15/10/15

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

(Ph.D/URS–EE–2015)

Sr. No. 10021 **Subject : CHEMISTRY** **Code A**

Time : 1¼ Hours **Max. Marks : 100** **Total Questions : 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 and carry equal marks. The candidates are required to attempt all questions.
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 / misbehaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such candidate will not be evaluated.
3. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing within two hours after the test is over. No such complaint(s) will be entertained thereafter.
4. 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.
5. **Use only Black or Blue <u>BALL POINT PEN</u> of good quality in the OMR Answer-Sheet.**
6. **There will be <u>NEGATIVE</u> marking. Each correct answer will be awarded one full mark and each incorrect answer will be negatively marked for which the candidate will get ¼ discredit. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.**
7. 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.

Question No.	Questions
1.	Structure of B_2H_6 is depicted as (1) Octahedral structure (2) Two BH_3 units joined together (3) Two BH_2 units joined by two B–H–B (4) Two BH_3 units joined by two B–H–B
2.	Calconides are the compounds of (1) Nitrogen and sulphur (2) Sulphur, selenium and tellurium (3) Sulphur and phosphorous (4) Sulphur and halogens
3.	π-acid ligands stabilize (1) The lower oxidation states of metal ions (2) The higher valency of metal ions (3) Do not form complexes with metal ions (4) Amphoteric nature of metal ions
4.	Noble gases form (1) Ionic compounds (2) Covalent compounds (3) Coordination compounds (4) Clathrate compounds
5.	In an EPR spectrum, if an odd electron is located over 'n' equivalent nuclei of equal spin I, the number of lines is given by (1) 2 nI (2) 2n + 1 (3) 2n I + 1 (4) 2^n

Question No.	Questions
6.	The name of the transition metal ion that activates insulin is (1) Chromium (2) Iron (3) Manganese (4) Copper
7.	Infra-red radiations received from solar system are absorbed by (1) Ozone layer (2) Hydrosphere (3) Troposphere (4) Nitrogen gas present in atmosphere
8.	Deoxy form of hemoglobin is (1) Diamagnetic (2) Anti ferromagnetic (3) Para magnetic (4) Ferromagnetic
9.	In AB_5 type TBP molecules, the number of IR active stretching vibrations are (1) Three (2) Four (3) Two (4) Five
10.	Which nuclear model can best explain that all elements with atomic number greater than 92 are radioactive ? (1) Liquid drop model (2) Shell model (3) Collective Model (4) All of these
11.	Ozone depletion in Antarctica is due to the formation of (1) Acrolin (2) Peroxyacetyl nitrate (3) SO_2 and SO_3 (4) Chlorine nitrate

Question No.	Questions
12.	Deficiency of Zn causes the disease (1) Convulsions (2) Dwarfism (3) Liver necrosis (4) Kinky-hair syndrome
13.	Which of the following carbonyls do not obey the EAR rule (1) $Fe(CO)_5$ (2) $Ni(CO)_4$ (3) $V(CO)_6$ (4) $Cr(CO)_6$
14.	The deep blue of $CoC\ell_4^{2-}$ is due to (1) Absence of centre of symmetry (2) Presence of principal axis (3) Absence of centre of symmetry (4) Presence of centre of symmetry
15.	Spotting electrolyte is used to eliminate (1) Diffusion current (2) Migration current (3) Limiting current (4) Condenser current
16.	Most common oxidation state of tellurium is (1) -2 (2) $+2$ (3) $+6$ (4) $+4$
17.	In Ferrocene, which metal orbital interacts with the composite ring orbitals C_pE_{1g} of ligand for the formation of covalent bonds (1) $4p_z$, $4p_x$ (2) $3d_{xz}$, $3d_{yz}$ (3) $4d_{xy}$, $3d_{x^2-y^2}$ (4) $(DS)_x$, $(DS)_y$

Question No.	Questions
18.	The Mössbauer spectra of $K_4Fe(CN)_6$ and $[K_3Fe(CN)_5No]$ consist of, respectively (1) One line each (2) Two lines each (3) Two and four lines (4) One and two lines
19.	The lowest energy transition in Orgel diagram of Octahedral Ni^{II} complexes is (1) $^3A_{2g} \rightarrow {}^3T_{1g}$ (F) (2) $^3A_{2g} \rightarrow {}^3T_{1g}$ (P) (3) $^3A_{2g} \rightarrow {}^3T_{2g}$ (4) None of these
20.	Which of the following statement is not correct ? (1) There exists an actinide contraction analogous to lanthanide contraction (2) Lanthanides have a poor tendency to form complexes (3) The chemistry of all lanthanides is almost identical (4) Actinides form oxocations
21.	An electrical cell is set up with two compartments each containing clean iron-electrodes in common air free KCℓ solution. When oxygen is bubbled around electrode, the other electrode is found to corrode and a current flows in the wire connecting two electrodes. The oxygenated solution will become (1) Acidic (2) Alkaline (3) Remains neutral (4) None of these
22.	The largest crystal field splitting will be for the ligand (same metal ion) (1) OX^{2-} (2) NO_2^- (3) NH_3 (4) CN^-

Question No.	Questions
23.	Which of the following is not an Organometallic compound (1) $Ti(C_3H_7O)_4$ (2) $Pb(C_2H_5)_4$ (3) $R_3PAU(CH_3)$ (4) $Fe(C_5H_5)_2$
24.	Which symbiotic bacteria is capable of fixing N_2 (1) Clostridium Pasteurianum (2) Azobacter (3) Nitrogenase (4) Rhizobia
25.	Which of the following is a reducing agent ? (1) La^{3+} (2) Ce^{4+} (3) Eu^{2+} (4) Na^{3+}
26.	Which of the following has no CFSE in octahedral field ? (1) Fe^{3+} (High spin) (2) Fe^{3+} (Low spin) (3) Co^{2+} (Low spin) (4) Cr^{3+} (High spin)
27.	The bond order in superoxide ion is (1) 1.5 (2) 2.5 (3) 3.0 (4) 2.0
28.	The correct order of acidic strength is (1) HClO > HIO > HBrO (2) HIO > HBrO > HClO (3) HBrO > HClO > HIO (4) HClO > HBrO > HIO
29.	The $[Si_3O_9]^{6-}$ ion is present in (1) Beryl (2) Wollastonite (3) Asbestos (4) Thorteveitite

Question No.	Questions
30.	A method of chemical analysis which involves interaction of a mobile phase carrying the mixture to be separated with a stationary phase acting as absorbent is called (1) Ion exchange (2) Solvent extraction (3) Chromatography (4) Electrography
31.	Which is correct order of chemical shift (δ) decrease in MB spectra (1) $C\ell^- > O^{2-} > N^{3-} > CN^-$ (2) $CN^- > O^{2-} > N^{3-} > C\ell^-$ (3) $C\ell^- > CN^- > O^{2-} > N^{3-}$ (4) $CN^- > N^{3-} > O^{2-} > C\ell^-$
32.	The substitution of ligand in the reaction $[Co(NH_3)_5 (CO)_3]^+ + 2\ H_3O^+ \rightarrow [Co(NH_3)_5 (H_2O)]^{3+} + 2\ H_2O + CO_2$ follow the mechanism (1) SN^1 (2) SN^2 (3) SN^1CB (4) Electrophilic substitution of ligand
33.	The Hamiltonian operator for a system comprise of nucleous and electron is expressed by (1) $H = \frac{-h^2}{2m}\nabla^2 + \frac{Ze^2}{r}$ (2) $\frac{-h^2}{2m}\nabla^2 - \frac{Ze^2}{r}$ (3) $H = \frac{-\hbar^2}{2m}\nabla^2 + \frac{Ze^2}{r^2}$ (4) $\frac{-\hbar^2}{2m}\nabla^2 - \frac{Ze^2}{r}$ Where m is the mass of electron and r is the distance between electron and nucleous.
34.	The number of macrostates for distributing three atoms among quantum states, having three quanta of energy are (1) 1 (2) 10 (3) 3 (4) 6

Question No.	Questions
35.	The molecular weight of cellulose varies between (1) 100 to 200 (2) 1000 to 20,000 (3) 20,000 to 5,00,000 (4) 10 lac to 50 lac
36.	The synthetic polymer which resembles natural rubber is (1) Glyptal (2) Neoprene (3) Chloroprene (4) Nylon
37.	Which of the following is not a use for mass spectrometry? (1) Confirming the presence of O–H and C = O in organic compounds (2) Calculating the isotopic abundance in elements (3) Investigating the elemental composition (4) Calculating molecular mass of organic compounds
38.	The wave function for a particle moving in a one dimensional box is given by (1) $\psi = \frac{\sqrt{2}}{a} . \sin \frac{n\pi}{a}$ (2) $\psi = \frac{\sqrt{2}}{a} \sin \frac{n\pi x}{a}$ (3) $\psi = \frac{\sqrt{2}}{a} . \sin \frac{\pi x}{a}$ (4) $\psi = \sqrt{\frac{2}{a}} . \sin \frac{n\pi x}{a}$
39.	If g_i and n_i are, respectively, the degeneracy and number of atoms occupying i^{th} quantum state, then the condition under which Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein statistics give identical results is (1) g_i/n_i is indeterminate (2) $g_i/n_i << 1$ (3) $g_i/n_i >> 1$ (4) $\frac{g_i}{n_i} < 0$

Question No.	Questions
40.	For a Cubic crystal $d_{100/a}$ is equal to (1) $1/2$ (2) 1 (3) $1/4$ (4) $1/8$
41.	What is the frequency of radiation possesing wavelength 400 nm ? (1) $7.5 \times 10^{14}\ S^{-1}$ (2) $7.5 \times 10^{-14}\ S^{-1}$ (3) $7.5 \times 10^{9}\ S^{-1}$ (4) $7.5 \times 10^{-9}\ S^{-1}$
42.	What term is used for a non-protein organic molecule that is required by some enzymes in order to catalyse a reaction on substrate ? (1) Prosthetic group (2) Co-enzyme (3) Modulator (4) Cofactor
43.	The step down Ladder operator is expressed as (1) $\hat{J}_- = \hat{J}_x - \hat{J}_y$ (2) $\hat{J}_- = \hat{J}_x - i\hat{J}_y$ (3) $\hat{J}_- = \hat{J}_x + \hat{J}_y$ (4) $\hat{J}_- = \hat{J}_x + i\hat{J}_y$
44.	Which of the following represents Michaeilis equation for enzyme catalysed reaction (1) $\frac{d}{dt}[\dot{P}] = \frac{[E_0]S}{1+K/K_3}$ (2) $\frac{d}{dt}[P] = k[E_0][S]$ (3) $\frac{d}{dt}[P] = \frac{[E_0]+S}{1+K/K_3}$ (4) $\frac{d}{dt}[P] = \frac{k_3[E_0]}{1+k/[S]}$ Where all the symbols have their usual meanings.

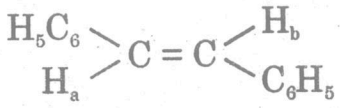
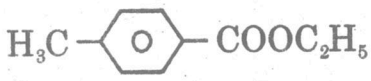
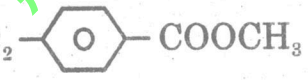
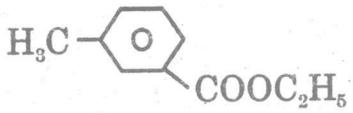
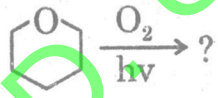
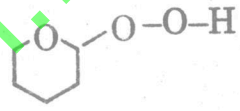
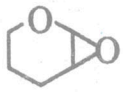
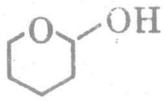
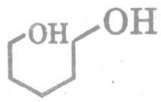
Question No.	Questions
45.	The Peltier Coefficient, π, is the ratio of two fluxes (1) $\pi = \left(\frac{I}{J}\right)_{\Delta T=0}$ (2) $\pi = \left(\frac{I}{J}\right)_{\Delta P=0}$ (3) $\pi = \left(\frac{J}{I}\right)_{\Delta T} = 0$ (4) $\pi = \left(\frac{J}{I}\right)_{\Delta P=0}$ Where I and J are flow of heat and electric current respectively.
46.	Which one is correct out of following relations (1) $dG = VdP - SdT$ (2) $dG = VdP + SdT$ (3) $dG = SdT - VdP$ (4) None of these
47.	50 mℓ of 0.1 M NaOH is added to 49 mℓ of 0.1 M HCℓ. The pH of resulting solution is (1) 10 (2) 11 (3) 9 (4) 12
48.	Which of the following is Boson ? (1) Electron (2) Proton (3) $^4He_2$ (4) D^2
49.	Henry's law is applicable to real gases, if (1) Pressure is high (2) Solubility of gas is appreciable (3) Dissolved gas react with solvent (4) Temperature is not too low

