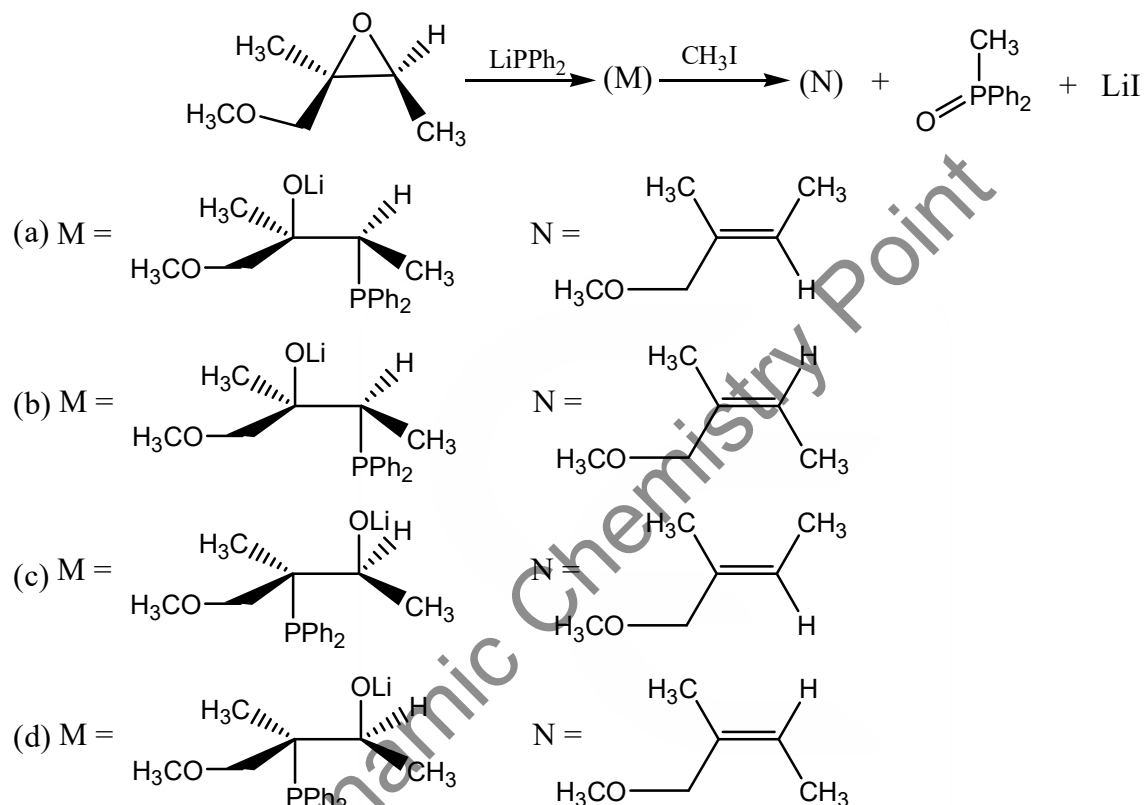
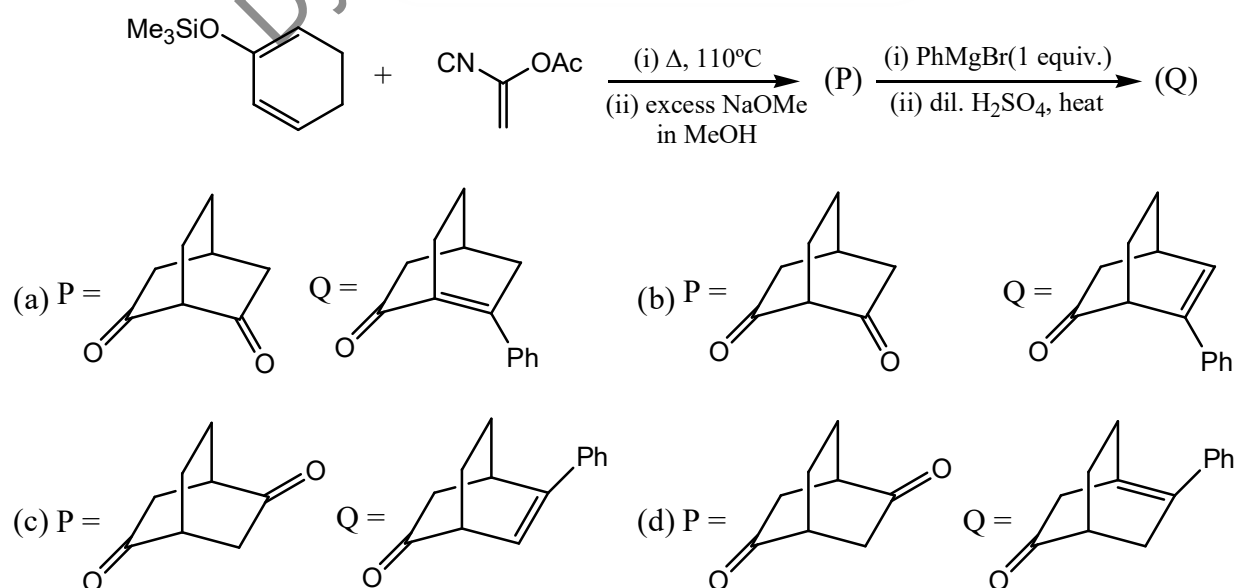


