[Time: 3Hours]   [Total marks: 100]

N.B. : (1) All questions are compulsory.

(2) Figures to the right indicate full marks.

(3) Use of logarithmic table/non-programmable calculator is allowed.

Physical Constants:

$N = 6.023 \times 10^{23}$ Charge on electron $= 1.66 \times 10^{-19}$ C

$F = 96500$ coulombs   Mass of an electron$= 9.1 \times 10^{-31}$ kg

$c = 3 \times 10^{8}$ m/s   2.303RT $/ F = 0.05916$ at 298K

$R = 8.314$ J $/$ K/mol $\pi = 3.142$

$h = 6.626 \times 10^{-34}$ J.s

1.   Attempt **any four** of the following:
   A.   Write a note on liquid junction potential. Give functions of salt bridge.   5
   B.   What are galvanic cells? Classify them.   5
   C.   Derive an expression for the emf of electrolyte concentration cell with   5
         transference reversible to cation.
   D.   Derive an expression for the emf of electrode concentration cell reversible   5
         to anion.
   E.   Explain the terms i) Polarization   ii) Decomposition potential   5
   F.   Define overvoltage. In electrolysis of 2 N sulfuric acid, the hydrogen   5
         overvoltage at lead cathode was found to be 0.64 V at 298 K for a given
         current density. What will be the hydrogen overvoltage if the current density
         is increased to twice its present value for the same cathode under same
         condition. (Given: b = 0.12)

2.   Attempt **any four** of the following**:**
   A.   How are polymers classified on the basis of physical properties?   **5**
   B.   Explain the method for determination of molecular weight of polymers.   **5**
   C.   Write a note on curing agents.   **5**
   D.   What are stabilisers? Explain with examples.   **5**
   E.   What is LEP? How are they prepared?   **5**
   F.   Equal weights of polymer molecules each of molecular weight 40,000 g/mol   **5**
           and 50,000 g/mol are mixed. Calculate $\overline{M}n$ and $\overline{M}w$.

3. Attempt **any four** of the following**:**

A. What is an operator? How is multiplication of operators carried out? Show **5**
that the following pairs of operator commute.

$\frac{d^2}{dx^2}$ and $\frac{d}{dx}$ on f(x) = Sinx

B. What are the salient features of a black body radiation? How does classical **5**
theory explain the variation of intensity with respect to Temperature?

C. Explain the Planck's theory of quantisation. **5**

D. The work function of silver metal is 4.7 eV. Calculate the Kinetic energy **5**
and velocity of the electron ejected when a radiation of wavelength 300 nm
is incident on the silver surface. Will photoelectrons be observed?

E. Explain the Structure of Solar cell with the help of diagram. **5**

F. Explain how Hydrogen be generated by direct electrolysis of water. **5**

4. Attempt **any four** of the following**:**

A. Explain the term nuclear spin in NMR. **5**

B. Explain spin-spin and spin- lattice relaxation in NMR. **5**

C. Explain the principle and fundamental equation of NMR. **5**

D. Explain the principle of ESR spectroscopy. **5**

E. Write a note on ESR spectrometer. **5**

F. Explain the ESR spectra of hydrogen. **5**

5. Answer the following:

A. Select whether the following statements are true or false **(Any five)** **5**

a. For galvanic cells the value of E°cell is always greater than 1.

b. In case of concentration cells both half cells are chemically identical with
differing in concentrations.

c. The value of the hydrogen overvoltage for lead cathode is less than
platinum cathode under same conditions.

d. Liquid junction potential cannot be removed completely, but it can be
minimised.

e. For sulfuric acid the activity can be represented as $a = (m.\gamma\pm)^2$

f. For ideal solution, the value of activity coefficient is always equal to one.

g. With change in pH of solution the value of overvoltage remains same.

h. The cell represented as, Zn / ZnSO4 || AgNO3 / Ag is an example of
chemical cell.

B. Fill in the blank with appropriate words given in the bracket. **(Any five)** **5**

a. ------is a linear polymer.
(Polyester, glycogen, bakelite, starch)

b. ------ is a thermoplastic polymer.
(PVC, starch, nylon, cellophane)

c. The repeated unit in a polymer is called------
(Monomer, elastomer, fibres, resin)

d. ------ is used as adhesives.
(Liquid resin, fibres, rubber, nylon)

e. Polymers having long range elasticity are called--------
(Elastomers, gum, nylon, protein)

f. Weight average molar mass is denoted as------
(M_w , M_n, M_z, M_v)

g. LED is made of --------material.
(semi-conductor, nylon, terylene, rubber)

C. Select and write the appropriate answer. **(Any five)** 5

a. Newton's law of mechanics is the backbone of
  i. Quantum mechanics
  ii. Classical mechanics
  iii. Wave mechanics
  iv. Body mechanics

b. Total radiation emitted per unit surface area is called.
  i. Energy
  ii. Intensity
  iii. Power
  iv. Surface energy

c. The waves which do not travel in vacuum.
  i. Matter
  ii. Translational
  iii. Rotational
  iv. vibrational

d. A -wave function contains information about
  i. Volume occupied by a particle.
  ii. location and motion of particle
  iii. area occupied by the particle.
  iv. shape of the particle

e. Schrodinger equation is a
  i. First order differential equation.
  ii. Second order differential equation.
  iii. Partial differential equation.
  iv. Nonlinear differential equation.

f. Hamiltonian is given by.
  i. Kinetic Energy
  ii. Potential energy
  iii. Sum of kinetic and potential energy
  iv. momentum

g. One of the ways to tap solar energy is
  i. stark effect
  ii. Photovoltaic effect
  iii. Einstein effect
  iv. Compton effect

h. The band possessed by valence electrons is called
  i. Valence band
  ii. Conduction band
  iii. Forbidden energy gap.
  iv. Equivalent band

D.   Match the column   **(Any five)**   **5**

a.	$_6C^{13}$	**i.**	ω_0
b.	$_7N^{14}$	**ii.**	Solvent in NMR spectrometer
c.	Angular velocity	**iii.**	$I=0$
d.	$_6C^{12}$	**iv.**	$I=1$
e.	CCl_4	**v.**	ESR spectra
f.	Hyperfine splitting of deuterium	**vi.**	$I=1/2$
g.	γ	**vii.**	2 peaks
		viii.	3 peaks
		ix.	Gyromagnetic ratio
		x.	Spin quantum number

****

221CDA312D5DBC796C257A4E21CE01B6