# GATE – 2008 – Chemistry

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**Q.1 – 20 Multiple Choice Question (MCQ), carry ONE mark each (for each wrong answer: –1/3).**

**1.** **The total number of isomers of $[Co(en)_2Cl_2]$ is $(en = ethylenediamine)$**

(a) 4 (b) 3 (c) 6 (d) 5

**2.** **Metal-metal quadruple bonds are well-known for the metal**

(a) Ni (b) Co (c) Fe (d) Re

**3.** **The reaction of $Al_4C_3$ with water leads to the formation of**

(a) Methane (b) Propyne (c) Propene (d) propane

**4.** **The correct statement about $C_{60}$ is**

(a) $C_{60}$ is soluble in benzene

(b) $C_{60}$ dose not react with tert-butyllithium

(c) $C_{60}$ is made up of 10 five-membered and 15 six-membered rings

(d) Two adjacent five-membered rings share a common edge

**5.** **The lattice parameters for a monoclinic crystal are**

(a) $a \neq b \neq c$; $\alpha = \gamma = 90°$ (b) $a = b \neq c$; $\alpha \neq \beta \neq \gamma$

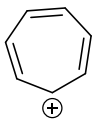
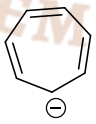
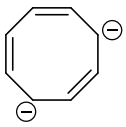
(c) $a \neq b \neq c$; $\alpha \neq \beta \neq \gamma$ (d) $a = b = c$; $\alpha = \gamma = 90^0$

**6.** **The magnetic moment of $[Ru(H_2O)_6]^{2+}$ corresponds to the presence of**

(a) Four unpaired electrons (b) Three unpaired electrons

(c) Two unpaired electrons (d) Zero unpaired electrons

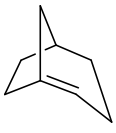
**7.** **The compound that is NOT aromatic is**

(a)  (b)  (c)  (d) 

**8.** **The order of stability for the following cyclic olefins is**

I

II



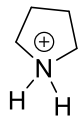
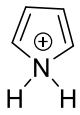
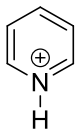
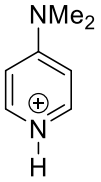
III

IV

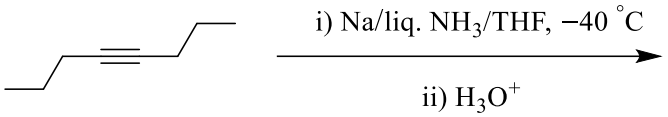
(a) I < II < III < IV (b) II < III < IV < I

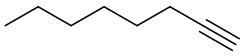
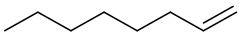
(c) II < III < I < IV (d) IV < II < I < III

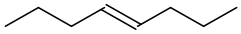
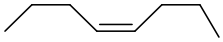
**9.** **The most acidic species is**

(a)  (b)  (c)  (d) 

**10.** **The major product of the following reaction is**




(a)  (b) 

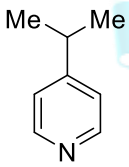
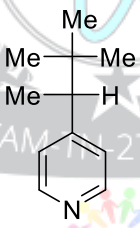
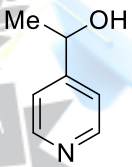
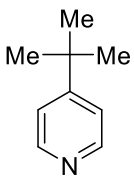
(c)  (d) 

**11.** **In the carbylamine reaction, R−X is converted to R−Y via the intermediate-Z. R−X, R−Y and Z, respectively, are**

(a) R−$NH_2$, R−NC, carbene (b) R−$NH_2$, R−NC, nitrene

(c) R−NC, R−$NH_2$, carbene (d) R−OH, R−NC, nitrene

**12.** **The compound that is NOT oxidized by $KMnO_4$ is**

(a)  (b)  (c)  (d) 

**13.** **Cyanogen bromide (CNBr) specifically hydrolyses the peptide bond formed by the C-side of**

(a) Methionine (b) Glycine (c) Proline (d) Serine

**14.** **The Hammett reaction constant ρ is based on**

(a) The rates of alkaline hydrolysis of substituted ethyl benzoates

(b) The dissociation constants of substituted acetic acids

(c) The dissociation constants of substituted benzoic acids

(d) The dissociation constants of substituted phenols

**15.** **The lifetime of a molecule in an excited electronic state is $10^{-10}$ s. The uncertainty in the energy (eV) approximately is**

