GATE 2008 Multiple Choice Questions

EE25BTECH11010-ARSH DHOKE

Q.1 – Q.20 Carry one mark each

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

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

   (GATE CY 2008)

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

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

   (GATE CY 2008)

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

   (a) methane
   (b) propyne
   (c) propene
   (d) propane

   (GATE CY 2008)

4. The correct statement about C_{60} is

   (a) C_{60} is soluble in benzene
   (b) C_{60} does not react with *tert*-butyllithium
   (c) C_{60} is made up of 10 five–membered and 15 six–membered rings
   (d) Two adjacent five–membered rings share a common edge (GATE CY 2008)

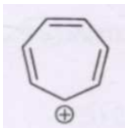
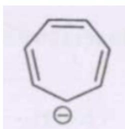
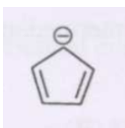
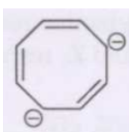
5. The lattice parameters for a monoclinic crystal are

   (a) $a \neq b \neq c;\ \alpha = \gamma = 90^\circ$
   (b) $a = b \neq c;\ \alpha \neq \beta \neq \gamma$
   (c) $a \neq b \neq c;\ \alpha \neq \beta \neq \gamma$
   (d) $a = b = c;\ \alpha = \gamma = 90^\circ$ (GATE CY 2008)

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

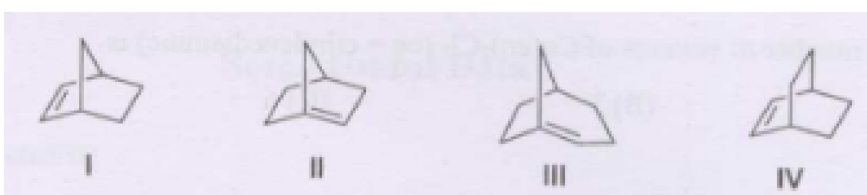
(a) four unpaired electrons
(b) three unpaired electrons
(c) two unpaired electrons
(d) zero unpaired electrons (GATE CY 2008)

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

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

(GATE CY 2008)

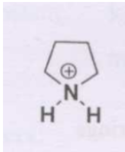
8. The order of stability for the following cyclic olefins is

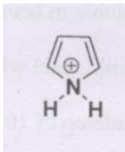


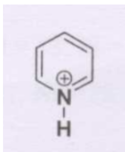
(a) I < II < III < IV
(b) I < III < IV < I
(c) II < III < I < IV
(d) IV < II < I < III

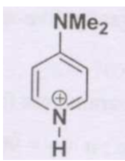
(GATE CY 2008)

9. The most acidic species is

(a) 

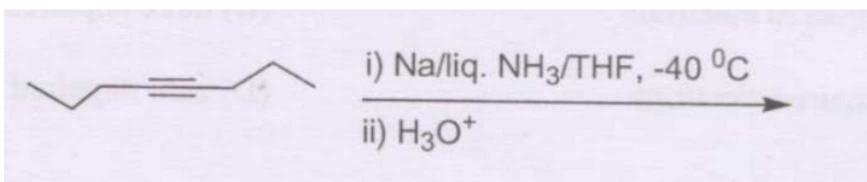
(b) 

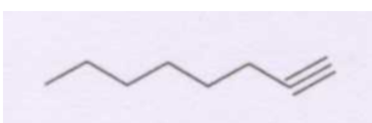
(c) 

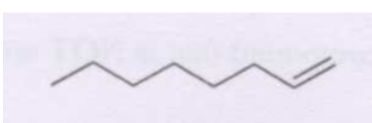
(d) 

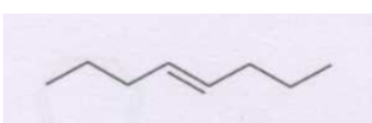
(GATE CY 2008)

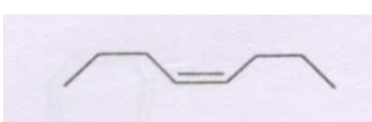
10. The major product of the following reaction is



(a) 

(b) 

(c) 

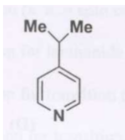
(d) 

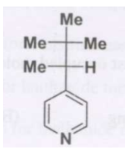
(GATE CY 2008)

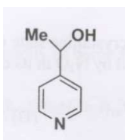
11. In the carbylamine reaction, R–X is converted to R–Y *via* the intermediate Z. R–X, R–Y and Z, respectively, are

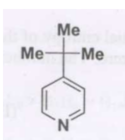
(a) $R\text{–}NH_2$, R–NC, carbene
(b) $R\text{–}NH_2$, R–NC, nitrene
(c) R–NC, $R\text{–}NH_2$, carbene
(d) R–OH, R–NC, nitrene (GATE CY 2008)

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

(a) 

(b) 

(c) 

(d) 

(GATE CY 2008)

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

(a) methionine (c) proline
(b) glycine (d) serine (GATE CY 2008)

