PUMDET-2018 **82190001**

Subject: Chemistry **(Booklet Number)**

Duration: 90 minutes **Full Marks: 100**

Instructions

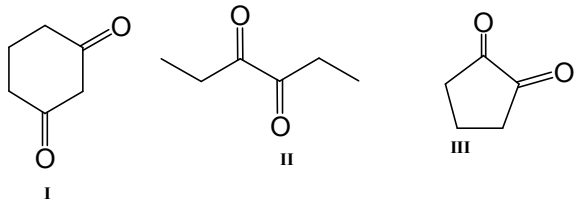
1. All questions are of objective type having four answer options for each. Only one option is correct. Correct answer will carry full marks 2. In case of incorrect answer or any combination of more than one answer, ½ marks will be deducted.
2. Questions must be answered on OMR sheet by darkening the appropriate bubble marked A, B, C, or D.
3. Use only Black/Blue ball point pen to mark the answer by complete filling up of the respective bubbles.
4. Do not make any stray mark on the OMR.
5. Write question booklet number and your roll number carefully in the specified locations of the OMR. Also fill appropriate bubbles.
6. Write your name (in block letter), name of the examination centre and put your full signature in appropriate boxes in the OMR.
7. The OMRs will be processed by electronic means. Hence it is liable to become invalid if there is any mistake in the question booklet number or roll number entered or if there is any mistake in filling corresponding bubbles. Also, it may become invalid if there is any discrepancy in the name of the candidate, name of the examination centre or signature of the candidate vis-a-vis what is given in the candidate's admit card. The OMR may also become invalid due to folding or putting stray marks on it or any damage to it. The consequence of such invalidation due to incorrect marking or careless handling by the candidate will be sole responsibility of candidate.
8. Candidates are not allowed to carry any written or printed material, calculator, pen, docu-pen, log table, any communication device like mobile phones etc. inside the examination hall. Any candidate found with such items will be reported against & his/her candidature will be summarily cancelled.
9. Rough work must be done on the question paper itself. Additional blank pages are given in the question paper for rough work.
10. Hand over the OMR to the invigilator before leaving the Examination Hall.

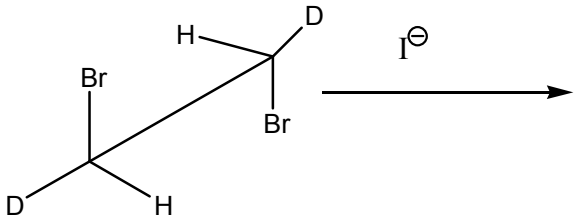
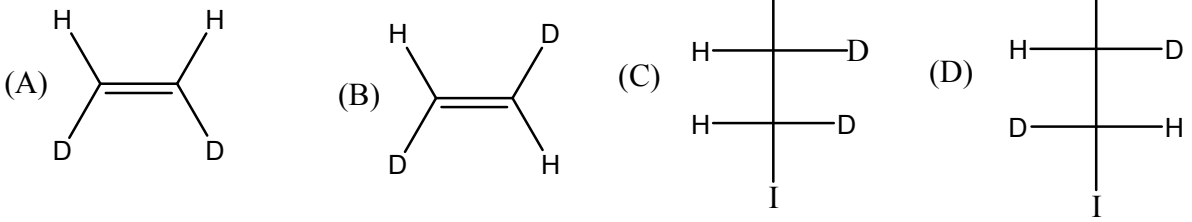
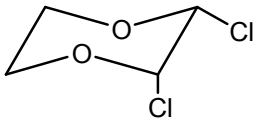
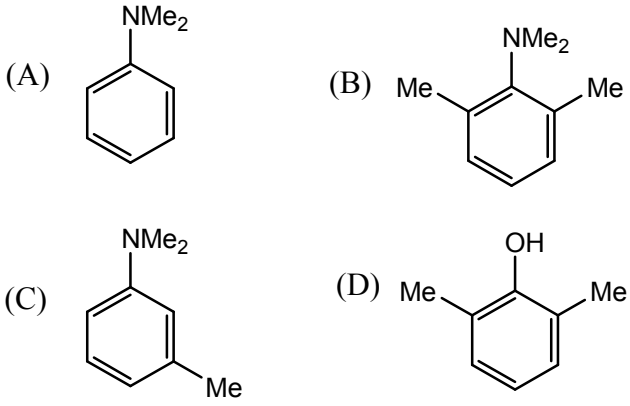
ROUGH WORK ONLY

