SET–"X"

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

(MPH/PHD/URS–EE–2020)

CHEMISTRY

Code **A**

Sr. No. 10013

Time : 1¼ Hours **Total Questions : 100** **Max. Marks : 100**

Roll No. _____ (in figure) _____ (in words)

Name : _____ Father's Name : _____

Mother's Name : _____ Date of Examination : _____

(Signature of the candidate) (Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/ INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. **All questions are compulsory.**
2. The candidates must return the Question book-let as well as OMR answer-sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A,B,C and D code will be got uploaded on the university website after the conduct of Entrance Examination. In case there is any discrepancy in the Question Booklet/Answer Key, the same may be brought to the notice of the Controller of Examination in writing/through E-Mail within 24 hours of uploading the same on the University Website. Thereafter, no complaint in any case, will be considered.
5. The candidate MUST NOT do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question book-let itself. Answers **MUST NOT** be ticked in the Question book-let.
6. **There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.**
7. Use only Black or Blue <u>BALL POINT PEN</u> of good quality in the OMR Answer-Sheet.
8. BEFORE ANSWERING THE QUESTIONS, THE CANDIDATES SHOULD ENSURE THAT THEY HAVE BEEN SUPPLIED CORRECT AND COMPLETE BOOK-LET. COMPLAINTS, IF ANY, REGARDING MISPRINTING ETC. WILL NOT BE ENTERTAINED 30 MINUTES AFTER STARTING OF THE EXAMINATION.

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Question No.	Questions
1.	A sudden large jump between the values of second and third ionisation energies of elements would be associated with which of the following electronic configurations ? (1) $1s^2\ 2s^2\ 2p^6\ 3s^1$ (2) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$ (3) $1s^2\ 2s^2\ 2p^6\ 3s^1\ 3p^2$ (4) $1s^2\ 2s^2\ 2p^6\ 3s^2$
2.	Among the following groupings which represents the collection of isoelectronic species ? (1) NO^+, C_2^{2-}, O_2, CO (2) N_2, C_2^{2-}, NO, CO (3) CO, N_2, CN^-, C_2^{2-} (4) NO, CN^-, N_2, O_2^-
3.	In the Molecular orbital diagram for O_2^+ ion the highest occupied orbital is : (1) σ MO orbital (2) π MO orbital (3) π^* MO orbital (4) σ^* MO orbital
4.	The correct order of hybridization of the central atom in the following species, NH_3, $[PtCl_4]^{2-}$, PCl_5, and BCl_3, is respectively : (1) dsp^2, dsp^3, sp^2, sp^3 (2) sp^3, dsp^2, dsp^3, sp^2 (3) dsp^2, sp^2, sp^3, dsp^3 (4) dsp^2, sp^3, sp^2, dsp^3
5.	Which of the following structure is most expected for the molecule $XeOF_4$? (1) Tetrahedral (2) Square Pyramid (3) Square planar (4) Octahedral

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Question No.	Questions
6.	Among the following, which is the weakest Lewis base ? (1) CH_3^- (2) NH_2^- (3) OH^- (4) F^-
7.	CH_3HgOH is classified as : (1) Soft - Hard (2) Soft - Soft (3) Hard - Hard (4) Hard - Soft
8.	$[Co(NH_3)_4(NO_2)_2]Cl$ exhibits : (1) Linkage isomerism, ionisation isomerism and optical isomerism. (2) Linkage isomerism, ionisation isomerism and geometrical isomerism. (3) Ionisation isomerism, geometrical isomerism and optical isomerism. (4) Linkage isomerism, geometrical isomerism and optical isomerism.
9.	Which one of the following shows maximum value of paramagnetic behaviour ? (1) $[Sc(CN)_6]^{3-}$ (2) $[Co(CN)_6]^{3-}$ (3) $[Fe(CN)_6]^{3-}$ (4) $[Cr(CN)_6]^{3-}$

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Question No.	Questions
10.	In which of the following pairs are both the ions coloured in aqueous solution ? (1) Ni^{2+}, Ti^{3+} (2) Sc^{3+}, Ti^{3+} (3) Sc^{3+}, Co^{2+} (4) Ni^{2+}, Cu^{+}
11.	Stainless steel does not rust because : (1) Chromium and nickel combine with iron (2) Chromium forms an oxide layer and protects iron from rusting (3) Nickel present in it, does not rust (4) Iron forms a hard chemical compound with chromium present in it
12.	The pair whose both species are used in antacid medicinal preparations is : (1) $NaHCO_3$ and $Mg(OH)_2$ (2) Na_2CO_3 and $Ca(HCO_3)_2$ (3) $Ca(HCO_3)_2$ and $Mg(OH)_2$ (4) $Ca(OH)_2$ and $NaHCO_3$
13.	Artificial gem used for cutting glass is : (1) graphite (2) diamond (3) SiC (4) $CaCN_2$
14.	Phosgene can be obtained when : (1) White phosphorus reacts with alkali. (2) Calcium phosphide reacts with water. (3) Chloroform reacts with air. (4) Bone comes in contact with water.

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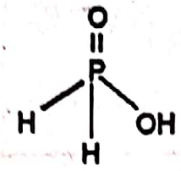
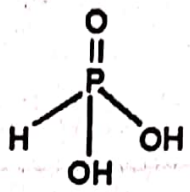
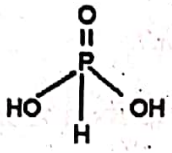
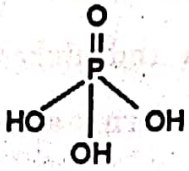
Question No.	Questions
15.	The structural formula of hypophosphorous acid is : (1)  (2)  (3)  (4) 
16.	In which of these processes platinum is used as a catalyst ? (1) Production of synthetic rubber (2) Hardening of oils (3) Oxidation of ammonia to form HNO_3 (4) Synthesis of methanol
17.	In Zeigler - Natta polymerisation of ethylene, the active species is : (1) $AlCl_3$ (2) Et_3Al (3) Ti^{III} (4) $TiCl_4$
18.	Which of the following is not an example of organometallic compound ? (1) Trimethylboron (2) Trimethylaluminium (3) Trimethoxytitanium chloride (4) Tetracarbonylnickel

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Question No.	Questions
19.	The nuclear reaction : $^{63}_{29}Cu + {}^{4}_{2}He \rightarrow {}^{37}_{17}Cl + 14\,{}^{1}_{1}H + 16\,{}^{1}_{0}n$ is referred to as : (1) Spallation reaction (2) Fusion reaction (3) Fission reaction (4) Chain reaction
20.	The nucleus resulting from $_{92}U^{238}$ after successive emission of two α and four β–particles is : (1) $_{90}Th^{230}$ (2) $_{94}Pu^{230}$ (3) $_{88}Ra^{230}$ (4) $_{92}U^{230}$
21.	The metal species present in Nitrogenase is : (1) Zinc (2) Molybdenum (3) Tungsten (4) Lead
22.	Which of the following compounds will show quadrupole splitting in Mossbauer spectroscopy ? (1) $K_4 Fe(CN)_6$ (2) $FeCl_3$ (3) $Fe_2(SO_4)_3$ (4) $FeSO_4$
23.	The most widely used standard reference substance in ESR is : (1) 1, 1 –diphenyl –2–Picryl – hydrazyl free radical (2) 1, 1 –diphenyl –2–Picryl – hydroxyl free radical (3) TMS (4) None of these

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Question No.	Questions
24.	In DTA, the differential temperature Vs temperature or time curve is highly sensitive to : (1) Heating rate (2) Sample size (3) Sample packing (4) All of these
25.	Radio metric titrations have been applied for : (1) Determination of the composition of compound (2) Investigation of co-precipitation (3) Determination of the specific activity of radioactive preparations (4) All of these
26.	Cytochromes in biological systems are involved in : (1) Proton transfer (2) Oxygen transfer (3) Electron transfer (4) Metal transfer
27.	In Ferrocene which metal orbital interact more effectively with ligand group orbital ? (1) $3d_z^2$ (2) $3d_{xy}$ $3d_{x^2-y^2}$ (3) $4P_x 4P_y$ (4) $3d_{xz}$, $3d_{yz}$
28.	The Electroanalytical technique in which the potential of the working electrode is stepped and the resulting current is monitored as a function of time is : (1) Coulometry (2) Chronopotentiometry (3) Chronoamperometry (4) Pulse polarography

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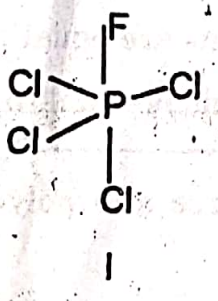
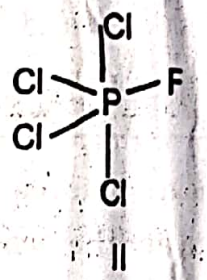
Question No.	Questions
29.	Lithium drugs are used in treatment of : (1) Dental caries (2) Psychiatric disorder (3) Malaria (4) Arthritis
30.	Which alkylating agent is used as Anticancer Drug in treatment of most of the cancers ? (1) Melphan (2) Cyclophosphamide (3) Chlorambucil (4) None of these
31.	How many signals are present in both isomers in NQR spectroscopy ?  I  II (1) two (2) three (3) one (4) four
32.	Auxochrome when attached to chromophore absorption band is shifted towards longer wavelength due to increase in : (1) Bonding (2) Conjugation (3) Inductive effect (4) None of these
33.	The quantitative shifting in PMR signals in addition to shielding and deshielding the protons also depends upon the : (1) Inductive effect (2) Space effect (3) H–bonding (4) All of above

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Question No.	Questions
34.	Ionic equivalent conductance value for Ca^{2+} is 0.0119 S m^2 mol^{-1} and for Cl^- is 0.0076 S m^2 mol^{-1}. The correct expected molar conductivity at infinite dilution for $CaCl_2$ is : (1) 0.0195 S m^2 mol^{-1} (2) 0.0271 S m^2 mol^{-1} (3) 0.0542 S m^2 mol^{-1} (4) 0.01355 S m^2 mol^{-1}
35.	A binary mixture of A_2 and B_2 will show negative deviation from Raoult's law when : (1) A–A and B–B interactions are stronger than A–B (2) A–A and B–B interactions are weaker than A–B (3) Both A–A and B–B interactions are equal to A–B (4) Either A–A or B–B interactions is equal to A–B
36.	The molar masses of monodisperse and polydisperse polymers obey respectively the conditions : (M_n=Number average molecular weight and M_w=Weight average molecular weight). (1) $M_n > M_w$ and $< M_w$ (2) $M_n = M_w$ and $M_n < M_w$ (3) $M_n < M_w$ and $M_n < M_w$ (4) $M_n = M_w$ and $M_n = M_w$
37.	$CH_3COOC_2H_5$ (aq) + H_3O^+ (ℓ) $\rightarrow$ CH_3COOH(aq)+C_2H_5OH(aq). What type of reaction is this ? (1) Unimolecular (elementary) (2) Pseudo first order (3) Zero order (4) Second order

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Question No.	Questions
38.	Micelle formation is accompanied by the : (1) decrease in overall entropy due to ordering of solvent near hydrophobic ends. (2) increase in overall entropy mostly due to increase in solvent entropy. (3) increase in overall entropy, mostly due to increase in solute entropy. (4) increase in overall entropy and decrease in enthalpy.
39.	The rotational partition function is expected to be smallest for the molecule, among the following : (1) H_2 (2) Li_2 (3) N_2 (4) F_2
40.	The temperature derivative of electrochemical cell potential E at constant pressure, $\left(\frac{\partial E}{\partial T}\right)_P$, is given by : (1) $-\frac{\Delta S}{nF}$ (2) $\frac{\Delta S}{nF}$ (3) $\frac{\Delta S}{nFT}$ (4) $-\frac{\Delta S}{nFT}$
41.	The number of rotational degrees of freedom of CO_2 is : (1) one (2) two (3) three (4) four

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Question No.	Questions
42.	When crystals of sodium chloride are heated in the presence of sodium vapor, they turn yellow. This is due to the formation of: (1) Schottky defects (2) Frenkel defects (3) F-centres (4) H-centres
43.	Of the following inequalities, the criterion/criteria for spontaneity of a chemical reaction is/are : (i) $(\Delta G)_{T,P} < 0$ (ii) $(\Delta U)_{S,V} > 0$ (iii) $(\Delta S)_{U,V} > 0$ (1) (i) only (2) (ii) only (3) (i) and (ii) (4) (i) and (iii)
44.	The concentration of a reactant decreases linearly with time. What is the order of the reaction ? (1) 1st order (2) Fractional order (3) 2nd order (4) Zero order
45.	The absorbance of solution having 20% transmittance is : (1) 0.301 (2) 0.699 (3) 1.301 (4) 1.699
46.	Electrolysis of an aqueous solution of 1.0 M NaOH results in : (1) Na at the cathode and O_2 at the anode. (2) H_2 at the cathode and O_2 at the anode. (3) Na and H_2 at the cathode and O_2 at the anode. (4) O_2 at the cathode and H_2 at the anode.

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Question No.	Questions
47.	The rate constant of decomposition of a compound is represented by $\ln K = 5.0 - \frac{12000}{T}$ The value of E_A (in Kcal mol^{-1}) for this compound at 300 K is : (1) 24 (2) 12 (3) 240 (4) 120
48.	For a reaction $2A \rightarrow$ Product the initial concentration of A is 0.1 M and the rate constant is $2 \times 10^{-3} dm^3 mol^{-1} s^{-1}$. The half life period of the reaction is : (1) 5 sec (2) 50 sec (3) 500 sec (4) 5000 sec
49.	The number of degenerate spatial orbitals of a hydrogen-like atom with principal quantum number n=6 is : (1) 12 (2) 6 (3) 72 (4) 36
50.	If the atoms/ions in the crystal are taken to be hard spheres touching each other in the unit cell, then the fraction of volume occupied in the body centered cubic structure is : (1) $\sqrt{3}\pi$ (2) $\frac{\sqrt{2}}{6}\pi$ (3) $\frac{\pi}{6}$ (4) $\frac{\sqrt{3}}{8}\pi$

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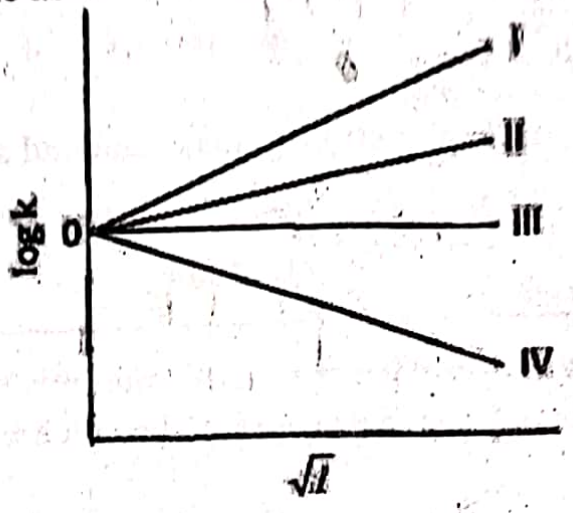
Question No.	Questions
51.	The plot of the rate constant vs. ionic strength of the reaction $A^{2+} + B^-$ follows the line as shown in the figure :  (1) I (2) II (3) III (4) IV
52.	Reaction between A and B is carried out for different initial concentrations and the corresponding half-life times are measured. The data are listed in the table :

Entry	$[A_o]$ M	$[B_o]$ M	$t_{1/2} s^{-1}$
1	500	10	60
2	500	20	60
3	10	500	60
4	20	500	30

The rate can be represented as :

(1) $k[A][B]$ (2) $k[A]^2$

(3) $k[A]^2[B]$ (4) $k[A][B]^2$

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Question No.	Questions
53.	The separation of the (123) planes of an orthorhombic unit cell is 3.12 nm. The separation of (246) and (369) planes are, respectively : (1) 1.56 nm and 1.04 nm (2) 1.04 nm and 1.56 nm (3) 3.12 nm and 1.50 nm (4) 1.04 nm and 3.12 nm
54.	The predicted electromotive force (emf) of the electrochemical cell $Fe(s) / Fe^{2+}(aq)\ (0.01M) \| Cd^{2+}(aq)\ (0.01M)/Cd(s)$ ($E^{o}_{(Fe^{2+}/Fe)} = -0.447V$ and $E^{o}_{Cd^{2}/Cd} = -0.403V$) (1) –0.850V (2) +0.044V (3) +0.0850V (4) –0.044V
55.	For a particle of mass m in a 1-D box of length 2L, the energy of level corresponding to n=8 is : (1) $\frac{h^2}{8ml^2}$ (2) $\frac{h^2}{32ml^2}$ (3) $\frac{4h^2}{ml^2}$ (4) $\frac{2h^2}{ml^2}$
56.	A thermodynamic equation that relates chemical potential to the composition of a mixture is known as : (1) Gibbs Helmholtz equation (2) Gibbs-Duhem equation (3) Joule-Thomson equation (4) Debye Huckel equation

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Question No.	Questions
57.	One mole of monontomic gas is transformed from 300K and 2 atm to 600K and 4 atm. The entropy change for the process is : (1) $\frac{3}{2}R\,ln\,2$ (2) $\frac{1}{2}R\,ln\,2$ (3) $\frac{7}{2}R\,ln\,2$ (4) $\frac{5}{2}R\,ln\,2$
58.	The electrical double layer model that consist of both the fixed layer and diffused layer among the following is : (1) Helmholtz (2) Gouy (3) Stern (4) Debye Huckel
59.	If e^{ax} is an eigen function and d^n/dx^n is an operator then the eigen value will be : (1) a^n (2) a (3) n (4) n^a
60.	The Gibbs energy for the decomposition of Al_2O_3 at 500°C is as follows : $\frac{2}{3}Al_2O_3 \rightarrow \frac{4}{3}Al + O_2$, $\Delta_r G = +966$ kJ mol^{-1} The potential difference needed for electrolytic reduction of Al_2O_3 at 500°C is at least : (1) 2.5 V (2) 5.0 V (3) 4.5 V (4) 3.0 V

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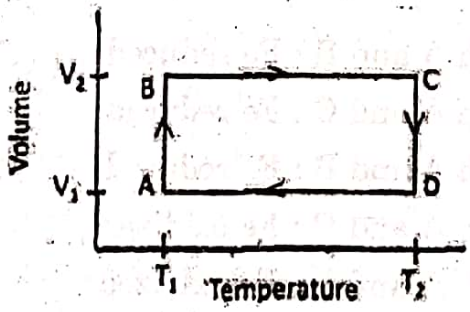
Question No.	Questions
61.	The equilibrium constants k_{p_1} and k_{p_2} for the reactions $X \rightleftharpoons 2Y$ and $Z \rightleftharpoons P + Q$, respectively are in the ratio of 1:9. If the degree of dissociation of X and Z be equal then the ratio of total pressure at these equilibria is : (1) 1:36 (2) 1:1 (3) 1:3 (4) 1:9
62.	Four distinguishable molecules are distributed in energy levels E_1 and E_2 with degeneracy of 2 and 3, respectively. Number of microstates, with 3 molecules in energy level E_1 and one in energy level E_2 is : (1) 4 (2) 12 (3) 96 (4) 192
63.	One mole of an ideal gas undergoes a cyclic process (ABCDA) starting from point A through 4 reversible steps as shown in the figure. Total work done in the process is :  (1) $R(T_1 - T_2)\frac{V_2}{V_1}$ (2) $R(T_1 + T_2)\frac{V_2}{V_1}$ (3) $R(T_1 + T_2)\, ln\, \frac{V_2}{V_1}$ (4) $R(T_1 - T_2)\, ln\, \frac{V_2}{V_1}$

