SG - 503

Total No. of Pages : 3

Seat No.	

M.Sc. (Part - I) (Semester - II) (NEP) Examination, March - 2023
CC-203 : PHYSICAL CHEMISTRY - II
Sub. Code : 90165/90075

Day and Date : Saturday, 17 - 06 - 2023 **Total Marks : 80**

Time : 10.30 a.m. to 1.30 p.m.

Instructions:
1) Question one is compulsory.
2) Solve any two questions from section-I and Section-II.
3) All questions carry equal marks.
4) Figures to the right indicates marks.
5) Use of log-tables/non programmable scientific calculator is allowed.
6) Neat diagrams and sketches should be drawn wherever necessary.

Q1) Answer the following. **[16]**

a) What is electric double layer?
b) What do you mean by streaming current?
c) The plot of surface tension verses applied potential is called as....
d) What is streaming current coefficient?
e) Write the Eigen value of a given wave function e^{ax} with $\frac{d^2}{dx^2}$ operator.
f) Write an expression for angular momentum operator.
g) Write the expression of Hamiltonian operator.
h) Two different wave functions are orthogonal means that the integral over all space of their product $\int \psi_i^* \psi_j \, d\tau = ?$
i) Write the Stern-Volmer equation of quenching.
j) A photophysical process shows deactivation of molecules from singlet excited state to the singlet ground state is _____
k) T^1- S° by nonradiation process is called. - (Fluorescence/ Phosphorescence)
l) Give any two photophysical and photochemical process.
m) Why heterogeneous catalysis is called as contact catalysis?
n) A catalyst does not affect the final position of equilibrium although it shortens the time. True or False.
o) In Haber process for the synthesis of ammonia along with iron. molybdenum is also used what is the role of molybdenum'?
p) Give the SI unit of activation energy.

P.T.O.

SECTION - I

Q2) a) Describe commutator operator. Determine the commutators $\left[x,\frac{\partial}{\partial x}\right],\left[y,\frac{\partial}{\partial x}\right]$ and $\left[\frac{\partial}{\partial x},\frac{\partial}{\partial x^2}\right]$ using wave function (ψ). **[8]**

b) What is Hermitian operator? Prove that the operator $\frac{h}{2\pi i}x\left(-\frac{d}{dx}\right)$ is not Hermitian. **[8]**

Q3) a) In an electrocapillary measurements of surface tension of Hg in contact with 2.0 NHCl gave the following data. **[8]**

γ surface tension (dynes cm^{-1})	414	406	391
V cell potential (V)	−0.20	0.00	+0.20

i) Based on the above data, calculate (a) the charge of the electrode, q_{M1}, for the change in potential from −0.20 to 0.00 V;

ii) The charge of the electrode, q_{M2}, for the change in potential from 0.00 to + 0.02 V;

iii) If q_{M1} is assigned a potential of −0.06 V, and q_{M2} of +0.06V, calculate the differential capacitance of the interface.

b) What is diffuse charge double layer? Derive an expression of capacitance by Gouy-Chapmann model. **[8]**

Q4) a) What is electrokinetic phenomenon'? Derive and expression for electro osmotic coefficient'? **[6]**

b) Describe the Dual nature of a particle in quantum mechanics. **[6]**

c) In an electrocapillary measurement, mercury is in contact with a solution. If the height of the column is 2 cm, the inner diameter of the capillary tube is 0.5 mm, and the density of mercury at 25 °C is 13.5457 g cm^{-3} and at 0 °C is 13.5951g cm^{-3}, what are the surface tension values of mercury at these two temperatures? **[4]**

SECTION - II

Q5) a) What is ionic strength? Explain the effect of ionic solution on the rate of reaction. [6]

b) Explain in brief the any one technique to determine the rate constant of chemical reaction. [6]

c) Explain the kinetics of enzymatic reaction. [4]

Q6) a) Define the quantum yield of fluorescence. The quantum yield and observed fluorescence lifetime of aqueous tryptophan are 0.2 and 2.6 ns, respectively. Calculate fluorescence rate constant (kf). [8]

b) Draw the Joblonski diagram and explain in detail type of activation and deactivation process. [8]

Q7) Short notes on any three of the following : [16]

a) Operators

b) Steady state approximations in kinetics

c) Quenching phenomenon in fluorescence

d) Reference electrodes