higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

CHEMISTRY N5

(15040015)

25 November 2022 (X-paper)
09:00–12:00

Drawing instruments may be used.

This question paper consists of 7 pages and 1 periodic table.

241Q1E2225

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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. Use only a blue or black pen
5. Write neatly and legibly.

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QUESTION 1

1.1 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (1.1.1–1.1.5) in the ANSWER BOOK. Give a reason for the answer.

1.1.1 Propyne is classified as a saturated compound.

1.1.2 Acyclic compounds are organic compounds in which the carbon atoms are arranged in ring structures.

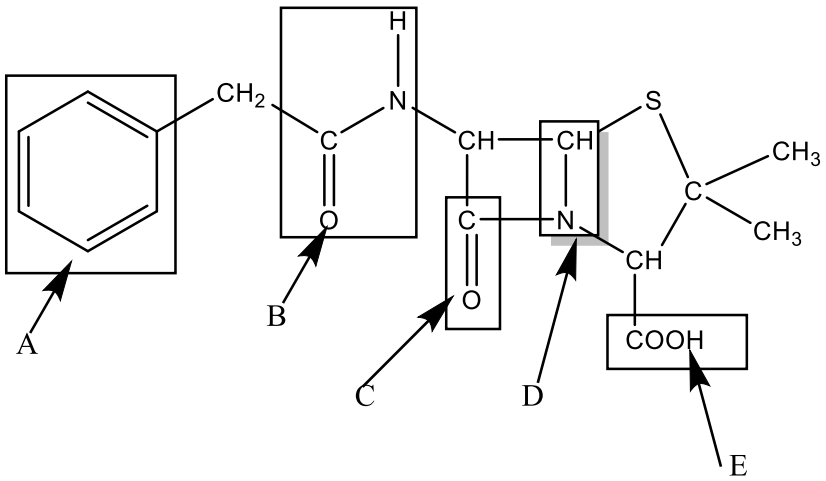
1.1.3 The carbon atom in methane has undergone a sp^3 hybridisation.

1.1.4 Acetone and propanal are isomers with molecular formula C_3H_6O.

1.1.5 Pentane has a higher boiling point than ethane.

(5 × 2) (10)

1.2 Given below is the molecular structure of penicillin (an antibiotic).



Penicillin

Identify the indicated functional groups by writing only the functional group next to the letter (A–E) in the ANSWER BOOK (e.g. F: Alcohol). (5)

[15]

QUESTION 2: ALKANES

2.1 Consider the following compound: 4,4-diethyl-5-methyloctane.

2.1.1 Draw the structure the alkane above. (3)

2.1.2 Give the molecular formula of the alkane above. (1)

2.2 Draw the structures of the respective alkyls A and B formed when the indicated hydrogen atom is removed from the given alkane.

2.2.1 $(CH_3)_2CHCH_2$—H → A

Isobutyl

2.2.2 $(CH_3)_3CCH_2$—H → B

Neopentyl

(2 × 2) (4)

2.3 An alkyl halide can be reduced to an alkane via the hydrolysis of a Grignard reagent.

2.3.1 Using structural formula, indicate how 3-bromo-2,3-dimethylpentane forms a Grignard reagent. (3)

2.3.2 Write the hydrolysis reaction for the Grignard reagent in QUESTION 2.3.1. (2)

2.3.3 Name the alkane formed in QUESTION 2.3.2. (1)

[14]

QUESTION 3: ALKENES

3.1 Draw the structure of 6-ethyl-2,3-dimethyl-2-nonene. (3)

3.2 3.2.1 State Saytseff's rule. (3)

3.2.2 Write down the equation for the elimination reaction of 2-butanol in sulfuric acid. Apply Saytseff's rule and name the major and minor products. (4)

[10]