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Question No.	Questions
64.	If the specific conductance of an electrolyte solution is 0.2 ohm^{-1} cm^{-1} and cell constant is 0.25, the conductance of the solution is : (1) 1.25 ohm^{-1} (2) 1.0 ohm^{-1} (3) 0.8 ohm^{-1} (4) 2.0 ohm^{-1}
65.	The slope and intercept obtained from (1/Rate) against (1/substrate concentration) of an enzyme catalyzed reaction are 300 and 2×10^5, respectively. The Michaelis-Menten constant of the enzyme in this reaction is : (1) 5×10^6 M (2) 5×10^{-6} M (3) 1.5×10^3 M (4) 1.5×10^{-3} M
66.	Given ; A. $Fe(OH)_2(s) + 2e^- \rightarrow Fe(s) + 2OH-(aq)$; $E_0 = -0.877V$ B. $Al^{3+}(aq) + 3e^- \rightarrow Al(s)$; $E_0 = -1.66V$ C. $AgBr(aq) + e^- \rightarrow Ag(s) + Br^-(aq)$; $E_0 = 0.071V$ The overall reaction for the cells in the direction of spontaneous change would be 1. Cell with A and B : Fe reduced Cell with A and C : Fe reduced 2. Cell with A and B : Fe reduced Cell with A and C : Fe oxidized 3. Cell with A and B : Fe oxidized Cell with A and C : Fe oxidized 4. Cell with A and B : Fe oxidized Cell with A and C : Fe reduced

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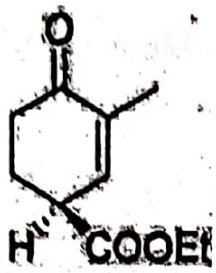
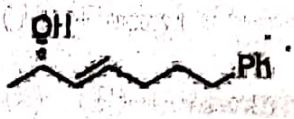
Question No.	Questions
67.	IUPAC name of the following compound is :  (1) Pethyl (S)-3-methyl-4-oxocyclohex-2-enecarboxylate (2) (R)-4-ethoxycarbonyl-2-methyl-4-oxocyclohex-2-enone (3) ethyl (R)-3-methyl-4-oxocyclohex-2-enecarboxylate (4) (S)-4-ethoxycarbonyl-2-methyl-4-oxocyclohex-2-enone
68.	Compound given below may be named as :  (1) (2R, 3Z)-7-phenylhept-3-en-2-ol (2) (2R, 3E)-7-phenylhept-3-en-2-ol (3) (2S, 3E)-7-phenylhept-3-en-2-ol (4) (2S, 3Z)-7-phenylhept-3-en-2-ol

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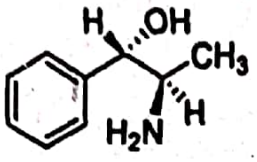
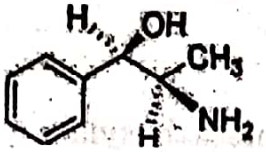
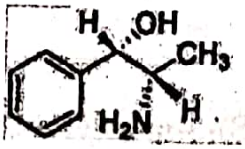
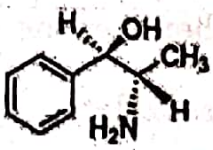
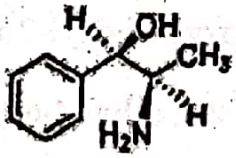
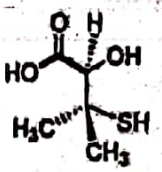
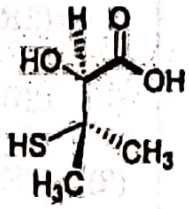
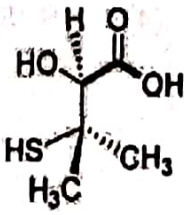
Question No.	Questions
69.	Enantiomer of the following structure is :  (1)  (2)  (3)  (4) 
70.	 A Consider compound A and choose the correct answer : (1) A could be optically active and its diastereomer is  (2) A could be optically active and its enantiomer is 

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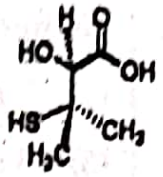
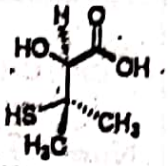
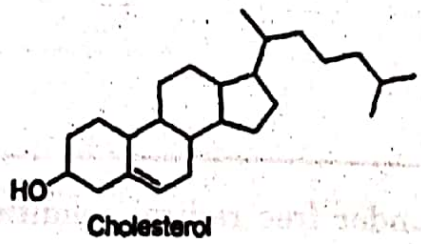
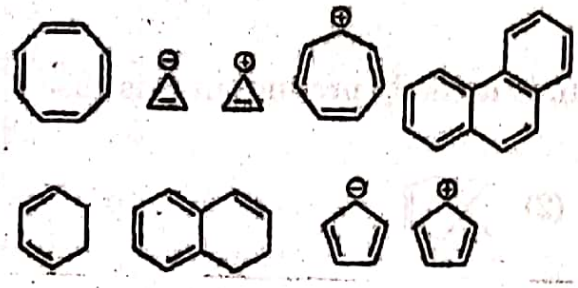
Question No.	Questions
	(3) A could be optically inactive and its diastereomer is  (4) A could be optically inactive and its enantiomer is 
71.	 Cholesterol Number of Optical isomers in Cholesterol would be : (1) 128 (2) 512 (3) 64 (4) 256
72.	Among the following structures, the number of aromatic compound(s) is :  (1) 3 (2) 4 (3) 5 (4) 6

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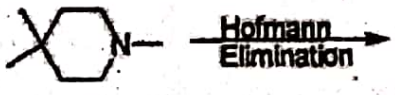
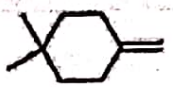
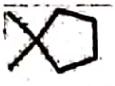
Question No.	Questions
73.	Number of sp^3 and sp hybridized carbon atoms present in benzyne is : (1) 3 and 1 (2) 6 and 0 (3) 4 and 2 (4) 4 and 0
74.	$\overset{\oplus}{C}H_3$, $\overset{\oplus}{C}H_3$, $CH_3\overset{\oplus}{C}H_2$, $CH_3\overset{\oplus}{C}HCH_3$ Number of carbonium ions in the above list is : (1) 4 (2) 3 (3) 2 (4) 1
75.	In the chlorination of 1-chlorobutane under free radical conditions, the most abundant compound formed is : (1) 1,1-dichlorobutane (2) 1,2-dichlorobutane (3) 1,3-dichlorobutane (4) 1,4-dichlorobutane
76.	Repeated Hofmann Elimination reaction will often remove a nitrogen atom from an amine molecule.  Which of the following compounds is likely product in this case ? (1) (2) (3)  (4) 

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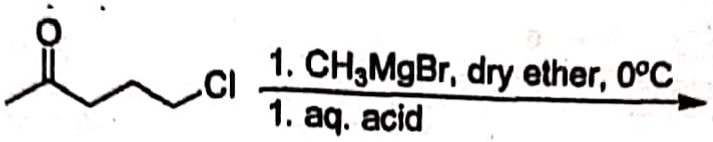
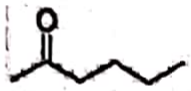
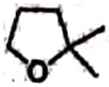
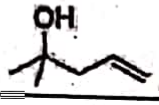
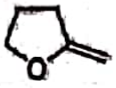
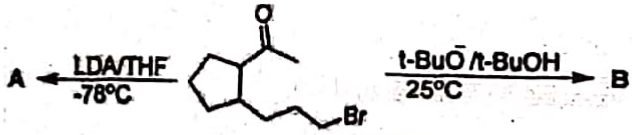
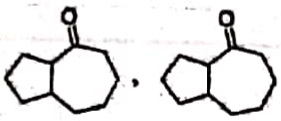
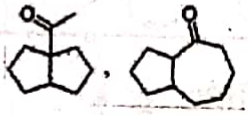
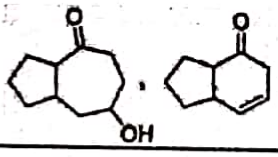
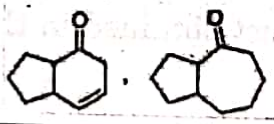
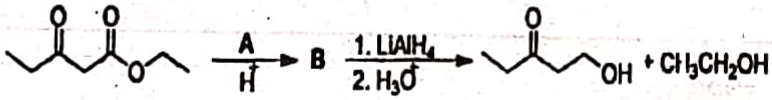
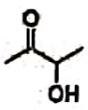
Question No.	Questions
77.	Major product of the following reaction is :  (1)  (2)  (3)  (4) 
78.	 Major product A and B are respectively : (1)  (2)  (3)  (4) 
79.	Identify A in the following reaction sequence :  (1) (2)  (3) (4) HCN

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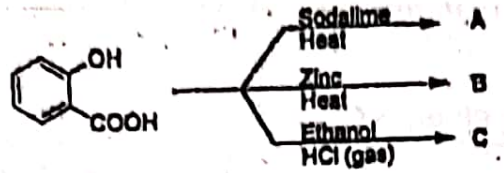
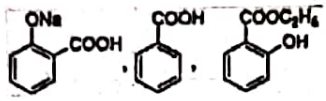
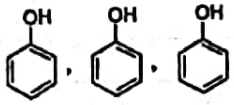
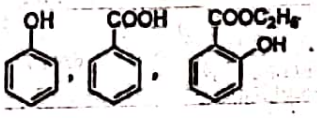
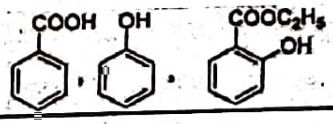
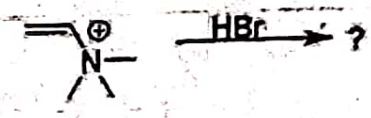
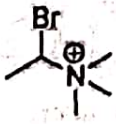
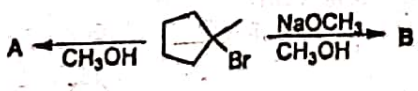
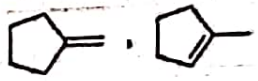
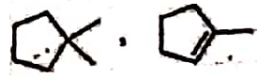
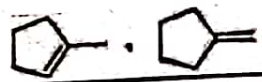
Question No.	Questions
80.	 Products A, B and C respectively are : (1)  (2)  (3)  (4) 
81.	 Major product obtained in this reaction is : (1)  (2) (3) $H_2C=CH_2$ (4)
82.	 Products A and B respectively are : (1)  (2)  (3) (4) 

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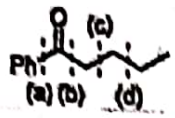
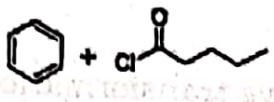
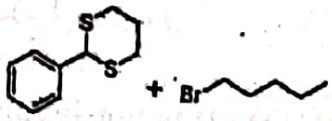
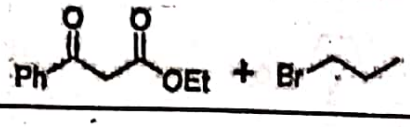
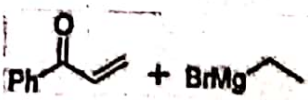
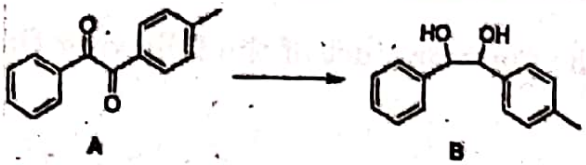
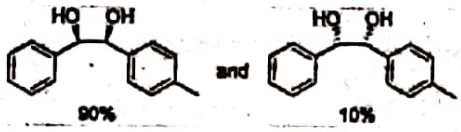
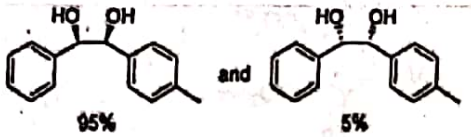
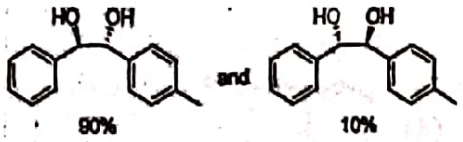
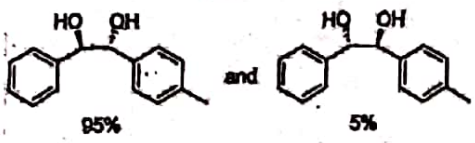
Question No.	Questions
83.	Which combination of reagents is wrong for disconnections (a)–(d) in the following ?  (1)  (2)  (3)  (4) 
84.	Stereoselective reduction of the dione A with a chiral reducing agent provides the corresponding diol B in 100% diastereoselectivity and 90% ee favoring R, R configuration.  A B The composition of the product is : (1)  (2)  (3)  (4) 

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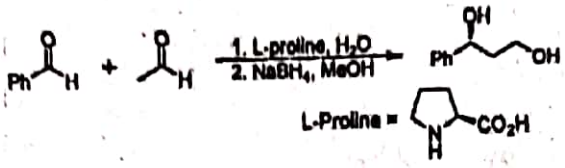
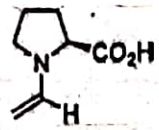
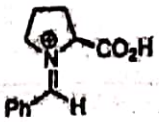
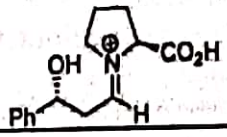
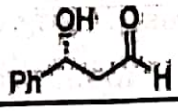
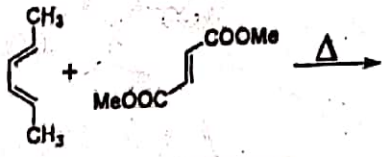
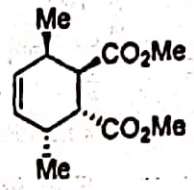
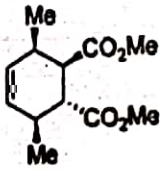
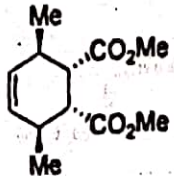
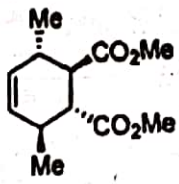
Question No.	Questions
85.	An α-amino acid, L–proline, can be used as a catalytic chiral auxiliary for a stereoselective aldol reaction.  Which of (1)-(4) is not involved in the above transformation ? (1)  (2)  (3)  (4) 
86.	Which of adducts (1)-(4) is the main product of the following Diels-Alder reaction ?  (1)  (2)  (3)  (4) 

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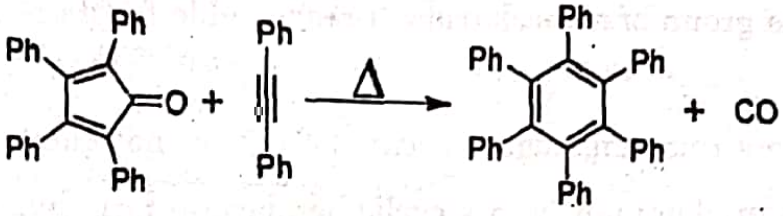
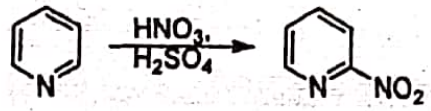
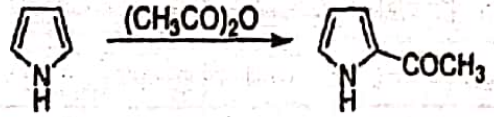
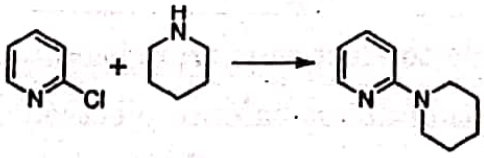
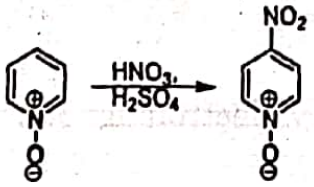
Question No.	Questions
87.	The following involves two pericyclic reactions. Which combination indicates correctly the types of reaction involved ?  (1) [4+2] cycloaddition + [2+2] cycloreversion (2) cheletropic reaction + [4+2] cycloaddition (3) [4+2] cycloaddition + [4+1] cycloreversion (4) [4+2] cycloaddition + cheletropic reaction
88.	Which of the following equations shows an unlikely result ? (1)  (2)  (3)  (4) 

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Question No.	Questions
89.	Which of the following statements regarding the reducing ability of a sugar is wrong ? (1) The aldehyde group of a saccharide is responsible for its reducing properties. (2) Ketoses are not reducing sugars because they are not aldehydes. (3) D-Glucose in predominantly in a cyclic hemiacetal form but it is a reducing sugar through the acyclic form with which the hemiacetal is in equilibrium. (4) A methyl glucoside is not a reducing sugar.
90.	Which of the following is not an important secondary structural feature in large peptides and proteins ? (1) the α-helix (2) the β-turn (3) chair conformations (4) the β-pleated sheet
91.	Which of the following statements is wrong ? (1) UV absorption is attributable to electronic transitions. (2) UV spectra provide information about valence electrons. (3) IR absorption is attributable to transitions between rotational energy levels of whole molecules. (4) NMR spectrometers use radiofrequency electromagnetic radiation.

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Question No.	Questions
92.	Which of the following statements regarding mass spectrometry is false ? (1) The base peak of a simple ketone is usually attributable to an acylium ion. (2) The molecular ion of carbonyl compounds with a –C-H readily undergoes elimination of an alkene to give a relatively stable enol radical cation. (3) The molecular ion peak of some alcohols is very weak because it readily loses an alkyl radical to give a relatively stable oxonium (hydroxycarbenium) ion. (4) Structurally isomeric alkanes cannot be distinguished by low resolution mass spectrometry.
93.	Neopentyl chloride, $(CH_3)_3CCH_2Cl$, reacts with the strong base sodium amide to form a new compound. This compound has a molecular ion at m/z = 70 amu and displays two ^1H NMR singlets at δ 0.20 & 1.05 ppm (integration ratio = 2:3). What is a plausible structure for this compound ? (1) 2-methyl-2-butene (2) 1,1-dimethylcyclopropane (3) methylcyclobutane (4) cyclopentane
94.	Combustion analysis of an organic compound shows it to be 64.3% carbon. It displays a molecular ion at m/z = 112 amu in the mass spectrum. Which of the following is a plausible molecular formula for this compound ? (1) C_8H_{16} (2) $C_7H_{12}O$ (3) $C_6H_8O_2$ (4) $C_5H_4O_3$

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Question No.	Questions
95.	The ^1H NMR spectrum of a diluted solution of a mixture of acetone and dichloromethane in $CDCl_3$ exhibits two singlets of 1:1 intensity. Molar ratio of acetone to dichloromethane in the solution is (1) 3:1 (2) 1:3 (3) 1:1 (4) 1:2
96.	Which of the following is the principal factor which causes the properties of nanomaterials to differ significantly from other materials ? (1) Size distribution (2) Specific surface feature (3) Quantum size effects (4) All the above
97.	_____ is an excellent 'green' solvent as well as a greenhouse gas ? (1) Methane (2) CFCs (3) Carbon monoxide (4) Carbon dioxide
98.	Which of the following statements is not true regrading the binding site of a receptor ? (1) The binding site is normally a hollow or cleft in the surface of a receptor. (2) The binding site is normally hydrophobic in nature. (3) The binding site contains amino acids which are important to the binding process and a catalytic mechanism. (4) Chemical messengers fit into binding sites and bind to functional groups within the binding site.

