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**Q.21 – Q.70 Multiple Choice Question (MCQ), carry TWO marks each (for each wrong answer: – 0.5). You are required to Answer Maximum 35 Questions.**

**21.** **Identify which of the following operators is NOT Hermitian?**

(a) $\frac{\hbar}{i}\frac{d}{dx}$ (b) $i\frac{d^2}{dx^2}$ (c) $\frac{d^2}{dx^2}$ (d) $x^2$

**22.** **The term symbol for the ground state of nitrogen atoms is**

(a) ${}^3P_0$ (b) ${}^4P_{\frac{3}{2}}$ (c) ${}^1P_1$ (d) ${}^4S_{\frac{3}{2}}$

**23.** **$P_A$ and $P_B$ denote the populations of two energy states $E_A$ and $E_B$, and $E_A > E_B$. The correct statement when the temperature $T_1 > T_2$ is**

(a) $P_A(T_1) > P_B(T_1), P_A(T_2) < P_B(T_2)$ and $\left(\frac{P_A}{P_B}\right)_{T_1} > \left(\frac{P_A}{P_B}\right)_{T_2}$

(b) $P_A(T_1) < P_B(T_1), P_A(T_2) > P_B(T_2)$ and $\left(\frac{P_A}{P_B}\right)_{T_1} < \left(\frac{P_A}{P_B}\right)_{T_2}$

(c) $P_A(T_1) < P_B(T_1), P_A(T_2) < P_B(T_2)$ and $\left(\frac{P_A}{P_B}\right)_{T_1} > \left(\frac{P_A}{P_B}\right)_{T_2}$

(d) $P_A(T_1) < P_B(T_1), P_A(T_2) < P_B(T_2)$ and $\left(\frac{P_A}{P_B}\right)_{T_1} < \left(\frac{P_A}{P_B}\right)_{T_2}$

**24.** **The uncertainty in the NMR frequency of a compound in liquid state (relaxation time = 1s) is 0.1 Hz. The uncertainty in the frequency (in Hz) of same compound in solid state (relaxation time = $10^{-4}$ s) is**

(a) $10^{-4}$ (b) 100 (c) 1000 (d) $10^{-3}$

**25.** **Which one of the following conductometric titrations will show a linear increase of the conductance with volume of the titrant added up to the break point and an almost constant conductance after-wards.**

(a) A strong acid with a strong base (b) A strong acid with a weak base

(c) A weak acid with a strong base (d) A weak acid a weak base

**26.** **Flocculation value of $K_2SO_4$ is much less than that of KBr for Sol A. Flocculation value of $CaCl_2$ is much less than that of NaCl for Sol B. Which of the following statements is correct?**

(a) Sol A is negatively charged and Sol B is positively charged

(b) Both the sols are negatively charged

(c) Sol A is positively charged and Sol B is negatively charged

(d) Both the sols are positively charged

**27. For a system of constant composition, the pressure (P) is given by,**

(a) $-\left(\frac{\partial U}{\partial S}\right)_V$ (b) $-\left(\frac{\partial U}{\partial V}\right)_S$ (c) $\left(\frac{\partial V}{\partial S}\right)_T$ (d) $\left(\frac{\partial U}{\partial V}\right)_T$

**28. The value of $d_{111}$ in a cubic crystal is $325.6$ pm. The value of $d_{333}$ is**

(a) 325.6 pm (b) 976.8 pm (c) 108.5 pm (d) 625.6 pm

**29. The symmetry point group of ethane in its staggered conformation is**

(a) $C_{3v}$ (b) $D_{3d}$ (c) $D_{3h}$ (d) $S_6$

**30. For the reaction $C_2H_{4(g)} + 3O_{2(g)} \longrightarrow 2CO_{2(g)} + 2H_2O_{(l)}$, the value of $\Delta H - \Delta U$ (in kJ) at 300 K and 1 bar is**

(a) $-5.0$ (b) 0.0 (c) 2.5 (d) 5.0

**31. The sodium D lines are due to $^2P_{1/2} \longrightarrow {}^2S_{1/2}$ $(\Delta E_1)$ and $^2P_{1/2} \longrightarrow {}^2S_{1/2}(\Delta E_2)$ transitions. The splitting due to spin-orbit coupling in $^2P$ state of the sodium atom is**

(a) $\Delta E_2 + \Delta E_1$ (b) $\Delta E_2 - \Delta E_1$ (c) $\frac{\Delta E_2 + \Delta E_1}{2}$ (d) $\frac{\Delta E_2 - \Delta E_1}{2}$

**32. The rate constant of a unimolecular reaction was $2.66 \times 10^{-3} s^{-1}$ and $2.2 \times 10^{-1} s^{-1}$ at $T = 120$ K and $360$ K respectively. The rate constant (in $s^{-1}$ units) at $240$ K would be**

(a) $2.4 \times 10^{-2}$ (b) $2.4 \times 10^{-1}$ (c) $4.8 \times 10^{-2}$ (d) $1.8 \times 10^{-3}$

**33. For a potentiometric titration, in the curve of emf (E) vs volume (V) of the titrant added, the equivalence point is indicated by**

(a) $|dE/dV| = 0, |d^2E/dV^2| = 0$ (b) $|dE/dV| = 0, |d^2E/dV^2| > 0$

(c) $|dE/dV| > 0, |d^2E/dV^2| = 0$ (d) $|dE/dV| > 0, |d^2E/dV^2| > 0$

**34. The osmotic pressure (π) of a polymer sample at different concentrations (c) was measured at T(K). A plot of (π/c) versus c gave a straight line with slope (m) and intercept (c′). The number average molecular weight of the polymer is (R = gas constant).**

(a) $\frac{Rt}{c'}$ (b) $\frac{c'}{RT}$ (c) RT (d) mRT

**35. The concentration of a reactant undergoing decomposition was $0.1, 0.08$ and $0.067$ mol $L^{-1}$ after $1.0, 2.0$ and $3.0$ hr respectively, the order of the reaction is**

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

**36. A particle is constrained in a one-dimensional box of length "2a" with potential $V(x) = \infty;\ x < -a, x > a$ and $V(x) = 0; -a \le x \le a$. Energy difference between levels n = 3 and n = 2 is**

(a) $\frac{5h^2}{8ma^2}$ (b) $\frac{9h^2}{8ma^2}$ (c) $\frac{9h^2}{32ma^2}$ (d) $\frac{5h^2}{32ma^2}$

**37. In the $^{19}F$-NMR spectrum of $PF_5$, the number of signals and multiplicity, at room temperature are**

(a) One, singlet (b) one, doublet (c) two, doublet (d) two, singlet

**38. The correct statement regarding closo-$\{B_nH_n\}$ species is**

(a) It always has $-2$ charge

(b) It always has $+2$ charge

(c) It is a neutral species

(d) It is more reactive than nido, arachno and hypo boranes

**39. Lewis acidity of $BCl_3$, $BPh_3$ and $BMe_3$, with respect to pyridine follows the order**

(a) $BCl_3 > BPh_3 > BMe_3$ (b) $BMe_3 > BPh_3 > BCl_3$

(c) $BPh_3 > BMe_3 > BCl_3$ (d) $BCl_3 > BMe_3 > BPh_3$

**40. Superoxide dismutase(SOD) contains the metal ions**

(a) $Zn^{2+}$ and $Ni^{2+}$ (b) $Cu^{2+}$ and $Zn^{2+}$ (c) $Ni^{2+}$ and $Co^{3+}$ (d) $Cu^{2+}$ and $Fe^{3+}$

**41. The number of antibonding electrons in NO and CO according to MO theory are respectively,**

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

**42. The correct combination of metal, number of carbonyl ligands and the charge for a metal carbonyl complex $[M(CO)_x]^{z-}$ that satisfies the 18 electron rule is**

(a) $M = Ti, x = 6, z = 1$ (b) $M = V, x = 6, z = 1$

(c) $M = Co, x = 4, z = 2$ (d) $M = Mo, x = 5, z = 1$

**43. Among the following pairs**

**Oxygen – Sulfur**
**P**

**Nitrogen – Phosphorus**
**Q**

**Phosphorus – Arsenic**
**R**

**Chlorine – Iodine**
**S**

**Those in which the first ionization energies differ by more than 300 kJ mole$^{-1}$ are**

(a) (P) and (S) (b) (P) and (Q) (c) (Q) and (R) (d) (R) and (S)

**44. The stable cyclopentadienyl complex of beryllium is**

(a) $[Be(\eta^2\text{-}C_5H_5)_2]$ (b) $[Be(\eta^2\text{-}C_5H_5)(\eta^3\text{-}C_5H_5)]$

(c) $[Be(\eta^1\text{-}C_5H_5)(\eta^3\text{-}C_5H_5)]$ (d) $[Be(\eta^1\text{-}C_5H_5)(\eta^5\text{-}C_5H_5)]$

**45. The reaction between $NH_4Br$ and Na metal in liquid ammonia (solvent) results in the products**

(a) NaBr, HBr (b) NaBr, $H_2$ (c) $H_2$, HBr (d) HBr, $H_2$

**46. The material that exhibits the highest electrical conductivity among the following Sulfur - Nitrogen compounds is**