QUESTION 4: ALKYNES

4.1 Give the structural formula of 1,1-dichloro-5-methyl-3-hexyne. (3)

4.2 Write a reaction for the preparation of 1-hexyne, using 1-bromobutane and sodium acetylide as starting material. (4)

4.3 Show, by means of a reaction equation, which alkyne is produced through the hydrolysis of calcium carbide. (Clearly name the alkyne in the reaction.) (4)

[11]

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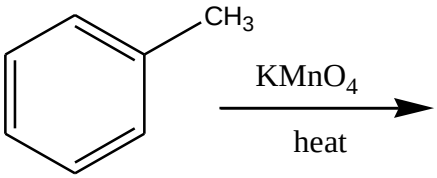
QUESTION 5: AROMATIC COMPOUNDS

5.1 Draw structures for the following aromatic compounds:

5.1.1 m-bromochlorobenzene (2)

5.1.2 3,4-dinitrobenzoic acid (3)

5.2 Draw and name the structure of the product formed during the following reaction:



(2)

5.3 Name the reaction in which benzene reacts with nitric acid in the presence of sulfuric acid to give nitrobenzene. (2)

5.4 What is the hybridisation of the carbon atom in a benzene ring? (1)

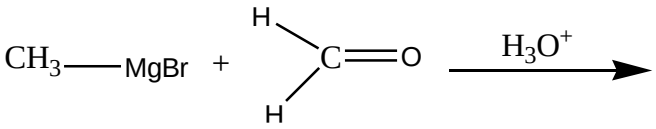
[10]

QUESTION 6: ALCOHOLS

6.1 The bulk of commercial ethanol is produced by the hydration of ethylene. In the process, sulfuric acid is added to ethylene, and the resulting ethyl hydrogen sulphate is hydrolysed to ethanol. Write down the reaction equation for the complete preparation of ethanol. (5)

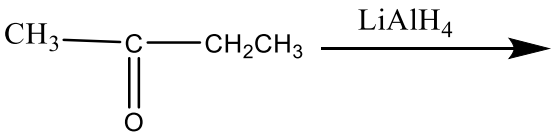
6.2 Draw and name the structures of the alcohols formed in the following reactions:

6.2.1



(3)

6.2.2



(3)

[11]

QUESTION 7: ALDEHYDES AND KETONES

7.1 The simplest ketone has the molecular formula CH_3COCH_3. What is its trivial name? (1)

7.2 Draw structures for the following compounds:

7.2.1 Ethyl methyl ketone

7.2.2 2-bromobutanal

(2 × 2) (4)

7.3 Give the name of the ketone/aldehyde formed during the oxidation of the following alcohols:

7.3.1 $CH_3CH_2CH_2OH + CrO_3 \xrightarrow{\text{Pyridine}}$

7.3.2 $CH_3CH_2CH(OH)CH_3 + H_2Cr_2O_7 \longrightarrow$

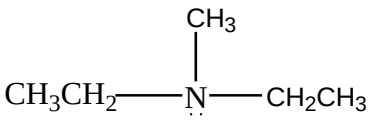
(2 × 2) (4)
[9]

QUESTION 8: AMINES

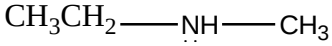
8.1 Name the following compounds and classify each of them as primary, secondary or tertiary amines:

8.1.1 $CH_3-\ddot{N}H_2$

8.1.2



8.1.3



(3 × 2) (6)

8.2 Write the reaction equation for the reaction between ammonia and chloropropane to form an alkylammonium salt, followed by the reaction of the salt with sodium hydroxide. (4)

8.3 Why can amines be classified as Lewis bases? (2)
[12]

QUESTION 9: CARBOXYLIC ACIDS

9.1 Draw the structures of the following compounds:

9.1.1 Propanoic acid

9.1.2 4-methylpentanoic acid

9.1.3 m-nitrobenzoic acid

(3 × 2) (6)

9.2 Name the ester formed by the reaction of methanol and formic acid. (2)

[8]

TOTAL: 100

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PERIODIC TABLE

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