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Question No.	Questions
99.	There is a lot of interest in the area of supramolecular catalysis at the moment, why is this ? (1) There is actually very little interest in this area, due to the fact that it is very difficult to make a supramolecular catalyst. (2) It would be useful for cutting down on the amount of solvent in the reaction and hence decrease costs. This is of particular significance to large scale industrial processes. (3) It would allow very efficient and stereoselective catalysis of often very difficult reactions. (4) It is thought that a supramolecular catalyst would be capable of replacing catalytic metals in reactions, thereby reducing cost while increasing efficiency.
100.	The term used to measure a product or person's environmental impact is (1) Handprint (2) CO_2 print (3) Footprint (4) Hazardous potential

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SET–"X"

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

(MPH/PHD/URS–EE–2020)

CHEMISTRY

Sr. No. 10002

Code **B**

Time : 1¼ Hours **Total Questions : 100** **Max. Marks : 100**

Roll No. _____ (in figure) _____ (in words)

Name : _____ Father's Name : _____

Mother's Name : _____ Date of Examination : _____

(Signature of the candidate) (Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/ INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. **All questions are compulsory.**
2. The candidates must return the Question book-let as well as OMR answer-sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A,B,C and D code will be got uploaded on the university website after the conduct of Entrance Examination. In case there is any discrepancy in the Question Booklet/Answer Key, the same may be brought to the notice of the Controller of Examination in writing/through E-Mail within 24 hours of uploading the same on the University Website. Thereafter, no complaint in any case, will be considered.
5. The candidate MUST NOT do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question book-let itself. Answers MUST NOT be ticked in the Question book-let.
6. **There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.**
7. Use only Black or Blue <u>BALL POINT PEN</u> of good quality in the OMR Answer-Sheet.
8. BEFORE ANSWERING THE QUESTIONS, THE CANDIDATES SHOULD ENSURE THAT THEY HAVE BEEN SUPPLIED CORRECT AND COMPLETE BOOK-LET. COMPLAINTS, IF ANY, REGARDING MISPRINTING ETC. WILL NOT BE ENTERTAINED 30 MINUTES AFTER STARTING OF THE EXAMINATION.

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Komal

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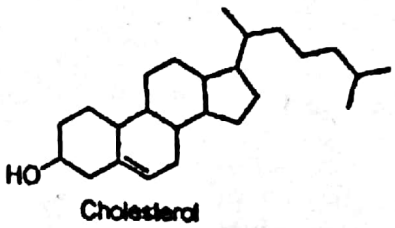
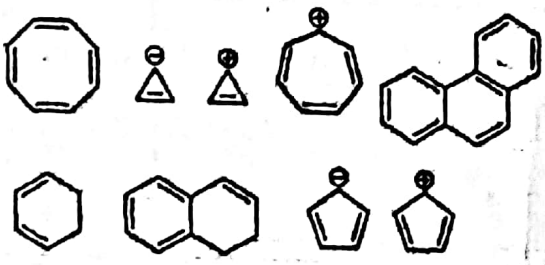
Question No.	Questions
1.	 Cholesterol Number of Optical isomers in Cholesterol would be : (1) 128 (2) 512 (3) 64 (4) 256
2.	Among the following structures, the number of aromatic compound(s) is :  (1) 3 (2) 4 (3) 5 (4) 6
3.	Number of sp^2 and sp hybridized carbon atoms present in benzyne is : (1) 3 and 1 (2) 6 and 0 (3) 4 and 2 (4) 4 and 0

56	4 2	4	2	4

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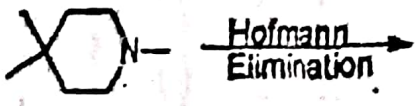
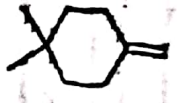
Question No.	Questions
4.	$\overset{\oplus}{C}H_3$, $CH_2\overset{\oplus}{C}H_2$, $CH_3\overset{\oplus}{C}H_2$, $CH_3\overset{\oplus}{C}HCH_3$ Number of carbonium ions in the above list is : (1) 4 (2) 3 (3) 2 (4) 1
5.	In the chlorination of 1-chlorobutane under free radical conditions, the most abundant compound formed is : (1) 1,1-dichlorobutane (2) 1,2-dichlorobutane (3) 1,3-dichlorobutane (4) 1,4-dichlorobutane
6.	Repeated Hofmann Elimination reaction will often remove a nitrogen atom from an amine molecule.  Which of the following compounds is likely product in this case ? (1) (2) (3)  (4)

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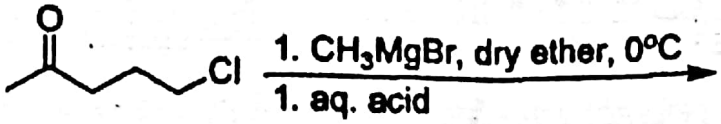
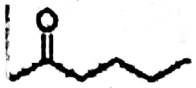
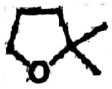
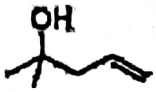
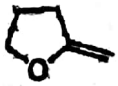
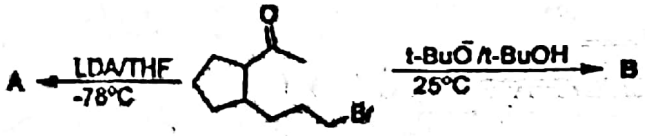
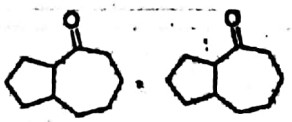
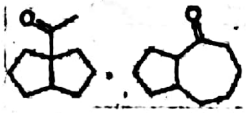
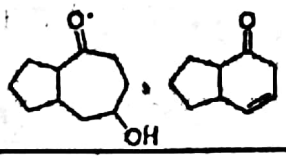
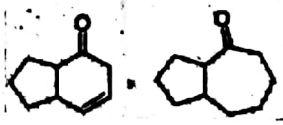
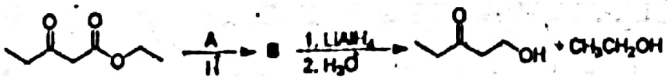
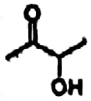
Question No.	Questions
7.	Major product of the following reaction is :  (1)  (2)  (3)  (4) 
8.	 Major product A and B are respectively : (1)  (2)  (3)  (4) 
9.	Identify A in the following reaction sequence :  (1) (2)  (3) (4) HCN

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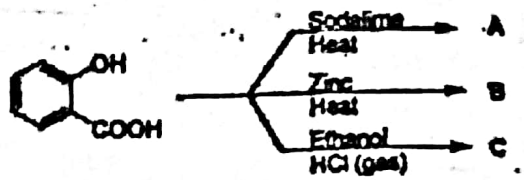
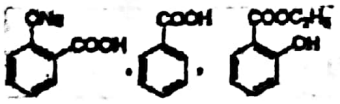
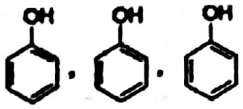
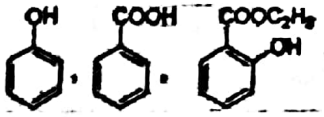
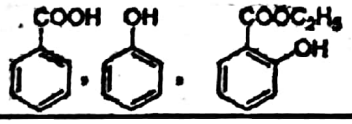
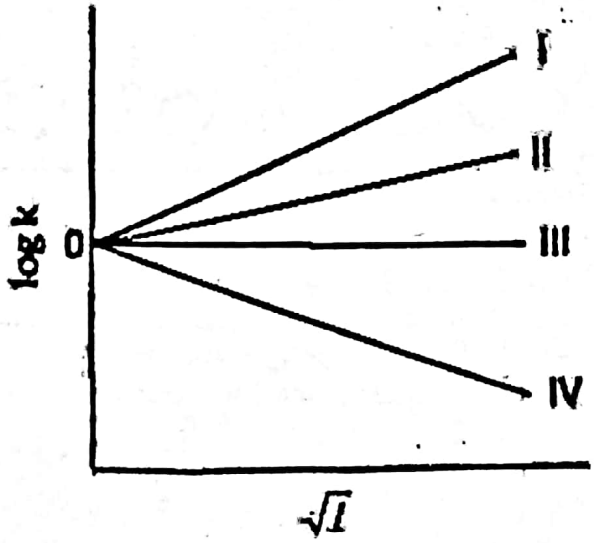
Question No.	Questions
10.	 Products A, B and C respectively are : (1)  (2)  (3)  (4) 
11.	The plot of the rate constant vs. ionic strength of the reaction $A^{2+} + B^-$ follows the line as shown in the figure :  (1) I (2) II (3) III (4) IV

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Question No.	Questions
12.	Reaction between A and B is carried out for different initial concentrations and the corresponding half-life times are measured. The data are listed in the table :

Entry	$[A_o]$ M	$[B_o]$ M	$t_{1/2}s^{-1}$
1	500	10	60
2	500	20	60
3	10	500	60
4	20	500	30

The rate can be represented as :

(1) $k[A]\,[B]$ (2) $k[A]^2$

(3) $k[A]^2\,[B]$ (4) $k[A]\,[B]^2$

13. The separation of the (123) planes of an orthorhombic unit cell is 3.12 nm. The separation of (246) and (369) planes are, respectively :

(1) 1.56 nm and 1.04 nm (2) 1.04 nm and 1.56 nm

(3) 3.12 nm and 1.50 nm (4) 1.04 nm and 3.12 nm

14. The predicted electromotive force (emf) of the electrochemical cell

$Fe(s) / Fe^{2+}(aq)\ (0.01M) \| Cd^{2+}(aq)\ (0.01M)/Cd(s)$

($E^{o}_{(Fe^{2+}/Fe)} = -0.447V$ and $E^{o}_{Cd^{2}/Cd} = -0.403V$)

(1) –0.850V (2) +0.044V

(3) +0.0850V (4) –0.044V

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Question No.	Questions
15.	For a particle of mass m in a 1-D box of length 2L, the energy of level corresponding to n=8 is : (1) $\frac{h^2}{8ml^2}$ (2) $\frac{h^2}{32ml^2}$ (3) $\frac{4h^2}{ml^2}$ (4) $\frac{2h^2}{ml^2}$
16.	A thermodynamic equation that relates chemical potential to the composition of a mixture is known as : (1) Gibbs Helmholtz equation (2) Gibbs-Duhem equation (3) Joule-Thomson equation (4) Debye Huckel equation
17.	One mole of monoatomic gas is transformed from 300K and 2 atm to 600K and 4 atm. The entropy change for the process is : (1) $\frac{3}{2}R\,ln\,2$ (2) $\frac{1}{2}R\,ln\,2$ (3) $\frac{7}{2}R\,ln\,2$ (4) $\frac{5}{2}R\,ln\,2$
18.	The electrical double layer model that consist of both the fixed layer and diffused layer among the following is : (1) Helmholtz (2) Gouy (3) Stern (4) Debye Huckel

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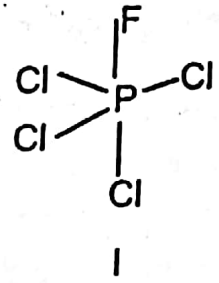
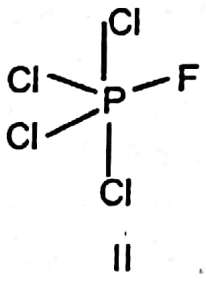
Question No.	Questions
19.	If e^{ax} is an eigen function and d^n/dx^n is an operator then the eigen value will be : (1) a^n (2) a (3) n (4) n^a
20.	The Gibbs energy for the decomposition of Al_2O_3 at 500°C is as follows : $\frac{2}{3}Al_2O_3 \rightarrow \frac{4}{3}Al + O_2$, $\Delta_r G = +966$ kJ mol^{-1} The potential difference needed for electrolytic reduction of Al_2O_3 at 500°C is at least : (1) 2.5 V (2) 5.0 V (3) 4.5 V (4) 3.0 V
21.	How many signals are present in both isomers in NQR spectroscopy ?  I  II (1) two (2) three (3) one (4) four
22.	Auxochrome when attached to chromophore absorption band is shifted towards longer wavelength due to increase in : (1) Bonding (2) Conjugation (3) Inductive effect (4) None of these

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Question No.	Questions
23.	The quantitative shifting in PMR signals in addition to shielding and deshielding the protons also depends upon the : (1) Inductive effect (2) Space effect (3) H–bonding (4) All of above
24.	Ionic equivalent conductance value for Ca^{2+} is 0.0119 S m^2 mol^{-1} and for Cl^- is 0.0076 S m^2 mol^{-1}. The correct expected molar conductivity at infinite dilution for $CaCl_2$ is : (1) 0.0195 S m^2 mol^{-1} (2) 0.0271 S m^2 mol^{-1} (3) 0.0542 S m^2 mol^{-1} (4) 0.01355 S m^2 mol^{-1}
25.	A binary mixture of A_2 and B_2 will show negative deviation from Raoult's law when : (1) A–A and B–B interactions are stronger than A–B (2) A–A and B–B interactions are weaker than A–B (3) Both A–A and B–B interactions are equal to A–B (4) Either A–A or B–B interactions is equal to A–B
26.	The molar masses of monodisperse and polydisperse polymers obey respectively the conditions : (M_n=Number average molecular weight and M_w=Weight average molecular weight). (1) $M_n > M_w$ and $< M_w$ (2) $M_n = M_w$ and $M_n < M_w$ (3) $M_n < M_w$ and $M_n < M_w$ (4) $M_n = M_w$ and $M_n = M_w$

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Question No.	Questions
27.	$CH_3COOC_2H_5$ (aq) + H_3O^+ (l) $\rightarrow$ CH_3COOH(aq)+C_2H_5OH(aq). What type of reaction is this ? (1) Unimolecular (elementary) (2) Pseudo first order (3) Zero order (4) Second order
28.	Micelle formation is accompanied by the : (1) decrease in overall entropy due to ordering of solvent near hydrophobic ends. (2) increase in overall entropy mostly due to increase in solvent entropy. (3) increase in overall entropy mostly due to increase in solute entropy. (4) increase in overall entropy and decrease in enthalpy.
29.	The rotational partition function is expected to be smallest for the molecule, among the following : (1) H_2 (2) Li_2 (3) N_2 (4) F_2
30.	The temperature derivative of electrochemical cell potential E at constant pressure, $\left(\frac{\partial E}{\partial T}\right)_p$, is given by : (1) $-\frac{\Delta S}{nF}$ (2) $\frac{\Delta S}{nF}$ (3) $\frac{\Delta S}{nFT}$ (4) $-\frac{\Delta S}{nFT}$

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Question No.	Questions
31.	Stainless steel does not rust because : (1) Chromium and nickel combine with iron (2) Chromium forms an oxide layer and protects iron from rusting (3) Nickel present in it, does not rust (4) Iron forms a hard chemical compound with chromium present in it
32.	The pair whose both species are used in antacid medicinal preparations is : (1) $NaHCO_3$ and $Mg(OH)_2$ (2) Na_2CO_3 and $Ca(HCO_3)_2$ (3) $Ca(HCO_3)_2$ and $Mg(OH)_2$ (4) $Ca(OH)_2$ and $NaHCO_3$
33.	Artificial gem used for cutting glass is : (1) graphite (2) diamond (3) SiC (4) $CaCN_2$
34.	Phosgene can be obtained when : (1) White phosphorus reacts with alkali. (2) Calcium phosphide reacts with water. (3) Chloroform reacts with air. (4) Bone comes in contact with water.

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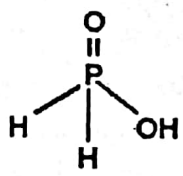
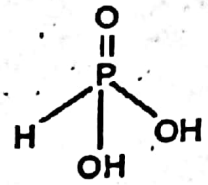
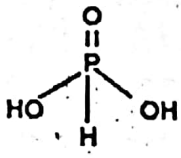
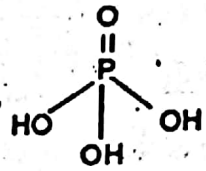
Question No.	Questions
35.	The structural formula of hypophosphorous acid is : (1)  (2)  (3)  (4) 
36.	In which of these processes platinum is used as a catalyst ? (1) Production of synthetic rubber (2) Hardening of oils (3) Oxidation of ammonia to form HNO_3 (4) Synthesis of methanol
37.	In Zeigler - Natta polymerisation of ethylene, the active species is : (1) $AlCl_3$ (2) Et_3Al (3) Ti^{III} (4) $TiCl_4$
38.	Which of the following is not an example of organometallic compound ? (1) Trimethylboron (2) Trimethylaluminium (3) Trimethoxytitanium chloride (4) Tetracarbonylnickel

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Question No.	Questions
43.	Neopentyl chloride, $(CH_3)_3CCH_2Cl$, reacts with the strong base sodium amide to form a new compound. This compound has a molecular ion at m/z = 70 amu and displays two ^1H NMR singlets at δ 0.20 & 1.05 ppm (integration ratio = 2:3). What is a plausible structure for this compound ? (1) 2-methyl-2-butene (2) 1,1-dimethylcyclopropane (3) methylcyclobutane (4) cyclopentane
44.	Combustion analysis of an organic compound shows it to be 64.3% carbon. It displays a molecular ion at m/z = 112 amu in the mass spectrum. Which of the following is a plausible molecular formula for this compound ? (1) C_8H_{16} (2) $C_7H_{12}O$ (3) $C_6H_8O_2$ (4) $C_5H_4O_3$
45.	The ^1H NMR spectrum of a diluted solution of a mixture of acetone and dichloromethane in $CDCl_3$ exhibits two singlets of 1:1 intensity. Molar ratio of acetone to dichloromethane in the solution is (1) 3:1 (2) 1:3 (3) 1:1 (4) 1:2
46.	Which of the following is the principal factor which causes the properties of nanomaterials to differ significantly from other materials ? (1) Size distribution (2) Specific surface feature (3) Quantum size effects (4) All the above
47.	_____ is an excellent 'green' solvent as well as a greenhouse gas ? (1) Methane (2) CFCs (3) Carbon monoxide (4) Carbon dioxide

