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

(MPH/PHD/URS–EE–2019)

CHEMISTRY

Sr. No. 10005

Code **A**

SET–"X"

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

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

Name : ______________ Father's Name : ______________

Mother's Name : ______________ Date of Examination : ______________

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

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

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

Sample copy for Scanning

Question No.	Questions
1.	Which one of the following high spin complexes has the largest CSFE Crystal field stabilization energy (1) $[Cr(H_2O)_6]^{2+}$ (2) $[Mn(H_2O)_6]^{2+}$ (3) $[Fe(H_2O)_6]^{2+}$ (4) $[Co(H_2O)_6]^{2+}$
2.	The number of 3c, 2e BHB and B-B bonds present in B_4H_{10} respectively are (1) 2, 4 (2) 3, 2 (3) 4, 1 (4) 4, 0
3.	The most unstable species among the following is (1) $Ti(C_2H_5)_4$ (2) $Ti(CH_2Ph)_4$ (3) $Pb(CH_3)_4$ (4) $Pb(C_2H_5)_4$
4.	The acid catalyzed hydrolysis of *trans*-$[Co(en)_2AX]^{n+}$ can give *cis*-product also due to the formation of (1) Square pyramidal intermediate (2) Trigonal bipyramidal intermediate (3) Pentagonal bipyramidal intermediate (4) Face capped octahedral intermediate
5.	Total number of lines expected in ^{31}P NMR spectrum of HPF_2 is (I = 1/2 for both ^{19}F and ^{31}P) (1) Six (2) Four (3) Five (4) Three

Question No.	Questions
6.	The number of faces, vertices and edges in IF_7 polyhedron are, respectively (1) 15, 7 and 15 (2) 10, 7 and 15 (3) 10, 8 and 12 (4) 12, 6 and 9
7.	The light pink colour of $[Co(H_2O)_6]^{2+}$ and the deep blue colour of $[CoC\ell_4]^{-2}$ are due to (1) MLCT transition in the first and d-d transition in the second (2) LMCT transitions in both (3) d-d transitions in both (4) d-d transition in the first and MLCT transition in the second
8.	In $[Mo_2(S_2)_6]^{2-}$ cluster the number of bridging S atoms and coordination number of Mo respectively, are (1) 2 and 8 (2) 2 and 6 (3) 1 and 8 (4) 1 and 6
9.	The number of possible isomers of $[Ru(PPh_3)_2(acac)_2]$ (acac = acetylacetonate) is (1) 2 (2) 5 (3) 4 (4) 3
10.	Which ones among CO_3^{2-}, XeO_3, SO_3, PO_3^{3-} and NO_3^- have planar structure ? (1) CO_3^{2-}, PO_3^{3-} and XeO_3 (2) CO_3^{2-}, XeO_3 and NO_3^- (3) SO_3, PO_3^{3-} and NO_3^- (4) CO_3^{2-}, SO_3 and NO_3^-

Question No.	Questions
11.	The molecule $(OC)_5M = CPh(OCH_3)$ obeys 18 electron rule. The two 'M' satisfying the condition are (1) Cr, Re^+ (2) Mo, V (3) V, Re^+ (4) Cr, V
12.	The number of lines exhibited by a high resolution EPR spectrum of the species $[Cu(ethylenediamine)_2]^{2+}$ is [Nuclear spin (I) of copper is 3/2 and of N = 1] (1) 12 (2) 15 (3) 20 (4) 36
13.	Complexes of general formula, fac-$[Mo(CO)_3\ (phosphine)_3]$ have the C–O stretching bands as given below : Phosphine : PF_3 (i); $PC\ell_3$ (ii); $P(C\ell)Ph_2$ (iii); PMe_3 (iv) v(CO) : in cm^{-1} : 2090 (a); 2040 (b); 1977 (c); 1945 (d) The correct combination of the phosphine and the stretching frequency is, (1) (i-a) (ii-b) (iii-c) (iv-d) (2) (i-b) (ii-a) (iii-d) (iv-c) (3) (i-d) (ii-c) (iii-b) (iv-a) (4) (i-c) (ii-d) (iii-a) (iv-b)
14.	Which one of the following will *NOT* undergo oxidative addition by methyl iodide ? (1) $[Rh(CO_2)I_2]$ (2) $[\eta^5\text{-}CpRh(CO)_2]$ (3) $[Ir(PPh_3)_2\ (CO)C\ell]$ (4) $[\eta^5\text{-}Cp_2Ti(Me)C\ell]$

Question No.	Questions
15.	C_{60} has (1) 14 pentagon rings and 18 Hexagon rings (2) 12 pentagon rings and 20 Hexagon rings (3) 12 pentagon rings and 18 Hexagon rings (4) 14 pentagon rings and 20 Hexagon rings
16.	In 'carbon-dating' application of radioisotopes, ^{14}C emits (1) Positron (2) γ particle (3) β particle (4) α particle
17.	The product of the reaction of propene, CO and H_2 in the presence of $Co_2(CO)_8$ as catalyst is (1) butanoic acid (2) butanal (3) 2-butanone (4) methylpropanoate
18.	Reductive elimination step in hydrogenation of alkenes by Wilkinson catalyst results in (neglecting solvent in coordination sphere of Rh) (1) T-shaped $[Rh(PPh_3)_2\ CI]$ (2) Trigonal-planar $[Rh(PPh_3)_2C\ell]$ (3) T-shaped $[Rh(H)(PPh_3)_2]$ (4) Trigonal-planar $[Rh(H)(PPh_3)_2]$
19.	The correct statement with respect to the bonding of the ligands, Mc_3N and Mc_3P with the metal ions Be^{2+} and Pd^{2+} is, (1) the ligands bind equally strong with both the metal ions as they are dicationic (2) the ligands bind equally strong with both the metal ions as both the ligands are pyramidal (3) the binding is stronger for Me_3N with Be^{2+} and Me_3P with Pd^{2+} (4) the binding is stronger for Me_3N with Pd^{2+} and Me_3P with Be^{2+}

Question No.	Questions
20.	In the iodometric titration of sodium thiosulfate ($Na_2S_2O_3$) with acidic dichromate solution, 25 mL of 0.1 M dichromate requires 50 mL of 'x' M thiosulfate. The value of 'x' is (1) 0.6 (2) 0.3 (3) 0.1 (4) 0.4
21.	The room temperature magnetic moment (μ_{eff} in BM) for a monomeric Cu(II) complex is greater than 1.73. This may be explained using the expression (1) $\mu_{eff} = \mu_s (1 - \alpha\lambda/\Delta)$ (2) $\mu_{eff} = [n(n+2)]^{1/2}$ (3) $\mu_{eff} = [4s(s+1) + L(L+1)]^{1/2}$ (4) $\mu_{eff} = g[J(J+1)]^{1/2}$
22.	The numbers of P–S and P–P bonds in the compound P_4S_3 are, respectively, (1) 3 and 6 (2) 4 and 3 (3) 6 and 3 (4) 6 and 2
23.	In the absence of bound globin chain, heme group on exposure to O_2 gives the iron-oxgen species (1) Fe(III)–O–Fe(III) (2) Fe(III)–O–O$^-$ (3) Fe(III)–O–O–Fe(III) (4) Fe(IV)–O–
24.	The complex $[Cr(bipyridyl)_3]^{2+}$, shows a red phosphorescence due to transition (1) $^4T_{1g} \leftarrow {}^4A_{2g}$ (2) $^2E_g \leftarrow {}^4A_{2g}$ (3) $^4T_{2g} \leftarrow {}^4A_{2g}$ (4) $^4A_{2g} \leftarrow {}^2E_g$

Question No.	Questions
25.	Consider the following reactions in N_2O_4 i. $NOC\ell + Sn$ ii. $NOC\ell + AgNO_3$ iii. $NOC\ell + BrF_3$ iv. $NOC\ell + SbC\ell_5$ Reactions which will give $[NO]^+$ as a major product are : (1) i and ii (2) iii and iv (3) i and iv (4) ii and iv
26.	The number of 3c–2e bonds present in $A\ell(BH_4)_3$ is (1) four (2) three (3) six (4) zero
27.	The role of copper salt as co-catalyst in Wacker process is (1) Oxidation of Pd(0) by Cu(II) (2) Oxidation of Pd(0) by Cu(I) (3) Oxidation of Pd(II) by Cu(I) (4) Oxidation of Pd(II) by Cu(II)
28.	For the oxidation state/s of sulphur atoms in S_2O, consider the following; i) -2 and $+4$ ii) 0 and $+2$ iii) $+4$ and 0 iv) $+2$ and $+2$ The correct answer is/are (1) i and ii (2) i and iii (3) ii and iv (4) iii and iv
29.	The geometries of $[C\ell F_4]^+$ and $[IF_4]^-$ respectively are (1) Tetrahedral and tetrahedral (2) Tetrahedral and trigonal bipyramidal (3) Tetrahedral and Square planar (4) Tetrahedral and Octahedral

Question No.	Questions
30.	Among the complexes (i) $K_4[(Cr(CN)_6]$, (ii) $K_4[(Fe(CN)_6]$, (iii) $K_3[(Co(CN)_6]$, and (iv) $K_4[(Mn(CN)_6]$, Jahn Teller distortion is expected in (1) i, ii and iii (2) ii, iii and iv (3) i and iv (4) ii and iii
31.	The complex $[Fe(Phen)_2(NCS)_2]$(Phen – 1, 10-phnanthroline) shows spin crossover behaviour. CFSE and μ_{eff} at 250 and 150 K, respectively will be : (1) 0.4 Δ_0, 4.90 BM and 2.4 Δ_0, 0.00 BM (2) 2.4 Δ_0, 2.90 BM and 0.4 Δ_0, 1.77 BM (3) 2.4 Δ_0, 0.00 BM and 0.4 Δ_0, 4.90 BM (4) 1-2 Δ_0, 4.90 BM and 2.4 Δ_0, 0.00 BM
32.	$[Ni^{II} L_6]^{n+ \text{ or } n-}$ show absorption bands at 8500, 15400 and 26000 cm^{-1} whereas $[Ni^{II} L'_6]^{n+ \text{ or } n-}$ at 10750, 17500 and 28200 cm^{-1}, L and L' are respectively (1) OH^- and N_3^- (2) $C\ell^-$ and I^- (3) NCS^- and $RCOO^-$ (4) H_2O and NH_3
33.	The rate of exchange of OH_2 present in the coordination sphere by $^{18}OH_2$ of i. $[Cu(H_2O)_6]^{2+}$; ii) $[Mn(H_2O)_6]^{2+}$; iii) $[Fe(H_2O)_6]^{2+}$; iv) $[Ni(H_2O)_6]^{2+}$, follows the order (1) i) > iv) > iii) > ii) (2) i) > ii) > iii) > iv) (3) ii) > iii) > iv) > i) (4) iii) > i) > iv) > ii)

Question No.	Questions
34.	On addition of an inert gas at constant volume to the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$ at equilibrium (1) The reaction remains unaffected (2) Forward reaction is favoured (3) The reaction halts (4) Backward reaction is favoured
35.	The transition zone for Raman spectra is (1) Between vibrational and rotational levels (2) Between electronic levels (3) Between magnetic levels of nuclei (4) Between magnetic levels of unpaired electrons
36.	Polarisation of the electron cloud by the cation forms (1) Ionic bond (2) Covalent bond (3) Coordinate bond (4) Metallic bond
37.	Activation energy of a chemical reaction can be determined by ______. (1) determining the rate constant at standard temperature (2) determining the rate constants at two temperatures (3) determining probability of collision (4) using catalyst

Question No.	Questions
38.	Due to Frenkel defect, the density of the ionic solids (1) increases (2) decreases (3) does not change (4) none of the above
39.	What is the simplest formula of a solid whose cubic unit cell has the atom A at each corner, the atom B at each face centre and a C atom at the body centre (1) AB_2C (2) A_2BC (3) AB_3C (4) ABC_3
40.	Which of the following thermodynamic function is called as the arrow of "time" (1) Enthalpy (2) Gibbs free energy (3) Entropy (4) Helmholtz free energy
41.	For a potentiometric titration in the curve of emf (E) v/s volume (V) of the titrant added, the equivalence point is indicated by (1) $\lvert dE/dV \rvert = 0, \lvert d^2E/dV^2 \rvert = 0$ (2) $\lvert dE/dV \rvert = 0, \lvert d^2E/dV^2 \rvert > 0$ (3) $\lvert dE/dV \rvert > 0, \lvert d^2E/dV^2 \rvert = 0$ (4) $\lvert dE/dV \rvert > 0, \lvert d^2E/dV^2 \rvert > 0$
42.	If the concentration (c) is increased to 4 times its original value (c), the change in molar conductivity for strong electrolytes is (where b is kohlrausch's constant) - (1) 0 (2) $b\sqrt{c}$ (3) $2b\sqrt{c}$ (4) $4b\sqrt{c}$

Question No.	Questions
43.	The energy levels of the harmonic oscillator (neglecting zero point energy) are $\varepsilon_v = nh\nu$ for $n = 0, 1, 2$ ..... Assuming $h\nu = k_B T/3$; the partition function is (1) e (2) $e^{1/3}(e^{1/3} - 1)$ (3) 1/3e (4) $3e/(3e^3 - 1)$
44.	The ground state of hydrogen atom is -13.598 eV. The exception values of kinetic energy $<T>$ and potential energy, $<V>$, in units of eV, are (1) $<T> = 13.598, <V> = -27.196$ (2) $<T> = -27.196, <V> = 13.598$ (3) $<T> = -6.799, <V> = -6.799$ (4) $<T> = 6.799, <V> = -20.397$
45.	The correct expression for the product $((M_n).(M_w))$ [where M_n and M_w are the number average and weight average molar masses, respectively, of a polymer] is (1) $N^{-1}\sum_i N_iM_i$ (2) $N^{-1}\sum_i N_iM_i^2$ (3) $N/\sum_i N_iM_i$ (4) $N/\sum_i N_iM_i^2$
46.	Match the following columns :

	Column–1		Column–2
A.	Energy of the ground state of He+	1.	-6.04 ev
B.	Potential energy of Ist orbit of H– atom	2.	-27.2 ev
C.	Kinetic energy of II excited state of He+	3.	$8.68 * 10^{-18}$ J
D.	Ionisation potential of He+	4.	-54.4 ev

Codes.

