MDU M.Sc Entrance: 2011

Chemistry

❖ Question Paper

All questions are compulsory (One mark each) **Total Marks: 100 (1.5 Hours)**

Q.1 When two ionic compounds are dissolved in water, a double replacement reaction can

(a) Never occurs since all ion in water are spectator ions.

(b) Occur if two of the ions form an insoluble ionic compound, which precipitate out of solution

(c) Occur if the ions react to form a gas, when bubbles out of the solution

(d) Occur only if the ions form covalent bonds with each other.

Q.2 The common feature among the species CN, CO and NO are

(a) Bond order three and iso-electronic (b) Bond order three and weak-field ligands

(c) Bond order two and strong-field ligands (d) Iso-electronic and weak-field ligands

Q.3 Wacker's process used the catalyst:

(a) $[PdCl_4]^{2-}$ (b) $[Rh\ (CO)_2I_2]^-$ (c) $[Pt(C_2H_4)Cl_3]^-$ (d) $Cp_2TiCl_2 - Al(C_2H_5)_3$

Q.4 Term symbols for d^2 configuration are ^3F, ^3P, ^1D, ^1S, ^1G and the ground state term is

(a) $^3F_4$ (b) $^3F_2$ (c) $^1G_4$ (d) $^3P_0$

Q.5 Capacity of anion exchanger resin decrease with

(a) Decrease in pH (b) Increase in pH (c) At pH = 7 (d) Not affected by pH

Q.6 Which of the following compound would be drawn most strongly into a magnetic field?

(a) $TiCl_4$ (b) VCl_3 (c) $FeCl_2$ (d) $CuCl_2$

Q.7 The central atom in BrF_5 have bonding and non-bonding electron pairs found to be:

(a) 1 and 5 (b) 0 and 5 (c) 5 and 1 (d) 5 and 0

Q.8 What you call an element if it has 18 electrons in penultimate shell and 3 electrons in outer most shell?

(a) s-block element (b) p-block element (c) d-block element (d) F-block element

Q.9 What is the geometry of $[AuCl_4]^-$ complex ion?

(a) Square-planar (b) Tetrahedral (c) Trigonal monopyramidal (d) See-saw

Q.10 Which of the following set of ions are colourless?

(a) Zn^{2+}, Cu^{2+}, Ti^{3+}, Co^{2+} (b) Zn^{2+}, Cu^{+}, Ti^{4+}, V^{5+}

(c) Cr^{3+}, Mn^{2+}, Zn^{2+}, Ti^{4+} (d) Mn^{7+}, Cr^{6+}, Cu^{+}, V^{2+}

Q.11 Which of the following ligand can be used to distinguish between cis and trans isomers of $[PtCl_2(NH_3)_2]$?

(a) H_2O (b) OH (c) CO (d) None

Q.12 the empirical formula of Layered silicate structure in clays is:

(a) SiO_4^{4-} (b) $Si_2O_5^{2-}$ (c) $Si_2O_7^{6-}$ (d) $(SiO_3)_n^{2n-}$

Q.13 The calculated magnetic moment (B.M) of Eu^{3+} system will be

(a) 0 (b) 3.42 (c) 7.91 (d) 3.61

Q.14 The molecule $[Pt(NH_3)(OH_2)\ BrCl]$ is square planar. How many geometrical isomers of this molecule can exist?

(a) 2 (b) 3 (c) 4 (d) 6

Q.15 Metal function needed in photosynthesis and respiration are:

(a) Zn, Ga and Ca (b) Zn, Mg and Ca (c) Al, Ga and In (d) Mn, Fe, Co and Cu

Q.16 The highest oxidation state shown by lanthanides is?

(a) +7 (b) +5 (c) +3 (d) +4

Q.17 Identify the correct IUPAC nomenclature for the given complex: $[Pt(NH_3)_2][PtCl_4]$

(a) Tetraamineplatinium(II) tetrachloroplatinate(II)

(b) Tetrachloroplatinate(II) tetraamineplatinium(II)

(c) Tetrachloro-tetraamine bis platinium(II)

(d) Platinum(II) tetraamine platinum(II) tetrachlorate

Q.18 predict the extrinsic semiconducting properties of WO_3 and CdO

(a) Both p-type semiconductor (b) Both n-type semiconductor

(c) WO_3 is n-type and CdO is insulator (d) WO_3 is n-type and CdO is p-type semiconductor

Q.19Which acid is present in lemon?

