

COMBINED COMPETITIVE EXAMINATION (MAIN)

CHEMISTRY

Paper-II

Time : 3 Hours

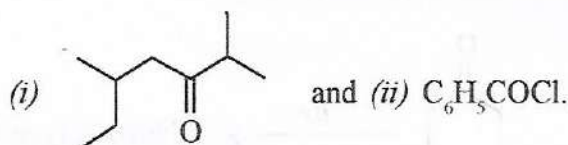
Full Marks : 200

- Note :* (1) The figures in the right-hand margin indicate full marks for the questions.
 (2) Attempt five questions in all.
 (3) Question No. 1 is compulsory.

1. Answer any *ten* questions from the following :

4×10=40

- (a) Out of *cis*-1,2-dichloroethylene and *trans*-1,2-dichloroethylene, which one will have more dipole moment and why?
 (b) Write the IUPAC names of the compounds represented by



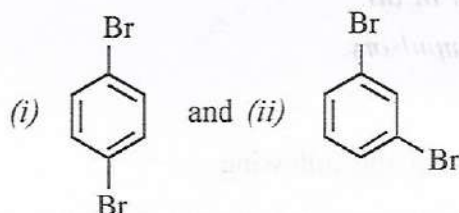
- (c) Differentiate between linear, branched and cross-lined polymers.
 (d) Write the Woodward-Hoffmann rules for [2+2] cycloaddition reactions.
 (e) Explain why CH_3OCH_2Cl undergoes substitution by the S_N1 mechanism even though it has a 1° -substrate carbon.
 (f) How is electronegativity going to influence the chemical shift value?
 (g) Why is Et_4N^+ neither an electrophile nor a nucleophile?
 (h) Why do the peaks in a UV spectrum appear as broad? Explain with the help of an energy diagram.
 (i) How will you distinguish between CH_3COSH and CH_3CSOH by IR technique?

- (j) Which of the following will not show ESR spectra? Give explanation.
 (i) O_2 (ii) C_2H_5 (iii) N_2 and (iv) Cu^{2+}
- (k) What are hot bands?
- (l) Which one is more acidic— *o*-nitrophenol or *m*-nitrophenol? Give reason.

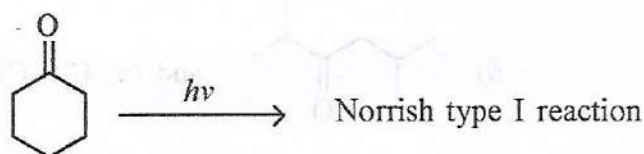
2. Answer any **eight** questions from the following :

5×8=40

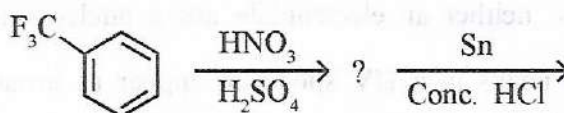
- (a) Suggest the mechanism of CO loss from phenol molecular ion.
- (b) Justify that the population in the ground state vibrational level of a diatomic molecule is more than an excited state.
- (c) What will be the multiplicities of the protons in 1H NMR spectra of the following compounds?



- (d) What are metastable ions in a mass spectrometric experiment?
- (e) Write the product of the following reaction :



- (f) For a solution, calculate the absorbance (A) at 50% transmittance (T)
- (g) Describe the role of $AlCl_3$ in Friedel-Crafts alkylation reaction from mechanistic point of view.
- (h) What is the relationship between relaxation and line broadening in NMR spectroscopy?
- (i) Write the product(s) in the following reaction :

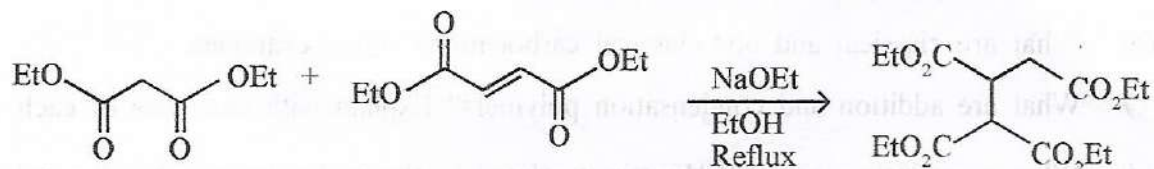


- (j) With a schematic diagram describe the bonding in acetylene.

3. Answer any *five* questions from the following : 8×5=40

(a) With suitable examples, elaborate the stereochemical outcome of addition of bromine to an alkene.

(b) Write the mechanism of the following reaction :



(c) Sketch the potential energy function of an harmonic oscillator and indicate the energy levels.

(d) Describe McLafferty rearrangement taking a suitable example.

(e) What is sedimentation? How is sedimentation method applied for the determination of molecular weight of polymers?

(f) Write a short note on Fermi resonance.

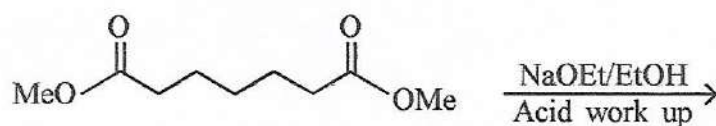
(g) Describe the magnetic anisotropy in aromatic compounds and its influence over chemical shift values.

4. Answer any *four* questions from the following : 10×4=40

(a) What is terylene? How will you synthesize terylene starting from ethylene and *p*-xylene? Describe with all reaction steps.

(b) Suggest the relative stability of the carbonium ions CH_3^+ , C_2H_5^+ , $(\text{CH}_3)_2\text{CH}^+$ and $(\text{CH}_3)_3\text{C}^+$ with logic.

(c) Suggest a suitable mechanism to rationalise the following reaction :



(d) Describe the uses of Na/Liq. NH_3 as a reducing agent in organic synthesis.

(e) How can you synthesise caprolactam via Beckmann rearrangement reaction?

(f) What do you understand by Larmor precession? Explain.

5. Answer any *two* questions from the following : 20×2=40

(a) Show the importance of diborane in synthesis.

- (b) Discuss the mechanism, utility and limitations of Aldol reaction.
- (c) Describe the determination of molecular weight of polymer by light scattering method.
6. Answer any *four* questions from the following : 10×4=40
- (a) Comment on the structure of benzyne.
- (b) What are classical and non-classical carbocations? Give examples.
- (c) What are addition and condensation polymers? Explain with examples of each.
- (d) What is intrinsic viscosity? How is it related to the molecular weight of a polymer? When does the viscosity average molecular weight become equal to weight average molecular weight?
- (e) How many normal modes of vibrations does the H₂O molecule possess? Show all of them.
7. Answer any *two* questions from the following : 20×2=40
- (a) With a suitable example, describe Walden inversion.
- (b) Draw and explain the correlation diagram for disrotatory interconversion of cyclobutene-butadiene system.
- (c) Discuss the geometry of singlet and triplet carbenes.
8. Describe the Jablonski diagram. 40
9. Explain catalytic cycle for ethylene polymerization by the Ziegler catalyst with the help of a suitable mechanism. 40
10. "Substitution reactions are accompanied by elimination reactions." Explain this statement from mechanistic point of view. 40

