JEE ADVANCED-2017

CHEMISTRY

A. General Instructions :

1. This sealed booklet is your Question Paper. Do not break the seal till you are instructed to do so.

2. The question paper CODE is printed on the left hand top corner of this sheet and the right hand top comer of the back cover of this booklet

3. Use the Optical Response Sheet (ORS) provided separately for answering the questions.

4. The paper CODE is printed on its left part as well as the right part of the ORS. Ensure that both these codes are identical and same as that on the question paper booklet If not contact the invigilator.

5. Blank spaces are provided within this booklet for rough work.

6. Write your name and roll number in the space provided on the back cover of this booklet

7. After breaking the seal of the booklet at 9:00 am, verify that the booklet contains 36 pages and that all the 54 questions along with the options are legible. If not contact the invigilator for replacement of the booklet

8. You are allowed to take away the Question Paper at the end of the examination.

Optical Response Sheet

9. The ORS (top sheet) will be provided with an attached Candidate’s Sheet (bottom sheet), The Candidate's Sheet is a carbon - less copy of the ORS.

10. Darken the appropriate bubbles on the ORS by applying sufficient pressure. This will leave an impression at the corresponding place on the Candidate's Sheet

11. The ORS will be collected by the invigilator at the end of the examination.

12. You will be allowed to take away the Candidate's Sheet at the end of the examination.

13. Do not tamper with of mutilate the ORS. Do not use the ORS for rough work.

14. Write your name, roll number and code of the examination center, and sign with pen in the space provided for this purpose on the ORS. Do not write any of these details anywhere else on the ORS. Darken the appropriate bubble under each digit of your roll number.

Darken the Bubbles on the ORS

15. Use a Black Ball Point Pen to darken the bubbles on the ORS.

16. Darken the bubble  completely.

17. The correct way of darkening a bubble is as: 

18. The ORS is machine - gradable. Ensure that the bubbles are darkened in the correct way.

19. Darken the bubbles only if you are sure of the answer. There is no way to erase or "un-darken" a darkened bubble.

SECTION -1 : (Maximum Marks : 28)

- This section contains **SEVEN** questions.
- Each question has FOUR options (A), (B), (C) and (D), **ONE OR MORE THAN ONE** of these four option(s) is(arc) correct.
- For each question, darken the bubble(s) corresponding to all the correct option(s) in the ORS.
- For each question, marks will be awarded in <u>one of the following categories</u> :

Full Marks	+4 If only the bubble(s) corresponding to all the correct option(s) is(are) darkened.
Partial Marks	+1 For darkening a bubble corresponding to each correct option, provided NO incorrect option is darkened.
Zero Marks	0 If none of the bubbles is darkened.
Negative Marks	-2 In all other cases.

- For example, if (A), (C) and (D) are all the correct options for a question, darkening all these three will get +4 marks; darkening only (A) and (D) will get +2 marks and darkening (A) and (B) will get -2 marks, as a wrong option is also darkened.

19. An ideal gas is expanded from (p_1, V_1, T_1) to (p_2, V_2, T_2) under different conditions. The correct statement(s) among the following is (are)

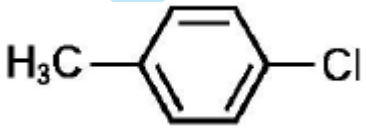
(A) The work done by the gas is less when it is expanded reversibly from V_1 to V_2 under adiabatic conditions as compared to that when expanded reversibly from V_1 to V_2 under isothermal conditions

(B) The change in internal energy of the gas is (i) zero, if it is expanded reversibly with $T_1 = T_2$, and (ii) positive, if it is expanded reversibly under adiabatic conditions with $T_1 \neq T_2$

(C) If the expansion is carried out freely, it is simultaneously both isothermal as well as adiabatic

(D) The work done on the gas is maximum when it is compressed irreversibly from (p_2, V_2) to (p_1, V_1) against constant pressure p_1

20. The IUPAC name (s) of the following compound is (are)



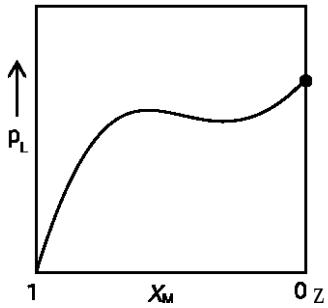
(A) 4-methylchlorobenzene

(B) 4-chlorotoluene

(C) 1-chloro-4-methylbenzene

(D) 1-methyl-4-chlorobenzene

21. For a solution formed by mixing liquids L and M, the vapour pressure of L plotted against the mole fraction of M in solution is shown in the following figure. Here X_L and X_M represent mole fractions of L and M, respectively, in the solution. The correct statement(s) applicable to this system is (are)



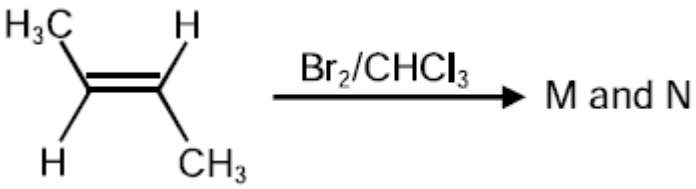
(A) The point Z represents vapour pressure of puree liquid M and Raoult's law is obeyed from $X_L = 0$ to $X_L = 1$