(a) $2 \times 10^{-5}$ (b) $3 \times 10^{-6}$ (c) 0 (d) $10^{-14}$

**16.** **For a one component system, the maximum number of phases that can coexist at equilibrium is**

(a) 3 (b) 2 (c) 1 (d) 4

**17.** **At $T = 300K$, the thermal energy $(k_BT)$ in $cm^{-1}$ is approximately**

(a) 20000 (b) 8000 (c) 5000 (d) 200

**18.** **For the reaction $2X_3 = 3X_2$, the rate of formation of $X_2$ is**

(a) $3(-d[X_3]/dt)$ (b) $\frac{1}{2}(-d[X_3]/dt)$ (c) $\frac{1}{3}(-d[X_3]/dt)$ (d) $\frac{3}{2}(-d[X_3]/dt)$

**19.** **The highest occupied molecular orbitals of HF is**

(a) Bonding (b) Antibonding (c) Ionic (d) Non-bonding

**20.** **The residual entropy of the asymmetric molecule $N_2O$ in its crystalline state is 5.8 J $K^{-1}$ $mol^{-1}$ at absolute zero. The number of orientations that can be adopted by $N_2O$ in its crystalline state is**

(a) 4 (b) 3 (c) 2 (d) 1

**Q.21 – Q.85 Multiple Choice Question (MCQ), carry TWO marks each (for each wrong answer: – 2/3).**

**21.** **The spectroscopic ground state symbol and the total number of electronic transitions of $[Ti(H_2O)_6]^{2+}$ are**

(a) $^3T_{1g}$ and 2 (b) $^3A_{2g}$ and 3 (c) $^3T_{1g}$ and 3 (d) $^3A_{2g}$ and 2

**22.** **The structures of the complexes $[Cu(NH_3)_4](ClO_4)_2$ and $[Cu(NH_3)_4](ClO_4)]$ in solution respectively are**

(a) Square planar and tetrahedral (b) Octahedral and square pyramidal

(c) Octahedral and trigonal bipyramidal (d) Tetrahedral and square planar

**23.** **In biological systems, the metal ions involved in electron transport are**

(a) $Na^+$ and $K^+$ (b) $Zn^{2+}$ and $Mg^{2+}$ (c) $Ca^{2+}$ and $Mg^{2+}$ (d) $Cu^{2+}$ and $Fe^{3+}$

**24.** **In a homogeneous catalytic reaction, 1.0 M of a substrate and 1.0 µM of a catalyst yields 1.0 mM of a product in 10 seconds. The turnover frequency (TOF) of the reaction $(s^{-1})$ is**

(a) $10^{-2}$ (b) $10^2$ (c) $10^{-3}$ (d) $10^3$

**25.** **The expected magnetic moments of the first-row transition metal complexes and those of the lanthanide metal complexes are usually calculated using,** (s.o = spin only)

(a) $\mu_{s.o}$ equation for both lanthanide and transition metal complexes

(b) $\mu_{s.o}$ equation for lanthanide metal complexes and $\mu_J$ equation for transition metal complexes

(c) $\mu_{s.o}$ equation for transition metal complexes and $\mu_J$ equation for lanthanide metal complexes

(d) $\mu_{L+S}$ equation for transition metal complexes and $\mu_{s.o}$ equation for lanthanide metal complexes

**26. The Bronsted acidity of boron hydrides follows the order**

(a) $B_2H_6 > B_4H_{10} > B_5H_9 > B_{10}H_{14}$

(b) $B_2H_6 = B_4H_{10} > B_5H_9 = B_{10}H_{14}$

(c) $B_{10}H_{14} > B_5H_9 > B_4H_{10} > B_2H_6$

(d) $B_5H_9 > B_4H_{10} > B_2H_6 > B_{10}H_{14}$

**27. NaCl is crystallized by slow evaporation of its aqueous solution at room temperature. The correct statement is**

(a) The crystals will be non-stoichiometric

(b) The crystals should have Frenkel defects

(c) The percentage of defects in the crystals will depend on the concentration of the solution and its rate of evaporation

(d) The nature of defects will depend upon the concentration of the solution and its rate of evaporation

**28. $CaTiO_3$ has perovskite crystal structure. The coordination number of titanium in $CaTiO_3$ is**

(a) 9 (b) 6 (c) 3 (d) 12

**29. If $ClF_3$ were to be stereochemically rigid, its $^{19}F$-NMR spectrum (I for $^{19}F = ½$) would be (assume that Cl is not NMR active)**

(a) a doublet and a triplet (b) a singlet (c) a doublet and a singlet (d) two singlets

**30. The point group of $NSF_3$ is**

(a) $D_{3d}$ (b) $C_{3h}$ (c) $D_{3h}$ (d) $C_{3v}$

**31. When NiO is heated with a small amount of $Li_2O$ in air at 1200 °C, a non-stoichiometric compound $Li_xNi_{(1-x)}O$ is formed. This compound is**

