

B.Sc. Semester-VI Examination, 2022-23**CHEMISTRY [Honours]**

Course ID : 61412 Course Code : SH/CHEM/602/C-14

Course Title : Physical Chemistry-IV

Time : 1 Hour 15 Minutes Full Marks : 25

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

1. Answer any **five** questions: 1×5=5
- What are the conditions for a molecule to be microwave active in rotational transition?
 - Is molar extinction coefficient depends on concentration for a particular coloured substance?
 - Suggest a suitable plot for verification of Freundlich isotherm.
 - Which of the following nuclei is NMR active?
 H^1, H^2, C^{12}, C^{13}
 - Explain why bubbles are easily formed in soap solution than in water?
 - What is gold number?

- Define critical micellar concentration (CMC).
- What are the selection rules for the ESR transition?

2. Answer any **two** of the following questions:5×2=10

- Write down the expression for Morse Potential. Find its value at $r = 0$ and at $r = \infty$.
 - Ground vibrational level of a diatomic molecule is densely populated'– Justify.
(1+3)+1=5
- Define quantum yield of a photochemical process. 'Quantum yield for a primary photochemical process may be greater than 1'– Comment.
 - When a monochromatic light is passed through a 0.02 M solution in a cell of 2.0 cm path length, the intensity of the transmitted light was found to be 0.45 times that of the incident light. Calculate the value of molar extinction coefficient.
(1+1)+3=5
- How does surface tension of a liquid change with temperature? Explain whether a liquid may have zero value of surface tension.

- ii) At 15°C, the surface tension of water is 73.5 dyne cm⁻¹ ($\rho_w = 1_x$)^{91cc}. What will be its capillary rise at this temperature in a capillary tube of internal diameter 0.02 cm? (2+1)+2=5

- d) i) Show that for the rotational spectrum of a diatomic molecule, the rotational quantum number (to the nearest integral value) for the maximum populated level is given by

$$J_{\max} = \sqrt{\frac{kT}{2Bh}} - \frac{1}{2}$$

The terms have their usual significance.

- ii) The symmetric stretching of CO₂ is IR inactive but Raman active.– Explain.

3+2=5

3. Answer any **one** of the following questions:

10×1=10

- a) i) Explain what is meant by a photosensitized reaction with an example observed in nature.
- ii) Amino acid molecules do not migrate to either of the electrodes at iso-electric point.– Explain.

- iii) $\Delta\bar{\nu}$ for H¹Cl³⁵ is 20.3 cm⁻¹. Find out the bond length of H¹Cl³⁵.

- iv) Find number of lines in the esr spectrum of phenyl radical. (2+1)+2+2+3=10

- b) i) Cl³⁵ nucleus has I = 3/2 and g_N = 0.5479. Assume that a 60 MHz spectrometer is used to detect that signal, what will be the value of the magnetic field? [$\mu_N = 6.06 \times 10^{-27} \text{ JT}^{-1}$]

- ii) Phosphorescence is a slower process than fluorescence.– Explain.

- iii) Define angle of contact. Discuss condition for wetting of a surface.

- iv) What is adsorption isotherm? Write the equation describing Langmuir adsorption isotherm. Show a linear graphical plot that may be used to verify the equation.

3+2+(1+1)+(1+1+1)=10