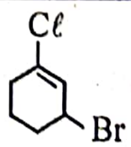
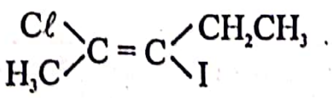
	A	B	C	D
(1)	1	2	3	4
(2)	4	3	2	1
(3)	4	2	1	3
(4)	2	3	1	4

Question No.	Questions
47.	The protecting power of lyophilic colloidal sol is expressed in terms of (1) Critical miscelle concentration (2) Oxidation number (3) Coagulation value (4) Gold number
48.	Which one of the following is an example for homogenous catalysis ? (1) Hydrogenation of oil (2) Manufacture of ammonia by Haber's process (3) Manufacture of sulphuric acid by Contact process (4) Hydrolysis of sucrose in presence of dilute hydrochloric acid
49.	The energy of a hydrogen atom in a state is ($-hcR_H/25$), where R_H = Rydberg Constant). The degeneracy of the state will be - (1) 25^1 (2) 25^2 (3) 25^3 (4) 25^4
50.	The value of the commutator $[x, p^2_x]$ is (1) 2i (2) $2\,i\,h\,p_x$ (3) $2ixp_x$ (4) $h\,i\,p_x/\pi$
51.	The number of the lines in the ESR spectrum of CD_3 is (the spin of D is 1) (1) 1 (2) 3 (3) 4 (4) 7
52.	Colligative properties are used for the determination of (1) molar mass (2) equivalent weight (3) arrangement of molecules (4) melting and boiling point

Question No.	Questions
53.	Which of the following does not contain a C_3 axis ? (1) $POC\ell_3$ (2) NH_4^+ (3) H_3O^+ (4) $C\ell F_3$
54.	Franck Condon principle is related to (1) time required for electronic transition to occur (2) absorption of light (3) time of electronic transition and change in internuclear distance (4) symmetry of molecules
55.	Which pairing of molecule and point group is correct ? (1) $BC\ell_3$, C_{3v} (2) $SiC\ell_4$, D_{4h} (3) H_2S, C_{2v} (4) SF_4, C_{4v}
56.	The symmetric stretching mode of the SiF_4 molecule : (1) IR active (2) IR inactive (3) generates a change in molecular dipole moment (4) gives rise to a strong absorption in IR spectrum
57.	Match the following columns : LIST–1 LIST-2 1. Sol A. Liquid dispersed in solid 2. Gel B. gas dispersed in liquid 3. Emulsion C. Solid dispersed in liquid 4. Foam D. liquid dispersed in liquid Codes (1) 1–A 2–B 3–C 4–D (2) 1–B 2–C 3–D 4–A (3) 1–C 2–A 3–D 4–B (4) 1–B 2–D 3–A 4–C

Question No.	Questions
58.	A heat engine operates between the boiling point of water and a room temperature of 25°C. The efficiency of the engine is largest, if water is allowed to boil at a pressure of – (1) 1 atm. (2) 10 atms (3) 25 atms (4) $1.01 * 10^6\ Nm^{-2}$
59.	Monomer of Orlon is (1) $CH_2=CH–OCH_3$ (2) $CF_2=CF_2$ (3) $CH_2=CH-CN$ (4) $CH_2=CH-C\ell$
60.	Chloroprene is obtained by the addition of $HC\ell$ to (1) ethylene (2) acetylene (3) vinylacetylene (4) phenylacetylene
61.	The normality of 2.3 M H_2SO_4 solution is (1) 2.3 N (2) 4.6 N (3) 6.9 N (4) 7.9 N
62.	Crystal cannot posses (1) 1 fold axis of symmetry (2) 3 fold axis of symmetry (3) 5 fold axis of symmetry (4) 6 fold axis of symmetry
63.	Number of sigma bonds in P_4O_{10} is (1) 6 (2) 7 (3) 17 (4) 16

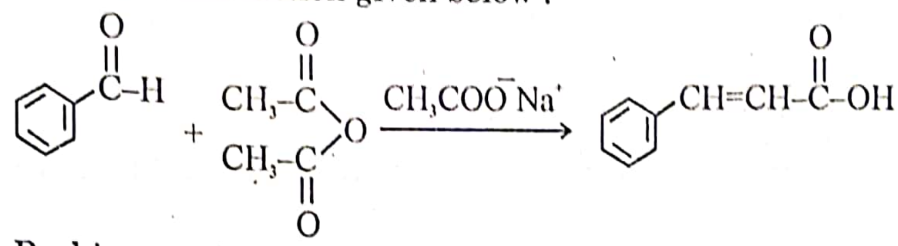
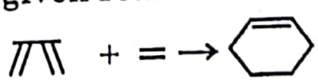
Question No.	Questions
64.	2 mol of an ideal gas at 27°C is expanded reversibly from 2 lit. To 20 lit. Find entropy change (R = 2 cal / mol K) (1) 92.1 (2) 0 (3) 4 (4) 9.2
65.	An adiabatic process is (1) isoenthalpic (2) isoentropic (3) isochoric (4) isobaric
66.	At a certain temperature, the following observations were made for the reaction $A \longrightarrow$ Products Time (From the start) — [A] 2 minutes — $5*10^{-3}$ 5 minutes — $4*10^{-3}$ 8 minutes — $3*10^{-3}$ 11 minutes — $2*10^{-3}$ The order of the reaction is (1) 1 (2) 2 (3) 3 (4) Zero

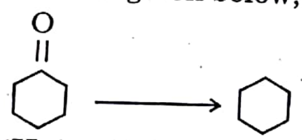
Question No.	Questions
67.	How many stereoisomers does have 2, 3-dichloropentane ? (1) 2 (2) 4 (3) 3 (4) 5
68.	Which statement about benzene is incorrect ? (1) The C_6 ring is planar (2) The C–Cπ–bonding is delocalised. (3) The reactivity of the benzene reflects the presence of carbon-carbon double bond. (4) Each C atom is sp^2 hybridized.
69.	Which of the following is not a Huckel (4n + 2) aromatic system ? (1) [18]–Annulene ($C_{18}H_{18}$) (2) Cyclooctatetraene (C_8H_8) (3) Benzene (C_6H_6) (4) Cyclopentadienyl anion ($C_5H_5^-$)
70.	The IUPAC name of  is : (1) 1-bromo-3-chlorocyclohexene (2) 2-bromo-6-chlorocyclohex-1-ene (3) 6-bromo-2-chlorocyclohexene (4) 3-bromo-1-chlorocyclohexene
71.	Which of the following is a correct name for the following compound ?  (1) cis-2-chloro-3-iodo-2-pentene (2) trans-2-chloro-3-ido-2-pentene (3) trans-3-iodo-4chloro-3-pentene (4) cis-3-iodo-4-chloro-3-pentene

Question No.	Questions
72.	Keto-enol tautomerism is observed in : (1) $C_6H_5-\overset{\overset{O}{\parallel}}{C}-CH_2-\overset{\overset{O}{\parallel}}{C}-CH_3$ (2) $C_6H_5-\overset{\overset{O}{\parallel}}{C}-C_6H_5$ (3) $CH_3CH_2\overset{\overset{O}{\parallel}}{C}-OH$ (4) $C_6H_5-\overset{\overset{O}{\parallel}}{C}-H$
73.	Which of the following gases is mainly responsible for acid rain ? (1) NO_2 and CO_2 (2) CO_2 and SO_2 (3) SO_2 and NO_2 (4) None of these
74.	Which of the following compound displays two singlets at $\delta_{2.3}$ and 7.1 ppm. (1) 1, 2-dimethylbenzene (2) 1, 3-dimethyl benzene (3) 1, 4-dimethyl benzene (4) methyl benzene
75.	A single strong and sharp absorption near 1650 cm^{-1} in IR spectra indicates the presence of (1) Acid chlorides (2) Amides (3) Anhydrides (4) Aldehydes
76.	The proteins in which prosthetic group is carbohydrate are known as (1) Lipo-protein (2) Mucoprotein (3) Chromoprotein (4) Nucleoprotein

Question No.	Questions
77.	Match the List I and List II and select the correct answer using codes given below : List I — 1 Nerol; 2 Citral; 3 Pinol; 4 Lupeol List II — A Lemon grass oil; B Geraniol; C Amyrin; D α-pinene Correct answer is : (1) 1–C, 2–B, 3–A, 4–D (2) 1–B, 2–A, 3–D, 4–C (3) 1–D, 2–C, 3–A, 4–D (4) 1–A, 2–D, 3–B, 4–D
78.	Hydrolysis product of sucrose is : (1) Fructose (2) Glucose + Galactose (3) Glucose (4) Glucose + Fructose
79.	The mass spectrum of primary amides shows a moderate molecular ion and an Intense peak at $m/z = 44$ due to : (1) Loss of an alkyl radical (2) Loss of HCN (3) Loss of CO (4) Loss of methyl radical
80.	Which one of the following is bacteriostatic drug ? (1) Chloramphenicol (2) Penicillin (3) Streptomycin (4) Phenacetin
81.	Heating 1, 4-dicarbonyl compounds in the presence of phosphorus pentoxide (P_2O_5) gives : (1) Pyrrole (2) Furan (3) Thiophene (4) Quinoline
82.	The Acetylation of thiophene occurs at : (1) C_3–position (2) C_4–position (3) C_2–position (4) both at C_2 and C_4–positions

Question No.	Questions
83.	Pyridine is basic in nature having (1) pKa = 5.21 (2) pKa = – 0.27 (3) pKa = 5.81 (4) pKa = – 0.35
84.	Least stable carbocation among the following is (1) $(CH_3)_3C^+$ (2) $(CH_3)_2CH^+$ (3) $CH_3CH_2^+$ (4) CH_3^+
85.	Due to the presence of an unpaired electron, free radicals are (1) Anions (2) Cations (3) Chemically reactive (4) Chemically inreactive
86.	Benzoyl peroxide undergoes hamolytic cleavage to produce (1) Phenyl radical (2) Methyl radical (3) Phenyl chloride (4) Methyl chloride
87.	SN^1 mechanism for the hydrolysis of an alkyl halide involves the formation of intermediate (1) Free radical (2) Carbanion (3) Carbocation (4) None of these
88.	Which of the following is NOT polar protic solvent ? (1) H_2O (2) C_2H_5OH (3) Fumaric acid (4) Acetone
89.	A new carbon-carbon bond formation is possible in (1) Clemmensen reduction (2) Wurtz reduction (3) Friedel-Craft alkylation (4) Oppenauer oxidation

Question No.	Questions
90.	Give the name of reaction given below :  (1) Perkin reaction (2) Pechmann condensation (3) Benzoin condensation (4) Claisen-Schmidt reaction
91.	What is meant by a reaction going in 94% enantiomeric excess ? (1) The product contains 94% of one enantiomer and 6% of other enantiomer (2) The product contains an enantiomer which is 94% pure (3) The product contains 94% of one enantiomer and 6% of the products (4) The product contains 97% of one enantiomer and 3% of other enantiomer
92.	Which of the following functional group is <u>not</u> reduced by sodium borohydride ($NaBH_4$) (1) $>C=O$ (2) $-\underset{\underset{O}{\|}}{C}-C\ell$ (3) $-\underset{\underset{O}{\|}}{C}-H$ (4) $-\underset{\underset{O}{\|}}{C}-OH$
93.	The given reaction is the example of :  (1) 2 + 4 cycloaddition (2) 2 + 2 cycloaddition (3) 2 + 2 + 2 cycloaddition (4) 2S + 2S cycloaddition
94.	A photo chemical reaction is : (1) catalysed by light (2) Initiated by light (3) accompanied with the emission of light (4) used to convert heat energy into light

Question No.	Questions
95.	Which of the following solvents is unacceptable on large scale ? (1) Dimethoxy ethane (2) Xylene (3) Diethyl ether (4) Heptane
96.	For the reaction given below, which reaction condition are not suitable ?  (1) $LiA\ell H_4 / \varepsilon t_2O$ (2) $H_2N\,NH_2$ / NaOH (3) Zn (Hg) / $HC\ell$ (4) $HSCH_2CH_2CH_2SH$ / H^+, H_2 / Ni
97.	Which of the following statements is not correct ? (1) The molecule to be synthesised is a target molecule (2) Synthetic equivalent is a real chemical compound resulting from disconnection (3) Regioselective reaction does not produce one of several possible structural isomers (4) Synthon is an idealised fragment (usually cation or anion) resulting from a disconnection.
98.	How many oxygen atoms lined up in a row would fit in a one nanomaterial space ? (1) Seventy (2) One (3) Seven (4) None
99.	The role of catalyst in chemical reaction is (1) Lowers the activation energy (2) Alters the amount of products (3) Increases ΔH of Forward reaction (4) Decreases of ΔH of Forward reaction
100.	Secondary pollutant is (1) SO_2 (2) CO (3) PAN (4) Aerosol

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

(MPH/PHD/URS–EE–2019)

CHEMISTRY

Sr. No. 10002

Code **B**

SET–"X"

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

Roll No. ______________ (in figure)______________________ (in words)

Name : __________________ Father's Name : __________________

Mother's Name : __________________ Date of Examination : __________________

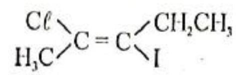
(Signature of the candidate) (Signature of the Invigilator)

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

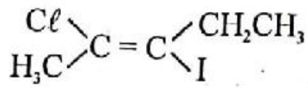
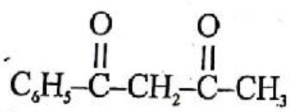
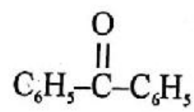
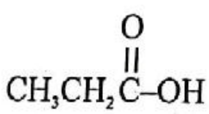
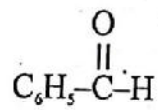
1. All questions are compulsory.
2. The candidates must return the Question book-let as well as OMR answer-sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / misbehaviour will be registered against him / her, in addition to lodging of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