(a) $S_4N_4$ (b) $S_7NH$ (c) $S_2N_2$ (d) $(SN)_x$

**47. Uranium fluorides co-precipitate with**

(a) $CaF_2$ (b) AgF (c) LiF (d) $MgF_2$

**48. The acid-base indicator (HIn) shows a colour change at pH $6.40$ when $20\ \%$ of it is ionized. The dissociation constant of the indicator is**

(a) $9.95 \times 10^{-8}$ (b) $3.95 \times 10^{-6}$ (c) $4.5 \times 10^{-8}$ (d) $6.0 \times 10^{-8}$

**49. The actual magnetic moment shows a large deviation from the spin-only formula in the case of**

(a) $Ti^{3+}$ (b) $V^{3+}$ (c) $Gd^{3+}$ (d) $Sm^{3+}$

**50. The complex that absorbs light of shortest wavelength is,**

(a) $[CoF_6]^{3-}$ (b) $[Co(H_2O)_6]^{3+}$ (c) $[Co(NH_3)_6]^{3+}$ (d) $[Co(ox)_3]^{3-}$

**51. Two α particles having speeds $S_1$ and $S_2$ have kinetic energies 1 and 2 MeV respectively; the relationship between $S_1$ and $S_2$ is:**

(a) $S_1 = 2S_2$ (b) $S_2 = 2S_1$ (c) $S_2 = \sqrt{2}S_1$ (d) $S_1 = \sqrt{2S_2}$

**52. Green coloured $[Ni(PPh_2Et)_2Br_2]$, has a magnetic moment of $3.20$ BM. The geometry and the number of isomers possible for the complex respectively, are**

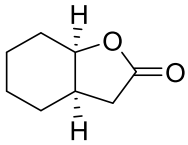
(a) square planar and one (b) tatrahedral and one

(c) Square planer and two (d) tetrahedral and two

**53. The chemiluminescence method for determining NO in environmental samples is based on formation of $NO_2^*$(excited) which is generally generated by reacting NO with**

(a) $O_2$ (b) $O_2^-$ (c) $O_3$ (d) $O_2^{2-}$

**54. In the IR spectrum, carbonyl absorption band for the following compound appears at**

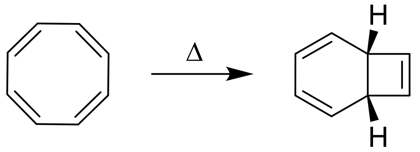


(a) 1810 $\text{cm}^{-1}$ (b) 1770 $\text{cm}^{-1}$ (c) 1730 $\text{cm}^{-1}$ (d) 1690 $\text{cm}^{-1}$

**55. Among the following compounds, the formyl anion equivalent is**

(a) acetylene (b) nitromethane (c) ethyl chloroformate (d) 1,4-dithiane

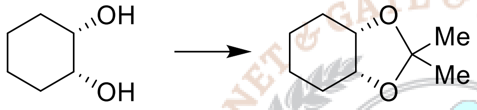
**56. In the following concerted reaction, the product is formed by a**



(a) 6π-disrotatory electrocyclization (b) 4π-disrotatory electrocyclization

(c) 6π-conrotatory electrocyclization (d) 4π-conrotatory electrocyclization

**57. A suitable reagent combination for carrying out the following conversion is**



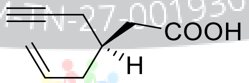
(a) trimethyl orthoacetate and p-toluenesulfonic acid

(b) trimethyl orthoacetate and sodium hydroxide

(c) 2-methoxypropene and p-toluenesulfonic acid

(d) 2-methoxypropene and sodium hydroxide

**58. The IUPAC name of the following compound is**



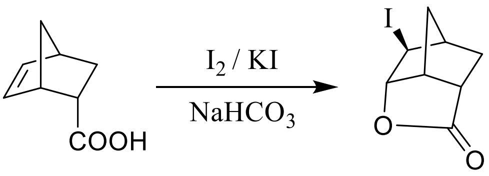
(a) (R)-3-(prop-2-enyl) hex-5-ynoic acid (b) (S)-3-(prop-2-enyl) hex-5-ynoic acid

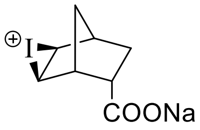
(c) (R)-3-(prop-2-enyl) hex-5-enoic acid (d) (S)-3-(prop-2-ynyl) hex-5-enoic acid

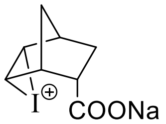
**59. In the mass spectrum of dodecahedrane ($C_{20}H_{20}$), approximate ratio of the peaks at $m/z$ 260 and 261 is:**

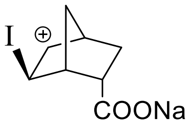
(a) 1 : 1 (b) 5 : 1 (c) 10 : 1 (d) 20 : 1

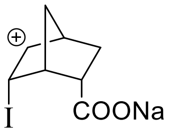
**60. The reaction given below proceeds through:**



(a)


(b)


(c)


(d)


**61. Among the following drugs, the anticancer agents is:**

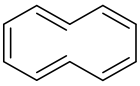
(a) captopril (b) chloroquine (c) camptothecin (d) ranitidine

**62. The reaction that involves the formation of both C-C and C-O bonds is**

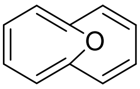
(a) Diels-Alder reaction (b) Darzen's glycidic ester condensation

(c) aldol reaction (d) Beckmann rearrangement

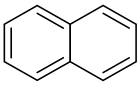
**63. Among P-R, the aromatic compounds are**



**P**



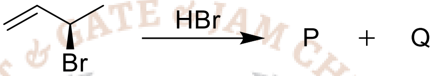
**Q**



**R**

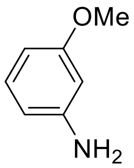
(a) P, Q and R (b) P and Q only (c) Q and R only (d) P and R only

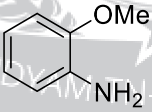
**64. In the following Markownikov addition reaction, the products P and Q are**

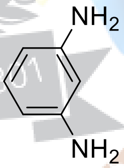


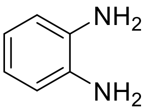
(a) homomers (b) enantiomers (c) diastereomers (d) regioisomers

**65. The major product formed in the following reaction is:**

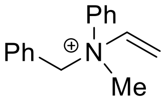
(a)


(b)


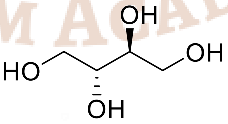
(c)


(d)


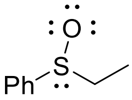
**66. Among P-R, the compounds which can exhibit optical activity are**



**P**



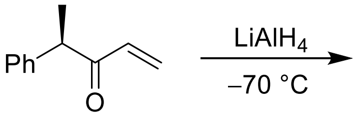
**Q**

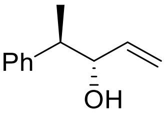


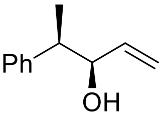
**R**

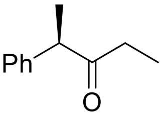
(a) P, Q and R (b) P and Q only (c) P and R only (d) Q and R only

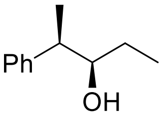
**67. The major product formed in the following reaction is:**



(a)


(b)


(c)


(d)


**68. An organic compound (MF : $C_8H_{10}O$) exhibited the following spectral data. The compound among the choices, is**

**$^1$H-NMR** : **$2.5$ ($3H, s$), $3.8$ ($3H, s$), $6.8$ ($2H, d, J = 8$ Hz), $7.2$ ($2H, d, J = 8$ Hz) ppm**

(a) 4-ethylphenol (b) 2-ethylphenol

(c) 4-methylanisole (d) 4-methylbenzyl alcohol

**69. With respect to electrophilic aromatic substitution, reactivity order of pyrrole, pyridine and indole is**

(a) indole > pyrrole > pyridine (b) pyrrole > pyridine > indole

(c) pyrrole > indole > pyridine (d) indole > pyridine > pyrrole

**70. The most appropriate reagent suitable for the conversion of 2-octyne into trans-2-octene is**

(a) zinc and acetic acid (b) 10% Pd/C

(c) lithium in liquid ammonia (d) hydrazine hydrate

**Q.71 – Q.145 Multiple Choice Question (MCQ), carry FOUR marks each (for each wrong answer: –1). You are required to Answer Maximum 25 Questions.**

**71. Consider a n-type semiconductor whose $E_v = 0$, $E_c = 2.0$ eV and $E_d = 1.98$ eV. The correct statement among the following is**

(a) $E_f = 1$ eV and is independent of T

(b) $E_f = 1.99$ eV and remains independent of T

(c) $E_f = 1.99$ eV and increases towards 2.0 eV with increase of T

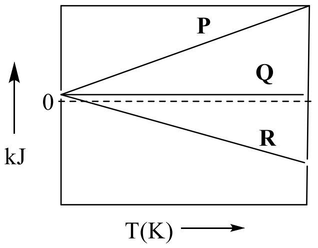
(d) $E_f = 1.99$ eV and decreases with increase of T

**72. Reaction of $[Fe(CO)_5]$ with $OH^-$ leads to complex-X which on oxidation with $MnO_2$ gives Y. Compounds X and Y respectively are**