(a) lactic acid (b) tartaric acid (c) citric acid (d) marlic acid

Q.20 which transitions are studied by UV spectrophotometer?

(a) Rotational (b) Electronic (c) Vibrational (d) Nuclear

Q.21 A covalent molecule AB_3 has pyramidal structure. The number of lone pair electrons in the molecule are respectively

(a) 2 and 2 (b) 1 and 3 (c) 0 and 4 (d) 3 and 1

Q.22 The halogen having metallic character is

(a) Bromine (b) Chlorine (c) Iodine (d) Fluorine

Q.23 The process of heating the concentrated ore in a limited supply of air or in the absence of air is known as

(a) Roasting (b) Calcination (c) Cupellation (d) Leaching

Q.24 Tritium is a radioisotope of hydrogen, it undergoes disintegration to give

(a) α-particles (b) β-particles (c) Neutrons (d) X-rays

Q.25 Cobalt is present in

(a) Vitamin B_2 (b) Vitamin B_1 (c) Vitamin B_6 (d) Vitamin B_{12}

Q.26 Which of the following pair has the same electronic structure?

(a) Ar, Cl^- (b) Ag, Sn (c) Ca, Ar (d) Mg, Na^+

Q.27 Which of the following is not a colligative property?

(a) Osmotic pressure (b) Relative increase in vapour pressure

(c) Depression in freezing point (d) Elevation of boiling point

Q.28 Pyrosilicates are the silicates in which the two tetrahedral units are linked at

(a) Three point (b) Two point (c) One point (d) Four point

Q.29 Which of the following nuclides, the one most likely to be radioactive is

(a) $^{14}_{6}C$ (b) $^{14}_{7}N$ (c) $^{31}_{15}P$ (d) $^{66}_{30}Zn$

Q.30 Which one of the following molecules doesn't obey the $18e^-$ rule

(a) $[Mn(CO)_6]^+$ (b) $[Fe(CO)_5]$ (c) $[Cr(CO)_5]^{2-}$ (d) $[Mn(CO)_4Cl_2]^{2-}$

Q.31 Which of the following acid does not have S – S bond?

(a) $H_2S_2O_3$ (b) $H_2S_2O_5$ (c) $H_2S_2O_7$ (d) $H_2S_2O_6$

Q.32 Which of the following compound is most stable?

(a) LiI (b) CsF (c) LiF (d) AgF_2^-

Q.33 The bond order of following sequence is?

(a) $O_2^+ > O_2 > O_2^- > O_2^{2-}$ (b) $O_2^{2-} > O_2^- > O_2 > O_2^+$

(c) $O_2 > O_2^+ > O_2^- > O_2^{2-}$ (d) $O_2^{2-} > O_2^- > O_2^+ > O_2$

Q.34 Hard acid – hard base complexes are stable predominantly due to?

(a) Ionic bonding (b) Covalent bonding

(c) Coordination bonding (d) Hydrogen bonding

Q.35 What is the relative area of each peak in a quartet spin-spin splitting pattern?

(a) 1 : 4 : 4 : 1 (b) 1 : 2 : 2 : 1 (c) 1 : 2 : 1 (d) 1 : 3 : 3 : 1

Q.36 The finger print region of the infrared spectrum, which is characteristic for each individual compound, is between

(a) 400 – 1400 cm^{-1} (b) 1400 – 900 cm^{-1} (c) 900 – 600 cm^{-1} (d) 600 – 250 cm^{-1}

Q.37 An acid (HA) have $K_a = 10^{-7}$, what will be its pK_a?

