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Basic Education

KwaZulu-Natal Department of Education
REPUBLIC OF SOUTH AFRICA

PHYSICAL SCIENCES P2 (CHEMISTRY)

COMMON TEST

MARCH 2016

**NATIONAL
SENIOR CERTIFICATE**

GRADE 12

MARKS: 50

TIME: 1 hour

This question paper consists of 9 pages including data sheet.

INSTRUCTIONS AND INFORMATION

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 are advised to use the attached DATA SHEETS.
8. Show ALL formulae and substitutions in ALL calculations.
9. Round off your final numerical answers to a minimum of TWO decimal places where applicable.
10. Give brief motivations, discussions, et cetera where required.
11. 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, B, C or D next to the question number (1.1 – 1.5) in your ANSWER BOOK.

1.1 A type/s of intermolecular force/s between ethanol molecules is/are ...

- A ion-dipole forces.
- B ion-induced dipole forces.
- C dipole-dipole forces and induced dipole forces.
- D induced dipole forces and ion-dipole forces. (2)

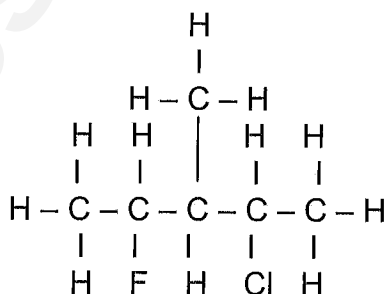
1.2 Consider the following organic compound: $C_2H_4O_2$
Which one of the following statements concerning this compound is TRUE?

- A It is an alcohol.
- B It is an ester.
- C It is used in welding.
- D It can turn red litmus blue. (2)

1.3 Which of the following sequences of the given organic compounds correctly represents them from the lowest to the highest boiling point?

- A Chloroethane; ethanol; ethane; ethanoic acid
- B Ethanol; ethane; chloroethane; ethanoic acid.
- C Ethanoic acid; ethanol; chloroethane; ethane
- D Ethane; chloroethane; ethanol; ethanoic acid (2)

1.4 Consider the following structural formula of an organic molecule.



The correct name of this molecule is ..

- A 2 – Fluoro – 3 – methyl – 4 – chloropentane
- B 2 – Fluoro – 4 – chloro – 3 – methylpentane
- C 4 – Fluoro – 2 – chloro – 3 – methylpentane
- D 2 – chloro – 4 – Fluoro – 3 – methylpentane (2)

- 1.5 Hot, concentrated KOH is reacted with 2-chlorobutane. The reaction type and the major organic product formed can best be described as:

	REACTION TYPE	PRODUCT FORMED
A	Elimination	But-2-ene
B	Substitution	Butan-2-ol
C	Elimination	But-1-ene
D	Substitution	Butan-1-ol

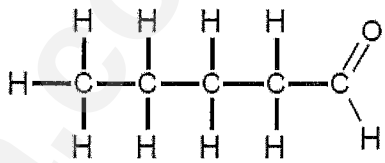
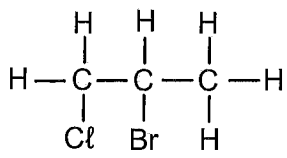
(2)
[10]

QUESTION 2 (Start on a new page)

2.1 What are positional isomers?

(1)

Consider the following organic compounds represented by the letters A to F and answer the questions that follow:

A	$\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$	B	2-chlorobutane
C	3,3 – dibromobut – 1 – ene	D	
E		F	CHCl_3