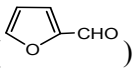
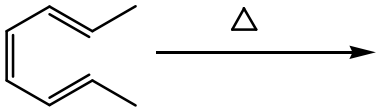
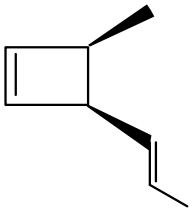
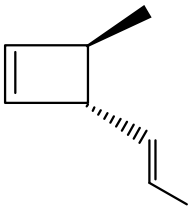
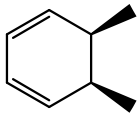
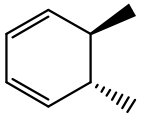
Chemistry

1.	Hybridization of C in solid C_3O_2 and gaseous CO_2 are : (A) sp in both (B) sp^2 and sp (C) sp^3 and sp^2 (D) both sp^2
2.	The reaction $2N_3^- + I_2 \rightarrow 3N_2 + 2I^-$ is strongly catalyzed by (A) NO_3^- (B) NO_2^- (C) K^+ (D) S^{2-}
3.	The attractive forces between metal ions and delocalized electrons can be weakened or overcome by: (A) water (B) sudden decrease in temperature (C) increasing the temperature (D) corrosion resistant materials
4.	Buffer species present in human blood contain (A) only haemoglobin (B) haemoglobin, HCO_3^- and $H_2PO_4^-$ (C) HCO_3^- and $H_2PO_4^-$ (D) $H_2PO_4^-$ and haemoglobin
5.	Given the following data (25^0C) for the sparingly soluble salt MX : $M + X^- \rightarrow MX + e;\ E^0 = -0.01V$ $M \rightarrow M^+ + e \quad ;\ E^0 = -0.60V$ The value of log K_{SP} for MX will be (A) - 20 (B) - 10 (C) - 15.6 (D) - 5.6
6.	Consider the following statements for $(NH_4)_2[Ce(NO_3]_6$ (i) Coordination number of Ce in the compound is 12 (ii) compound is paramagnetic (iii) compound is an oxidising agent. The correct combination of statements is : (A) (ii) and (iii) (B) (i), (ii) and (iii) (C) (i) and (ii) (D) (i) and (iii)