(a) 7 (b) –7 (c) –0.7 (d) 1/7

Q.38 Vander Waal's equation for n moles of a gas is

(a) $\left(P + \frac{a}{V^2}\right)(V - b) = RT$ (b) $\left(P + \frac{na}{V^2}\right)(V - nb) = nRT$

(c) $\left(P + \frac{na}{V^2}\right)(V - b) = nRT$ (d) $\left(P + \frac{n^2a}{V^2}\right)(V - nb) = nRT$

Q.39 With increase in temperature, the viscosities of gases and liquids respectively:

(a) Increase, Decrease
(b) Decrease, Increase
(c) Increase, Increase
(d) Decrease, Decrease

Q.40 The fraction of molecules of a gas possessing velocities in a given range depends on

(a) Total no. of molecules
(b) Temperature
(c) Volume of gas
(d) Pressure of gas

Q.41 Reverse osmosis is an example of

(a) Reversible process
(b) Irreversible process
(c) Equilibrium process
(d) Non-spontaneous process

Q.42 The triple point of water is 273.16K; what will be the temperature in degree Celsius:

(a) 0
(b) 0.01
(c) –0.01
(d) 100

Q.43 MV, MPV and RMS velocity are approximately in the ratio

(a) 1.13 : 1 : 1.23
(b) 1.23 : 1 : 1.13
(c) 1.23 : 1.13 : 1
(d) 1 : 1.13 : 1.23

Q.44 For the first order reaction, if the time taken for 50% of the reaction is t secs; the time required for completion of 99.99% reaction is

(a) 5 t
(b) 10 t
(c) 2 t
(d) 100 t

Q.45 Which of the following is not a perfect differential?

(a) dG
(b) dT
(c) dQ
(d) dH

Q.46 The E^0_{cell} of an Al-air battery is 2.73 V and it involves a 12 electrons process. The ΔG^0 in kJ will be

(a) –3161.340 (b) 3161.340 (c) 32.76 (d) –32.76

Q.47 A condition for equilibrium is

(a) $\delta G = 0$ (b) $\delta G_{T, V} = 0$ (c) $\delta G_{T, P} = 0$ (d) $\delta G_{P, V} = 0$

Q.48 The largest amount of energy is required for transition in a hydrogen atom is from?

(a) n = 3 to n = 5 (b) n = ∞ to n = 1 (c) n = 1 to n = 2 (d) None

Q.49 The electron population in an energy level is limited to?

(a) $2n$ (b) n (c) $2n^2 + 1$ (d) $2n^2$

Q.50 The ionization potential of H-atom is 13.6 eV. The amount of energy required to promote electron from $n = 1$ to $n = 2$ is?

(a) 10.2 eV (b) 8.7 eV (c) 8 eV (d) 20 eV

Q.51 The complete wavefunction Ψ_{400} represents?

(a) *4s* (b) *4p* (c) *4d* (d) *4f*

Q.52 The energy difference between the energy levels corresponding to *n = 1 and n = 5* for a particle of mass '*m*' in 1-D box of length '*a*' is?

(a) $\frac{3h^2}{ma^2}$ (b) $\frac{h^2}{ma^2}$ (c) $\frac{3h^2}{8ma^2}$ (d) $\frac{13h^2}{8ma^2}$

Q.53 A particle in 3-D cubic box of length L has energy of $27h^2/8mL^2$. The degeneracy of state is?

(a) 1 (b) 3 (c) 4 (d) 9

Q.54 The expression for the eigen function and eigen value for a particle of mass '*m*' in a 3-D box of dimension *a, b, c* are respectively: -

(a) $\psi = \sqrt{\frac{8}{abc}} sin\left(\frac{n_x \pi x}{a}\right) sin\left(\frac{n_y \pi y}{b}\right) sin\left(\frac{n_z \pi z}{c}\right)$ and $E = \frac{h^2}{8m}\left[\frac{nx^2}{a^2} + \frac{ny^2}{b^2} + \frac{nz^2}{c^2}\right]$

(b) $\psi = \sqrt{\frac{4}{abc}} sin\left(\frac{n_x \pi x}{a}\right) sin\left(\frac{n_y \pi y}{b}\right) sin\left(\frac{n_z \pi z}{c}\right)$ and $E = \frac{h^2}{4m}\left[\frac{nx^2}{a^2} + \frac{ny^2}{b^2} + \frac{nz^2}{c^2}\right]$

(c) $\psi = \sqrt{\frac{8}{abc}} sin\left(\frac{n_x \pi x}{a}\right) sin\left(\frac{n_y \pi y}{b}\right) sin\left(\frac{n_z \pi z}{c}\right)$ and $E = \frac{h}{8m}\left[\frac{nx^2}{a^2} + \frac{ny^2}{b^2} + \frac{nz^2}{c^2}\right]$

(d) $\psi = \sqrt{\frac{8}{abc}} sin\left(\frac{n_x \pi x}{a}\right) cos\left(\frac{n_y \pi y}{b}\right) tan\left(\frac{n_z \pi z}{c}\right)$ and $E = \frac{h^2}{8m}\left[\frac{nx^2}{a^2} + \frac{ny^2}{b^2} + \frac{nz^2}{c^2}\right]$

Q.55 The maximum radius ratio r_A / r_B for an atom A to fit into tetrahedral B lattice is?