(a) $[HFe(CO)_4]^-$ and $Fe_3(CO)_{12}$ (b) $[Fe(CO)_5(OH)]^-$ and $Fe_2(CO)_9$

(c) $[Fe(CO)_4]^{2-}$ and $Mn_2(CO)_{10}$ (d) $[HFe(CO)_4]^-$ and $Fe_2O_3$

**73. For the reaction $H_2O_{(g)} + C_{(graphite)} \rightleftharpoons CO_{(g)} + H_{2(g)}$, the variation of energy parameter $\Delta G°, \Delta H°$ and $T\Delta S°$ of the reaction over a large temperature range is shown below. The correct identification of the curves is given by**



| | P | Q | R | | P | Q | R |
|---|---|---|---|---|---|---|---|
| (a) | $\Delta G^\circ$ ; | $\Delta H^\circ$ ; | $T\Delta S^\circ$ | (b) | $\Delta H^\circ$ ; | $\Delta G^\circ$ ; | $T\Delta S^\circ$ |
| (c) | $\Delta G^\circ$ ; | $T\Delta S^\circ$ ; | $\Delta H^\circ$ | (d) | $T\Delta S^\circ$ ; | $\Delta H^\circ$ ; | $\Delta G^\circ$ |

**74.** **A Sodalite cage in zeolites is**

(a) a truncated tetrahedron
(b) an icosahedron
(c) a truncated octahedron
(d) a dodecahedron

**75.** **Two moles of a non-volatile solute is dissolved in 48 mol of water and the resultant solution has a vapour pressure of $0.0392$ bar at 300 K. If the vapour pressure of pure water at 300 K is $0.0400$ bar, the activity coefficient of water in the solution is:**

(a) 0.96
(b) 0.98
(c) 1.00
(d) 1.02

**76.** **The final product(s) of the reaction $P(OR)_3 + R'X$ is/are:**

(a) $R'PO(OR)_2$ and RX
(b) $[R'PO(OR)_2]X$
(c) $[R'RPO_2(OR)]X$
(d) ROR′ and $P(OR)_2X$

**77.** **1 mol of $CO_2$, 1 mol of $N_2$ and 2 mol of $O_2$ were mixed at 300 K. The entropy of mixing is**

(a) 6 R ln2
(b) 8 R ln2
(c) $\frac{8R\ln 2}{300}$
(d) 16R ln2

**78.** **For the eigenstates of the hydrogen atom, which of the following relations between the expectation value of kinetic energy (T) and potential (V) holds true?**

(a) $\langle T\rangle = \langle V\rangle$
(b) $2\langle T\rangle = -\langle V\rangle$
(c) $2\langle T\rangle = \langle V\rangle$
(d) $\langle T\rangle = -2\langle V\rangle$

**79.** **For the liquid $\rightleftharpoons$ vapour equilibrium of a substance $\frac{dP}{dT}$ at 1 bar and 400 K is $8 \times 10^{-3}$ bar $K^{-1}$. If the molar volume in the vapour form is 200 L $mol^{-1}$ and the molar volume in the liquid form is negligible, the molar enthalpy of vapourisation is $(1.0 \text{ bar L} = 100 \text{ J})$**

(a) 640 kJ $mol^{-1}$
(b) 100 kJ $mol^{-1}$
(c) 80 kJ $mol^{-1}$
(d) 64 kJ $mol^{-1}$

**80.** **The correct order of acidity among the following species is:**

(a) $[Na(H_2O)_6]^+ > [Ni(H_2O)_6]^{2+} > [Mn(H_2O)_6]^{2+} > [Sc(H_2O)_6]^{3+}$
(b) $[Sc(H_2O)_6]^{3+} > [Ni(H_2O)_6]^{2+} > [Mn(H_2O)_6]^{2+} > [Na(H_2O)_6]^+$
(c) $[Mn(H_2O)_6]^{2+} > [Ni(H_2O)_6]^{2+} > [Sc(H_2O)_6]^{3+} > [Na(H_2O)_6]^+$
(d) $[Sc(H_2O)_6]^{3+} > [Na(H_2O)_6]^+ > [Ni(H_2O)_6]^{2+} > [Mn(H_2O)_6]^{2+}$

**81.** **The Langmuir adsorption isotherm is given by $\theta = \frac{KP}{1+KP}$, where P is the pressure of the adsorbate gas. The Langmuir adsorption isotherm for a diatomic gas $A_2$**

**undergoing dissociative adsorption is:**

(a) $\theta = \frac{KP}{1+KP}$ (b) $\theta = \frac{2KP}{1+2KP}$ (c) $\theta = \frac{(KP)^2}{1+(KP)^2}$ (d) $\theta = \frac{(KP)^{1/2}}{1+(KP)^{1/2}}$

**82.** **The standard electrode potentials ($E^\circ$) and $Fe^{3+}/Fe^{2+}$ and $Fe^{2+}/Fe$ electrodes are $+0.77$ V and $-0.44$ V respectively at 300 K. The $E^\circ$ of $Fe^{3+}/Fe$ electrode at the same temperature is**

(a) 1.21 V (b) 0.33 V (c) $-0.11$V (d) $-0.04$ V

**83.** **Which of the following is true for the radial part of the hydrogen atom wave functions $R_{nl}(r)$(where n is principal quantum number) and the nodes associated with them?**

(a) The radial part of only s function is non-zero at the origin and has $(n - 1)$ nodes

(b) The radial part of s function is zero at the origin and has n number of nodes

(c) All radial functions have values of zero at the origin and have $(n - 1)$ nodes

(d) The radial parts of all s functions are zero at the origin and have no nodes

**84.** **For non-degenerate perturbation theory for ground state, with $E_0^{(0)}$ as zeroth order energy, $E_0^{(1)}$ as the first-order perturbation correction and $E_0$ as the exact energy, which of the following is true?**

(a) $\left(E_0^{(0)} + E_0^{(1)}\right)$ is always equal to $E_0$ (b) $\left(E_0^{(0)} + E_0^{(1)}\right) \leq E_0$

(c) $\left(E_0^{(0)} + E_0^{(1)}\right) \geq E_0$ (d) $E_0^{(0)} \leq \left(E_0 + E_0^{(1)}\right)$

**85.** **Observe the following electronic transition of a diatomic molecule, the allowed transitions are**

| **P** | **Q** | **R** | **S** |
|---|---|---|---|
| $^1\Sigma_g^+ \longrightarrow {}^3\Sigma_g^+$ | $^1\Sigma_u^+ \longrightarrow {}^1\Sigma_g^+$ | $^1\Delta_u \longrightarrow {}^1\Sigma_g^+$ | $^1\pi_g \longrightarrow {}^1\Sigma_u^+$ |

(a) (P) and (R) (b) (Q) and (S) (c) (P), (Q) and (R) (d) (P), (R) and (S)

**86.** **An excited triplet state wave function of hydrogen molecule with the electronic configuration $\sigma_g^1\sigma_u^1$ has the following space part**

(a) $\sigma_g(1)\,\sigma_u(2)$ (b) $\sigma_g(1)\,\sigma_u(2) + \sigma_u(1)\,\sigma_g(2)$

(c) $\sigma_g(1)\,\sigma_u(2) - \sigma_u(1)\,\sigma_g(2)$ (d) $\sigma_g(1)\,\sigma_g(2) + \sigma_u(1)\,\sigma_u(2)$

**87.** **The NMR spectrum of $AX_3$ exhibits lines at $\delta = 2.1$ and $2.3$ ppm (for X type protons) and $\delta = 4.1, 4.3, 4.5$ and $4.7$ ppm (for A type protons), measured from TMS with an instrument operating at 100 MHz. The chemical shift (in ppm) of A**

**and X protons and coupling constant (in (Hz) are respectively,**

(a) 4.4, 2.2 and 20 (b) 2.2, 4.4 and 10 (c) 2.2, 4.4 and 5 (d) 4.3, 2.1 and 20

**88. The character table of the $C_{2V}$ point group is given below:**

| $C_{2V}$ | E | $C_2$ | $\sigma_V$ | $\sigma'_V$ |
|---|---|---|---|---|
| $A_1$ | 1 | 1 | 1 | 1 |
| $A_2$ | 1 | 1 | −1 | −1 |
| $B_1$ | 1 | −1 | 1 | −1 |
| $B_2$ | 1 | −1 | −1 | 1 |

**The two functions $\varphi_1 = p_1 + 2p_2 + 2p_3 + p_4$ and $\varphi_2 = 2p_1 - p_2 - p_3 + 2p_4$ (where $p_k$ is the p-orbital on the $k^{th}$ atom of cis-butadiene and $\sigma_v$ is the molecular plane) belong to**

(a) $A_1$ and $A_2$ respectively (b) Both $A_2$ (c) Both $B_2$ (d) $B_1$ and $B_2$ respectively

**89. If $\theta_r$ denotes the characteristic temperature of rotation then the magnitude of: $[\theta_r(H_2)\,\theta_r(D_2)] / [\theta_r(HD)]^2$(assume the bond lengths to be the same for all the molecules) is**