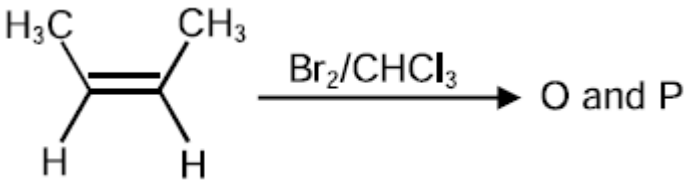
(B) Attractive intermolecular interactions between $L-L$ in pure liquid L and $M-M$ in pure liquid M are stronger than those between $L-M$ when mixed in solution

(C) The point Z represents vapour pressure of pure liquid M and Raoult's law is obeyed when $X_L \to 0$

(D) The point Z represents vapour pressure of pure liquid L and Raoult's law is obeyed when $X_L \to 1$

22. The correct statement(s) for the following addition reactions is (are)

(i) 

(ii) 

(A) (M and O) and (N and P) are two pairs of enantiomers

(B) Bromination proceeds through trans-addition in both the reactions

(C) O and P are identical molecules

(D) (M and O) and (N and P) are two pairs of diastereomers

23. Addition of excess aqueous ammonia to a pink coloured aqueous solution of $MCl_2.6H_2O(X)$ and NH_4Cl gives an octahedral complex Y in the presence of air. In aqueous solution, complex Y behaves as $1:3$ electrolyte. The reaction of X with excess HCl at room temperature results in the formation of a blue coloured complex Z. The calculated spin only magnetic moment of X and Z is $3.87 B.M.$, whereas it is zero for complex Y.

Among the following options, which statement(s) is (are) correct?

(A) The hybridization of the central metal ion in Y is d^2sp^3

(B) Addition of silver nitrate to Y gives only two equivalents of silver chloride

(C) When X and Z are in equilibrium at $0°C$, , the colour of the solution is pink

24. The correct statement(s) about the oxoacids, $HClO_4$ and $HClO_4$, is(are)

(A) The central atom in both $HClO_4$, and HClO is sp^3 hybridized

(B) $HClO_4$ is fonmed in the reaction between Cl_2 and H_2O

(C) The conjugate base of $HClO_4$, is weaker base than H_2O

(D) $HClO_4$ is more acidic than HClO because of the resonance stabilization of its anion

25. The Colour of the X_2 molecules of group 17 elements changes gradually from yellow to violet down the group. This is due to

(A) decrease in $\pi^* - \sigma^*$

(B) decrease in ionization energy down the group

(C) the physical state of X_2 at room temperature changes from gas to solid down the group

(D) decrease in HOMO-LUMO gap down the group

SECTION - 2 : (Maximum Marks : 15)

- This section contains **FIVE** questions.
- The answer to each question is a **SINGLE DIGIT INTEGER** ranging from 0 to 9, both inclusive. For each question, darken the bubble corresponding to the correct integer in the ORS.
- For each question, marks will be awarded in one of the following categories :

Full Marks : +3 If only the bubble corresponding to the correct answer is darkened.

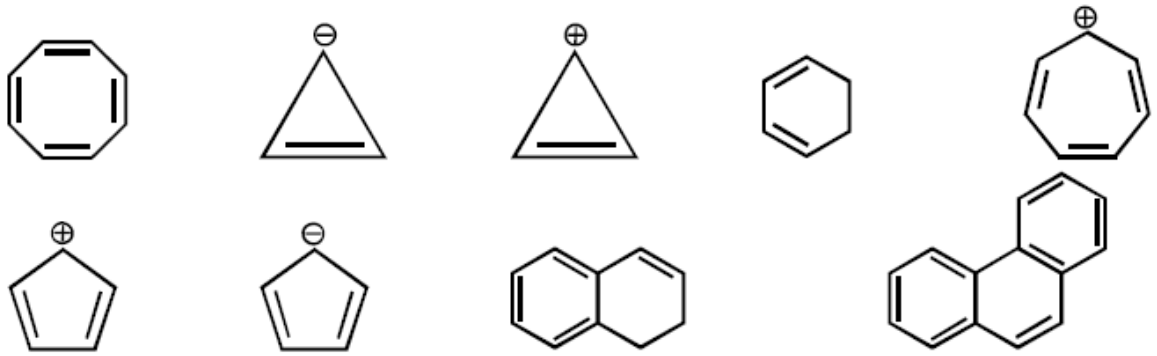
Zero Marks : 0 In all other cases.

