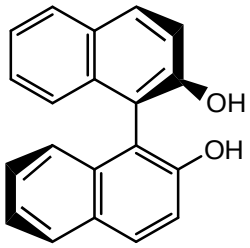
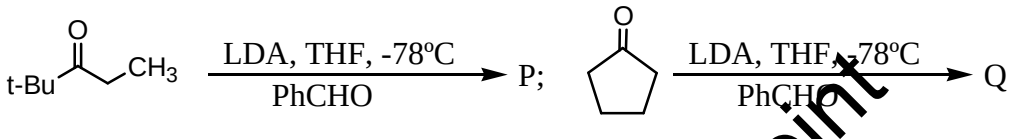
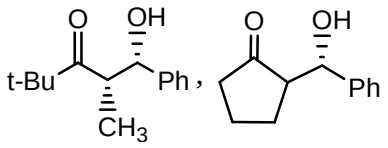
51. The binaphthol (Bnp) is:

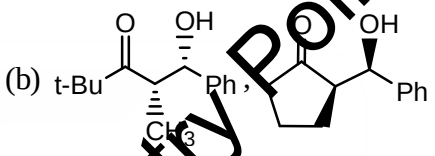


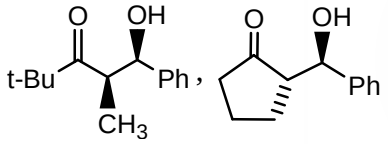
(a) An optically active compound with (R)-configuration.
(b) An optically inactive compound.
(c) A meso compound
(d) An optically active compound with (S)-configuration.

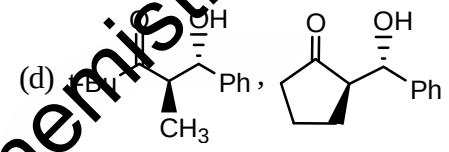
52. In the given reactions, identify the correct combination of their major products P and Q $\left[\text{LDA} = \text{LiN(i-Pr)}_2\right]$



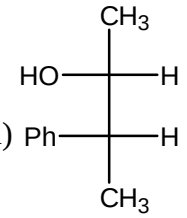
(a) 

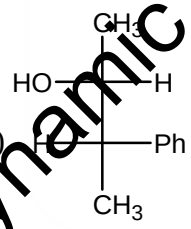
(b) 

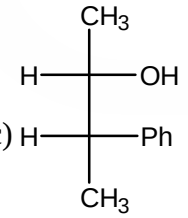
(c) 

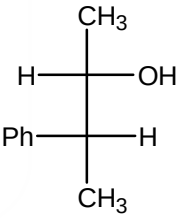
(d) 

53. The major stereoisomer obtained in the reaction of (S)-2-phenylpropanal with MeMgBr is:

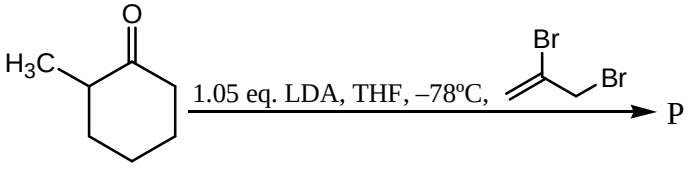
(a) 

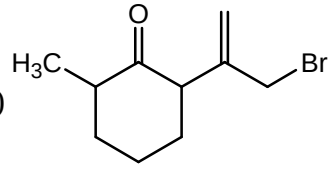
(b) 

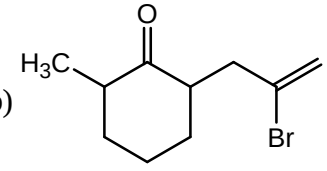
(c) 

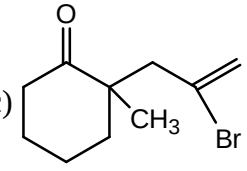
(d) 

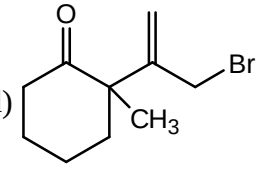
54. The major product P formed in the following reaction is



