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 revrsible electrocyhemical cell ? 1+3

2. Derive an expression for the *emf* of a cell where the reaction, $\gamma_1 A + \gamma_2 B \rightarrow \gamma_3 C + \gamma_4 D$ takes place and hence relate the equilibrium constant for this reaction with standard cell potential. 3+1

3. Given that $E^0_{MnO_4^-/Mn^{2+}} = 1{\cdot}51$ V and $E^0_{MnO_2/Mn^{2+}} = 1{\cdot}23$ V in acid solution. Calculate $E^0_{MnO_4^-/MnO_2}$ in acid solution. 3

4. Set up a cell where the following reaction takes place :

   $P_4 + 3NaOH + 3H_2O \rightarrow 3NaH_2PO_4 + PH_3$ 2

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

$Ag/AgCl/(HCl(a_1) : HCl(a_2)/AgCl/Ag$ 4

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 K ? 2+2

11. When lithium is irradiated with light, the kinetic energy of the ejected electrons is $2{\cdot}935 \times 10^{-19}$ J for $\lambda = 300{\cdot}0$ nm and $1{\cdot}280 \times 10^{-19}$ J for $\lambda = 400.$ 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 $(m_e = 9{\cdot}1 \times 10^{-31} kg)$ having KE equal to 1000 eV (protonic charge = $1{\cdot}6 \times 10^{-19} C$). 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