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Question No.	Questions
48.	Which of the following statements is not true regrading the binding site of a receptor ? (1) The binding site is normally a hollow or cleft in the surface of a receptor. (2) The binding site is normally hydrophobic in nature. (3) The binding site contains amino acids which are important to the binding process and a catalytic mechanism. (4) Chemical messengers fit into binding sites and bind to functional groups within the binding site.
49.	There is a lot of interest in the area of supramolecular catalysis at the moment, why is this ? (1) There is actually very little interest in this area, due to the fact that it is very difficult to make a supramolecular catalyst. (2) It would be useful for cutting down on the amount of solvent in the reaction and hence decrease costs. This is of particular significance to large scale industrial processes. (3) It would allow very efficient and stereoselective catalysis of often very difficult reactions. (4) It is thought that a supramolecular catalyst would be capable of replacing catalytic metals in reactions, thereby reducing cost while increasing efficiency.
50.	The term used to measure a product or person's environmental impact is (1) Handprint (2) CO_2 print (3) Footprint (4) Hazardous potential

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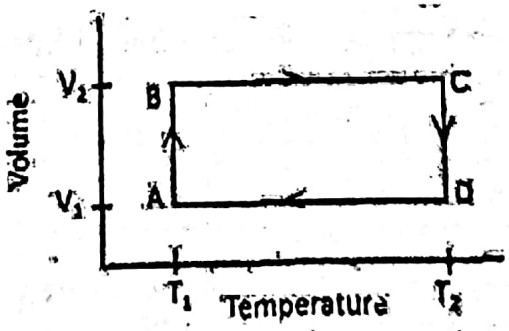
Question No.	Questions
51.	The equilibrium constants k_{P1} and k_{P2} for the reactions $X \rightleftharpoons 2Y$ and $Z \rightleftharpoons P + Q$, respectively are in the ratio of 1:9. If the degree of dissociation of X and Z be equal then the ratio of total pressure at these equilibria is : (1) 1:36 (2) 1:1 (3) 1:3 (4) 1:9
52.	Four distinguishable molecules are distributed in energy levels E_1 and E_2 with degeneracy of 2 and 3, respectively. Number of microstates, with 3 molecules in energy level E_1 and one in energy level E_2 is : (1) 4 (2) 12 (3) 96 (4) 192
53.	One mole of an ideal gas undergoes a cyclic process (ABCDA) starting from point A through 4 reversible steps as shown in the figure. Total work done in the process is :  (1) $R(T_1 - T_2)\frac{V_2}{V_1}$ (2) $R(T_1 + T_2)\frac{V_2}{V_1}$ (3) $R(T_1 + T_2)\ ln\ \frac{V_2}{V_1}$ (4) $R(T_1 - T_2)\ ln\ \frac{V_2}{V_1}$

55	2	3	2	4
	4			

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Question No.	Questions
54.	If the specific conductance of an electrolyte solution is 0.2 ohm^{-1} cm^{-1} and cell constant is 0.25, the conductance of the solution is : (1) 1.25 ohm^{-1} (2) 1.0 ohm^{-1} (3) 0.8 ohm^{-1} (4) 2.0 ohm^{-1}
55.	The slope and intercept obtained from (1/Rate) against (1/substrate concentration) of an enzyme catalyzed reaction are 300 and 2 $\times 10^6$, respectively. The Michaelis-Menten constant of the enzyme in this reaction is : (1) 5×10^6 M (2) 5×10^{-6} M (3) 1.5×10^3 M (4) 1.5×10^{-3} M
56.	Given ; A. $Fe(OH)_2(s) + 2e^- \rightarrow Fe(s) + 2OH-(aq)$; $E_0 = -0.877V$ B. $Al^{3+}(aq) + 3e^- \rightarrow Al(s)$; $E_0 = -1.66V$ C. $AgBr(aq) + e^- \rightarrow Ag(s) + Br^-(aq)$; $E_0 = 0.071V$ The overall reaction for the cells in the direction of spontaneous change would be 1. Cell with A and B : Fe reduced Cell with A and C : Fe reduced 2. Cell with A and B : Fe reduced Cell with A and C : Fe oxidized 3. Cell with A and B : Fe oxidized Cell with A and C : Fe oxidized 4. Cell with A and B : Fe oxidized Cell with A and C : Fe reduced

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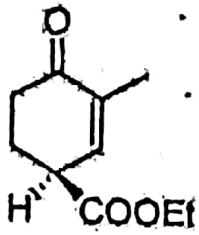
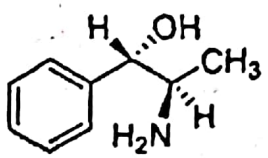
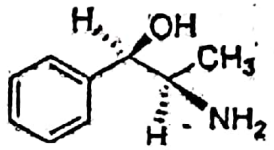
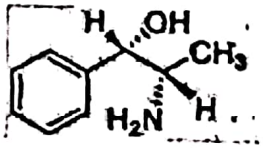
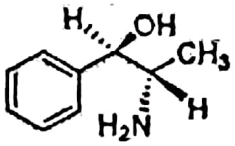
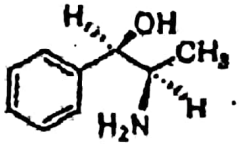
Question No.	Questions
57.	IUPAC name of the following compound is :  (1) Pethyl (S)-3-methyl-4-oxocyclohex-2-enecarboxylate (2) (R)-4-ethoxycarbonyl-2-methyl-4-oxocyclohex-2-enone (3) ethyl (R)-3-methyl-4-oxocyclohex-2-enecarboxylate (4) (S)-4-ethoxycarbonyl-2-methyl-4-oxocyclohex-2-enone
58.	Compound given below may be named as : (1) (2R, 3Z)-7-phenylhept-3-en-2-ol (2) (2R, 3E)-7-phenylhept-3-en-2-ol (3) (2S, 3E)-7-phenylhept-3-en-2-ol (4) (2S, 3Z)-7-phenylhept-3-en-2-ol
59.	Enantiomer of the following structure is :  (1)  (2)  (3)  (4) 

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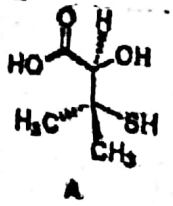
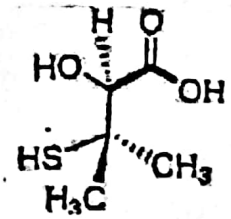
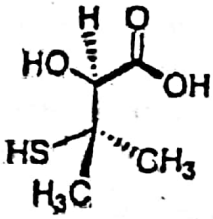
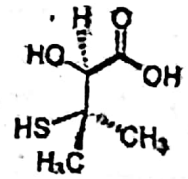
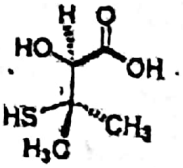
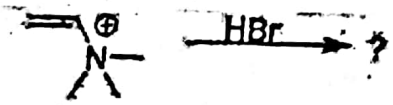
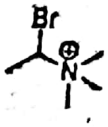
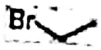
Question No.	Questions
60.	 A Consider compound A and choose the correct answer : (1) A could be optically active and its diastereomer is  (2) A could be optically active and its enantiomer is  (3) A could be optically inactive and its diastereomer is  (4) A could be optically inactive and its enantiomer is 
61.	 Major product obtained in this reaction is : (1)  (2)  (3) $H_2C{=}CH_2$ (4)

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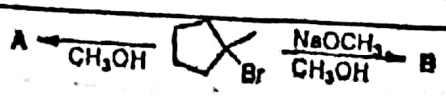
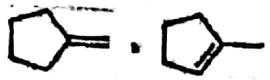
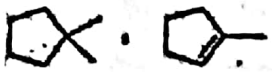
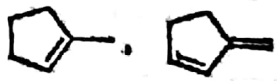
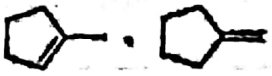
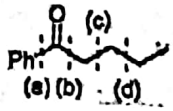
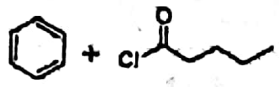
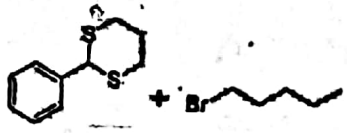
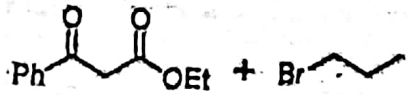
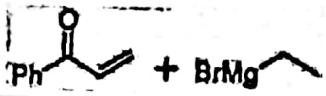
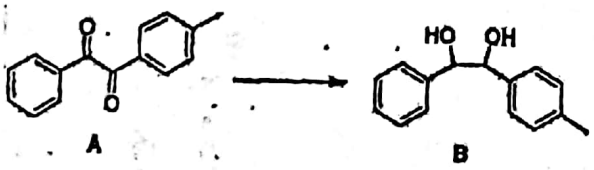
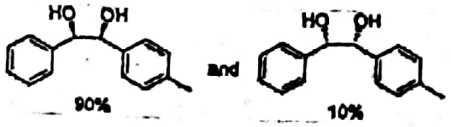
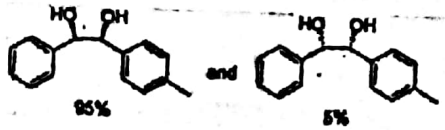
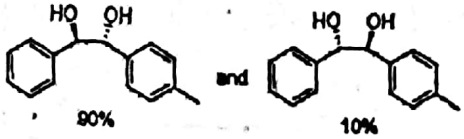
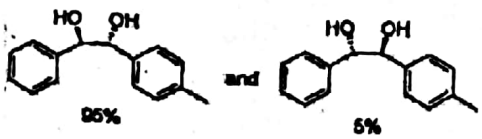
Question No.	Questions
62.	 Products A and B respectively are : (1)  (2)  (3)  (4) 
63.	Which combination of reagents is wrong for disconnections (a)–(d) in the following ?  (1)  (2)  (3)  (4) 
64.	Stereoselective reduction of the dione A with a chiral reducing agent provides the corresponding diol B in 100% diastereoselectivity and 90% ee favoring R, R configuration.  The composition of the product is : (1)  (2)  (3)  (4) 

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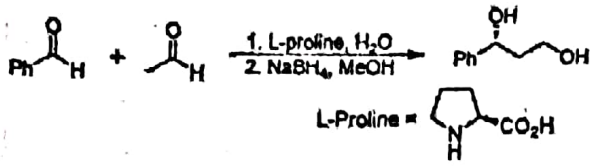
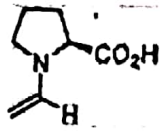
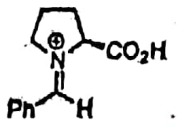
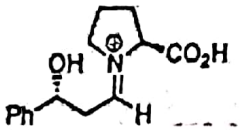
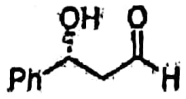
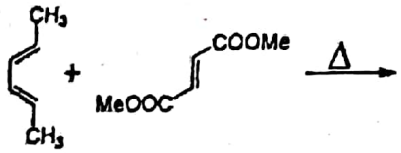
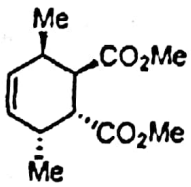
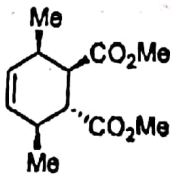
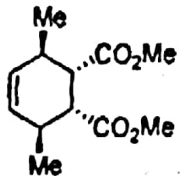
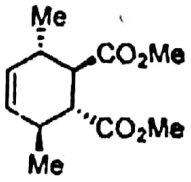
Question No.	Questions
65.	An α-amino acid, L–proline, can be used as a catalytic chiral auxiliary for a stereoselective aldol reaction.  Which of (1)-(4) is not involved in the above transformation ? (1)  (2)  (3)  (4) 
66.	Which of adducts (1)-(4) is the main product of the following Diels-Alder reaction ?  (1)  (2)  (3)  (4) 

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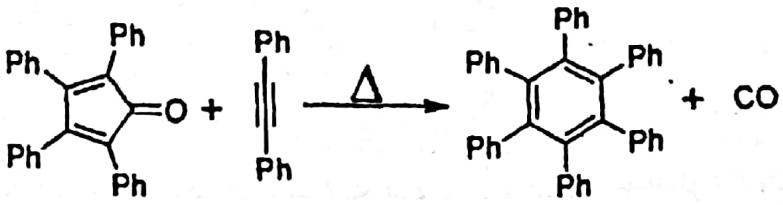
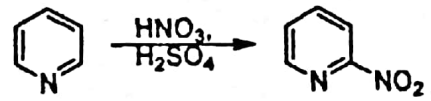
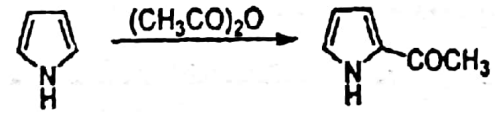
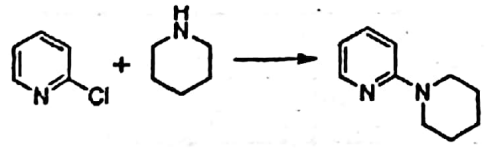
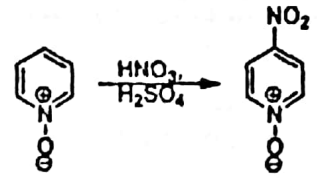
Question No.	Questions
67.	The following involves two pericyclic reactions. Which combination indicates correctly the types of reaction involved ?  (1) [4+2] cycloaddition + [2+2] cycloreversion (2) cheletropic reaction + [4+2] cycloaddition (3) [4+2] cycloaddition + [4+1] cycloreversion (4) [4+2] cycloaddition + cheletropic reaction
68.	Which of the following equations shows an unlikely result ? (1)  (2)  (3)  (4) 

55	4	3	2	4
56	2	4	2	4
57		2	2	3

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Question No.	Questions
69.	Which of the following statements regarding the reducing ability of a sugar is wrong ? (1) The aldehyde group of a saccharide is responsible for its reducing properties. (2) Ketoses are not reducing sugars because they are not aldehydes. (3) D-Glucose in predominantly in a cyclic hemiacetal form but it is a reducing sugar through the acyclic form with which the hemiacetal is in equilibrium. (4) A methyl glucoside is not a reducing sugar.
70.	Which of the following is not an important secondary structural feature in large peptides and proteins ? (1) the α-helix (2) the β-turn (3) chair conformations (4) the β-pleated sheet
71.	The number of rotational degrees of freedom of CO_2 is : (1) one (2) two (3) three (4) four
72.	When crystals of sodium chloride are heated in the presence of sodium vapor, they turn yellow. This is due to the formation of: (1) Schottky defects (2) Frenkel defects (3) F-centres (4) H-centres

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Question No.	Questions
73.	Of the following inequalities, the criterion/criteria for spontaneity of a chemical reaction is/are : (i) $(\Delta G)_{T,P} < 0$ (ii) $(\Delta U)_{S,V} > 0$ (iii) $(\Delta S)_{U,V} > 0$ (1) (i) only (2) (ii) only (3) (i) and (ii) (4) (i) and (iii)
74.	The concentration of a reactant decreases linearly with time. What is the order of the reaction ? (1) 1st order (2) Fractional order (3) 2nd order (4) Zero order
75.	The absorbance of solution having 20% transmittance is : (1) 0.301 (2) 0.699 (3) 1.301 (4) 1.699
76.	Electrolysis of an aqueous solution of 1.0 M NaOH results in : (1) Na at the cathode and O_2 at the anode. (2) H_2 at the cathode and O_2 at the anode. (3) Na and H_2 at the cathode and O_2 at the anode. (4) O_2 at the cathode and H_2 at the anode.

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Question No.	Questions
77.	The rate constant of decomposition of a compound is represented by $\ln K = 5.0 - \frac{12000}{T}$ The value of E_A (in Kcal mol^{-1}) for this compound at 300 K is : (1) 24 (2) 12 (3) 240 (4) 120
78.	For a reaction $2A \rightarrow$ Product the initial concentration of A is 0.1 M and the rate constant is $2 \times 10^{-3} dm^3 mol^{-1} s^{-1}$. The half life period of the reaction is : (1) 5 sec (2) 50 sec (3) 500 sec (4) 5000 sec
79.	The number of degenerate spatial orbitals of a hydrogen-like atom with principal quantum number n=6 is : (1) 12 (2) 6 (3) 72 (4) 36
80.	If the atoms/ions in the crystal are taken to be hard spheres touching each other in the unit cell, then the fraction of volume occupied in the body centered cubic structure is : (1) $\sqrt{3}\pi$ (2) $\frac{\sqrt{2}}{6}\pi$ (3) $\frac{\pi}{6}$ (4) $\frac{\sqrt{3}}{8}\pi$

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Question No.	Questions
81.	The metal species present in Nitrogenase is : (1) Zinc (2) Molybdenum (3) Tungsten (4) Lead
82.	Which of the following compounds will show quadrupole splitting in Mossbauer spectroscopy ? (1) $K_4 Fe(CN)_6$ (2) $FeCl_3$ (3) $Fe_2(SO_4)_3$ (4) $FeSO_4$
83.	The most widely used standard reference substance in ESR is : (1) 1, 1 –diphenyl –2–Picryl – hydrazyl free radical (2) 1, 1 –diphenyl –2–Picryl – hydroxyl free radical (3) TMS (4) None of these
84.	In DTA, the differential temperature Vs temperature or time curve is highly sensitive to : (1) Heating rate (2) Sample size (3) Sample packing (4) All of these
85.	Radio metric titrations have been applied for : (1) Determination of the composition of compound (2) Investigation of co-precipitation (3) Determination of the specific activity of radioactive preparations (4) All of these

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Question No.	Questions
86.	Cytochromes in biological systems are involved in : (1) Proton transfer (2) Oxygen transfer (3) Electron transfer (4) Metal transfer
87.	In Ferrocene which metal orbital interact more effectively with ligand group orbital ? (1) $3d_z^2$ (2) $3d_{xy}$ $3d_{x^2-y^2}$ (3) $4P_x 4P_y$ (4) $3d_{xz}$, $3d_{yz}$
88.	The Electroanalytical technique in which the potential of the working electrode is stepped and the resulting current is monitored as a function of time is : (1) Coulometry (2) Chronopotentiometry (3) Chronoamperometry (4) Pulse polarography
89.	Lithium drugs are used in treatment of : (1) Dental caries (2) Psychiatric disorder (3) Malaria (4) Arthritis
90.	Which alkylating agent is used as Anticancer Drug in treatment of most of the cancers ? (1) Melphan (2) Cyclophosphamide (3) Chlorambucil (4) None of these

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Question No.	Questions
91.	A sudden large jump between the values of second and third ionisation energies of elements would be associated with which of the following electronic configurations ? (1) $1s^2\ 2s^2\ 2p^6\ 3s^1$ (2) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$ (3) $1s^2\ 2s^2\ 2p^6\ 3s^1\ 3p^2$ (4) $1s^2\ 2s^2\ 2p^6\ 3s^2$
92.	Among the following groupings which represents the collection of isoelectronic species ? (1) NO^+, C_2^{2-}, O_2, CO (2) N_2, C_2^{2-}, NO, CO (3) CO, N_2, CN^-, C_2^{2-} (4) NO, CN^-, N_2, O_2^-
93.	In the Molecular orbital diagram for O_2^+ ion the highest occupied orbital is : (1) σ MO orbital (2) π MO orbital (3) π^* MO orbital (4) σ^* MO orbital
94.	The correct order of hybridization of the central atom in the following species, NH_3, $[PtCl_4]^{2-}$, PCl_5, and BCl_3, is respectively : (1) dsp^2, dsp^3, sp^2, sp^3 (2) sp^3, dsp^2, dsp^3, sp^2 (3) dsp^2, sp^2, sp^3, dsp^3 (4) dsp^2, sp^3, sp^2, dsp^3

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Question No.	Questions
95.	Which of the following structure is most expected for the molecule $XeOF_4$? (1) Tetrahedral (2) Square Pyramid (3) Square planar (4) Octahedral
96.	Among the following, which is the weakest Lewis base ? (1) CH_3^- (2) NH_2^- (3) OH^- (4) F^-
97.	CH_3HgOH is classified as : (1) Soft - Hard (2) Soft - Soft (3) Hard - Hard (4) Hard - Soft
98.	$[Co(NH_3)_4(NO_2)_2]Cl$ exhibits : (1) Linkage isomerism, ionisation isomerism and optical isomerism. (2) Linkage isomerism, ionisation isomerism and geometrical isomerism. (3) Ionisation isomerism, geometrical isomerism and optical isomerism. (4) Linkage isomerism, geometrical isomerism and optical isomerism.

