GROUP - C

Answer ***any four*** questions

8. Show 'KE of photoelectron' vs. 'frequency' plots of two different metals in photoelectric experiment. The work function for cesium is 2.14 eV. Calculate the KE of the electrons ejected by the light of wavelength 300 nm. 2+2

9. a) Find the operator $\hat{A}^2$, if $\hat{A} = \frac{d}{dx} + x$.

   b) Solve the equation : $\frac{d^2\psi}{dx^2} - 3\frac{d\psi}{dx} + 2\psi = 0$. 2+2

10. A wave function $\psi = Ne^{-ax^2}$ satisfies an eigen value equation $\hat{H}\psi = E\psi$ with $\hat{H} = -\frac{d}{dx} + x^2$. Find the possible values of a and eigen value E. 4

11. Write down the expressions of energy and normalized wave function for a free particle in a rectangular box of lengths L and 2L. Show that (1, 4) and (2, 2) energy states are degenerate and find wave function for the state (1, 0) and comment on the result. 4

12. the normalized wave function for 1s-orbital of H-atom is, $\psi_{1s} = (\pi a_o)^{-\frac{3}{2}} e^{-r/a_o}$ (a_o =Bohr radius). Depict graphically the plots of (a) 'ψ_{1s}' vs. 'r' and (b) $4\pi r^2 \psi_{1s}^2$ vs. 'r'. Explain the graphs and find the most probable value of 'r'. 4

FINAL B.SC. EXAMINATION, 2018

(1st Semester)

CHEMISTRY (HONOURS)

PHYSICAL CHEMISTRY

PAPER - XI

Time : Two hours Full Marks : 50

(25 marks for each group)

Use a separate answerscript for each group.

GROUP - A

1. Answer ***any three*** from the following :

   a) What is liquid junction potential (LJP) for an electrochemical cell ? ''Cell without LJP can be given exact thermodynamic treatment.'' – Justify or criticized.

   b) What will be amount of electric work, if one mole of electric charge for the ion A^{z-} transfer through a potential difference E ? Explain how equilibrium constant of a reaction occurring in galvanic cell can be calculated from standard electrode potential value ?

   c) Describe a method with suitable example for the determination of solubility product of a sparingly soluble salt by a proper conversion of 1st kind electrode into 2nd kind electrode. Mention the limitation for such method.

d) Why electrochemical cell can be utilized as a better power source than that of general heat engine ? What are the basic requirement for an electrochemical process to act as an efficient power source ? 3×3

2. a) If E_o of a given cell at 25°C representing the equilibrium

$$Fe + Zn^{2+} = Zn\ |+\ Fe^{2+}$$

is –0·40 V, calculate the concentration of Fe^{2+} at equilibrium.

(Given that the concentration of Zn^{2+} is 1·2 M at 25°C.)

b) The thermodynamic dissociation constant of a weak acid (HA) is $1{\cdot}0 \times 10^{-5}$ at 25°C. Find out E^o of the half cell :

$HA\,(aq) + e \rightarrow A^-\,(aq) + H_2(g)$ $2\frac{1}{2}\times2$

3. What is activation overpotential ? Show that the logarithmic value of current follows linear relation with activation overpotential value for a large applied potential. 3

GROUP - B

4. How can we experimentally determine the surface area of a powdered solid sample using BET equation ? 5

5. What happens when an electric field is applied on a lyphobic sol ? 4

6. Describe a method of determination of viscosity avrage molar mass ($\overline{M_v}$) of a polymer sample. 5

7. What is Hardy-Schulze rule in connection with coagulation of a colloid ? 3