

SUBJECT : PAPER – II : RECENT ADVANCES IN CHEMISTRY

Day : Wednesday  
Date : 24/04/2019

Time : 10.00 AM TO 1.00 PM  
Max. Marks : 100

S-2019-5323

N.B.:

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.

**Q.1** Attempt **ANY FOUR** of the following: [20]

- a) What are organometallic compounds? Give their applications.
- b) Discuss synthetic methodology of coordination compounds.
- c) Name and draw structures of the following complexes:  
i)  $[\text{CoCl}_4]^{2-}$  ii)  $[\text{Ni}(\text{CN})_4]^{2-}$
- d) Discuss spectroscopic characterization of organometallic compounds.
- e) Comment on applications of coordination compounds.
- f) Write a note on : Geometry of complexes.

**Q.2** Attempt **ANY FOUR** of the following: [20]

- a) Explain principle and applications of X-ray diffraction (XRD) technique.
- b) What is TEM? Explain its use in Nanotechnology.
- c) Discuss principle and use of Scanning Electron Microscopy (SEM) for surface morphology of materials.
- d) Comment on X-ray Photoelectron Spectroscopy (XPS).
- e) Discuss principle and applications Electron Spectroscopy for Chemical Analysis (ESCA).
- f) Write a note on : Applications of Thermo Gravimetric (TG) and Differential Thermal Analysis (DTA).

**Q.3** Attempt **ANY FOUR** of the following: [20]

- a) Discuss fluorescence-lifetime imaging microscopy.
- b) Explain instrumentation for fluorescence spectroscopy.
- c) Discuss applications of fluorescence in analytical work.
- d) How is the fluorescence techniques useful for molecular interactions? Explain.
- e) Discuss phenomenon and characteristics of fluorescence.
- f) Write a note on : Fluorescence quenching.

**Q.4** Attempt **ANY FOUR** of the following: [20]

- a) What are hyphenated techniques? Give their advantages.
- b) Describe the principle and instrumentation of ICP-MS.
- c) Discuss instrumentation and applications of HP-TLC.
- d) Comment on principle and instrumentation LC-MS.
- e) Comment on applications of LC-MS.
- f) Write a note on : GC-MS technique.

P.T.O.

Q.5 Attempt ANY FOUR of the following:

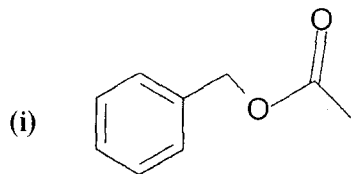
[20]

a) Explain the following:

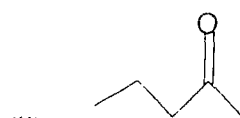
i) In ethanol the proton of OH group shows only a singlet although  $-CH_2$  group is adjacent to it.

ii) TMS is used as an internal reference standard in NMR spectroscopy.

b) Explain genesis of the following ions:

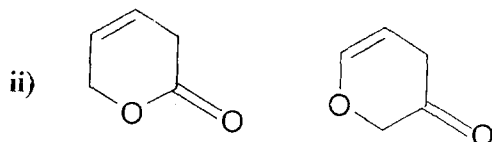
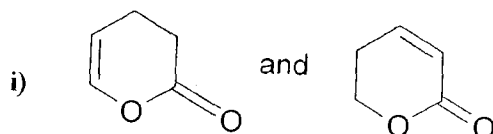


$m/e = 108, 91, 77, 43$

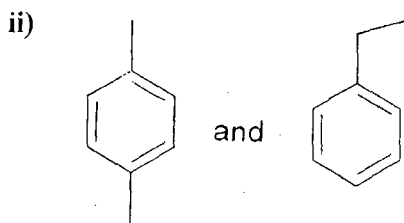
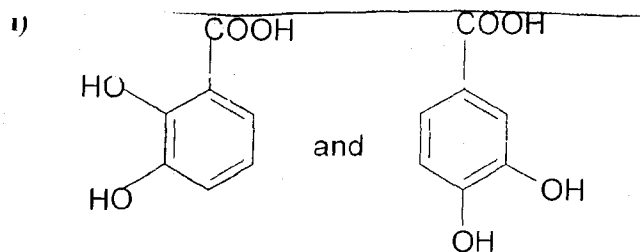


$m/e = 86, 71, 58, 57, 43, 29$

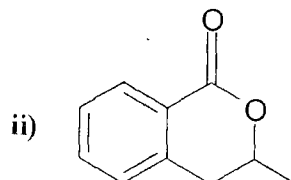
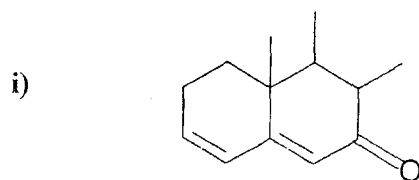
c) Distinguish between the following pairs by using IR spectroscopy.



d) Distinguish between the following pairs by PMR spectroscopy.



e) Calculate  $\lambda_{max}$  for the following:



f) Assign the structure by using spectral data:

MW : 122

$m/e$  : 122, 105, 77, 51

UV :  $\lambda_{max}$  272 nm

IR : 2500 – 3000 (br) 1690, 1602, 1504, 1486, 1285, 750, 690  $cm^{-1}$

PMR : 7.6  $\delta$  (m, 2H)

: 8.2  $\delta$  (m, 2H)

: 12.7  $\delta$  (s, 1H)

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