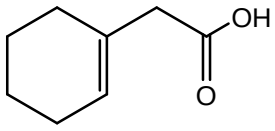
(a) 

(b) 

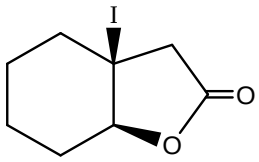
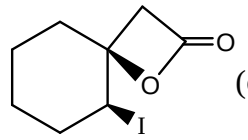
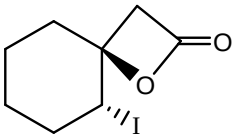
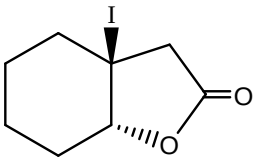
(c) 

(d) 

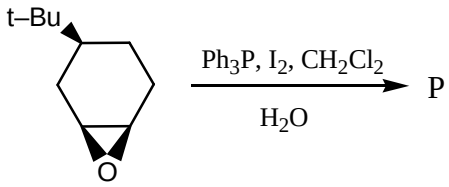
55. Iodo-lactonization of β, γ – unsaturated carboxylic acid X with I_2 and $NaHCO_3$ gives.

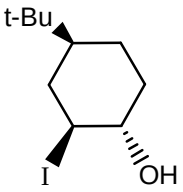
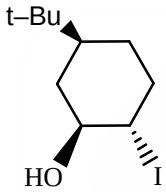
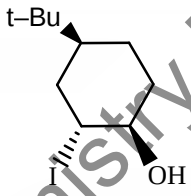
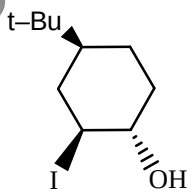


X

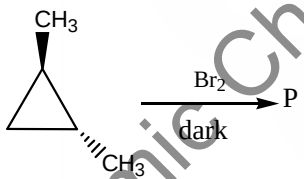
(a) 
(b) 
(c) 
(d) 

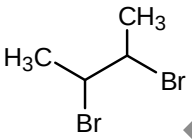
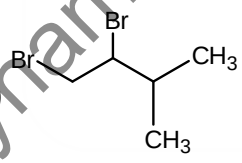
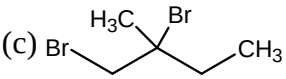
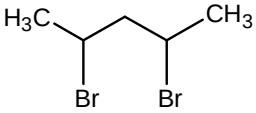
56. The major stereoisomer P obtained in the following reaction is:



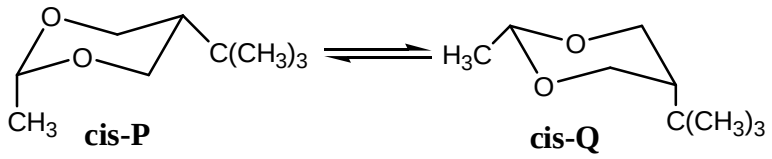
(a) 
(b) 
(c) 
(d) 

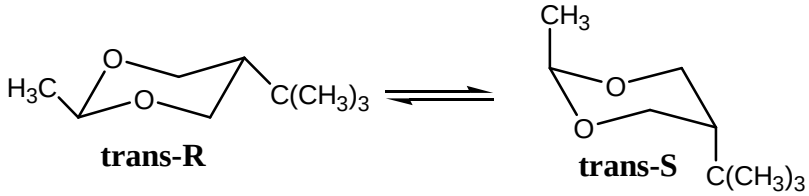
57. The major product P of the following reaction is:



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

58. Cis-and trans-2-methyl-5-t-butyl-1, 3-dioxane each can exist as two conformers as shown below

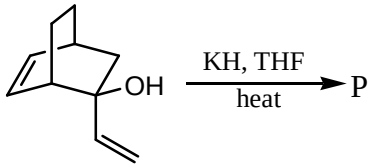


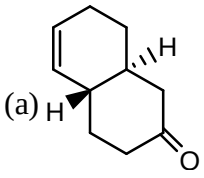


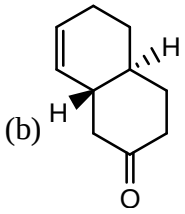
The preferred conformations for the cis- and trans-compounds will be

