

Time: 3 Hrs

Marks:100

Please check whether you have got the right question paper.

- N.B:** 1. All questions are compulsory.
2. Figures to right indicates full marks

Q.1 Answer ANY FOUR of the following:

- A** Discuss whether the addition of bromine to 2-butene is stereospecific or stereoselective. **5**
B Explain the mechanism and stereochemistry of S_N1 reactions using suitable example. **5**
C a) Write a note on enantiotopic ligands. **3**
 b) Explain the term: Prochiral centre **2**
D Explain the stereochemistry of $KMnO_4$ oxidation of maleic acid and fumaric acid. **5**
E a) What are α -amino acids? How are they classified? **3**
 b) Give preparation of alanine by Strecker synthesis. **2**
F Explain stepwise synthesis of a tripeptide using Merrifield's solid phase synthesis method. **5**
 Give two advantages of this method of synthesis.

Q.2 Answer ANY FOUR of the following:

- A** Complete the following reaction, identify it and explain its mechanism: **5**
- $$\begin{array}{c} \text{H}_3\text{C} \\ \diagdown \\ \text{C}=\text{N}-\text{OH} \\ \diagup \\ \text{C}_6\text{H}_5 \end{array} \xrightarrow{\text{conc. H}_2\text{SO}_4} ?$$
- B** What is Michael reaction? Explain the mechanism of the reaction. Identify the intermediate. **5**
C Give reactions for the following:
 a) Conversion of D-Glucose into D-Arabinose **3**
 b) Action of conc. HNO_3 on D-Glucose and D-Fructose **2**
D a) Write stepwise reactions to show the action of phenylhydrazine on D-Fructose? **3**
 b) Explain the phenomenon of mutarotation in Glucose. **2**
E a) Draw the Fischer projection of D-Fructose and convert to Haworth formula (β -pyranose form). **3**
 b) What are epimers? Draw the structure of anyone epimer of D-Glucose. **2**
F Draw structures for the following: **5**
- Enantiomer of D-Glucose
 - Open chain structure of Aldotriose
 - Product formed by action NaBH_4 on D-Glucose
 - Chair conformation of β -D-Glucopyranose
 - Diastereomer of D-Glucose

Q.3 Answer ANY FOUR of the following:

- A** Explain the following terms: **5**
- Finger print region
 - Types of bending vibrations
- B** a) Explain how inductive effect plays an important role in deciding the value of chemical shift with a simple example? **3**
 b) Why TMS is used as a standard in PMR spectroscopy? **2**
C a) Give the structure of pyrimidine bases present in DNA? **3**
 b) Distinguish between DNA & RNA? **2**
D Explain the primary structure of nucleic acids? **5**

E An organic compound has the molecular formula M.F: $C_8H_{10}O$. Determine the index of hydrogen deficiency and deduce its structural formula from the following spectral data? **5**

IR Spectrum (cm^{-1}): 3500, 1600, 1570, 760 & 710

PMR Spectrum: (in δ ppm): 1.6(3H,d) , 4.2(1H, s, D_2O exchangeable) , 4.9 (1H,q) , 7.4 (5H,m) . Suggest a structure for the compound and justify your answer.

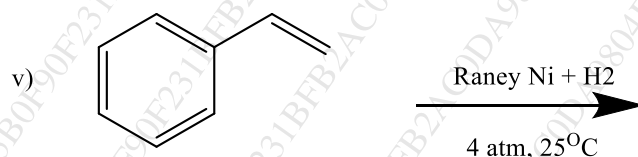
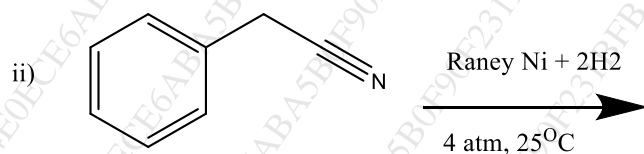
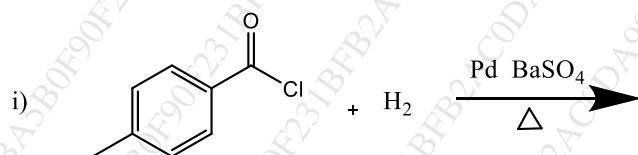
F An organic compound has the molecular formula M.F $C_9H_{10}O_2$. Determine the index of hydrogen deficiency and suggest a structure for the compound. Justify your answer? **5**