Sample copy for website

SEAL
Confidential

Question No.	Questions
1.	Which of the following is a correct name for the following compound ?  (1) cis-2-chloro-3-iodo-2-pentene (2) trans-2-chloro-3-ido-2-pentene (3) trans-3-iodo-4chloro-3-pentene (4) cis-3-iodo-4-chloro-3-pentene
2.	Keto-enol tautomerism is observed in : (1) $C_6H_5\text{–}\overset{O}{\overset{\Vert}{C}}\text{–}CH_2\text{–}\overset{O}{\overset{\Vert}{C}}\text{–}CH_3$ (2) $C_6H_5\text{–}\overset{O}{\overset{\Vert}{C}}\text{–}C_6H_5$ (3) $CH_3CH_2\overset{O}{\overset{\Vert}{C}}\text{–}OH$ (4) $C_6H_5\text{–}\overset{O}{\overset{\Vert}{C}}\text{–}H$
3.	Which of the following gases is mainly responsible for acid rain ? (1) NO_2 and CO_2 (2) CO_2 and SO_2 (3) SO_2 and NO_2 (4) None of these
4.	Which of the following compound displays two singlets at $\delta_{2.3}$ and 7.1 ppm. (1) 1, 2-dimethylbenzene (2) 1, 3-dimethyl benzene (3) 1, 4-dimethyl benzene (4) methyl benzene
5.	A single strong and sharp absorption near 1650 cm^{-1} in IR spectra indicates the presence of (1) Acid chlorides (2) Amides (3) Anhydrides (4) Aldehydes

Code–B

Question No.	Questions
1.	Which of the following is a correct name for the following compound ?  (1) cis-2-chloro-3-iodo-2-pentene (2) trans-2-chloro-3-ido-2-pentene (3) trans-3-iodo-4chloro-3-pentene (4) cis-3-iodo-4-chloro-3-pentene
2.	Keto-enol tautomerism is observed in : (1)  (2)  (3)  (4) 
3.	Which of the following gases is mainly responsible for acid rain ? (1) NO_2 and CO_2 (2) CO_2 and SO_2 (3) SO_2 and NO_2 (4) None of these
4.	Which of the following compound displays two singlets at $\delta_{2.3}$ and 7.1 ppm. (1) 1, 2-dimethylbenzene (2) 1, 3-dimethyl benzene (3) 1, 4-dimethyl benzene (4) methyl benzene
5.	A single strong and sharp absorption near 1650 cm^{-1} in IR spectra indicates the presence of (1) Acid chlorides (2) Amides (3) Anhydrides (4) Aldehydes

Question No.	Questions
6.	The proteins in which prosthetic group is carbohydrate are known as (1) Lipo-protein (2) Mucoprotein (3) Chromoprotein (4) Nucleoprotein
7.	Match the List I and List II and select the correct answer using codes given below : List I / List II 1 Nerol — A Lemon grass oil 2 Citral — B Geraniol 3 Pinol — C Amyrin 4 Lupeol — D α-pinene Correct answer is : (1) 1–C, 2–B, 3–A, 4–D (2) 1–B, 2–A, 3–D, 4–C (3) 1–D, 2–C, 3–A, 4–D (4) 1–A, 2–D, 3–B, 4–D
8.	Hydrolysis product of sucrose is : (1) Fructose (2) Glucose + Galactose (3) Glucose (4) Glucose + Fructose
9.	The mass spectrum of primary amides shows a moderate molecular ion and an Intense peak at m/z = 44 due to : (1) Loss of an alkyl radical (2) Loss of HCN (3) Loss of CO (4) Loss of methyl radical
10.	Which one of the following is bacteriostatic drug ? (1) Chloramphenicol (2) Penicillin (3) Streptomycin (4) Phenacetin
11.	The number of the lines in the ESR spectrum of CD_3 is (the spin of D is 1) (1) 1 (2) 3 (3) 4 (4) 7

Question No.	Questions
12.	Colligative properties are used for the determination of (1) molar mass (2) equivalent weight (3) arrangement of molecules (4) melting and boiling point
13.	Which of the following does not contain a C_3 axis ? (1) $POC\ell_3$ (2) NH_4^+ (3) H_3O^+ (4) $C\ell F_3$
14.	Franck Condon principle is related to (1) time required for electronic transition to occur (2) absorption of light (3) time of electronic transition and change in internuclear distance. (4) symmetry of molecules
15.	Which pairing of molecule and point group is correct ? (1) $BC\ell_3$, C_{3v} (2) $SiC\ell_4$, D_{4h} (3) H_2S, C_{2v} (4) SF_4, C_{4v}
16.	The symmetric stretching mode of the SiF_4 molecule : (1) IR active (2) IR inactive (3) generates a change in molecular dipole moment (4) gives rise to a strong absorption in IR spectrum
17.	Match the following columns : LIST–1 / LIST-2 1. Sol — A. Liquid dispersed in solid 2. Gel — B. gas dispersed in liquid 3. Emulsion — C. Solid dispersed in liquid 4. Foam — D. liquid dispersed in liquid Codes (1) 1–A 2–B 3–C 4–D (2) 1–B 2–C 3–D 4–A (3) 1–C 2–A 3–D 4–B (4) 1–B 2–D 3–A 4–C

Question No.	Questions
18.	A heat engine operates between the boiling point of water and a room temperature of 25°C. The efficiency of the engine is largest, if water is allowed to boil at a pressure of – (1) 1 atm. (2) 10 atms (3) 25 atms (4) $1.01 * 10^6\ Nm^{-2}$
19.	Monomer of Orlon is (1) $CH_2=CH\text{–}OCH_3$ (2) $CF_2=CF_2$ (3) $CH_2=CH-CN$ (4) $CH_2=CH-C\ell$
20.	Chloroprene is obtained by the addition of $HC\ell$ to (1) ethylene (2) acetylene (3) vinylacetylene (4) phenylacetylene
21.	The complex $[Fe(Phen)_2(NCS)_2]$(Phen – 1, 10-phnanthroline) shows spin crossover behaviour. CFSE and μ_{eff} at 250 and 150 K, respectively will be : (1) $0.4\ \Delta_0$, 4.90 BM and $2.4\ \Delta_0$, 0.00 BM (2) $2.4\ \Delta_0$, 2.90 BM and $0.4\ \Delta_0$, 1.77 BM (3) $2.4\ \Delta_0$, 0.00 BM and $0.4\ \Delta_0$, 4.90 BM (4) $1\text{-}2\ \Delta_0$, 4.90 BM and $2.4\ \Delta_0$, 0.00 BM
22.	$[Ni^{II}L_6]^{n+ or n-}$ show absorption bands at 8500, 15400 and 26000 cm^{-1} whereas $[Ni^{II}L'_6]^{n+ or n-}$ at 10750, 17500 and 28200 cm^{-1}, L and L′ are respectively (1) OH^- and N_3^- (2) $C\ell^-$ and I^- (3) NCS^- and $RCOO^-$ (4) H_2O and NH_3

Question No.	Questions
23.	The rate of exchange of OH_2 present in the coordination sphere by $^{18}OH_2$ of i. $[Cu(H_2O)_6]^{2+}$; ii) $[Mn(H_2O)_6]^{2+}$; iii) $[Fe(H_2O)_6]^{2+}$; iv) $[Ni(H_2O)_6]^{2+}$, follows the order (1) i) > iv) > iii) > ii) (2) i) > ii) > iii) > iv) (3) ii) > iii) > iv) > i) (4) iii) > i) > iv) > ii)
24.	On addition of an inert gas at constant volume to the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$ at equilibrium (1) The reaction remains unaffected (2) Forward reaction is favoured (3) The reaction halts (4) Backward reaction is favoured
25.	The transition zone for Raman spectra is (1) Between vibrational and rotational levels (2) Between electronic levels (3) Between magnetic levels of nuclei (4) Between magnetic levels of unpaired electrons
26.	Polarisation of the electron cloud by the cation forms (1) Ionic bond (2) Covalent bond (3) Coordinate bond (4) Metallic bond

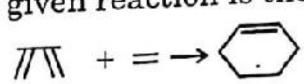
Question No.	Questions
27.	Activation energy of a chemical reaction can be determined by ______. (1) determining the rate constant at standard temperature (2) determining the rate constants at two temperatures (3) determining probability of collision (4) using catalyst
28.	Due to Frenkel defect, the density of the ionic solids (1) increases (2) decreases (3) does not change (4) none of the above
29.	What is the simplest formula of a solid whose cubic unit cell has the atom A at each corner, the atom B at each face centre and a C atom at the body centre (1) AB_2C (2) A_2BC (3) AB_3C (4) ABC_3
30.	Which of the following thermodynamic function is called as the arrow of "time" (1) Enthalpy (2) Gibbs free energy (3) Entropy (4) Helmholtz free energy
31.	The molecule $(OC)_5M = CPh(OCH_3)$ obeys 18 electron rule. The two 'M' satisfying the condition are (1) Cr, Re^+ (2) Mo, V (3) V, Re^+ (4) Cr, V

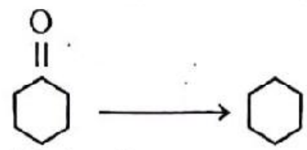
Question No.
32.
33.
34.
35.

Scanned by CamScanner

Question No.	Questions
32.	The number of lines exhibited by a high resolution EPR spectrum of the species $[Cu(ethylenediamine)_2]^{2+}$ is [Nuclear spin (I) of copper is 3/2 and of N = 1] (1) 12 (2) 15 (3) 20 (4) 36
33.	Complexes of general formula, fac-$[Mo(CO)_3 (phosphine)_3]$ have the C–O stretching bands as given below : Phosphine : PF_3 (i); $PC\ell_3$ (ii); $P(C\ell)Ph_2$ (iii); PMe_3 (iv) v(CO) : in cm^{-1} : 2090 (a); 2040 (b); 1977 (c); 1945 (d) The correct combination of the phosphine and the stretching frequency is, (1) (i-a) (ii-b) (iii-c) (iv-d) (2) (i-b) (ii-a) (iii-d) (iv-c) (3) (i-d) (ii-c) (iii-b) (iv-a) (4) (i-c) (ii-d) (iii-a) (iv-b)
34.	Which one of the following will *NOT* undergo oxidative addition by methyl iodide ? (1) $[Rh(CO_2)I_2]$ (2) $[\eta^5\text{-}CpRh(CO)_2]$ (3) $[Ir(PPh_3)_2(CO)C\ell]$ (4) $[\eta^5\text{-}Cp_2Ti(Me)C\ell]$
35.	C_{60} has (1) 14 pentagon rings and 18 Hexagon rings (2) 12 pentagon rings and 20 Hexagon rings (3) 12 pentagon rings and 18 Hexagon rings (4) 14 pentagon rings and 20 Hexagon rings

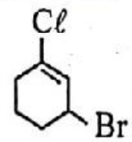
Question No.	Questions
36.	In 'carbon-dating' application of radioisotopes, ^{14}C emits (1) Positron (2) γ particle (3) β particle (4) α particle
37.	The product of the reaction of propene, CO and H_2 in the presence of $Co_2(CO)_8$ as catalyst is (1) butanoic acid (2) butanal (3) 2-butanone (4) methylpropanoate
38.	Reductive elimination step in hydrogenation of alkenes by Wilkinson catalyst results in (neglecting solvent in coordination sphere of Rh) (1) T-shaped $[Rh(PPh_3)_2 CI]$ (2) Trigonal-planar $[Rh(PPh_3)_2C\ell]$ (3) T-shaped $[Rh(H)(PPh_3)_2]$ (4) Trigonal-planar $[Rh(H)(PPh_3)_2]$
39.	The correct statement with respect to the bonding of the ligands, Mc_3N and Mc_3P with the metal ions Be^{2+} and Pd^{2+} is, (1) the ligands bind equally strong with both the metal ions as they are dicationic (2) the ligands bind equally strong with both the metal ions as both the ligands are pyramidal (3) the binding is stronger for Me_3N with Be^{2+} and Me_3P with Pd^{2+} (4) the binding is stronger for Me_3N with Pd^{2+} and Me_3P with Be^{2+}
40.	In the iodometric titration of sodium thiosulfate ($Na_2S_2O_3$) with acidic dichromate solution, 25 mL of 0.1 M dichromate requires 50 mL of 'x' M thiosulfate. The value of 'x' is (1) 0.6 (2) 0.3 (3) 0.1 (4) 0.4

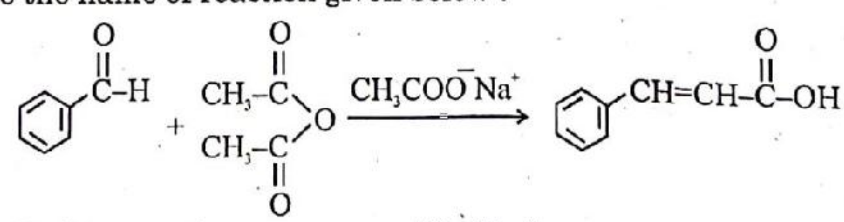
Question No.	Questions
41.	What is meant by a reaction going in 94% enantiomeric excess ? (1) The product contains 94% of one enantiomer and 6% of other enantiomer (2) The product contains an enantiomer which is 94% pure (3) The product contains 94% of one enantiomer and 6% of the products (4) The product contains 97% of one enantiomer and 3% of other enantiomer
42.	Which of the following functional group is <u>not</u> reduced by sodium borohydride ($NaBH_4$) (1) $>C=O$ (2) $-\underset{\underset{O}{\Vert}}{C}-C\ell$ (3) $-\underset{\underset{O}{\Vert}}{C}-H$ (4) $-\underset{\underset{O}{\Vert}}{C}-OH$
43.	The given reaction is the example of :  (1) 2 + 4 cycloaddition (2) 2 + 2 cycloaddition (3) 2 + 2 + 2 cycloaddition (4) 2S + 2S cycloaddition
44.	A photo chemical reaction is : (1) catalysed by light (2) Initiated by light (3) accompanied with the emission of light (4) used to convert heat energy into light
45.	Which of the following solvents is unacceptable on large scale ? (1) Dimethoxy ethane (2) Xylene (3) Diethyl ether (4) Heptane