14. The Hammett reaction constant ρ is based on

(a) the rates of alkaline hydrolysis of substituted ethyl benzoates
(b) the dissociation constants of substituted acetic acids
(c) the dissociation constants of substituted benzoic acids
(d) the dissociation constants of substituted phenols (GATE CY 2008)

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

(a) 2×10^5

(b) 3×10^6

(c) 0

(d) 10^{-14}

(GATE CY 2008)

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

(a) 3

(b) 2

(c) 1

(d) 4

(GATE CY 2008)

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

(a) 20000

(b) 8000

(c) 5000

(d) 200

(GATE CY 2008)

18. For the reaction $2X_3 \rightarrow 3X_2$, the rate of formation of X_2 is

(a) $3\left(-\frac{d[X_3]}{dt}\right)$

(b) $\frac{1}{2}\left(-\frac{d[X_3]}{dt}\right)$

(c) $\frac{1}{3}\left(-\frac{d[X_3]}{dt}\right)$

(d) $\frac{3}{2}\left(-\frac{d[X_3]}{dt}\right)$

(GATE CY 2008)

19. The highest occupied molecular orbital of HF is

(a) bonding

(b) antibonding

(c) ionic

(d) nonbonding

(GATE CY 2008)

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

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

(GATE CY 2008)

Q.21 to Q.75 Carry two marks each

21. The spectroscopic ground state symbol and the total number of electronic transitions of $[Ti(H_2O)_6]^{3+}$ are

(a) $^3T_{1g}$ and 2

(b) $^3A_{2g}$ and 3

(c) $^1T_{1g}$ and 3

(d) $^3A_{2g}$ and 2

(GATE CY 2008)

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

(a) square planar and tetrahedral

(b) octahedral and square pyramidal

(c) octahedral and trigonal bipyramidal

(d) tetrahedral and square planar (GATE CY 2008)

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

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

(GATE CY 2008)

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

(a) 10^2

(b) 10^1

(c) 10^{-3}

(d) 10^3

(GATE CY 2008)

25. The expected magnetic moments of the first-row transition metal complexes and those of the lanthanide metal complexes are usually calculated using

(a) μ_{so} equation (s.o. = spin only) for both lanthanide and transition metal complexes

(b) μ_{so} equation for lanthanide metal complexes and μ equation for transition metal complexes

(c) μ_{so} equation for transition metal complexes and μ equation for lanthanide metal complexes

(d) μ_{eff} equation for transition metal complexes and μ_{so} equation for lanthanide metal complexes (GATE CY 2008)

26. The Brønsted acidity of boron hydrides follows the order

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

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

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

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

(GATE CY 2008)

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

(a) The crystals will be non-stoichiometric

(b) The crystals should have Frenkel defects

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

(d) The nature of defects will depend upon the concentration of the solution and its rate of evaporation (GATE CY 2008)

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

(a) 9 (c) 3

(b) 6 (d) 12

(GATE CY 2008)

29. If ClF_5 were to be stereochemically rigid, its ^{19}F NMR spectrum $\left(I for ^{19}F = \frac{1}{2}\right)$ would be (assume that Cl is not NMR active)

(a) a doublet and a triplet

(b) a singlet

(c) a doublet and a singlet

(d) two singlets (GATE CY 2008)

30. The point group of NSF_3 is

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

(GATE CY 2008)

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

(a) an n-type semiconductor containing only Ni^{1+}

(b) an n-type semiconductor containing Ni^{1+} and Ni^{2+}

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

(d) a p-type semiconductor containing only Ni^{3+} (GATE CY 2008)

∘

32. White phosphorus, P_4, belongs to the

(a) *closo* system (b) *nido* system (c) *arachno* system (d) *hypho* system

(GATE CY 2008)

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

(a) $NiFe_2O_4$ and Mn_3O_4 are normal spinels

(b) Fe_3O_4 and Mn_3O_4 are normal spinels

(c) Fe_3O_4 and Mn_3O_4 are inverse spinels

(d) Fe_3O_4 and $NiFe_2O_4$ are inverse spinels (GATE CY 2008)

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

(a) four

(b) six

(c) eight

(d) zero

(GATE CY 2008)

35. Schrock carbenes are

(a) triplets and nucleophilic

(b) triplets and electrophilic

(c) singlets and nucleophilic

(d) singlets and electrophilic

(GATE CY 2008)

