2022
Chemistry
B.Sc. Fifth Semester End Examination - 2022
PAPER - CC-II Th

Full Marks : 40   *Time : 2 hours*

The figures in the right-hand margin indicate marks.
Candidates are required to give their answers in their own
words as far as practicable.
Illustrate the answers wherever necessary.

Group-A

Answer any five questions :   **5×2=10**

1. (a) A linear moilecule has the formula AB_2. Discuss how you would ascertain whether the molecule has the structure BAB or ABB using its Raman and IR spectra together.

    (b) In the pure rotational spectrum of CO, $V_{0 \to 1} = 3.88 cm^{-1}$ Calculate the internuclear distance of the molecule. Given reduced mass ofr $CO = 11.8 \times 10^{11}$ Kg.

(Turn Over)

(c) Gelatin and strach are two protective lyophilic colliods having 'gold number' 0.008 and 12.0 respectively. Which one has greater protective action and why?

(d) How can one obtain a linear plot using Langmuir isotherm and what information can be obtained from the plot? 1+1

(e) Low temperature and viscous medium are suitable for observing phosphorescence. Explain.

(f) Show that in an orthorhombic unit cell the separation of the hkl planes will be reduced by a factor 'n' if all three Miller indices are multiplied by that factor.

(g) The decomposition of PH_3 on tungsten surface is found to be first order at low pressures and zero order at high pressures. Give the possible reason.

(h) To what maximum extent will capillary rise occur in a capillary of diameter 0.2 mm, assuming the surface tension of the liquid=70 dyne/cm and its density= 1g/cc?

Group - B

Answer any four questions : 4×5=20

2. (a) Explain the origin of electrical change on collidal particles. 2

(b) "Quantum yield $\phi > 1$ of a photochemical reaction is in contradiction to the Einstein's law of photochemical equivalence." Justify or criticize. 3

3. (a) A reaction responds to both red and violet light (l=800 nm and 400 nm respectively) with an equal quantum yield. Will there be more photochemical reaction per 400 J of light in the red than in the violet or vice versa? 3

(b) Explain photosentitized reaction with a suitable example. 2

4. (a) What are lyophobic colloids? Give an example. Explain in the same context, the meaning of the term peptization. 1+1+1

(b) The element polonium (at.wt=210) crystallises in the cubic system. Bragg's first order reflections using X-rays of wave length 0.154 nm occur at $\sin\theta$ values of 0.225, 0.316, 0.388 for reflections from (100), (110) and (111) type planes respectively. Show whether the unit cell is simple, face centred or body centred.

5. (a) Illustrate Frank-condon principle with the help of potential energy curves of ground and first electronic exited state. 2

(b) How many normal modes of vibration are there for benzene molecule? Comment on the Raman and infrared activity of the vibrational mode that corresponds to the boat-like bending of the benzene ring. 3

6. (a) What are radiative and non radiative transitions. Explain with Jablokski diagram. 3

(b) What is Zeta potential and how is it affected by the addition of electrolytes to the sol? 1+1

7. (a) The surface tension of water is 72.8 dynes.cm^{-1}. Calculate the energy required of disperse one spherical drops of radius 3.0 mm into spherical drops of radius 3.0×10^{-3} mm. 3

(b) Quantum efficiency of a primary step of a photochemical process is always one. Justify. 2

Group - C

Answer any one question. 1×10=10

8. (a) Show that the excess pressure inside a spherical bubble is given by $P_2 - P_2 = \frac{2\gamma}{r}$; where P_2 and P_1 are the pressure inside and outside th bubble respectively and r is the radius of the bubble.

(b) At a certain temperature, for pure CH_2I_2, γ=51mN/m and for water, γ=73mN/m; their interfacial tension is 46mN/m. Calculate the work of adhesion between CH_2I_2 and water.

(c) The Raman shift of a given Raman-spectrum line is independent of the value of the exciting frequency. γ_0 Explain.

(d) Explain why the intensities of spectral lines of a rigid rotor pass through a maximum, when plotted against the quantim number J. 3

9. (a) Which of the following nuclei do not shoe NMR? Explain ^1H, ^2H, ^{12}C, ^{13}C, ^{14}N, ^{15}N, ^{16}O, ^{19}F, ^{31}P.

(b) What is meant by sheilding and deshielding of protons? 2

(c) Show that the distance of separation between two successive hk-planes in a two dimensional square lattice is $\dfrac{a}{\sqrt{h^2 + k^2}}$, where 'a' is the unit distance along X and Y axes.

(d) A certain substance in a cell of length 'l' absorbs 10% of the incident light. What fraction of the incident light will be absorbed in a cell which is five times long? 3

(e) What is the phycisal significance of extinction co-efficient? 1