IR Spectrum (cm^{-1}) : 3100 (broad), 1715, 1600, 750 & 710

PMR Spectrum: (in δ ppm): 1.5(3H,d) , 3.7(1H,q), 7.5 (m, 5H) , 11.8 (1H, s)

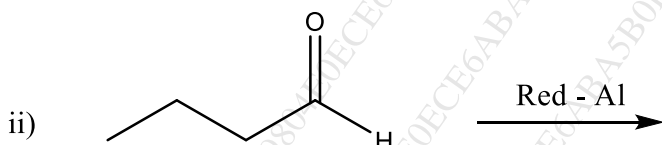
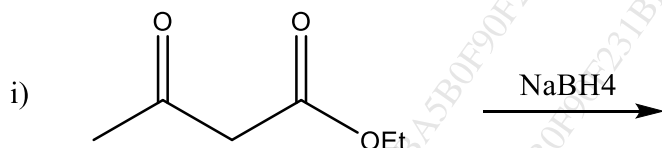
Q.4 Answer ANY FOUR of the following:

A Complete the following reactions



B a) What is Lindlar's catalyst? Explain its use in partial reduction of alkynes and its selectivity? **3**

b) Complete the following reactions:



- C a) How are polymers classified on the basis of properties of polymers? **3**
 b) Give the preparation and uses of Nylon 6,6? **2**
- D a) Explain the following terms with examples **3**
 i) Plasticizers ii) Stabilizer iii) Fillers
 b) Write the synthesis of Buna – S rubber. **2**
- E a) Explain reaction of epoxidation using m-CPBA. **3**
 b) Explain the allylic and benzylic bromination using NBS **2**
- F a) Draw the structure and give one use of the following polymers- **3**
 i) Neoprene ii) Nylon 6 iii) Polyester
 b) Write the structure and use of Ziegler Natta catalyst. **2**

Q.5 A **State whether the following are true or false: (any five)** **5**

- a) The two faces in ethyl methyl ketone are homotopic in nature.
 b) E₂ elimination reaction requires antiperiplanar geometry of the two leaving groups of substrates.
 c) Epoxide contains a three membered heterocyclic ring with one oxygen atom present in the ring.
 d) All stereospecific reactions are not stereoselective in nature.
 e) The reactions where only one diastereomer of all the possible diastereomers of the product is formed, are known as diastereoselective reactions.
 f) A dipeptide is formed from two α-amino acids.
 g) K-phthalimide is used as one of the reactants in Gabriel's synthesis of α-amino acids.
 h) Proteins are formed by ester linkages between different α-amino acids.

B Choose the most correct option to answer the following (ANY FIVE): **5**

- a) What is the intermediate formed in Pinacol-Pinacolone rearrangement?
 i) Carbocation iii) Carbanion
 ii) Nitrene iv) Carbene
- b) What is the base catalysed rearrangement of α-haloketones to carboxylic acid derivatives called?
 i) Beckmann reaction iii) Favorski reaction
 ii) Wittig reaction iv) Michael reaction
- c) Which of the following is an aldotetrose?
 i) Mannose iii) Xylose
 ii) Threose iv) Arabinose
- d) Identify the anomer of α-D-Fructofuranose.
 i) α-D-Fructopyranose iii) β-D-Glucopyranose
 ii) β-D-Glucofuranose iv) β-D- Fructofuranose.

