higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T360**(E)**(A7)T

NATIONAL CERTIFICATE

CHEMISTRY N5

(15040015)

7 August 2019 (X-Paper)
09:00–12:00

Calculators may be used.

This question paper consists of 6 pages and 1 periodic table.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
CHEMISTRY N5
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Read ALL the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Write neatly and legibly.

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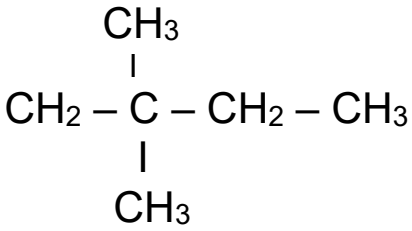
QUESTION 1: INTRODUCTION TO ORGANIC CHEMISTRY AND ALKANES

1.1 Consider the following compound and answer the questions:



1.1.1 Indicate the type of hybridisation that occurs at C2 and C3. (2)

1.1.2 What is the general formula of the compound? (1)

1.1.3 Classify the compound as either a saturated or an unsaturated hydrocarbon. Explain your answer. (2)

1.1.4 Name the type of reactive species that are formed when the compound above is reacted with chlorine in the presence of light. (1)

1.1.5 Briefly describe a homolytic bond cleavage and give an example. (5)

1.2 Draw ONE structure of the following:

1.2.1 Aliphatic compound

1.2.2 Aromatic compound

1.2.3 Heterocyclic compound

(3 × 2) (6)

1.3 Classify the following as either nucleophiles or electrophiles:

1.3.1 H_3O^+

1.3.2 $C\ell^-$

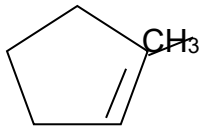
1.3.3 NH_3

(3 × 1) (3)

[20]

QUESTION 2: ALKENES, ALKYNES AND AROMATIC COMPOUNDS

2.1



2.1.1 Write the molecular formula of the compound shown above. (2)

2.1.2 To what homologous series does the compound belong? (2)

2.1.3 Write the IUPAC name of the compound. (2)

2.1.4 Briefly discuss the solubility of the above compound in water. (2)

2.1.5 Use Markovnikov's rule to predict names of a major and a minor product when the compound reacts with hydrogen bromide.
(2 × 2) (4)

2.1.6 State Markovnikov's rule. (2)

2.2 2-Chlorobutane is used to prepare an alkene through an elimination reaction.

2.2.1 Apply the Zaitsev's rule and name both the major and the minor products that are formed from the reaction.

2.2.2 State the Zaitsev's rule.
(2 × 2) (4)

2.3 Alkynes are easily reduced to alkanes by addition of hydrogen over a metal catalyst.

Draw and name a product that is formed when 2-pentyne is reduced in the presence of a Lindlar catalyst. (2)

2.4 A conjugate polyene has SIX carbon atoms.

2.4.1 Draw the structure for the above conjugate polyene.

2.4.2 Give the IUPAC name of the above conjugate polyene.
(2 × 3) (6)

2.5 Draw the structures of the following aromatic compounds:

2.5.1 Phenol

2.5.2 Toluene
(2 × 2) (4)

[30]

QUESTION 3: ALCOHOLS, ALDEHYDES AND KETONES

3.1 Throughout history, ethanol has been made by the fermentation of sugars and carbohydrates. Beer and wine are still made in this way.

3.1.1 Complete and balance the following equation:

$C_6H_{12}O_6 \xrightarrow{\text{Yeast}}$ (3)

3.1.2 State THREE physical properties of alcohols. (3)

3.1.3 Write a balanced equation of the industrial preparation of methanol through the catalytic reduction of carbon monoxide with hydrogen. (3)

3.1.4 Alcohols are weak proton donors.

Write a reaction equation for the dissociation of ethanol in water. (2)

3.2 Consider the following compound and answer the questions:

$CH_3CHOCH_2CH_3$

3.2.1 Name the compound.

3.2.2 Classify the compound as primary, secondary or tertiary alcohol and briefly explain your choice.

3.2.3 Give the IUPAC name of a product that is obtained when the compound above is dehydrated with sulphuric acid.

(3 × 2) (6)

3.3 2-Butanone is reacted with methyl magnesium bromide to form an alcohol.