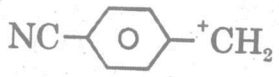
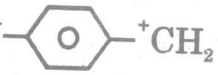
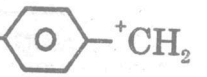
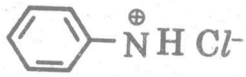
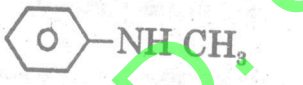
Question No.	Questions
50.	Which of the following can be used for cathodic protection ? (1) Cu (2) Cd (3) Au (4) Aℓ
51.	A crystal plane has intercepts on three axis of the crystal in the rati $\frac{3}{2}$: 2 : 1. The Miller indices of plane are (1) 463 (2) 364 (3) 643 (4) 436
52.	Which of the following nuclides is beta emitter ? (1) $^{195}_{80}Hg$ (2) $^{120}_{50}Sn$ (3) $^{40}_{20}Ca$ (4) $^{208}_{82}Pb$
53.	A rotational constant of PF_5 molecule is 3.586 Hz. The length of P – equatorial bond is (1) 2.731 Å (2) 1.577 Å (3) 1.109 Å (4) 1.325 Å
54.	Which one of the following is an irreversible cell ? (1) $Zn / H_2SO_4 / Ag$ (2) $Zn / Zn^{2+} / AgC\ell / Ag$ (3) $Zn / Zn^{2+} // Cd^{2+} / Cd$ (4) $Cd / Cd^{2+} // KC\ell, Hg_2C\ell_2$ (S) / Hg
55.	For a zero-order reaction A → Products, $t_{1/2}$ is proportional to (1) [A] (2) $1/[A]$ (3) $[A]_0^2$ (4) $1/[A_0]^2$

Question No.	Questions
56.	Which of the following is not a state function ? (1) Heat (2) Work (3) Entropy (4) Enthalpy
57.	The emulsifiers consist of (1) Ionic compound (2) Ionic surfactants (3) Non-ionic surfactants (4) Ionic as well as Non-ionogenic surfactant
58.	The boiling point of a liquid is 36°C. Assuming that it obeys Trouton's rule, its molar heat of vaporization will be (1) 27.19 kJ mol^{-1} (2) 2.72 kJ mol^{-1} (3) 271.91 kJ mol^{-1} (4) 2719.1 kJ mol^{-1}
59.	Isotonic solutions have same (1) Molar concentration (2) Viscosity (3) Osmotic pressure (4) Dipole moment
60.	The values of van der Waal's constant 'a' for gases O_2, N_2, NH_3, CH_4 are 1.36, 1.39, 4.19 and 2.253 litre^2 atm. mole^{-2} respectively. The gas which can most easily be liquified is (1) O_2 (2) NH_3 (3) CH_4 (4) N_2

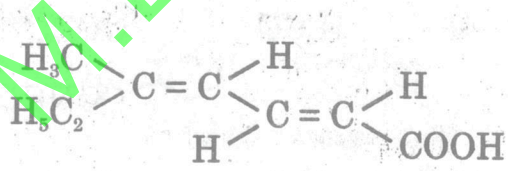
Question No.	Questions
61.	Rate of adsorption of particles by the surface is given by (1) Rate of adsorption = Rate of collosion with surface (2) Rate of adsorption = Rate of sticking probability (3) Rate of adsorption = Rate of collosion with surface × Rate of sticki probabili (4) Rate of adsorption = $\frac{\text{Rate of collosion with surface}}{\text{Rate of sticking probability}}$
62.	Huckel secular equation for ethylene molecule is (1) $\begin{vmatrix} x & 1 \\ 1 & x \end{vmatrix} = 0$ (2) $\begin{vmatrix} 1 & x \\ x & 1 \end{vmatrix} = 0$ (3) $\begin{vmatrix} x & x \\ 1 & 1 \end{vmatrix} = 0$ (4) None of these Where $x = \frac{\alpha - \beta}{E}$; where E is the energy and α, β are constants.
63.	Water molecule belongs to the following point group (1) D_{2h} (2) D_{2d} (3) C_{3v} (4) C_{2v}
64.	In an ESR spectrometer at 9.30 GHz, the spectrum of hydrogen at gave two lines, one at 357.5 mT and other at 306.8 mT. The hyperf coupling constant of hydrogen atom is then given by (1) 50.7 mT (2) 664.3 mT (3) 1.16 mT (4) 11.6 mT

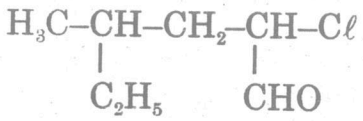
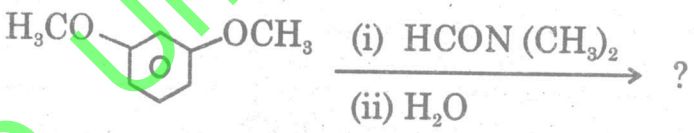
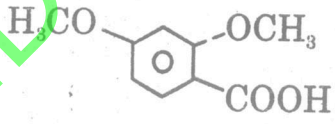
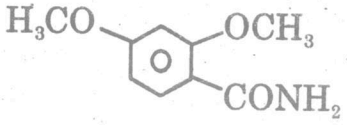
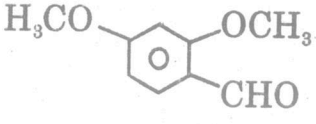
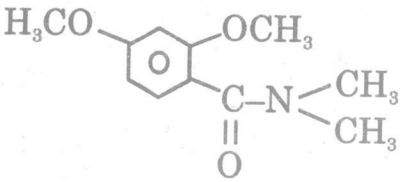
Question No.	Questions
65.	For an van der Waals gas, the Boyle temperature, T_B is (1) $T_B = Rb$ (2) $T_B = aR$ (3) $T_B = aRb$ (4) $T_B = \frac{a}{Rb}$ Where 'a' and 'b' are van der Waal's constants.
66.	Difficult to monitor and very dangerous form of corrosion (1) Crevice (2) Pitting (3) Galvanic (4) Stress
67.	Following pair of compounds are  (1) Enantiomers (2) Dia stereomers (3) Geometrical isomers (4) Homomers
68.	Reactive intermediate involved in the following reaction is  (1) Carbocation (2) Carbanion (3) Carbene (4) Free radical

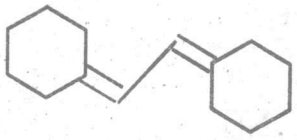
Question No.	Questions
69.	In $^1H_{nmr}$ of  $J_{Ha} - J_{Hb}$ will be (1) 6 Hz (2) 14 Hz (3) 9 Hz (4) 2 Hz
70.	$^1H_{nmr}$ of a compound shows peaks at δ1.2 (t, 3H) ; 2.1 (s, 3H) ; 4.3 (q, 2H) ; 7.1 (d, J = 9 Hz, 2H) and 8.0 (d, J = 9 Hz, 2H), the compound is (1)  (2)  (3)  (4) 
71.	The product in the given reaction is  (1)  (2)  (3)  (4) 

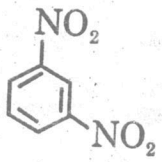
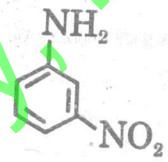
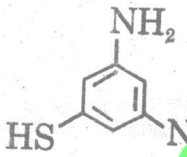
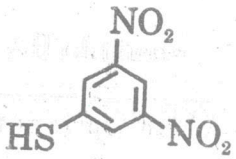
Question No.	Questions
72.	Which carbocation of the following is most stable ? (1)  (2)  (3)  (4) 
73.	The range of fluorine chemical shift in NMR is (1) 12 ppm (2) 56 ppm (3) 300 ppm (4) 542 ppm
74.	Which of the following compounds is a phase transfer catalyst ? (1) $CH_3(CH_2)_4NH_2$ (2) $C_6H_5CH_2N^{\oplus}(C_6H_5)Cl^-$ (3) $(n-C_4H_9)_3$ (4) 
75.	Which is strongest base among the following ? (1)  (2)  (3)  (4) 
76.	Which is not an anticancer drug ? (1) Gabapentin (2) Vincristine (3) Cyclophosphamide (4) Doxorubicin

Question No.	Questions
77.	What kind of spectroscopy is FTNMR ? (1) Absorption (2) Emission (3) Both of these (4) None
78.	The CH proton in isopropyl carbocation absorbs at (1) 5.06 ppm (2) 6.28 ppm (3) 13.50 ppm (4) 4.75
79.	By which of these, acetophenone can be converted in to phenol ? (1) Conc. HNO_3 (2) Iodine and NaOH (3) Singlet oxygen followed by base catalyzed hydrolysis (4) m-CPBA followed by base catalyzed hydrolysis
80.	The decreasing order of chemical shifts for protons among Alkanes, Alkene and Alkynes follow the sequence : (1) Alkynes > Alkanes > Alkenes (2) Alkynes > Alkenes > Alkanes (3) Alkanes > Alkynes > Alkenes (4) Alkenes > Alkynes > Alkanes
81.	By adding sodium dedecyl sulphate during the electrophoresis of proteins, it is possible to (1) predict a protein isoelectric point (2) predict an enzyme specific activity (3) preserve a protein native structure (4) determine the amino acid composition

Question No.	Questions
82.	The number of orientations with respect to applied magnetic field for deuterium is (1) 3 (2) 2 (3) 1 (4) 4
83.	How many spatial arrangements are possible for α-β-dibromobutyric acid ? (1) Two (2) Three (3) Four (4) Five
84.	Which of the following pair of compounds can be differentiated by Tollen's reagent ? (1) Glucose and acetaldehyde (2) Formic acid and benzoic acid (3) Formic acid and formaldehyde (4) Acetophenone and benzo-phenone
85.	The configuration of the given compound is  (1) 2Z, 4Z (2) 2E, 4E (3) 2Z, 4E (4) 2E, 4Z

Question No.	Questions
86.	IUPAC name of the given compound is  (1) 2-chloromethyl-4-methyl hexanal (2) 1-chloro-4-ethyl-2-pentanal (3) 1-chloro-4-methyl-2-hexanal (4) 1-chloro-2-formyl-4-ethyl hexane
87.	When an auxochrome is attached to carbon-carbon double bond, then λ_{max} in its UV spectrum undergoes (1) Hypsochromic shift (2) Bathochromic shift (3) Hyperchromic shift (4) Hypochromic shift
88.	Which of the following compound can be used as homogeneous catalyst in hydrogenation (1) $Ni(Co)_4$ (2) $Fe(Co)_5$ (3) $[\{(C_6H_5)_3P\}_3Rh]C\ell$ (4) $[\{(C_6H_5)_3P\}_4Ni]C\ell_2$
89.	The product in the given reaction is  (1)  (2)  (3)  (4) 

Question No.	Questions
90.	Which of the following forms a Diels-Alder adduct most readily (1) Pyridine (2) Pyrrole (3) Furan (4) Thiophene
91.	An SN^1 reaction at an asymmetric carbon atom of a compound always gives (1) product that does not show any optical rotation (2) an enantiomer of the substrate (3) diastereomer of the substrate (4) product with opposite optical rotation
92.	In UV the compound  will show λ_{max} at (1) 225 nm (2) 247 nm (3) 237 nm (4) 242 nm
93.	Ion-selective membrane used in ion selective electrodes are : (1) Glass membranes (2) Crystalline membranes (3) ion exchange resin membrane (4) All of these
94.	The isomer of C_4H_8 which produces an nmr spectrum with four different signal is (1) Cyclobutane (2) $CH_3CH=CH-CH_3$ (3) $CH_2=CHCH_2CH_3$ (4) $(CH_3)_2C=CH_2$
95.	Following is the unique to polymeric materials : (1) Elasticity (2) Visco elasticity (3) Plasticity (4) None

Question No.	Questions
96.	In the stomach, the proteins are hydrolysed in the acid medium by the action pepsin to yield : (1) Proteoses (2) Peptones (3) Polypeptides (4) α-Amino acids
97.	Grignard reagent shows addition on (1) $>C=O$ (2) $>C=S$ (3) $-C\equiv N$ (4) All of these
98.	The major product (70–80%) of the reaction between m-dinitrobenzene and NH_4HS is (1)  (2)  (3)  (4) 
99.	Isoelectric point is the pH at which (1) An amino aicd becomes acidic (2) An amino acid becomes basic (3) Zwitter ion has zero charge (4) Zwitter ion has positive charge
100.	Stirling approximation, $\ell n\ N\ ! = N\ \ell n\ N - N$, (where N is the number of particles) is applicable only, when (1) $N = 1$ (2) $N > 1$ (3) N is very high (4) None of these

15-10-15

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

(Ph.D/URS–EE–2015)

Subject : CHEMISTRY

Code B

Sr. No. 10018

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

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

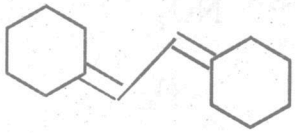
Name : _____ Father's Name : _____

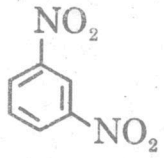
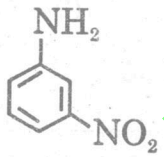
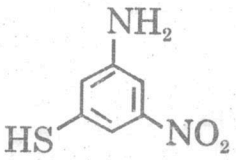
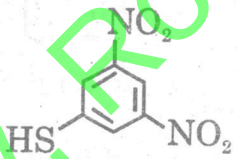
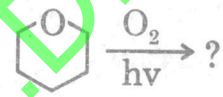
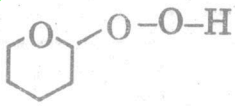
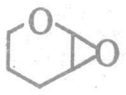
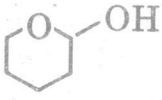
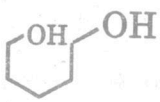
Mother's Name _____ Date of Examination _____

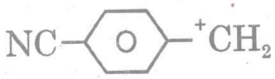
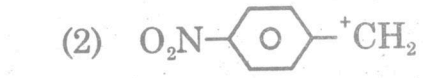
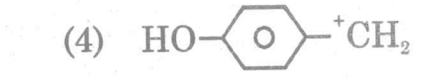
(Signature of the candidate) (Signature of the Invigilator)

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

1. All questions are compulsory and carry equal marks. The candidates are required to attempt all questions.
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 / misbehaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such candidate will not be evaluated.
3. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing within two hours after the test is over. No such complaint(s) will be entertained thereafter.
4. 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.
5. **Use only Black or Blue BALL POINT PEN of good quality in the OMR Answer-Sheet.**
6. **There will be NEGATIVE marking. Each correct answer will be awarded one full mark and each incorrect answer will be negatively marked for which the candidate will get ¼ discredit. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.**
7. 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.