(a) an n-type semiconductor containing only $Ni^+$

(b) an n-type semiconductor containing $Ni^+$ and $Ni^{2+}$

(c) a p-type semiconductor containing $Ni^{2+}$ and $Ni^{3+}$

(d) a p-type semiconductor containing only $Ni^{3+}$

**32. White phosphorous, $P_4$, belongs to the**

(a) Closo system (b) Nido system (c) Arachno system (d) Hypho system

**33.** **Among the compounds $Fe_3O_4$, $NiFe_2O_4$ and $Mn_3O_4$**

(a) $NiFe_2O_4$ and $Mn_3O_4$ are normal spinels

(b) $Fe_3O_4$ and $Mn_3O_4$ are normal spinels

(c) $Fe_3O_4$ and $Mn_3O_4$ are inverse spinels

(d) $Fe_3O_4$ and $NiFe_2O_4$ are inverse spinels

**34.** **The number of M-M bonds in $Ir_4(CO)_{12}$ are**

(a) Four (b) six (c) eight (d) zero

**35.** **Schrock carbenes are**

(a) Triplets and nucleophilic (b) Triplets and electrophilic

(c) Singlets and nucleophilic (d) Singlets and electrophilic

**36.** **The INCORRECT statement about linear dimethylpolysiloxane, $[(CH_3)_2SiO]_n$, is**

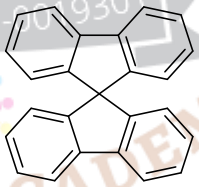
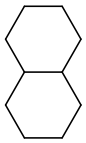
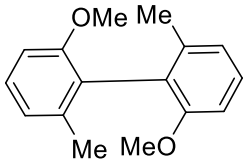
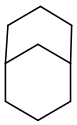
(a) It is extremely hydrophilic

(b) It is prepared by a KOH catalysed ring-opening reaction of $[Me_2SiO]_4$

(c) It has a very low glass transition temperature

(d) It can be reinforced to give silicon elastomers

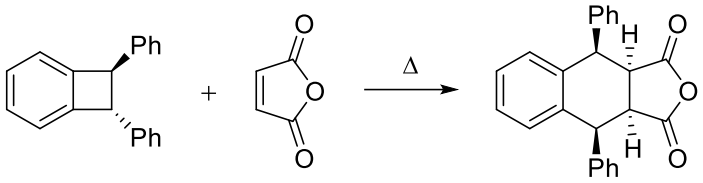
**37.** **Match the entries a-d with their corresponding structures p-s.**

| | | | |
|---|---|---|---|
| **(I)** | **Bridged system** | **p.** |  |
| **(II)** | **Atropisomeric system** | **q.** |  |
| **(III)** | **Spiro system** | **r.** |   |
| **(IV)** | **Fused system** | **s.** |  |

| | I | II | III | IV |
|---|---|---|---|---|
| (a) | s | r | q | p |
| (c) | q | p | s | r |

| | I | II | III | IV |
|---|---|---|---|---|
| (b) | p | s | q | r |
| (d) | s | r | p | q |

**38. The reaction between X and Y to give Z proceeds via**




**X** **Y** **Z**

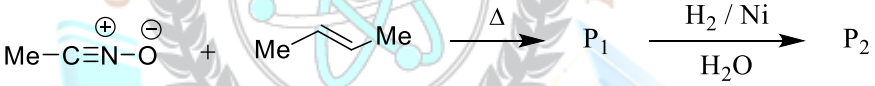
(a) 4π-conrotatory opening of **X** followed by endo Diels-Alder cycloaddition

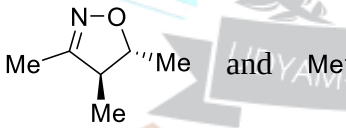
(b) 4π-disrotatory opening of **X** followed by endo Diels-Alder cycloaddition

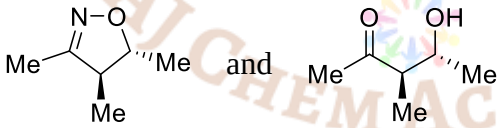
(c) 4π-conrotatory opening of **X** followed by exo Diels-Alder cycloaddition

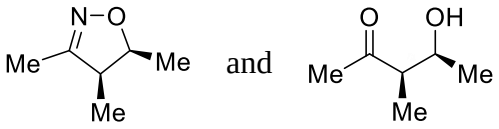
(d) 4π-disrotatory opening of **X** followed by exo Diels-Alder cycloaddition

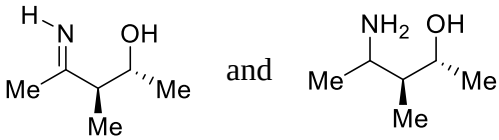
**39. The major products $P_1$ and $P_2$, respectively, in the following reaction sequence are**