Question No.	Questions
46.	For the reaction given below, which reaction condition are not suitable ?  (1) $LiA\ell H_4 / \varepsilon t_2O$ (2) $H_2N\,NH_2$ / NaOH (3) Zn (Hg) / $HC\ell$ (4) $HSCH_2CH_2CH_2SH / H^+, H_2$ / Ni
47.	Which of the following statements is not correct ? (1) The molecule to be synthesised is a target molecule (2) Synthetic equivalent is a real chemical compound resulting from disconnection (3) Regioselective reaction does not produce one of several possible structural isomers (4) Synthon is an idealised fragment (usually cation or anion) resulting from a disconnection.
48.	How many oxygen atoms lined up in a row would fit in a one nanomaterial space ? (1) Seventy (2) One (3) Seven (4) None
49.	The role of catalyst in chemical reaction is (1) Lowers the activation energy (2) Alters the amount of products (3) Increases ΔH of Forward reaction (4) Decreases of ΔH of Forward reaction
50.	Secondary pollutant is (1) SO_2 (2) CO (3) PAN (4) Aerosol
51.	The normality of 2.3 M H_2SO_4 solution is (1) 2.3 N (2) 4.6 N (3) 6.9 N (4) 7.9 N

Question No.	Questions
52.	Crystal cannot posses (1) 1 fold axis of symmetry (2) 3 fold axis of symmetry (3) 5 fold axis of symmetry (4) 6 fold axis of symmetry
53.	Number of sigma bonds in P_4O_{10} is (1) 6 (2) 7 (3) 17 (4) 16
54.	2 mol of an ideal gas at 27°C is expanded reversibly from 2 lit. To 20 lit. Find entropy change (R = 2 cal / mol K) (1) 92.1 (2) 0 (3) 4 (4) 9.2
55.	An adiabatic process is (1) isoenthalpic (2) isoentropic (3) isochoric (4) isobaric

Question No.	Questions
56.	At a certain temperature, the following observations were made for the reaction A $\longrightarrow$ Products Time (From the start) — [A] 2 minutes — $5*10^{-3}$ 5 minutes — $4*10^{-3}$ 8 minutes — $3*10^{-3}$ 11 minutes — $2*10^{-3}$ The order of the reaction is (1) 1 (2) 2 (3) 3 (4) Zero
57.	How many stereoisomers does have 2, 3-dichloropentane ? (1) 2 (2) 4 (3) 3 (4) 5
58.	Which statement about benzene is incorrect ? (1) The C_6 ring is planar (2) The C–Cπ–bonding is delocalised. (3) The reactivity of the benzene reflects the presence of carbon-carbon double bond. (4) Each C atom is sp^2 hybridized.

Question No.	Questions
59.	Which of the following is not a Huckel (4n + 2) aromatic system ? (1) [18]–Annulene ($C_{18}H_{18}$) (2) Cyclooctatetraene (C_8H_8) (3) Benzene (C_6H_6) (4) Cyclopentadienyl anion ($C_5H_5^-$)
60.	The IUPAC name of  is : (1) 1-bromo-3-chlorocyclohexene (2) 2-bromo-6-chlorocyclohex-1-ene (3) 6-bromo-2-chlorocyclohexene (4) 3-bromo-1-chlorocyclohexene
61.	Heating 1, 4-dicarbonyl compounds in the presence of phosphorus pentoxide (P_2O_5) gives (1) Pyrrole (2) Furan (3) Thiophene (4) Quinoline
62.	The Acetylation of thiophene occurs at : (1) C_3–position (2) C_4–position (3) C_2–position (4) both at C_2 and C_4–positions
63.	Pyridine is basic in nature having (1) pKa = 5.21 (2) pKa = – 0.27 (3) pKa = 5.81 (4) pKa = – 0.35
64.	Least stable carbocation among the following is (1) $(CH_3)_3C^+$ (2) $(CH_3)_2CH^+$ (3) $CH_3CH_2^+$ (4) CH_3^+

Question No.	Questions
65.	Due to the presence of an unpaired electron, free radicals are (1) Anions (2) Cations (3) Chemically reactive (4) Chemically inreactive
66.	Benzoyl peroxide undergoes hamolytic cleavage to produce (1) Phenyl radical (2) Methyl radical (3) Phenyl chloride (4) Methyl chloride
67.	SN^1 mechanism for the hydrolysis of an alkyl halide involves the formation of intermediate (1) Free radical (2) Carbanion (3) Carbocation (4) None of these
68.	Which of the following is <u>NOT</u> polar protic solvent ? (1) H_2O (2) C_2H_5OH (3) Fumaric acid (4) Acetone
69.	A new carbon-carbon bond formation is possible in (1) Clemmensen reduction (2) Wurtz reduction (3) Friedel-Craft alkylation (4) Oppenauer oxidation
70.	Give the name of reaction given below :  (1) Perkin reaction (2) Pechmann condensation (3) Benzoin condensation (4) Claisen-Schmidt reaction

Question No.	Questions
71.	For a potentiometric titration in the curve of emf (E) v/s volume (V) of the titrant added, the equivalence point is indicated by (1) $\lvert dE/dV \rvert = 0$, $\lvert d^2E/dV^2 \rvert = 0$ (2) $\lvert dE/dV \rvert = 0$, $\lvert d^2E/dV^2 \rvert > 0$ (3) $\lvert dE/dV \rvert > 0$, $\lvert d^2E/dV^2 \rvert = 0$ (4) $\lvert dE/dV \rvert > 0$, $\lvert d^2E/dV^2 \rvert > 0$
72.	If the concentration (c) is increased to 4 times its original value (c), the change in molar conductivity for strong electrolytes is (where b is kohlrausch's constant) - (1) 0 (2) $b\sqrt{c}$ (3) $2b\sqrt{c}$ (4) $4b\sqrt{c}$
73.	The energy levels of the harmonic oscillator (neglecting zero point energy) are $\varepsilon_v = nh\nu$ for n = 0, 1, 2 ..... Assuming $h\nu = k_B T/3$; the partition function is (1) e (2) $e^{1/3} (e^{1/3} - 1)$ (3) 1/3e (4) $3e/(3e^3 - 1)$
74.	The ground state of hydrogen atom is – 13.598 eV. The exception values of kinetic energy <T> and potential energy, <V>, in units of eV, are (1) $\langle T \rangle = 13.598$, $\langle V \rangle = -27.196$ (2) $\langle T \rangle = -27.196$, $\langle V \rangle = 13.598$ (3) $\langle T \rangle = -6.799$, $\langle V \rangle = -6.799$ (4) $\langle T \rangle = 6.799$, $\langle V \rangle = -20.397$
75.	The correct expression for the product $((M_n).(M_w))$ [where M_n and M_w are the number average and weight average molar masses, respectively, of a polymer] is (1) $N^{-1} \sum_i N_i M_i$ (2) $N^{-1} \sum_i N_i M_i^2$ (3) $N/\sum_i N_i M_i$ (4) $N/\sum_i N_i M_i^2$

Question No.	Questions
76.	Match the following columns : Column–1 / Column–2 A. Energy of the ground state of He+ — 1. -6.04 ev B. Potential energy of Ist orbit of H– atom — 2. -27.2 ev C. Kinetic energy of II excited state of He+ — 3. $8.68 * 10^{-18}$ J D. Ionisation potential of He+ — 4. -54.4 ev Codes. A B C D (1) 1 2 3 4 (2) 4 3 2 1 (3) 4 2 1 3 (4) 2 3 1 4
77.	The protecting power of lyophilic colloidal sol is expressed in terms of (1) Critical miscelle concentration (2) Oxidation number (3) Coagulation value (4) Gold number
78.	Which one of the following is an example for homogenous catalysis ? (1) Hydrogenation of oil (2) Manufacture of ammonia by Haber's process (3) Manufacture of sulphuric acid by Contact process (4) Hydrolysis of sucrose in presence of dilute hydrochloric acid
79.	The energy of a hydrogen atom in a state is $(-hcR_H/25)$, where R_H = Rydberg Constant). The degeneracy of the state will be - (1) 25^1 (2) 25^2 (3) 25^3 (4) 25^4

Question No.	Questions
80.	The value of the commutator $[x, p^2_x]$ is (1) 2i (2) $2\,i\,h\,p_x$ (3) $2ixp_x$ (4) $h\,i\,p_x/\pi$
81.	The room temperature magnetic moment (μ_{eff} in BM) for a monomeric Cu(II) complex is greater than 1.73. This may be explained using the expression (1) $\mu_{eff} = \mu_s\,(1 - \alpha\lambda/\Delta)$ (2) $\mu_{eff} = [n\,(n+2)]^{½}$ (3) $\mu_{eff} = [4s\,(s+1) + L\,(L+1)]^{½}$ (4) $\mu_{eff} = g\,[J\,(J+1)]^{½}$
82.	The numbers of P–S and P–P bonds in the compound P_4S_3 are, respectively, (1) 3 and 6 (2) 4 and 3 (3) 6 and 3 (4) 6 and 2
83.	In the absence of bound globin chain, heme group on exposure to O_2 gives the iron-oxgen species (1) Fe(III) –O– Fe(III) (2) Fe(III) –O–O^- (3) Fe(III) –O–O– Fe(III) (4) Fe(IV) –O–
84.	The complex $[Cr(bipyridyl)_3]^{2+}$, shows a red phosphorescence due to transition (1) $^4T_{1g} \leftarrow {}^4A_{2g}$ (2) $^2E_g \leftarrow {}^4A_{2g}$ (3) $^4T_{2g} \leftarrow {}^4A_{2g}$ (4) $^4A_{2g} \leftarrow {}^2E_g$
85.	Consider the following reactions in N_2O_4 i. $NOC\ell + Sn$ ii. $NOC\ell + AgNO_3$ iii. $NOC\ell + BrF_3$ iv. $NOC\ell + SbC\ell_5$ Reactions which will give $[NO]^+$ as a major product are : (1) i and ii (2) iii and iv (3) i and iv (4) ii and iv

Question No.	Questions
86.	The number of 3c–2e bonds present in $A\ell(BH_4)_3$ is (1) four (2) three (3) six (4) zero
87.	The role of copper salt as co-catalyst in Wacker process is (1) Oxidation of Pd(0) by Cu(II) (2) Oxidation of Pd(0) by Cu(I) (3) Oxidation of Pd(II) by Cu(I) (4) Oxidation of Pd(II) by Cu(II)
88.	For the oxidation state/s of sulphur atoms in S_2O, consider the following; i) -2 and $+4$ ii) 0 and $+2$ iii) $+4$ and 0 iv) $+2$ and $+2$ The correct answer is/are (1) i and ii (2) i and iii (3) ii and iv (4) iii and iv
89.	The geometries of $[C\ell F_4]^+$ and $[IF_4]^-$ respectively are (1) Tetrahedral and tetrahedral (2) Tetrahedral and trigonal bipyramidal (3) Tetrahedral and Square planar (4) Tetrahedral and Octahedral
90.	Among the complexes (i) $K_4[(Cr(CN)_6]$, (ii) $K_4[(Fe(CN)_6]$, (iii) $K_3[(Co(CN)_6]$, and (iv) $K_4[(Mn(CN)_6]$, Jahn Teller distortion is expected in (1) i, ii and iii (2) ii, iii and iv (3) i and iv (4) ii and iii

Question No.	Questions
91.	Which one of the following high spin complexes has the largest CSFE Crystal field stabilization energy (1) $[Cr(H_2O)_6]^{2+}$ (2) $[Mn(H_2O)_6]^{2+}$ (3) $[Fe(H_2O)_6]^{2+}$ (4) $[Co(H_2O)_6]^{2+}$
92.	The number of 3c, 2e BHB and B-B bonds present in B_4H_{10} respectively are (1) 2, 4 (2) 3, 2 (3) 4, 1 (4) 4, 0
93.	The most unstable species among the following is (1) $Ti(C_2H_5)_4$ (2) $Ti(CH_2Ph)_4$ (3) $Pb(CH_3)_4$ (4) $Pb(C_2H_5)_4$
94.	The acid catalyzed hydrolysis of *trans*-$[Co(en)_2AX)^{n+}$ can give *cis*-product also due to the formation of (1) Square pyramidal intermediate (2) Trigonal bipyramidal intermediate (3) Pentagonal bipyramidal intermediate (4) Face capped octahedral intermediate
95.	Total number of lines expected in ^{31}P NMR spectrum of HPF_2 is (I = 1/2 for both ^{19}F and ^{31}P) (1) Six (2) Four (3) Five (4) Three

Question No.	Questions
96.	The number of faces, vertices and edges in IF_7 polyhedron are, respectively (1) 15, 7 and 15 (2) 10, 7 and 15 (3) 10, 8 and 12 (4) 12, 6 and 9
97.	The light pink colour of $[Co(H_2O)_6]^{2+}$ and the deep blue colour of $[CoC\ell_4]^{-2}$ are due to (1) MLCT transition in the first and d-d transition in the second (2) LMCT transitions in both (3) d-d transitions in both (4) d-d transition in the first and MLCT transition in the second
98.	In $[Mo_2(S_2)_6]^{2-}$ cluster the number of bridging S atoms and coordination number of Mo respectively, are (1) 2 and 8 (2) 2 and 6 (3) 1 and 8 (4) 1 and 6
99.	The number of possible isomers of $[Ru(PPh_3)_2(acac)_2]$ (acac = acetylacetonate) is (1) 2 (2) 5 (3) 4 (4) 3
100.	Which ones among CO_3^{2-}, XeO_3, SO_3, PO_3^{3-} and NO_3^- have planar structure ? (1) CO_3^{2-}, PO_3^{3-} and XeO_3 (2) CO_3^{2-}, XeO_3 and NO_3^- (3) SO_3, PO_3^{3-} and NO_3^- (4) CO_3^{2-}, SO_3 and NO_3^-

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

(MPH/PHD/URS–EE–2019)

CHEMISTRY

Sr. No. 10003

Code **C**

SET–"X"

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

Roll No. ________________ (in figure) ________________________ (in words)