Question No.	Questions
1.	An SN^1 reaction at an asymmetric carbon atom of a compound always gives (1) product that does not show any optical rotation (2) an enantiomer of the substrate (3) diastereomer of the substrate (4) product with opposite optical rotation
2.	In UV the compound  will show λ_{max} at (1) 225 nm (2) 247 nm (3) 237 nm (4) 242 nm
3.	Ion-selective membrane used in ion selective electrodes are : (1) Glass membranes (2) Crystalline membranes (3) ion exchange resin membrane (4) All of these
4.	The isomer of C_4H_8 which produces an nmr spectrum with four different signal is (1) Cyclobutane (2) $CH_3CH=CH–CH_3$ (3) $CH_2=CHCH_2CH_3$ (4) $(CH_3)_2C=CH_2$
5.	Following is the unique to polymeric materials : (1) Elasticity (2) Visco elasticity (3) Plasticity (4) None
6.	In the stomach, the proteins are hydrolysed in the acid medium by the action pepsin to yield : (1) Proteoses (2) Peptones (3) Polypeptides (4) α-Amino acids

Question No.	Questions
7.	Grignard reagent shows addition on (1) $>C=O$ (2) $>C=S$ (3) $-C\equiv N$ (4) All of these
8.	The major product (70–80%) of the reaction between m-dinitrobenzene and NH_4HS is (1)  (2)  (3)  (4) 
9.	Isoelectric point is the pH at which (1) An amino aicd becomes acidic (2) An amino acid becomes basic (3) Zwitter ion has zero charge (4) Zwitter ion has positive charge
10.	Stirling approximation, $\ell n\ N! = N\ \ell n\ N - N$, (where N is the number of particles) is applicable only, when (1) $N = 1$ (2) $N > 1$ (3) N is very high (4) None of these
11.	The product in the given reaction is  (1)  (2)  (3)  (4) 

Question No.	Questions
12.	Which carbocation of the following is most stable ? (1)  (2)  (3)  (4) 
13.	The range of fluorine chemical shift in NMR is (1) 12 ppm (2) 56 ppm (3) 300 ppm (4) 542 ppm
14.	Which of the following compounds is a phase transfer catalyst ? (1) $CH_3(CH_2)_4NH_2$ (2) $C_6H_5CH_2N^{\oplus}(C_6H_5)Cl^-$ (3) $(n-C_4H_9)_3$ (4) 
15.	Which is strongest base among the following ? (1)  (2)  (3)  (4) 
16.	Which is not an anticancer drug ? (1) Gabapentin (2) Vincristine (3) Cyclophosphamide (4) Doxorubicin

Question No.	Questions
17.	What kind of spectroscopy is FTNMR ? (1) Absorption (2) Emission (3) Both of these (4) None
18.	The CH proton in isopropyl carbocation absorbs at (1) 5.06 ppm (2) 6.28 ppm (3) 13.50 ppm (4) 4.75
19.	By which of these, acetophenone can be converted in to phenol ? (1) Conc. HNO_3 (2) Iodine and NaOH (3) Singlet oxygen followed by base catalyzed hydrolysis (4) m-CPBA followed by base catalyzed hydrolysis
20.	The decreasing order of chemical shifts for protons among Alkanes, Alkene and Alkynes follow the sequence : (1) Alkynes > Alkanes > Alkenes (2) Alkynes > Alkenes > Alkanes (3) Alkanes > Alkynes > Alkenes (4) Alkenes > Alkynes > Alkanes
21.	A crystal plane has intercepts on three axis of the crystal in the ratio $\frac{3}{2}$: 2 : 1. The Miller indices of plane are (1) 463 (2) 364 (3) 643 (4) 436

Question No.	Questions
22.	Which of the following nuclides is beta emitter ? (1) $^{195}_{80}Hg$ (2) $^{120}_{50}Sn$ (3) $^{40}_{20}Ca$ (4) $^{208}_{82}Pb$
23.	A rotational constant of PF_5 molecule is 3.586 Hz. The length of P – F equatorial bond is (1) 2.731 $\overset{o}{A}$ (2) 1.577 $\overset{o}{A}$ (3) 1.109 $\overset{o}{A}$ (4) 1.325 $\overset{o}{A}$
24.	Which one of the following is an irreversible cell ? (1) $Zn / H_2SO_4 / Ag$ (2) $Zn / Zn^{2+} / AgC\ell / Ag$ (3) $Zn / Zn^{2+} // Cd^{2+} / Cd$ (4) $Cd / Cd^{2+} // KC\ell, Hg_2C\ell_2 (S) / Hg$
25.	For a zero-order reaction A → Products, $t_{1/2}$ is proportional to (1) [A] (2) $1/[A]$ (3) $[A]_0^2$ (4) $1/[A_0]^2$
26.	Which of the following is not a state function ? (1) Heat (2) Work (3) Entropy (4) Enthalpy
27.	The emulsifiers consist of (1) Ionic compound (2) Ionic surfactants (3) Non-ionic surfactants (4) Ionic as well as Non-ionogenic surfactant

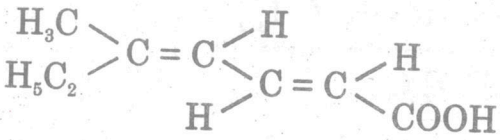
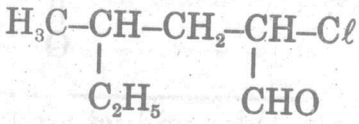
Question No.	Questions
28.	The boiling point of a liquid is 36°C. Assuming that it obeys Trouton's rule, its molar heat of vaporization will be (1) 27.19 kJ mol^{-1} (2) 2.72 kJ mol^{-1} (3) 271.91 kJ mol^{-1} (4) 2719.1 kJ mol^{-1}
29.	Isotonic solutions have same (1) Molar concentration (2) Viscosity (3) Osmotic pressure (4) Dipole moment
30.	The values of van der Waal's constant 'a' for gases O_2, N_2, NH_3, CH_4 are 1.36, 1.39, 4.19 and 2.253 litre^2 atm. mole^{-2} respectively. The gas which can most easily be liquified is (1) O_2 (2) NH_3 (3) CH_4 (4) N_2
31.	An electrical cell is set up with two compartments each containing clean iron-electrodes in common air free KCℓ solution. When oxygen is bubbled around electrode, the other electrode is found to corrode and a current flows in the wire connecting two electrodes. The oxygenated solution will become (1) Acidic (2) Alkaline (3) Remains neutral (4) None of these
32.	The largest crystal field splitting will be for the ligand (same metal ion) (1) OX^{2-} (2) NO_2^- (3) NH_3 (4) CN^-

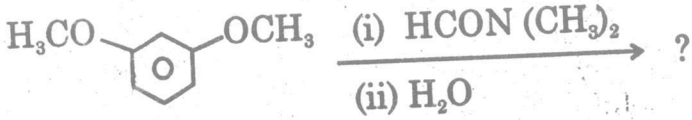
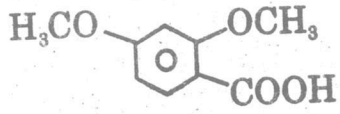
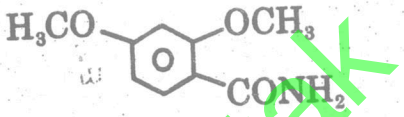
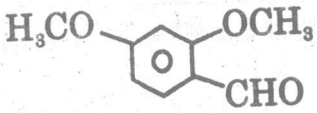
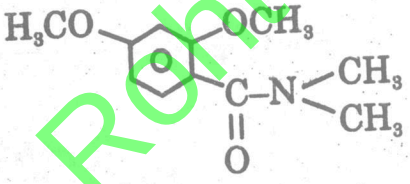
Question No.	Questions
33.	Which of the following is not an Organometallic compound (1) $Ti(C_3H_7O)_4$ (2) $Pb(C_2H_5)_4$ (3) $R_3PAU(CH_3)$ (4) $Fe(C_5H_5)_2$
34.	Which symbiotic bacteria is capable of fixing N_2 (1) Clostridium Pasteurianum (2) Azobacter (3) Nitrogenase (4) Rhizobia
35.	Which of the following is a reducing agent ? (1) La^{3+} (2) Ce^{4+} (3) Eu^{2+} (4) Na^{3+}
36.	Which of the following has no CFSE in octahedral field ? (1) Fe^{3+} (High spin) (2) Fe^{3+} (Low spin) (3) Co^{2+} (Low spin) (4) Cr^{3+} (High spin)
37.	The bond order in superoxide ion is (1) 1.5 (2) 2.5 (3) 3.0 (4) 2.0
38.	The correct order of acidic strength is (1) $HC\ell O > HIO > HBrO$ (2) $HIO > HBrO > HC\ell O$ (3) $HBrO > HC\ell O > HIO$ (4) $HC\ell O > HBrO > HIO$
39.	The $[Si_3O_9]^{6-}$ ion is present in (1) Beryl (2) Wollastonite (3) Asbestos (4) Thorteveitite

Question No.	Questions
40.	A method of chemical analysis which involves interaction of a mobile phase carrying the mixture to be separated with a stationary phase acting as absorbent is called (1) Ion exchange (2) Solvent extraction (3) Chromatography (4) Electrography
41.	Structure of B_2H_6 is depicted as (1) Octahedral structure (2) Two BH_3 units joined together (3) Two BH_2 units joined by two B–H–B (4) Two BH_3 units joined by two B–H–B
42.	Calconides are the compounds of (1) Nitrogen and sulphur (2) Sulphur, selenium and tellurium (3) Sulphur and phosphorous (4) Sulphur and halogens
43.	π-acid ligands stabilize (1) The lower oxidation states of metal ions (2) The higher valency of metal ions (3) Do not form complexes with metal ions (4) Amphoteric nature of metal ions
44.	Noble gases form (1) Ionic compounds (2) Covalent compounds (3) Coordination compounds (4) Clathrate compounds

Question No.	Questions
45.	In an EPR spectrum, if an odd electron is located over 'n' equivalent nuclei of equal spin I, the number of lines is given by (1) 2 nI (2) 2n + 1 (3) 2n I + 1 (4) 2^n
46.	The name of the transition metal ion that activates insulin is (1) Chromium (2) Iron (3) Manganese (4) Copper
47.	Infra-red radiations received from solar system are absorbed by (1) Ozone layer (2) Hydrosphere (3) Troposphere (4) Nitrogen gas present in atmosphere
48.	Deoxy form of hemoglobin is (1) Diamagnetic (2) Anti ferromagnetic (3) Para magnetic (4) Ferromagnetic
49.	In AB_5 type TBP molecules, the number of IR active stretching vibrations are (1) Three (2) Four (3) Two (4) Five
50.	Which nuclear model can best explain that all elements with atomic number greater than 92 are radioactive ? (1) Liquid drop model (2) Shell model (3) Collective Model (4) All of these

Question No.	Questions
51.	By adding sodium dedecyl sulphate during the electrophoresis of proteins, it is possible to (1) predict a protein isoelectric point (2) predict an enzyme specific activity (3) preserve a protein native structure (4) determine the amino acid composition
52.	The number of orientations with respect to applied magnetic field for deuterium is (1) 3 (2) 2 (3) 1 (4) 4
53.	How many spatial arrangements are possible for α-β-dibromobutyric acid ? (1) Two (2) Three (3) Four (4) Five
54.	Which of the following pair of compounds can be differentiated by Tollen's reagent ? (1) Glucose and acetaldehyde (2) Formic acid and benzoic acid (3) Formic acid and formaldehyde (4) Acetophenone and benzo-phenone