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Question No.	Questions
99.	Which one of the following shows maximum value of paramagnetic behaviour ? (1) $[Sc(CN)_6]^{3-}$ (2) $[Co(CN)_6]^{3-}$ (3) $[Fe(CN)_6]^{3-}$ (4) $[Cr(CN)_6]^{3-}$
100.	In which of the following pairs are both the ions coloured in aqueous solution ? (1) Ni^{2+}, Ti^{3+} (2) Sc^{3+}, Ti^{3+} (3) Sc^{3+}, Co^{2+} (4) Ni^{2+}, Cu^{+}

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SET–"X"

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

(MPH/PHD/URS–EE–2020)

CHEMISTRY

Code **C**

Sr. No. 10007

Time : 1¼ Hours **Total Questions : 100** **Max. Marks : 100**

Roll No. _____ (in figure)_____ (in words)

Name : _____ Father's Name : _____

Mother's Name : _____ Date of Examination : _____

(Signature of the candidate) (Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/ INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. **All questions are compulsory.**
2. The candidates must return the Question book-let as well as OMR answer-sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A,B,C and D code will be got uploaded on the university website after the conduct of Entrance Examination. In case there is any discrepancy in the Question Booklet/Answer Key, the same may be brought to the notice of the Controller of Examination in writing/through E-Mail within 24 hours of uploading the same on the University Website. Thereafter, no complaint in any case, will be considered.
5. The candidate MUST NOT do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question book-let itself. Answers **MUST NOT** be ticked in the Question book-let.
6. **There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.**
7. Use only Black or Blue **BALL POINT PEN** of good quality in the OMR Answer-Sheet.
8. BEFORE ANSWERING THE QUESTIONS, THE CANDIDATES SHOULD ENSURE THAT THEY HAVE BEEN SUPPLIED CORRECT AND COMPLETE BOOK-LET. COMPLAINTS, IF ANY, REGARDING MISPRINTING ETC. WILL NOT BE ENTERTAINED 30 MINUTES AFTER STARTING OF THE EXAMINATION.

To be opened for Display

Kamal

Question No.	Questions
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3.	Of the following inequalities, the criterion/criteria for spontaneity of a chemical reaction is/are : (i) $(\Delta G)_{T,P} < 0$ (ii) $(\Delta U)_{S,V} > 0$ (iii) $(\Delta S)_{U,V} > 0$ (1) (i) only (2) (ii) only (3) (i) and (ii) (4) (i) and (iii)
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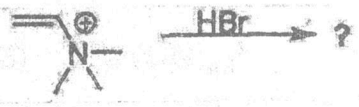
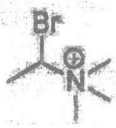
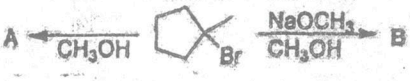
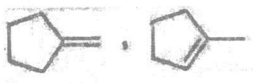
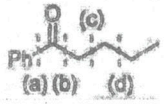
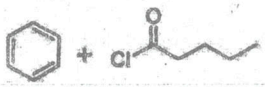
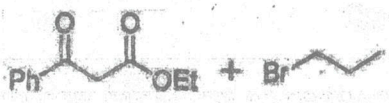
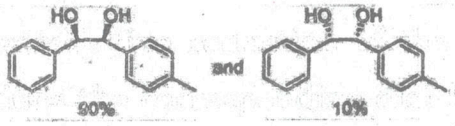
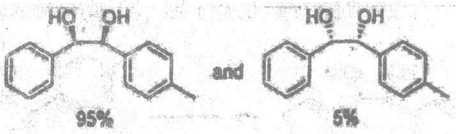
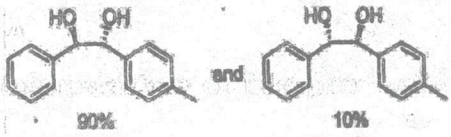
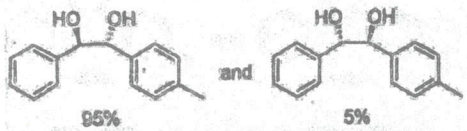
10.	If the atoms/ions in the crystal are taken to be hard spheres touching each other in the unit cell, then the fraction of volume occupied in the body centered cubic structure is : (1) $\sqrt{3}\,\pi$ (2) $\frac{\sqrt{2}}{6}\pi$ (3) $\frac{\pi}{6}$ (4) $\frac{\sqrt{3}}{8}\pi$
11.	The metal species present in Nitrogenase is : (1) Zinc (2) Molybdenum (3) Tungsten (4) Lead
12.	Which of the following compounds will show quadrupole splitting in Mossbauer spectroscopy ? (1) $K_4\,Fe\,(CN)_6$ (2) $FeCl_3$ (3) $Fe_2\,(SO_4)_3$ (4) $FeSO_4$
13.	The most widely used standard reference substance in ESR is : (1) 1,,1 –diphenyl –2–Picryl – hydrazyl free radical (2) 1, 1 –diphenyl –2–Picryl – hydroxyl free radical (3) TMS (4) None of these

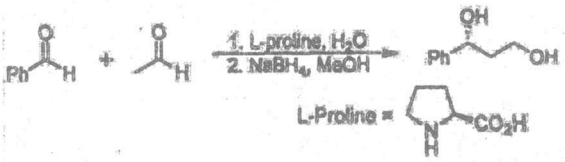
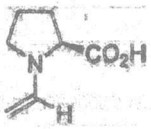
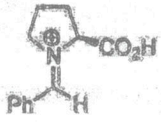
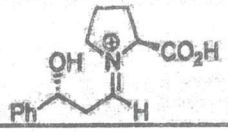
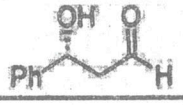
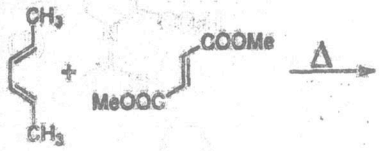
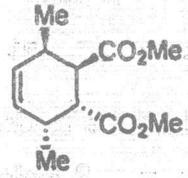
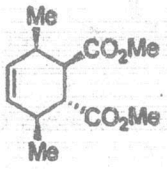
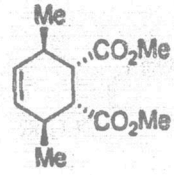
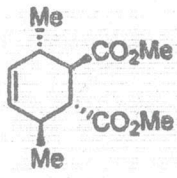
Question No.	Questions
14.	In DTA, the differential temperature Vs temperature or time curve is highly sensitive to : (1) Heating rate (2) Sample size (3) Sample packing (4) All of these
15.	Radio metric titrations have been applied for : (1) Determination of the composition of compound (2) Investigation of co-precipitation (3) Determination of the specific activity of radioactive preparations (4) All of these
16.	Cytochromes in biological systems are involved in : (1) Proton transfer (2) Oxygen transfer (3) Electron transfer (4) Metal transfer
17.	In Ferrocene which metal orbital interact more effectively with ligand group orbital ? (1) $3d_z^2$ (2) $3d_{xy}$ $3d_{x^2-y^2}$ (3) $4P_x 4P_y$ (4) $3d_{xz}$, $3d_{yz}$
18.	The Electroanalytical technique in which the potential of the working electrode is stepped and the resulting current is monitored as a function of time is : (1) Coulometry (2) Chronopotentiometry (3) Chronoamperometry (4) Pulse polarography

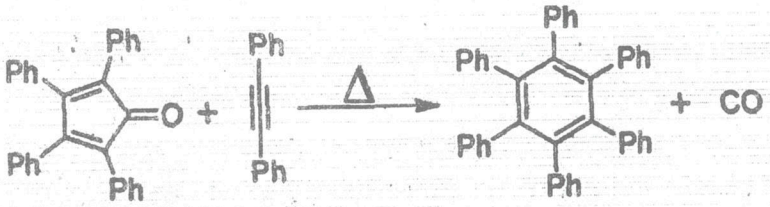
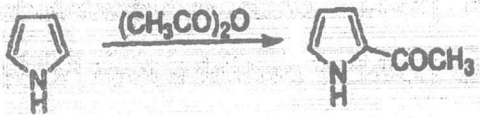
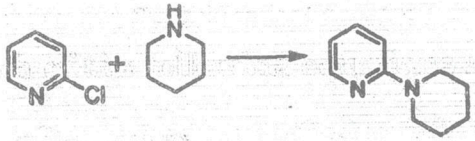
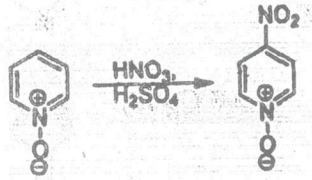
Question No.	Questions
19.	Lithium drugs are used in treatment of : (1) Dental caries (2) Psychiatric disorder (3) Malaria (4) Arthritis
20.	Which alkylating agent is used as Anticancer Drug in treatment of most of the cancers ? (1) Melphan (2) Cyclophosphamide (3) Chlorambucil (4) None of these
21.	A sudden large jump between the values of second and third ionisation energies of elements would be associated with which of the following electronic configurations ? (1) $1s^2\ 2s^2\ 2p^6\ 3s^1$ (2) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$ (3) $1s^2\ 2s^2\ 2p^6\ 3s^1\ 3p^2$ (4) $1s^2\ 2s^2\ 2p^6\ 3s^2$
22.	Among the following groupings which represents the collection of isoelectronic species ? (1) NO^+, C_2^{2-}, O_2, CO (2) N_2, C_2^{2-}, NO, CO (3) CO, N_2, CN^-, C_2^{2-} (4) NO, CN^-, N_2, O_2^-
23.	In the Molecular orbital diagram for O_2^+ ion the highest occupied orbital is : (1) σ MO orbital (2) π MO orbital (3) π^* MO orbital (4) σ^* MO orbital

Question No.	Questions
24.	The correct order of hybridization of the central atom in the following species, NH_3, $[PtCl_4]^{2-}$, PCl_5, and BCl_3, is respectively : (1) dsp^2, dsp^3, sp^2, sp^3 (2) sp^3, dsp^2, dsp^3, sp^2 (3) dsp^2, sp^2, sp^3, dsp^3 (4) dsp^2, sp^3, sp^2, dsp^3
25.	Which of the following structure is most expected for the molecule $XeOF_4$? (1) Tetrahedral (2) Square Pyramid (3) Square planar (4) Octahedral
26.	Among the following, which is the weakest Lewis base ? (1) CH_3^- (2) NH_2^- (3) OH^- (4) F^-
27.	CH_3HgOH is classified as : (1) Soft - Hard (2) Soft - Soft (3) Hard - Hard (4) Hard - Soft
28.	$[Co(NH_3)_4(NO_2)_2]Cl$ exhibits : (1) Linkage isomerism, ionisation isomerism and optical isomerism. (2) Linkage isomerism, ionisation isomerism and geometrical isomerism. (3) Ionisation isomerism, geometrical isomerism and optical isomerism. (4) Linkage isomerism, geometrical isomerism and optical isomerism.

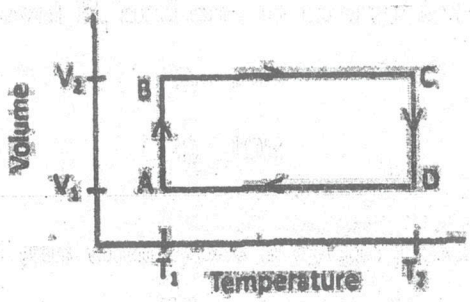
Question No.	Questions
29.	Which one of the following shows maximum value of paramagnetic behaviour ? (1) $[Sc(CN)_6]^{3-}$ (2) $[Co(CN)_6]^{3-}$ (3) $[Fe(CN)_6]^{3-}$ (4) $[Cr(CN)_6]^{3-}$
30.	In which of the following pairs are both the ions coloured in aqueous solution ? (1) Ni^{2+}, Ti^{3+} (2) Sc^{3+}, Ti^{3+} (3) Sc^{3+}, Co^{2+} (4) Ni^{2+}, Cu^{+}
31.	 Major product obtained in this reaction is : (1)  (2) (3) $H_2C{=}CH_2$ (4)
32.	 Products **A** and **B** respectively are : (1)  (2) (3) (4)

Question No.	Questions
33.	Which combination of reagents is wrong for disconnections (a)–(d) in the following ?  (1)  (2) (3)  (4)
34.	Stereoselective reduction of the dione **A** with a chiral reducing agent provides the corresponding diol **B** in 100% diastereoselectivity and 90% ee favoring R, R configuration. A B The composition of the product is : (1)  (2)  (3)  (4) 

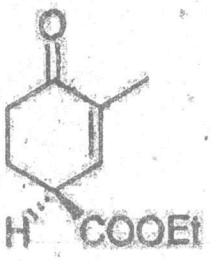
Question No.	Questions
35.	An α-amino acid, L–proline, can be used as a catalytic chiral auxiliary for a stereoselective aldol reaction.  Which of (1)-(4) is not involved in the above transformation ? (1)  (2)  (3)  (4) 
36.	Which of adducts (1)-(4) is the main product of the following Diels-Alder reaction ?  (1)  (2)  (3)  (4) 

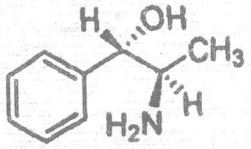
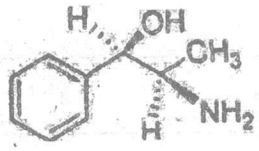
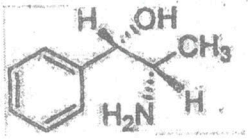
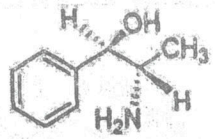
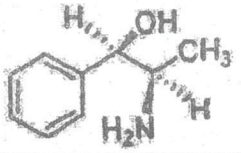
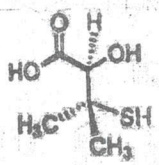
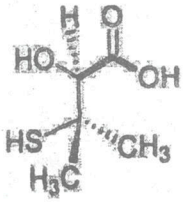
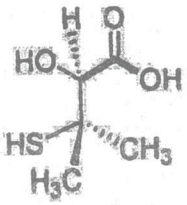
Question No.	Questions
37.	The following involves two pericyclic reactions. Which combination indicates correctly the types of reaction involved ?  (1) [4+2] cycloaddition + [2+2] cycloreversion (2) cheletropic reaction + [4+2] cycloaddition (3) [4+2] cycloaddition + [4+1] cycloreversion (4) [4+2] cycloaddition + cheletropic reaction
38.	Which of the following equations shows an unlikely result ? (1) (2)  (3)  (4) 

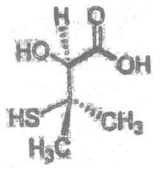
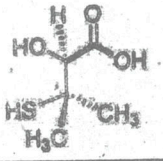
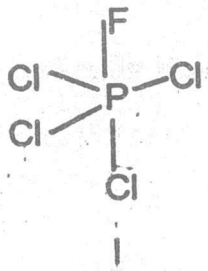
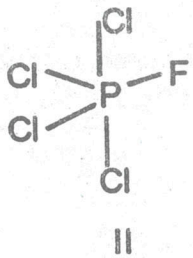
Question No.	Questions
39.	Which of the following statements regarding the reducing ability of a sugar is wrong ? (1) The aldehyde group of a saccharide is responsible for its reducing properties. (2) Ketoses are not reducing sugars because they are not aldehydes. (3) D-Glucose in predominantly in a cyclic hemiacetal form but it is a reducing sugar through the acyclic form with which the hemiacetal is in equilibrium. (4) A methyl glucoside is not a reducing sugar.
40.	Which of the following is not an important secondary structural feature in large peptides and proteins ? (1) the α-helix (2) the β-turn (3) chair conformations (4) the β-pleated sheet
41.	The equilibrium constants k_{P_1} and k_{P_2} for the reactions $X \rightleftharpoons 2Y$ and $Z \rightleftharpoons P + Q$, respectively are in the ratio of 1:9. If the degree of dissociation of X and Z be equal then the ratio of total pressure at these equilibria is : (1) 1:36 (2) 1:1 (3) 1:3 (4) 1:9

Question No.	Questions
42.	Four distinguishable molecules are distributed in energy levels E_1 and E_2 with degeneracy of 2 and 3, respectively. Number of microstates, with 3 molecules in energy level E_1 and one in energy level E_2 is : (1) 4 (2) 12 (3) 96 (4) 192
43.	One mole of an ideal gas undergoes a cyclic process (ABCDA) starting from point A through 4 reversible steps as shown in the figure. Total work done in the process is :  (1) $R(T_1 - T_2)\frac{V_2}{V_1}$ (2) $R(T_1 + T_2)\frac{V_2}{V_1}$ (3) $R(T_1 + T_2)\, ln\, \frac{V_2}{V_1}$ (4) $R(T_1 - T_2)\, ln\, \frac{V_2}{V_1}$
44.	If the specific conductance of an electrolyte solution is 0.2 ohm^{-1} cm^{-1} and cell constant is 0.25, the conductance of the solution is : (1) 1.25 ohm^{-1} (2) 1.0 ohm^{-1} (3) 0.8 ohm^{-1} (4) 2.0 ohm^{-1}

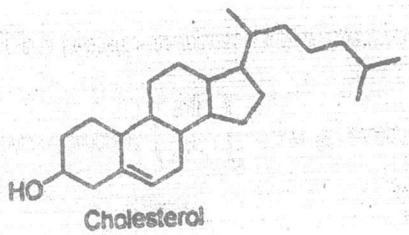
Question No.	Questions
45.	The slope and intercept obtained from (1/Rate) against (1/substrate concentration) of an enzyme catalyzed reaction are 300 and 2×10^5, respectively. The Michaelis-Menten constant of the enzyme in this reaction is : (1) 5×10^6 M (2) 5×10^{-6} M (3) 1.5×10^3 M (4) 1.5×10^{-3} M
46.	Given ; A. $Fe(OH)_2(s) + 2e^- \rightarrow Fe(s) + 2OH-(aq)$; $E_0 = -0.877V$ B. $Al^{3+}(aq) + 3e^- \rightarrow Al(s)$; $E_0 = -1.66V$ C. $AgBr(aq) + e^- \rightarrow Ag(s) + Br^-(aq)$; $E_0 = 0.071V$ The overall reaction for the cells in the direction of spontaneous change would be 1. Cell with A and B : Fe reduced Cell with A and C : Fe reduced 2. Cell with A and B : Fe reduced Cell with A and C : Fe oxidized 3. Cell with A and B : Fe oxidized Cell with A and C : Fe oxidized 4. Cell with A and B : Fe oxidized Cell with A and C : Fe reduced