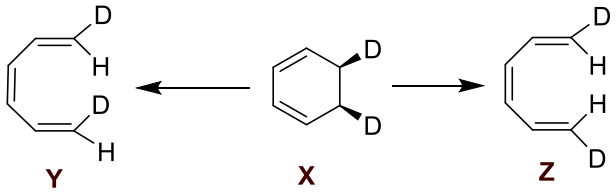

(a) 


(b) 


(c) 


(d) 


**40. The products Y and Z are formed, respectively, from X via**



(a) hν, conrotatory opening and Δ, disrotatory opening

(b) hν, disrotatory opening and Δ, conrotatory opening

(c) Δ, conrotatory opening and hν, disrotatory opening

(d) Δ, disrotatory opening and hν, conrotatory opening

**41. o-bromophenol is readily prepared from the phenol using the following conditions**

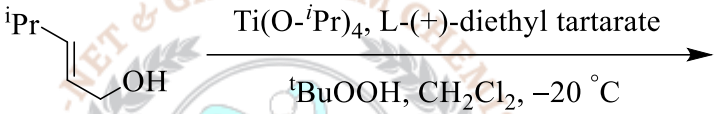
(a) (i) $(CH_3CO)_2O$; (ii) $Br_2$ (iii) $HCl\text{-}H_2O, \Delta$

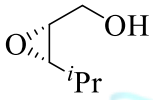
(b) (i) $H_2SO_4, 100\ ^\circ C$ (ii) $Br_2$ (iii) $H_3O^+, 100\ ^\circ C$

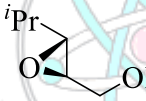
(c) N-bromo succinimide, dibenzoyl peroxide, $CCl_4, \Delta$

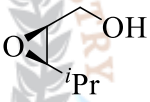
(d) $Br_2$ /$FeBr_3$

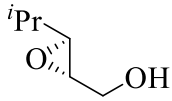
**42. The major product of the following reaction is**




(a) 

(b) 

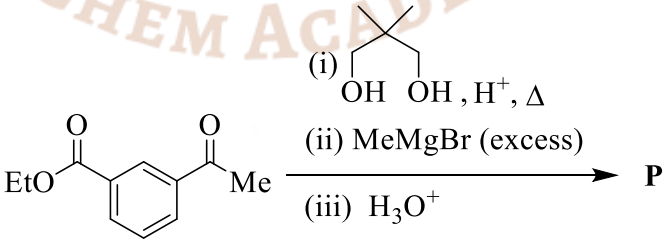
(c) 

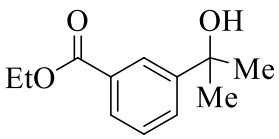
(d) 

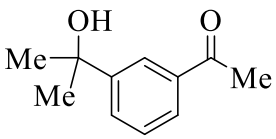
**43. The photochemical reaction of 2-methylpropane with $F_2$ gives 2-fluoro-2-methylpropane and 1-fluoro-2-methylpropane in 14 : 86 ratio. The corresponding ratio of the bromo products in the above reaction using $Br_2$ is most likely to be**

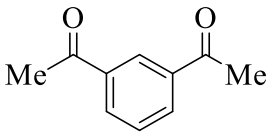
(a) 14 : 86 (b) 50 : 50 (c) 1 : 9 (d) 99 : 1

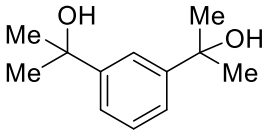
**44. The major product-P of the following reactions is**



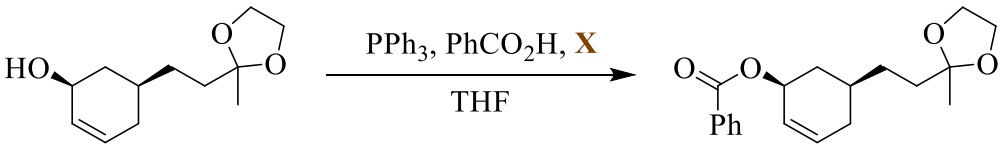

(a) 

(b) 

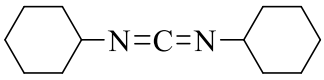
(c) 

(d) 

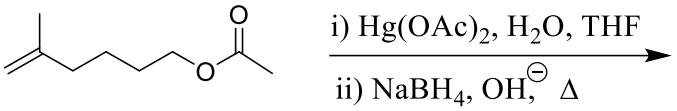
**45. The reagent-X in the following rection is**