Question No.	Questions
55.	The configuration of the given compound is  (1) 2Z, 4Z (2) 2E, 4E (3) 2Z, 4E (4) 2E, 4Z
56.	IUPAC name of the given compound is  (1) 2-chloromethyl-4-methyl hexanal (2) 1-chloro-4-ethyl-2-pentanal (3) 1-chloro-4-methyl-2-hexanal (4) 1-chloro-2-formyl-4-ethyl hexane
57.	When an auxochrome is attached to carbon-carbon double bond, then λ_{max} in its UV spectrum undergoes (1) Hypsochromic shift (2) Bathochromic shift (3) Hyperchromic shift (4) Hypochromic shift
58.	Which of the following compound can be used as homogeneous catalyst in hydrogenation (1) $Ni(Co)_4$ (2) $Fe(Co)_5$ (3) $[\{(C_6H_5)_3P\}_3 Rh] C\ell$ (4) $[\{(C_6H_5)_3P\}_4 Ni] C\ell_2$

Question No.	Questions
59.	The product in the given reaction is  (1)  (2)  (3)  (4) 
60.	Which of the following forms a Diels-Alder adduct most readily (1) Pyridine (2) Pyrrole (3) Furan (4) Thiophene
61.	What is the frequency of radiation possesing wavelength 400 nm ? (1) $7.5 \times 10^{14}\ S^{-1}$ (2) $7.5 \times 10^{-14}\ S^{-1}$ (3) $7.5 \times 10^{9}\ S^{-1}$ (4) $7.5 \times 10^{-9}\ S^{-1}$
62.	What term is used for a non-protein organic molecule that is required by some enzymes in order to catalyse a reaction on substrate ? (1) Prosthetic group (2) Co-enzyme (3) Modulator (4) Cofactor
63.	The step down Ladder operator is expressed as (1) $\hat{J}_- = \hat{J}_x - \hat{J}_y$ (2) $\hat{J}_- = \hat{J}_x - i\hat{J}_y$ (3) $\hat{J}_- = \hat{J}_x + \hat{J}_y$ (4) $\hat{J}_- = \hat{J}_x + i\hat{J}_y$

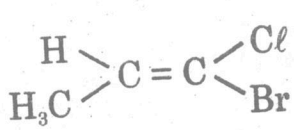
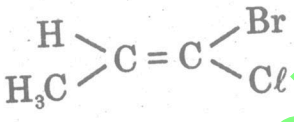
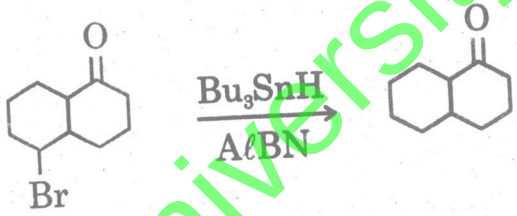
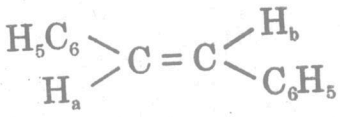
Question No.	Questions
64.	Which of the following represents Michaeilis equation for enzyme catalysed reaction (1) $\frac{d}{dt}[\dot{P}] = \frac{[E_0]S}{1+K/K_3}$ (2) $\frac{d}{dt}[P] = k[E_0][S]$ (3) $\frac{d}{dt}[P] = \frac{[E_0]+S}{1+K/K_3}$ (4) $\frac{d}{dt}[P] = \frac{k_3[E_0]}{1+k/[S]}$ Where all the symbols have their usual meanings.
65.	The Peltier Coefficient, π, is the ratio of two fluxes (1) $\pi = \left(\frac{I}{J}\right)_{\Delta T=0}$ (2) $\pi = \left(\frac{I}{J}\right)_{\Delta P=0}$ (3) $\pi = \left(\frac{J}{I}\right)_{\Delta T} = 0$ (4) $\pi = \left(\frac{J}{I}\right)_{\Delta P=0}$ Where I and J are flow of heat and electric current respectively.
66.	Which one is correct out of following relations (1) $dG = VdP - SdT$ (2) $dG = VdP + SdT$ (3) $dG = SdT - VdP$ (4) None of these
67.	50 mℓ of 0.1 M NaOH is added to 49 mℓ of 0.1 M HCℓ. The pH of resulting solution is (1) 10 (2) 11 (3) 9 (4) 12

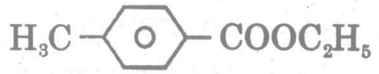
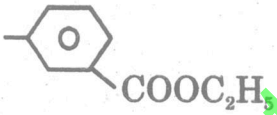
Question No.	Questions
68.	Which of the following is Boson ? (1) Electron (2) Proton (3) $^4He_2$ (4) D^2
69.	Henry's law is applicable to real gases, if (1) Pressure is high (2) Solubility of gas is appreciable (3) Dissolved gas react with solvent (4) Temperature is not too low
70.	Which of the following can be used for cathodic protection ? (1) Cu (2) Cd (3) Au (4) Aℓ
71.	Which is correct order of chemical shift (δ) decrease in MB spectra (1) $C\ell^- > O^{2-} > N^{3-} > CN^-$ (2) $CN^- > O^{2-} > N^{3-} > C\ell^-$ (3) $C\ell^- > CN^- > O^{2-} > N^{3-}$ (4) $CN^- > N^{3-} > O^{2-} > C\ell^-$
72.	The substitution of ligand in the reaction $[Co(NH_3)_5 (CO)_3]^+ + 2\ H_3O^+ \rightarrow [Co(NH_3)_5 (H_2O)]^{3+} + 2\ H_2O + CO_2$ follow the mechanism (1) SN^1 (2) SN^2 (3) SN^1CB (4) Electrophilic substitution of ligand

Question No.	Questions
73.	The Hamiltonian operator for a system comprise of nucleous and electron is expressed by (1) $H = \frac{-h^2}{2m}\nabla^2 + \frac{Ze^2}{r}$ (2) $\frac{-h^2}{2m}\nabla^2 - \frac{Ze^2}{r}$ (3) $H = \frac{-\hbar^2}{2m}\nabla^2 + \frac{Ze^2}{r^2}$ (4) $\frac{-\hbar^2}{2m}\nabla^2 - \frac{Ze^2}{r}$ Where m is the mass of electron and r is the distance between electron and nucleous.
74.	The number of macrostates for distributing three atoms among quantum states, having three quanta of energy are (1) 1 (2) 10 (3) 3 (4) 6
75.	The molecular weight of cellulose varies between (1) 100 to 200 (2) 1000 to 20,000 (3) 20,000 to 5,00,000 (4) 10 lac to 50 lac
76.	The synthetic polymer which resembles natural rubber is (1) Glyptal (2) Neoprene (3) Chloroprene (4) Nylon
77.	Which of the following is not a use for mass spectrometry ? (1) Confirming the presence of O–H and C = O in organic compounds (2) Calculating the isotopic abundance in elements (3) Investigating the elemental composition (4) Calculating molecular mass of organic compounds

Question No.	Questions
78.	The wave function for a particle moving in a one dimensional box is given by (1) $\psi = \frac{\sqrt{2}}{a} . \sin \frac{n\pi}{a}$ (2) $\psi = \frac{\sqrt{2}}{a} \sin \frac{n\pi x}{a}$ (3) $\psi = \frac{\sqrt{2}}{a} . \sin \frac{\pi x}{a}$ (4) $\psi = \sqrt{\frac{2}{a}} . \sin \frac{n\pi x}{a}$
79.	If g_i and n_i are, respectively, the degeneracy and number of atoms occupying i^{th} quantum state, then the condition under which Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein statistics give identical results is (1) g_i/n_i is indeterminate (2) $g_i/n_i << 1$ (3) $g_i/n_i >> 1$ (4) $\frac{g_i}{n_i} < 0$
80.	For a Cubic crystal d_{100}/a is equal to (1) $1/2$ (2) 1 (3) $1/4$ (4) $1/8$
81.	Rate of adsorption of particles by the surface is given by (1) Rate of adsorption = Rate of collosion with surface (2) Rate of adsorption = Rate of sticking probability (3) Rate of adsorption = Rate of collosion with surface × Rate of sticking probability (4) Rate of adsorption = $\frac{\text{Rate of collosion with surface}}{\text{Rate of sticking probability}}$

Question No.	Questions
82.	Huckel secular equation for ethylene molecule is (1) $\begin{vmatrix} x & 1 \\ 1 & x \end{vmatrix} = 0$ (2) $\begin{vmatrix} 1 & x \\ x & 1 \end{vmatrix} = 0$ (3) $\begin{vmatrix} x & x \\ 1 & 1 \end{vmatrix} = 0$ (4) None of these Where $x = \frac{\alpha - \beta}{E}$; where E is the energy and α, β are constants.
83.	Water molecule belongs to the following point group (1) D_{2h} (2) D_{2d} (3) C_{3v} (4) C_{2v}
84.	In an ESR spectrometer at 9.30 GHz, the spectrum of hydrogen atom gave two lines, one at 357.5 mT and other at 306.8 mT. The hyperfine coupling constant of hydrogen atom is then given by (1) 50.7 mT (2) 664.3 mT (3) 1.16 mT (4) 11.6 mT
85.	For an van der Waals gas, the Boyle temperature, T_B is (1) $T_B = Rb$ (2) $T_B = aR$ (3) $T_B = aRb$ (4) $T_B = \frac{a}{Rb}$ Where 'a' and 'b' are van der Waal's constants.

Question No.	Questions
86.	Difficult to monitor and very dangerous form of corrosion (1) Crevice (2) Pitting (3) Galvanic (4) Stress
87.	Following pair of compounds are   (1) Enantiomers (2) Dia stereomers (3) Geometrical isomers (4) Homomers
88.	Reactive intermediate involved in the following reaction is  (1) Carbocation (2) Carbanion (3) Carbene (4) Free radical
89.	In $^1H_{nmr}$ of  $J_{Ha} - J_{Hb}$ will be (1) 6 Hz (2) 14 Hz (3) 9 Hz (4) 2 Hz

Question No.	Questions
90.	$^1H_{nmr}$ of a compound shows peaks at δ1.2 (t, 3H) ; 2.1 (s, 3H) ; 4.3 (q, 2H) ; 7.1 (d, J = 9 Hz, 2H) and 8.0 (d, J = 9 Hz, 2H), the compound is (1)  (2)  (3)  (4) 
91.	Ozone depletion in Antarctica is due to the formation of (1) Acrolin (2) Peroxyacetyl nitrate (3) SO_2 and SO_3 (4) Chlorine nitrate
92.	Deficiency of Zn causes the disease (1) Convulsions (2) Dwarfism (3) Liver necrosis (4) Kinky-hair syndrome
93.	Which of the following carbonyls do not obey the EAR rule (1) $Fe(CO)_5$ (2) $Ni(CO)_4$ (3) $V(CO)_6$ (4) $Cr(CO)_6$
94.	The deep blue of $CoC\ell_4^{2-}$ is due to (1) Absence of centre of symmetry (2) Presence of principal axis (3) Absence of centre of symmetry (4) Presence of centre of symmetry

Question No.	Questions
95.	Spotting electrolyte is used to eliminate (1) Diffusion current (2) Migration current (3) Limiting current (4) Condenser current
96.	Most common oxidation state of tellurium is (1) -2 (2) $+2$ (3) $+6$ (4) $+4$
97.	In Ferrocene, which metal orbital interacts with the composite ring orbitals C_pE_{1g} of ligand for the formation of covalent bonds (1) $4p_z$, $4p_x$ (2) $3d_{xz}$, $3d_{yz}$ (3) $4d_{xy}$, $3d_{x^2-y^2}$ (4) $(DS)_x$, $(DS)_y$
98.	The Mössbauer spectra of $K_4Fe(CN)_6$ and $[K_3Fe(CN)_5No]$ consist of, respectively (1) One line each (2) Two lines each (3) Two and four lines (4) One and two lines
99.	The lowest energy transition in Orgel diagram of Octahedral Ni^{II} complexes is (1) $^3A_{2g} \rightarrow {}^3T_{1g}$ (F) (2) $^3A_{2g} \rightarrow {}^3T_{1g}$ (P) (3) $^3A_{2g} \rightarrow {}^3T_{2g}$ (4) None of these
100.	Which of the following statement is not correct ? (1) There exists an actinide contraction analogous to lanthanide contraction (2) Lanthanides have a poor tendency to form complexes (3) The chemistry of all lanthanides is almost identical (4) Actinides form oxocations

15-10-15

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

(Ph.D/URS–EE–2015)

Sr. No. 10011 **Subject : CHEMISTRY** **Code C**

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

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

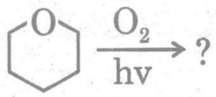
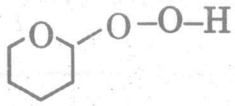
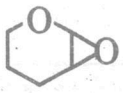
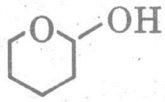
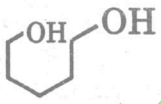
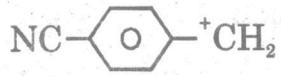
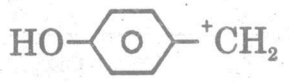
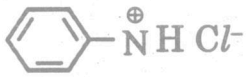
Name : _____ Father's Name : _____

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 and carry equal marks. The candidates are required to attempt all questions.
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 / misbehaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such candidate will not be evaluated.
3. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing **within two hours** after the test is over. No such complaint(s) will be entertained thereafter.
4. 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.
5. **Use only Black or Blue BALL POINT PEN of good quality in the OMR Answer-Sheet.**
6. **There will be NEGATIVE marking. Each correct answer will be awarded one full mark and each incorrect answer will be negatively marked for which the candidate will get ¼ discredit. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.**
7. 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.