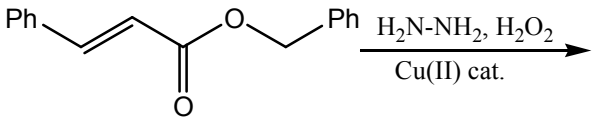
7.	Which of the following statements is correct? (A) 2, 3 – bisphosphoglycerate (BPG) increases the affinity of haemoglobin for oxygen. (B) Deoxygenated haemoglobin has a higher binding affinity for protons than oxyhaemoglobin. (C) Haemoglobin has a higher affinity for oxygen than does myoglobin. (D) One molecule of haemoglobin binds sixteen molecules of oxygen (four per subunit).
8.	The correct observation for the reaction $\text{trans}-\left[\text{IrCl}(\text{CO})(\text{PPh}_3)_2\right]+\text{Cl}_2 \rightarrow \text{trans}-\left[\text{IrCl}_3(\text{CO})(\text{PPh}_3)_2\right]$ is (A) υ_{CO} (product) > υ_{CO} (reactant) (B) υ_{CO} (product) < υ_{CO} (reactant) (C) υ_{CO} (product) = υ_{CO} (reactant) (D) υ_{CO} (product) = υ_{CO} (free CO)
9.	Which of the following electronic transition will exhibit highest energy? (n = principal quantum number). (A) $n_6 \rightarrow n_5$ (B) $n_5 \rightarrow n_4$ (C) $n_3 \rightarrow n_2$ (D) $n_4 \rightarrow n_3$
10.	The Madelung constant value for an ionic solid depends on : (A) Geometry and charge of ions. (B) Only geometry of the solid. (C) Only the charge of ions. (D) Geometry and radius of ions.
11.	Ozone molecule is : (A) Diamagnetic with zero dipole moment. (B) Diamagnetic with high dipole moment. (C) Paramagnetic with low dipole moment. (D) Diamagnetic with low dipole moment.
12.	Consider the feasibility of the following reactions (i) $CH_3HgOH + HSO_3^- \rightarrow CH_3HgSO_3^- + HOH$ (ii) $OH^- + CH_3HgSO_3^- \rightarrow CH_3HgOH + SO_3^{2-}$ (A) k_{eq} for both (i) and (ii) are < 1. (B) Reaction (i) has $k_{eq} > 1$, but (ii) has $k_{eq} < 1$. (C) Both reactions have $k_{eq} > 1$. (D) Reaction (i) has $k_{eq} < 1$, but (ii) has $k_{eq} > 1$.
13.	If the cell potential of the cell at 298 k $Ni\,|\,Ni^{+2}(0.01\ M)\,||\,Cu^{+2}(0.1\ M)\,|\,Cu$ is 0.58 V, standard potential of Ni^{+2}/Ni couple will be: (Given $E^0_{Cu^{+2}/Cu} = 0.34 v$). (A) - 0.24 V (B) 0.0295 V (C) - 0.2105 V (D) 0.55 V

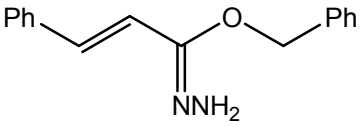
14.	The compound $CoCl_4^{2-}$ will have a CFSE of : (A) $-0.54\ \Delta_0$ (B) $-0.54\ \Delta_t$ (C) $-1.2\ \Delta_0$ (D) $-0.6\ \Delta_0$
15.	The basic character of Ce_2O_3, Gd_2O_3 and Lu_2O_3 follows the order : (A) $Lu_2O_3 > Gd_2O_3 > Ce_2O_3$ (B) $Lu_2O_3 < Gd_2O_3 < Ce_2O_3$ (C) $Ce_2O_3 > Lu_2O_3 > Gd_2O_3$ (D) $Gd_2O_3 < Ce_2O_3 < Lu_2O_3$
16.	The compound $Fe(CO)_2(NO)_2$ contains two nitrosyl groups which are (A) both bent (B) both linear (C) one bent and one linear (D) can be both (A) and (B)
17.	The approximate gravimetric factor for determination of Fe gravimetrically when it is precipitated as $Fe(OH)_3$ is (At. Wt. Fe = 56, O = 16) (A) 0.52 (B) 0.96 (C) 0.70 (D) 0.35
18.	When the π modecular orbitals of butadiene are constructed by combination of the π molecular orbitals of two ethylene molecules, it is oberved that due to this process the energy levels of (A) both HOMO and LUMO are raised. (B) both HOMO and LUMO are lowered. (C) HOMO is raised and LUMO is lowered. (D) HOMO is lowered and LUMO is raised.
19.	The enol content of the following dienones will follow the order  I II III (A) I > II > III (B) III > II > I (C) I > III > II (D) III > I > II

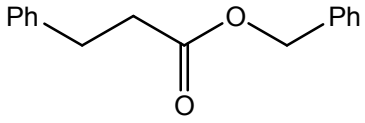
20.	The product of the following reaction  will be 
21.	Choose the correct statement regarding the bond lengths between the two C – Cl bonds of the dichlorodioxane conformer shown below  (A) Both are equal (B) Axial C – Cl bond is longer than equatorial C – Cl bond (C) Equatorial C – Cl bond is longer than axial C – Cl bond (D) Axial C – Cl bond is shorter than C – Cl bond of $CH_3 – Cl$
22.	Among the following compounds identify the compound which fails to undergo coupling with $PhN_2^{\oplus}Cl^{\ominus}$. 