(a) 2/3 (b) 3/2 (c) 8/9 (d) 9/8

**90. The overall reaction for the passage of 1.0 faraday of charge in the following cell: $Ag_{(s)} - AgCl_{(s)}\ KCl_{(a_1)} \mid KCl_{(a_2)} \mid AgCl_{(s)} - Ag_{(s)}$ is given by (t is transport number)**

(a) $t_{+KCl_{(a_1)}} \longrightarrow t_{+KCl_{(a_2)}}$ (b) $t_{+KCl_{(a_2)}} \longrightarrow t_{+KCl_{(a_1)}}$

(c) $t_{-KCl_{(a_1)}} \longrightarrow t_{-KCl_{(a_2)}}$ (d) $t_{+KCl_{(a_1)}} \longrightarrow t_{+KCl_{(a_2)}}$

**91. A system consisting of 4 identical and distinguishable particle, each possessing three available states of 1, 2 and 3 units, has 10 units of energy. The number of ways, W, in which these conditions are satisfied is**

(a) 2 (b) 4 (c) 6 (d) 10

**92. The molar conductivities at infinite dilution $\Lambda_m^0$ for $Na_2SO_4$, $K_2SO_4$, KCl , HCl and HCOONa at 300K are 260, 308, 150, 426 and 105 S $cm^{-1}$ $mol^{-2}$ respectively. Hence $\Lambda_m^0$ for formic acid in the same unit and at the same temperature is**

(a) 381 (b) 405 (c) 429 (d) 531

**93. If the displacement vectors of all atoms in cis-butadiene are taken as the basis vectors the characters of the reducible representation of E, $C_2$, $\sigma_v$ (molecular plane) and $\sigma'_v$ are**

(a) 30, 10, 30, 0 (b) 30, 0, 10, 0 (c) 30, 20, 0, 0 (d) 30, 0, 20, 0

**94.** **In least square fitting of a data set $\{X_iY_i\}$ to the equation $Y = A\,.\,X$, the regression coefficient (A) is estimated by**

(a) $\sum Y_i^2 / \sum X_i^2$ (b) $\sum X_iY_i / \sum X_i^2$ (c) $\sum X_iY_i / \sum Y_i^2$ (d) $\sum X_i^2 / \sum Y_i^2$

**95.** **At any temperature for the following reaction correct statement is:**

**(D and T are Deuterium and Tritium respectively)**

| (i) | (ii) | (iii) |
|---|---|---|
| $HCl + F \longrightarrow HF + Cl$ | $DCl + F \longrightarrow DF + Cl$ | $TCl + F \longrightarrow TF + Cl$ |

(a) (i) is fastest (b) (ii) is fastest

(c) (iii) is fastest (d) All the above reaction have the same rate constant

**96.** **An example of a relaxation method of measuring rate is:**

(a) Spectroscopic monitoring of product concentration

(b) Stopped flow technique

(c) Temperature jump experiments

(d) Measurement of special line widths

**97.** **The overall rate of the following complex reaction,**

$$2A \overset{k_1}{\rightleftharpoons} A_2 \ \textbf{(fast equilibrium)}$$

$$A + B \overset{k_2}{\rightleftharpoons} C \ \textbf{(fast equilibrium)}$$

$$A_2 + C \xrightarrow{k_3} P + 2A \ \textbf{(Slow)}$$

**By steady state approximation would be**

(a) $K_1K_2K_3[A]^3[B]$ (b) $K_2K_1K_3[A][B]^3$ (c) $K_1K_2K_3[A][B]^2$ (d) $K_1K_2K_3[A][B]$

**98.** **The vibrational energy levels, $v'' = 0$ and $v' = 1$ of a diatomic molecule are separated by $2143\ cm^{-1}$. Its anharmonicity $(\omega_e x_e)$ is $14\ cm^{-1}$. The values $\omega_e$ (in $cm^{-1}$) and first overtone $(cm^{-1})$ of this molecule are respectively.**

(a) 2143 and 4286 (b) 2157 and 4286 (c) 2157 and 4314 (d) 2171 and 4258

**99.** **The addition polymerization of M (monomer) involves the following stages:**

**(I = initiator, R = free radical)**

$$\mathbf{I \xrightarrow{k_1} R} \quad \textbf{(Initiation)}$$

$$\mathbf{R + M \xrightarrow{k_2} RM}$$

$$RM + M \longrightarrow RM_2 \text{ and so on}$$

$$RM_n + M_{n'}R \xrightarrow{k_3} R - M_n - M_{n'} - R$$

The rate constant for free radical formation is $2 \times 10^{-3}\ s^{-1}$. The initial concentration of initiator is $10^{-3}$ mol $dm^{-3}$. The overall rate of reaction is $4 \times 10^{-3}$ mol $dm^{-3}$ $s^{-1}$. Assuming steady state approximation for free radical, the kinetic chain length is:

(a) 2000 (b) $8 \times 10^9$ (c) 20 (d) 200

100. The electronic spectrum $[CrF_6]^{3-}$ shows three bands at $14,900$ $cm^{-1}$, $22,400\ cm^{-1}$ and $34,800\ cm^{-1}$. The value of $\Delta_o$ in this case is:

(a) 5,500 $cm^{-1}$ (b) 14,900 $cm^{-1}$ (c) 22,400 $cm^{-1}$ (d) $34,800$ $cm^{-1}$

101. Among the following pairs, those in which both species have similar structures are:

| P | Q | R | S |
|---|---|---|---|
| $N_3^-, XeF_2$ | $[ICl_4]^-, [PtCl_4]^{2-}$ | $[ClF_2]^+, [ICl_2]^-$ | $XeO_3, SO_3$ |

(a) P and Q only (b) P and R only (c) P, Q and R only (d) Q, R and S only

102. The number of metal–metal bonds in the dimers, $[CpFe(CO)(NO)]_2$ and $[CpMo(CO)_3]_2$ respectively, are

(a) two and two (b) two and three (c) one and two (d) zero and one

103. The reduction of nitrogen to ammonia, carried out by the enzyme nitrogenase, needs

(a) 2 electrons (b) 4 electrons (c) 6 electrons (d) 8 electrons

104. In the titration of 50 mL of 0.1 M HCl with 0.1 M NaOH using methyl orange as an indicator, the end point (colour change) occurs as pH reaches 4.0. The titration error is:

(a) −0.2 % (b) −84.7 % (c) +0.2 % (d) + 84.2 %

105. The styx code $B_4H_{10}$ is:

(a) 4120 (b) 4220 (c) 4012 (d) 3203

106. Match list I (compounds) with list II (structure), and select the correct answer using the codes given below.

| | List I | | List II |
|---|---|---|---|
| P | $XeO_4$ | i | Square planar |
| Q | $BrF_4^-$ | ii | Tetrahedral |
| R | $SeCl_4$ | iii | Distorted tetrahedral |

| | P | Q | R |
|---|---|---|---|
| (a) | ii | iii | i |
| (b) | iii | i | ii |
| (c) | ii | i | iii |

(d) i ; ii ; iii

107. **In the trans $PtCl_2L(CO)$ complex, the CO stretching frequency for $L = NH_3$, Pyridine, $NMe_3$ decreases in the order**

(a) Pyridine > $NH_3$ > $NMe_3$ (b) $NH_3$ > Pyridine > $NMe_3$

(c) $NMe_3$ > $NH_3$ > Pyridine (d) Pyridine > $NMe_3$ > $NH_3$

108. **For the nuclear reactions. (P) $^{8}_{4}Be \longrightarrow 2^{4}_{2}He$ (Q) $^{80}_{36}Kr \longrightarrow 2^{40}_{18}Ar$**

**($^{8}Be = 8.005300$, $^{4}He = 4.002603$ and $^{80}_{36}Kr = 79.81638$, $^{40}_{18}Ar = 39.96238$).**

**The correct statements is:**

(a) (P) and (Q) are both spontaneous fission processes

(b) (P) is spontaneous fission but (Q) is not

(c) (Q) is spontaneous fission but (P) is not

(d) Both (P) and (Q) are not spontaneous fission process

109. **A metal ion that replaces manganese (II) ion in mangano-proteins without changing its function, is**

(a) Fe(II) (b) Zn(II) (c) Mg(II) (d) Cu(II)

110. **In $^{57}Fe^*$ Mossbauer experiment, Source of $14.4$ keV (equivalent to $3.48 \times 10^{12}$ MHz) is moved towards absorber at a velocity of $2.2\ mm\ s^{-1}$. The shift in frequency of the source for this sample is:**

(a) 35.5 MHz (b) 25.5 MHz (c) 20.2 MHz (d) 15.5 MHz

111. **Bayer's process involves**

(a) Synthesis of $B_2H_6$ from $NaBH_4$ (b) Synthesis of $NaBH_4$ from borax

(c) Synthesis of $NaBH_4$ from $B_2H_6$ (d) Synthesis of $B_3N_3H_6$ from $B_2H_6$

112. **A true statement about base hydrolysis $[Co(NH_3)_5Cl]^{2+}$ is:**

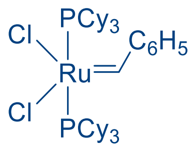
(a) It is a first order reaction

(b) The Rate determining step involves the dissociation of chloride in $[Co(NH_3)_4(NH_2)Cl]^+$