(a) 0.732 (b) 0.414 (c) 0.225 (d) 0.155

Q.56 In hydrogen molecule, when hydrogen is replaced by deuterium. What will happen to the rotational constant B?

(a) Increase (b) Becomes zero (c) Decrease (d) Remains same

Q.57 The crystal plane for which interplanar separation $d_{hkl} = a/\sqrt{2}$ is?

(a) 1 1 0 (b) 1 1 1 (c) 2 2 1 (d) 2 2 2

Q.58 Bragg's law can be stated as

(a) $n\lambda = 2d \sin\theta$ (b) $n\lambda = 2a \sin\theta$ (c) $n\lambda = 3d \sin\theta$ (d) $n\lambda = 2\sin\theta$

Q.59 Which has maximum value of mean free path?

(a) CO_2 (b) H_2 (c) O_2 (d) N_2

Q.60 60g of urea is dissolved in 1100g solution. To keep $\Delta T/K_f$ as 1 mol/kg, water separated in the form of ice is

(a) 40 g (b) 60 g (c) 100 g (d) 200 g

Q.61 For reaction 2A+B → product, rate law is $-\frac{d[A]}{dt} = k[A]$. At a time t = $1/k$, concentration of the reactant is

(a) $\frac{C_0}{e}$ (b) $\frac{1}{C_0}$ (c) $\frac{C_0}{e^2}$ (d) $\frac{2}{C_0}$

Q.62 For a 1 molar aqueous solution of NaCl, the mean ionic activity coefficient ($\gamma_\pm$) and the Debye-Huckle limiting law constant (A) are related as?

(a) $log\ \gamma_\pm = \sqrt{2}A$ (b) $log\ \gamma_\pm = -\sqrt{2}A$ (c) $\gamma_\pm = 10^A$ (d) $\gamma_\pm = 10^{-A}$

Q.63 Ionic equivalent conductance value for Ca^{2+} is 0.0119 ($S\ m^2mol^{-1}$) and for Cl^- is 0.0076 ($S\ m^2mol^{-1}$). The correct expected molar conductivity at infinite dilution for $CaCl_2$ is?

(a) 0.0195 $S\ m^2mol^{-1}$ (b) 0.0271 $S\ m^2mol^{-1}$ (c) 0.0542 $S\ m^2mol^{-1}$ (d) 0.01355 $S\ m^2mol^{-1}$

Q.64 The most probable speed is expressed as?

(a) $\alpha = \left(\frac{3RT}{m}\right)^{1/2}$ (b) $\alpha = \left(\frac{2RT}{m}\right)^{1/2}$ (c) $\alpha = \left(\frac{8RT}{\pi m}\right)^{1/2}$ (d) $\alpha = \left(\frac{2RT}{m}\right)^{1/3}$

Q.65 The molecules which are IR-inactive but remain active is

(a) N_2 (b) HCl (c) SO_2 (d) Protein

Q.66 Temperature of 1 mol of gas is increased by 1° constant pressure. Work done:

(a) R (b) 2R (c) R/2 (d) 3R

Q.67 If E_0 is the zero-point energy of a harmonic oscillator of frequency v and h is the plank's constant than its energy in the n = 2 state will be

(a) (E_0+hv) (b) $2E_0$ (c) $4E_0$ (d) (E_0+2hv)

Q.68 Bromination of toluene gives

(a) Only 3-bromotoulene as product

(b) Only 4-bromotoulene as product

(c) Mixture of 2-bromotoulene and 4-bromotoulene as product

(d) Mixture of 3-bromotoulene and 4-bromotoulene as product

Q.69 SN^1 reaction on optically active substrate mainly gives

(a) Racemic product (b) Inversion of configuration

(c) Retention of configuration (d) No product

Q.70 The electrophilic substitution proceeds through

(a) Free radical (b) Sigma complex (c) Benzyne (d) Carbene

Q.71 Aldose and ketose are differentiated by

(a) Tollen's reagents (b) Fehling's reagents (c) Br_2 water (d) HIO_4

Q.72 Which one of the following reactions will not result in the formation of anisole

