MANIPAL UNIVERSITY

FIFTH SEMESTER B.E.(CHEMICAL) DEGREE EXAMINATIONS
JUNE / JULY, 2008
SUBJECT: CHEMISTRY – IV (CHM 301)
REVISED CREDIT SYSTEM

Time: 3hr. **Max. Marks: 50**

Note: Answer any FIVE full questions.

1. (i) Give reason: Polymorphism of substances can be studied by differential scanning calorimeter and not by thermo gravimetric analysis.
   (ii) Give reason: Triple headed reciprocating pump is more advantageous than the other pumps in HPLC instrument.
   (iii) The distribution coefficient of iodine between CCl_4 and water is 85. Calculate the conc. of I_2 remaining in aqueous layer after extraction of 50 mL of 1.0 x 10^{-3} M I_2 with one 50 mL portion and five 10 mL portions of CCl_4 separately.
   (2+2+6)

2. A compound with a molecular formula $AC_2O_4.2H_2O$ exists as AC_2O_4 between 150 – 200 ^{0}C, ACO_2 between 280 – 320 ^{0}C, as AO above 450 ^{0}C. Another compound $BH_2P_4O_7$ exists as BP_4O_6 between 140 – 350 ^{0}C and as BP_2O above 400 ^{0}C. 323 mg. of the mixture containing above two compounds at 25 ^{0}C, on TG analysis, weighed 278 mg at 175 ^{0}C, 234 mg at 300 ^{0}C and 135 mg at 500 ^{0}C. Determine the composition of the mixture at 25 ^{0}C, if atomic weights of A, B, C, H, O and P are 60, 40, 12, 1, 16 and 31 respectively.
   (10)

3. Derive an expression for Beer – Lambert's law. Discuss in detail, the different types of deviations from Beer – Lambert's law. (10)

4. What are the different components of High Performance Liquid Chromatography (HPLC) instrument? Explain the instrumentation of HPLC with a neat diagram and also explain the elution of solutes by HPLC. (10)

5.A. Give reasons:
   (i) Though there are four modes of vibration for CO_2, only two IR absorption peaks are observed.
   (ii) Saturated hydrocarbons are the most suitable solvents in the UV region.

5.B. The following data were obtained by GLC on a 40 cm packed column.

compound	t_r *(min.)*	*Width of the peak (min.)*
Un retained species	1.9	---
A	10.9	0.82
B	10.0	0.76

Calculate (i) the average number of plates
(ii) the average plate height for the column
(iii) resolution for the compounds A and B
(iv) if the resolution of 1.5 was desired in resolving A & B, how long would the column have to be, if the same packing were employed? (4+6)

6.A. Write a short note on photo multiplier tube and scintillation detector.

6.B. If HCl^{35} is irradiated with 435.8 nm mercury line, calculate the Raman line in nm, if the fundamental vibrational frequency of HCl^{35} is 8.667 x 10^{13} sec^{-1}.
(4+6)

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Time: 3hr. **Max. Marks: 50**

Note: Answer any FIVE full questions.

1. (i) Give reason: Helium is a suitable carrier gas in GLC when Differential Thermal Conductivity Detector is used.
   (ii) Write a short note on the preparation of plates for Thin Layer Chromatography (TLC).
   (iii) Explain the isolation of chemical species from a natural product by Soxhlet solvent extraction technique with a neat diagram.
   (2+2+6)

2. Explain the working of Heat flux and power compensated DSC with neat diagrams.(10)

3. The successive line separations in the rotational spectra of $^{12}C^{16}O$ and $^{x}C^{16}O$ are 3.84235 cm^{-1} and 3.67337 cm^{-1} respectively. Calculate the isotope mass of ^{x}C. (10)

4. What are the different components of Gas Liquid Chromatography (GLC) instrument? Explain the instrumentation of GLC with a neat diagram and also explain the elution of solutes by GLC. (10)

5.A. Give reasons:
   (i) Stokes lines are more intense than the anti-stokes lines.
   (ii) It is not possible for a molecule to have zero vibrational energy.

5.B. The following data were obtained by GLC on a 40 cm packed column.

compound	t_r *(min.)*	*Width of the peak (min.)*
Un retained species	1.9	---
A	10.9	0.82
B	10.0	0.76

Calculate (i) the average number of plates
(ii) the average plate height for the column
(iii) resolution for the compounds A and B
(iv) if the resolution of 1.5 was desired in resolving A & B, how long would the column have to be, if the same packing were employed?
(3+7)

6.A. Write a short note on production of X-rays.

6.B. The fundamental vibrational frequency of HCl is 2890 cm^{-1}. Calculate the force constant of this molecule. The atomic masses are ^{1}H = 1.673 x 10^{-27} Kg, ^{35}Cl is 58.06 x 10^{-27} Kg. (4+6)

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