(c) The rate is independent of concentration of the base

(d) The rate determining step involves the abstraction of a proton in $[Co(NH_3)_5Cl]^{2+}$

113. **The catalyst involved in carrying out the metathesis of 1-butene to give ethylene and 3-hexene is:**

(a) 

(b) $Na_2PdCl_4$ (c) $Co_2(CO)_8$, $H_2$ (d) $RhCl(PPh_3)_3$

**114.** **The correct order of d orbitals splitting in a trigonal bipyramidal geometry is**

(a) $d_{z^2} > d_{xz} > d_{x^2-y^2}, d_{xy}$

(b) $d_{xz}, d_{yz} > d_{x^2-y^2}, d_{xy} > d_{z^2}$

(c) $d_{x^2-y^2}, d_{xy} > d_{z^2} > d_{xz}, d_{yz}$

(d) $d_{z^2} > d_{x^2-y^2} > d_{xy} > d_{xz}, d_{yz}$

**115.** **For the following outer sphere electron transfer reactions:**

$[Co(NH_3)_6]^{2+} + [Co^*(NH_3)_6]^{3+} \longrightarrow [Co(NH_3)_6]^{3+} + [Co^*(NH_3)_6]^{2+}$

$[Ru(NH_3)_6]^{2+} + [Ru^*(NH_3)_6]^{3+} \longrightarrow [Ru(NH_3)_6]^{3+} + [Ru^*(NH_3)_6]^{2+}$

**The rate constants are $10^{-6}\ M^{-1}\ S^{-1}$ and $8.2 \times 10^2\ M^{-1}\ S^{-1}$ respectively. This difference in the rate constants due to**

(a) A change from high spin to low spin in Co* and high spin to low spin in Ru

(b) A change from high spin to low spin in Co* and low spin to high spin in Ru*

(c) A change from low spin to high spin in Co* and the low spin state remains unchanged in Ru.

(d) A change from low spin to high spin in Co* and high spin to low spin in Ru*

**116.** **The greater stability of (P) $((CH_3)_3C-CH_2-)_4Ti$ compared to that of (Q) $((CH_3)_2CH-CH_2-)_4Ti$ is due to**

(a) Hypercojugation present in complex (P)

(b) β-Hydride elimination is not possible in complex (P)

(c) Steric protection of titanium from reactive species in complex (P)

(d) The stronger nature of Ti-C bond in complex (P)

**117.** **The coordination number and geometry of cerium in $[Ce(NO_3)_6]^{2-}$ are respectively**

(a) 6 and octahedron

(b) 6 and trigonal prism

(c) 8 and cubic

(d) 12 and icosahedron

**118.** **A compound-X having the composition $FeC_9H_8O_3$ shows one signal at $2.5$ ppm and another one around $5.0$ ppm in its $^1$H-NMR spectrum. The IR spectrum of this compound shows two bands around and $1680\ cm^{-1}$. The compound follows the 18 electron rule of the following statements for X, the correct one is/are**

**P.** **It has $\eta^5$-Cp group**

**Q.** **It has a terminal CO ligand**

**R.** **It has a $CH_3$ ligand**

**S.** **It has Fe-H bond**

(a) P and Q only

(b) R only

(c) P and R

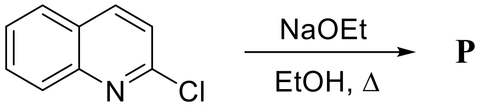
(d) Q and S

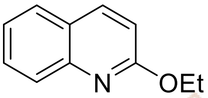
**119.** **In bacterial rubredoxin, the number of iron atoms, sulphur bridges and cysteine**

**ligands are**

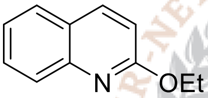
| | Fe atom | | Sulphur bridge | | Cysteine |
|---|---|---|---|---|---|
| (a) | 4 | ; | 4 | ; | 4 |
| (b) | 2 | ; | 2 | ; | 4 |
| (c) | 2 | ; | 2 | ; | 2 |
| (d) | 1 | ; | 0 | ; | 4 |

**120. In the following reaction, the product formed and the mechanism involved are**

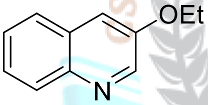


(a) P is 

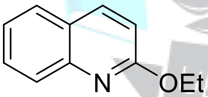
and is formed by addition-elimination mechanism

(b) P is 

and is formed by benzyne mechanism

(c) P is 

and is formed by benzyne mechanism

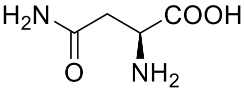
(d) P is 

and is formed by $S_N2$ displacement

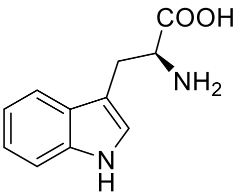
**121. An optically active compound enriched with R-enantiomer (60% ee) exhibited $[\alpha]_D = +90°$ . If the $[\alpha]_D$ value of the sample is $-135°$, the ratio of R and S enantiomer would be**

(a) R : S = 1 : 19 (b) R : S = 19 : 1 (c) R : S = 1 : 9 (d) R : S = 9 : 1

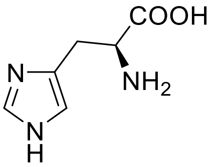
**122. Match the amino acids with their structures:**

**(i)** 

**(P) Tryptophan**

**(ii)** 

**(Q) istidine**

**(iii)** 

**(R) Asparagine**

**(S) Serine**

| | i | | ii | | iii |
|---|---|---|---|---|---|
| (a) | P | ; | T | ; | R |
| (b) | R | ; | S | ; | Q |
| (c) | P | ; | Q | ; | S |

**(T) Glutamic acid** (d) R ; P ; Q

**123. Statement I : U(VI) is more stable than Nd(VI)**

**Statement II : The valence electrons in U are in 5f, 6d and 7s orbitals**

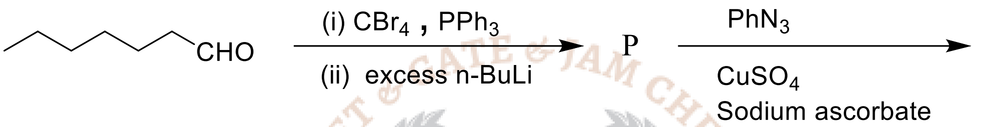
(a) Statements I and II are correct and Statement II is correct explanation of I

(b) Statements I and II are correct but Statement II is not an correct explanation for Statement I

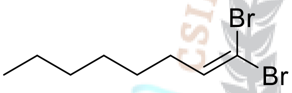
(c) Statements I is correct and statement II is incorrect

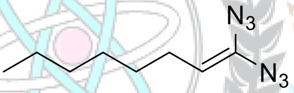
(d) Statements I and II both are incorrect

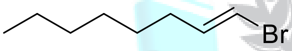
**124. The major products P and Q in the following reaction sequence are**



**P** **Q**

(a)


;


(b)


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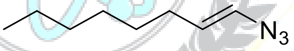
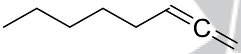


(c)


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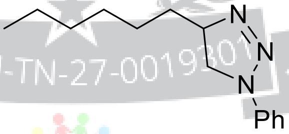
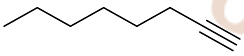
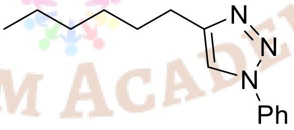
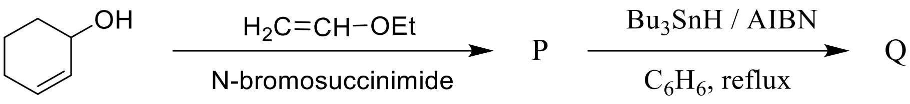
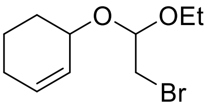


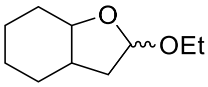
(d)

;


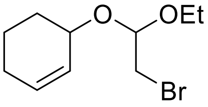
**125. The major products P and Q in the following reaction sequence are**

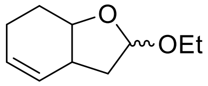


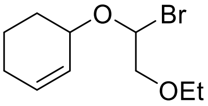
**P** **Q**

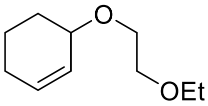
(a)


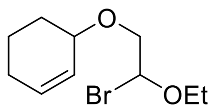
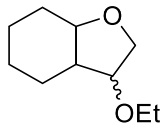
;


(b)


;


(c)


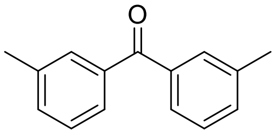
;


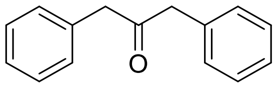
(d)  ; 

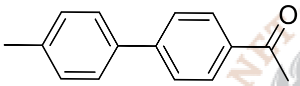
126. An organic compound having molecular formula $C_{15}H_{14}O$ exhibited the following $^1H$ and $^{13}C$-NMR spectral data;

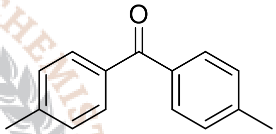
$^1H$-NMR (ppm) : $\delta 2.4$ (s), 7.2 (d, J = 8Hz), 7.7 (d, J = 8Hz)

