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AI—283—2017

FACULTY OF SCIENCE

M.Sc. (Second Semester) EXAMINATION

OCTOBER/NOVEMBER, 2017

CHEMISTRY

Paper (CH-424)

(Principles of Spectroscopy)

(Saturday, 18-11-2017)   **Time : 10.00 a.m. to 1.00 p.m.**

Time—Three Hours   *Maximum Marks*—75

N.B. :—   (*i*)   Attempt *All* questions.

       (*ii*)   Use of calculator or logarithmic table is allowed.

       (*iii*)   Useful constants :

$$c = 3 \times 10^8 \text{ m/s}$$

$$h = 6.626 \times 10^{-34} \text{ Js}.$$

1.   Answer any *three* of the following :   3×5=15

   (*a*)   Give an account of transition probability.

   (*b*)   The internuclear distance of CO molecule is 1.13 Å. Caculate the energy of the first excited rotational level. ($^{12}C = 1.99 \times 10^{-26}$ kg, $^{16}O = 2.66 \times 10^{-26}$ kg).

   (*c*)   State and explain stark effect.

   (*d*)   Give the chemical information obtained from ESCA.

   (*e*)   Explain factors influencing coupling constant T.

2.   Answer any *three* of the following :   15

   (*a*)   Give an account of polarisation and scattering of electromagnetic radiation.

   (*b*)   Calculate the vibrational of the C—H bond if the force constant for the single bond is 5×10^5 dynes cm^{-1}.

                                               P.T.O.

(c) Explain the vector coupling with suitable diagram.

(d) Explain the factors affecting the 'g' value.

(e) Explain classical theory of Raman effect.

3. Answer the following :

(a) State and explain Franck-Condon principle. Give an account of transition metal complexes. 8

Or

Give an account of quadrupole, nuclei , quadrupole moments and electric field gradient. 8

(b) Explain vibrational-rotational Raman spectra and mutual exclusion principle. 7

Or

Explain Morse potential energy diagram. Give an account of Vibration-rotation Spectroscopy with P, Q, R branches. 7

4. (a) Enumerate the principle involved in nuclear magnetic resonance spectroscopy. Explain ABX and AMX splitting in NMR. 8

Or

Explain the principle of electron spin resonance spectroscopy. Give an account of hyperfine interaction. 8

(b) What is chemical shift ? Describe the factors influencing the chemical shift. 7

Or

Explain the principle involved in Raman Spectroscopy. Give the applications of Raman spectroscopy. 7

5. (A) Select the *correct* alternative for the following : 5

(i) The absorbance of solution with transmittance 0.309 is :

(a) 0.51

(b) 0.41

(c) 5.1

(d) 4.1

(ii) The oblate symmetric top molecule in which the moment of inertia is :

(a) $I_B \neq I_C = I_A$

(b) $I_B = I_C < I_A$

(c) $I_B = I_C > I_A$

(d) $I_B = I_C = I_A$

(iii) The actual value of nuclear spin depends upon :

(a) mass number

(b) atomic number

(c) both (a) and (b)

(d) shielding effect

(iv) A prolate charge distribution with its axis parallel to z-axis will give :

(a) Positive quadrapole movement

(b) Negative quadrapole movement

(c) Zero

(d) None of the above

P.T.O.

(*v*) When an unpaired electron interact with three equivalent protons, how many number of lines are observed in e.s.r spectrum ?

(*a*) 1

(*b*) 2

(*c*) 3

(*d*) 4

(B) Write short notes on any two of the following : 10

(*i*) Nuclear resonance

(*ii*) Charge transfer spectra

(*iii*) Karmer's degeneracy.