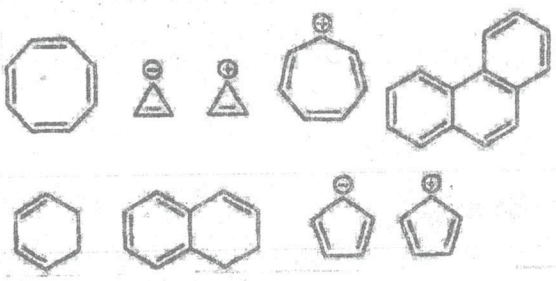
Question No.	Questions
47.	IUPAC name of the following compound is :  (1) Pethyl (S)-3-methyl-4-oxocyclohex-2-enecarboxylate (2) (R)-4-ethoxycarbonyl-2-methyl-4-oxocyclohex-2-enone (3) ethyl (R)-3-methyl-4-oxocyclohex-2-enecarboxylate (4) (S)-4-ethoxycarbonyl-2-methyl-4-oxocyclohex-2-enone
48.	Compound given below may be named as : (1) (2R, 3Z)-7-phenylhept-3-en-2-ol (2) (2R, 3E)-7-phenylhept-3-en-2-ol (3) (2S, 3E)-7-phenylhept-3-en-2-ol (4) (2S, 3Z)-7-phenylhept-3-en-2-ol

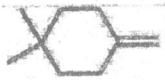
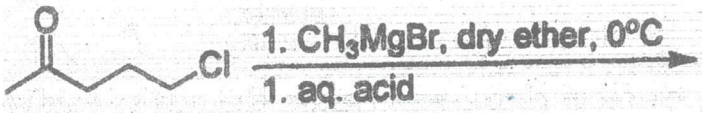
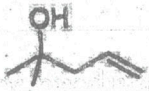
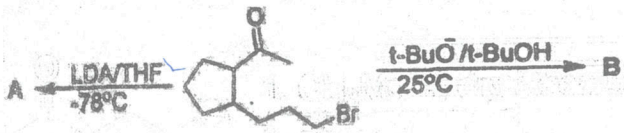
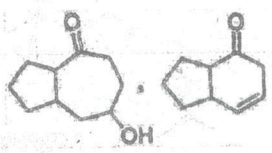
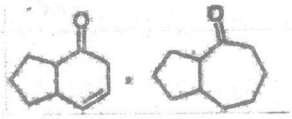
Question No.	Questions
49.	Enantiomer of the following structure is :  (1)  (2)  (3)  (4) 
50.	 A Consider compound A and choose the correct answer : (1) A could be optically active and its diastereomer is  (2) A could be optically active and its enantiomer is 

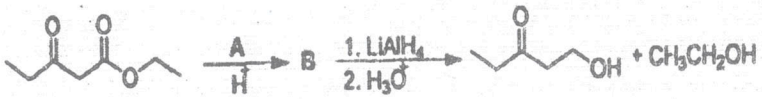
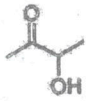
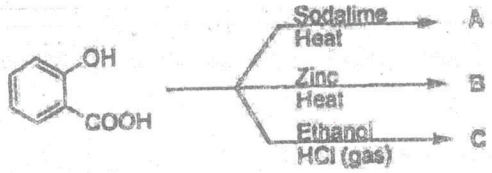
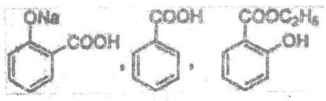
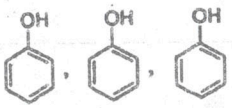
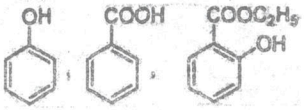
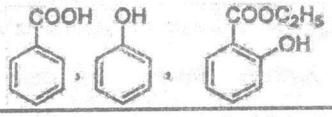
Question No.	Questions
	(3) A could be optically inactive and its diastereomer is  (4) A could be optically inactive and its enantiomer is 
51.	How many signals are present in both isomers in NQR spectroscopy ?  I  II (1) two (2) three (3) one (4) four
52.	Auxochrome when attached to chromophore absorption band is shifted towards longer wavelength due to increase in : (1) Bonding (2) Conjugation (3) Inductive effect (4) None of these
53.	The quantitative shifting in PMR signals in addition to shielding and deshielding the protons also depends upon the : (1) Inductive effect (2) Space effect (3) H–bonding (4) All of above

Question No.	Questions
54.	Ionic equivalent conductance value for Ca^{2+} is 0.0119 S m^2 mol^{-1} and for Cl^- is 0.0076 S m^2 mol^{-1}. The correct expected molar conductivity at infinite dilution for $CaCl_2$ is : (1) 0.0195 S m^2 mol^{-1} (2) 0.0271 S m^2 mol^{-1} (3) 0.0542 S m^2 mol^{-1} (4) 0.01355 S m^2 mol^{-1}
55.	A binary mixture of A_2 and B_2 will show negative deviation from Raoult's law when : (1) A–A and B–B interactions are stronger than A–B (2) A–A and B–B interactions are weaker than A–B (3) Both A–A and B–B interactions are equal to A–B (4) Either A–A or B–B interactions is equal to A–B
56.	The molar masses of monodisperse and polydisperse polymers obey respectively the conditions : (M_n=Number average molecular weight and M_w=Weight average molecular weight). (1) $M_n > M_w$ and $< M_w$ (2) $M_n = M_w$ and $M_n < M_w$ (3) $M_n < M_w$ and $M_n < M_w$ (4) $M_n = M_w$ and $M_n = M_w$
57.	$CH_3COOC_2H_5$ (aq) + H_3O^+ (ℓ) $\rightarrow$ CH_3COOH(aq)+C_2H_5OH(aq). What type of reaction is this ? (1) Unimolecular (elementary) (2) Pseudo first order (3) Zero order (4) Second order

Question No.	Questions
58.	Micelle formation is accompanied by the : (1) decrease in overall entropy due to ordering of solvent near hydrophobic ends. (2) increase in overall entropy mostly due to increase in solvent entropy. (3) increase in overall entropy mostly due to increase in solute entropy. (4) increase in overall entropy and decrease in enthalpy.
59.	The rotational partition function is expected to be smallest for the molecule, among the following : (1) H_2 (2) Li_2 (3) N_2 (4) F_2
60.	The temperature derivative of electrochemical cell potential E at constant pressure, $\left(\frac{\partial E}{\partial T}\right)_P$, is given by : (1) $-\frac{\Delta S}{nF}$ (2) $\frac{\Delta S}{nF}$ (3) $\frac{\Delta S}{nFT}$ (4) $-\frac{\Delta S}{nFT}$
61.	 Cholesterol Number of Optical isomers in Cholesterol would be : (1) 128 (2) 512 (3) 64 (4) 256

Question No.	Questions
62.	Among the following structures, the number of aromatic compound(s) is :  (1) 3 (2) 4 (3) 5 (4) 6
63.	Number of sp^2 and sp hybridized carbon atoms present in benzyne is : (1) 3 and 1 (2) 6 and 0 (3) 4 and 2 (4) 4 and 0
64.	$\overset{\oplus}{C}H_3, \overset{\oplus}{C}H_5, CH_3\overset{\oplus}{C}H_2, CH_3\overset{\oplus}{C}HCH_3$ Number of carbonium ions in the above list is : (1) 4 (2) 3 (3) 2 (4) 1
65.	In the chlorination of 1-chlorobutane under free radical conditions, the most abundant compound formed is : (1) 1,1-dichlorobutane (2) 1,2-dichlorobutane (3) 1,3-dichlorobutane (4) 1,4-dichlorobutane

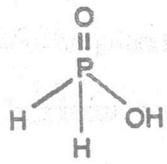
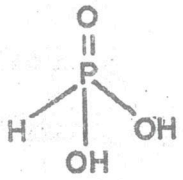
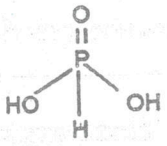
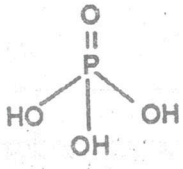
Question No.	Questions
66.	Repeated Hofmann Elimination reaction will often remove a nitrogen atom from an amine molecule. Which of the following compounds is likely product in this case ? (1) (2) (3)  (4)
67.	Major product of the following reaction is :  (1) (2) (3)  (4)
68.	 Major product A and B are respectively : (1) (2) (3)  (4) 

Question No.	Questions
69.	Identify A in the following reaction sequence :  (1) (2)  (3) (4) HCN
70.	 Products A, B and C respectively are : (1)  (2)  (3)  (4) 
71.	Which of the following statements is wrong ? (1) UV absorption is attributable to electronic transitions. (2) UV spectra provide information about valence electrons. (3) IR absorption is attributable to transitions between rotational energy levels of whole molecules. (4) NMR spectrometers use radiofrequency electromagnetic radiation.

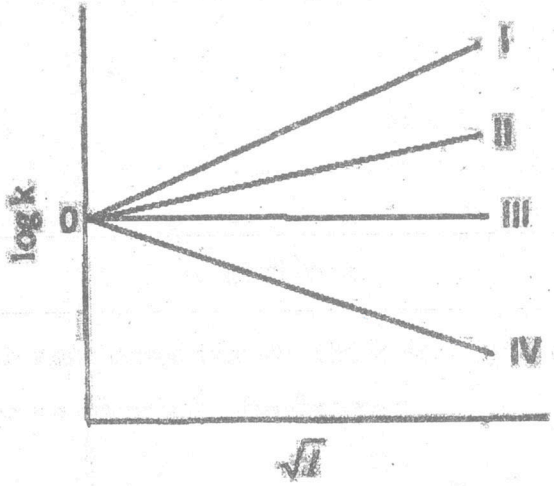
Question No.	Questions
72.	Which of the following statements regarding mass spectrometry is false ? (1) The base peak of a simple ketone is usually attributable to an acylium ion. (2) The molecular ion of carbonyl compounds with a –C-H readily undergoes elimination of an alkene to give a relatively stable enol radical cation. (3) The molecular ion peak of some alcohols is very weak because it readily loses an alkyl radical to give a relatively stable oxonium (hydroxycarbenium) ion. (4) Structurally isomeric alkanes cannot be distinguished by low resolution mass spectrometry.
73.	Neopentyl chloride, $(CH_3)_3CCH_2Cl$, reacts with the strong base sodium amide to form a new compound. This compound has a molecular ion at m/z = 70 amu and displays two ^1H NMR singlets at δ 0.20 & 1.05 ppm (integration ratio = 2:3). What is a plausible structure for this compound ? (1) 2-methyl-2-butene (2) 1,1-dimethylcyclopropane (3) methylcyclobutane (4) cyclopentane
74.	Combustion analysis of an organic compound shows it to be 64.3% carbon. It displays a molecular ion at m/z = 112 amu in the mass spectrum. Which of the following is a plausible molecular formula for this compound ? (1) C_8H_{16} (2) $C_7H_{12}O$ (3) $C_6H_8O_2$ (4) $C_5H_4O_3$

Question No.	Questions
75.	The ^1H NMR spectrum of a diluted solution of a mixture of acetone and dichloromethane in $CDCl_3$ exhibits two singlets of 1:1 intensity. Molar ratio of acetone to dichloromethane in the solution is (1) 3:1 (2) 1:3 (3) 1:1 (4) 1:2
76.	Which of the following is the principal factor which causes the properties of nanomaterials to differ significantly from other materials ? (1) Size distribution (2) Specific surface feature (3) Quantum size effects (4) All the above
77.	_____ is an excellent 'green' solvent as well as a greenhouse gas ? (1) Methane (2) CFCs (3) Carbon monoxide (4) Carbon dioxide
78.	Which of the following statements is not true regrading the binding site of a receptor ? (1) The binding site is normally a hollow or cleft in the surface of a receptor. (2) The binding site is normally hydrophobic in nature. (3) The binding site contains amino acids which are important to the binding process and a catalytic mechanism. (4) Chemical messengers fit into binding sites and bind to functional groups within the binding site.

Question No.	Questions
79.	There is a lot of interest in the area of supramolecular catalysis at the moment, why is this ? (1) There is actually very little interest in this area, due to the fact that it is very difficult to make a supramolecular catalyst. (2) It would be useful for cutting down on the amount of solvent in the reaction and hence decrease costs. This is of particular significance to large scale industrial processes. (3) It would allow very efficient and stereoselective catalysis of often very difficult reactions. (4) It is thought that a supramolecular catalyst would be capable of replacing catalytic metals in reactions, thereby reducing cost while increasing efficiency.
80.	The term used to measure a product or person's environmental impact is (1) Handprint (2) CO_2 print (3) Footprint (4) Hazardous potential
81.	Stainless steel does not rust because : (1) Chromium and nickel combine with iron (2) Chromium forms an oxide layer and protects iron from rusting (3) Nickel present in it, does not rust (4) Iron forms a hard chemical compound with chromium present in it

Question No.	Questions
82.	The pair whose both species are used in antacid medicinal preparations is : (1) $NaHCO_3$ and $Mg(OH)_2$ (2) Na_2CO_3 and $Ca(HCO_3)_2$ (3) $Ca(HCO_3)_2$ and $Mg(OH)_2$ (4) $Ca(OH)_2$ and $NaHCO_3$
83.	Artificial gem used for cutting glass is : (1) graphite (2) diamond (3) SiC (4) $CaCN_2$
84.	Phosgene can be obtained when : (1) White phosphorus reacts with alkali. (2) Calcium phosphide reacts with water. (3) Chloroform reacts with air. (4) Bone comes in contact with water.
85.	The structural formula of hypophosphorous acid is : (1)  (2)  (3)  (4) 

Question No.	Questions
86.	In which of these processes platinum is used as a catalyst ? (1) Production of synthetic rubber (2) Hardening of oils (3) Oxidation of ammonia to form HNO_3 (4) Synthesis of methanol
87.	In Zeigler - Natta polymerisation of ethylene, the active species is : (1) $AlCl_3$ (2) Et_3Al (3) Ti^{III} (4) $TiCl_4$
88.	Which of the following is not an example of organometallic compound ? (1) Trimethylboron (2) Trimethylaluminium (3) Trimethoxytitanium chloride (4) Tetracarbonylnickel
89.	The nuclear reaction : $^{63}_{29}Cu + {}^{4}_{2}He \rightarrow {}^{37}_{17}Cl + 14\ {}^{1}_{1}H + 16\ {}^{1}_{0}n$ is referred to as : (1) Spallation reaction (2) Fusion reaction (3) Fission reaction (4) Chain reaction
90.	The nucleus resulting from $_{92}U^{238}$ after successive emission of two α and four β–particles is : (1) $_{90}Th^{230}$ (2) $_{94}Pu^{230}$ (3) $_{88}Ra^{230}$ (4) $_{92}U^{230}$

Question No.	Questions
91.	The plot of the rate constant vs. ionic strength of the reaction $A^{2+} + B^-$ follows the line as shown in the figure :  (1) I (2) II (3) III (4) IV
92.	Reaction between A and B is carried out for different initial concentrations and the corresponding half-life times are measured. The data are listed in the table : Entry | $[A_0]$ M | $[B_0]$ M | $t_{1/2}s^{-1}$ 1 | 500 | 10 | 60 2 | 500 | 20 | 60 3 | 10 | 500 | 60 4 | 20 | 500 | 30 The rate can be represented as : (1) k[A] [B] (2) $k[A]^2$ (3) $k[A]^2$ [B] (4) k[A] $[B]^2$

Question No.	Questions
93.	The separation of the (123) planes of an orthorhombic unit cell is 3.12 nm. The separation of (246) and (369) planes are, respectively : (1) 1.56 nm and 1.04 nm (2) 1.04 nm and 1.56 nm (3) 3.12 nm and 1.50 nm (4) 1.04 nm and 3.12 nm
94.	The predicted electromotive force (emf) of the electrochemical cell $Fe(s) / Fe^{2+}(aq)\ (0.01M) \| Cd^{2+}(aq)\ (0.01M)/Cd(s)$ ($E^{\circ}_{(Fe^{2+}/Fe)} = -0.447V$ and $E^{\circ}_{Cd^{2}/Cd} = -0.403V$) (1) –0.850V (2) +0.044V (3) +0.0850V (4) –0.044V
95.	For a particle of mass m in a 1-D box of length 2L, the energy of level corresponding to n=8 is : (1) $\frac{h^2}{8ml^2}$ (2) $\frac{h^2}{32ml^2}$ (3) $\frac{4h^2}{ml^2}$ (4) $\frac{2h^2}{ml^2}$
96.	A thermodynamic equation that relates chemical potential to the composition of a mixture is known as : (1) Gibbs Helmholtz equation (2) Gibbs-Duhem equation (3) Joule-Thomson equation (4) Debye Huckel equation

Question No.	Questions
97.	One mole of monoatomic gas is transformed from 300K and 2 atm to 600K and 4 atm. The entropy change for the process is : (1) $\frac{3}{2}$R *ln* 2 (2) $\frac{1}{2}$R *ln* 2 (3) $\frac{7}{2}$R *ln* 2 (4) $\frac{5}{2}$ R *ln* 2
98.	The electrical double layer model that consist of both the fixed layer and diffused layer among the following is : (1) Helmholtz (2) Gouy (3) Stern (4) Debye Huckel
99.	If e^{ax} is an eigen function and d^n/dx^n is an operator then the eigen value will be : (1) a^n (2) a (3) n (4) n^a
100.	The Gibbs energy for the decomposition of Al_2O_3 at 500°C is as follows : $\frac{2}{3}Al_2O_3 \rightarrow \frac{4}{3}Al + O_2$, $\Delta_r G$ =+966 kJ mol^{-1} The potential difference needed for electrolytic reduction of Al_2O_3 at 500°C is at least : (1) 2.5 V (2) 5.0 V (3) 4.5 V (4) 3.0 V

SET–"X"

(DO NOT OPEN THIS QUESTION BOOKLET BEFORE TIME OR UNTIL YOU ARE ASKED TO DO SO)

(MPH/PHD/URS–EE–2020)

CHEMISTRY

Sr. No. 10004

Code **D**

Time : 1¼ Hours **Total Questions : 100** **Max. Marks : 100**

Roll No. _____ (in figure) _____ (in words)

Name : _____ Father's Name : _____

Mother's Name : _____ Date of Examination : _____

(Signature of the candidate) (Signature of the Invigilator)

CANDIDATES MUST READ THE FOLLOWING INFORMATION/ INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

1. **All questions are compulsory.**
2. The candidates must return the Question book-let as well as OMR answer-sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / mis-behaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such a candidate will not be evaluated.
3. Keeping in view the transparency of the examination system, carbonless OMR Sheet is provided to the candidate so that a copy of OMR Sheet may be kept by the candidate.
4. Question Booklet along with answer key of all the A,B,C and D code will be got uploaded on the university website after the conduct of Entrance Examination. In case there is any discrepancy in the Question Booklet/Answer Key, the same may be brought to the notice of the Controller of Examination in writing/through E-Mail within 24 hours of uploading the same on the University Website. Thereafter, no complaint in any case, will be considered.
5. The candidate MUST NOT do any rough work or writing in the OMR Answer-Sheet. Rough work, if any, may be done in the question book-let itself. Answers **MUST NOT** be ticked in the Question book-let.
6. **There will be no negative marking. Each correct answer will be awarded one full mark. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.**
7. Use only Black or Blue **BALL POINT PEN** of good quality in the OMR Answer-Sheet.
8. BEFORE ANSWERING THE QUESTIONS, THE CANDIDATES SHOULD ENSURE THAT THEY HAVE BEEN SUPPLIED CORRECT AND COMPLETE BOOK-LET. COMPLAINTS, IF ANY, REGARDING MISPRINTING ETC. WILL NOT BE ENTERTAINED 30 MINUTES AFTER STARTING OF THE EXAMINATION.