- e) Identify the product/s formed on treating D-Fructose with H_2/Ni .
- | | |
|--------------|--------------------------|
| i) Sorbitol | iii) Sorbitol & Mannitol |
| ii) Mannitol | iv) Allitol |
- f) How many moles of periodic acid are required per mole of D-Fructose?
- | | |
|-------|--------|
| i) 3 | iii) 5 |
| ii) 4 | iv) 6 |
- g) Identify the oligosaccharide.
- | | |
|-------------|-------------|
| i) Starch | iii) Ribose |
| ii) Sucrose | iv) Idose |

C Fill in the blanks: (Any five)

5

- a) A sharp absorption band due to $>C=O$ stretching in ketones appears in the region ---

- b) Nujol is -----
- c) The position of the signals in NMR represents the ----- of the protons.
- d) NMR is based on the property of -----
- e) In Tau scale the position of TMS signal is taken as ----- ppm
- f) The sugar component in DNA is -----
- g) Uracil is a derivative of -----
- h) A-T and C-G are called ----- base pairs

D State whether the following are True or False: (any five)

5

- a) Polyhydroxyalkanoates (PHAs) is biodegradable polymer.
- b) Lithium Aluminum hydride (LAH) is mild reducing agent.
- c) In isotactic polymer all the side chains are arranged on the same side of the polymeric backbone.
- d) Polycarbonates are used in bike helmets.
- e) $RhCl(PPh_3)_3$ is Wilkinson's catalyst.
- f) SeO_2 oxidises only active methyl or methylene group without affecting carbonyl group.
- g) α - cyano acrylate can be used as artificial skin.

(Time: 3 hours)

Total Marks: 100

- N.B.:** (1) All questions are compulsory.
 (2) Figures to the right indicate full marks.
 (3) Use of log table/ non-programmable calculator is allowed.

Q.1 Attempt any four of the following. **20**

- A) Draw a polarogram and label all the regions. Explain the role of supporting electrolyte used in polarographic analysis.
- B) Explain the term polarographic maxima with a neat diagram. How is it eliminated?
- C) In a polarographic determination of nickel, the wave heights determined for a series of solutions were as follows:

Conc. of Ni ²⁺ (mM)	0.25	0.5	0.75	1.0	unknown
Wave height (mm)	31.8	64.0	95.8	128.0	70.0

- D) Find the concentration Ni²⁺ in unknown solution.
- E) With the help of labelled diagram, explain dropping mercury electrode. Give any one of its limitation.
- F) What are the advantages and limitations of amperometric titrations?
- G) Give the basic difference between amperometry and voltammetry. Explain the nature of amperometric titration curve when both titrand and titrant are reducible, and product is non-reducible.

Q.2 Attempt any four of the following. **20**

- A) Draw schematic diagram of gas chromatograph and explain any two components.
- B) Explain electron capture detector in GC and write any one advantage.
- C) Give the applications of gas chromatography.
- D) In GC, components of A and B were found to have retention time of 16.30 min and 13.30 min respectively on a 30 cm column. The peak width at base for components A and B were 1.00 min and 1.30 min respectively. Calculate the average number of plates in the column and plate height of the column.
- E) Explain ion exchange capacity? How is it determined for cation exchanger.
- F) Explain any two applications of ion-exchange chromatography in detail.

Q.3. Attempt any four of the following. **20**

- A) What is food processing? Explain the need of food processing?
- B) Explain the Lane Eynon method for analysis of lactose in milk.
- C) What are objectives of pasteurization? Explain any two methods of pasteurization.
- D) Enlist the types of tea and explain any two in detail.
- E) Explain a method to estimate amount of calcium and magnesium in face powder complexometrically.