2.2 Is compound **A**, a saturated or unsaturated hydrocarbon? Give reason for your answer. (2)

2.3 Write down name of the homologous series to which compound **D** belongs. (1)

2.4 Draw a structural formula for compound **C**. (2)

2.5 Is compound **B** a PRIMARY, SECONDARY or TERTIARY haloalkane? Give a reason for your answer. (2)

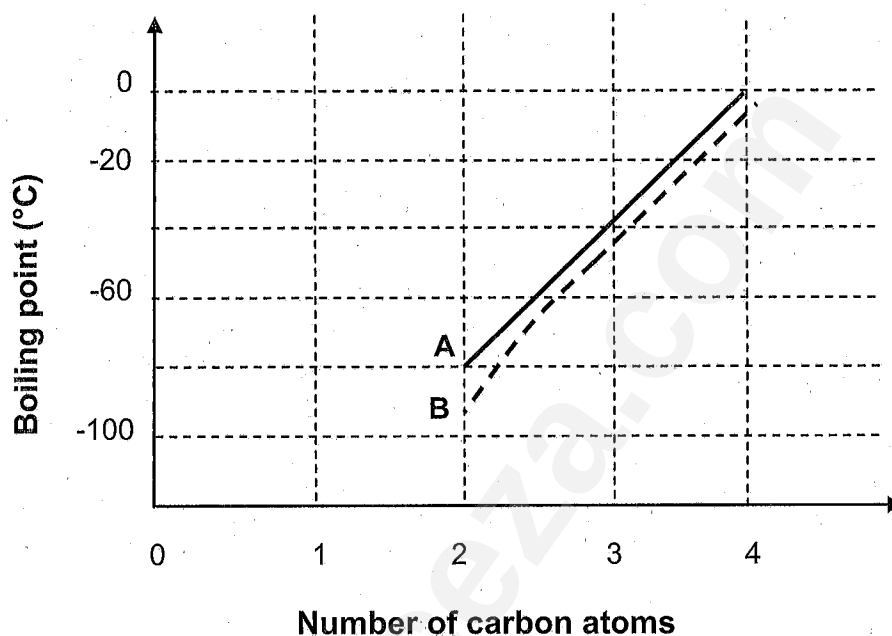
2.6 Compound **F** is commonly known as chloroform. What is its IUPAC name? (1)

2.7 Write down the IUPAC name of compound **E**. (1)

[10]

QUESTION 3 (Start on a new page)

The accompanying graphs show the relationship between the boiling points and the number of carbon atoms in the first few UNBRANCHED alkanes and alkenes.

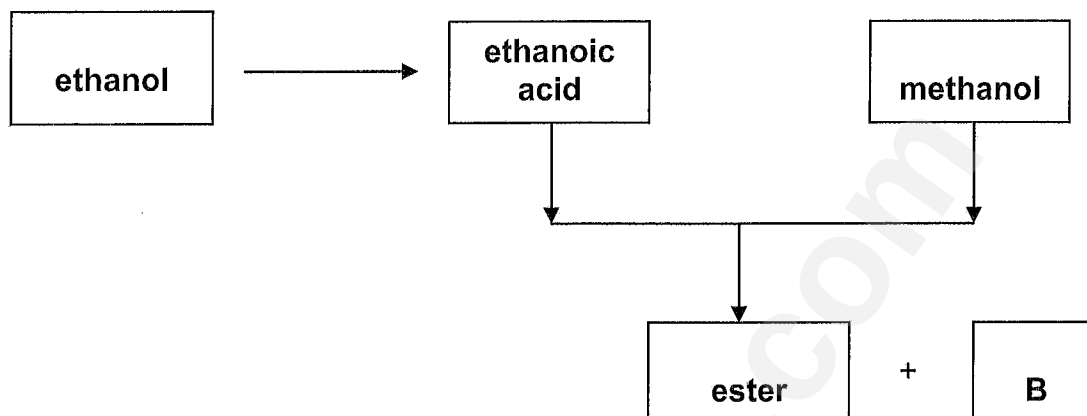


- 3.1 Alkanes and alkenes are hydrocarbons. Define the term **hydrocarbon**. (1)
- 3.2 What is the relationship between boiling point and number of carbon atoms for the same homologous series as shown in the graph? (1)
- 3.3 Explain the relationship in QUESTION 3.2 in terms of intermolecular forces and energy. (3)
- 3.4 Which of the graphs, **A** or **B** is that of the alkanes? (1)
- 3.5 Explain your answer in QUESTION 3.4. (2)

[8]

QUESTION 4 (Start on a new page)

- 4.1 Consider the following flow-diagram of a chemical process that leads to the formation of an ester.



- 4.1.1 State ONE harmful effect when methanol is consumed by humans. (1)
- 4.1.2 Write down the NAME or FORMULA of compound B. (1)
- 4.1.3 Give the IUPAC name and STRUCTURAL FORMULA of the ester formed. (3)
- 4.2 The hydration of C_2H_4 is one way by which ethanol can be prepared. Using STRUCTURAL FORMULAE, write down this reaction. (4)
- Identify the catalyst used in this reaction.
- 4.3 The following extract appeared in a daily newspaper:

Explosion rocks Winery

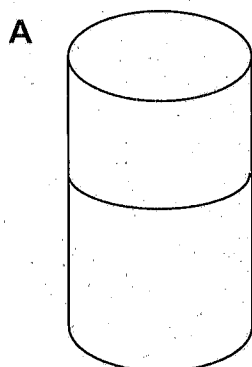
Huge damage occurred at the Pinetown Winery. A stainless steel tank in which sparkling wine is produced, exploded yesterday. The fermentation of the sugar in the grape juice apparently took place at such a high rate that the valves of the tank could not release the gaseous product of this reaction fast enough.

