	33 As 75 2,0	34 Se 79 2,4	35 Br 80 2,8	36 Kr 84
37 Rb 86 0,8	38 Sr 88 1,0	39 Y 89 1,2	40 Zr 91 1,4	41 Nb 92 1,6	42 Mo 96 1,8	43 Tc 1,9	44 Ru 101 2,2	45 Rh 103 2,2	46 Pd 106 2,2	47 Ag 108 1,9	48 Cd 112 1,7	49 In 115 1,7	50 Sn 119 1,8	51 Sb 122 1,9	52 Te 128 2,1	53 I 127 2,5	54 Xe 131
55 Cs 133 0,7	56 Ba 137 0,9	57 La 139	72 Hf 179 1,6	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 1,8	82 Pb 207 1,8	83 Bi 209 1,9	84 Po 2,0	85 At 2,2	86 Rn
87 Fr 0,7	88 Ra 226 0,9	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

KEY/*SLEUTEL*

Atomic number *Atoomgetal*

Symbol *Simbool*

29
Cu
1,9
63,5

Electronegativity *Elektronegatiwiteit*

Approximate relative atomic mass *Benaderde relatiewe atoommassa*

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GRADE 12

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MARKING GUIDELINE

COMMON TEST

MARCH 2019

MARKS: 50

TIME: 1 hour

This marking guideline consists of 5 pages.

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QUESTION 1

1.1 C ✓✓ (2)

1.2 D✓✓ (2)

1.3 A✓✓ (2)

1.4 B✓✓ (2)
[8]

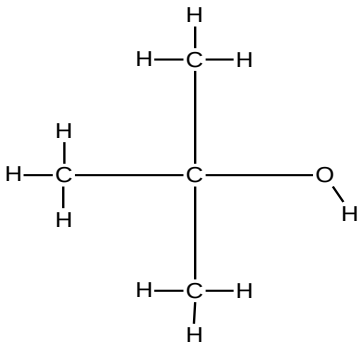
QUESTION 2

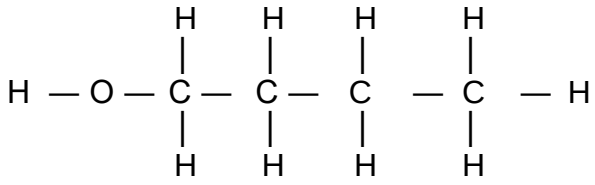
2.1.1 Hydroxyl group ✓ (1)

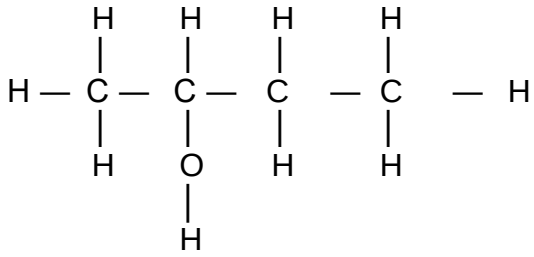
2.1.2 methylpropan - 1 - ol ✓ Accept 2 – methylpropan - 1 - ol (2)

2.1.3 (Any One)

NOTE:
- For any additional bond on the carbon atoms subtract 1 mark.
- If there are missing hydrogens subtract 1 mark.







✓✓ (2)

2.2

2.2.1 C_nH_{2n+2} ✓✓ (2)

2.2.2 $2C_8H_{18} + 25O_2 \rightarrow 16CO_2 + 18H_2O$

Reactants ✓ / Products ✓ / Balancing ✓

If structural/condensed formula is used then 2/3 max. (3)

2.3 $(\frac{12,5}{100})$ x $M(C_nH_{2n}O_2)$ = 32✓

$M(C_nH_{2n}O_2)$ = 256 $g.mol^{-1}$✓

Calc. molar mass of compound✓✓
Determining the value of n ✓
Calc. % of C in whole comp. ✓✓

But 12(n) + 2(n) = 256 - 32

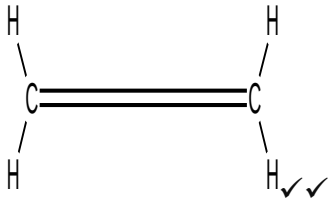
n = 16✓

∴ % C = $(\frac{16 \times 12}{256}) \times 100$ ✓

= 75 % ✓ (5)

2.4

2.4.1



✓✓ (2)

2.4.2 polyethene✓✓ (2)

[19]

QUESTION 3

3.1 A series of organic compounds that can be described by the same general formula ✓✓

OR

A series of organic compounds in which one member differs from the next by a -CH_2 group. (2)

3.2 What is the relationship between boiling point and type of functional group? ✓✓
(Accept any other correct investigative question as long as there is a relationship between boiling point and functional group.) (2)

3.3 P✓
P has the lowest boiling point. ✓ (2)

3.4

3.4.1 $CH_3(CH_2)_2COOH$ ✓ (1)

3.4.2 $CH_3(CH_2)_2COOH$ and $CH_3(CH_2)_3CH_2OH$ have hydrogen bonding and $CH_3(CH_2)CHO$ has no hydrogen bonding. ✓
$CH_3(CH_2)_2COOH$ has TWO sites for hydrogen bonding. ✓
The intermolecular forces between molecules of $CH_3(CH_2)_2COOH$ is therefore the strongest ✓ and will require the most amount of energy to separate its molecule. ✓ (4)

3.5 greater than ✓ (1)
[12]

QUESTION 4

4.1

4.1.1 substitution/hydrolysis ✓ (1)

4.1.2 dissolve $CH_3CH_2CHBrCH_3$ in ethanol/ethanol as a solvent ✓
mild heat ✓
dilute strong base/NaOH / KOH ✓ (any 2) (2)

4.1.3 butan – 2 – ol ✓✓
Accept 2-butanol (2)

4.2

4.2.1 dehydration ✓ (1)

4.2.2 water ✓ (1)

4.2.3 major product ✓ (1)

4.3

4.3.1 addition/hydrohalogenation ✓ (1)

4.3.2 Prevents the formation of an alcohol ✓✓ (2)
[11]

TOTAL MARKS: [50]

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