(a) Phenol + dimethyl sulfate in presence of base

(b) Sodium phenoxide treated with methyl iodide

(c) Reaction of diazomethane with phenol

(d) Reaction of methyl magnesium iodide with phenol

Q.73 2-acetoxy benzoic acid is known as

(a) Aspirin (b) Paracetamol (c) Ibuprofen (d) Wintergreen oil

Q.74 The number of signals observed in ^1H NMR of 1,3-dibromobenzene

(a) 3 (b) 4 (c) 2 (d) 6

Q.75 The fisher projection of meso-tartaric acid represents:

(a) Skew form (b) Staggered form (c) Eclipsed form (d) Gauche form

Q.76 What is the relationship between keto and enol tautomers?

(a) Resonance form (b) Stereoisomers

(c) Constitutional isomers (d) Differential conformations of the same compound

Q.77 Lucas reagent is

(a) Anhydrous $CuCl_2$ / HCl (b) Anhydrous $CuCl_2$ / H_2SO_4

(c) Anhydrous $ZnCl_2$ / HCl (d) Anhydrous $ZnCl_2$ / H_2SO_4

Q.78 Which of the following reacts fastest with NaOH, H_2O?

(a) Ethylene oxide(oxirane) (b) Cis-2,3-dimethyloxirane

(c) Trans-2,3-dimethyloxirane (d) 2,2,3,3-tetramethyloxirane

Q.79 The correct order of reactivity towards electrophilic aromatic substitution is:

(a) Furan > Thiophene > Pyrrole > Benzene (b) Thiophene > Furan > Pyrrole > Benzene

(c) Benzene > Thiophene > Furan > Pyrrole (d) Pyrrole > Furan > Thiophene > Benzene

Q.80 Ethylene molecule may be joined together in large numbers to form polymers which of the following best describes this process?

(a) Electrophilic addition catalysed by an acid (b) Nucleophilic addition catalysed by an acid

(c) Addition reaction involves free radicals (d) Substitution reaction catalysed by oxygen

Q.81 Amino acids with OH group are

(a) Serine and alanine (b) Alanine and valine

(c) Serine and threonine (d) Valine and isoleucine

Q.82 Which of the following techniques would be most useful to identify and qualify the presence of a known impurity in a drug substance?

(a) HPLC (b) NMR (c) IR (d) UV

Q.83 Which of the following compounds does not absorb the light in the UV/visible spectrum?

(a) Aspirin (b) Paracetamol (c) Chloral hydrate (d) Phenobarbitone

Q.84 Victor Mayer test is used for the formation of

(a) 1°, 2°, 3° Amines (b) 1°, 2°, 3° Alcohols (c) Carbonyl group (d) Nitro group

Q.85 Correct statement about carbonyl stretching frequency in the IR of cyclopentanone and cyclohexanone is?

(a) Both have same frequency stretching

(b) Cyclopentanone: 1745 cm^{-1}; Cyclohexanone: 1715 cm^{-1}

(c) Cyclopentanone: 1715 cm^{-1}; Cyclohexanone: 1745 cm^{-1}

(d) Cyclopentanone: 1690 cm^{-1}; Cyclohexanone: 1675 cm^{-1}

Q.86 Major product that would be formed when 2-bromohexane undergoes 1 : 1 elimination reaction

(a) Z-2-hexane (b) 1-Hexane (c) E-2-Hexane (d) Mixture of E/Z 2-hexane

Q.87 Electrophilic substitution in pyridine occurs at

(a) At -N atom (b) 2-postion (c) 3-position (d) 4-position

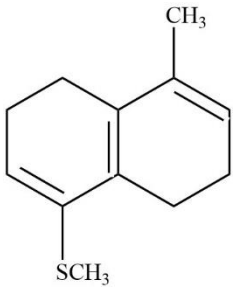
Q.88 The spin state of the electron at the instant of excitation?

(a) Changes (b) Remain same (c) May or may not change (d) None

Q.89 Shift of the absorption maxima towards larger wavelength is known as ?