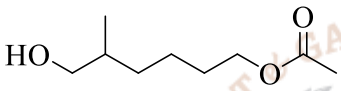


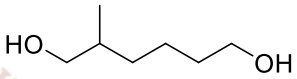

(a) $HO_2C-N=N-CO_2H$ (b) $EtO_2C-HC=CH-CO_2Et$

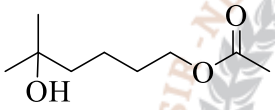
(c) $EtO_2C-N=N-CO_2Et$ (d) 

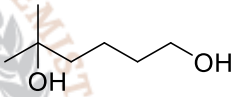

**46. The major product of the following reaction is**



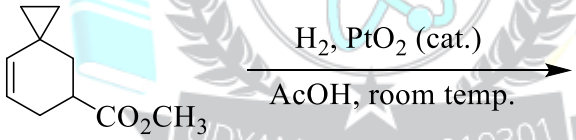

(a) 

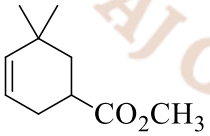

(b) 

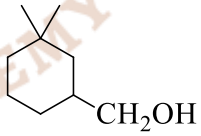

(c) 

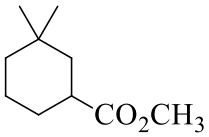

(d) 

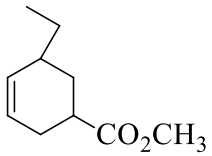

**47 The major product of the following reaction is**



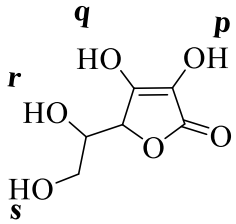

(a) 


(b) 


(c) 

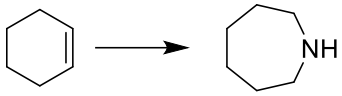

(d) 


**48. In the following compound, the hydroxy group that is most readily methylated with $CH_2N_2$ is**




(a) p (b) q (c) r (d) s

**49.** **The most appropriate sequence of the reactions for carrying out the following transformation is**

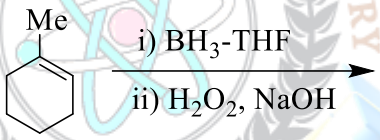


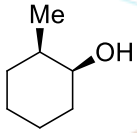

| | (i) | (ii) | (iii) | (iv) |
|---|---|---|---|---|
| (a) | $O_3/H_2O_2$ | Excess $SOCl_2$ /pyridine | Excess $NH_3$ | $LiAlH_4$ |
| (b) | $O_3/Me_2S$ | Excess $SOCl_2$ /pyridine | $LiAlH_4$ | Excess $NH_3$ |
| (c) | $O_3/H_2O_2$ | Excess $SOCl_2$ /pyridine | $LiAlH_4$ | Excess $NH_3$ |
| (d) | $O_3/Me_2S$ | Excess $SOCl_2$ /pyridine | Excess $NH_3$ | $LiAlH_4$ |

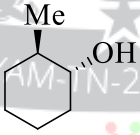
**50.** **The number of optically active stereoisomers possible for 1,3-cyclohexanediol in its chair conformation is**

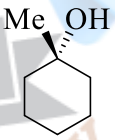
(a) 4 (b) 3 (c) 2 (d) 1

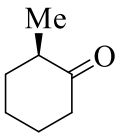
**51.** **The major product of the following reaction is**



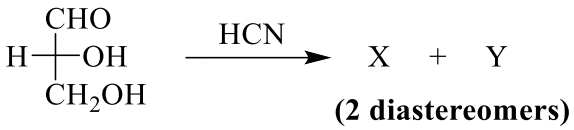

(a) 


(b) 


(c) 


(d) 


**52.** **In the following reaction, the absolute configurations of the chiral centres in X and Y are**



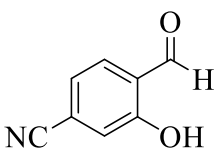

**D-Glyceraldehyde**

(a) 2S, 3R and 2R, 3R (b) 2R, 3R and 2R,3S

(c) 2S, 3S and 2R, 3R (d) 2S, 3R and 2S, 3R

**53.** **The IR stretching frequencies ($cm^{-1}$) for the compound-X are as follows:**

**3300 - 3500 (s, br); 3000 (m); 2225 (s); 1680 (s).**




**X**

**The correct assignment of the absorption band is**

| | $\nu_{(OH)}$ | ; | $\nu_{(CH)}$ | ; | $\nu_{(CN)}$ | ; | $\nu_{(CO)}$ |
|---|---|---|---|---|---|---|---|
| (a) | 3300 – 3500 | ; | 3000 | ; | 2225 | ; | 1680 |
| (b) | 3000 | ; | 3300 – 3500 | ; | 2225 | ; | 1680 |
| (c) | 3300 – 3500 | ; | 3000 | ; | 1680 | ; | 2225 |
| (d) | 3000 | ; | 3300 – 3500 | ; | 1680 | ; | 2225 |