Write a reaction equation for this reaction. (4)

3.4 $CH_3(CH_2)_2CH_2OH \xrightarrow{\text{Oxidation}}$ Carbonyl compound

3.4.1 Draw the structure of the carbonyl compound. (3)

3.4.2 Name TWO reagents that are used during the oxidation of alcohols to form carbonyl compounds. (2)

3.4.3 Write the IUPAC name of a carbonyl compound. (2)

3.4.4 To which homologous series does the carbonyl compound belong? (1)

3.5 Name the reagent that is used to distinguish aldehydes from ketones. (1)

[30]

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QUESTION 4: CARBOXYLIC ACIDS, ESTERS AND AMINES

4.1 **A** + $CH_3CH_2CH_2OH$ → $CH_3COOCH_2CH_2CH_3$ + **D**
B **C**

4.1.1 Give the homologous series to which compounds A and C belong. (2)

4.1.2 Give the IUPAC name of compound A. (1)

4.1.3 Give the IUPAC name of compound B. (1)

4.1.4 Give the IUPAC name of compound D. (1)

4.1.5 With the aid of a reaction equation, indicate how compound A is prepared from a primary alcohol. (5)

4.2 Amines are compounds that are derived from ammonia and like ammonia they are weak bases.

4.2.1 Complete the following equation:

$CH_3OH(aq) + NH_3(g) \rightarrow$

4.2.2 Draw the structure of a simple aniline.

4.2.3 State TWO properties of amines.

(3 × 2) (6)

4.3 Draw the structure of:

4.3.1 Formic acid

4.3.2 Ethanamide

(2 × 2) (4)
[20]

TOTAL: 100

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(15040015)

THE PERIODIC TABLE OF ELEMENTS
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)
2,1 1 **H** 1																	2 **He** 4
1,0 3 **Li** 7	1,5 4 **Be** 9											2,0 5 **B** 11	2,5 6 **C** 12	3,0 7 **N** 14	3,5 8 **O** 16	4,0 9 **F** 19	10 **Ne** 20
0,9 11 **Na** 23	1,2 12 **Mg** 24											1,5 13 **Aℓ** 27	1,8 14 **Si** 28	2,1 15 **P** 31	2,5 16 **S** 32	3,0 17 **Cℓ** 35,5	18 **Ar** 40
0,8 19 **K** 39	1,0 20 **Ca** 40	1,3 21 **Sc** 45	1,5 22 **Ti** 48	1,6 23 **V** 51	1,6 24 **Cr** 52	1,5 25 **Mn** 55	1,8 26 **Fe** 56	1,8 27 **Co** 59	1,8 28 **Ni** 59	1,9 29 **Cu** 63,5	1,6 30 **Zn** 65	1,6 31 **Ga** 70	1,8 32 **Ge** 73	2,0 33 **As** 75	2,4 34 **Se** 79	2,8 35 **Br** 80	36 **Kr** 84
0,8 37 **Rb** 86	1,0 38 **Sr** 88	1,2 39 **Y** 89	1,4 40 **Zr** 91	1,8 41 **Nb** 92	1,8 42 **Mo** 96	1,9 43 **Tc**	2,2 44 **Ru** 101	2,2 45 **Rh** 103	2,2 46 **Pd** 106	1,9 47 **Ag** 108	1,7 48 **Cd** 112	1,7 49 **In** 115	1,8 50 **Sn** 119	1,9 51 **Sb** 122	2,1 52 **Te** 128	2,5 53 **I** 127	54 **Xe** 131
0,7 55 **Cs** 133	0,9 56 **Ba** 137	57 **La** 139	1,6 72 **Hf** 179	1,6 73 **Ta** 181	1,8 74 **W** 184	1,9 75 **Re** 186	2,2 76 **Os** 190	2,2 77 **Ir** 192	2,2 78 **Pt** 195	1,9 79 **Au** 197	1,7 80 **Hg** 201	1,8 81 **Tℓ** 204	1,8 82 **Pb** 207	1,9 83 **Bi** 209	2,0 84 **Po**	2,5 85 **At**	86 **Rn**
0,7 87 **Fr**	0,9 88 **Ra** 226	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*

Electronegativity *Elektronegatiwiteit*

Symbol *Simbool*

Approximate relative atomic mass *Benaderde relatiewe atoommassa*

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