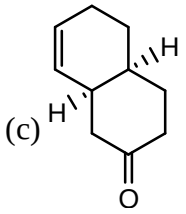
(a) P, R (b) Q, S (c) P, S (d) Q, R

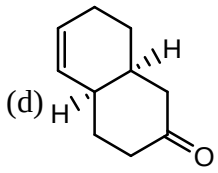
59. The major product P of the given reaction is



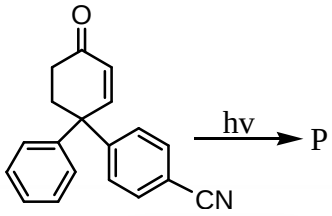
(a) 

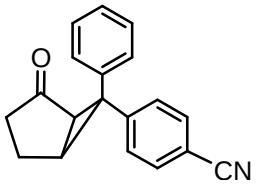
(b) 

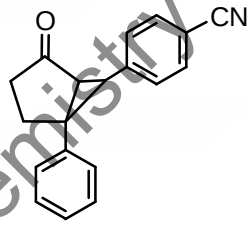
(c) 

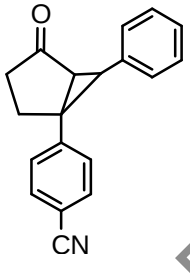
(d) 

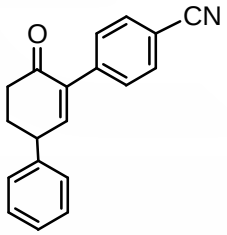
60. The major product P formed in the following photochemical reaction is



(a) 

(b) 

(c) 

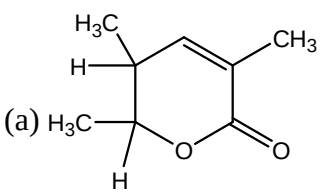
(d) 

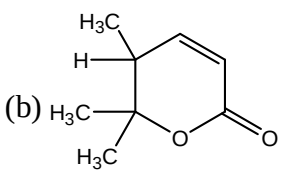
61. An organic compound having molecular formula $C_8H_{12}O_2$ exhibits the following peaks in IR and ^{1}H NMR spectra.

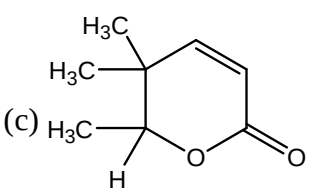
IR : $1720\left(cm^{-1}\right)$

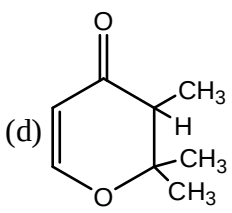
^{1}H NMR : $6.95\left(1H, d, J = 8.5\ Hz\right) 5.90\left(1H, d, J = 8.5\ Hz\right), 4.53\left(1H, q, J = 6\ Hz\right),$

$1.41\left(3H, d, J = 6\ Hz\right), 1.20\left(3H, s\right), 1.15\left(3H, s\right)$

(a) 

(b) 

(c) 

(d) 

62. The phase diagram of $NaCl–H_2O$ is of simple eutectic type. The utectic composition is 23.3 weight% NaCl and it freezes at –21.1ºC. The phases present in a solution containing 10 weight% NaCl at –20ºC are
(a) ice + NaCl solution (b) ice + solid NaCl
(c) NaCl + pure water (d) NaCl + saturated NaCl solution

63. Hydrogen adsorption on a platinum surface is
(a) Endothermic with positive ΔS and positive ΔG
(b) Endothermic with positive ΔS and negative ΔG
(c) Exothermic with negative ΔS and negative ΔG
(d) Exothermic with positive ΔS and negative ΔG

64. In the reversible chemical reaction taking place under standard condition at 298 K and 1 atm in a Daniel cell,

$$Zn\left|Zn^{2+}(aq)\right|\left|Cu^{2+}(aq)\right|Cu$$

the heat change is:
(a) equal to ΔH^0 (b) equal to $T\Delta S^0$ (c) equal to zero (d) equal to ΔU^0

