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(A-34) SARDAR PATEL UNIVERSITY

M. Sc. (Industrial Chemistry), Third Semester Examination

April-2015

PS03CICH02, Spectroscopy & Instrumental Techniques

Tuesday, 21st April 2015

Time: 10:30 a.m. to 01:30 p.m. **Total Marks: 70**

Note: i) Attempt all the questions.
ii) Figures to right indicate full marks.
iii) Draw neat diagrams whenever it requires.

Q-1 Answer the following Multiple Choice Questions. **(08)**

1. During mass spectroscopy, samples with lower vapour pressure are inserted directly into _____.
   (a) ion separator (c) detector zone
   (b) ionization chamber (d) vaporization chamber
2. NMR spectroscopy is used to find the presence of:_____.
   (a) ^{3}H (c) ^{14}N
   (b) ^{12}C (d) None of these
3. In IR spectroscopy stretching frequencies for $-NH_2$ groups are_____ cm^{-1}.
   (a) 3300-3400 (c) 1500-1700
   (b) 2900-3000 (d) 2500-3000
4. In_____ technique sample should convert into gaseous state.
   (a) IR (c) Mass spectrometer
   (b) FT-IR (d) HPLC
5. Column is _____ in normal phase chromatography.
   (a) polar (c) bi-polar
   (b) non-polar (d) all of these
6. During _____ process, nucleus losses the absorbed energy ΔE in the form of reemissions of radio waves.
   (a) relaxation (c) transition
   (b) ionization (d) coupling
7. _____band arises when a molecule in a lowest vibration energy level directly goes to the second energy level.
   (a) Combination (c) Fermi
   (b) overtone (d) None of these
8. ^{1}H has _____precessional orbit.
   (a) 1 (c) 1/2
   (b) 2 (d) 3/2

Q-2 Answer the following short questions. Each question carries equal mark. (**Any Seven**) **(14)**

1. What is stretching vibration?
2. What is Beer's law for absorption?
3. What are the basic requirements for IR-absorption?
4. What is guard column?
5. Define molecular ion in mass spectrometry.
6. What is partition coefficient?
7. Differentiate between normal and reverse phase chromatography.
8. Draw a neat figure of quadra pole mass filter.
9. Give the condition for NMR spectroscopy.

Q-3 (a) Write a note on sampling techniques that are used for solid & liquid samples for IR spectroscopy. **(06)**

Q-3 (b) Discuss possible band and vibration frequency of alkenes and aromatic hydrocarbon. **(06)**

OR

Q-3 (b) Draw a schematic diagram of IR spectrometer and explain various parts of it. **(06)**

Q-4 (a) Explain with diagram components of single focusing mass spectrometer. **(06)**

Q-4 (b) Explain isotope abundance of bromobenzene & Chlorobenze. **(06)**

OR

Q-4 (b) 1) Briefly explain the cleavage of alkyl substituted aromatic compound. **(03)**
2) Explain the cleavage of 1-pentene and show possible peaks. **(03)**

Q-5 (a) Explain eddy diffusion and loagitudial diffusion in chromatographic techniques. **(06)**

Q-5 (b) Write a short note on 1) peak asymmetry 2) column resolution **(06)**

OR

Q-5 (b) Explain the theory of elution chromatography. **(06)**

Q-6 (a) What is shielding & de-shielding in NMR? **(06)**

Q-6 (b) 1) Give the condition for NMR spectroscopy. **(03)**

2) Interpret the spectral data and deduce the structure of following compound: **(03)**

Molecular formula: $C_{14}H_{10}O_2$
Mass data: m/z - 210 (M*), m/z-105
IR data: 3050 cm^{-1}, 1680 cm^{-1}, 1600 cm^{-1}, 1580 cm^{-1},1450 cm^{-1}, 700 cm^{-1} & 748 cm^{-1}.
NMR data: δ - 7.10, multiplet, 10H

OR

Q-6 (b) 1) What is relaxation process in NMR? **(03)**

2) Interpret the spectral data and deduce the structure of following compound: **(03)**

Molecular formula: C_7H_9N

IR Data (in cm^{-1}): 3401, 2899, 2830,1510,1499,1456.

NMR Data:

δ	Multiplicity	No. of Protons
7.26-7.56	Singlet	5H
4.62	Singlet	2H
3.86	Singlet	2H

UV: 255 nm

---------All the Best---------

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