Question No.	Questions
1.	The product in the given reaction is  (1)  (2)  (3)  (4) 
2.	Which carbocation of the following is most stable ? (1)  (2)  (3)  (4) 
3.	The range of fluorine chemical shift in NMR is (1) 12 ppm (2) 56 ppm (3) 300 ppm (4) 542 ppm
4.	Which of the following compounds is a phase transfer catalyst ? (1) $CH_3(CH_2)_4NH_2$ (2) $C_6H_5CH_2N^{\oplus}(C_6H_5)Cl^-$ (3) $(n-C_4H_9)_3$ (4) 

Question No.	Questions
5.	Which is strongest base among the following ? (1)  (2)  (3)  (4) 
6.	Which is not an anticancer drug ? (1) Gabapentin (2) Vincristine (3) Cyclophosphamide (4) Doxorubicin
7.	What kind of spectroscopy is FTNMR ? (1) Absorption (2) Emission (3) Both of these (4) None
8.	The CH proton in isopropyl carbocation absorbs at (1) 5.06 ppm (2) 6.28 ppm (3) 13.50 ppm (4) 4.75
9.	By which of these, acetophenone can be converted in to phenol ? (1) Conc. HNO_3 (2) Iodine and NaOH (3) Singlet oxygen followed by base catalyzed hydrolysis (4) m-CPBA followed by base catalyzed hydrolysis

Question No.	Questions
10.	The decreasing order of chemical shifts for protons among Alkanes, Alkene and Alkynes follow the sequence : (1) Alkynes > Alkanes > Alkenes (2) Alkynes > Alkenes > Alkanes (3) Alkanes > Alkynes > Alkenes (4) Alkenes > Alkynes > Alkanes
11.	A crystal plane has intercepts on three axis of the crystal in the ratio $\frac{3}{2}$: 2 : 1. The Miller indices of plane are (1) 463 (2) 364 (3) 643 (4) 436
12.	Which of the following nuclides is beta emitter ? (1) $^{195}_{80}Hg$ (2) $^{120}_{50}Sn$ (3) $^{40}_{20}Ca$ (4) $^{208}_{82}Pb$
13.	A rotational constant of PF_5 molecule is 3.586 Hz. The length of P – F equatorial bond is (1) 2.731 $\overset{o}{A}$ (2) 1.577 $\overset{o}{A}$ (3) 1.109 $\overset{o}{A}$ (4) 1.325 $\overset{o}{A}$
14.	Which one of the following is an irreversible cell ? (1) $Zn / H_2SO_4 / Ag$ (2) $Zn / Zn^{2+} / AgC\ell / Ag$ (3) $Zn / Zn^{2+} // Cd^{2+} / Cd$ (4) $Cd / Cd^{2+} // KC\ell, Hg_2C\ell_2 (S) / Hg$
15.	For a zero-order reaction A → Products, $t_{1/2}$ is proportional to (1) [A] (2) $1/[A]$ (3) $[A]_0^2$ (4) $1/[A_0]^2$

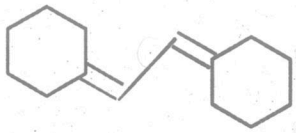
Question No.	Questions
16.	Which of the following is not a state function ? (1) Heat (2) Work (3) Entropy (4) Enthalpy
17.	The emulsifiers consist of (1) Ionic compound (2) Ionic surfactants (3) Non-ionic surfactants (4) Ionic as well as Non-ionogenic surfactant
18.	The boiling point of a liquid is 36°C. Assuming that it obeys Trouton's rule, its molar heat of vaporization will be (1) 27.19 kJ mol^{-1} (2) 2.72 kJ mol^{-1} (3) 271.91 kJ mol^{-1} (4) 2719.1 kJ mol^{-1}
19.	Isotonic solutions have same (1) Molar concentration (2) Viscosity (3) Osmotic pressure (4) Dipole moment
20.	The values of van der Waal's constant 'a' for gases O_2, N_2, NH_3, CH_4 are 1.36, 1.39, 4.19 and 2.253 litre^2 atm. mole^{-2} respectively. The gas which can most easily be liquified is (1) O_2 (2) NH_3 (3) CH_4 (4) N_2

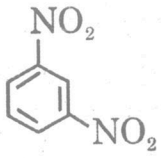
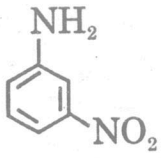
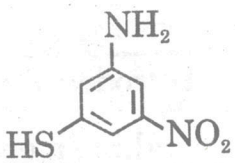
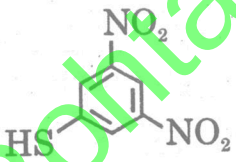
Question No.	Questions
21.	Which is correct order of chemical shift (δ) decrease in MB spectra (1) $C\ell^- > O^{2-} > N^{3-} > CN^-$ (2) $CN^- > O^{2-} > N^{3-} > C\ell^-$ (3) $C\ell^- > CN^- > O^{2-} > N^{3-}$ (4) $CN^- > N^{3-} > O^{2-} > C\ell^-$
22.	The substitution of ligand in the reaction $[Co(NH_3)_5 (CO)_3]^+ + 2\ H_3O^+ \rightarrow [Co(NH_3)_5 (H_2O)]^{3+} + 2\ H_2O + CO_2$ follow the mechanism (1) SN^1 (2) SN^2 (3) SN^1CB (4) Electrophilic substitution of ligand
23.	The Hamiltonian operator for a system comprise of nucleous and electron is expressed by (1) $H = \frac{-h^2}{2m}\nabla^2 + \frac{Ze^2}{r}$ (2) $\frac{-h^2}{2m}\nabla^2 - \frac{Ze^2}{r}$ (3) $H = \frac{-\hbar^2}{2m}\nabla^2 + \frac{Ze^2}{r^2}$ (4) $\frac{-\hbar^2}{2m}\nabla^2 - \frac{Ze^2}{r}$ Where m is the mass of electron and r is the distance between electron and nucleous.
24.	The number of macrostates for distributing three atoms among quantum states, having three quanta of energy are (1) 1 (2) 10 (3) 3 (4) 6
25.	The molecular weight of cellulose varies between (1) 100 to 200 (2) 1000 to 20,000 (3) 20,000 to 5,00,000 (4) 10 lac to 50 lac

Question No.	Questions
26.	The synthetic polymer which resembles natural rubber is (1) Glyptal (2) Neoprene (3) Chloroprene (4) Nylon
27.	Which of the following is not a use for mass spectrometry ? (1) Confirming the presence of O–H and C = O in organic compounds (2) Calculating the isotopic abundance in elements (3) Investigating the elemental composition (4) Calculating molecular mass of organic compounds
28.	The wave function for a particle moving in a one dimensional box is given by (1) $\psi = \frac{\sqrt{2}}{a} . \sin \frac{n\pi}{a}$ (2) $\psi = \frac{\sqrt{2}}{a} \sin \frac{n\pi x}{a}$ (3) $\psi = \frac{\sqrt{2}}{a} . \sin \frac{\pi x}{a}$ (4) $\psi = \sqrt{\frac{2}{a}} . \sin \frac{n\pi x}{a}$
29.	If g_i and n_i are, respectively, the degeneracy and number of atoms occupying i^{th} quantum state, then the condition under which Maxwell-Boltzmann Fermi-Dirac and Bose-Einstein statistics give identical results is (1) g_i/n_i is indeterminate (2) $g_i/n_i << 1$ (3) $g_i/n_i >> 1$ (4) $\frac{g_i}{n_i} < 0$
30.	For a Cubic crystal $d_{100/a}$ is equal to (1) $1/2$ (2) 1 (3) $1/4$ (4) $1/8$

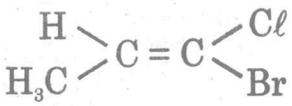
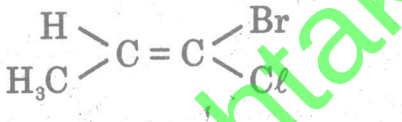
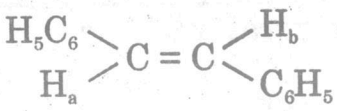
Question No.	Questions
31.	Structure of B_2H_6 is depicted as (1) Octahedral structure (2) Two BH_3 units joined together (3) Two BH_2 units joined by two B–H–B (4) Two BH_3 units joined by two B–H–B
32.	Calconides are the compounds of (1) Nitrogen and sulphur (2) Sulphur, selenium and tellurium (3) Sulphur and phosphorous (4) Sulphur and halogens
33.	π-acid ligands stabilize (1) The lower oxidation states of metal ions (2) The higher valency of metal ions (3) Do not form complexes with metal ions (4) Amphoteric nature of metal ions
34.	Noble gases form (1) Ionic compounds (2) Covalent compounds (3) Coordination compounds (4) Clathrate compounds
35.	In an EPR spectrum, if an odd electron is located over 'n' equivalent nuclei of equal spin I, the number of lines is given by (1) 2 nI (2) 2n + 1 (3) 2n I + 1 (4) 2^n

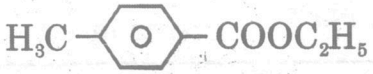
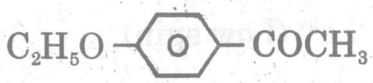
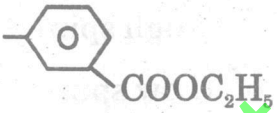
Question No.	Questions
36.	The name of the transition metal ion that activates insulin is (1) Chromium (2) Iron (3) Manganese (4) Copper
37.	Infra-red radiations received from solar system are absorbed by (1) Ozone layer (2) Hydrosphere (3) Troposphere (4) Nitrogen gas present in atmosphere
38.	Deoxy form of hemoglobin is (1) Diamagnetic (2) Anti ferromagnetic (3) Para magnetic (4) Ferromagnetic
39.	In AB_5 type TBP molecules, the number of IR active stretching vibrations are (1) Three (2) Four (3) Two (4) Five
40.	Which nuclear model can best explain that all elements with atomic numbe greater than 92 are radioactive ? (1) Liquid drop model (2) Shell model (3) Collective Model (4) All of these
41.	An SN^1 reaction at an asymmetric carbon atom of a compound alway gives (1) product that does not show any optical rotation (2) an enantiomer of the substrate (3) diastereomer of the substrate (4) product with opposite optical rotation

Question No.	Questions
42.	In UV the compound  will show λ_{max} at (1) 225 nm (2) 247 nm (3) 237 nm (4) 242 nm
43.	Ion-selective membrane used in ion selective electrodes are : (1) Glass membranes (2) Crystalline membranes (3) ion exchange resin membrane (4) All of these
44.	The isomer of C_4H_8 which produces an nmr spectrum with four different signal is (1) Cyclobutane (2) $CH_3CH=CH-CH_3$ (3) $CH_2=CHCH_2CH_3$ (4) $(CH_3)_2C=CH_2$
45.	Following is the unique to polymeric materials : (1) Elasticity (2) Visco elasticity (3) Plasticity (4) None
46.	In the stomach, the proteins are hydrolysed in the acid medium by the action pepsin to yield : (1) Proteoses (2) Peptones (3) Polypeptides (4) α-Amino acids
47.	Grignard reagent shows addition on (1) $>C=O$ (2) $>C=S$ (3) $-C\equiv N$ (4) All of these

Question No.	Questions
48.	The major product (70–80%) of the reaction between m-dinitrobenzene and NH_4HS is (1)  (2)  (3)  (4) 
49.	Isoelectric point is the pH at which (1) An amino aicd becomes acidic (2) An amino acid becomes basic (3) Zwitter ion has zero charge (4) Zwitter ion has positive charg
50.	Stirling approximation, $\ell n\, N! = N\, \ell n\, N - N$, (where N is the number of particles) is applicable only, when (1) $N = 1$ (2) $N > 1$ (3) N is very high (4) None of these
51.	Rate of adsorption of particles by the surface is given by (1) Rate of adsorption = Rate of collosion with surface (2) Rate of adsorption = Rate of sticking probability (3) Rate of adsorption = Rate of collosion with surface × Rate of stickir probabilit (4) Rate of adsorption = $\frac{\text{Rate of collosion with surface}}{\text{Rate of sticking probability}}$

Question No.	Questions
52.	Huckel secular equation for ethylene molecule is (1) $\begin{vmatrix} x & 1 \\ 1 & x \end{vmatrix} = 0$ (2) $\begin{vmatrix} 1 & x \\ x & 1 \end{vmatrix} = 0$ (3) $\begin{vmatrix} x & x \\ 1 & 1 \end{vmatrix} = 0$ (4) None of these Where $x = \frac{\alpha - \beta}{E}$; where E is the energy and α, β are constants.
53.	Water molecule belongs to the following point group (1) D_{2h} (2) D_{2d} (3) C_{3v} (4) C_{2v}
54.	In an ESR spectrometer at 9.30 GHz, the spectrum of hydrogen atom gave two lines, one at 357.5 mT and other at 306.8 mT. The hyperfine coupling constant of hydrogen atom is then given by (1) 50.7 mT (2) 664.3 mT (3) 1.16 mT (4) 11.6 mT
55.	For an van der Waals gas, the Boyle temperature, T_B is (1) $T_B = Rb$ (2) $T_B = aR$ (3) $T_B = aRb$ (4) $T_B = \frac{a}{Rb}$ Where 'a' and 'b' are van der Waal's constants.