**54.** **The $T_d$ point group has 24 elements and 5 classes. Given that it has two 3- dimensional irreducible representation, the number of one-dimensional irreducible representations is**

(a) 1 (b) 2 (c) 0 (d) 3

**55.** **The total number of ways in which two non-identical spin (½) particles can be oriented relative to a constant magnetic field is**

(a) 1 (b) 2 (c) 3 (d) 4

**56.** **Approximately one hydrogen atom per cubic meter is present in interstellar space. Assuming that the H-atom has a diameter of $10^{-10}$ m, the mean free path (m) approximately is**

(a) $10^{10}$ (b) $10^{19}$ (c) $10^{24}$ (d) $10^{14}$

**57.** **The wavefunction of a diatomic molecule has the form $\Psi = 0.89\,\varphi_{covalent} + 0.45\,\Psi_{ionic}$. The chance that both electrons of the bond will be found on the same atom in 100 inspections of the molecule approximately is**

(a) 79 (b) 20 (c) 45 (d) 60

**58.** **For the reaction given below, the relaxation time is $10^{-6}$ s. Given that 10 % of A remains at equilibrium, the value of $k_1(s^{-1})$ is**

$$A \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} B$$

(a) $9 \times 10^5$ (b) $10^{-5}$ (c) $10^5$ (d) $9 \times 10^{-5}$

**59.** **The minimum number of electrons needed to form a chemical bond between two atoms is**

(a) 1 (b) 2 (c) 3 (d) 4

**60.** **The ground state electronic energy (Hartree) of a helium atom, neglecting the inter-electron repulsion, is**

(a) $-1.0$ (b) $-0.5$ (c) $-2.0$ (d) $-4.0$

**61.** **A particle is confined to a one-dimensional box of length 1 mm. If the length is changed by $10^{-9}$ m, the % change in the ground state energy is**

(a) $2 \times 10^{-4}$ (b) $2 \times 10^{-7}$ (c) $2 \times 10^{-2}$ (d) 0

**62.** **A certain molecule can be treated as having only a doubly degenerate state lying at $360\ cm^{-1}$ above the non-degenerate ground state. The approximate temperature (K) at which 15 % of the molecules will be in the upper state is**

(a) 500 (b) 150 (c) 200 (d) 300

**63.** **A box of volume V contains one mole of an ideal gas. The probability that all N particles will be found occupying one half of the volume leaving the other half empty is**

(a) $1/2$ (b) $2/N$ (c) $(1/2)^N$ (d) $(1/2)^{6N}$

**64.** **According to the Debye-Huckel limiting law, the mean activity coefficient of $5 \times 10^{-4}$ mol $kg^{-1}$ aqueous solution of $CaCl_2$ at 25 °C is**

**(the Debye- Huckel constant 'A' can be taken to be 0.509)**

(a) 0.63 (b) 0.72 (c) 0.80 (d) 0.91

**65.** **The operation of the commutator $[x, d/dx]$ on a function $f(x)$ is equal to**

(a) 0 (b) $f(x)$ (c) $-f(x)$ (d) $x\,df/dx$

**66.** **If a gas obeys the equation of the state $P(V - nb) = nRT$, the ratio $(C_p - C_v)/(C_p - C_v)_{ideal}$ is**

(a) $> 1$ (b) $< 1$ (c) 1 (d) $(1 - b)$

**67.** **Physisorbed particles undergo desorption at 27 °C with the activation energy of $16.628\ kJ\ mol^{-1}$. Assuming first-order process and frequency factor of $10^{12}$ Hz, the average residence time (in seconds) of the particles on the surface is**

(a) $8 \times 10^{-10}$ (b) $8 \times 10^{-11}$ (c) $2 \times 10^{-9}$ (d) $1 \times 10^{-12}$

**68.** **The rotational constant for CO in the ground and the excited vibrational states are 1.9 and 1.6 $cm^{-1}$, respectively. The % change in internuclear distance due to vibrational excitation is**

(a) 9 (b) 30 (c) 16 (d) 0

**69.** **The mechanism of enzyme (E) catalysed reaction of a substrate (S) to yield product (P) is**

$$E + S \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} [ES] \underset{k_{-2}}{\overset{k_2}{\rightleftharpoons}} E + P \quad ; \quad \frac{-d[S]}{dt} = \frac{k_1 k_2 [S] - k_{-1} k_{-2} [P]}{k_1 [S] + k_{-2} [P] + k_{-1} + k_2} [E]_0$$