- F) Write constituents of lipstick and any three properties of antiperspirant.
- Q.4** **Attempt any four of the following.** **20**
- A) Draw a neat labelled diagram of thermobalance and write the function of any three of its components.
- B) Name the factors which influence the TG curve. Explain thermal decomposition of calcium oxalate.
- C) Distinguish between TGA and DTA
- D) Discuss thermometric titrations of:
 1) HCl v/s NaOH
 2) Boric acid v/s NaOH
- E) What are the important applications of DTA?
- F) Explain linearity and accuracy w.r.t. method validation.
- Q.5** **A) Select the correct option and complete the following statements: 05 (any five)**
- a) The diffusion of particles from bulk of the solution to the surface of DME due to the difference in concentration is called _____.
 i) decomposition ii) electrical potential gradient
 iii) concentration gradient
- b) The electrode which has its own potential and cannot take up potential applied on it is called _____.
 i) dropping mercury electrode ii) non-polarizable electrode
 iii) rotating platinum electrode
- c) Oxygen dissolved in the electrolytic solutions is easily reduced at the DME produces polarogram consisting of _____ waves.
 i) three ii) four iii) two
- d) In polarography the time that lapses between the detachment of two successive drops of mercury is called _____.
 i) drop time ii) dead time iii) inactive time
- e) In polarographic analysis the diffusion current is proportional to the concentration of _____.
 i) supporting electrolyte ii) reducible ion iii) triton X-100
- f) When titrand is reducible but titrant and product are not in amperometric titration shows _____.
 i) constant current till the equivalence point, then increases.
 ii) decrease in current till the equivalence point, then constant
 iii) increase in current till the equivalence point, then decreases
- g) In amperometric titration of Ni^{2+} determined by titrating with _____.
 i) dimethyl glyoxime ii) silver nitrate iii) iodine
- h) In rotating platinum electrode, the diffusion current is _____ times larger than in case of DME.
 i) 100 ii) 400 iii) 20

Q.5 B) State whether true or false: (any five) 05

- The retention time of the mobile phase is called dead time.
- Nitrogen gas is used as carrier gas in gas chromatography.
- If a component A is more soluble in the stationary phase than component B, then A will come out of the column later than B.
- Eddy diffusion is a band broadening factor in chromatography caused by the non-equal path of the solute molecules.
- Diatomaceous earth is the commonly used solid support material in gas chromatography.
- Standard solution of sodium nitrate is used in the determination of capacity of an anion exchanger.
- In ion exchange chromatography, density of the resin should be less than that of the water.

Q.5 C) Fill in the blanks with correct alternatives given in the bracket: 05

(any five)

(Sensory, 8-hydroxy quinoline, dimethyl glyoxime, TiO_2 , irradiation, caffeine, fructose, alkaline phosphatase, meats.)

- _____ is a physical method of food preservation.
- _____ enzyme is present in milk.
- _____ is the major pharmacologically active compound in coffee.
- _____ present in talcum powder has UV reflection properties.
- Honey contains large quantity of _____ than glucose.
- _____ properties are detected by the five sense organs.
- In estimation of Zinc from deodorants and antiperspirants _____ is used as a complexing agent.
- Nitrates and nitrites are generally used for preservation of _____.

Q.5 D) Match the columns: (any five) 05

	A	B
i)	Thermometric titration	a) Reference standard
ii)	TGA thermobalance	b) ΔH
iii)	Plateau in TGA	c) Accuracy
iv)	SiC	d) No loss in mass
v)	Recovery study	e) single pan
vi)	Thermocouple	f) Analysis of polymer
vii)	Application of DTA	g) Ni-Cr Alloy

[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 .**

1. Attempt **any four** of the following:
- A. What is crystal field splitting? Explain with reference to square planar complexes. **5**
- B. Explain why $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ is a high spin and $[\text{Fe}(\text{CN})_6]^{3-}$ is a low spin complex. **5**
- C. Explain the following with respect to the factors affecting crystal field splitting parameter.
i) Geometry of the complex **21/2**
ii) Nature of the ligands **21/2**
- D. Explain the term crystal field stabilization energy [CFSE]. Calculate CFSE for d^3 and d^8 configurations in strong field octahedral complexes. **5**
- E. Discuss in brief the merits and demerits of Crystal Field theory. **5**
- F. Discuss any two experimental evidences which proves covalent bonding in the metal complexes. **5**
2. Attempt **any four** of the following:
- A. Draw and explain a neat labelled molecular orbital diagram for hexacyanoferrate (II) ion. $[\text{Fe}(\text{CN})_6]^{4-}$ **5**
- B. Discuss the effect of π bonding on Δ_0 values of octahedral complexes with ligands having filled π orbital. **5**
- C. What are chelating agents? Discuss their effect on stability of complexes. **5**
- D. Write a note on the Associative mechanism for ligand substitution reaction. **5**
- E. What is Russell-Saunders (*LS*) coupling? Explain with suitable example. **5**
- F. i. Calculate the ground state term for ' d^1 ' configuration of Ti^{3+} . **3**
ii. Explain spin multiplicity for two electrons. **2**
3. Attempt **any four** of the following:
- A. Write a note on ionic organometallic compound. **5**
- B. How will you prepare organometallic compound by Transmetallation reaction? **5**
- C. Explain the complex formation reaction for the organometallic compound. **5**
- D. What is ferrocene? Explain structure of ferrocene according to valence bond theory. **5**
- E. Discuss homogeneous catalysis with suitable example. **5**
- F. Discuss the following steps involved in hydrogenation of alkene using Wilkinson's catalyst. a) oxidative addition b) alkene coordination. **5**