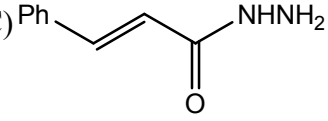
23.	Among the following esters, the compound which will undergo acid catalysed hydrolysis by A_{AL}^1 mechanism is (A) $PhCH_2CO_2CH_2CH_3$ (B) $Ph\ CO_2CH_2CH_2CH_3$ (C) $Ph\ CH_2CH_2\ CO_2CH_3$ (D) $CH_3CO_2\underset{\displaystyle CH_3}{\underset{\vert}{C}}H\text{-}Ph$
24.	Identify the aldehyde which fails to undergo benzoin condensation (A) p - nitrobenzaldelyde (B) p - chlorobenzaldehyde (C) o - nitrobenzaldelyde (D) furfural ()
25.	Treatment of phenylhydrazone of acetone with acid gives (A) quinoline (B) isoquinoline (C) 2 – methylindole (D) 3 - methylindole
26.	The product of the following reaction  will be (A)  (B)  (C)  (D) 
27.	Nylon and PVC are two common polymers. Their structural features indicate that (A) nylon is condensation polymer while PVC is addition polymer. (B) nylon is addition polymer while PVC is condensation polymer. (C) both nylon and PVC are addition polymers. (D) both nylon and PVC are condensation polymers.

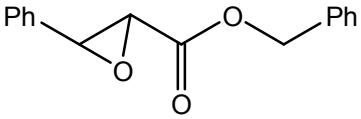
28. The predominant product from the following reaction is



(A) 

(B) 

(C) 

(D) 

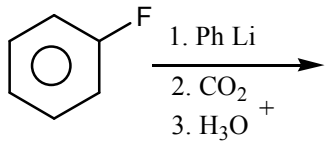
29. The following reaction yields mainly

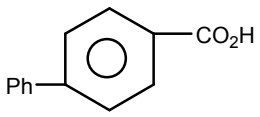
$CH_2 = CH - CHO + C_2H_5OH + HCl \rightarrow$

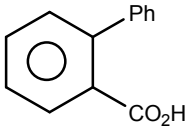
(A) $ClCH_2CH_2CHO$ (B) $CH_3CHCl\,CHO$

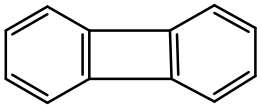
(C) $Cl\,CH_2\,CH_2\,CH(OC_2H_5)_2$ (D) $CH_3\,CHCl\,CH(OC_2H_5)_2$

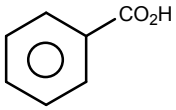
30. The reaction depicted below will provide mainly

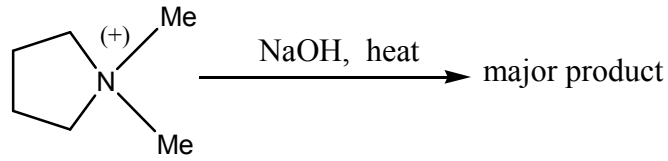
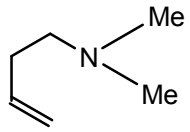
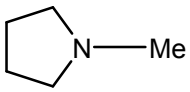
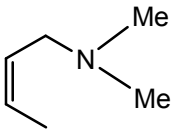
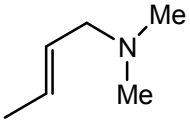
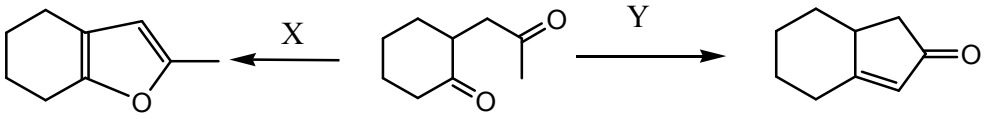