65. The orbital $\psi = 1s_{H_A} - 1s_{H_B}$ of water belongs to the irreducible representation
(a) A_1 (b) B_1 (c) A_2 (d) B_2

66. The vibrational partition function for a molecule with fundamental frequency ν is given by
(a) $\exp\left(-\frac{\hbar\upsilon}{k_B T}\right)$ (b) $\left[1-\exp\left(\frac{\hbar\upsilon}{k_B T}\right)\right]^{-1}$
(c) $\exp\left(-\frac{\hbar\upsilon}{k_B T}\right)\left[1-\exp-\left(\frac{\hbar\upsilon}{k_B T}\right)\right]^{-1}$ (d) $\exp\left(-\frac{\hbar\upsilon}{2k_B T}\right)\left[1-\exp-\left(\frac{\hbar\upsilon}{k_B T}\right)\right]^{-1}$

67. The internal pressure, $\pi_T = T\left(\frac{\partial P}{\partial T}\right)_V - P$ for one mole a Vander waals gas is
(a) $\frac{a}{V^2}$ (b) $\frac{a}{V^2}\left(\frac{RT}{V-b}\right)$ (c) Zero (d) $\frac{RT}{V-b}$

of 10^{-3} mol of this sample. Assuming the sample absorbs all the light, the quantum yield for this photochemical reaction is:
(a) 6.023 (b) 0.602 (c) 60.230 (d) 0.060

69. If standard emf of the cell,

$$Cu\,|\,Cu^{2+}(aq)\,||\,[Cu(NH_3)_4]^{2+},\ aq.\ NH_3\,|\,Cu$$

is 0.35, then stability constant of the formation cupric amine complex is
(a) 1.0×10^{27} (b) 8.4×10^{5} (c) 7.0×10^{11} (d) 4.3×10^{13}

70. Standard entropy of crystalline carbon monoxide (in J/mol) at 0 K is around
(a) 0.03 (b) 2.50 (c) Zero (d) 5.76

71. Matals used in automobile catalytic converters are:
(a) Pt and Pd (b) Pt and Rh (c) Pd and Rh (d) Rh and Ni

Q. 72 to Q. 77 contain a Statement with a Reason and an Assertion. For each question, choose the correct answer from the following four choices.
(a) Both Reason and Assertion are correct (b) Both Reason and Assertion are wrong
(c) Reason is correct but Assertion is wrong (d) Reason is wrong but Assertion is correct

72. Statement: The characteristic spectroscopic feature of the quadruply bonded $\left[Re_2\ Cl_8\right]^{2-}$ is a strong royal blue colur
Reason: This is due to an absorption band in the visible region due to excitation of an electron from $\sigma^2\pi^4\delta^2$ ground state to $\sigma^2\pi^4\delta^1\delta^{*1}$ excited state
Assertion: This transition is quantum mechanically allowed

73. Statement: For the reaction $L_nMH \rightarrow L_nM^- + H^+$, the important factors are the strength of the M–H bond and the nature of the ligand, L
Reason: The key here is the stability of the complex ion, L_nM^-
Assertion: Weak π-bonding ligands will stabilize L_nM^- and so will disfavour the forward reaction.

74. **Statement:** D-Glucose and D-mannose give the same phenylosazone. **[GATE 2005]**
Reason: Osazone formation results in a loss of the stereocentre at C_2 but does not affect other stereocenters.
Assertion: D-Glucose and D-mannose are enantiomers.
(a) Both **Reason** and **Assertion** are correct
(b) Both **Reason** and **Assertion** are wrong.
(c) **Reason** is correct but **Assertion** is wrong.
(d) **Reason** is wrong but **Assertion** is correct.

75. **Statement:** Nucleosides are stable in dilute base but undergo hydrolysis in dilute acid. **[GATE 2005]**
Reason: Nucleosides have an N-glycosidic linkage.
Assertion: N-Glycosidic linkage behaves like an O-glycosidic linkage which is rapidly hydrolyzed by aqueous acid but stable in aqueous base.
(a) Both **Reason** and **Assertion** are correct
(b) Both **Reason** and **Assertion** are wrong.
(c) **Reason** is correct but **Assertion** is wrong.
(d) **Reason** is wrong but **Assertion** is correct.