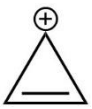
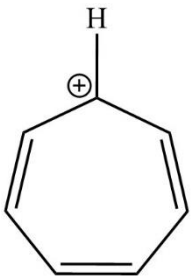
(a) Blue shift (b) Bathochrome shift (c) Hyperchromic shift (d) None

Q.90 The value for λ_{max} for the following compound is?

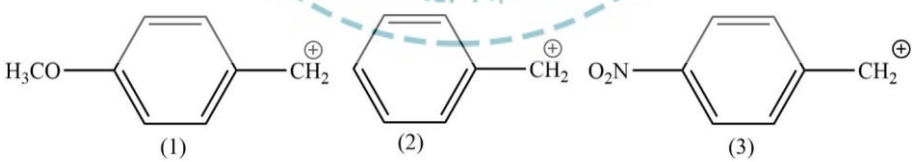


(a) 323 nm (b) 338 nm (c) 353 nm (d) 370 nm

Q.91 Which of the following compound is not aromatic:

(a)  (b)  (c)  (d) 

Q.92 Stability of the following carbocations follows the order:

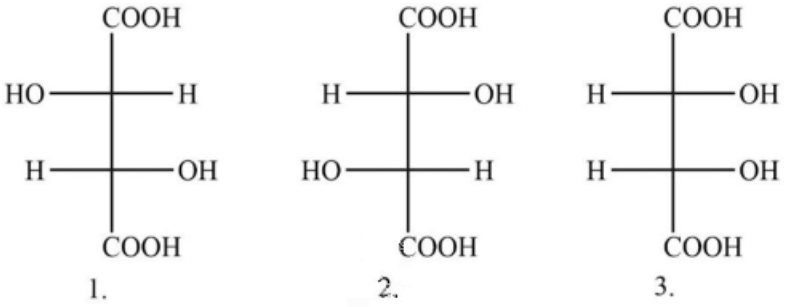


(a) 3 > 2 > 1 (b) 1 > 2 > 3 (c) 2 > 3 > 1 (d) 1 > 3 > 2

Q.93 Carbocations are stabilized by:

(a) 1,4-shift (b) 1,3-shift (c) 1,2-shift (d) None

Q.94 Configuration for following molecules are respectively:



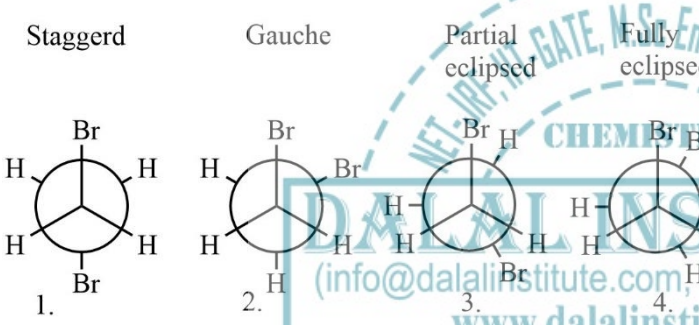
(a) (2S, 3S), (2R, 3R), (2R, 3S)

(b) (2R, 3R), (2S, 3S), (2R, 3S)

(c) (2S, 3R), (2R, 3R), (2R, 3S)

(d) (2R, 3R), (2R, 3S), (2S, 3R)

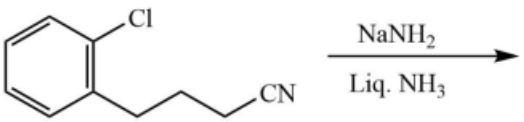
Q.95 Consider the following conformations of 12-dibromoethane:

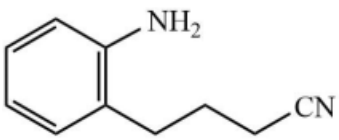


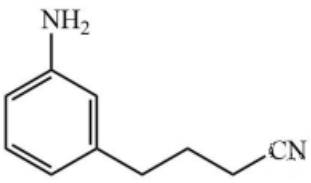
The order of stability is?