Name : ____________________ Father's Name : ____________________

Mother's Name : ____________________ Date of Examination : ____________________

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

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

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

Sample copy for website

Question No.	Questions
1.	For a potentiometric titration in the curve of emf (E) v/s volume (V) of the titrant added, the equivalence point is indicated by (1) $\lvert dE/dV \rvert = 0, \lvert d^2E/dV^2 \rvert = 0$ (2) $\lvert dE/dV \rvert = 0, \lvert d^2E/dV^2 \rvert > 0$ (3) $\lvert dE/dV \rvert > 0, \lvert d^2E/dV^2 \rvert = 0$ (4) $\lvert dE/dV \rvert > 0, \lvert d^2E/dV^2 \rvert > 0$
2.	If the concentration (c) is increased to 4 times its original value (c), the change in molar conductivity for strong electrolytes is (where b is kohlrausch's constant) - (1) 0 (2) $b\sqrt{c}$ (3) $2b\sqrt{c}$ (4) $4b\sqrt{c}$
3.	The energy levels of the harmonic oscillator (neglecting zero point energy) are $\varepsilon_v = nh\nu$ for n = 0, 1, 2 ..... Assuming $h\nu = k_B T/3$; the partition function is (1) e (2) $e^{1/3}(e^{1/3} - 1)$ (3) 1/3e (4) $3e/(3e^3 - 1)$
4.	The ground state of hydrogen atom is – 13.598 eV. The exception values of kinetic energy <T> and potential energy, <V>, in units of eV, are (1) $\langle T \rangle = 13.598, \langle V \rangle = -27.196$ (2) $\langle T \rangle = -27.196, \langle V \rangle = 13.598$ (3) $\langle T \rangle = -6.799, \langle V \rangle = -6.799$ (4) $\langle T \rangle = 6.799, \langle V \rangle = -20.397$
5.	The correct expression for the product $((M_n).(M_w))$ [where M_n and M_w are the number average and weight average molar masses, respectively, of a polymer] is (1) $N^{-1}\sum_i N_iM_i$ (2) $N^{-1}\sum_i N_iM_i^2$ (3) $N/\sum_i N_iM_i$ (4) $N/\sum_i N_iM_i^2$

Question No.	Questions
6.	Match the following columns : Column–1 / Column–2 A. Energy of the ground state of He+ — 1. – 6.04 ev B. Potential energy of Ist orbit of H– atom — 2. – 27.2 ev C. Kinetic energy of II excited state of He+ — 3. $8.68 * 10^{-18}$ J D. Ionisation potential of He+ — 4. – 54.4 ev Codes. A B C D (1) 1 2 3 4 (2) 4 3 2 1 (3) 4 2 1 3 (4) 2 3 1 4
7.	The protecting power of lyophilic colloidal sol is expressed in terms of (1) Critical miscelle concentration (2) Oxidation number (3) Coagulation value (4) Gold number
8.	Which one of the following is an example for homogenous catalysis ? (1) Hydrogenation of oil (2) Manufacture of ammonia by Haber's process (3) Manufacture of sulphuric acid by Contact process (4) Hydrolysis of sucrose in presence of dilute hydrochloric acid
9.	The energy of a hydrogen atom in a state is $(-hcR_H/25)$, where R_H = Rydberg Constant). The degeneracy of the state will be (1) 25^1 (2) 25^2 (3) 25^3 (4) 25^4

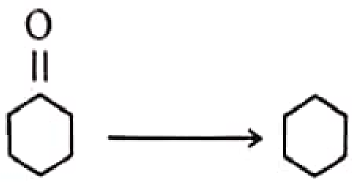
Question No.	Questions
10.	The value of the commutator $[x, p^2_x]$ is (1) 2i (2) $2\,i\,h\,p_x$ (3) $2ixp_x$ (4) $h\,i\,p_x/\pi$
11.	The room temperature magnetic moment (μ_{eff} in BM) for a monomeric Cu(II) complex is greater than 1.73. This may be explained using the expression (1) $\mu_{eff} = \mu_s\,(1 - \alpha\lambda/\Delta)$ (2) $\mu_{eff} = [n\,(n + 2)]^{½}$ (3) $\mu_{eff} = [4s\,(s + 1) + L\,(L + 1)]^{½}$ (4) $\mu_{eff} = g\,[J\,(J + 1)]^{½}$
12.	The numbers of P–S and P–P bonds in the compound P_4S_3 are, respectively, (1) 3 and 6 (2) 4 and 3 (3) 6 and 3 (4) 6 and 2
13.	In the absence of bound globin chain, heme group on exposure to O_2 gives the iron-oxgen species (1) Fe(III) –O– Fe(III) (2) Fe(III) –O–O$^-$ (3) Fe(III) –O–O– Fe(III) (4) Fe(IV) –O–
14.	The complex $[Cr(bipyridyl)_3]^{2+}$, shows a red phosphorescence due to transition (1) $^4T_{1g} \leftarrow {}^4A_{2g}$ (2) $^2E_g \leftarrow {}^4A_{2g}$ (3) $^4T_{2g} \leftarrow {}^4A_{2g}$ (4) $^4A_{2g} \leftarrow {}^2E_g$

Question No.	Questions
15.	Consider the following reactions in N_2O_4 i. $NOC\ell + Sn$ ii. $NOC\ell + AgNO_3$ iii. $NOC\ell + BrF_3$ iv. $NOC\ell + SbC\ell_5$ Reactions which will give $[NO]^+$ as a major product are : (1) i and ii (2) iii and iv (3) i and iv (4) ii and iv
16.	The number of 3c–2e bonds present in $A\ell(BH_4)_3$ is (1) four (2) three (3) six (4) zero
17.	The role of copper salt as co-catalyst in Wacker process is (1) Oxidation of Pd(0) by Cu(II) (2) Oxidation of Pd(0) by Cu(I) (3) Oxidation of Pd(II) by Cu(I) (4) Oxidation of Pd(II) by Cu(II)
18.	For the oxidation state/s of sulphur atoms in S_2O, consider the following; i) -2 and $+4$ ii) 0 and $+2$ iii) $+4$ and 0 iv) $+2$ and $+2$ The correct answer is/are (1) i and ii (2) i and iii (3) ii and iv (4) iii and iv
19.	The geometries of $[C\ell F_4]^+$ and $[IF_4]^-$ respectively are (1) Tetrahedral and tetrahedral (2) Tetrahedral and trigonal bipyramidal (3) Tetrahedral and Square planar (4) Tetrahedral and Octahedral

Question No.	Questions
20.	Among the complexes (i) $K_4[(Cr(CN)_6]$, (ii) $K_4[(Fe(CN)_6]$, (iii) $K_3[(Co(CN)_6]$, and (iv) $K_4[(Mn(CN)_6]$, Jahn Teller distortion is expected in (1) i, ii and iii (2) ii, iii and iv (3) i and iv (4) ii and iii
21.	Which one of the following high spin complexes has the largest CSFE Crystal field stabilization energy (1) $[Cr(H_2O)_6]^{2+}$ (2) $[Mn(H_2O)_6]^{2+}$ (3) $[Fe(H_2O)_6]^{2+}$ (4) $[Co(H_2O)_6]^{2+}$
22.	The number of 3c, 2e BHB and B-B bonds present in B_4H_{10} respectively are (1) 2, 4 (2) 3, 2 (3) 4, 1 (4) 4, 0
23.	The most unstable species among the following is (1) $Ti(C_2H_5)_4$ (2) $Ti(CH_2Ph)_4$ (3) $Pb(CH_3)_4$ (4) $Pb(C_2H_5)_4$
24.	The acid catalyzed hydrolysis of *trans*-$[Co(en)_2AX]^{n+}$ can give *cis*-product also due to the formation of (1) Square pyramidal intermediate (2) Trigonal bipyramidal intermediate (3) Pentagonal bipyramidal intermediate (4) Face capped octahedral intermediate

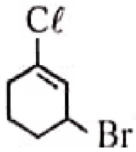
Question No.	Questions
25.	Total number of lines expected in ^{31}P NMR spectrum of HPF_2 is (I = 1/2 for both ^{19}F and ^{31}P) (1) Six (2) Four (3) Five (4) Three
26.	The number of faces, vertices and edges in IF_7 polyhedron are, respectively (1) 15, 7 and 15 (2) 10, 7 and 15 (3) 10, 8 and 12 (4) 12, 6 and 9
27.	The light pink colour of $[Co(H_2O)_6]^{2+}$ and the deep blue colour of $[CoC\ell_4]^{-2}$ are due to (1) MLCT transition in the first and d-d transition in the second (2) LMCT transitions in both (3) d-d transitions in both (4) d-d transition in the first and MLCT transition in the second
28.	In $[Mo_2(S_2)_6]^{2-}$ cluster the number of bridging S atoms and coordination number of Mo respectively, are (1) 2 and 8 (2) 2 and 6 (3) 1 and 8 (4) 1 and 6
29.	The number of possible isomers of $[Ru(PPh_3)_2(acac)_2]$ (acac = acetylacetonate) is (1) 2 (2) 5 (3) 4 (4) 3

Question No.	Questions
30.	Which ones among CO_3^{2-}, XeO_3, SO_3, PO_3^{3-} and NO_3^- have planar structure ? (1) CO_3^{2-}, PO_3^{3-} and XeO_3 (2) CO_3^{2-}, XeO_3 and NO_3^- (3) SO_3, PO_3^{3-} and NO_3^- (4) CO_3^{2-}, SO_3 and NO_3^-
31.	What is meant by a reaction going in 94% enantiomeric excess ? (1) The product contains 94% of one enantiomer and 6% of other enantiomer (2) The product contains an enantiomer which is 94% pure (3) The product contains 94% of one enantiomer and 6% of the products (4) The product contains 97% of one enantiomer and 3% of other enantiomer
32.	Which of the following functional group is <u>not</u> reduced by sodium borohydride ($NaBH_4$) (1) $>C=O$ (2) $-C(=O)-Cl$ (3) $-C(=O)-H$ (4) $-C(=O)-OH$
33.	The given reaction is the example of :  (1) 2 + 4 cycloaddition (2) 2 + 2 cycloaddition (3) 2 + 2 + 2 cycloaddition (4) 2S + 2S cycloaddition
34.	A photo chemical reaction is : (1) catalysed by light (2) Initiated by light (3) accompanied with the emission of light (4) used to convert heat energy into light

Question No.	Questions
35.	Which of the following solvents is unacceptable on large scale ? (1) Dimethoxy ethane (2) Xylene (3) Diethyl ether (4) Heptane
36.	For the reaction given below, which reaction condition are not suitable ?  (1) $LiA\ell H_4 / \varepsilon t_2O$ (2) $H_2N\,NH_2$ / NaOH (3) Zn (Hg) / $HC\ell$ (4) $HSCH_2CH_2CH_2SH / H^+$, H_2 / Ni
37.	Which of the following statements is not correct ? (1) The molecule to be synthesised is a target molecule (2) Synthetic equivalent is a real chemical compound resulting from disconnection (3) Regioselective reaction does not produce one of several possible structural isomers (4) Synthon is an idealised fragment (usually cation or anion) resulting from a disconnection.
38.	How many oxygen atoms lined up in a row would fit in a one nanomaterial space ? (1) Seventy (2) One (3) Seven (4) None
39.	The role of catalyst in chemical reaction is (1) Lowers the activation energy (2) Alters the amount of products (3) Increases ΔH of Forward reaction (4) Decreases of ΔH of Forward reaction
40.	Secondary pollutant is (1) SO_2 (2) CO (3) PAN (4) Aerosol

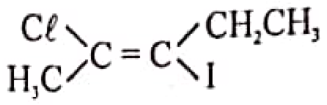
Question No.	Questions
41.	The normality of 2.3 M H_2SO_4 solution is (1) 2.3 N (2) 4.6 N (3) 6.9 N (4) 7.9 N
42.	Crystal cannot posses (1) 1 fold axis of symmetry (2) 3 fold axis of symmetry (3) 5 fold axis of symmetry (4) 6 fold axis of symmetry
43.	Number of sigma bonds in P_4O_{10} is (1) 6 (2) 7 (3) 17 (4) 16
44.	2 mol of an ideal gas at 27°C is expanded reversibly from 2 lit. To 20 lit. Find entropy change (R = 2 cal / mol K) (1) 92.1 (2) 0 (3) 4 (4) 9.2
45.	An adiabatic process is (1) isoenthalpic (2) isoentropic (3) isochoric (4) isobaric

Question No.	Questions
46.	At a certain temperature, the following observations were made for the reaction A ⟶ Products Time (From the start) — [A] 2 minutes — $5*10^{-3}$ 5 minutes — $4*10^{-3}$ 8 minutes — $3*10^{-3}$ 11 minutes — $2*10^{-3}$ The order of the reaction is (1) 1 (2) 2 (3) 3 (4) Zero
47.	How many stereoisomers does have 2, 3-dichloropentane ? (1) 2 (2) 4 (3) 3 (4) 5
48.	Which statement about benzene is incorrect ? (1) The C_6 ring is planar (2) The C–Cπ–bonding is delocalised. (3) The reactivity of the benzene reflects the presence of carbon-carbon double bond. (4) Each C atom is sp^2 hybridized.