- 4.3.1 Write down the **FORMULA** of the product of fermentation that caused the tank to explode. (1)
- 4.3.2 Write down the chemical **NAME** of the alcohol formed in the tank. (1)
- [11]**

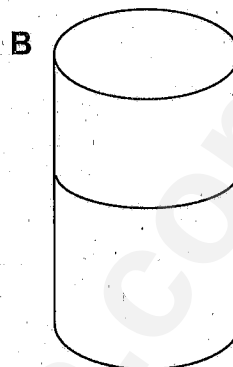
QUESTION 5 (Start on a new page)

- 5.1 You are provided with samples of pentane and pent-1-ene in two separate test tubes.

You need to distinguish between these 2 compounds in the laboratory.



pentane



pent-1-ene

- 5.1.1 Describe a simple chemical test that you could do, and show how you would distinguish between these 2 compounds. (3)
- 5.1.2 Write down the reaction, using condensed formula, taking place in test tube B and also name the product formed. (3)
- 5.2 The following table shows the boiling points of the isomers X, Y and Z of C_5H_{12} .

Isomers	Boiling points ($^{\circ}C$)
X	10
Y	30
Z	36

- 5.2.1 Define boiling point. (1)
- 5.2.2 Identify compound Y. Explain **fully** how you arrived at your answer. (4)

[11]
TOTAL: 50

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)
1 H 1,01	2 He 4,0																
3 Li 7,0	4 Be 9,0																
11 Na 23,0	12 Mg 24,3																
19 K 39,1	20 Ca 40,1	21 Sc 45,0	22 Ti 47,9	23 V 50,9	24 Cr 52,0	25 Mn 54,9	26 Fe 55,8	27 Co 58,9	28 Ni 58,7	29 Cu 63,5	30 Zn 65,4	31 Ga 70,0	32 Ge 72,6	33 As 74,9	34 Se 78,9	35 Br 79,9	36 Kr 83,8
37 Rb 85,5	38 Sr 87,6	39 Y 88,9	40 Zr 91,2	41 Nb 92,9	42 Mo 95,9	43 Tc 98,0	44 Ru 101,1	45 Rh 102,9	46 Pd 106,4	47 Ag 107,9	48 Cd 112,4	49 In 114,8	50 Sn 118,7	51 Sb 121,8	52 Te 127,6	53 I 126,9	54 Xe 131,3
55 Cs 132,9	56 Ba 137,3	57 La 138,9	72 Hf 178,5	73 Ta 180,9	74 W 183,8	75 Re 186,2	76 Os 190,2	77 Ir 192,2	78 Pt 195,1	79 Au 196,9	80 Hg 200,6	81 Tl 204,4	82 Pb 207,2	83 Bi 208,9	84 Po 209,0	85 At 210,0	86 Rn 222,0
87 Fr 223,0	88 Ra 226,0	89 Ac															

58 Ce 140,1	59 Pr 140,9	60 Nd 144,2	61 Pm	62 Sm 150,4	63 Eu 152,0	64 Gd 157,3	65 Tb 158,9	66 Dy 162,5	67 Ho 164,9	68 Er 167,3	69 Tm 168,9	70 Yb 173,0	71 Lu 174,9
90 Th 232,0	91 Pa 231,0	92 U 238,0	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

2 He	3 Li	4 Be	5 B	6 C	7 N	8 O	9 F	10 Ne
13 Al	14 Si	15 P	16 S	17 Cl	18 Ar	19 K	20 Ca	21 Sc
23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga
33 As	34 Se	35 Br	36 Kr	37 Rb	38 Sr	39 Y	40 Zr	41 Nb
43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb
53 I	54 Xe	55 Cs	56 Ba	57 La	58 Ce	59 Pr	60 Nd	61 Pm
63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
73 Lu	74 Hf	75 Ta	76 W	77 Re	78 Os	79 Ir	80 Pt	81 Au
83 Bi	84 Po	85 At	86 Rn	87 Fr	88 Ra	89 Ac	90 Th	91 Pa
93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md
103 Lr	104 No	105 Nh	106 Fl	107 Mc	108 Lv	109 Ts	110 Og	111 Nh

Electronegativity Elektronnegatieweif	Symbol Simbool
2,1	He
0,7	Fr

Approximate relative atomic mass Benaderde relatiewe atoommassa
63,5

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MARCH 2016

MEMORANDUM

NATIONAL
SENIOR CERTIFICATE

GRADE 12

MARKS: 50

This memorandum consists of 5 pages.