**If a small amount of S is converted to P, the maximum rate for the reaction will be observed for**

(a) $(k_{-1} + k_2) \gg k_1[S]_0$ (b) $(k_{-1} + k_2) \ll k_1[S]_0$

(c) $(k_{-2} + k_2) = (k_{-1} + k_1)$ (d) $k_{-2} \ll k_1$

**70.** **The lowest energy state of the following $(1s)^2(2s)^1(3s)^1$ configuration of Be is**

(a) $^1S_0$ (b) $^1D_2$ (c) $^3S_1$ (d) $^3P_1$

**Common Data Questions 71, 72, and 73:**

**An electron accelerated through a potential difference of φ of volts impinges on a nickel surface, whose (100) planes have a spacing $(d) = 351.8 \times 10^{-12}$ m $(351.8$ pm$)$.**

**71.** **The de-Broglie wavelength of the electron is $\lambda/\text{pm} = (a/\varphi)^{1/2}$. The value of 'a' in volts is**

(a) $1.5 \times 10^{-18}$ (b) $1.5 \times 10^{6}$ (c) $6.63 \times 10^{-5}$ (d) $2.5 \times 10^{18}$

**72.** **The condition for observing diffraction from the nickel surface is**

(a) $\lambda \gg 2d$ (b) $\lambda \leq 2d$ (c) $\lambda \leq ad$ (d) $\lambda \geq ad$

**73.** **The minimum value of φ(V) for the electron to diffract from the (100) planes is**

(a) 3000 (b) 300 (c) 30 (d) 3

**Common Data Questions 74 and 75:**

**An iron complex $[FeL_6]^{2+}$ catalyses the oxidation of $(CH_3)_2S$ by perbenzoic acid. (L = neutral monodendate ligand)**

**74.** **The formation of organic product in the above reaction is monitored by**

(a) Gas chromatography (b) Cyclic voltammetry

(c) Electron spin resonance (d) Fluorescence spectroscopy

**75.** **The oxidation state of the metal ion in the catalyst can be detected by**

(a) Atomic absorption spectroscopy (b) Mossbauer spectroscopy

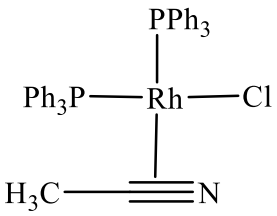
(c) HPLC (d) Gas chromatography

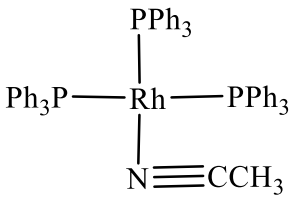
**Linked Answer Questions 76 and 77:**

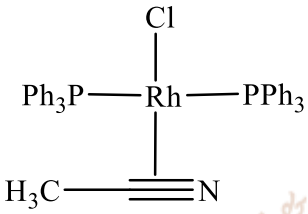
**In the reaction,**

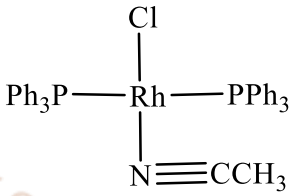
$$[(PPh_3)_3RhCl] \xrightarrow{CH_3CN} X + Y$$

**76. Compound X is**

(a) 

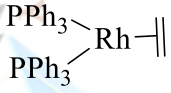
(b) 

(c) 

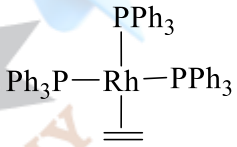
(d) 

**77. $[Rh(PPh_3)_3Cl]$ reacts very fast with a gaseous mixture of $H_2$ and $C_2H_4$ to immediately give Z. The structure of Z is**

(a) $H_3C-CH_3$

(b) 

(c) $(PPh_3)_2RhCl(\eta^2\text{-}C_2H_4)$

(d) 

**Linked Answer Questions 78 and 79:**

**The reaction of $PCl_3$ with methanol in the presence of triethylamine affords compound-X. EI mass spectrum of X shows a parent ion peak at $m/z = 124$. Microanalysis of X shows that it contains C, H, O and P. The $^1$H-NMR spectrum of X shows a doublet at 4.0 ppm. The separation between the two lines of the doublet is approximately 15 Hz (1 for $^1$H and $^{31}$P = ½).**

**78. Compound X is**

(a) $(CH_3O)_3P$ (b) $(CH_3O)_2P(O)$ (c) $(CH_3O)_2P(O)(OH)$ (d) $(CH_3O)_3PH$

**79. Upon heating, compound-X is converted to Y, which has the same molecular formula as that of X. The $^1$H-NMR spectrum shows two doublets centered at 3.0 ppm (Separation of two lines ~20 Hz) and 4.0 ppm (separation of two lines ~ 15Hz) respectively.**