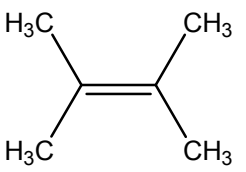
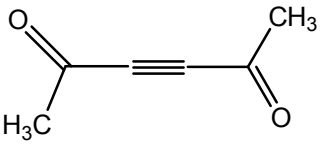
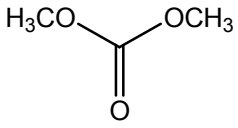
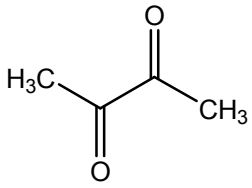
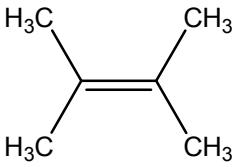
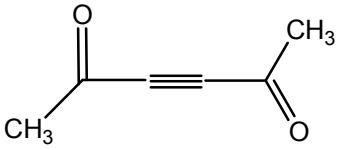
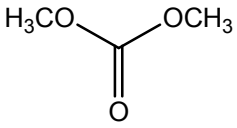
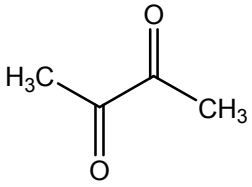
(A) 

(B) 

(C) 

(D) 

31.	The major product obtained in the following reaction is  (A)  (B)  (C)  (D) 
32.	The best reaction condition (X & Y) for the cyclisations shown below are  (A) X is Et_3N & Me_3SiOTf and Y is piperidine (B) X is LDA and Y is $TiCl_4$ (C) X is P_2O_5 and Y is NaOEt (D) X is piperidine and Y is $ZnCl_2$
33.	In a 300 MHz NMR instrument the difference of chemical shifts between the most deshielded and most shielded Hs of butanone is 390 Hz. The chemical shift of methylene Hs is recorded at δ 2.5. So the chemical shift of the most upfield proton of butanone in δ scale is (A) 3.6 (B) 0.9 (C) 1.2 (D) 2.1

34.	One of the compounds shown below shows very weak UV absorption but very strong IR absorption around 1650 – 1750 cm^{-1}. It shows only one ^{1}H-NMR signal at δ 2.5. The compound is     (A)  (B)  (C)  (D) 
35.	Two ideal gases P and Q (mol.wt = 16 and 64 respectively) are kept at 727^0C and T Kelvin respectively. The average momentum of the molecules of P and Q will be equal when T is (A) 300 (B) 250 (C) 25 (D) 500
36.	An ideal gas at temperature T Kelvin undergoes an adiabatic free expansion (expansion against zero opposing pressure) to 1.11 times its original volume. The final temperature, in Kelvin, will be (A) T – 1.11 (B) T + 1.11 (C) T (D) $T/1.11$
37.	One mole of an ideal gas undergoes a change of state, from (P_1, V_1, T_1) to (sP_1, rV_1, T_2) where s and r are non-zero positive numbers. The entropy change is given by the expression (A) $\overline{C}_p \ln(r)$ (B) $\overline{C}_v \ln(s)$ (C) $\overline{C}_p \ln(r) - \overline{C}_v \ln(s)$ (D) $\overline{C}_p \ln(r) + \overline{C}_v \ln(s)$
38.	The vapour pressure of a homogeneous mixture of two liquids A and B, both obeying Raoult's law, under the following conditions : same temperature T, mole ratio of A : B is 1 : 2, P^0_A = 90 mm Hg, P^0_B = 60 mm Hg ; will be (A) 60 mm Hg (B) 70 mm Hg (C) 80 mm Hg (D) 210 mm Hg
39.	At a certain temperature of T Kelvin, the osmotic pressure of an aqueous solution, which is a mixture of 0.01 (M) glucose and 0.01 (M) NaCl (assumed to be 100% dissociated) is P atm. At the same temperature P atm will be the osmotic pressure of (A) 0.02 (M) glucose (B) 0.02 (M) NaCl (100% dissociated) (C) 0.03 (M) glucose (D) None of these