Question No.	Questions
49.	Which of the following is not a Huckel (4n + 2) aromatic system ? (1) [18]–Annulene ($C_{18}H_{18}$) (2) Cyclooctatetraene (C_8H_8) (3) Benzene (C_6H_6) (4) Cyclopentadienyl anion ($C_5H_5^-$)
50.	The IUPAC name of  is : (1) 1-bromo-3-chlorocyclohexene (2) 2-bromo-6-chlorocyclohex-1-ene (3) 6-bromo-2-chlorocyclohexene (4) 3-bromo-1-chlorocyclohexene
51.	The complex $[Fe(Phen)_2(NCS)_2]$(Phen – 1, 10-phnanthroline) shows spin crossover behaviour. CFSE and μ_{eff} at 250 and 150 K, respectively will be : (1) 0.4 Δ_0, 4.90 BM and 2.4 Δ_0, 0.00 BM (2) 2.4 Δ_0, 2.90 BM and 0.4 Δ_0, 1.77 BM (3) 2.4 Δ_0, 0.00 BM and 0.4 Δ_0, 4.90 BM (4) 1-2 Δ_0, 4.90 BM and 2.4 Δ_0, 0.00 BM
52.	$[Ni^{II} L_6]^{n+ \text{ or } n-}$ show absorption bands at 8500, 15400 and 26000 cm^{-1} whereas $[Ni^{II} L'_6]^{n+ \text{ or } n-}$ at 10750, 17500 and 28200 cm^{-1}, L and L' are respectively (1) OH^- and N_3^- (2) $C\ell^-$ and I^- (3) NCS^- and $RCOO^-$ (4) H_2O and NH_3

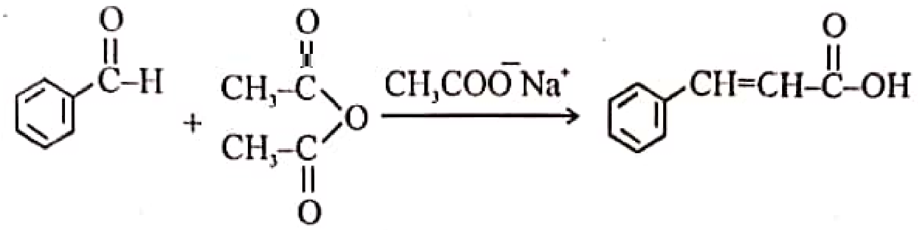
Question No.	Questions
53.	The rate of exchange of OH_2 present in the coordination sphere by $^{18}OH_2$ of i. $[Cu(H_2O)_6]^{2+}$; ii) $[Mn(H_2O)_6]^{2+}$; iii) $[Fe(H_2O)_6]^{2+}$; iv) $[Ni(H_2O)_6]^{2+}$, follows the order (1) i) > iv) > iii) > ii) (2) i) > ii) > iii) > iv) (3) ii) > iii) > iv) > i) (4) iii) > i) > iv) > ii)
54.	On addition of an inert gas at constant volume to the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$ at equilibrium (1) The reaction remains unaffected (2) Forward reaction is favoured (3) The reaction halts (4) Backward reaction is favoured
55.	The transition zone for Raman spectra is (1) Between vibrational and rotational levels (2) Between electronic levels (3) Between magnetic levels of nuclei (4) Between magnetic levels of unpaired electrons
56.	Polarisation of the electron cloud by the cation forms (1) Ionic bond (2) Covalent bond (3) Coordinate bond (4) Metallic bond

Question No.	Questions
57.	Activation energy of a chemical reaction can be determined by ______. (1) determining the rate constant at standard temperature (2) determining the rate constants at two temperatures (3) determining probability of collision (4) using catalyst
58.	Due to Frenkel defect, the density of the ionic solids (1) increases (2) decreases (3) does not change (4) none of the above
59.	What is the simplest formula of a solid whose cubic unit cell has the atom A at each corner, the atom B at each face centre and a C atom at the body centre (1) AB_2C (2) A_2BC (3) AB_3C (4) ABC_3
60.	Which of the following thermodynamic function is called as the arrow of "time" (1) Enthalpy (2) Gibbs free energy (3) Entropy (4) Helmholtz free energy

Question No.	Questions
61.	Which of the following is a correct name for the following compound ?  (1) cis-2-chloro-3-iodo-2-pentene (2) trans-2-chloro-3-ido-2-pentene (3) trans-3-iodo-4chloro-3-pentene (4) cis-3-iodo-4-chloro-3-pentene
62.	Keto-enol tautomerism is observed in : (1) $C_6H_5-\overset{\overset{O}{\|}}{C}-CH_2-\overset{\overset{O}{\|}}{C}-CH_3$ (2) $C_6H_5-\overset{\overset{O}{\|}}{C}-C_6H_5$ (3) $CH_3CH_2\overset{\overset{O}{\|}}{C}-OH$ (4) $C_6H_5-\overset{\overset{O}{\|}}{C}-H$
63.	Which of the following gases is mainly responsible for acid rain ? (1) NO_2 and CO_2 (2) CO_2 and SO_2 (3) SO_2 and NO_2 (4) None of these
64.	Which of the following compound displays two singlets at $\delta_{2.3}$ and 7.1 ppm. (1) 1, 2-dimethylbenzene (2) 1, 3-dimethyl benzene (3) 1, 4-dimethyl benzene (4) methyl benzene
65.	A single strong and sharp absorption near 1650 cm^{-1} in IR spectra indicates the presence of (1) Acid chlorides (2) Amides (3) Anhydrides (4) Aldehydes
66.	The proteins in which prosthetic group is carbohydrate are known as (1) Lipo-protein (2) Mucoprotein (3) Chromoprotein (4) Nucleoprotein

Question No.	Questions
67.	Match the List I and List II and select the correct answer using codes given below : List I — List II 1 Nerol — A Lemon grass oil 2 Citral — B Geraniol 3 Pinol — C Amyrin 4 Lupeol — D α-pinene Correct answer is : (1) 1–C, 2–B, 3–A, 4–D (2) 1–B, 2–A, 3–D, 4–C (3) 1–D, 2–C, 3–A, 4–D (4) 1–A, 2–D, 3–B, 4–D
68.	Hydrolysis product of sucrose is : (1) Fructose (2) Glucose + Galactose (3) Glucose (4) Glucose + Fructose
69.	The mass spectrum of primary amides shows a moderate molecular ion and an Intense peak at m/z = 44 due to : (1) Loss of an alkyl radical (2) Loss of HCN (3) Loss of CO (4) Loss of methyl radical
70.	Which one of the following is bacteriostatic drug ? (1) Chloramphenicol (2) Penicillin (3) Streptomycin (4) Phenacetin
71.	Heating 1, 4-dicarbonyl compounds in the presence of phosphorus pentoxide (P_2O_5) gives : (1) Pyrrole (2) Furan (3) Thiophene (4) Quinoline
72.	The Acetylation of thiophene occurs at : (1) C_3–position (2) C_4–position (3) C_2–position (4) both at C_2 and C_4–positions

Question No.	Questions
73.	Pyridine is basic in nature having (1) pKa = 5.21 (2) pKa = – 0.27 (3) pKa = 5.81 (4) pKa = – 0.35
74.	Least stable carbocation among the following is (1) $(CH_3)_3C^+$ (2) $(CH_3)_2CH^+$ (3) $CH_3CH_2^+$ (4) CH_3^+
75.	Due to the presence of an unpaired electron, free radicals are (1) Anions (2) Cations (3) Chemically reactive (4) Chemically inreactive
76.	Benzoyl peroxide undergoes hamolytic cleavage to produce (1) Phenyl radical (2) Methyl radical (3) Phenyl chloride (4) Methyl chloride
77.	SN^1 mechanism for the hydrolysis of an alkyl halide involves the formation of intermediate (1) Free radical (2) Carbanion (3) Carbocation (4) None of these
78.	Which of the following is NOT polar protic solvent ? (1) H_2O (2) C_2H_5OH (3) Fumaric acid (4) Acetone
79.	A new carbon-carbon bond formation is possible in (1) Clemmensen reduction (2) Wurtz reduction (3) Friedel-Craft alkylation (4) Oppenauer oxidation

Question No.	Questions
80.	Give the name of reaction given below :  (1) Perkin reaction (2) Pechmann condensation (3) Benzoin condensation (4) Claisen-Schmidt reaction
81.	The molecule $(OC)_5M = CPh(OCH_3)$ obeys 18 electron rule. The two 'M' satisfying the condition are (1) Cr, Re^+ (2) Mo, V (3) V, Re^+ (4) Cr, V
82.	The number of lines exhibited by a high resolution EPR spectrum of the species $[Cu(ethylenediamine)_2]^{2+}$ is [Nuclear spin (I) of copper is 3/2 and of N = 1] (1) 12 (2) 15 (3) 20 (4) 36
83.	Complexes of general formula, fac-$[Mo(CO)_3(phosphine)_3]$ have the C–O stretching bands as given below : Phosphine : PF_3 (i); $PC\ell_3$ (ii); $P(C\ell)Ph_2$ (iii); PMe_3 (iv) ν(CO) : in cm^{-1} : 2090 (a); 2040 (b); 1977 (c); 1945 (d) The correct combination of the phosphine and the stretching frequency is, (1) (i-a) (ii-b) (iii-c) (iv-d) (2) (i-b) (ii-a) (iii-d) (iv-c) (3) (i-d) (ii-c) (iii-b) (iv-a) (4) (i-c) (ii-d) (iii-a) (iv-b)

Question No.	Questions
84.	Which one of the following will *NOT* undergo oxidative addition by methyl iodide ? (1) $[Rh(CO_2)I_2]$ (2) $[\eta^5\text{-}CpRh(CO)_2]$ (3) $[Ir(PPh_3)_2(CO)C\ell]$ (4) $[\eta^5\text{-}Cp_2Ti(Me)C\ell]$
85.	C_{60} has (1) 14 pentagon rings and 18 Hexagon rings (2) 12 pentagon rings and 20 Hexagon rings (3) 12 pentagon rings and 18 Hexagon rings (4) 14 pentagon rings and 20 Hexagon rings
86.	In 'carbon-dating' application of radioisotopes, ^{14}C emits (1) Positron (2) γ particle (3) β particle (4) α particle
87.	The product of the reaction of propene, CO and H_2 in the presence of $Co_2(CO)_8$ as catalyst is (1) butanoic acid (2) butanal (3) 2-butanone (4) methylpropanoate
88.	Reductive elimination step in hydrogenation of alkenes by Wilkinson catalyst results in (neglecting solvent in coordination sphere of Rh) (1) T-shaped $[Rh(PPh_3)_2 CI]$ (2) Trigonal-planar $[Rh(PPh_3)_2C\ell]$ (3) T-shaped $[Rh(H)(PPh_3)_2]$ (4) Trigonal-planar $[Rh(H)(PPh_3)_2]$
89.	The correct statement with respect to the bonding of the ligands, Mc_3N and Mc_3P with the metal ions Be^{2+} and Pd^{2+} is, (1) the ligands bind equally strong with both the metal ions as they are dicationic (2) the ligands bind equally strong with both the metal ions as both the ligands are pyramidal (3) the binding is stronger for Me_3N with Be^{2+} and Me_3P with Pd^{2+} (4) the binding is stronger for Me_3N with Pd^{2+} and Me_3P with Be^{2+}

Question No.	Questions
90.	In the iodometric titration of sodium thiosulfate ($Na_2S_2O_3$) with acidic dichromate solution, 25 mL of 0.1 M dichromate requires 50 mL of 'x' M thiosulfate. The value of 'x' is (1) 0.6 (2) 0.3 (3) 0.1 (4) 0.4
91.	The number of the lines in the ESR spectrum of CD_3 is (the spin of D is 1) (1) 1 (2) 3 (3) 4 (4) 7
92.	Colligative properties are used for the determination of (1) molar mass (2) equivalent weight (3) arrangement of molecules (4) melting and boiling point
93.	Which of the following does not contain a C_3 axis ? (1) $POC\ell_3$ (2) NH_4^+ (3) H_3O^+ (4) $C\ell F_3$
94.	Franck Condon principle is related to (1) time required for electronic transition to occur (2) absorption of light (3) time of electronic transition and change in internuclear distance (4) symmetry of molecules
95.	Which pairing of molecule and point group is correct ? (1) $BC\ell_3$, C_{3v} (2) $SiC\ell_4$, D_{4h} (3) H_2S, C_{2v} (4) SF_4, C_{4v}
96.	The symmetric stretching mode of the SiF_4 molecule : (1) IR active (2) IR inactive (3) generates a change in molecular dipole moment (4) gives rise to a strong absorption in IR spectrum

Question No.	Questions
97.	Match the following columns : LIST-1 / LIST-2 1. Sol — A. Liquid dispersed in solid 2. Gel — B. gas dispersed in liquid 3. Emulsion — C. Solid dispersed in liquid 4. Foam — D. liquid dispersed in liquid Codes (1) 1–A 2–B 3–C 4–D (2) 1–B 2–C 3–D 4–A (3) 1–C 2–A 3–D 4–B (4) 1–B 2–D 3–A 4–C
98.	A heat engine operates between the boiling point of water and a room temperature of 25°C. The efficiency of the engine is largest, if water is allowed to boil at a pressure of – (1) 1 atm. (2) 10 atms (3) 25 atms (4) $1.01 * 10^6$ Nm^{-2}
99.	Monomer of Orlon is (1) $CH_2=CH-OCH_3$ (2) $CF_2=CF_2$ (3) $CH_2=CH-CN$ (4) $CH_2=CH-C\ell$
100.	Chloroprene is obtained by the addition of $HC\ell$ to (1) ethylene (2) acetylene (3) vinylacetylene (4) phenylacetylene

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

(MPH/PHD/URS–EE–2019)

CHEMISTRY

Sr. No. ~~10012~~ 10012

Code **D**

SET–"X"

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

Roll No. ______________ (in figure) ______________________________ (in words)

Name : ______________________________ Father's Name : ______________________

Mother's Name : ______________________ Date of Examination : ________________

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

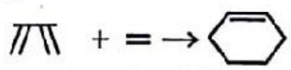
CANDIDATES MUST READ THE FOLLOWING INFORMATION/ INSTRUCTIONS BEFORE STARTING THE QUESTION PAPER.

