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INTERIM JOINT MATRICULATION BOARD
AHMADU BELLO UNIVERSITY
ZARIA

INTERIM JOINT MATRICULATION BOARD EXAMINATION 2016

SUBJECT: CHEMISTRY PAPER II: ORGANIC
DATE SCHEDULED: TUESDAY 23RD FEBRUARY, 2016
TIME ALLOWED: TWO HOURS (2 HRS)

Instruction: Answer ALL questions in SECTION A, which carries a total of 50 marks. Answer any TWO (2) questions in SECTION B, each question carries 25 marks. The use of scientific non-programmable calculator is allowed.

C=12, H=1, O=16, N=14, Cl=35.5, S=32, Na=23

SECTION A: Answer ALL questions in this Section. Each question carries 5 marks.

1. List five (5) common techniques used for purification in organic chemistry.

2. Give the structure of the first member of the following homologous series:
   (a) Alkyne
   (b) Alkanone
   (c) Alkanoic acid
   (d) Alkanamide
   (e) Alkanol

3. Give the organic product of the following reactions or indicate 'no reaction' if no product is formed:
   (a) $2CH_3CH_2Br + Na \longrightarrow$
   (b) $CH_3CH_2CH_3 + LiAlH_4 \longrightarrow$
   (c) $CH_3CH{=}CHCH_2Cl + H_2/Pt \longrightarrow$
   (d) $CH_3CH_2CH_2Br + CH_3ONa \longrightarrow$
   (e) $(CH_3)_2CHCH_2CH_3 + Cl_2 \longrightarrow$

4. Classify the following statements as True or False:
   (a) Increase in molar mass leads to decrease in melting point of compounds in a homologous series.
   (b) Weak conjugate bases is obtained from strong acids.
   (c) The structure of a molecule does not affect its boiling point.
   (d) Polar compounds generally boils at higher temperature than non-polar compounds.
   (e) Water solubility of compounds generally increases with hydrogen bonding.

5. (a) Write the electron configuration of carbon in the: (i) ground state (ii) excited state
   (b) Which hybrid orbitals are involved in:
   (i) C – C bond
   (ii) C = C bond
   (iii) C ≡ C bond

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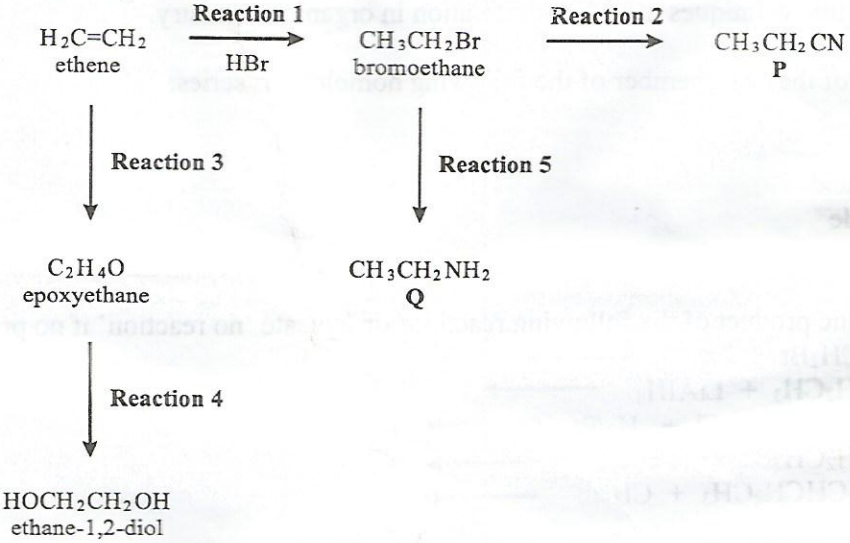
6. Define Resonance effect and Electrometric effect.

7. Give the name of five (5) structural isomers of pentenes.

8. Use formulae to illustrate the following:
   (a) tertiary amine
   (b) organometallic compound
   (c) quaternary ammonium salt
   (d) alkane triol
   (e) diazonium salt.

9. List Five (5) conversion processes in the refining of crude oil (petroleum).

10. Consider the following scheme of reactions.



(a) Identify a reagent for **Reaction 2**. Name the organic product, **P**.
(b) Identify a reagent for **Reaction 5**. Name the organic product, **Q**.
(c) Identify a reagent for **Reaction 3**.

SECTION B : Attempt Any TWO (2) Questions in this Section

11. (a) Write the expected product(s) of the reaction between ethyl ethanoate ($CH_3CO_2C_2H_5$) and the following reagents –
   (i) H^+, H_2O, heat
   (ii) NaOH, H_2O
   (iii) aqueous NH_3, heat
   (iv) $LiAlH_4$ followed by H_3O^+ (8 marks)

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(b) The reaction of Grignard reagent (e.g. CH_3MgBr) with carbonyl compounds is an important synthetic route to primary, secondary & tertiary alkanols. Use appropriately named starting materials to write balanced equations to justify this statement. The appropriate name of the products should be indicated. (9 marks)

(c) Briefly describe the fermentation process of starch. (8 marks)

12. (a) A carbonyl compound has a relative molar mass of 86 and contain 69.8 % carbon and 11.6 % hydrogen.
(i) What is the molecular formula of this compound?
(ii) Write out ALL the possible chemical formulae of the compound. (13 marks)

(b) Write an equation to illustrate the oxidation of each of the following compounds using CrO_3 with aqueous H_2SO_4 in acetone as reagent. Give the name of the organic products.
(i) 3-Pentanol (ii) Pentanol
(iii) Pentanal (iv) 3-Pentanone (12 marks)

13. (a) Write chemical equations to illustrate an industrial process to make a detergent (**D**) which involve the following reaction steps
(i) tetramerisation of propene to give the starting alkene (**X**)
(ii) acid catalysed reaction of the alkene (**X**) with benzene to give product, **Y**.
(iii) sulphonation of the product, **Y**, with concentrated tetraoxosulphate (VI) acid gave product, **Z**.
(iv) sodium hydroxide neutralization of product, **Z**, gave the detergent, **D**. (12 marks)

(b) Give the name of the detergent, **D**, and calculate its percentage elemental composition. (9 marks)

(c) Outline two (2) similarities and two (2) differences between detergents and soaps. (4 marks)

14. (a) Draw the condensed structure of the following compounds:
(i) 2-bromo-3-chloro-4,4-dimethylpentanal
(ii) 2,3-dihydroxybutan-1-ol
(iii) 3-amino-2-methoxypentanoic acid
(iv) 4-methylhex-2-ene
(v) 2,4,6-tribromophenol. (10 marks)

(b) Explain the following scientific observations:
(i) ethanol is miscible with water in all proportions but phenol is only sparingly soluble in water.
(ii) propan-2-one in the presence of trace acid gives positive test for both carbonyl and hydroxyl groups. (10 marks)

(c) Give the name of the monomer(s) of the following polymers:
(i) protein
(ii) natural rubber
(iii) Nylon 6,6
(iv) Dacron or Terylene
(v) Starch. (5 marks)