$^{13}C$-NMR (ppm) : $\delta$ 21.0, 129.0, 130.0, 136.0, 141.0, 190.0

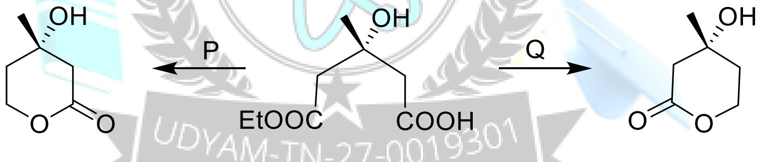
(a) 

(b) 

(c) 

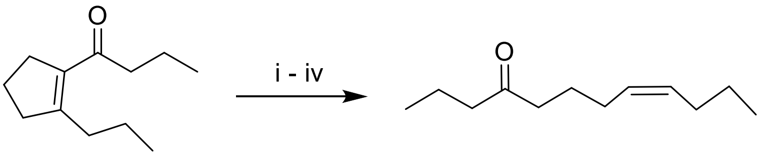
(d) 

127. Identify appropriate reagents P and Q in the following reactions.



| | P | Q | | P | Q |
|---|---|---|---|---|---|
| (a) | $LiAlH_4$ | $BH_3.Me_2S$ | (b) | $BH_3.Me_2S$ | $LiAlH_4$ |
| (c) | $LiBH_4$ | $BH_3.Me_2S$ | (d) | $BH_3.Me_2S$ | $LiBH_4$ |

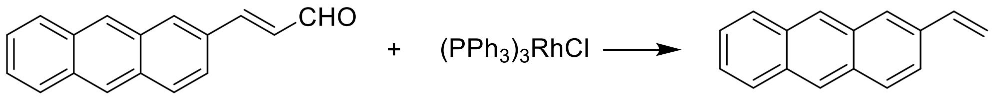
128. The correct sequence of the reagents to be employed in the following transformations is



| | (i) | (ii) | (iiii) | (iv) |
|---|---|---|---|---|
| (a) | m-CPBA | $TsNHNH_2$ | AcOH | $H_2$, Pd/$BaSO_4$ |
| (b) | $H_2O_2$, NaOH | $NH_2NH_2$ | AcOH | $H_2$, Pd/C |
| (c) | m-CPBA | $TsNHNH_2$ | NaOH | $H_2$, Pd/C |
| (d) | $H_2O_2$, NaOH | $TsNHNH_2$ | AcOH | $H_2$, Lindlar's Catalyst |

129. Reaction of 11.6 g of the aldehyde A with 462 mg of Wilkinson's catalyst provided 9.2 g of alkene B. The mol % of the catalyst used and the yield of the reaction,

**approximately are**

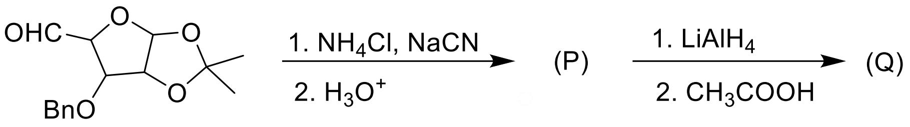


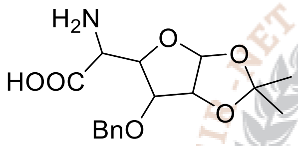
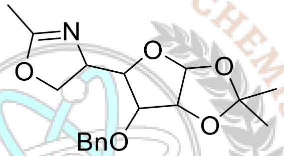
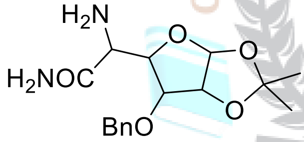
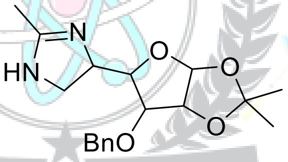
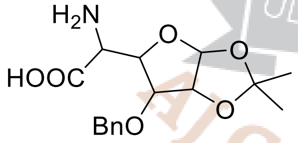
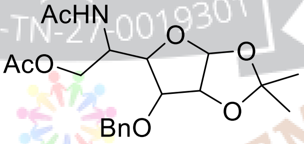
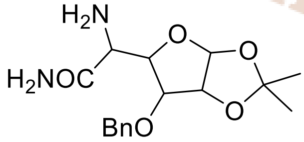
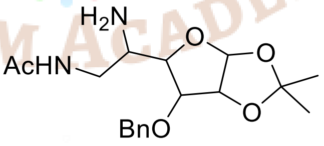
**A (mol. Wt. 232)** **(mol.Wt. 923)**

(a) 1.0 mol % ; and 80% (b) 1.0 mol % ; 90%

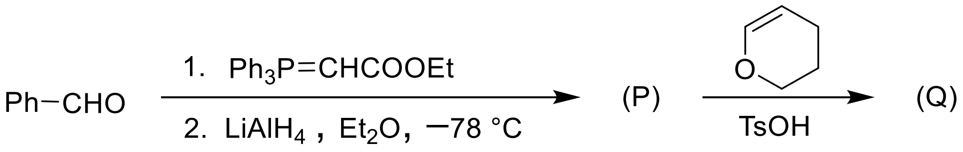
(c) 0.1 mol % ; and 90% (d) 0.2 mol % ; 80%

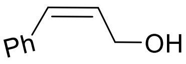
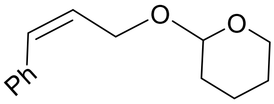
**130. The major products P and Q in the following sequence are**

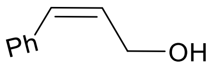
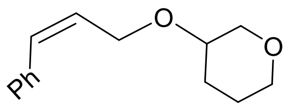


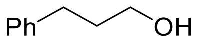
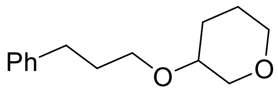
| | **P** | | **Q** |
|---|---|---|---|
| (a) |  | ; |  |
| (b) |  | ; |  |
| (c) |  | ; |  |
| (d) |  | ; |  |

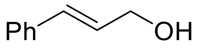
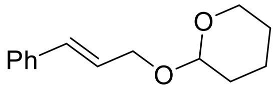
**131. The major products P and Q in the following reaction sequence are**



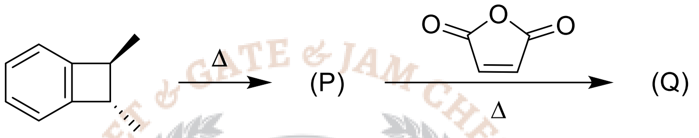
| | **P** | | **Q** |
|---|---|---|---|
| (a) |  | ; |  |

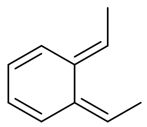
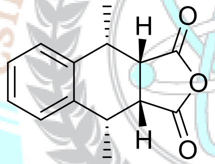
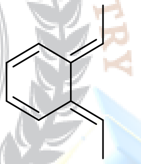
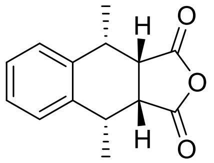
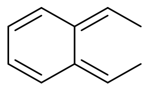
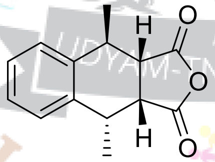
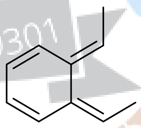
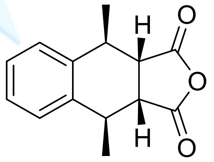
(b)  ; 

(c)  ; 

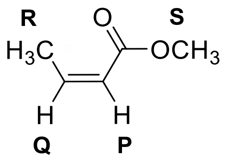
(d)  ; 

**132.** **The major products P and Q in the following reaction sequence are**



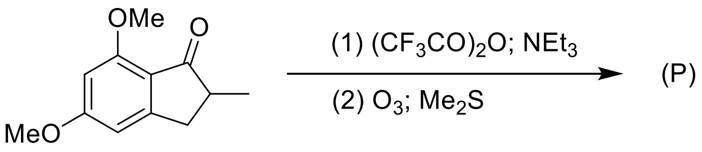
|  | P |  | Q | P |  | Q |
|---|---|---|---|---|---|---|
| (a) |  | ; |  | (b)  | ; |  |
| (c) |  | ; |  | (d)  | ; |  |

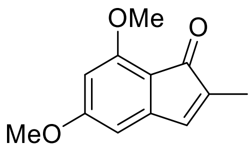
**133.** **Appropriate $^1$H-NMR chemical shifts (δ in ppm) for the protons P-S for the following compound are**

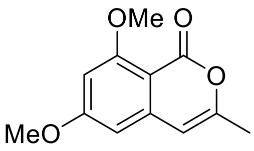


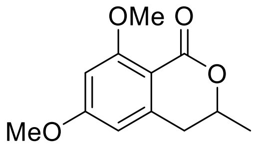
|  | P |  | Q |  | R |  | S |
|---|---|---|---|---|---|---|---|
| (a) | 6.8 | ; | 5.7 | ; | 3.9 | ; | 2.1 |
| (b) | 6.8 | ; | 5.7 | ; | 2.1 | ; | 3.9 |
| (c) | 5.7 | ; | 6.8 | ; | 3.9 | ; | 2.1 |
| (d) | 5.7 | ; | 6.8 | ; | 2.1 | ; | 3.9 |