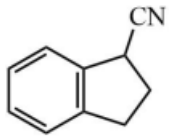
(a) 1 > 3 > 2 > 4 (b) 4 > 3 > 2 > 1 (c) 3 > 2 > 1 > 4 (d) 1 > 2 > 3 > 4

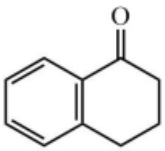
Q.96 The major product formed in the following reaction is



(a) 

(b) 

(c) 

(d) 

Q.97 Number of angular nodes in $4d_z^2$ orbital?

(a) Two (b) One

(c) Zero (d) Three

Q.98 Which of the following cannot be obtained from microwave spectroscopy?

(a) Moment of inertia (b) Bond length

(c) Functional group (d) Relative abundance of an isotope

Q . 99 Correct characteristics of the functional groups of adenine in DNA base pair are

(a) N) 3 (is a hydrogen bond acceptor and C) 6 (NH_2 is a hydrogen bond donor .

(b) N) 1 (is a hydrogen bond acceptor and C) 6 (NH_2 is a hydrogen bond donor .

(c) Both N) 3 (and C) 6 (NH_2 are hydrogen bond acceptors .

(d) Both N) 1 (and C) 6 (NH_2 are hydrogen bond acceptors

Q.100 Which is not an anti-cancerous durg ?

(a) Vincristine (b) Cyclophosphamide (c) Doxorubicin (d) Gabapentin

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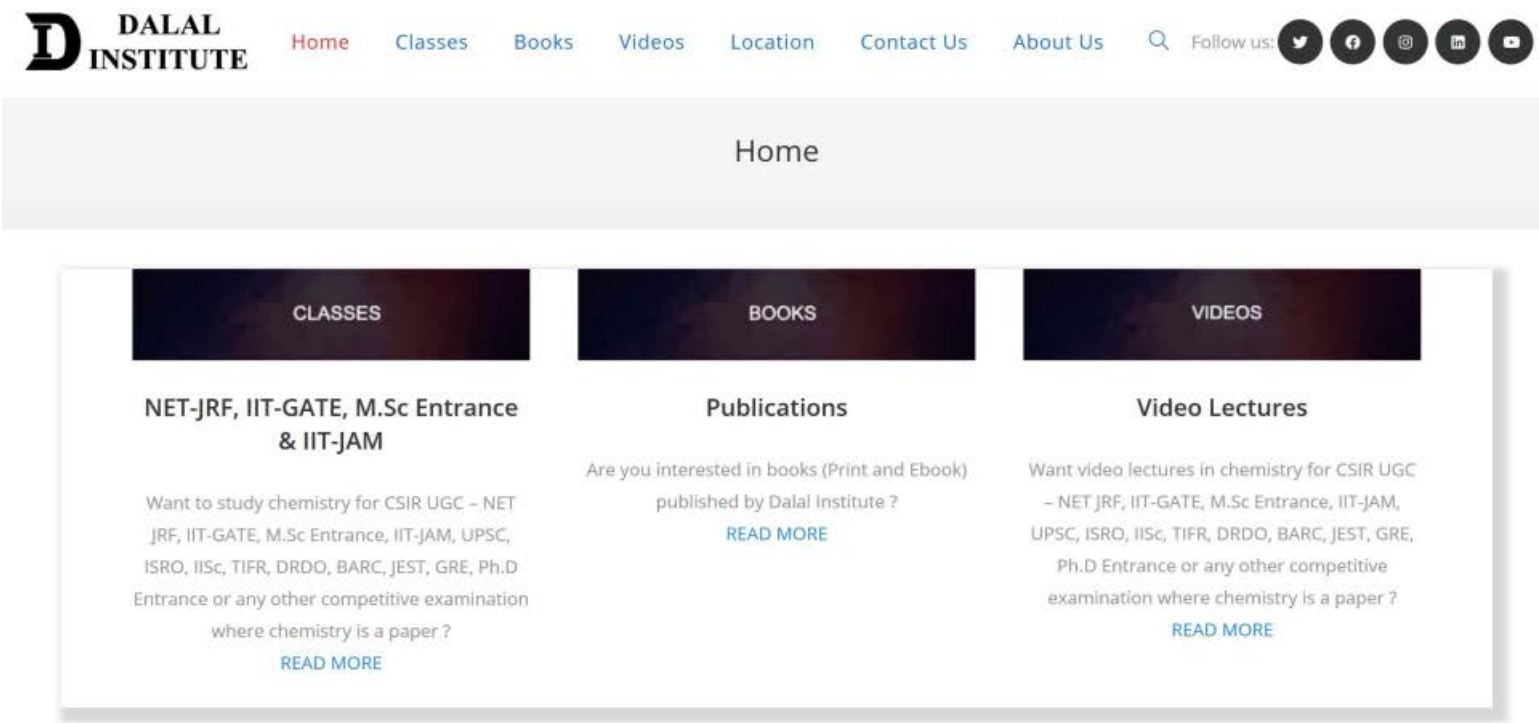