76. **Statement :** For the reaction of $NO + O_2 \rightarrow 2NO_2$ the rate constant is observed to decrease with temperature.
Reason : As per the proposed mechanism, the first step is the dimerization of nitric oxide which is exothermic.
Assertion : Rate law = $k_2K.[NO]_2[O_2]$
(a) Both Reason and Assertion are correct
(b) Both Reason and Assertion are wrong
(c) Reason is correct but Assertion is wrong
(d) Reason is wrong but Assertion is correct.

77. Statement: Hydrogen gas gets warmer on expanding under isenthalpic condition
Reason: Joule Thomson coefficient for hydrogen is –0.03 K/atm
Assertion: Attractive forces are the dominant intermolecular interactions in hydrogen gas at 273 K.

Common Data for Q. 78, Q.79 and Q.80:
Vapour pressures of water above pure liquid water 24, 529 and 760 torr respectively at 298, 363 and 373 K. Use these data to answer the questions 78, 79 and 80.

78. Change in chemical potential (in kJ/mol) for the equilibrium H_2O (liquid) = H_2O (gas) at 298K is
(a) 8.6 (b) –3.8 (c) 7.87 (d) 3.72

79. Aqueous solution of sodium chloride ($\chi_{NaCl} = 0.015$) at 298 K is in equilibrium with a water vapour pressure (in torr) of
(a) 23.64 (b) 748.60 (c) 24.36 (d) negligible

80. Average value of enthalpy of vaporisation (in kJ/mol) of water between 363 and 373 K is
(a) 42.50 (b) 40.80 (c) –40.65 (d) –40.80

Linked Answer Q.81(a) and Q.81(b):

81.(a) As per Huckel theory, π-electron energy levels of cyclobutadiene are

(a) $\alpha+2\beta, \alpha+\beta, \alpha-\beta, \alpha-2\beta$ (b) $\alpha+2\beta, \alpha-\beta, \alpha-\beta, \alpha-2\beta$

(c) $\alpha+2\beta, \alpha, \alpha, \alpha-2\beta$ (d) $\alpha+\beta, \alpha-\beta, \alpha-\beta, \alpha-2\beta$

81.(b) Given that $\beta = -75\ kJ/mol$, cyclobutadiene is
(a) paramagnetic and its lowest absorption energy is 150 kJ
(b) paramagnetic and its lowest absorption energy is 75 kJ
(c) diamagnetic and its lowest absorption energy is 75 kJ
(d) diamagnetic and its lowest absorption energy is 150 kJ.

Linked Answer Q.82(a) and Q.82(b):

82.(a) For the complex ion $\left[Cu\left(NH_3\right)_6\right]^{2+}$, the coordination geometric will be
(a) octahedral (b) tetragonally distorted octahedral
(c) trigonal prismatic (d) trigonal antiprismatic

82.(b) The number of possible d-d transitions will be
(a) one (b) two (c) three (d) four

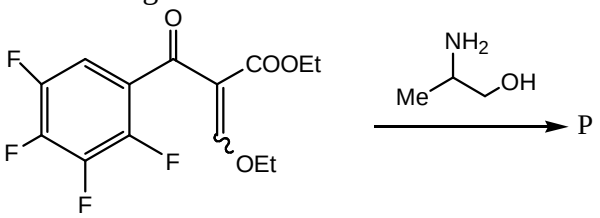
Linked Answer Q.83(a) and Q.83(b):

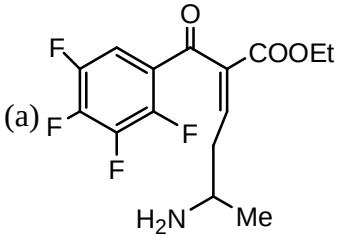
83.(a). The following data was obtained with the GLC. Column temperature, 60°C, inlet pressure, 1270 torr, outlet pressure, 770 torr, flow rate of carrier gas at 25°C, 18 mL/min and retention time for air, 0.30 min, the pressure drop correction factor will be
(a) 0.648 (b) 0.740 (c) 0.770 (d) 0.715