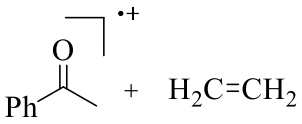
**The compound Y is**

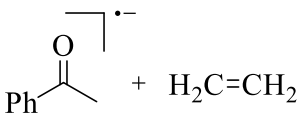
(a) $(CH_3O)_2P(O)(OH)$ (b) $(CH_3O)_3P$

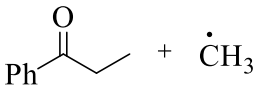
(c) $(CH_3O)_2(CH_3)P(O)$ (d) $(CH_3O)_2(CH_3)P(OH)$

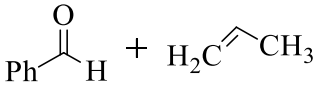
**Linked Answer Questions 80 and 81:** For butyrophenone ($PhCOCH_2CH_2CH_3$),

**80.** The most probable fragmentation observed in the electron impact ionization (EI) mass spectrometry is

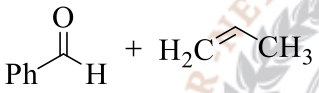
(a) 

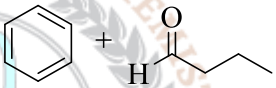
(b) 

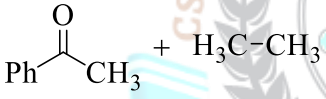
(c) 

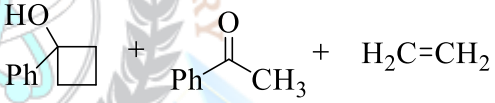
(d) 

**81.** Photoirradiation leads to the following set of the products.

(a) 

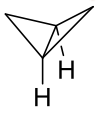
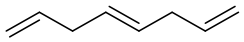
(b) 

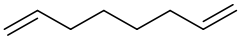
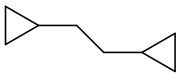
(c) 

(d) 

**Linked Answer Questions 82 and 83:** In the following reaction,


**82.** The reactive intermediate-I and the product-P are

(a) Carbene and  (b) Radical and 

(c) Carbene and  (d) Radical and 

**83.** The product-P shows 'm' and 'n' number of signals in $^1H$ and $^{13}C$-NMR spectra, respectively. The values of 'm' and 'n' are

(a) m = 3 and n = 2 (b) m = 2 and n = 3 (c) m = 2 and n = 2 (d) m = 4 and n= 3

**Linked Answer Questions 84 and 85:**

The infrared spectrum of a diatomic molecule exhibits transitions at 2144, 4262 and 6354 $cm^{-1}$ corresponding to excitations from the ground state to the first, second and, third vibration states respectively.

**84.** The fundamental transition ($cm^{-1}$) of the diatomic molecule is at

(a) 2157 (b) 2170 (c) 2183 (d) 2196

**85.** **The anharmonicity constant ($cm^{-1}$) of the diatomic molecule is**

(a) 0.018 (b) 0.012 (c) 0.006 (d) 0.003

## Answer Key

| Q.No | Ans | | Q.No | Ans | | Q.No | Ans | | Q.No | Ans |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. | b | | 26. | c | | 51. | b | | 76. | d |
| 2. | d | | 27. | c | | 52. | a | | 77. | d |
| 3. | a | | 28. | b | | 53. | a | | 78. | a |
| 4. | a | | 29. | a | | 54. | b | | 79. | b |
| 5. | a | | 30. | d | | 55. | d | | 80. | a |
| 6. | d | | 31. | c | | 56. | b | | 81. | d |
| 7. | b | | 32. | b | | 57. | b | | 82. | a |
| 8. | c | | 33. | d | | 58. | a | | 83. | a |
| 9. | b | | 34. | b | | 59. | a | | 84. | b |
| 10. | c | | 35. | a | | 60. | c | | 85. | c |
| 11. | a | | 36. | a | | 61. | a | | | |
| 12. | d | | 37. | d | | 62. | c | | | |
| 13. | a | | 38. | a | | 63. | c | | | |
| 14. | c | | 39. | b | | 64. | d | | | |
| 15. | b | | 40. | a | | 65. | c | | | |
| 16. | a | | 41. | d | | 66. | c | | | |
| 17. | d | | 42. | d | | 67. | a | | | |
| 18. | d | | 43. | d | | 68. | a | | | |
| 19. | d | | 44. | b | | 69. | b | | | |
| 20. | c | | 45. | d | | 70. | c | | | |
| 21. | c | | 46. | d | | 71. | b | | | |
| 22. | a | | 47. | c | | 72. | b | | | |
| 23. | d | | 48. | b | | 73. | d | | | |
| 24. | b | | 49. | a | | 74. | c | | | |
| 25. | c | | 50. | c | | 75. | b | | | |