Question No.	Questions
56.	Difficult to monitor and very dangerous form of corrosion (1) Crevice (2) Pitting (3) Galvanic (4) Stress
57.	Following pair of compounds are   (1) Enantiomers (2) Dia stereomers (3) Geometrical isomers (4) Homomers
58.	Reactive intermediate involved in the following reaction is  (1) Carbocation (2) Carbanion (3) Carbene (4) Free radical
59.	In $^1H_{nmr}$ of  $J_{Ha} - J_{Hb}$ will be (1) 6 Hz (2) 14 Hz (3) 9 Hz (4) 2 Hz

Question No.	Questions
60.	$^1H_{nmr}$ of a compound shows peaks at δ1.2 (t, 3H) ; 2.1 (s, 3H) ; 4.3 (q, 2H) ; 7.1 (d, J = 9 Hz, 2H) and 8.0 (d, J = 9 Hz, 2H), the compound is (1)  (2)  (3)  (4) 
61.	An electrical cell is set up with two compartments each containing clean iron-electrodes in common air free KCℓ solution. When oxygen is bubbled around electrode, the other electrode is found to corrode and a current flows in the wire connecting two electrodes. The oxygenated solution will become (1) Acidic (2) Alkaline (3) Remains neutral (4) None of these
62.	The largest crystal field splitting will be for the ligand (same metal ion) (1) OX^{2-} (2) NO_2^- (3) NH_3 (4) CN^-
63.	Which of the following is not an Organometallic compound (1) $Ti(C_3H_7O)_4$ (2) $Pb(C_2H_5)_4$ (3) $R_3PAU(CH_3)$ (4) $Fe(C_5H_5)_2$
64.	Which symbiotic bacteria is capable of fixing N_2 (1) Clostridium Pasteurianum (2) Azobacter (3) Nitrogenase (4) Rhizobia

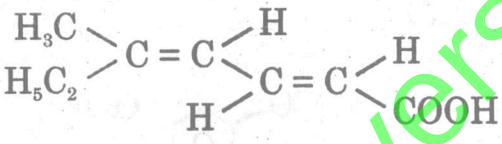
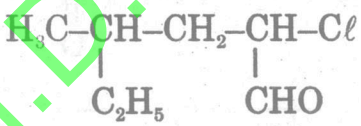
Question No.	Questions
65.	Which of the following is a reducing agent ? (1) La^{3+} (2) Ce^{4+} (3) Eu^{2+} (4) Na^{3+}
66.	Which of the following has no CFSE in octahedral field ? (1) Fe^{3+} (High spin) (2) Fe^{3+} (Low spin) (3) Co^{2+} (Low spin) (4) Cr^{3+} (High spin)
67.	The bond order in superoxide ion is (1) 1.5 (2) 2.5 (3) 3.0 (4) 2.0
68.	The correct order of acidic strength is (1) $HC\ell O > HIO > HBrO$ (2) $HIO > HBrO > HC\ell O$ (3) $HBrO > HC\ell O > HIO$ (4) $HC\ell O > HBrO > HIO$
69.	The $[Si_3O_9]^{6-}$ ion is present in (1) Beryl (2) Wollastonite (3) Asbestos (4) Thorteveitite
70.	A method of chemical analysis which involves interaction of a mobile pha carrying the mixture to be separated with a stationary phase acting absorbent is called (1) Ion exchange (2) Solvent extraction (3) Chromatography (4) Electrography
71.	Ozone depletion in Antarctica is due to the formation of (1) Acrolin (2) Peroxyacetyl nitrate (3) SO_2 and SO_3 (4) Chlorine nitrate

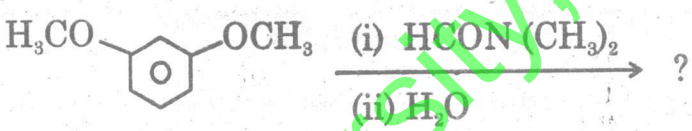
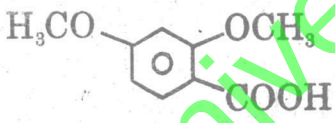
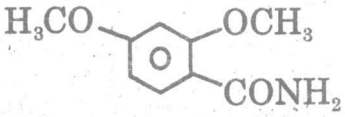
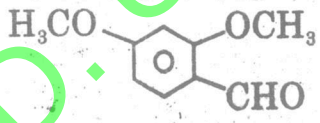
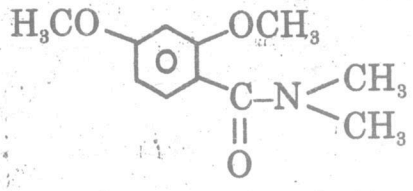
Question No.	Questions
72.	Deficiency of Zn causes the disease (1) Convulsions (2) Dwarfism (3) Liver necrosis (4) Kinky-hair syndrome
73.	Which of the following carbonyls do not obey the EAR rule (1) $Fe(CO)_5$ (2) $Ni(CO)_4$ (3) $V(CO)_6$ (4) $Cr(CO)_6$
74.	The deep blue of $CoC\ell_4^{2-}$ is due to (1) Absence of centre of symmetry (2) Presence of principal axis (3) Absence of centre of symmetry (4) Presence of centre of symmetry
75.	Spotting electrolyte is used to eliminate (1) Diffusion current (2) Migration current (3) Limiting current (4) Condenser current
76.	Most common oxidation state of tellurium is (1) -2 (2) $+2$ (3) $+6$ (4) $+4$
77.	In Ferrocene, which metal orbital interacts with the composite ring orbitals C_PE_{1g} of ligand for the formation of covalent bonds (1) $4p_z$, $4p_x$ (2) $3d_{xz}$, $3d_{yz}$ (3) $4d_{xy}$, $3d_{x^2-y^2}$ (4) $(DS)_x$, $(DS)_y$

Question No.	Questions
78.	The Mössbauer spectra of $K_4Fe(CN)_6$ and $[K_3Fe(CN)_5No]$ consist respectively (1) One line each (2) Two lines each (3) Two and four lines (4) One and two lines
79.	The lowest energy transition in Orgel diagram of Octahedral Ni^{II} comple is (1) $^3A_{2g} \rightarrow {}^3T_{1g}$ (F) (2) $^3A_{2g} \rightarrow {}^3T_{1g}$ (P) (3) $^3A_{2g} \rightarrow {}^3T_{2g}$ (4) None of these
80.	Which of the following statement is not correct ? (1) There exists an actinide contraction analogous to lanthan contraction (2) Lanthanides have a poor tendency to form complexes (3) The chemistry of all lanthanides is almost identical (4) Actinides form oxocations
81.	What is the frequency of radiation possesing wavelength 400 nm ? (1) $7.5 \times 10^{14}\ S^{-1}$ (2) $7.5 \times 10^{-14}\ S^{-1}$ (3) $7.5 \times 10^{9}\ S^{-1}$ (4) $7.5 \times 10^{-9}\ S^{-1}$
82.	What term is used for a non-protein organic molecule that is require some enzymes in order to catalyse a reaction on substrate ? (1) Prosthetic group (2) Co-enzyme (3) Modulator (4) Cofactor
83.	The step down Ladder operator is expressed as (1) $\hat{J}_- = \hat{J}_x - \hat{J}_y$ (2) $\hat{J}_- = \hat{J}_x - i\hat{J}_y$ (3) $\hat{J}_- = \hat{J}_x + \hat{J}_y$ (4) $\hat{J}_- = \hat{J}_x + i\hat{J}_y$

Question No.	Questions
84.	Which of the following represents Michaeilis equation for enzyme catalysed reaction (1) $\frac{d}{dt}[\dot{P}] = \frac{[E_0]S}{1+K/K_3}$ (2) $\frac{d}{dt}[P] = k[E_0][S]$ (3) $\frac{d}{dt}[P] = \frac{[E_0]+S}{1+K/K_3}$ (4) $\frac{d}{dt}[P] = \frac{k_3[E_0]}{1+k/[S]}$ Where all the symbols have their usual meanings.
85.	The Peltier Coefficient, π, is the ratio of two fluxes (1) $\pi = \left(\frac{I}{J}\right)_{\Delta T=0}$ (2) $\pi = \left(\frac{I}{J}\right)_{\Delta P=0}$ (3) $\pi = \left(\frac{J}{I}\right)_{\Delta T} = 0$ (4) $\pi = \left(\frac{J}{I}\right)_{\Delta P=0}$ Where I and J are flow of heat and electric current respectively.
86.	Which one is correct out of following relations (1) $dG = VdP - SdT$ (2) $dG = VdP + SdT$ (3) $dG = SdT - VdP$ (4) None of these
87.	50 mℓ of 0.1 M NaOH is added to 49 mℓ of 0.1 M HCℓ. The pH of resulting solution is (1) 10 (2) 11 (3) 9 (4) 12

Question No.	Questions
88.	Which of the following is Boson ? (1) Electron (2) Proton (3) $^4He_2$ (4) D^2
89.	Henry's law is applicable to real gases, if (1) Pressure is high (2) Solubility of gas is appreciable (3) Dissolved gas react with solvent (4) Temperature is not too low
90.	Which of the following can be used for cathodic protection ? (1) Cu (2) Cd (3) Au (4) Aℓ
91.	By adding sodium dedecyl sulphate during the electrophoresis of proteins, it is possible to (1) predict a protein isoelectric point (2) predict an enzyme specific activity (3) preserve a protein native structure (4) determine the amino acid composition
92.	The number of orientations with respect to applied magnetic field for deuterium is (1) 3 (2) 2 (3) 1 (4) 4

Question No.	Questions
93.	How many spatial arrangements are possible for α-β-dibromobutyric acid ? (1) Two (2) Three (3) Four (4) Five
94.	Which of the following pair of compounds can be differentiated by Tollen's reagent ? (1) Glucose and acetaldehyde (2) Formic acid and benzoic acid (3) Formic acid and formaldehyde (4) Acetophenone and benzo-phenone
95.	The configuration of the given compound is  (1) 2Z, 4Z (2) 2E, 4E (3) 2Z, 4E (4) 2E, 4Z
96.	IUPAC name of the given compound is  (1) 2-chloromethyl-4-methyl hexanal (2) 1-chloro-4-ethyl-2-pentanal (3) 1-chloro-4-methyl-2-hexanal (4) 1-chloro-2-formyl-4-ethyl hexane

Question No.	Questions
97.	When an auxochrome is attached to carbon-carbon double bond, then λ_{max} in its UV spectrum undergoes (1) Hypsochromic shift (2) Bathochromic shift (3) Hyperchromic shift (4) Hypochromic shift
98.	Which of the following compound can be used as homogeneous catalyst in hydrogenation (1) $Ni(Co)_4$ (2) $Fe(Co)_5$ (3) $[\{(C_6H_5)_3P\}_3 Rh] C\ell$ (4) $[\{(C_6H_5)_3P\}_4 Ni] C\ell_2$
99.	The product in the given reaction is  (1)  (2)  (3)  (4) 
100.	Which of the following forms a Diels-Alder adduct most readily (1) Pyridine (2) Pyrrole (3) Furan (4) Thiophene

15.10.15

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

(Ph.D/URS–EE–2015)

Sr. No. 10032 **Subject : CHEMISTRY** **Code D**

Time : 1¼ Hours **Max. Marks : 100** **Total Questions : 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 and carry equal marks. The candidates are required to attempt all questions.
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 / misbehaviour will be registered against him / her, in addition to lodging of an FIR with the police. Further the answer-sheet of such candidate will not be evaluated.
3. In case there is any discrepancy in any question(s) in the Question Booklet, the same may be brought to the notice of the Controller of Examinations in writing **within two hours** after the test is over. No such complaint(s) will be entertained thereafter.
4. 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.
5. **Use only Black or Blue <u>BALL POINT PEN</u> of good quality in the OMR Answer-Sheet.**
6. **There will be <u>NEGATIVE</u> marking. Each correct answer will be awarded one full mark and each incorrect answer will be negatively marked for which the candidate will get ¼ discredit. Cutting, erasing, overwriting and more than one answer in OMR Answer-Sheet will be treated as incorrect answer.**
7. 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.