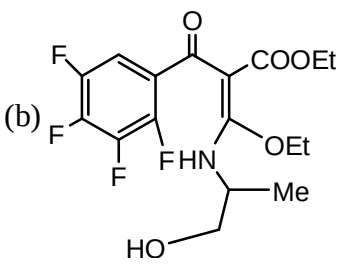
83.(b). Corrected retention volume for air (mL) will be
(a) 4.02 (b) 4.72 (c) 4.46 (d) 4.25

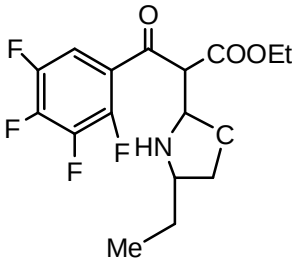
Linked Answer Q.84(a) and Q.84(b):

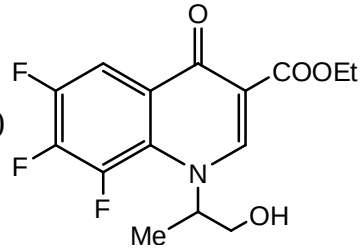
84.(a). The major product P of the following reaction is:



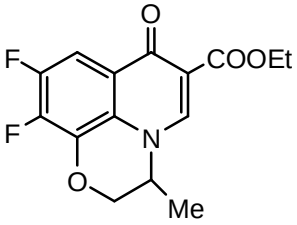
(a)


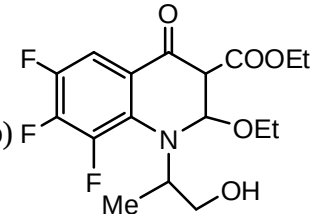
(b)


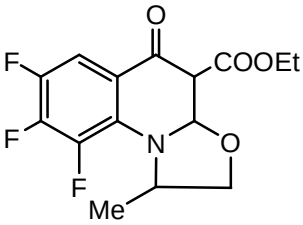
(c) 

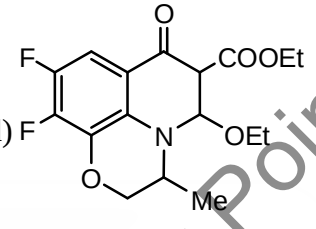
(d) 

84.(b). Major compound Q obtained on reaction of P with NaH in DMF is:

(a) 

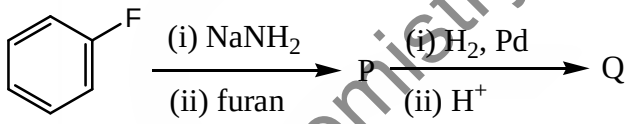
(b) 

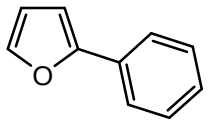
(c) 

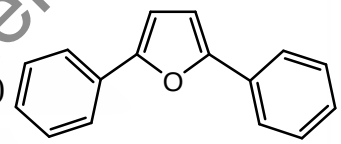
(d) 

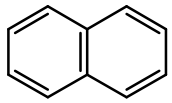
Linked Answer Q.85(a) and Q.85(b):

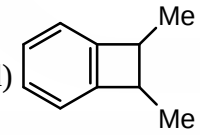
85. (a) In the follwoing sequence of reactions, the major product Q is:



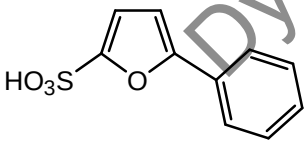
(a) 

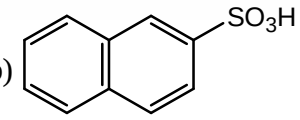
(b) 

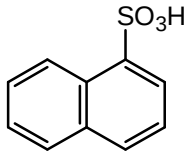
(c) 

(d) 

85.(b) The major product on sulphonation of Q with H_2SO_4 at 160°C is:

(a) 

(b) 

(c) 

(d)