Komal

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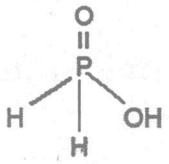
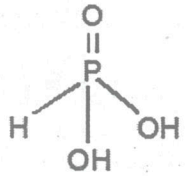
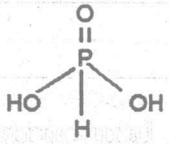
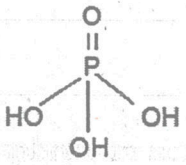
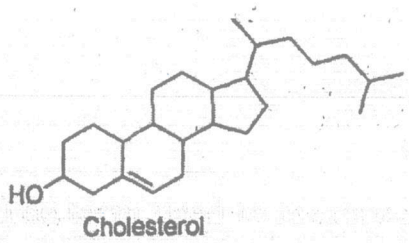
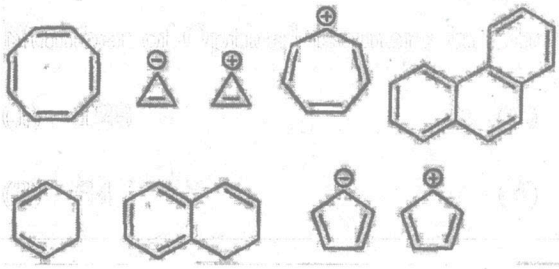
Question No.	Questions
1.	Stainless steel does not rust because : (1) Chromium and nickel combine with iron (2) Chromium forms an oxide layer and protects iron from rusting (3) Nickel present in it, does not rust (4) Iron forms a hard chemical compound with chromium present in it
2.	The pair whose both species are used in antacid medicinal preparations is : (1) $NaHCO_3$ and $Mg(OH)_2$ (2) Na_2CO_3 and $Ca(HCO_3)_2$ (3) $Ca(HCO_3)_2$ and $Mg(OH)_2$ (4) $Ca(OH)_2$ and $NaHCO_3$
3.	Artificial gem used for cutting glass is : (1) graphite (2) diamond (3) SiC (4) $CaCN_2$
4.	Phosgene can be obtained when : (1) White phosphorus reacts with alkali. (2) Calcium phosphide reacts with water. (3) Chloroform reacts with air. (4) Bone comes in contact with water.

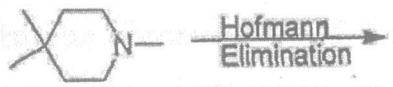
Question No.	Questions
5.	The structural formula of hypophosphorous acid is : (1)  (2)  (3)  (4) 
6.	In which of these processes platinum is used as a catalyst ? (1) Production of synthetic rubber (2) Hardening of oils (3) Oxidation of ammonia to form HNO_3 (4) Synthesis of methanol
7.	In Zeigler - Natta polymerisation of ethylene, the active species is : (1) $AlCl_3$ (2) Et_3Al (3) Ti^{III} (4) $TiCl_4$
8.	Which of the following is not an example of organometallic compound ? (1) Trimethylboron (2) Trimethylaluminium (3) Trimethoxytitanium chloride (4) Tetracarbonylnickel

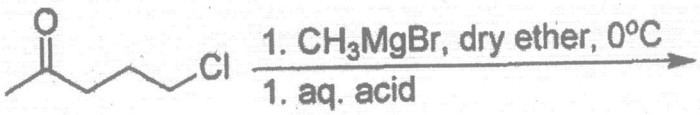
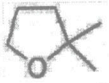
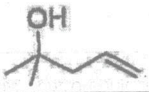
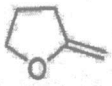
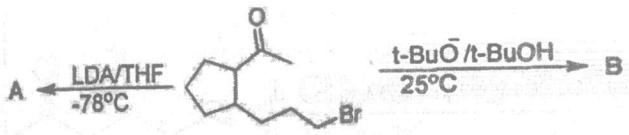
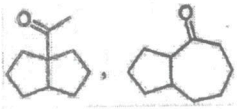
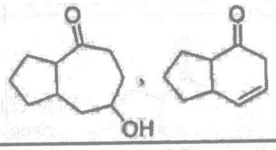
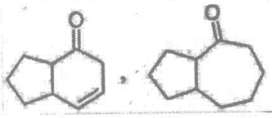
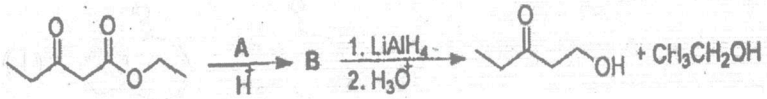
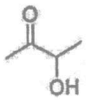
Question No.	Questions
9.	The nuclear reaction : $^{63}_{29}Cu + {}^{4}_{2}He \rightarrow {}^{37}_{17}Cl + 14\ {}^{1}_{1}H + 16\ {}^{1}_{0}n$ is referred to as : (1) Spallation reaction (2) Fusion reaction (3) Fission reaction (4) Chain reaction
10.	The nucleus resulting from $_{92}U^{238}$ after successive emission of two α and four β–particles is : (1) $_{90}Th^{230}$ (2) $_{94}Pu^{230}$ (3) $_{88}Ra^{230}$ (4) $_{92}U^{230}$
11.	Which of the following statements is wrong ? (1) UV absorption is attributable to electronic transitions. (2) UV spectra provide information about valence electrons. (3) IR absorption is attributable to transitions between rotational energy levels of whole molecules. (4) NMR spectrometers use radiofrequency electromagnetic radiation.
12.	Which of the following statements regarding mass spectrometry is false ? (1) The base peak of a simple ketone is usually attributable to an acylium ion. (2) The molecular ion of carbonyl compounds with a –C-H readily undergoes elimination of an alkene to give a relatively stable enol radical cation. (3) The molecular ion peak of some alcohols is very weak because it readily loses an alkyl radical to give a relatively stable oxonium (hydroxycarbenium) ion. (4) Structurally isomeric alkanes cannot be distinguished by low resolution mass spectrometry.

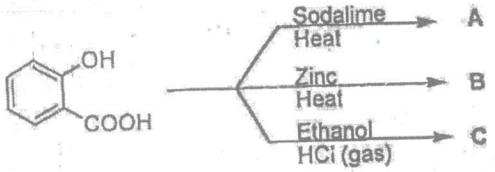
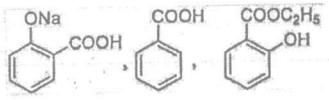
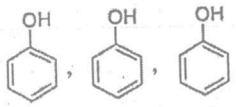
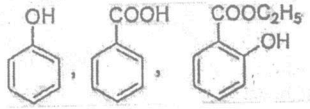
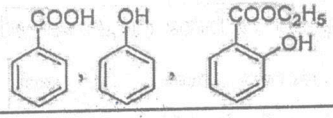
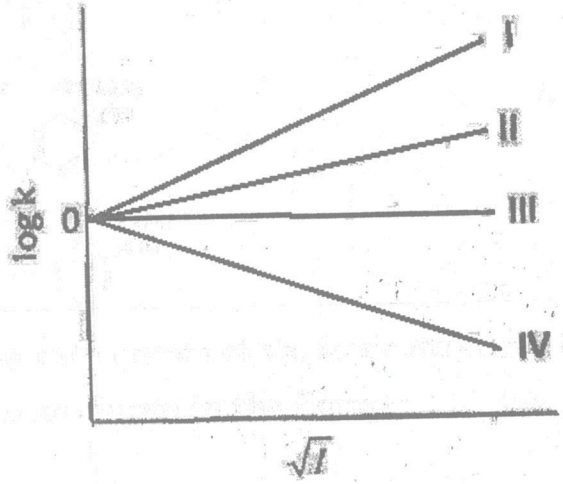
Question No.	Questions
13.	Neopentyl chloride, $(CH_3)_3CCH_2Cl$, reacts with the strong base sodium amide to form a new compound. This compound has a molecular ion at m/z = 70 amu and displays two ^1H NMR singlets at δ 0.20 & 1.05 ppm (integration ratio = 2:3). What is a plausible structure for this compound ? (1) 2-methyl-2-butene (2) 1,1-dimethylcyclopropane (3) methylcyclobutane (4) cyclopentane
14.	Combustion analysis of an organic compound shows it to be 64.3% carbon. It displays a molecular ion at m/z = 112 amu in the mass spectrum. Which of the following is a plausible molecular formula for this compound ? (1) C_8H_{16} (2) $C_7H_{12}O$ (3) $C_6H_8O_2$ (4) $C_5H_4O_3$
15.	The ^1H NMR spectrum of a diluted solution of a mixture of acetone and dichloromethane in $CDCl_3$ exhibits two singlets of 1:1 intensity. Molar ratio of acetone to dichloromethane in the solution is (1) 3:1 (2) 1:3 (3) 1:1 (4) 1:2
16.	Which of the following is the principal factor which causes the properties of nanomaterials to differ significantly from other materials ? (1) Size distribution (2) Specific surface feature (3) Quantum size effects (4) All the above

Question No.	Questions
17.	_____ is an excellent 'green' solvent as well as a greenhouse gas ? (1) Methane (2) CFCs (3) Carbon monoxide (4) Carbon dioxide
18.	Which of the following statements is not true regrading the binding site of a receptor ? (1) The binding site is normally a hollow or cleft in the surface of a receptor. (2) The binding site is normally hydrophobic in nature. (3) The binding site contains amino acids which are important to the binding process and a catalytic mechanism. (4) Chemical messengers fit into binding sites and bind to functional groups within the binding site.
19.	There is a lot of interest in the area of supramolecular catalysis at the moment, why is this ? (1) There is actually very little interest in this area, due to the fact that it is very difficult to make a supramolecular catalyst. (2) It would be useful for cutting down on the amount of solvent in the reaction and hence decrease costs. This is of particular significance to large scale industrial processes. (3) It would allow very efficient and stereoselective catalysis of often very difficult reactions. (4) It is thought that a supramolecular catalyst would be capable of replacing catalytic metals in reactions, thereby reducing cost while increasing efficiency.

Question No.	Questions
20.	The term used to measure a product or person's environmental impact is (1) Handprint (2) CO_2 print (3) Footprint (4) Hazardous potential
21.	 Cholesterol Number of Optical isomers in Cholesterol would be : (1) 128 (2) 512 (3) 64 (4) 256
22.	Among the following structures, the number of aromatic compound(s) is :  (1) 3 (2) 4 (3) 5 (4) 6

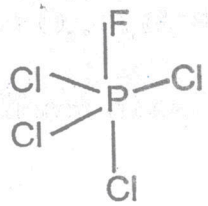
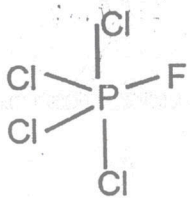
Question No.	Questions
23.	Number of sp^2 and sp hybridized carbon atoms present in benzyne is : (1) 3 and 1 (2) 6 and 0 (3) 4 and 2 (4) 4 and 0
24.	$\overset{\oplus}{C}H_3, \overset{\oplus}{C}H_5, CH_3\overset{\oplus}{C}H_2, CH_3\overset{\oplus}{C}HCH_3$ Number of carbonium ions in the above list is : (1) 4 (2) 3 (3) 2 (4) 1
25.	In the chlorination of 1-chlorobutane under free radical conditions, the most abundant compound formed is : (1) 1,1-dichlorobutane (2) 1,2-dichlorobutane (3) 1,3-dichlorobutane (4) 1,4-dichlorobutane
26.	Repeated Hofmann Elimination reaction will often remove a nitrogen atom from an amine molecule.  Which of the following compounds is likely product in this case ? (1) (2) (3) (4)

Question No.	Questions
27.	Major product of the following reaction is :  (1) (2)  (3)  (4) 
28.	 Major product A and B are respectively : (1) (2)  (3)  (4) 
29.	Identify A in the following reaction sequence :  (1) (2)  (3) (4) HCN

Question No.	Questions
30.	 Products A, B and C respectively are : (1)  (2)  (3)  (4) 
31.	The plot of the rate constant vs. ionic strength of the reaction $A^{2+} + B^-$ follows the line as shown in the figure :  (1) I (2) II (3) III (4) IV

Question No.	Questions
32.	Reaction between A and B is carried out for different initial concentrations and the corresponding half-life times are measured. The data are listed in the table : Entry | $[A_o]$ M | $[B_o]$ M | $t_{1/2}s^{-1}$ 1 | 500 | 10 | 60 2 | 500 | 20 | 60 3 | 10 | 500 | 60 4 | 20 | 500 | 30 The rate can be represented as : (1) $k[A][B]$ (2) $k[A]^2$ (3) $k[A]^2[B]$ (4) $k[A][B]^2$
33.	The separation of the (123) planes of an orthorhombic unit cell is 3.12 nm. The separation of (246) and (369) planes are, respectively : (1) 1.56 nm and 1.04 nm (2) 1.04 nm and 1.56 nm (3) 3.12 nm and 1.50 nm (4) 1.04 nm and 3.12 nm
34.	The predicted electromotive force (emf) of the electrochemical cell $Fe(s) / Fe^{2+}(aq)\ (0.01M) \| Cd^{2+}(aq)\ (0.01M)/Cd(s)$ ($E^{\circ}_{(Fe^{2+}/Fe)} = -0.447V$ and $E^{\circ}_{Cd^2/Cd} = -0.403V$) (1) –0.850V (2) +0.044V (3) +0.0850V (4) –0.044V

Question No.	Questions
35.	For a particle of mass m in a 1-D box of length 2L, the energy of level corresponding to n=8 is : (1) $\frac{h^2}{8ml^2}$ (2) $\frac{h^2}{32ml^2}$ (3) $\frac{4h^2}{ml^2}$ (4) $\frac{2h^2}{ml^2}$
36.	A thermodynamic equation that relates chemical potential to the composition of a mixture is known as : (1) Gibbs Helmholtz equation (2) Gibbs-Duhem equation (3) Joule-Thomson equation (4) Debye Huckel equation
37.	One mole of monoatomic gas is transformed from 300K and 2 atm to 600K and 4 atm. The entropy change for the process is : (1) $\frac{3}{2}$R *ln* 2 (2) $\frac{1}{2}$R *ln* 2 (3) $\frac{7}{2}$R *ln* 2 (4) $\frac{5}{2}$ R *ln* 2
38.	The electrical double layer model that consist of both the fixed layer and diffused layer among the following is : (1) Helmholtz (2) Gouy (3) Stern (4) Debye Huckel

Question No.	Questions
39.	If e^{ax} is an eigen function and d^n/dx^n is an operator then the eigen value will be : (1) a^n (2) a (3) n (4) n^a
40.	The Gibbs energy for the decomposition of Al_2O_3 at 500°C is as follows : $\frac{2}{3}Al_2O_3 \rightarrow \frac{4}{3}Al + O_2$, $\Delta_r G = +966$ kJ mol^{-1} The potential difference needed for electrolytic reduction of Al_2O_3 at 500°C is at least : (1) 2.5 V (2) 5.0 V (3) 4.5 V (4) 3.0 V
41.	How many signals are present in both isomers in NQR spectroscopy ?  I  II (1) two (2) three (3) one (4) four
42.	Auxochrome when attached to chromophore absorption band is shifted towards longer wavelength due to increase in : (1) Bonding (2) Conjugation (3) Inductive effect (4) None of these

Question No.	Questions
43.	The quantitative shifting in PMR signals in addition to shielding and deshielding the protons also depends upon the : (1) Inductive effect (2) Space effect (3) H–bonding (4) All of above
44.	Ionic equivalent conductance value for Ca^{2+} is 0.0119 S m^2 mol^{-1} and for Cl^- is 0.0076 S m^2 mol^{-1}. The correct expected molar conductivity at infinite dilution for $CaCl_2$ is : (1) 0.0195 S m^2 mol^{-1} (2) 0.0271 S m^2 mol^{-1} (3) 0.0542 S m^2 mol^{-1} (4) 0.01355 S m^2 mol^{-1}
45.	A binary mixture of A_2 and B_2 will show negative deviation from Raoult's law when : (1) A–A and B–B interactions are stronger than A–B (2) A–A and B–B interactions are weaker than A–B (3) Both A–A and B–B interactions are equal to A–B (4) Either A–A or B–B interactions is equal to A–B
46.	The molar masses of monodisperse and polydisperse polymers obey respectively the conditions : (M_n=Number average molecular weight and M_w=Weight average molecular weight). (1) $M_n > M_w$ and $< M_w$ (2) $M_n = M_w$ and $M_n < M_w$ (3) $M_n < M_w$ and $M_n < M_w$ (4) $M_n = M_w$ and $M_n = M_w$

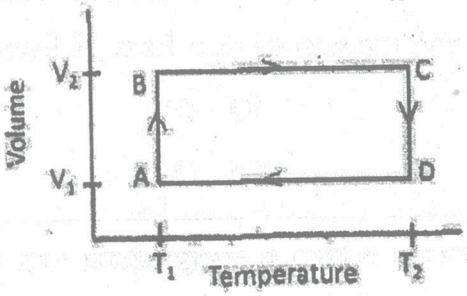
Question No.	Questions
47.	$CH_3COOC_2H_5$ (aq) + H_3O^+ (ℓ)$\rightarrow$ CH_3COOH(aq)+C_2H_5OH(aq). What type of reaction is this ? (1) Unimolecular (elementary) (2) Pseudo first order (3) Zero order (4) Second order
48.	Micelle formation is accompanied by the : (1) decrease in overall entropy due to ordering of solvent near hydrophobic ends. (2) increase in overall entropy mostly due to increase in solvent entropy. (3) increase in overall entropy mostly due to increase in solute entropy. (4) increase in overall entropy and decrease in enthalpy.
49.	The rotational partition function is expected to be smallest for the molecule, among the following : (1) H_2 (2) Li_2 (3) N_2 (4) F_2
50.	The temperature derivative of electrochemical cell potential E at constant pressure, $\left(\frac{\partial E}{\partial T}\right)_P$, is given by : (1) $-\frac{\Delta S}{nF}$ (2) $\frac{\Delta S}{nF}$ (3) $\frac{\Delta S}{nFT}$ (4) $-\frac{\Delta S}{nFT}$

