



# higher education & training

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Department:  
Higher Education and Training  
**REPUBLIC OF SOUTH AFRICA**

T360(E)(A9)T

**NATIONAL CERTIFICATE**

**CHEMISTRY N5**

(15040015)

**9 April 2019 (X-Paper)**

**09:00–12:00**

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

**DEPARTMENT OF HIGHER EDUCATION AND TRAINING**  
**REPUBLIC OF SOUTH AFRICA**  
NATIONAL CERTIFICATE  
CHEMISTRY N5  
TIME: 3 HOURS  
MARKS: 100

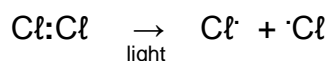
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**INSTRUCTIONS AND INFORMATION**

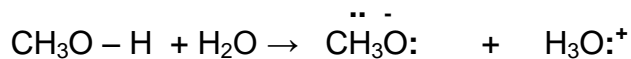
1. Answer ALL the questions.
  2. Read ALL the questions carefully.
  3. Number the answers according to the numbering system used in this question paper.
  4. Write neatly and legibly.
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**QUESTION 1: INTRODUCTION TO ORGANIC CHEMISTRY AND ALKANES**

1.1 Reaction 1:



Reaction 2:



- 1.1.1 Which reaction involves a homolytic bond cleavage? (1)
- 1.1.2 Name the species formed in reaction 1. (1)
- 1.1.3 Reaction 2 involves the formation of an electrophile and a nucleophile.  
Which product is the nucleophile? (1)
- 1.1.4 Briefly define the term *electrophile*. (2)
- 1.1.5 Write a reaction equation for the chlorination of methane. (4)
- 1.1.6 Classify the reaction mentioned in QUESTION 1.1.5 as a substitution or addition reaction. Justify the answer. (2)
- 1.1.7 Briefly describe heterolytic bond cleavage. (2)
- 1.2  $\text{CH}_3\text{CH}_2\text{CHCH}_2$
- 1.2.1 Name the type of hybridisation that occurs at C1 and C4. (2)
- 1.2.2 Is the compound a saturated or unsaturated hydrocarbon? Justify the answer. (2)
- 1.3 Give ONE example of each of the following:
- 1.3.1 Aliphatic compound
- 1.3.2 Aromatic compound
- 1.3.3 Heterocyclic compound
- (3 × 1) (3)  
**[20]**

**QUESTION 2: ALKENES, ALKYNES AND AROMATIC COMPOUNDS**

Compound number	Structural formula	Condensed structural formula	Molecular formula
1	$\text{CH}_3 - \text{CH}_3$		$\text{C}_2\text{H}_6$
2		$\text{CH}_3(\text{CH}_2)_3\text{CH}_3$	
3			$\text{C}_7\text{H}_{16}$

- 2.1.1 Write the general formula of compound 3. (1)
- 2.1.2 Draw the condensed structure of compound 1. (1)
- 2.1.3 Which ONE of the compounds is classified as an unsaturated compound? (1)
- 2.1.4 Briefly discuss the polarity of the THREE compounds. (2)
- 2.1.5 Write the IUPAC name of compound 2. (2)
- 2.1.6 Write the molecular formula of compound 2. (1)
- 2.1.7 Draw the structures of TWO branched isomers of compound 3. (2 × 2) (4)
- 2.2 Electrophilic addition of hydrogen bromide to 1-methylcyclohexene produced a mixture of two products according to Markovnikov's rule.
- 2.2.1 State Markovnikov's rule. (2)
- 2.2.2 Use Markovnikov's rule to predict the major and minor products formed when 1-methylcyclohexane reacts with hydrogen bromide. (2 + 2) (4)
- 2.3 Alkynes are easily converted to alkanes by addition of hydrogen over a metal catalyst like a Lindlar catalyst.
- 2.3.1 Briefly describe a Lindlar catalyst. (3)
- 2.3.2 Draw and name the alkane product that is produced when 2-pentyne is reduced in the presence of a Lindlar catalyst. (2)
- 2.4 Write a balanced reaction equation for the combustion of 2-butene. (4)

2.5 Draw the structures of each of the following compounds:

2.5.1 Aminobenzene

2.5.2 Benzoic acid

2.5.3 *p*-bromotoluene

(3 × 1) (3)  
[30]

### QUESTION 3: ALCOHOLS, ALDEHYDES AND KETONES

3.1 Alcohols are organic derivatives of water with the same geometry as water and a bond with an approximate tetrahedral value of 109°.

3.1.1 Alcohols, like water, are weak proton donors.

Write a reaction equation for the dissociation of methanol in water. (3)

3.1.2 Write the equilibrium expression ( $K_a$ ) for the reaction. (2)

3.1.3 Will the  $K_a$  value be big or small? (1)

3.1.4 Briefly account for the high boiling points of alcohols. (3)

3.1.5 Which reagent is used to convert compound alcohols to alkenes? (2)

3.1.6 Give TWO uses of methanol. (2)

3.2 Chlorine is added to ethene in the presence of water to yield a halohydrin.

3.2.1 Write a reaction equation for the formation of the halohydrin. (4)

3.2.2 Name the product formed in QUESTION 3.2.1. (2)

3.3

Alcohol  $\xrightarrow{\text{oxidation}}$   $\text{CH}_3 - \text{CH}_2 - \overset{\text{O}}{\parallel}{\text{C}} - \text{H}$   $\xrightarrow{\text{oxidation}}$  carboxylic acid

3.3.1 Name the alcohol used for the reaction. (1)

3.3.2 Classify the alcohol as primary, secondary or primary alcohol. Justify the answer. (2)

3.3.3 Write the formula of the reagent used during the reaction. (1)

3.3.4 Write the general formula of carboxylic acids. (1)

3.3.5 Draw the structure of a carboxylic acid. (2)

- 3.3.6 What is the IUPAC name of the aldehyde produced during the reaction? (1)
- 3.3.7 Briefly explain how to distinguish aldehydes from ketones. (3)
- [30]**