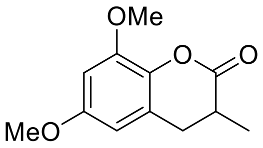
**134.** **The major product formed in the following reaction sequence is:**



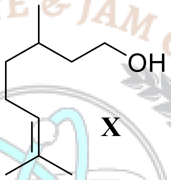
(a) 

(b) 

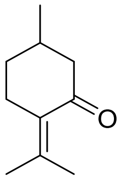
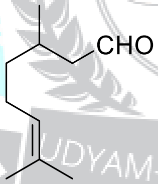
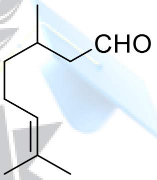
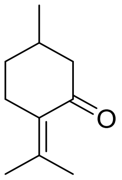
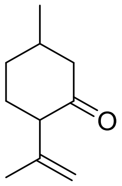
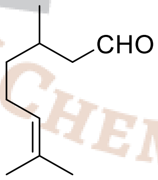
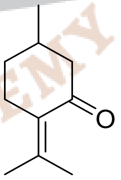
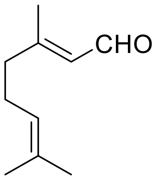
(c) 

(d) 

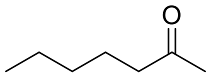
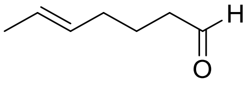
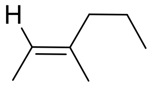
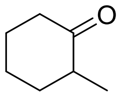
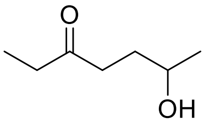
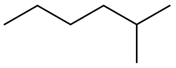
**135.** **Citronellol-X on oxidation with pyridinium chlorochromate (PCC) followed by treatment with aq.sodium hydroxide gives the product P (IR: 1680 $cm^{-1}$); whereas oxidation with PCC in the presence of sodium acetate gives product Q (IR: 1720 $cm^{-1}$). Compound P and Q are**

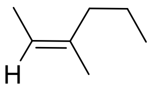


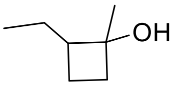
**X**

| | **P** | **Q** |
|---|---|---|
| (a) |  |  |
| (b) |  |  |
| (c) |  |  |
| (d) |  |  |

**136.** **Match the following starting compounds with corresponding products in photochemical reactions:**

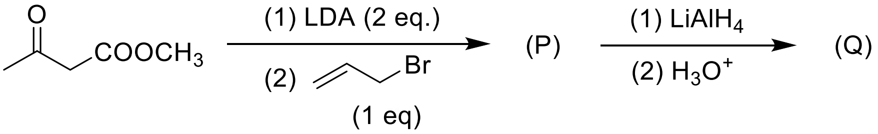
| **Starting material** | | **Products** | |
|---|---|---|---|
| **(i)** |  | **(P)** |  |
| | | **(Q)** |  |
| **(ii)** |  | **(R)** |  |
| | | **(S)** |  |

**(iii)** 

**(T)** 

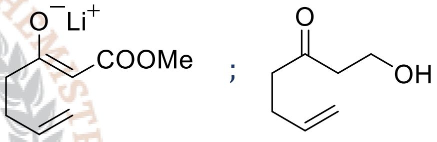
| | i | ii | iii | | | i | ii | iii |
|---|---|---|---|---|---|---|---|---|
| (a) | T ; | P ; | Q | | (b) | P ; | R ; | Q |
| (c) | S ; | R ; | P | | (d) | T ; | P ; | S |

**137. The major products P and Q in the following reaction sequence are**

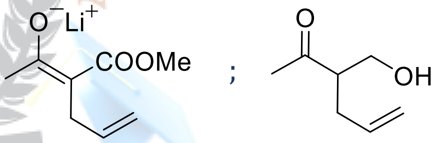


**P** **Q** **P** **Q**

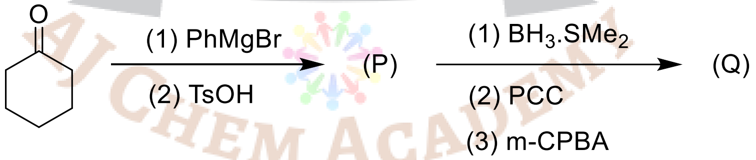
(a) 

(b) 

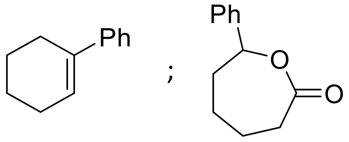
(c) 

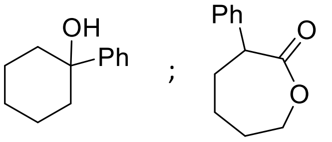
(d) 

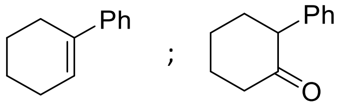
**138. The major products P and Q of the following reaction sequence are**

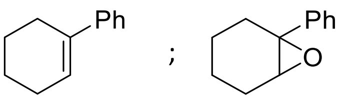


**P** **Q** **P** **Q**

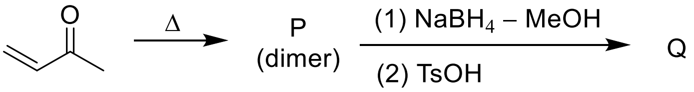
(a) 

(b) 

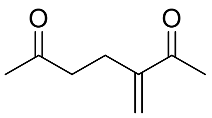
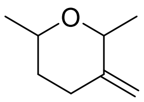
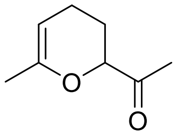
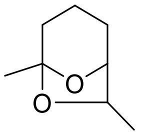
(c) 

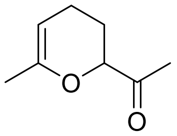
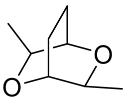
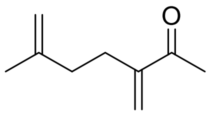
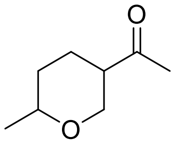
(d) 

**139. The major products P and Q in the following reaction sequence are**

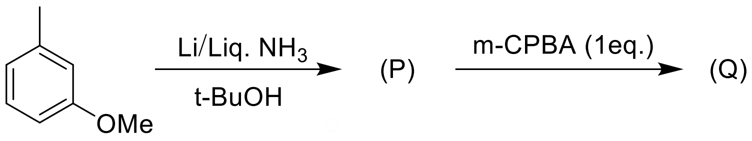


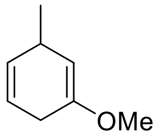
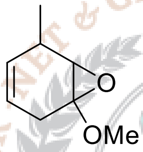
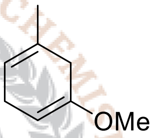
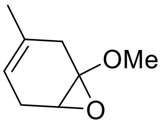
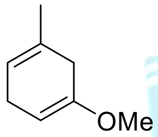
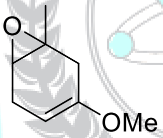
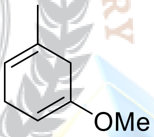
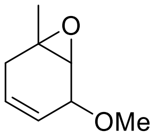
**P** **Q** **P** **Q**

(a)  ;  (b)  ; 

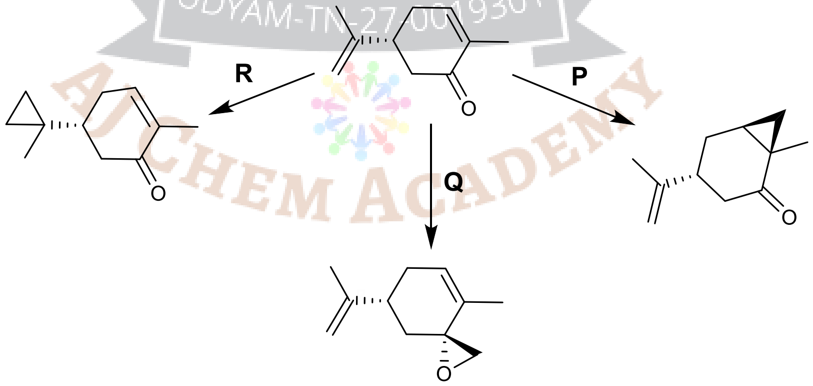
(d)  ;  (d)  ; 

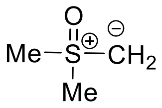
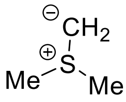
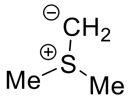
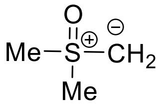
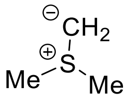
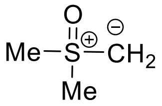
**140. The major products P and Q in the following reaction sequence are**

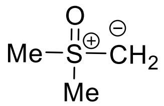


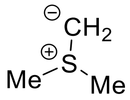
| | P | Q | | P | Q |
|---|---|---|---|---|---|
| (a) |  |  | (b) |  |  |
| (c) |  |  | (d) |  |  |