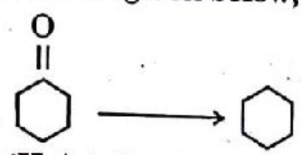
1. All questions are compulsory.
2. The candidates must return the Question book-let as well as OMR answer-sheet to the Invigilator concerned before leaving the Examination Hall, failing which a case of use of unfair-means / misbehaviour will be registered against him / her, in addition to lodging of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

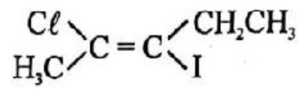
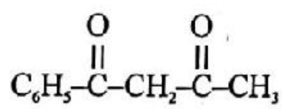
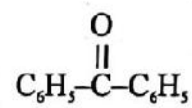
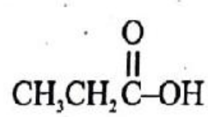
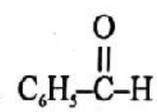
Sample copy for website

Question No.	Questions
1.	The molecule $(OC)_5M = CPh(OCH_3)$ obeys 18 electron rule. The two 'M' satisfying the condition are (1) Cr, Re^+ (2) Mo, V (3) V, Re^+ (4) Cr, V
2.	The number of lines exhibited by a high resolution EPR spectrum of the species $[Cu(ethylenediamine)_2]^{2+}$ is [Nuclear spin (I) of copper is 3/2 and of N = 1] (1) 12 (2) 15 (3) 20 (4) 36
3.	Complexes of general formula, fac-$[Mo(CO)_3$ (phosphine)$_3]$ have the C–O stretching bands as given below : Phosphine : PF_3 (i); $PC\ell_3$ (ii); $P(C\ell)Ph_2$ (iii); PMe_3 (iv) v(CO) : in cm^{-1} : 2090 (a); 2040 (b); 1977 (c); 1945 (d) The correct combination of the phosphine and the stretching frequency is, (1) (i-a) (ii-b) (iii-c) (iv-d) (2) (i-b) (ii-a) (iii-d) (iv-c) (3) (i-d) (ii-c) (iii-b) (iv-a) (4) (i-c) (ii-d) (iii-a) (iv-b)
4.	Which one of the following will *NOT* undergo oxidative addition by methyl iodide ? (1) $[Rh(CO_2)I_2]$ (2) $[\eta^5\text{-}CpRh(CO)_2]$ (3) $[Ir(PPh_3)_2(CO)C\ell]$ (4) $[\eta^5\text{-}Cp_2Ti(Me)C\ell]$

Question No.	Questions
5.	C_{60} has (1) 14 pentagon rings and 18 Hexagon rings (2) 12 pentagon rings and 20 Hexagon rings (3) 12 pentagon rings and 18 Hexagon rings (4) 14 pentagon rings and 20 Hexagon rings
6.	In 'carbon-dating' application of radioisotopes, ^{14}C emits (1) Positron (2) γ particle (3) β particle (4) α particle
7.	The product of the reaction of propene, CO and H_2 in the presence of $Co_2(CO)_8$ as catalyst is (1) butanoic acid (2) butanal (3) 2-butanone (4) methylpropanoate
8.	Reductive elimination step in hydrogenation of alkenes by Wilkinson catalyst results in (neglecting solvent in coordination sphere of Rh) (1) T-shaped $[Rh(PPh_3)_2 CI]$ (2) Trigonal-planar $[Rh(PPh_3)_2C\ell]$ (3) T-shaped $[Rh(H)(PPh_3)_2]$ (4) Trigonal-planar $[Rh(H)(PPh_3)_2]$
9.	The correct statement with respect to the bonding of the ligands, Mc_3N and Mc_3P with the metal ions Be^{2+} and Pd^{2+} is, (1) the ligands bind equally strong with both the metal ions as they are dicationic (2) the ligands bind equally strong with both the metal ions as both the ligands are pyramidal (3) the binding is stronger for Me_3N with Be^{2+} and Me_3P with Pd^{2+} (4) the binding is stronger for Me_3N with Pd^{2+} and Me_3P with Be^{2+}

Question No.	Questions
10.	In the iodometric titration of sodium thiosulfate ($Na_2S_2O_3$) with acidic dichromate solution, 25 mL of 0.1 M dichromate requires 50 mL of 'x' M thiosulfate. The value of 'x' is (1) 0.6 (2) 0.3 (3) 0.1 (4) 0.4
11.	What is meant by a reaction going in 94% enantiomeric excess ? (1) The product contains 94% of one enantiomer and 6% of other enantiomer (2) The product contains an enantiomer which is 94% pure (3) The product contains 94% of one enantiomer and 6% of the products (4) The product contains 97% of one enantiomer and 3% of other enantiomer
12.	Which of the following functional group is <u>not</u> reduced by sodium borohydride ($NaBH_4$) (1) $>C=O$ (2) $-\underset{\underset{O}{\Vert}}{C}-Cl$ (3) $-\underset{\underset{O}{\Vert}}{C}-H$ (4) $-\underset{\underset{O}{\Vert}}{C}-OH$
13.	The given reaction is the example of :  (1) 2 + 4 cycloaddition (2) 2 + 2 cycloaddition (3) 2 + 2 + 2 cycloaddition (4) 2S + 2S cycloaddition
14.	A photo chemical reaction is : (1) catalysed by light (2) Initiated by light (3) accompanied with the emission of light (4) used to convert heat energy into light

Question No.	Questions
15.	Which of the following solvents is unacceptable on large scale ? (1) Dimethoxy ethane (2) Xylene (3) Diethyl ether (4) Heptane
16.	For the reaction given below, which reaction condition are not suitable ?  (1) $LiA\ell H_4 / \varepsilon t_2O$ (2) $H_2N\,NH_2$ / NaOH (3) Zn (Hg) / $HC\ell$ (4) $HSCH_2CH_2CH_2SH$ / H^+, H_2 / Ni
17.	Which of the following statements is <u>not</u> correct ? (1) The molecule to be synthesised is a target molecule (2) Synthetic equivalent is a real chemical compound resulting from disconnection (3) Regioselective reaction does not produce one of several possible structural isomers (4) Synthon is an idealised fragment (usually cation or anion) resulting from a disconnection.
18.	How many oxygen atoms lined up in a row would fit in a one nanomaterial space ? (1) Seventy (2) One (3) Seven (4) None
19.	The role of catalyst in chemical reaction is (1) Lowers the activation energy (2) Alters the amount of products (3) Increases ΔH of Forward reaction (4) Decreases of ΔH of Forward reaction
20.	Secondary pollutant is (1) SO_2 (2) CO (3) PAN (4) Aerosol

Question No.	Questions
21.	Which of the following is a correct name for the following compound ?  (1) cis-2-chloro-3-iodo-2-pentene (2) trans-2-chloro-3-ido-2-pentene (3) trans-3-iodo-4chloro-3-pentene (4) cis-3-iodo-4-chloro-3-pentene
22.	Keto-enol tautomerism is observed in : (1)  (2)  (3)  (4) 
23.	Which of the following gases is mainly responsible for acid rain ? (1) NO_2 and CO_2 (2) CO_2 and SO_2 (3) SO_2 and NO_2 (4) None of these
24.	Which of the following compound displays two singlets at $\delta_{2.3}$ and 7.1 ppm. (1) 1, 2-dimethylbenzene (2) 1, 3-dimethyl benzene (3) 1, 4-dimethyl benzene (4) methyl benzene
25.	A single strong and sharp absorption near 1650 cm^{-1} in IR spectra indicates the presence of (1) Acid chlorides (2) Amides (3) Anhydrides (4) Aldehydes

Question No.	Questions
26.	The proteins in which prosthetic group is carbohydrate are known as (1) Lipo-protein (2) Mucoprotein (3) Chromoprotein (4) Nucleoprotein
27.	Match the List I and List II and select the correct answer using codes given below : List I — List II 1 Nerol — A Lemon grass oil 2 Citral — B Geraniol 3 Pinol — C Amyrin 4 Lupeol — D α-pinene Correct answer is : (1) 1–C, 2–B, 3–A, 4–D (2) 1–B, 2–A, 3–D, 4–C (3) 1–D, 2–C, 3–A, 4–D (4) 1–A, 2–D, 3–B, 4–D
28.	Hydrolysis product of sucrose is : (1) Fructose (2) Glucose + Galactose (3) Glucose (4) Glucose + Fructose
29.	The mass spectrum of primary amides shows a moderate molecular ion and an Intense peak at m/z = 44 due to : (1) Loss of an alkyl radical (2) Loss of HCN (3) Loss of CO (4) Loss of methyl radical
30.	Which one of the following is bacteriostatic drug ? (1) Chloramphenicol (2) Penicillin (3) Streptomycin (4) Phenacetin

Question No.	Questions
31.	The number of the lines in the ESR spectrum of CD_3 is (the spin of D is 1) (1) 1 (2) 3 (3) 4 (4) 7
32.	Colligative properties are used for the determination of (1) molar mass (2) equivalent weight (3) arrangement of molecules (4) melting and boiling point
33.	Which of the following does not contain a C_3 axis ? (1) $POC\ell_3$ (2) NH_4^+ (3) H_3O^+ (4) $C\ell F_3$
34.	Franck Condon principle is related to (1) time required for electronic transition to occur (2) absorption of light (3) time of electronic transition and change in internuclear distance (4) symmetry of molecules
35.	Which pairing of molecule and point group is correct ? (1) $BC\ell_3$, C_{3v} (2) $SiC\ell_4$, D_{4h} (3) H_2S, C_{2v} (4) SF_4, C_{4v}
36.	The symmetric stretching mode of the SiF_4 molecule : (1) IR active (2) IR inactive (3) generates a change in molecular dipole moment (4) gives rise to a strong absorption in IR spectrum

Question No.	Questions
37.	Match the following columns : LIST–1 / LIST-2 1. Sol — A. Liquid dispersed in solid 2. Gel — B. gas dispersed in liquid 3. Emulsion — C. Solid dispersed in liquid 4. Foam — D. liquid dispersed in liquid Codes (1) 1–A 2–B 3–C 4–D (2) 1–B 2–C 3–D 4–A (3) 1–C 2–A 3–D 4–B (4) 1–B 2–D 3–A 4–C
38.	A heat engine operates between the boiling point of water and a room temperature of 25°C. The efficiency of the engine is largest, if water is allowed to boil at a pressure of – (1) 1 atm. (2) 10 atms (3) 25 atms (4) $1.01 * 10^6$ Nm^{-2}
39.	Monomer of Orlon is (1) $CH_2 = CH–OCH_3$ (2) $CF_2 = CF_2$ (3) $CH_2 = CH – CN$ (4) $CH_2 = CH – C\ell$
40.	Chloroprene is obtained by the addition of $HC\ell$ to (1) ethylene (2) acetylene (3) vinylacetylene (4) phenylacetylene

Question No.	Questions
41.	The complex $[Fe(Phen)_2(NCS)_2]$(Phen – 1, 10-phnanthroline) shows spin crossover behaviour. CFSE and μ_{eff} at 250 and 150 K, respectively will be : (1) $0.4\ \Delta_0$, 4.90 BM and $2.4\ \Delta_0$, 0.00 BM (2) $2.4\ \Delta_0$, 2.90 BM and $0.4\ \Delta_0$, 1.77 BM (3) $2.4\ \Delta_0$, 0.00 BM and $0.4\ \Delta_0$, 4.90 BM (4) 1-2 Δ_0, 4.90 BM and $2.4\ \Delta_0$, 0.00 BM
42.	$[Ni^{II} L_6]^{n+ \text{ or } n-}$ show absorption bands at 8500, 15400 and 26000 cm^{-1} whereas $[Ni^{II} L'_6]^{n+ \text{ or } n-}$ at 10750, 17500 and 28200 cm^{-1}, L and L' are respectively (1) OH^- and N_3^- (2) $C\ell^-$ and I^- (3) NCS^- and $RCOO^-$ (4) H_2O and NH_3
43.	The rate of exchange of OH_2 present in the coordination sphere by $^{18}OH_2$ of i. $[Cu(H_2O)_6]^{2+}$; ii) $[Mn(H_2O)_6]^{2+}$; iii) $[Fe(H_2O)_6]^{2+}$; iv) $[Ni(H_2O)_6]^{2+}$, follows the order (1) i) > iv) > iii) > ii) (2) i) > ii) > iii) > iv) (3) ii) > iii) > iv) > i) (4) iii) > i) > iv) > ii)
44.	On addition of an inert gas at constant volume to the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$ at equilibrium (1) The reaction remains unaffected (2) Forward reaction is favoured (3) The reaction halts (4) Backward reaction is favoured

Question No.	Questions
45.	The transition zone for Raman spectra is (1) Between vibrational and rotational levels (2) Between electronic levels (3) Between magnetic levels of nuclei (4) Between magnetic levels of unpaired electrons
46.	Polarisation of the electron cloud by the cation forms (1) Ionic bond (2) Covalent bond (3) Coordinate bond (4) Metallic bond
47.	Activation energy of a chemical reaction can be determined by ______. (1) determining the rate constant at standard temperature (2) determining the rate constants at two temperatures (3) determining probability of collision (4) using catalyst
48.	Due to Frenkel defect, the density of the ionic solids (1) increases (2) decreases (3) does not change (4) none of the above
49.	What is the simplest formula of a solid whose cubic unit cell has the atom A at each corner, the atom B at each face centre and a C atom at the body centre (1) AB_2C (2) A_2BC (3) AB_3C (4) ABC_3

Question No.	Questions
50.	Which of the following thermodynamic function is called as the arrow of "time" (1) Enthalpy (2) Gibbs free energy (3) Entropy (4) Helmholtz free energy
51.	The room temperature magnetic moment (μ_{eff} in BM) for a monomeric Cu(II) complex is greater than 1.73. This may be explained using the expression (1) $\mu_{eff} = \mu_s (1 - \alpha\lambda/\Delta)$ (2) $\mu_{eff} = [n (n + 2)]^{½}$ (3) $\mu_{eff} = [4s (s + 1) + L (L + 1)]^{½}$ (4) $\mu_{eff} = g [J (J + 1)]^{½}$
52.	The numbers of P–S and P–P bonds in the compound P_4S_3 are, respectively, (1) 3 and 6 (2) 4 and 3 (3) 6 and 3 (4) 6 and 2
53.	In the absence of bound globin chain, heme group on exposure to O_2 gives the iron-oxgen species (1) Fe(III) –O– Fe(III) (2) Fe(III) –O–O$^-$ (3) Fe(III) –O–O– Fe(III) (4) Fe(IV) –O–
54.	The complex $[Cr(bipyridyl)_3]^{2+}$, shows a red phosphorescence due to transition (1) $^4T_{1g} \leftarrow {}^4A_{2g}$ (2) $^2E_g \leftarrow {}^4A_{2g}$ (3) $^4T_{2g} \leftarrow {}^4A_{2g}$ (4) $^4A_{2g} \leftarrow {}^2E_g$