The marking guidelines as per 2014 Examination Guidelines, pages 34-37 must be applied when marking this Paper.

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Physical Sciences P2

2
NSC-Memorandum

Common Test March 2016

QUESTION 1

- 1.1 C ✓✓ (2)
1.2 B ✓✓ (2)
1.3 D ✓✓ (2)
1.4 D ✓✓ (2)
1.5 A ✓✓ (2)
TOTAL [10]

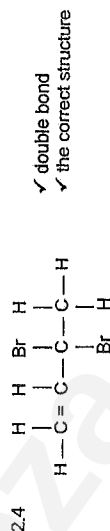
QUESTION 2

2.1 Same molecular formula, but different positions of the side chain, substituents or functional groups on the parent chain ✓ (1)

2.2 Saturated ✓, (2)

no multiple bonds between C atoms in their hydrocarbon chains OR
only single bonds between C atoms OR
no double or triple bonds between C atoms ✓ (1)

2.3 Aldehyde ✓ (2)



2.5 Secondary ✓ (2)

The C-atom to which Cl is attached, is attached to two other C-atoms ✓ (2)

2.6 trichloromethane ✓ (1)

2.7 2-bromo-1-chloropropane (1)

[10]

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QUESTION 4

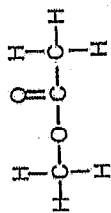
4.1.1 Causes blindness OR
Causes death ✓

(1)

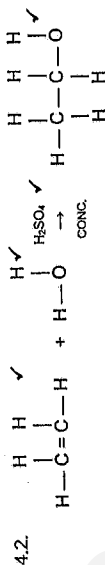
4.1.2 Water / H₂O ✓

(1)

4.1.3 Methyl ethanoate ✓

✓ the correct structure
✓ double bond

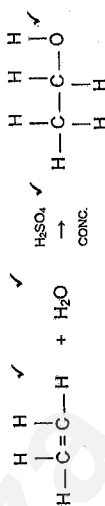
(NOTE: If H omitted: max 1 mark)



4.2.

(3)

OR



OR

NOTE:

If H omitted from organic molecules: max 3 marks)
Accept H₂O for water.
Accept H₃PO₄ / HCl / HNO₃

(4)

4.3.1 CO₂

(1)

(NOTE: if name - carbon dioxide: 0 marks)

4.3.2 Ethanol

(1)

(NOTE: if formula - C₂H₅OH: 0 marks)

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QUESTION 3

3.1 Organic compounds that consist of hydrogen and carbon only ✓

(1)

3.2 Boiling points increase with an increase in the number of C atoms ✓

(1)

(direct proportional – 0 marks)

3.3 The strength of the intermolecular (London forces) forces increase ✓ with an increase in the molecular mass (increase in the size) ✓ of the molecules more energy is required to separate the molecules/ to break intermolecular forces/ to overcome intermolecular forces. ✓

OR

The greater the number of C atoms ✓, the longer the chain length. Hence more sites for London force interaction ✓ more energy is required to separate the molecules/ to break intermolecular forces/ to overcome intermolecular forces. ✓

(to break the bond – 0 marks)

A ✓

(3)

3.4

For the same number of carbon atoms the boiling point of the alkenes are slightly lower because it contains 2 H atoms less than that of the alkanes, therefore smaller molecular mass ✓ and hence weaker IMF. ✓

OR

Fewer sites for London force interaction ✓ and hence weaker IMF ✓.

(2)

[8]

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QUESTION 5

5.1.1 Add bromine water ✓ to each test tube and note / observe the time taken for the decolourisation ✓. Compound with shorter time is pent-1-ene ✓. (3)



1,2 – dibromopentane ✓ (3)

5.2.1 The temperature at which the vapour pressure of a substance equals atmospheric pressure. ✓ (1)

5.2.2 2 – methylbutane ✓

3 possible isomers are pentane, 2 – methylbutane and 2,2 – dimethylpropane. pentane have highest boiling point due to it having the longest chain. ✓
 2,2 – dimethylpropane will have the lowest boiling point as it has the shortest carbon chain. ✓
 Therefore Y, is 2 – methylbutane. ✓

[11]

TOTAL = 50

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