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MCH-003

P.G. DIPLOMA IN ANALYTICAL CHEMISTRY (PGDAC)

00393

Term-End Examination

December, 2013

MCH-003 : SPECTROSCOPIC METHODS

Time : 3 hours *Maximum Marks : 75*

Note : *Answer **any five** questions. All questions carry **equal** marks.*

1. Answer **any five** of the following. **3x5=15**

   (a) What is meant by a monochromatic radiation ? Name the device used for obtaining a monochromatic radiation from the output of a polychromatic source.

   (b) What is meant by Room temperature phosphorescence ? Explain its importance.

   (c) What is 'source resolution in atomic absorption spectro photometry ? How is it achieved ?

   (d) The ICP torches use Argon as plasma gas. What makes argon a good choice for the purpose ?

   (e) Draw a schematic energy level diagram showing the origin of Rayleigh line, Stroke's lines and Anti-stroke's lines in Raman spectroscopy.

   (f) What is meant by total combustion burner ? What are its advantages ?

2. (a) Explain the operating principle of photomultiplier tube. **5x3=15**

(b) Calculate the absorbance and transmittance of a 0.002m solution of a substance having molar absorption coefficient of 460 $m^{-1}cm^{-1}$. The measurement is made by using a curvature of 1cm pathlength.

(c) What is meant by charge transfer complexes ? Explain with the help of an example.

3. (a) What are the advantages of FT-IR instrument over the dispersine instrument ? **5x3=15**

(b) In the Raman spectrum of CFy, obtained by using mercury radiation of 435.8nm, the stoke's lines were observed at 444.25, 448.16, 453.80 and 461.64nm. Calculate the position of the corresponding anti-stroke's lines. At what warelength would the Rayleigh line be observed ?

(c) Explain the principle of Resonance Raman spectroscopy. What is its advantage ?

4. (a) What is meant by quantum yield ? How does it depend on the rates of different encitation and relaxation processes ? **5x3=15**

(b) Why do we need to modify the instrumental setup of a florescence spectrometer for the measurement of phosphorescence ? Describe the modification.

(c) SO_2 is one of the main components of air pollution. Explain the principle of its fluoremetic determination.

5. (a) Briefly describe the types of reactions taking place when the analyte is placed in flame for flame photometry. **5x3=15**

(b) Describe the working of Halogen Cathode Lamp (HCL) used for atomic fluorescence measurement. How is it better than a continuous source ?

(c) Different types of calibration methods are employed for quantitative application of AAS. Descibe the standard addition method used for AAS. How is it better than the standard solution method ?

6. (a) Atomic emmission spectroscopy finds diverse qualitative and quantitative application. Outline qualitative methodology of AES using ICP as the source.

(b) Describe the acid digestion method of solution preparation in AES. **5x3=15**

(c) Compare the flame and flameless atomisation of the analyte in term of sensetivity and detection limits.

7. (a) Explain different relaxation mechanisms that contribute to the relaxation of nuclear spim in the encited state. **5x3=15**

(b) Write down the formulae for the structural isomers of an organic compound having molecular formula, C_3H_6O. How can these be differentiated on the basis of NMR.

(c) Explain the method for determination of molecular formula of the analyte on the basis of mass spectroscopy.

8. (a) The mass spectrum of butanoic acid ($M_m = 88 gmol^{-1}$) gives a characteristic peak at m/t = 60, Justify. 5

(b) An organic compound having molecular formula, $C_3H_6O_2$ shows the following spectral data. 10

Mass : m/t = 74(molecular ion); m/t = 57, 45 and 29)

IR : $1700 cm^{-1}$(s) $3000 cm^{-1}$(broad)

NMR : $\delta = 10.5$ (1H, s); $\delta = 2.3$(2H, q), $\delta = 1.2$ (3H,t)

Deduce the structure of the compound.