4. Attempt **any four** of the following:
- What is meant by term metallurgy? Explain self-reduction process in pyrometallurgy. **5**
 - Define roasting. Explain different types of roasting methods used for extraction of ore. **5**
 - Describe electrolytic refining of copper with suitable diagram. **5**
 - Explain with suitable diagram Froth floatation process for concentration of ore. **5**
 - Discuss the structure of XeOF_4 molecules on the basis of VSEPR theory. **5**
 - Give an account of $\text{Na}^+ - \text{K}^+$ ion pump with suitable diagram. **5**
5. Answer the following:
- Select whether the following statements are **true** or **false** (Any five) **5**
 - Splitting of d - orbitals is maximum in tetrahedral complexes.
 - Triply degenerate set of dxy, dyz, dxz are called as t_{2g} orbitals.
 - The value of $10Dq$ does not depend on the nature of central metal atom.
 - In octahedral complexes, due to the crystal field splitting, orbital with maximum energy is $dx^2 - y^2$.
 - In the absorption spectrum of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$, one transitions are possible.
 - In an octahedral complex, metal ion with d^2 configuration has CFSE value $- 8 dq$.
 - Electrons prefer to pair up in eg orbital when $\Delta_0 < P$.
 - The effect of ligands in expanding the d-electron cloud is called Jahn -Teller effect .
 - Fill in the blank with appropriate words given in the bracket (Any five) **5**
[weakening, isomerization, unpaired electrons, microstates, even and symmetrical, less stable, two, bonding]
 - The term gerade corresponds to _____
 - If the matching orbitals overlap combines with maximum positive overlap, they form _____ molecular orbitals.
 - Presence of bulky ligands in a chelate results in _____ of metal ligand bond.
 - The complexes with forced configurations are _____
 - The reactions which involve structural changes are called _____ reactions.
 - With respect to octahedral complexes, dissociative mechanism can be considered as _____ step mechanism.
 - The allowed combinations of m_l and m_s for electrons are called _____
 - A transition is said to be spin forbidden, if it involves different number of _____

- C.** Select and write the appropriate answer . (Any five) **5**
- _____ is the example of organometallic compound.
a) CH_4 b) H_2O c) CH_3MgCl d) CH_3Cl
 - In preparation of organometallic compound by metallation reaction, Hydrogen from R-H is replaced by _____
a) carbon b) metal c) non-metal d) nitrogen
 - In the complex formation reaction of organometallic compound, organometallic compound acts as _____
a) Lewis acid b) Lewis base c) Arrhenius acid d) Arrhenius base
 - _____ is the best example of metallocene.
a) Ferrocene b) Ferric chloride c) Ferrous sulphate d) Ferric Hydroxide
 - According to valence bond theory, ferrocene is _____
a) Diamagnetic b) paramagnetic c) ferromagnetic d) antiferromagnetic
 - _____ is known as Wilkinson's Catalyst $\text{RhCl}_3(\text{PPh}_3)$
a) $\text{RhCl}_3(\text{PPh}_3)$ b) $\text{RhCl}(\text{PPh}_3)_3$ c) $\text{RhCl}_2(\text{PPh}_3)_2$ d) $\text{Rh}(\text{PPh}_3)_4$
 - In Homogeneous catalysis, if reactants and products are in gaseous phase then catalyst may be in _____ phase only
a) solid b) liquid c) gaseous d) changing
 - Ferrocene can be prepared by oxidation of cyclopentadienyl Grignard Reagent with _____
a) KOH b) HCl c) FeCl_3 d) NaCl

