

FINAL B. SC. EXAMINATION, 2018

(1st Semester, Special Supplementary)

CHEMISTRY (HONOURS)**PAPER - XI****PHYSICAL CHEMISTRY**

Time : Two hours

Full Marks : 50

Use a separate answerscript for each group.

GROUP - A

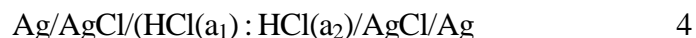
1. Why ordinary voltmeter is not used for determination of reversible cell *emf*? Explain briefly a principle for determining the *emf* for a reversible electrochemical cell ? 1+3
2. Derive an expression for the *emf* of a cell where the reaction, $\gamma_1A + \gamma_2B \rightarrow \gamma_3C + \gamma_4D$ takes place and hence relate the equilibrium constant for this reaction with standard cell potential. 3+1
3. Given that $E_{\text{MnO}_4^-/\text{Mn}^{2+}}^0 = 1.51 \text{ V}$ and $E_{\text{MnO}_2/\text{Mn}^{2+}}^0 = 1.23 \text{ V}$ in acid solution. Calculate $E_{\text{MnO}_4^-/\text{MnO}_2}^0$ in acid solution. 3
4. Set up a cell where the following reaction takes place :

$$\text{P}_4 + 3\text{NaOH} + 3\text{H}_2\text{O} \rightarrow 3\text{NaH}_2\text{PO}_4 + \text{PH}_3$$
 2

[Turn over

[2]

5. Determine the *emf* at the electrolyte junction of the following cell:



GROUP - B

6. Derive the expression for Langmuir adsorption isotherm. Show under what condition it can be truncated to the Freundlich isotherm. 4+1
7. How can a hydrophobic sol be stabilized? What does 'Gold number' reflect and how? 3+2
8. What happens when an electric field is applied on a lyophobic sol? 3
9. Describe a method of determination of viscosity average molar mass (\overline{M}_v) of a polymer sample. 4

GROUP - C

Answer any *four* questions

10. Write down 'Wien displacement law' with symbolic significances. At what wave length does the maximum in the radiant energy density distribution function for a black body occur at $T = 300 \text{ K}$? 2+2

[3]

11. When lithium is irradiated with light, the kinetic energy of the ejected electrons is $2.935 \times 10^{-19} \text{ J}$ for $\lambda = 300.0 \text{ nm}$ and $1.280 \times 10^{-19} \text{ J}$ for $\lambda = 400. \text{ nm}$. Calculate the *Planck constant* (h). 4

12. a) Find the operator \hat{A}^2 , if $\hat{A} = \frac{d}{dx} + x$.
- b) If ψ_1 and ψ_2 are two *eigen functions* with same *eigen value* E , prove that any linear combination of two is also an *eigen function* with same *eigen value*. 2+2

13. a) Solve the equation: $\frac{d^2\psi}{dx^2} - 3\frac{d\psi}{dx} + 2\psi = 0$.
- b) Calculate the *de-Broglie* wavelength of an electron ($m_e = 9.1 \times 10^{-31} \text{ kg}$) having KE equal to 1000 eV (protonic charge = $1.6 \times 10^{-19} \text{ C}$). 2+2
14. A free particle in one-dimensional box of length ' a ' is in its ground state. What is the probability of finding the particle within the range ' $a/3$ ' and ' $2a/3$ '? 4