GV – 22

B.Sc. (Semester – V) Examination, October/November 2016
CHEMISTRY (Paper – I) (Six Units)
Physical Chemistry

Duration : 2 Hours | Total Marks : 80

Instructions : *1) Answer to the **two** Sections should be written in **separate** answer books.*
*2) Figures to the **right** indicate **full** marks.*
*3) **Use** of non programmable calculator is **allowed**.*
4) Log tables will be supplied on request.
*5) **All** questions are compulsory, however **internal** choice is available.*

Physical Constants :
$N = 6.023 \times 10^{23}$ molecules / mole, $h = 6.626 \times 10^{-34}$ Js,
1 a.m.u. = 931.5 MeV, F = 96500 Coulombs.
$m = 9.109 \times 10^{-31}$ Kg.

SECTION – I

1. Answer **any four** questions from the following : **(4×4)**
   a) Explain the effect of temperature on molar polarisation of molecules.
   b) With the help of 'square well potential' explain nuclear binding forces.
   c) Explain radial and angular wave function.
   d) Briefly explain de Broglie hypothesis related to dual nature of matter.
   e) Explain with the help of diagram primary reference electrode.
   f) What does principle and azimuthal quantum numbers signify ?

2. A) i) A cricket ball weighing 100 g is to be located within 0.1Å. What is the uncertainty in its velocity ? **2**
   ii) State Meson field theory. How does it explain the nature of nuclear forces ? **4**

OR

2. A) i) Calculate the de Broglie wavelength of electron moving with a velocity of 1.20×10^5 ms^{-1}. **2**
   ii) Define half life of a radioelement. Derive an expression for decay constant. **4**

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2. B) i) Explain any two reversible electrode. 4

ii) What is standard electrode potential ? 2

3. A) i) Write a short note on orientation polarisation. 4

ii) Calculate the mass defect and binding energy of the $_{56}Ba^{140}$ which has isotopic mass of 139.9544 amu. Given that $m_H = 1.00814$ and $m_n = 1.00898$ amu. 2

OR

3. A) i) Using dipole moment explain the structure of tri atomic molecules. 4

ii) The disintegration constant of U^{238} is 1.54×10^{-10} per year. Calculate

i) Half life and ii) Average life of uranium. 2

3. B) i) Derive the expression for energy for the particle in a one dimensional box. 4

ii) What is an operator ? Explain Hamiltonian operator. 2

SECTION – II

4. Answer **any four** of the following questions : (4×4)

a) What is overvoltage ? Explain the 3 important factors which affects overvoltage.

b) For Diatomic molecule as Rigid rotator show that $I = \mu r^2$.

c) What is specific Ionization ? Explain the working of Ionization Chamber.

d) Define Polarisation. How it is minimized ?

e) State 2 examples of Microwave active and inactive molecules. What are the selection rules for Microwave spectroscopy ?

f) Explain with neat diagram the working of semiconductor counter.

5. A) i) Explain the origin of the Liquid Junction Potential. How it is eliminated ? 3

ii) Derive an expression for electrode concentration cell without transference reversible to cations. 3

OR

5. A) i) What is Decomposition potential ? How it is experimentally determined ? 3

ii) Derive an expression for electrolyte concentration cell reversible to cations. 3

5. B) Explain with neat diagram the principle, construction and working of Scintillation Counter. 6

6. A) i) For the cell Ag / $AgNO_3$ ($m_1 = 0.01$ m, $\gamma_1 = 0.94$) / $AgNO_3$ ($m_2 = 0.1$ m, $\gamma_2 = 0.82$) / Ag. The emf is 0.057 V at 298 K. Determine the Transport number of the Ag^+ and NO_3^- ions in the given range of concentration. 4

ii) State the role of Ethyl Alcohol and Argon gas used in Geiger-Muller counter. 2

OR

6. A) i) The EMF of the cell Ag / $AgCl_{(s)}$ ($m_1 = 0.05$ m, $\gamma_1 = 0.821$) // $AgNO_3$ ($m_2 = 0.1$ m, $\gamma_2 = 0.725$) / Ag is 0.4298 V. Calculate the solubility and solubility product of AgCl in pure water at 298 K. 4

ii) Explain the Dead time in Geiger-Muller Counter. 2

6. B) i) From the microwave spectrum of the HI molecule it is observed that the frequency difference between the successive absorption lines is found to be 12.8 cm^{-1}. Calculate the bond length of the molecule. (H = 1.008 amu, I = 127 amu, N = 6.023×10^{23}). 3

ii) Explain the application of emf measurements for the determination of Ionic product of water. 3
