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**PG CBCS**  
**M.SC. Semester-IV Examination, 2021**  
**CHEMISTRY**  
 PAPER: CEM-401  
 (ADVANCED SPECTROSCOPY-II)

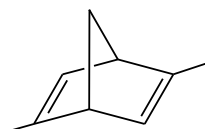
Full Marks: 40

Time: 2 Hours

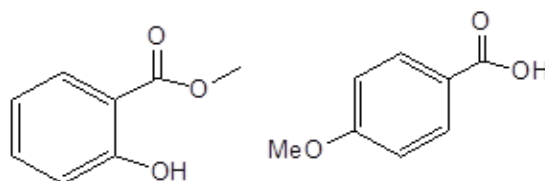
Answer any **FOUR** questions from the following:

4x10=40

- Reaction of styrene ( $\text{PhCH}=\text{CH}_2$ ) with HBr gives a mixture of regioisomers A (major) and B (minor). The  $^1\text{H}$  NMR spectrum of the mixture shows four signals. Amongst others, at  $\delta$  5.17, 3.53, 3.15, and 2.00 ppm with relative integration of 2: 1: 1:6, respectively. Calculate the molar ratio of A and B. What is homo aromaticity? 10
- (a) Identify the number of  $^1\text{H}$  NMR peaks observed in the following structure.



- (b) Which of the following compound will show a base peak at  $m/z$  120 in its EI mass spectrum.

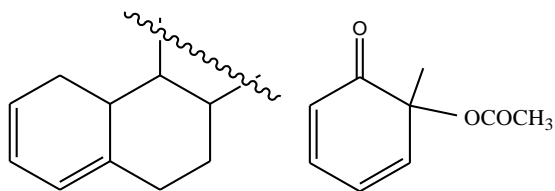


- (c) What is the chemical shift in NMR spectroscopy? 4+4+2
- (a)  $\text{C}_5\text{H}_8\text{O}_2$ . Find the structure of an organic compound with the help of the following data  
 $\delta$  128 d,  $\delta$  60 t,  $\delta$  132 t,  $\delta$  35 q,  $\delta$  170 s,  
 (b) What is ORD in chemistry?  
 (c) What is the principle of Mossbauer spectroscopy? 4+3+3
  - (a) What is Doppler effect?  
 (b) Calculate Doppler shift in Mossbauer experiment, where  $v_{\text{Source}} = 3.84 \times 10^{18}$  Hz and relative velocity of source and observer is  $2.2 \text{ mms}^{-1}$ .  
 (c) The MB-spectrum of  $\text{K}_4[\text{Fe}(\text{CN})_6]$  consists of one line, whereas that of  $\text{K}_3[\text{Fe}(\text{CN})_6]$  consists of two lines. Draw these spectra qualitatively and account for their appearance. 2+3+5
  - (a) The PMR spectrum of a mixture of methyl iodide and tert-butyl bromide shows two signals at  $2.20\delta$  and  $1.8\delta$  with relative integrals of 5:1. What is the mole percent of each compound in the mixture?  
 (b) Why TMS is used as a reference standard in NMR spectroscopy? 5+5
  - (a) Aromatic protons are more deshielded than ethylenic protons, although both the types of protons are attached to  $\text{sp}^2$  hybridized carbon atom?  
 (b) How will you distinguish cis- and trans-stilbene using NMR spectroscopy? 5+5

[P. T. O]

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7. (a) Elucidate the structure of the compound having the following spectral data,  
 $^1\text{H NMR}$ :  $\delta$  6.2 (br s, 1H), 5.5 (br s, 1H), 4.2 (q, 2H), 2.0 (s, 3H), 1.1 (t, 3H).  
 (b) Calculate the  $\lambda_{\text{max}}$  value of the given compounds using the Woodward Fieser rule.



5+5

8. (a) What is the nitrogen rule in mass spectroscopy?  
 (b) What is the basic principle of ORD spectroscopy?  
 (c) Write application of ORD and CD spectroscopy?

2+4+4

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