#### QUESTION 4: CARBOXYLIC ACIDS, ESTERS AND AMINES

- 4.1 Give ONE term for each of the following descriptions. Write only the term next to the question number (4.1.1–4.1.5) in the ANSWER BOOK.
- 4.1.1 Common name of a carboxylic acid with two carbon atoms
- 4.1.2 Amine with two carbon atoms
- 4.1.3 Common name of methanamide
- 4.1.4 Major animal waste product found in urine
- 4.1.5 IUPAC name of a simple aromatic amine (5 × 2) (10)
- 4.2 Alcohol + carboxylic acid  $\xrightarrow{\text{acid}}$  methylbutanoate
- 4.2.1 Draw and name the structure of the carboxylic acid used to prepare the product. (4)
- 4.2.2 Name the alcohol used in the reaction. (2)
- 4.2.3 Carboxylic acids are weak proton donors.
- Write a reaction equation for the dissociation of acetic acid in water. (4)
- [20]**

**TOTAL: 100**

THE PERIODIC TABLE OF ELEMENTS  
DIE PERIODIEKE TABEL VAN ELEMENTE

	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 2,1 <b>H</b> 1																		2 <b>He</b> 4	
	3 1,0 <b>Li</b> 7	4 0,9 <b>Be</b> 9												6 1,2 <b>Na</b> 23	7 0,9 <b>Mg</b> 24				10 2,0 <b>Ne</b> 20	
	11 0,9 <b>Na</b> 23	12 1,2 <b>Mg</b> 24		21 1,3 <b>Sc</b> 45	22 1,5 <b>Ti</b> 48	23 1,6 <b>V</b> 51	24 1,6 <b>Cr</b> 52	25 1,6 <b>Mn</b> 55	26 1,8 <b>Fe</b> 56	27 1,8 <b>Co</b> 59	28 1,8 <b>Ni</b> 59	29 1,9 <b>Cu</b> 63,5	30 1,6 <b>Zn</b> 65	31 1,6 <b>Ga</b> 70	32 1,8 <b>Ge</b> 73	33 2,0 <b>As</b> 75	34 2,4 <b>Se</b> 79	35 2,8 <b>Br</b> 80	36 3,6 <b>Kr</b> 84	
	19 0,8 <b>K</b> 39	20 1,0 <b>Ca</b> 40		39 1,2 <b>Y</b> 89	40 1,4 <b>Zr</b> 91	41 1,6 <b>Nb</b> 92	42 1,6 <b>Mo</b> 96	43 1,6 <b>Tc</b> 101	44 1,8 <b>Ru</b> 103	45 1,8 <b>Rh</b> 106	46 1,9 <b>Pd</b> 108	47 1,7 <b>Ag</b> 112	48 1,7 <b>Cd</b> 115	49 1,7 <b>In</b> 119	50 1,8 <b>Sn</b> 122	51 1,9 <b>Sb</b> 127	52 2,1 <b>Te</b> 128	53 2,5 <b>I</b> 131	54 3,6 <b>Xe</b> 131	
	37 0,8 <b>Rb</b> 86	38 1,0 <b>Sr</b> 88		57 1,6 <b>La</b> 139	72 1,6 <b>Hf</b> 179	73 1,6 <b>Ta</b> 181	74 1,6 <b>W</b> 184	75 1,6 <b>Re</b> 186	76 1,9 <b>Os</b> 190	77 1,9 <b>Ir</b> 192	78 1,9 <b>Pt</b> 195	79 1,9 <b>Au</b> 197	80 1,9 <b>Hg</b> 201	81 1,9 <b>Tl</b> 204	82 2,0 <b>Pb</b> 207	83 2,0 <b>Bi</b> 209	84 2,0 <b>Po</b> 210	85 2,5 <b>At</b> 210	86 3,6 <b>Rn</b> 222	
	55 0,7 <b>Cs</b> 133	56 0,9 <b>Ba</b> 137		89 0,9 <b>Ac</b> 226																
	87 0,7 <b>Fr</b> 223	88 0,9 <b>Ra</b> 226																		
			58 1,4 <b>Ce</b> 140	59 1,4 <b>Pr</b> 141	60 1,4 <b>Nd</b> 144	61 1,5 <b>Pm</b> 147	62 1,5 <b>Sm</b> 150	63 1,5 <b>Eu</b> 152	64 1,5 <b>Gd</b> 157	65 1,5 <b>Tb</b> 159	66 1,6 <b>Dy</b> 163	67 1,6 <b>Ho</b> 165	68 1,6 <b>Er</b> 167	69 1,6 <b>Tm</b> 169	70 1,6 <b>Yb</b> 173	71 1,6 <b>Lu</b> 175				
			90 2,3 <b>Th</b> 232	91 2,3 <b>Pa</b> 231	92 2,3 <b>U</b> 238	93 2,3 <b>Np</b> 237	94 2,3 <b>Pu</b> 244	95 2,3 <b>Am</b> 243	96 2,3 <b>Cm</b> 247	97 2,3 <b>Bk</b> 247	98 2,3 <b>Cf</b> 251	99 2,3 <b>Es</b> 252	100 2,3 <b>Fm</b> 257	101 2,3 <b>Md</b> 288	102 2,3 <b>No</b> 289	103 2,3 <b>Lr</b> 260				

**KEY / SLEUTEL**

Atomic number  
Atoomgetal

Electronegativity  
Elektronegatiwiteit

Symbol  
Simbool

Approximate relative atomic mass  
Benaderde relatiewe atoommassa

**29 Cu 63,5**