**141. The correct reagents for effecting the following reactions are**



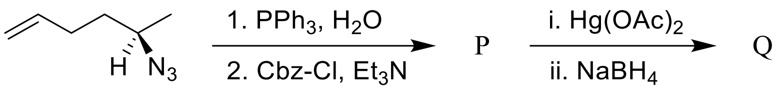
| | P | Q | R |
|---|---|---|---|
| (a) |  $Me-\overset{O}{\underset{Me}{S^{\oplus}}}-\overset{\ominus}{C}H_2$ |  $Me-\underset{Me}{S^{\oplus}}-\overset{\ominus}{C}H_2$ | $CH_2I_2$, Zn-Cu |
| (b) |  $Me-\underset{Me}{S^{\oplus}}-\overset{\ominus}{C}H_2$ |  $Me-\overset{O}{\underset{Me}{S^{\oplus}}}-\overset{\ominus}{C}H_2$ | $CH_2I_2$, Zn-Cu |
| (c) | $CH_2I_2$, Zn-Cu |  $Me-\underset{Me}{S^{\oplus}}-\overset{\ominus}{C}H_2$ |  $Me-\overset{O}{\underset{Me}{S^{\oplus}}}-\overset{\ominus}{C}H_2$ |

(d) 

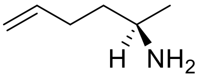
; 

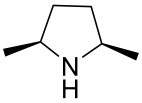
; Tebbe's Reagent

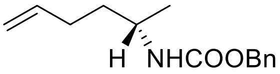
**142. The major products P and Q in the following reaction sequence are**

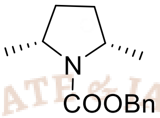


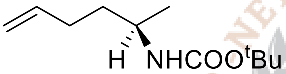
**P** **Q**

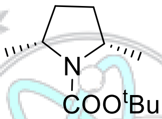
(a) 

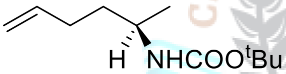
; 

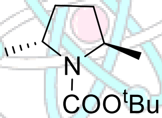
(b) 

; 

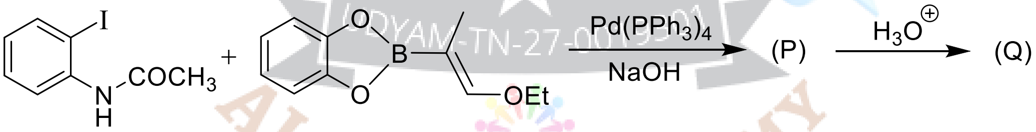
(c) 

; 

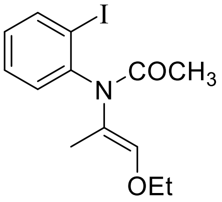
(d) 

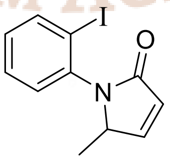
; 

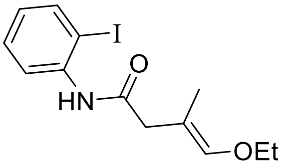
**143. The major products P and Q in the following synthetic sequence are**

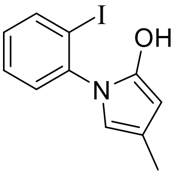


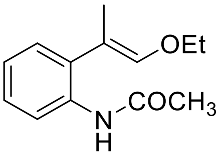
**P** **Q**

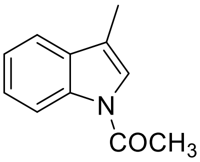
(a) 

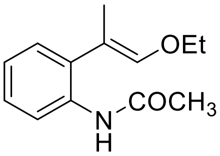
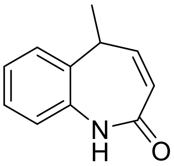
; 

(b) 

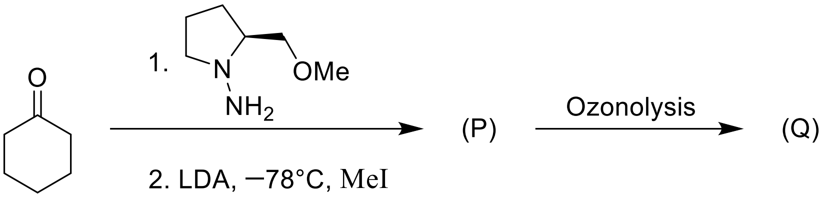
; 

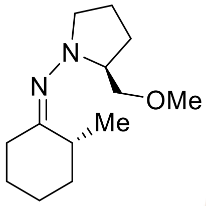
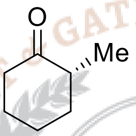
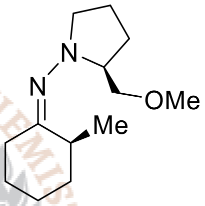
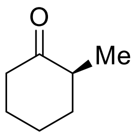
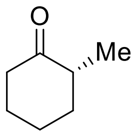
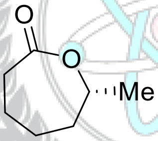
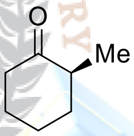
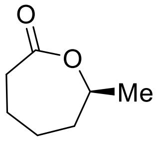
(c) 

; 

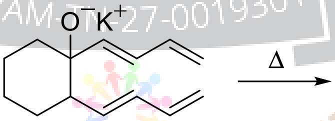
(d)  ; 

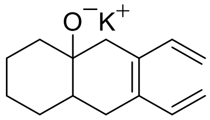
**144. The major products P and Q in the following synthetic strategy are**

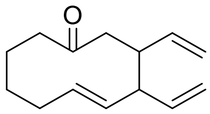


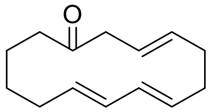
| | **P** | **Q** | | **P** | **Q** |
|---|---|---|---|---|---|
| (a) |  ; |  | (b) |  ; |  |
| (c) |  ; |  | (d) |  ; |  |

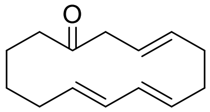
**145. The product formed and the process involved in the following reaction are**



(a)  [3,3] - Sigmatropic rearrangement

(b)  [1,3] - Sigmatropic rearrangement

(c)  [5,5] - Sigmatropic rearrangement

(d)  [1,5] - Sigmatropic rearrangement

## Answer Key

## PART - B

| Q.No | Ans |
|---|---|
| 21. | b |
| 22. | d |
| 23. | c |
| 24. | c |
| 25. | d |
| 26. | c |
| 27. | b |
| 28. | c |
| 29. | b |
| 30. | a |
| 31. | b |
| 32. | a |
| 33. | c |
| 34. | b |
| 35. | c |

| Q.No | Ans |
|---|---|
| 36. | d |
| 37. | b |
| 38. | a |
| 39. | b |
| 40. | b |
| 41. | a |
| 42. | b |
| 43. | b |
| 44. | d |
| 45. | b |
| 46. | d |
| 47. | a |
| 48. | a |
| 49. | d |
| 50. | c |

| Q.No | Ans |
|---|---|
| 51. | c |
| 52. | b |
| 53. | c |
| 54. | b |
| 55. | b |
| 56. | a |
| 57. | c |
| 58. | d |
| 59. | b |
| 60. | a |

| Q.No | Ans |
|---|---|
| 61. | c |
| 62. | b |
| 63. | c |
| 64. | c |
| 65. | a |
| 66. | c |
| 67. | a |
| 68. | c |
| 69. | c |
| 70. | c |

## PART - C

| Q.No | Ans |
|---|---|
| 71. | d |
| 72. | a |
| 73. | d |
| 74. | c |
| 75. | d |
| 76. | a |
| 77. | a |
| 78. | b |

| Q.No | Ans |
|---|---|
| 91. | d |
| 92. | b |
| 93. | b |
| 94. | b |
| 95. | a |
| 96. | c |
| 97. | a |
| 98. | d |

| Q.No | Ans |
|---|---|
| 111. | b |
| 112. | b |
| 113. | a |
| 114. | d |
| 115. | c |
| 116. | b |
| 117. | d |
| 118. | a |

| Q.No | Ans |
|---|---|
| 131. | d |
| 132. | b |
| 133. | d |
| 134. | b |
| 135. | a |
| 136. | a |
| 137. | a |
| 138. | a |

| | |
|---|---|
| 79. | d |
| 80. | b |
| 81. | d |
| 82. | d |
| 83. | a |
| 84. | c |
| 85. | b |
| 86. | c |
| 87. | a |
| 88. | c |
| 89. | c |
| 90. | a |

| | |
|---|---|
| 99. | a |
| 100. | b |
| 101. | a |
| 102. | d |
| 103. | d |
| 104. | a |
| 105. | c |
| 106. | c |
| 107. | a |
| 108. | b |
| 109. | c |
| 110 | b |

| | |
|---|---|
| 119. | d |
| 120. | a |
| 121. | a |
| 122. | d |
| 123. | b |
| 124. | d |
| 125. | a |
| 126. | d |
| 127. | c |
| 128. | d |
| 129. | b |
| 130. | c |

| | |
|---|---|
| 139. | b |
| 140. | b |
| 141. | a |
| 142. | b |
| 143. | c |
| 144. | a |
| 145 | c |