



FEDERAL PUBLIC SERVICE COMMISSION
COMPETITIVE EXAMINATION-2023
FOR RECRUITMENT TO POSTS IN BS-17
UNDER THE FEDERAL GOVERNMENT

Roll Number

CHEMISTRY, PAPER-II

TIME ALLOWED: THREE HOURS	PART-I (MCQS)	MAXIMUM MARKS = 20
PART-I(MCQS): MAXIMUM 30 MINUTES	PART-II	MAXIMUM MARKS = 80

- NOTE:** (i) Part-II is to be attempted on the separate Answer Book.
(ii) Attempt **ONLY FOUR** questions from PART-II. ALL questions carry **EQUAL** marks.
(iii) All the parts (if any) of each Question must be attempted at one place instead of at different places.
(iv) Candidate must write Q. No. in the Answer Book in accordance with Q. No. in the Q.Paper.
(v) No Page/Space be left blank between the answers. All the blank pages of Answer Book must be crossed.
(vi) Extra attempt of any question or any part of the attempted question will not be considered.
(vii) **Use of calculator is allowed.**

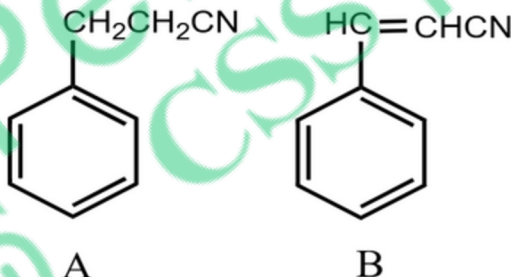
PART-II

- Q. 2. (a) Arrange the following alkenes in order of their relative stability. How will you proceed to determine the order practically? (5)

- i. 1-hexene
- ii. cis-3-hexene
- iii. trans-3-hexene
- (iv) 2-methyl-2-pentene
- (v) 2,3-dimethyl-2-butene

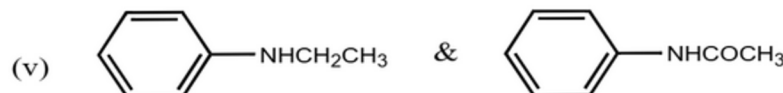
- (b) Explain why? (5)

- (i) Poly substitution is a complicating factor in aromatic alkylation but not in aromatic nitration or halogenation.
- (ii) A undergoes nitration predominantly at the ortho/ para positions but B mainly at meta position



- (c) Compare the basicity of: (5)

- (i) (CH₃)₃N & (CCl₃)₃N
- (ii) C₆H₅CH₂NH₂ & CH₃C₆H₄NH₂
- (iii) Aniline & Cyclohexyl amine



- (d) Explain why? (2.5 each) (5) (20)

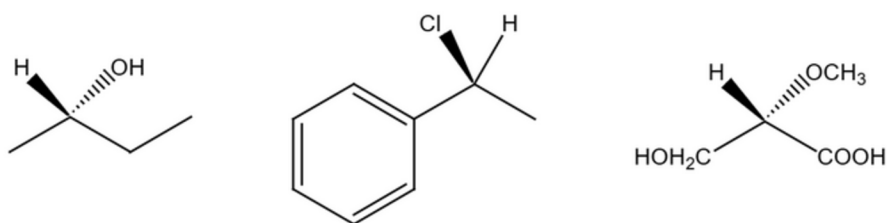
- (i) Tertiary carbocation is more stable than primary.
- (ii) Ethanol has higher boiling point than diethyl ether.

- Q. 3. (a) Write the structural formula for more stable conformation of each of the following compounds. (8)

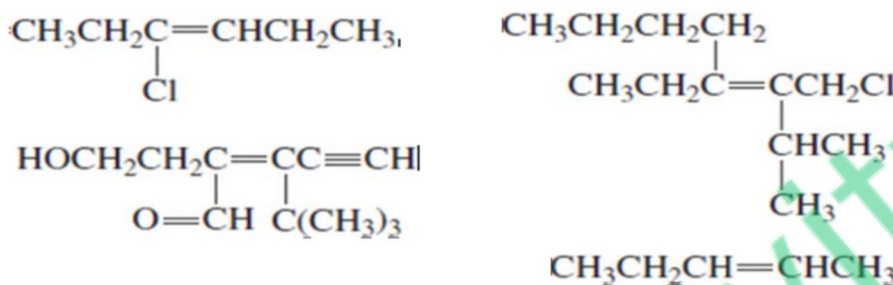
- a) *trans*-1-Fluoro-3-methylcyclohexane,
- b) *cis*-1-Iodo-4-methylcyclohexane
- c) *cis*-1-*tert*-Butyl-4-methylcyclohexane,
- d) *cis*-1,3,5-Trimethylcyclohexane