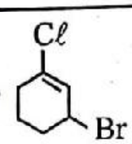
Question No.	Questions
55.	Consider the following reactions in N_2O_4 i. $NOC\ell + Sn$ ii. $NOC\ell + AgNO_3$ iii. $NOC\ell + BrF_3$ iv. $NOC\ell + SbC\ell_5$ Reactions which will give $[NO]^+$ as a major product are : (1) i and ii (2) iii and iv (3) i and iv (4) ii and iv
56.	The number of 3c–2e bonds present in $A\ell(BH_4)_3$ is (1) four (2) three (3) six (4) zero
57.	The role of copper salt as co-catalyst in Wacker process is (1) Oxidation of Pd(0) by Cu(II) (2) Oxidation of Pd(0) by Cu(I) (3) Oxidation of Pd(II) by Cu(I) (4) Oxidation of Pd(II) by Cu(II)
58.	For the oxidation state/s of sulphur atoms in S_2O, consider the following; i) -2 and $+4$ ii) 0 and $+2$ iii) $+4$ and 0 iv) $+2$ and $+2$ The correct answer is/are (1) i and ii (2) i and iii (3) ii and iv (4) iii and iv
59.	The geometries of $[C\ell F_4]^+$ and $[IF_4]^-$ respectively are (1) Tetrahedral and tetrahedral (2) Tetrahedral and trigonal bipyramidal (3) Tetrahedral and Square planar (4) Tetrahedral and Octahedral

Question No.	Questions
60.	Among the complexes (i) $K_4[(Cr(CN)_6]$, (ii) $K_4[(Fe(CN)_6]$, (iii) $K_3[(Co(CN)_6]$, and (iv) $K_4[(Mn(CN)_6]$, Jahn Teller distortion is expected in (1) i, ii and iii (2) ii, iii and iv (3) i and iv (4) ii and iii
61.	For a potentiometric titration in the curve of emf (E) v/s volume (V) of the titrant added, the equivalence point is indicated by (1) $\lvert dE/dV \rvert = 0$, $\lvert d^2E/dV^2 \rvert = 0$ (2) $\lvert dE/dV \rvert = 0$, $\lvert d^2E/dV^2 \rvert > 0$ (3) $\lvert dE/dV \rvert > 0$, $\lvert d^2E/dV^2 \rvert = 0$ (4) $\lvert dE/dV \rvert > 0$, $\lvert d^2E/dV^2 \rvert > 0$
62.	If the concentration (c) is increased to 4 times its original value (c), the change in molar conductivity for strong electrolytes is (where b is kohlrausch's constant) - (1) 0 (2) $b\sqrt{c}$ (3) $2b\sqrt{c}$ (4) $4b\sqrt{c}$
63.	The energy levels of the harmonic oscillator (neglecting zero point energy) are $\varepsilon_v = nh\nu$ for n = 0, 1, 2 ..... Assuming $h\nu = k_B T/3$; the partition function is (1) e (2) $e^{1/3} (e^{1/3} - 1)$ (3) 1/3e (4) $3e/(3e^3 - 1)$
64.	The ground state of hydrogen atom is – 13.598 eV. The exception values of kinetic energy <T> and potential energy, <V>, in units of eV, are (1) <T> = 13.598, <V> = –27.196 (2) <T> = –27.196, <V> = 13.598 (3) <T> = –6.799, <V> = –6.799 (4) <T> = 6.799, <V> = –20.397

Question No.	Questions
65.	The correct expression for the product $((M_n).(M_w))$ [where M_n and M_w are the number average and weight average molar masses, respectively, of a polymer] is (1) $N^{-1}\sum_i N_iM_i$ (2) $N^{-1}\sum_i N_iM_i^2$ (3) $N/\sum_i N_iM_i$ (4) $N/\sum_i N_iM_i^2$
66.	Match the following columns : Column–1 / Column–2 A. Energy of the ground state of He+ — 1. – 6.04 ev B. Potential energy of Ist orbit of H– atom — 2. – 27.2 ev C. Kinetic energy of II excited state of He+ — 3. $8.68 * 10^{-18}$ J D. Ionisation potential of He+ — 4. – 54.4 ev Codes. A B C D (1) 1 2 3 4 (2) 4 3 2 1 (3) 4 2 1 3 (4) 2 3 1 4
67.	The protecting power of lyophilic colloidal sol is expressed in terms of (1) Critical miscelle concentration (2) Oxidation number (3) Coagulation value (4) Gold number
68.	Which one of the following is an example for homogenous catalysis ? (1) Hydrogenation of oil (2) Manufacture of ammonia by Haber's process (3) Manufacture of sulphuric acid by Contact process (4) Hydrolysis of sucrose in presence of dilute hydrochloric acid

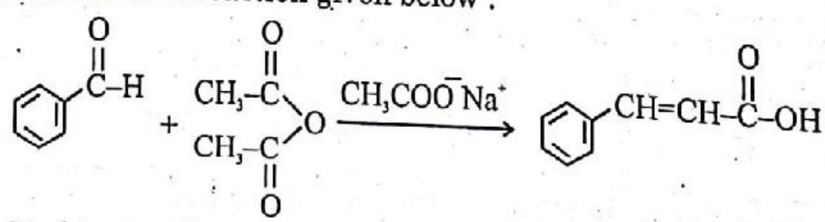
Question No.	Questions
69.	The energy of a hydrogen atom in a state is $(-hcR_H/25)$, where R_H = Rydberg Constant). The degeneracy of the state will be - (1) 25^1 (2) 25^2 (3) 25^3 (4) 25^4
70.	The value of the commutator $[x, p^2_x]$ is (1) 2i (2) $2\,i\,h\,p_x$ (3) $2ixp_x$ (4) $h\,i\,p_x/\pi$
71.	The normality of 2.3 M H_2SO_4 solution is (1) 2.3 N (2) 4.6 N (3) 6.9 N (4) 7.9 N
72.	Crystal cannot posses (1) 1 fold axis of symmetry (2) 3 fold axis of symmetry (3) 5 fold axis of symmetry (4) 6 fold axis of symmetry
73.	Number of sigma bonds in P_4O_{10} is (1) 6 (2) 7 (3) 17 (4) 16
74.	2 mol of an ideal gas at 27°C is expanded reversibly from 2 lit. To 20 lit. Find entropy change (R = 2 cal / mol K) (1) 92.1 (2) 0 (3) 4 (4) 9.2

Question No.	Questions
75.	An adiabatic process is (1) isoenthalpic (2) isoentropic (3) isochoric (4) isobaric
76.	At a certain temperature, the following observations were made for the reaction $A \longrightarrow$ Products Time (From the start) — [A] 2 minutes — $5*10^{-3}$ 5 minutes — $4*10^{-3}$ 8 minutes — $3*10^{-3}$ 11 minutes — $2*10^{-3}$ The order of the reaction is (1) 1 (2) 2 (3) 3 (4) Zero
77.	How many stereoisomers does have 2, 3-dichloropentane ? (1) 2 (2) 4 (3) 3 (4) 5

Question No.	Questions
78.	Which statement about benzene is incorrect ? (1) The C_6 ring is planar (2) The C–Cπ–bonding is delocalised. (3) The reactivity of the benzene reflects the presence of carbon-carbon double bond. (4) Each C atom is sp^2 hybridized.
79.	Which of the following is not a Huckel (4n + 2) aromatic system ? (1) [18]–Annulene ($C_{18}H_{18}$) (2) Cyclooctatetraene (C_8H_8) (3) Benzene (C_6H_6) (4) Cyclopentadienyl anion ($C_5H_5^-$)
80.	The IUPAC name of  is : (1) 1-bromo-3-chlorocyclohexene (2) 2-bromo-6-chlorocyclohex-1-ene (3) 6-bromo-2-chlorocyclohexene (4) 3-bromo-1-chlorocyclohexene
81.	Which one of the following high spin complexes has the largest CSFE Crystal field stabilization energy (1) $[Cr(H_2O)_6]^{2+}$ (2) $[Mn(H_2O)_6]^{2+}$ (3) $[Fe(H_2O)_6]^{2+}$ (4) $[Co(H_2O)_6]^{2+}$
82.	The number of 3c, 2e BHB and B-B bonds present in B_4H_{10} respectively are (1) 2, 4 (2) 3, 2 (3) 4, 1 (4) 4, 0

Question No.	Questions
83.	The most unstable species among the following is (1) $Ti(C_2H_5)_4$ (2) $Ti(CH_2Ph)_4$ (3) $Pb(CH_3)_4$ (4) $Pb(C_2H_5)_4$
84.	The acid catalyzed hydrolysis of *trans*-$[Co(en)_2AX)^{n+}$ can give *cis*-product also due to the formation of (1) Square pyramidal intermediate (2) Trigonal bipyramidal intermediate (3) Pentagonal bipyramidal intermediate (4) Face capped octahedral intermediate
85.	Total number of lines expected in ^{31}P NMR spectrum of HPF_2 is (I = 1/2 for both ^{19}F and ^{31}P) (1) Six (2) Four (3) Five (4) Three
86.	The number of faces, vertices and edges in IF_7 polyhedron are, respectively (1) 15, 7 and 15 (2) 10, 7 and 15 (3) 10, 8 and 12 (4) 12, 6 and 9
87.	The light pink colour of $[Co(H_2O)_6]^{2+}$ and the deep blue colour of $[CoC\ell_4]^{-2}$ are due to (1) MLCT transition in the first and d-d transition in the second (2) LMCT transitions in both (3) d-d transitions in both (4) d-d transition in the first and MLCT transition in the second

Question No.	Questions
88.	In $[Mo_2(S_2)_6]^{2-}$ cluster the number of bridging S atoms and coordination number of Mo respectively, are (1) 2 and 8 (2) 2 and 6 (3) 1 and 8 (4) 1 and 6
89.	The number of possible isomers of $[Ru(PPh_3)_2(acac)_2]$ (acac = acetylacetonate) is (1) 2 (2) 5 (3) 4 (4) 3
90.	Which ones among CO_3^{2-}, XeO_3, SO_3, PO_3^{3-} and NO_3^- have planar structure ? (1) CO_3^{2-}, PO_3^{3-} and XeO_3 (2) CO_3^{2-}, XeO_3 and NO_3^- (3) SO_3, PO_3^{3-} and NO_3^- (4) CO_3^{2-}, SO_3 and NO_3^-
91.	Heating 1, 4-dicarbonyl compounds in the presence of phosphorus pentoxide (P_2O_5) gives : (1) Pyrrole (2) Furan (3) Thiophene (4) Quinoline
92.	The Acetylation of thiophene occurs at : (1) C_3–position (2) C_4–position (3) C_2–position (4) both at C_2 and C_4–positions
93.	Pyridine is basic in nature having (1) $pKa = 5.21$ (2) $pKa = -0.27$ (3) $pKa = 5.81$ (4) $pKa = -0.35$
94.	Least stable carbocation among the following is (1) $(CH_3)_3C^+$ (2) $(CH_3)_2CH^+$ (3) $CH_3CH_2^+$ (4) CH_3^+

Question No.	Questions
95.	Due to the presence of an unpaired electron, free radicals are (1) Anions (2) Cations (3) Chemically reactive (4) Chemically inreactive
96.	Benzoyl peroxide undergoes hamolytic cleavage to produce (1) Phenyl radical (2) Methyl radical (3) Phenyl chloride (4) Methyl chloride
97.	SN^1 mechanism for the hydrolysis of an alkyl halide involves the formation of intermediate (1) Free radical (2) Carbanion (3) Carbocation (4) None of these
98.	Which of the following is NOT polar protic solvent ? (1) H_2O (2) C_2H_5OH (3) Fumaric acid (4) Acetone
99.	A new carbon-carbon bond formation is possible in (1) Clemmensen reduction (2) Wurtz reduction (3) Friedel-Craft alkylation (4) Oppenauer oxidation
100.	Give the name of reaction given below :  (1) Perkin reaction (2) Pechmann condensation (3) Benzoin condensation (4) Claisen-Schmidt reaction

Answer Key of Entrance Exam of Ph.D/URS Chemistry 2019

Question No.	Code-A	Code-B	Code-C	Code-D
1	4	2	3	1
2	3	1	2	4
3	1	3	2	1
4	2	3	1	4
5	1	2	2	2
6	2	2	3	3
7	3	2	4	2
8	1	4	4	2
9	4	1	1	3
10	4	1	4	2
11	1	4	1	4
12	4	1	3	4
13	1	4	1	1
14	4	3	4	2
15	2	3	2	3
16	3	2	3	1
17	2	3	1	3
18	2	3	1	3
19	3	3	4	1
20	2	3	3	3
21	1	1	4	2
22	3	4	3	1
23	1	2	1	3
24	4	1	2	3
25	2	1	1	2
26	3	2	2	2
27	1	2	3	2
28	1	3	1	4
29	4	3	4	1
30	3	3	4	1
31	1	1	4	4
32	4	4	4	1
33	2	1	1	4
34	1	4	2	3
35	1	2	3	3
36	2	3	1	2
37	2	2	3	3
38	3	2	3	3
39	3	3	1	3
40	3	2	3	3
41	3	4	2	1
42	2	4	3	4
43	2	1	4	2
44	1	2	4	1
45	2	3	2	1
46	3	1	4	2
47	4	3	2	2
48	4	3	3	3
49	1	1	2	3
50	4	3	4	3
51	4	2	1	1
52	1	3	4	3

Answer Key of Entrance Exam of Ph.D/URS Chemistry 2019

Question No.	Code-A	Code-B	Code-C	Code-D
53	4	4	2	1
54	3	4	1	4
55	3	2	1	2
56	2	4	2	3
57	3	2	2	1
58	3	3	3	1
59	3	2	3	4
60	3	4	3	3
61	2	2	2	3
62	3	3	1	2
63	4	1	3	2
64	4	4	3	1
65	2	3	2	2
66	4	1	2	3
67	2	3	2	4
68	3	4	4	4
69	2	3	1	1
70	4	1	1	4
71	2	3	2	2
72	1	2	3	3
73	3	2	1	4
74	3	1	4	4
75	2	2	3	2
76	2	3	1	4
77	2	4	3	2
78	4	4	4	3
79	1	1	3	2
80	1	4	1	4
81	2	1	1	4
82	3	3	4	3
83	1	1	1	1
84	4	4	4	2
85	3	2	2	1
86	1	3	3	2
87	3	1	2	3
88	4	1	2	1
89	3	4	3	4
90	1	3	2	4
91	4	4	4	2
92	4	3	1	3
93	1	1	4	1
94	2	2	3	4
95	3	1	3	3
96	1	2	2	1
97	3	3	3	3
98	3	1	3	4
99	1	4	3	3
100	3	4	3	1