

MANIPAL ACADEMY OF HIGHER EDUCATION

FOURTH SEMESTER B TECH. END SEMESTER EXAMINATIONS, JUNE 2023 ANALYTICAL METHODS AND INSTRUMENTATION [CHM 4301]

| Marks: | 50 Duration: 180 | mins. |
|--|--|--------|
| | Α | |
| Answer all the questions. Section Duration | | 0 mins |
| Instruct | ons to Candidates: Answer ALL questions Missing data may be suitably assumed | |
| 1) | Discuss about the different types of molecular energies. | |
| | | (4) |
| A) | | |
| B) | The bond length of CO molecule is 1.13 Å. Calculate the reduced mass, moment of inertia and energy of this molecule in joules. | (4) |
| | | |
| C) | Calculate frequency and energy for UV radiation of wavelength 1500 Å. | (2) |
| 2) | Discuss the applications of Raman spectroscopy. | |
| | | (4) |
| A) | | |
| B) | Discuss about the principle and various modes of vibrations involved in Infrared spectroscopy. | (4) |
| C) | Using the concept of rigid diatomic rotator molecule show that the distance between successive rotational lines is 2B cm ⁻¹ . | (2) |
| 3) | Explain the instrumentation involved in UV-visible spectroscopy. | |
| | | (4) |
| A) | | |
| B) | The IR main peaks obtained for the compound B ($C_9H_{10}O_2$) appearing at 3058, 2941, | (4) |

1745, 1385, 1225, 1026, 749 and 697 cm⁻¹. The proton NMR data obtained for the same are as follows

| Chemical Shift (ppm) | Peak area | Splitting |
|----------------------|-----------|-----------|
| 7.22 | 5 | Singlet |
| 5.00 | 2 | Singlet |

| 1.96 | 3 | Singlet |
|------|---|---------|
|------|---|---------|

Identify the Compound.

| | C) Account for the difference in C=O IR peaks in the following compounds | | |
|----|--|--|-----|
| | | CH ₃ CHO 1745 cm ⁻¹ | |
| | | Acetone 1715 cm ⁻¹ | (2) |
| | | Chloroacetone 1725 cm ⁻¹ | |
| 4) | | Describe the various steps involved in Thin layer Chromatography | (4) |
| | A) | | |
| | B) | Discuss with a neat graph, the determination of concentration of strong acid and weak acid in an acid mixture by conductometric titration against strong base. | (4) |
| | C) | Give reason for the following | |
| | | i. Conductometric titrations can be carried out using non aqueous solvents. | (2) |
| | | ii. Potentiometric titration is preferred over direct potentiometry | (2) |
| 5) | | Discuss the classification of chromatographic techniques based on mechanism of separation. | (4) |
| | A) | | |
| | B) | Define Beer-Lambert's law. Explain any 3 reasons for deviations from Beer-Lambert's law. | (4) |
| | C) | Differentiate between guard and analytical column used in HPLC. | (2) |

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