B.Sc. 3rd Semester (Honours) Examination 2020 (CBCS)
Subject: Chemistry
(Physical Chemistry II)
Paper: CC-5

Time: 2 hrs **Full Marks: 40**

Candidates are required to give their answers in their own words as far as practicable.

Answer any eight questions **8 x 5 = 40**

1. In the absolute method of determination of viscosity coefficient η by Poiseuille formula, what should be the error in radius, if error in η is to be kept with 4%? Highly viscous liquids are less volatile. – Explain.
2. The relation Λ = (1000K/C) between equivalent conductance (Λ) and specific conductance (K) means that Λ is inversely proportional to concentration (C). – Comment. Explain qualitatively whether transport number is a characteristic property of an ion.
3. Consider ideal mixing of 2 moles of toluene and 2 moles of benzene at 1 atm and 300K. Calculate the values of ΔH_{mix} , ΔS_{mix} and ΔG_{mix} for the process. (ln 2 = 0.69)
4. Derive van't Hoff equation from van't Hoff reaction isotherm. Suggest a suitable plot which shows the dependence of equilibrium constant on temperature. How does the slope differ for different type of reaction?
5. State Walden's rule, pointing out its fundamental limitations.
   In conductometric titration, the titre should be at least 10 times stronger than the solution to be titrated. – Explain.
6. Using Gibbs-Duhem equation, prove that $\left(\partial A/\partial n_i\right)_{T,V,n_{j\neq i}} = \left(\partial H/\partial n_i\right)_{S,P,n_{j\neq i}}$.
   Using the expression for $\left(\partial \mu_i/\partial P\right)_{T,n_j}$, obtain the expression for chemical potential for a pure ideal gas.
7. Using Heisenberg position-momentum uncertainty relation, arrive at the energy-time uncertainty relation. Average life time of an excited atom is 10^{-8} s. What is the minimum uncertainty in frequency of the radiation emitted by the atom while decaying to the ground state?
8. Define stopping potential in relation to the Einstein's photoelectric effect. Draw schematic diagram with brief explanation to show how it depends on the varying

frequency of the incident radiation of a given intensity. State the dimension of work function.

9. Prove that the sum of two hermitian operators is also a hermitian.

   Evaluate the commutator: $[1/x, p_x]$; p_x is the x-component linear momentum operator.

   Test whether the function $f(x) = e^{-x}$ in the range $(-\infty, +\infty)$ is acceptable or not.

10. The wave function of a particle of mass 'm' moving in one dimension between $x = a$ and $x = b$ is $\psi = (A/x)$; where A is the normalization constant. Calculate A.

    Show that for a particle in one dimensional box the length of the box is an integral multiple of $(\lambda/2)$, where λ is the wavelength associated with the particle wave.