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- (b) Mention R & S configuration of the following compounds. (5)



- (c) Draw and label the
- E*
- and
- Z*
- isomers for each of the following compounds. (5)



- (d) Draw the structure of (
- Z*
-)-3-isopropyl-2-heptene. (2) (20)

- Q. 4. (a) In benzaldehyde, two of the ring protons have resonance at 7.87 ppm, and the other three have resonance in the range from 7.5 to 7.6 ppm. Explain. (4each) (20)
- (b) Arrange the following protons in the decreasing order of their δ values in ¹H-NMR and account for your order: Methyl, ethylenic, acetylenic, aryl and aldehydic.
- (c) List the solvents most commonly used in IR spectroscopy. Why water and ethanol are not suitable solvents?
- (d) The UV spectrum of acetone shows absorption maxima at 166, 189, and 279 nm. What type of transition is responsible for each of these bands?
- (e) What types of electronic transitions are possible for each of the following compounds?
- Cyclopentene,
 - Acetaldehyde,
 - Dimethyl ether,
 - Methyl vinyl ether.

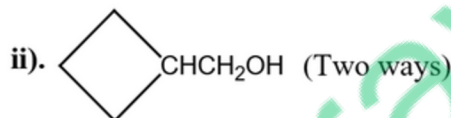
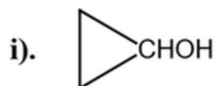
- Q. 5. (a) Write down the reagents, conditions and mechanisms of the following reactions. (10 each) (20)
- Kolbe reaction.
 - Williamson synthesis
 - Dow Process
 - Reimer-Tiemann reaction
 - Bromination of phenol
- (b) Outline all steps involved in the synthesis of the following compounds from benzene or toluene, assuming that the ortho / para mixtures are separable.
- n-Butylbenzene
 - m-Nitrotoluene
 - p- Bromonitrobenzene
 - p- Bromobenzoic acid.
 - 1,2-Dibromo-4-nitrobenzene

- Q. 6. (a) Describe with equations all possible methods that can be used for the preparation of n-hexane. (10)
- (b) Why Corey-House Method is more suitable as compared to Wurtz reaction for the synthesis of alkane. Explain with examples. (5)

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- (c) Draw the structures of following compounds and label them with IUPAC systematic rules. (5) (20)
- 3-cyclopentylhexane
 - 2-cyclobutyl-3-methylpentane
 - Isopropylcyclodecane
 - 2-methylbicyclo [3.2.0] heptanes
 - 8-methylbicyclo [3.2.1] octane

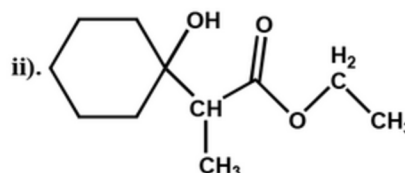
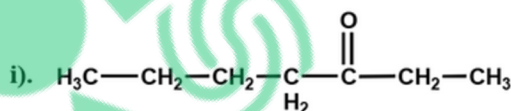
- Q. 7. (a) How can you prepare each of the following substances by a reaction involving Grignard reagent? (5)



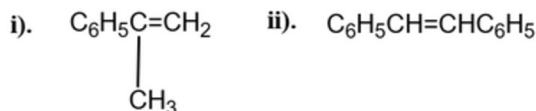
- (b) How will you bring about the following conversions? (5)



- (c) How would you synthesize each of the following compounds by the Reformatsky reaction? (5)



- (d) How would you synthesize each of the following compounds by the Wittig reaction? (2.5)



- (e) How will you synthesize each of the following substances by an acetoacetic ester synthesis? (2.5) (20)

- 3,4-dimethyl-2,5-hexanedione
- 3-acetyl-5-hexanoic acid.

- Q. 8. (a) Discuss the following topics. (6 each) (12)
- Prostaglandins
 - Terpenes

- (b) Name the epimers of d -glucose. (4)

- (c) Clearly represent the most stable conformation of the -pyranose form of each of the following sugars. (4) (20)

- D-Galactose
- D-Mannose
- L-Mannose
- L-Ribose