Question No.	Questions
1.	A crystal plane has intercepts on three axis of the crystal in the ratio $\frac{3}{2} : 2 : 1$. The Miller indices of plane are (1) 463 (2) 364 (3) 643 (4) 436
2.	Which of the following nuclides is beta emitter ? (1) $^{195}_{80}Hg$ (2) $^{120}_{50}Sn$ (3) $^{40}_{20}Ca$ (4) $^{208}_{82}Pb$
3.	A rotational constant of PF_5 molecule is 3.586 Hz. The length of P – F equatorial bond is (1) 2.731 $\mathring{A}$ (2) 1.577 $\mathring{A}$ (3) 1.109 $\mathring{A}$ (4) 1.325 $\mathring{A}$
4.	Which one of the following is an irreversible cell ? (1) $Zn / H_2SO_4 / Ag$ (2) $Zn / Zn^{2+} / AgC\ell / Ag$ (3) $Zn / Zn^{2+} // Cd^{2+} / Cd$ (4) $Cd / Cd^{2+} // KC\ell, Hg_2C\ell_2 (S) / Hg$
5.	For a zero-order reaction A → Products, $t_{1/2}$ is proportional to (1) [A] (2) $1/[A]$ (3) $[A]_0^2$ (4) $1/[A_0]^2$
6.	Which of the following is not a state function ? (1) Heat (2) Work (3) Entropy (4) Enthalpy

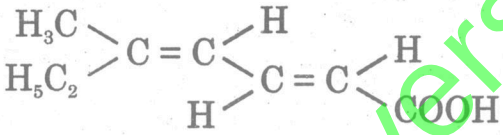
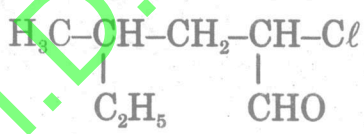
Question No.	Questions
7.	The emulsifiers consist of (1) Ionic compound (2) Ionic surfactants (3) Non-ionic surfactants (4) Ionic as well as Non-ionogenic surfactant
8.	The boiling point of a liquid is 36°C. Assuming that it obeys Trouton's rule, its molar heat of vaporization will be (1) 27.19 kJ mol^{-1} (2) 2.72 kJ mol^{-1} (3) 271.91 kJ mol^{-1} (4) 2719.1 kJ mol^{-1}
9.	Isotonic solutions have same (1) Molar concentration (2) Viscosity (3) Osmotic pressure (4) Dipole moment
10.	The values of van der Waal's constant 'a' for gases O_2, N_2, NH_3, CH_4 are 1.36, 1.39, 4.19 and 2.253 litre^2 atm. mole^{-2} respectively. The gas which can most easily be liquified is (1) O_2 (2) NH_3 (3) CH_4 (4) N_2
11.	Which is correct order of chemical shift (δ) decrease in MB spectra (1) $C\ell^- > O^{2-} > N^{3-} > CN^-$ (2) $CN^- > O^{2-} > N^{3-} > C\ell^-$ (3) $C\ell^- > CN^- > O^{2-} > N^{3-}$ (4) $CN^- > N^{3-} > O^{2-} > C\ell^-$

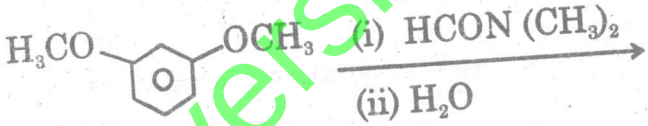
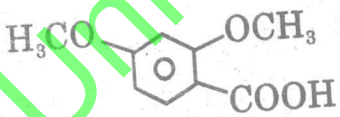
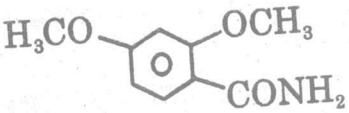
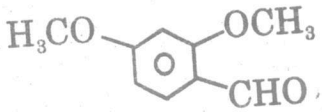
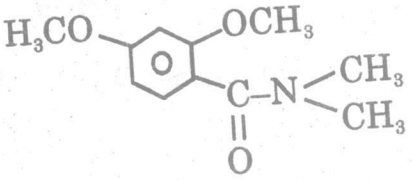
Question No.	Questions
12.	The substitution of ligand in the reaction $[Co(NH_3)_5 (CO)_3]^+ + 2\ H_3O^+ \rightarrow [Co(NH_3)_5 (H_2O)]^{3+} + 2\ H_2O + CO_2$ follow the mechanism (1) SN^1 (2) SN^2 (3) SN^1CB (4) Electrophilic substitution of ligand
13.	The Hamiltonian operator for a system comprise of nucleous and electron is expressed by (1) $H = \frac{-h^2}{2m}\nabla^2 + \frac{Ze^2}{r}$ (2) $\frac{-h^2}{2m}\nabla^2 - \frac{Ze^2}{r}$ (3) $H = \frac{-\hbar^2}{2m}\nabla^2 + \frac{Ze^2}{r^2}$ (4) $\frac{-\hbar^2}{2m}\nabla^2 - \frac{Ze^2}{r}$ Where m is the mass of electron and r is the distance between electron and nucleous.
14.	The number of macrostates for distributing three atoms among quantum states, having three quanta of energy are (1) 1 (2) 10 (3) 3 (4) 6
15.	The molecular weight of cellulose varies between (1) 100 to 200 (2) 1000 to 20,000 (3) 20,000 to 5,00,000 (4) 10 lac to 50 lac
16.	The synthetic polymer which resembles natural rubber is (1) Glyptal (2) Neoprene (3) Chloroprene (4) Nylon

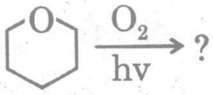
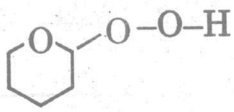
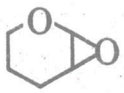
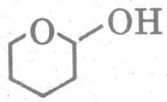
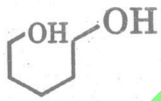
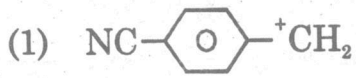
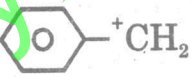
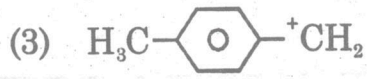
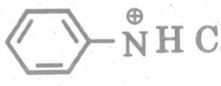
Question No.	Questions
17.	Which of the following is not a use for mass spectrometry ? (1) Confirming the presence of O–H and C = O in organic compounds (2) Calculating the isotopic abundance in elements (3) Investigating the elemental composition (4) Calculating molecular mass of organic compounds
18.	The wave function for a particle moving in a one dimensional box is given by (1) $\psi = \frac{\sqrt{2}}{a} . \sin \frac{n\pi}{a}$ (2) $\psi = \frac{\sqrt{2}}{a} \sin \frac{n\pi x}{a}$ (3) $\psi = \frac{\sqrt{2}}{a} . \sin \frac{\pi x}{a}$ (4) $\psi = \sqrt{\frac{2}{a}} . \sin \frac{n\pi x}{a}$
19.	If g_i and n_i are, respectively, the degeneracy and number of atoms occupying i^{th} quantum state, then the condition under which Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein statistics give identical results is (1) g_i/n_i is indeterminate (2) $g_i/n_i << 1$ (3) $g_i/n_i >> 1$ (4) $\frac{g_i}{n_i} < 0$
20.	For a Cubic crystal $d_{100/a}$ is equal to (1) $1/2$ (2) 1 (3) $1/4$ (4) $1/8$
21.	Ozone depletion in Antarctica is due to the formation of (1) Acrolin (2) Peroxyacetyl nitrate (3) SO_2 and SO_3 (4) Chlorine nitrate

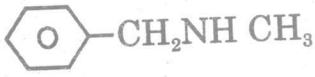
Question No.	Questions
22.	Deficiency of Zn causes the disease (1) Convulsions (2) Dwarfism (3) Liver necrosis (4) Kinky-hair syndrome
23.	Which of the following carbonyls do not obey the EAR rule (1) $Fe(CO)_5$ (2) $Ni(CO)_4$ (3) $V(CO)_6$ (4) $Cr(CO)_6$
24.	The deep blue of $CoC\ell_4^{2-}$ is due to (1) Absence of centre of symmetry (2) Presence of principal axis (3) Absence of centre of symmetry (4) Presence of centre of symmetry
25.	Spotting electrolyte is used to eliminate (1) Diffusion current (2) Migration current (3) Limiting current (4) Condenser current
26.	Most common oxidation state of tellurium is (1) -2 (2) $+2$ (3) $+6$ (4) $+4$
27.	In Ferrocene, which metal orbital interacts with the composite ring orbitals C_pE_{1g} of ligand for the formation of covalent bonds (1) $4p_z$, $4p_x$ (2) $3d_{xz}$, $3d_{yz}$ (3) $4d_{xy}$, $3d_{x^2-y^2}$ (4) $(DS)_x$, $(DS)_y$

Question No.	Questions
28.	The Mössbauer spectra of $K_4Fe(CN)_6$ and $[K_3Fe(CN)_5No]$ consist of, respectively (1) One line each (2) Two lines each (3) Two and four lines (4) One and two lines
29.	The lowest energy transition in Orgel diagram of Octahedral Ni^{II} complexes is (1) $^3A_{2g} \rightarrow {}^3T_{1g}(F)$ (2) $^3A_{2g} \rightarrow {}^3T_{1g}(P)$ (3) $^3A_{2g} \rightarrow {}^3T_{2g}$ (4) None of these
30.	Which of the following statement is not correct ? (1) There exists an actinide contraction analogous to lanthanide contraction (2) Lanthanides have a poor tendency to form complexes (3) The chemistry of all lanthanides is almost identical (4) Actinides form oxocations
31.	By adding sodium dedecyl sulphate during the electrophoresis of proteins, it is possible to (1) predict a protein isoelectric point (2) predict an enzyme specific activity (3) preserve a protein native structure (4) determine the amino acid composition
32.	The number of orientations with respect to applied magnetic field fo deuterium is (1) 3 (2) 2 (3) 1 (4) 4

Question No.	Questions
33.	How many spatial arrangements are possible for α-β-dibromobutyric acid ? (1) Two (2) Three (3) Four (4) Five
34.	Which of the following pair of compounds can be differentiated by Tollen's reagent ? (1) Glucose and acetaldehyde (2) Formic acid and benzoic acid (3) Formic acid and formaldehyde (4) Acetophenone and benzo-phenone
35.	The configuration of the given compound is  (1) 2Z, 4Z (2) 2E, 4E (3) 2Z, 4E (4) 2E, 4Z
36.	IUPAC name of the given compound is  (1) 2-chloromethyl-4-methyl hexanal (2) 1-chloro-4-ethyl-2-pentanal (3) 1-chloro-4-methyl-2-hexanal (4) 1-chloro-2-formyl-4-ethyl hexane

Question No.	Questions
37.	When an auxochrome is attached to carbon-carbon double bond, then λ_{max} in its UV spectrum undergoes (1) Hypsochromic shift (2) Bathochromic shift (3) Hyperchromic shift (4) Hypochromic shift
38.	Which of the following compound can be used as homogeneous catalyst in hydrogenation (1) $Ni(Co)_4$ (2) $Fe(Co)_5$ (3) $[\{(C_6H_5)_3P\}_3 Rh]\ C\ell$ (4) $[\{(C_6H_5)_3P\}_4 Ni]\ C\ell_2$
39.	The product in the given reaction is  (1)  (2)  (3)  (4) 
40.	Which of the following forms a Diels-Alder adduct most readily (1) Pyridine (2) Pyrrole (3) Furan (4) Thiophene

Question No.	Questions
41.	The product in the given reaction is     
42.	Which carbocation of the following is most stable ?    
43.	The range of fluorine chemical shift in NMR is (1) 12 ppm (2) 56 ppm (3) 300 ppm (4) 542 ppm
44.	Which of the following compounds is a phase transfer catalyst ? (1) $CH_3(CH_2)_4NH_2$ (2) $C_6H_5CH_2N^{\oplus}(C_6H_5)Cl^-$ (3) $(n-C_4H_9)_3$ 

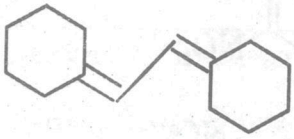
Question No.	Questions
45.	Which is strongest base among the following ? (1)  (2)  (3)  (4) 
46.	Which is not an anticancer drug ? (1) Gabapentin (2) Vincristine (3) Cyclophosphamide (4) Doxorubicin
47.	What kind of spectroscopy is FTNMR ? (1) Absorption (2) Emission (3) Both of these (4) None
48.	The CH proton in isopropyl carbocation absorbs at (1) 5.06 ppm (2) 6.28 ppm (3) 13.50 ppm (4) 4.75
49.	By which of these, acetophenone can be converted in to phenol ? (1) Conc. HNO_3 (2) Iodine and NaOH (3) Singlet oxygen followed by base catalyzed hydrolysis (4) m-CPBA followed by base catalyzed hydrolysis