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

a.	Azurite	i.	Pyramidal geometry
b.	Gangue	ii.	Calcium deficiency
c.	Smelting	iii.	Square Planar Geometry
d.	XeF_4	iv.	Used in electronic tubes
e.	XeO_3	v.	Pyrometallurgical reduction
f.	Krypton-85	vi.	Purification of metal
g.	Rickets	vii.	Copper Ore
h.	Oxygen transfer	viii.	Concentration of Ore
		ix.	Non-Metallic Impurities
		x.	Heamoglobin

[Time: 3Hours]

[Total marks: 100]

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(2) Figures to the right indicate full marks.

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

Physical Constants:

$$N = 6.023 \times 10^{23}$$

$$F = 96500 \text{ coulombs}$$

$$c = 3 \times 10^8 \text{ m/s}$$

$$R = 8.314 \text{ J / K/mol}$$

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

$$\text{Charge on electron} = 1.66 \times 10^{-19} \text{ C}$$

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

$$2.303RT / F = 0.05916 \text{ at } 298\text{K}$$

$$\pi = 3.142$$

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 transference reversible to cation. | 5 |
| D. | Derive an expression for the emf of electrode concentration cell reversible to anion. | 5 |
| E. | Explain the terms i) Polarization ii) Decomposition potential | 5 |
| F. | Define overvoltage. In electrolysis of 2 N sulfuric acid, the hydrogen 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: $b = 0.12$) | 5 |

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 and 50,000 g/mol are mixed. Calculate \bar{M}_n and \bar{M}_w . | 5 |

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

- A. What is an operator? How is multiplication of operators carried out? Show that the following pairs of operator commute. 5
 $\frac{d^2}{dx^2}$ and $\frac{d}{dx}$ on $f(x) = \sin x$
- B. What are the salient features of a black body radiation? How does classical theory explain the variation of intensity with respect to Temperature? 5
- C. Explain the Planck's theory of quantisation. 5
- D. The work function of silver metal is 4.7 eV. Calculate the Kinetic energy and velocity of the electron ejected when a radiation of wavelength 300 nm is incident on the silver surface. Will photoelectrons be observed? 5
- 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
- For galvanic cells the value of E°_{cell} is always greater than 1.
 - In case of concentration cells both half cells are chemically identical with differing in concentrations.
 - The value of the hydrogen overvoltage for lead cathode is less than platinum cathode under same conditions.
 - Liquid junction potential cannot be removed completely, but it can be minimised.
 - For sulfuric acid the activity can be represented as $a = (m \cdot \gamma_{\pm})^2$
 - For ideal solution, the value of activity coefficient is always equal to one.
 - With change in pH of solution the value of overvoltage remains same.
 - The cell represented as, $\text{Zn} / \text{ZnSO}_4 \parallel \text{AgNO}_3 / \text{Ag}$ is an example of chemical cell.
- B. Fill in the blank with appropriate words given in the bracket. (**Any five**) 5
- is a linear polymer.
(Polyester, glycogen, bakelite, starch)
 - is a thermoplastic polymer.
(PVC, starch, nylon, cellophane)
 - The repeated unit in a polymer is called-----
(Monomer, elastomer, fibres, resin)
 - 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. | ${}^6\text{C}^{13}$ | i. | ω_0 |
| b. | ${}^7\text{N}^{14}$ | ii. | Solvent in NMR spectrometer |
| c. | Angular velocity | iii. | $I=0$ |
| d. | ${}^6\text{C}^{12}$ | 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 |