Question No.	Questions
51.	The metal species present in Nitrogenase is : (1) Zinc (2) Molybdenum (3) Tungsten (4) Lead
52.	Which of the following compounds will show quadrupole splitting in Mossbauer spectroscopy ? (1) $K_4 Fe(CN)_6$ (2) $FeCl_3$ (3) $Fe_2(SO_4)_3$ (4) $FeSO_4$
53.	The most widely used standard reference substance in ESR is : (1) 1, 1 –diphenyl –2–Picryl – hydrazyl free radical (2) 1, 1 –diphenyl –2–Picryl – hydroxyl free radical (3) TMS (4) None of these
54.	In DTA, the differential temperature Vs temperature or time curve is highly sensitive to : (1) Heating rate (2) Sample size (3) Sample packing (4) All of these
55.	Radio metric titrations have been applied for : (1) Determination of the composition of compound (2) Investigation of co-precipitation (3) Determination of the specific activity of radioactive preparations (4) All of these

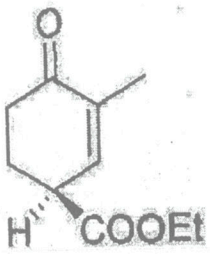
Question No.	Questions
56.	Cytochromes in biological systems are involved in : (1) Proton transfer (2) Oxygen transfer (3) Electron transfer (4) Metal transfer
57.	In Ferrocene which metal orbital interact more effectively with ligand group orbital ? (1) $3d_z^2$ (2) $3d_{xy}$ $3d_{x^2-y^2}$ (3) $4P_x 4P_y$ (4) $3d_{xz}$, $3d_{yz}$
58.	The Electroanalytical technique in which the potential of the working electrode is stepped and the resulting current is monitored as a function of time is : (1) Coulometry (2) Chronopotentiometry (3) Chronoamperometry (4) Pulse polarography
59.	Lithium drugs are used in treatment of : (1) Dental caries (2) Psychiatric disorder (3) Malaria (4) Arthritis
60.	Which alkylating agent is used as Anticancer Drug in treatment of most of the cancers ? (1) Melphan (2) Cyclophosphamide (3) Chlorambucil (4) None of these
61.	The number of rotational degrees of freedom of CO_2 is : (1) one (2) two (3) three (4) four

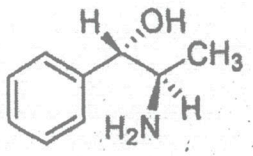
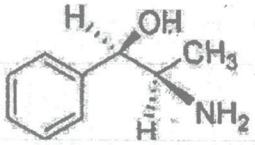
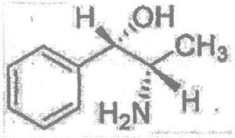
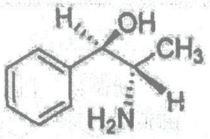
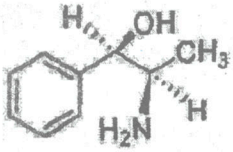
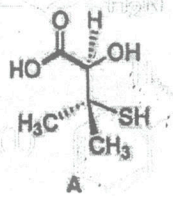
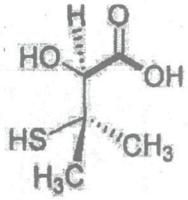
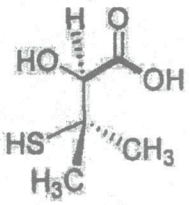
Question No.	Questions
62.	When crystals of sodium chloride are heated in the presence of sodium vapor, they turn yellow. This is due to the formation of: (1) Schottky defects (2) Frenkel defects (3) F-centres (4) H-centres
63.	Of the following inequalities, the criterion/criteria for spontaneity of a chemical reaction is/are : (i) $(\Delta G)_{T,P} < 0$ (ii) $(\Delta U)_{S,V} > 0$ (iii) $(\Delta S)_{U,V} > 0$ (1) (i) only (2) (ii) only (3) (i) and (ii) (4) (i) and (iii)
64.	The concentration of a reactant decreases linearly with time. What is the order of the reaction ? (1) 1st order (2) Fractional order (3) 2nd order (4) Zero order
65.	The absorbance of solution having 20% transmittance is : (1) 0.301 (2) 0.699 (3) 1.301 (4) 1.699
66.	Electrolysis of an aqueous solution of 1.0 M NaOH results in : (1) Na at the cathode and O_2 at the anode. (2) H_2 at the cathode and O_2 at the anode. (3) Na and H_2 at the cathode and O_2 at the anode. (4) O_2 at the cathode and H_2 at the anode.

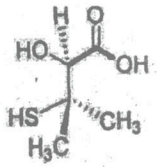
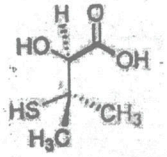
Question No.	Questions
67.	The rate constant of decomposition of a compound is represented by $\text{in } K = 5.0 - \frac{12000}{T}$ The value of E_A (in Kcal mol^{-1}) for this compound at 300 K is : (1) 24 (2) 12 (3) 240 (4) 120
68.	For a reaction $2A \rightarrow$ Product the initial concentration of A is 0.1 M and the rate constant is $2 \times 10^{-3} dm^3 mol^{-1} s^{-1}$. The half life period of the reaction is : (1) 5 sec (2) 50 sec (3) 500 sec (4) 5000 sec
69.	The number of degenerate spatial orbitals of a hydrogen-like atom with principal quantum number n=6 is : (1) 12 (2) 6 (3) 72 (4) 36
70.	If the atoms/ions in the crystal are taken to be hard spheres touching each other in the unit cell, then the fraction of volume occupied in the body centered cubic structure is : (1) $\sqrt{3}\pi$ (2) $\frac{\sqrt{2}}{6}\pi$ (3) $\frac{\pi}{6}$ (4) $\frac{\sqrt{3}}{8}\pi$

Question No.	Questions
71.	The equilibrium constants k_{P1} and k_{P2} for the reactions $X \rightleftharpoons 2Y$ and $Z \rightleftharpoons P + Q$, respectively are in the ratio of 1:9. If the degree of dissociation of X and Z be equal then the ratio of total pressure at these equilibria is : (1) 1:36 (2) 1:1 (3) 1:3 (4) 1:9
72.	Four distinguishable molecules are distributed in energy levels E_1 and E_2 with degeneracy of 2 and 3, respectively. Number of microstates, with 3 molecules in energy level E_1 and one in energy level E_2 is : (1) 4 (2) 12 (3) 96 (4) 192
73.	One mole of an ideal gas undergoes a cyclic process (ABCDA) starting from point A through 4 reversible steps as shown in the figure. Total work done in the process is :  (1) $R(T_1 - T_2)\frac{V_2}{V_1}$ (2) $R(T_1 + T_2)\frac{V_2}{V_1}$ (3) $R(T_1 + T_2)\, ln\, \frac{V_2}{V_1}$ (4) $R(T_1 - T_2)\, ln\, \frac{V_2}{V_1}$

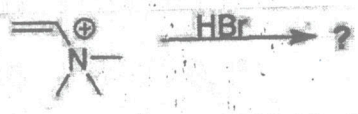
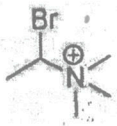
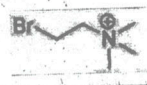
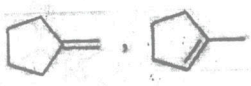
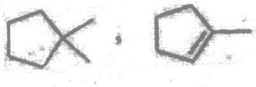
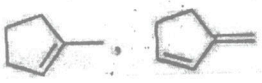
Question No.	Questions
74.	If the specific conductance of an electrolyte solution is 0.2 ohm^{-1} cm^{-1} and cell constant is 0.25, the conductance of the solution is : (1) 1.25 ohm^{-1} (2) 1.0 ohm^{-1} (3) 0.8 ohm^{-1} (4) 2.0 ohm^{-1}
75.	The slope and intercept obtained from (1/Rate) against (1/substrate concentration) of an enzyme catalyzed reaction are 300 and 2 $\times 10^5$, respectively. The Michaelis-Menten constant of the enzyme in this reaction is : (1) 5×10^6 M (2) 5×10^{-6} M (3) 1.5×10^3 M (4) 1.5×10^{-3} M
76.	Given ; A. $Fe(OH)_2(s) + 2e^- \rightarrow Fe(s) + 2OH^-(aq)$; $E_0 = -0.877V$ B. $Al^{3+}(aq) + 3e^- \rightarrow Al(s)$; $E_0 = -1.66V$ C. $AgBr(aq) + e^- \rightarrow Ag(s) + Br^-(aq)$; $E_0 = 0.071V$ The overall reaction for the cells in the direction of spontaneous change would be 1. Cell with A and B : Fe reduced Cell with A and C : Fe reduced 2. Cell with A and B : Fe reduced Cell with A and C : Fe oxidized 3. Cell with A and B : Fe oxidized Cell with A and C : Fe oxidized 4. Cell with A and B : Fe oxidized Cell with A and C : Fe reduced

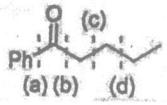
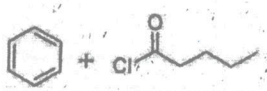
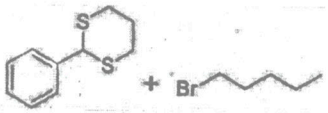
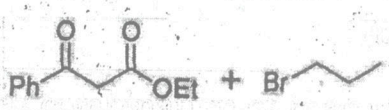
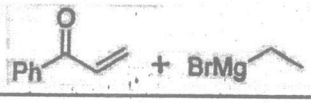
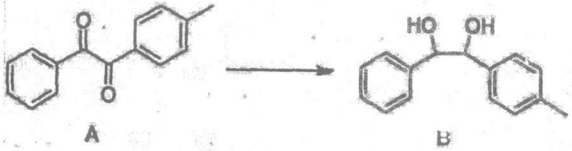
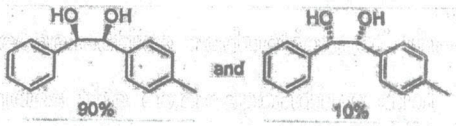
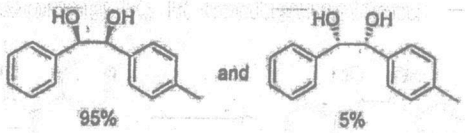
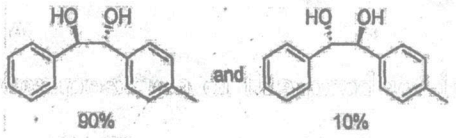
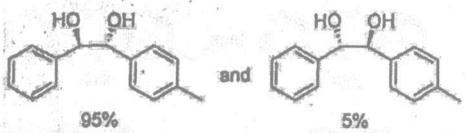
Question No.	Questions
77.	IUPAC name of the following compound is :  (1) Pethyl (S)-3-methyl-4-oxocyclohex-2-enecarboxylate (2) (R)-4-ethoxycarbonyl-2-methyl-4-oxocyclohex-2-enone (3) ethyl (R)-3-methyl-4-oxocyclohex-2-enecarboxylate (4) (S)-4-ethoxycarbonyl-2-methyl-4-oxocyclohex-2-enone
78.	Compound given below may be named as : (1) (2R, 3Z)-7-phenylhept-3-en-2-ol (2) (2R, 3E)-7-phenylhept-3-en-2-ol (3) (2S, 3E)-7-phenylhept-3-en-2-ol (4) (2S, 3Z)-7-phenylhept-3-en-2-ol

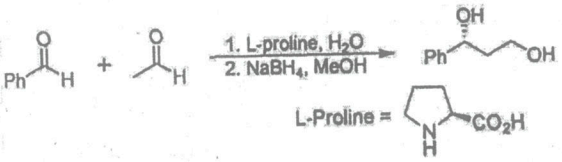
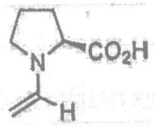
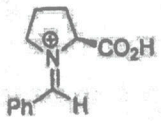
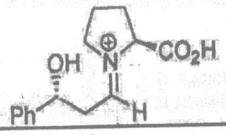
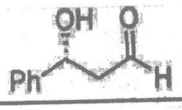
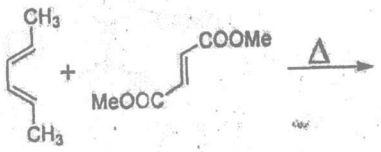
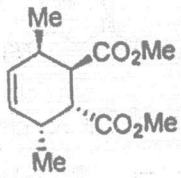
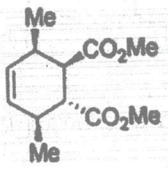
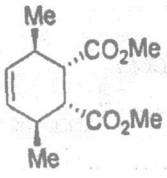
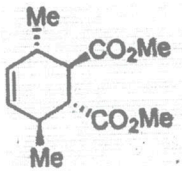
Question No.	Questions
79.	Enantiomer of the following structure is :  (1)  (2)  (3)  (4) 
80.	 A Consider compound A and choose the correct answer : (1) A could be optically active and its diastereomer is  (2) A could be optically active and its enantiomer is 

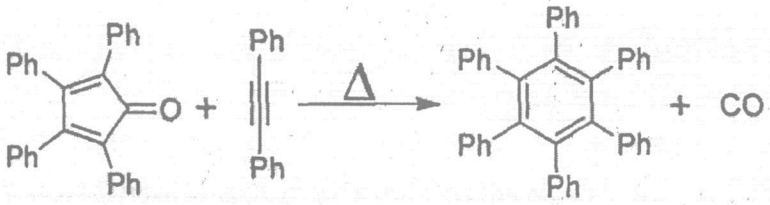
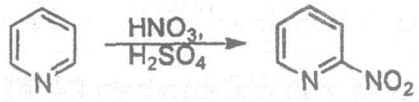
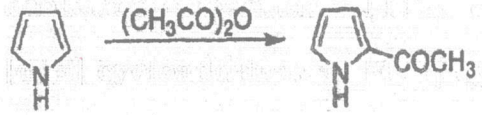
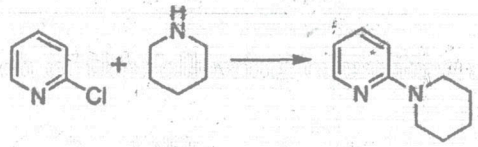
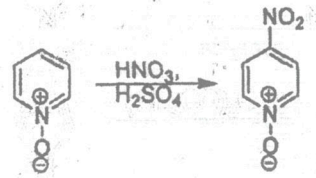
Question No.	Questions
	(3) A could be optically inactive and its diastereomer is  (4) A could be optically inactive and its enantiomer is 
81.	A sudden large jump between the values of second and third ionisation energies of elements would be associated with which of the following electronic configurations ? (1) $1s^2\ 2s^2\ 2p^6\ 3s^1$ (2) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$ (3) $1s^2\ 2s^2\ 2p^6\ 3s^1\ 3p^2$ (4) $1s^2\ 2s^2\ 2p^6\ 3s^2$
82.	Among the following groupings which represents the collection of isoelectronic species ? (1) NO^+, C_2^{2-}, O_2, CO (2) N_2, C_2^{2-}, NO, CO (3) CO, N_2, CN^-, C_2^{2-} (4) NO, CN^-, N_2, O_2^-
83.	In the Molecular orbital diagram for O_2^+ ion the highest occupied orbital is : (1) σ MO orbital (2) π MO orbital (3) π^* MO orbital (4) σ^* MO orbital

Question No.	Questions
84.	The correct order of hybridization of the central atom in the following species, NH_3, $[PtCl_4]^{2-}$, PCl_5, and BCl_3, is respectively : (1) dsp^2, dsp^3, sp^2, sp^3 (2) sp^3, dsp^2, dsp^3, sp^2 (3) dsp^2, sp^2, sp^3, dsp^3 (4) dsp^2, sp^3, sp^2, dsp^3
85.	Which of the following structure is most expected for the molecule $XeOF_4$? (1) Tetrahedral (2) Square Pyramid (3) Square planar (4) Octahedral
86.	Among the following, which is the weakest Lewis base ? (1) CH_3^- (2) NH_2^- (3) OH^- (4) F^-
87.	CH_3HgOH is classified as : (1) Soft - Hard (2) Soft - Soft (3) Hard - Hard (4) Hard - Soft
88.	$[Co(NH_3)_4(NO_2)_2]Cl$ exhibits : (1) Linkage isomerism, ionisation isomerism and optical isomerism. (2) Linkage isomerism, ionisation isomerism and geometrical isomerism. (3) Ionisation isomerism, geometrical isomerism and optical isomerism. (4) Linkage isomerism, geometrical isomerism and optical isomerism.

Question No.	Questions
89.	Which one of the following shows maximum value of paramagnetic behaviour ? (1) $[Sc(CN)_6]^{3-}$ (2) $[Co(CN)_6]^{3-}$ (3) $[Fe(CN)_6]^{3-}$ (4) $[Cr(CN)_6]^{3-}$
90.	In which of the following pairs are both the ions coloured in aqueous solution ? (1) Ni^{2+}, Ti^{3+} (2) Sc^{3+}, Ti^{3+} (3) Sc^{3+}, Co^{2+} (4) Ni^{2+}, Cu^{+}
91.	 Major product obtained in this reaction is : (1)  (2) (3) $H_2C=CH_2$ (4) 
92.	 Products **A** and **B** respectively are : (1)  (2)  (3)  (4)

Question No.	Questions
93.	Which combination of reagents is wrong for disconnections (a)–(d) in the following ?  (1)  (2)  (3)  (4) 
94.	Stereoselective reduction of the dione **A** with a chiral reducing agent provides the corresponding diol **B** in 100% diastereoselectivity and 90% ee favoring R, R configuration.  The composition of the product is : (1)  (2)  (3)  (4) 

Question No.	Questions
95.	An α-amino acid, L–proline, can be used as a catalytic chiral auxiliary for a stereoselective aldol reaction.  Which of (1)-(4) is not involved in the above transformation ? (1)  (2)  (3)  (4) 
96.	Which of adducts (1)-(4) is the main product of the following Diels-Alder reaction ?  (1)  (2)  (3)  (4) 

Question No.	Questions
97.	The following involves two pericyclic reactions. Which combination indicates correctly the types of reaction involved ?  (1) [4+2] cycloaddition + [2+2] cycloreversion (2) cheletropic reaction + [4+2] cycloaddition (3) [4+2] cycloaddition + [4+1] cycloreversion (4) [4+2] cycloaddition + cheletropic reaction
98.	Which of the following equations shows an unlikely result ? (1)  (2)  (3)  (4) 

Question No.	Questions
99.	Which of the following statements regarding the reducing ability of a sugar is wrong ? (1) The aldehyde group of a saccharide is responsible for its reducing properties. (2) Ketoses are not reducing sugars because they are not aldehydes. (3) D-Glucose in predominantly in a cyclic hemiacetal form but it is a reducing sugar through the acyclic form with which the hemiacetal is in equilibrium. (4) A methyl glucoside is not a reducing sugar.
100.	Which of the following is not an important secondary structural feature in large peptides and proteins ? (1) the α-helix (2) the β-turn (3) chair conformations (4) the β-pleated sheet

A

Chemistry Ph.D Entrance Key				
Qus no.	A	B	C	D
1	4	4	2	2
2	3	3	3	1
3	3	2	4	3
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59	1	3	1	2

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100	3	1	1	3

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