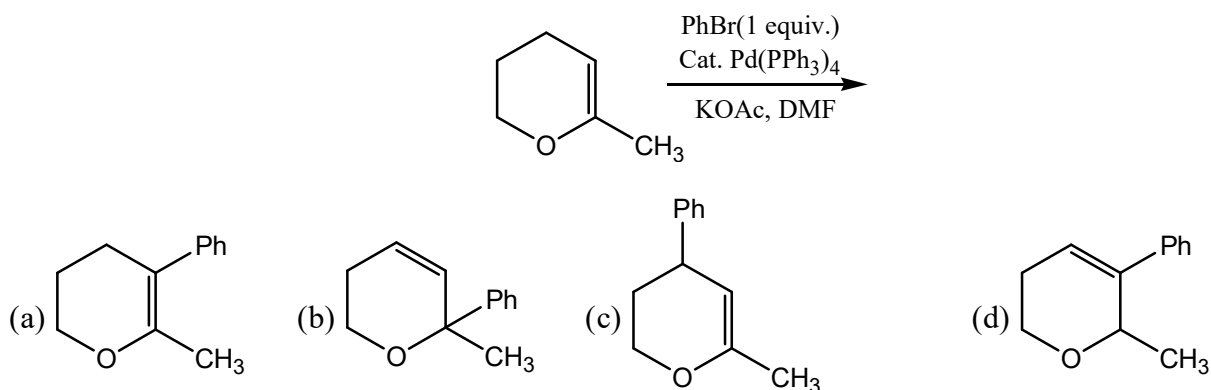
42. The major products M and N in the following reaction sequence are



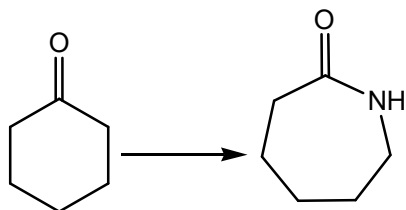
43. The major products P and Q in the following reaction sequence, are



44. The major product formed in the following reaction, is



45. The following synthetic transformation can be achieved using



Reagents:

(p) (i) $\text{NH}_2\text{OH}/\text{H}^+$, (ii) H_2SO_4

(q) NH_3/H^+

(r) (i) $\text{NH}_2\text{OH}/\text{H}^+$, (ii) NaOH

(a) p only

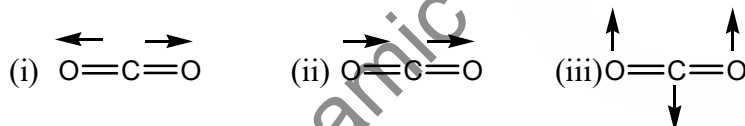
(b) p and q

(c) q and r

(d) r only

46. Consider a two-state system at thermal equilibrium with equal degeneracy where the excited state is higher in energy than the ground state by 0.1 eV. The ratio of the population of the excited state to that of the ground state, at a temperature for which $k_B T = 0.05$ eV, is _____

47. Of the vibrational modes given below, the IR active mode(s) is(are)



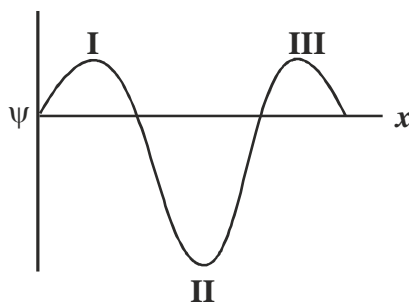
(a) (ii) only

(b) (iii) only

(c) (i) and (ii)