26. The sum of the number of lone pairs of electrons on each central atom in the following species is

$[TeBr_6]^{2-}$, $[BrF_2]^+$, SNF_3, and $[XeF_3]^-$

(Atomic numbers: $N = 7$, $F = 9$, $S = 16$, $Br = 35$, $Te = 52$, $Xe = 54$)

27. Among the following, the number of aromatic compound(s) is



28. Among $H_2, He_2^+, Li_2, Be_2, B_2, C_2, N_2, O_2^-$ and F_2. the number of diamagnetic species is

(Atomic numbers: $H=1$, $He=2$, $Li=3$, $Be=4\,B=5$, $C=6$, $N=7$, $O=8$, $F=9$)

29. A crystalline solid of a pure substance has a face-centred cubic structure with a cell edge of $400\,pm$. If the density of the substance in the crystalis $8\,gcm^{-3}$. then the number of atoms present in $256\,g$ of the crystalis $N\times10^{24}$. The value of N is

30. The conductance of a $0.0015M$ aqueous solution of a weak monobasic acid was determined by using a conductivity cell consisting of platinized Pt electrodes. The distance between the electrodes is $120\,cm$ with an area of cross section of $1cm^2$. The conductance of this solution was found to be $5\times10^{-7}S$. The pH of the solution is 4. The value of limiting molar conductivity (A_m°) of this weak monobasic acid in aqueous solution is $Z\times10^2 S\,cm^{-1}mol^{-1}$. The value of Z is

SECTION – 3: (Maximum Marks:18)

- This section contains **SIX** questions of matching type,
- This section contains **TWO** tables (each having 3 columns and 4 rows).
- Based on each table, there are **THREE** questions
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :

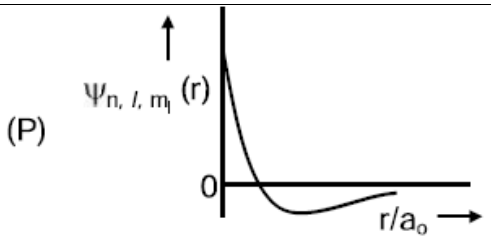
  Full Marks : +3 If only the bubble corresponding to the correct option is darkened,

  Zero Marks : 0 If none of the bubbles is darkened.

  Negative Marks : -1 In all other cases.

Answer Q.31, Q.32 and Q.33 by appropriately matching the information given in the three columns of the following table.

The wave function, ψ_{n,l,m_1} is a mathematical function whose value depends upon spherical polar (r,θ,ϕ) of the electron and characterized by the quantum numbers n, l and m_1 Here r is distance from nucleus . θ is colatitude and ϕ is azimuth. In the mathematical functions given in the Table, Z is atomic number and a_0 is Bohr radius.

Column1	Column2	Column3
(I) 1s orbita	$\psi_{n,l,m_1} \alpha \left(\frac{Z}{a_0}\right)^{\frac{3}{2}} e^{-\left(\frac{zr}{a_0}\right)}$	(P) 
(II) 2s orbital	(ii) One radial node	(Q) Probability density at nucleus $\propto \frac{1}{a_0^3}$
(III) $2p_Z$ orbital	(iii) $\psi_{n,l,m_1} \propto \left(\frac{Z}{a_0}\right)^{\frac{5}{2}} re^{-\left(\frac{zr}{2a_0}\right)} \cos\theta$	(R) Probability density is maximum at nucleus

(IV) $3d_{z^2}$ orbital	(iv) xy – plane is a nodal plane	(S) Energy needed toexcite electron from $n = 2$ state to $n = 4$ state is $\frac{27}{32}$ times the energy needed to exite electron from $n = 2$ state to $n = 6$ state

31. For He^+ ion, the only **INNCORRECT** combination is

(A) (I) (i) (S)

(B) (II) (ii) (Q)

(C) (I) (iii) (R)

(D) (I) (i) (R)

32. For the given orbital in Column 1, the only **CORRECT** combination for any hydrogen-like species is

(A) (II) (ii) (P)

(B) (I) (ii) (S)

(C) (IV) (iv) (R)

(D) (Ill) (iii) (P)

33. For hydrogen atom, the only **CORRECT** combination is

(A) (I) (i) (P)

(B) (I) (iv) (R)

(C) (II) (i) (Q)

(D) (I) (i) (S)

Answer Q.34, Q.35 and Q.36 by appropriately matching the information given in the three columns of the following table.

Columns 1, 2 and 3 contain starting materials, reaction conditions,and type of reactions,respectively.		
Column1	Column 2	Column 3
(I) Toluene	(i) $NaOH/Br_2$	(P) Condensation
(II) Acetophenone	(ii) Br_2/hv	(Q) Carboxylation
(III) Benzaldehyde	(iii) $(CH_3CO)_2O/CH_3COOK$	(R) Substitution
(IV) Phenol	(iv) $NaOH/CO_2$	(S) Haloform

34. The only **CORRECT** combination in which the reaction proceeds through radical mechanism is

(A) (IV) (i) (Q)

(B) (III) (ii) (P)

(C) (II) (iii) (R)

(D) (I) (ii) (R)

35. For the synthesis of benzoic acid, the only **CORRECT** combination is

(A) (II) (i) (S)

(B) (I) (iv) (Q)

(C) (IV) (ii) (P)

(D) (III) (iv) (R)

36. The only CORRECT combination that gives two different carboxylic acids is

(A) (IV) (iii) (Q)

(B) (II) (iv) (R)

(C) (I) (i) (S)

(D) (III) (iii) (P)