40.	The ionic strength of an aqueous solution of a 0.1 (M) weak monobasic acid HA (degree of dissociation, $\propto << 1$) with $K_a = 1 \times 10^{-5}$ is very nearly (A) 10^{-4} g-ion . L^{-1} (B) 10^{-3} g-ion . L^{-1} (C) 10^{-2} g-ion . L^{-1} (D) 10^{-1} g-ion . L^{-1}
41.	A 0.1 (M) aqueous solution of a weak monobasic acid HA (with $\propto << 1$) whose $K_a = 1 \times 10^{-5}$ is titrated against 1.0 (M) NaOH solution. The ratio of pH at 0% and 50% neutralization will be (A) 2 : 5 (B) 3 : 5 (C) 4 : 5 (D) 1 : 5
42.	The 'solubility' (in grams) of KHTa (Potassium Hydrogen Tartrate) in water, 0.1 (M) KCl (aq) and 0.1 (M) KOH (aq) are s_0, s_1, s_2 respectively. The order of 'solubility' is ['solubility is measured by the amount of salt (solute) required to saturate 100 ml of solution] (A) $s_0 < s_1 << s_2$ (B) $s_0 > s_1 > s_2$ (C) $s_2 >> s_0 > s_1$ (D) $s_2 = s_0 > s_1$
43.	A coloured solution of a dye (concentration c_1 mol / L) absorbs at wavelength λ and temperature T with 7% transmittance. At a concentration c_2 mol / L it absorbs 30% of the incident light of same wavelength. Assuming $\in \ell = 1.0$ L / mol , the value of $(c_2 - c_1)$ will be (A) 1.0 (B) 10.0 (C) 0.0 (D) - 0.1
44.	For a particle in a one-dimensional box, a transition from a level with quantum number m to another with quantum number n is allowed only if (A) (m + n) is odd (B) (m + n) is even (C) m is odd (D) n is even
45.	For a simple harmonic oscillator (SHO) in one dimension the zero point energy is M times the energy gap between the successive levels. The value of M is (A) 2.0 (B) 1.0 (C) 0.5 (D) $\sqrt{0.5}$
46.	Two optically active substances A and B are mixed taking 5 g each, and the mixture was dissolved in 100 ml of water. The specific rotations of A and B are ($+ 50^0$) and ($- 110^0$) respectively. The mixture is placed in a 2 dm polarimeter tube and the optical rotation is noted. The value will be (A) $+ 6^0$ (B) $- 6^0$ (C) $+ 16^0$ (D) 0^0
47.	If the reaction $N_2 + 3H_2 \rightarrow 2NH_3$ has $d[H_2]/dt = -0.006$ mol $L^{-1}s^{-1}$ at a certain instant what is the value of $d[NH_3]/dt$ at that instant (in the same units) ? (A) - 0.004 (B) - 0.002 (C) + 0.004 (D) +0.015
48.	Among the molecules , H_2O, NO, CO_2, N_2O and CH_4, those having microwave spectrum are (A) NO, H_2O and CH_4 (B) N_2O, CO_2 and H_2O (C) NO, N_2O and H_2O (D) H_2O, CH_4 and N_2O

49.	Consider two liquids A and B such that A has half the surface tension and twice the density of B. If liquid A rises a height of 2.0 cm in a capillary, what will be the height to which the liquid B will rise in the same capillary? (A) 1.0 cm (B) 2.0 cm (C) 4.0 cm (D) 8.0 cm
50.	For a second order reaction of decomposition of a compound, the time taken to reduce initial concentration by a factor of half is 10 min. The time required to reduce the initial concentration by a factor of $1/4$ will be (A) 20 min (B) 30 min (C) 40 min (D) 60 min