(d) (ii) and (iii)

48. A system is described by the following real wavefunction.



The probability (P) of finding the particle in a region dx around points I, II and III in the figure obeys the trend

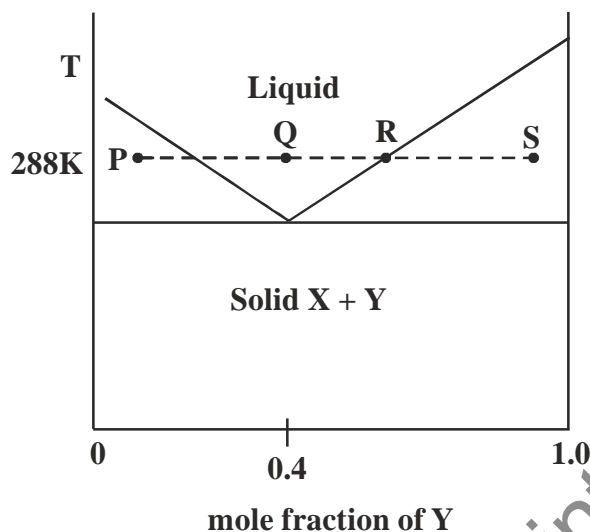
(a) $P(\text{I}) > P(\text{II}) > P(\text{III})$

(b) $P(\text{II}) > P(\text{III}) > P(\text{I})$

(c) $P(\text{II}) > P(\text{I}) > P(\text{III})$

(d) $P(\text{III}) > P(\text{I}) > P(\text{II})$

49. The temperature-composition ($T-x$) phase diagram of the two-component system made of X and Y is given below. At a temperature of 288K and starting at the point P, Y is added until the composition reaches S. Which of the following statements is NOT TRUE?



- (a) At P, the solid and liquid are present in almost equal proportions
 (b) At Q, the system is all liquid
 (c) At S, the system has more solid than liquid
 (d) At R, the liquid is pure X
50. For a system subjected to only P-V work, entropy is given by
 (I) $-\left(\frac{\partial G}{\partial T}\right)_P$ (II) $\left(\frac{\partial G}{\partial P}\right)_T$ (III) $-\left(\frac{\partial A}{\partial V}\right)_T$ (IV) $-\left(\frac{\partial A}{\partial T}\right)_V$
 (a) I and II (b) I and IV (c) I only (d) II only
51. According to Irving-Williams series, the number of d electrons for the first row transition metal (M) ion having the highest overall stability constant ($\log\beta$) for $[M(\text{EDTA})]^{2-}$ is _____
52. The magnitude of the difference in the crystal field stabilization energies, in Δ_0 (ignoring pairing energy), of $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{Fe}(\text{CN})_6]^{4-}$ is _____
53. The calculated and observed magnetic moments differ considerably for an aqua complex of a Lanthanide (III) ion as a result of low lying states of high J . The ion, among the following, is
 (a) Ce^{3+} (b) Pr^{3+} (c) Eu^{3+} (d) Yb^{3+}
54. In the electronic spectra of $[\text{CrF}_6]^{3-}$, absorption bands observed at 670, 440 and 290 nm are, respectively, due to the transitions.
 (a) ${}^4A_{2g} \rightarrow {}^4T_{1g}(\text{P})$, ${}^4A_{2g} \rightarrow {}^4T_{1g}(\text{F})$ and ${}^4A_{2g} \rightarrow {}^4T_{2g}$
 (b) ${}^4A_{2g} \rightarrow {}^4T_{1g}(\text{P})$, ${}^4A_{2g} \rightarrow {}^4T_{2g}$ and ${}^4A_{2g} \rightarrow {}^4T_{1g}(\text{F})$
 (c) ${}^4A_{2g} \rightarrow {}^4T_{1g}(\text{F})$, ${}^4A_{2g} \rightarrow {}^4T_{1g}(\text{P})$ and ${}^4A_{2g} \rightarrow {}^4T_{2g}$
 (d) ${}^4A_{2g} \rightarrow {}^4T_{2g}$, ${}^4A_{2g} \rightarrow {}^4T_{1g}(\text{F})$ and ${}^4A_{2g} \rightarrow {}^4T_{1g}(\text{P})$
55. Amongst the following, the group that is bound to the metal ion in coenzyme B_{12} is
 (a) methyl (b) cyanide (c) adenosyl (d) hydroxyl