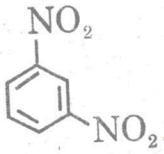
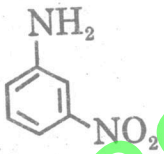
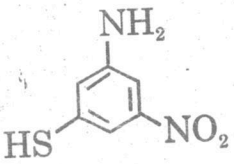
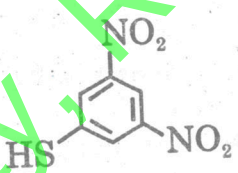
Question No.	Questions
50.	The decreasing order of chemical shifts for protons among Alkanes, Alkene and Alkynes follow the sequence : (1) Alkynes > Alkanes > Alkenes (2) Alkynes > Alkenes > Alkanes (3) Alkanes > Alkynes > Alkenes (4) Alkenes > Alkynes > Alkanes
51.	What is the frequency of radiation possesing wavelength 400 nm ? (1) $7.5 \times 10^{14}\ S^{-1}$ (2) $7.5 \times 10^{-14}\ S^{-1}$ (3) $7.5 \times 10^{9}\ S^{-1}$ (4) $7.5 \times 10^{-9}\ S^{-1}$
52.	What term is used for a non-protein organic molecule that is required by some enzymes in order to catalyse a reaction on substrate ? (1) Prosthetic group (2) Co-enzyme (3) Modulator (4) Cofactor
53.	The step down Ladder operator is expressed as (1) $\hat{J}_- = \hat{J}_x - \hat{J}_y$ (2) $\hat{J}_- = \hat{J}_x - i\hat{J}_y$ (3) $\hat{J}_- = \hat{J}_x + \hat{J}_y$ (4) $\hat{J}_- = \hat{J}_x + i\hat{J}_y$
54.	Which of the following represents Michaeilis equation for enzyme catalysed reaction (1) $\frac{d}{dt}[P] = \frac{[E_0]S}{1+K/K_3}$ (2) $\frac{d}{dt}[P] = k[E_0][S]$ (3) $\frac{d}{dt}[P] = \frac{[E_0]+S}{1+K/K_3}$ (4) $\frac{d}{dt}[P] = \frac{k_3[E_0]}{1+k/[S]}$ Where all the symbols have their usual meanings.

Question No.	Questions
55.	The Peltier Coefficient, π, is the ratio of two fluxes (1) $\pi = \left(\frac{I}{J}\right)_{\Delta T=0}$ (2) $\pi = \left(\frac{I}{J}\right)_{\Delta P=0}$ (3) $\pi = \left(\frac{J}{I}\right)_{\Delta T} = 0$ (4) $\pi = \left(\frac{J}{I}\right)_{\Delta P=0}$ Where I and J are flow of heat and electric current respectively.
56.	Which one is correct out of following relations (1) $dG = VdP - SdT$ (2) $dG = VdP + SdT$ (3) $dG = SdT - VdP$ (4) None of these
57.	50 mℓ of 0.1 M NaOH is added to 49 mℓ of 0.1 M HCℓ. The pH of resulting solution is (1) 10 (2) 11 (3) 9 (4) 12
58.	Which of the following is Boson ? (1) Electron (2) Proton (3) $^4He_2$ (4) D^2
59.	Henry's law is applicable to real gases, if (1) Pressure is high (2) Solubility of gas is appreciable (3) Dissolved gas react with solvent (4) Temperature is not too low

Question No.	Questions
60.	Which of the following can be used for cathodic protection ? (1) Cu (2) Cd (3) Au (4) Aℓ
61.	Structure of B_2H_6 is depicted as (1) Octahedral structure (2) Two BH_3 units joined together (3) Two BH_2 units joined by two B–H–B (4) Two BH_3 units joined by two B–H–B
62.	Calconides are the compounds of (1) Nitrogen and sulphur (2) Sulphur, selenium and tellurium (3) Sulphur and phosphorous (4) Sulphur and halogens
63.	π-acid ligands stabilize (1) The lower oxidation states of metal ions (2) The higher valency of metal ions (3) Do not form complexes with metal ions (4) Amphoteric nature of metal ions
64.	Noble gases form (1) Ionic compounds (2) Covalent compounds (3) Coordination compounds (4) Clathrate compounds

Question No.	Questions
65.	In an EPR spectrum, if an odd electron is located over 'n' equivalent nuclei of equal spin I, the number of lines is given by (1) 2 nI (2) 2n + 1 (3) 2n I + 1 (4) 2^n
66.	The name of the transition metal ion that activates insulin is (1) Chromium (2) Iron (3) Manganese (4) Copper
67.	Infra-red radiations received from solar system are absorbed by (1) Ozone layer (2) Hydrosphere (3) Troposphere (4) Nitrogen gas present in atmosphere
68.	Deoxy form of hemoglobin is (1) Diamagnetic (2) Anti ferromagnetic (3) Para magnetic (4) Ferromagnetic
69.	In AB_5 type TBP molecules, the number of IR active stretching vibrations are (1) Three (2) Four (3) Two (4) Five
70.	Which nuclear model can best explain that all elements with atomic number greater than 92 are radioactive ? (1) Liquid drop model (2) Shell model (3) Collective Model (4) All of these

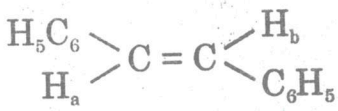
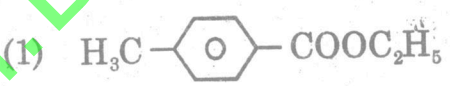
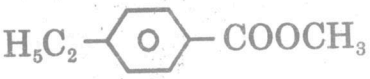
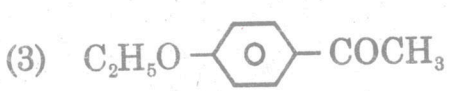
Question No.	Questions
71.	An SN^1 reaction at an asymmetric carbon atom of a compound always gives (1) product that does not show any optical rotation (2) an enantiomer of the substrate (3) diastereomer of the substrate (4) product with opposite optical rotation
72.	In UV the compound  will show λ_{max} at (1) 225 nm (2) 247 nm (3) 237 nm (4) 242 nm
73.	Ion-selective membrane used in ion selective electrodes are : (1) Glass membranes (2) Crystalline membranes (3) ion exchange resin membrane (4) All of these
74.	The isomer of C_4H_8 which produces an nmr spectrum with four different signal is (1) Cyclobutane (2) $CH_3CH=CH-CH_3$ (3) $CH_2=CHCH_2CH_3$ (4) $(CH_3)_2C=CH_2$
75.	Following is the unique to polymeric materials : (1) Elasticity (2) Visco elasticity (3) Plasticity (4) None
76.	In the stomach, the proteins are hydrolysed in the acid medium by the action pepsin to yield : (1) Proteoses (2) Peptones (3) Polypeptides (4) α-Amino acids

Question No.	Questions
77.	Grignard reagent shows addition on (1) $>C=O$ (2) $>C=S$ (3) $-C\equiv N$ (4) All of these
78.	The major product (70–80%) of the reaction between m-dinitrobenzene and NH_4HS is (1)  (2)  (3)  (4) 
79.	Isoelectric point is the pH at which (1) An amino aicd becomes acidic (2) An amino acid becomes basic (3) Zwitter ion has zero charge (4) Zwitter ion has positive charge
80.	Stirling approximation, $\ell n\ N\ ! = N\ \ell n\ N - N$, (where N is the number of particles) is applicable only, when (1) $N = 1$ (2) $N > 1$ (3) N is very high (4) None of these
81.	An electrical cell is set up with two compartments each containing clean iron-electrodes in common air free KCℓ solution. When oxygen is bubbled around electrode, the other electrode is found to corrode and a current flows in the wire connecting two electrodes. The oxygenated solution will become (1) Acidic (2) Alkaline (3) Remains neutral (4) None of these

Question No.	Questions
82.	The largest crystal field splitting will be for the ligand (same metal ion) (1) OX^{2-} (2) NO_2^- (3) NH_3 (4) CN^-
83.	Which of the following is not an Organometallic compound (1) $Ti(C_3H_7O)_4$ (2) $Pb(C_2H_5)_4$ (3) $R_3PAU(CH_3)$ (4) $Fe(C_5H_5)_2$
84.	Which symbiotic bacteria is capable of fixing N_2 (1) Clostridium Pasteurianum (2) Azobacter (3) Nitrogenase (4) Rhizobia
85.	Which of the following is a reducing agent ? (1) La^{3+} (2) Ce^{4+} (3) Eu^{2+} (4) Na^{3+}
86.	Which of the following has no CFSE in octahedral field ? (1) Fe^{3+} (High spin) (2) Fe^{3+} (Low spin) (3) Co^{2+} (Low spin) (4) Cr^{3+} (High spin)
87.	The bond order in superoxide ion is (1) 1.5 (2) 2.5 (3) 3.0 (4) 2.0
88.	The correct order of acidic strength is (1) $HC\ell O > HIO > HBrO$ (2) $HIO > HBrO > HC\ell O$ (3) $HBrO > HC\ell O > HIO$ (4) $HC\ell O > HBrO > HIO$

Question No.	Questions
89.	The $[Si_3O_9]^{6-}$ ion is present in (1) Beryl (2) Wollastonite (3) Asbestos (4) Thorteveitite
90.	A method of chemical analysis which involves interaction of a mobile phase carrying the mixture to be separated with a stationary phase acting as absorbent is called (1) Ion exchange (2) Solvent extraction (3) Chromatography (4) Electrography
91.	Rate of adsorption of particles by the surface is given by (1) Rate of adsorption = Rate of collosion with surface (2) Rate of adsorption = Rate of sticking probability (3) Rate of adsorption = Rate of collosion with surface × Rate of sticking probability (4) Rate of adsorption = $\frac{\text{Rate of collosion with surface}}{\text{Rate of sticking probability}}$
92.	Huckel secular equation for ethylene molecule is (1) $\begin{vmatrix} x & 1 \\ 1 & x \end{vmatrix} = 0$ (2) $\begin{vmatrix} 1 & x \\ x & 1 \end{vmatrix} = 0$ (3) $\begin{vmatrix} x & x \\ 1 & 1 \end{vmatrix} = 0$ (4) None of these Where $x = \frac{\alpha - \beta}{E}$; where E is the energy and α, β are constants.

Question No.	Questions
93.	Water molecule belongs to the following point group (1) D_{2h} (2) D_{2d} (3) C_{3v} (4) C_{2v}
94.	In an ESR spectrometer at 9.30 GHz, the spectrum of hydrogen atom gave two lines, one at 357.5 mT and other at 306.8 mT. The hyperfine coupling constant of hydrogen atom is then given by (1) 50.7 mT (2) 664.3 mT (3) 1.16 mT (4) 11.6 mT
95.	For an van der Waals gas, the Boyle temperature, T_B is (1) $T_B = Rb$ (2) $T_B = aR$ (3) $T_B = aRb$ (4) $T_B = \frac{a}{Rb}$ Where 'a' and 'b' are van der Waal's constants.
96.	Difficult to monitor and very dangerous form of corrosion (1) Crevice (2) Pitting (3) Galvanic (4) Stress
97.	Following pair of compounds are  (1) Enantiomers (2) Dia stereomers (3) Geometrical isomers (4) Homomers

Question No.	Questions
98.	Reactive intermediate involved in the following reaction is  (1) Carbocation (2) Carbanion (3) Carbene (4) Free radical
99.	In $^1H_{nmr}$ of  $J_{Ha} - J_{Hb}$ will be (1) 6 Hz (2) 14 Hz (3) 9 Hz (4) 2 Hz
100.	$^1H_{nmr}$ of a compound shows peaks at δ1.2 (t, 3H) ; 2.1 (s, 3H) ; 4.3 (q, 2H) ; 7.1 (d, J = 9 Hz, 2H) and 8.0 (d, J = 9 Hz, 2H), the compound is (1)  (2)  (3)  (4) 

Sr No.	A	B	C	D
1	3	1	1	4
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3	1	4	4	2
4	4	3	2	1
5	3	2	2	1
6	1	1	1	2
7	2	4	2	4
8	3	2	3	1
9	3	3	4	3
10	1	3	4	2
11	4	1	4	1
12	2	4	1	4
13	3	4	2	1
14	1	2	1	3
15	2	2	1	3
16	4	1	2	2
17	2	2	4	1
18	4	3	1	4
19	3	4	3	3
20	1	4	2	2
21	2	4	1	4
22	4	1	4	2
23	1	2	1	3
24	4	1	3	1
25	3	1	3	2
26	2	2	2	4
27	1	4	1	2
28	4	1	4	4
29	2	3	3	3
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31	1	2	3	3
32	4	4	2	1
33	1	1	1	3
34	3	4	4	2
35	3	3	3	4
36	2	2	1	1
37	1	1	2	2
38	4	4	3	3
39	3	2	3	3
40	2	3	1	3
41	1	3	1	1
42	2	2	2	4
43	2	1	4	4
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45	3	3	2	2
46	1	1	1	1
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94	3	1	2	1
95	2	2	4	4
96	1	4	1	2
97	4	2	2	3
98	2	4	3	4
99	3	3	3	2
100	3	1	3	1