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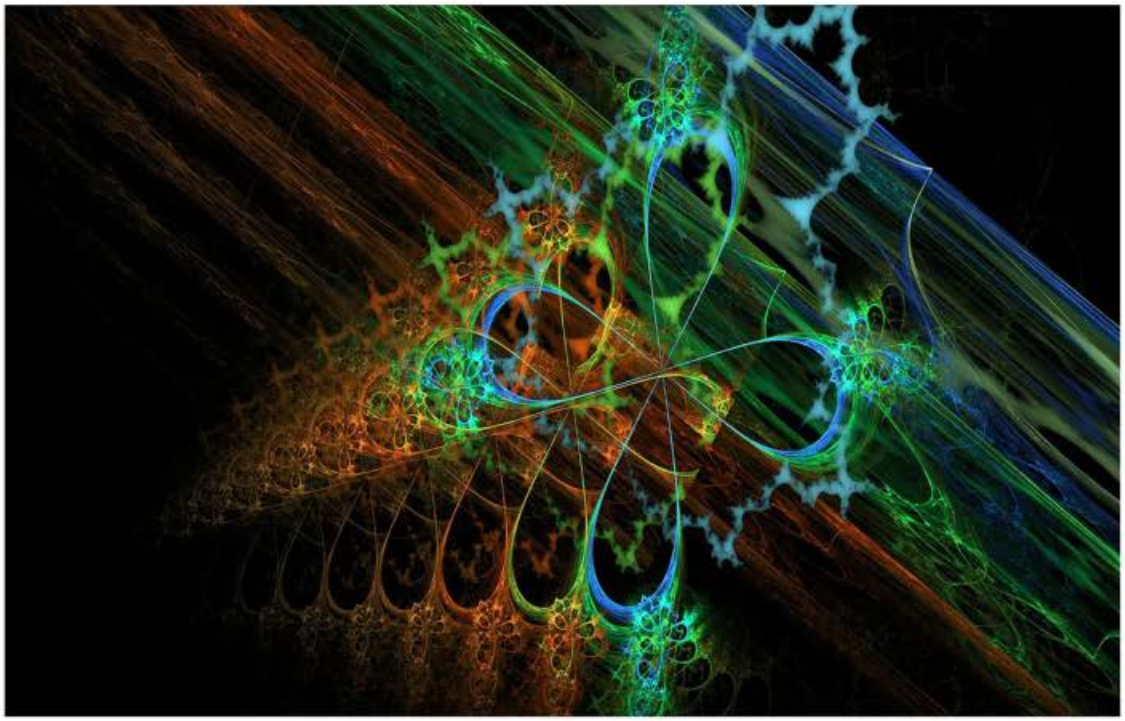

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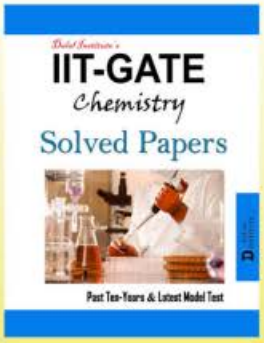

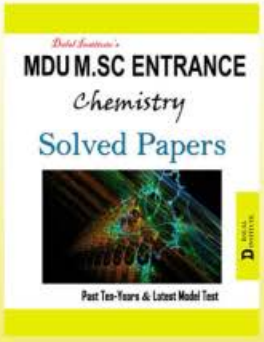

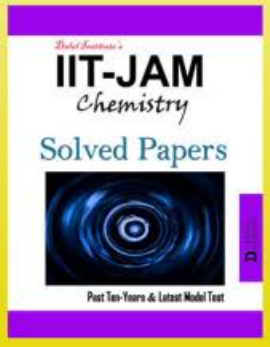

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