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

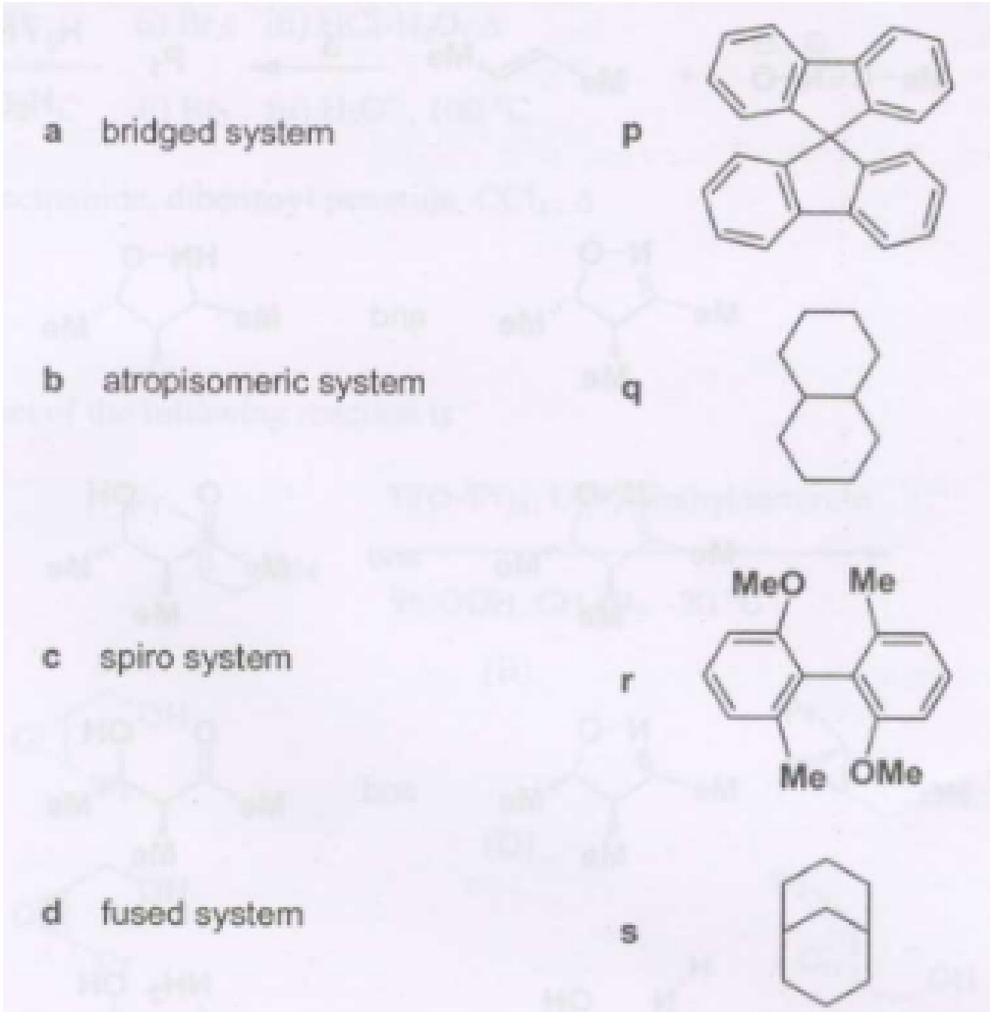
(a) it is extremely hydrophilic

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

(c) it has a very low glass transition temperature

(d) it can be reinforced to give silicon elastomers (GATE CY 2008)

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



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

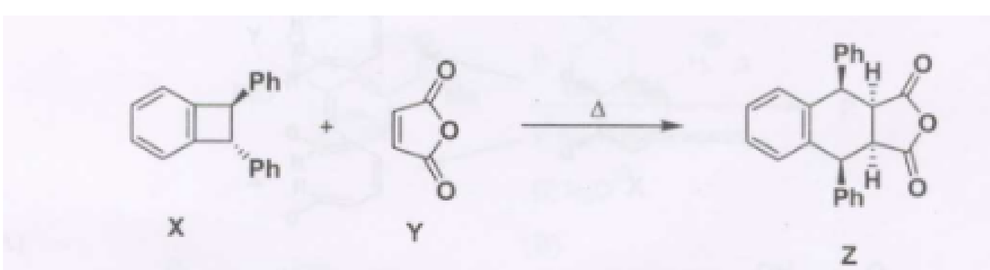
(b) a - p, b - s, c - q, d - r

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

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

(GATE CY 2008)

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



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

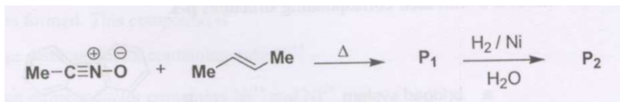
(b) 4π-disrotatory opening of X followed by *endo* Diels–Alder cycloaddition

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

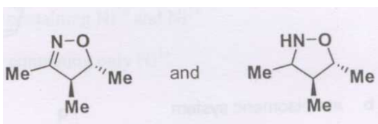
(d) 4π-disrotatory opening of X followed by *exo* Diels–Alder cycloaddition

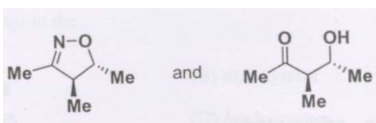
(GATE CY 2008)

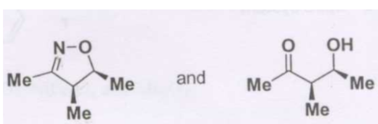
39. The major products P_1 and P_2, respectively, in the following reaction sequence are

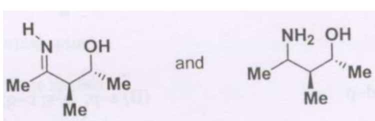


(GATE CY 2008)

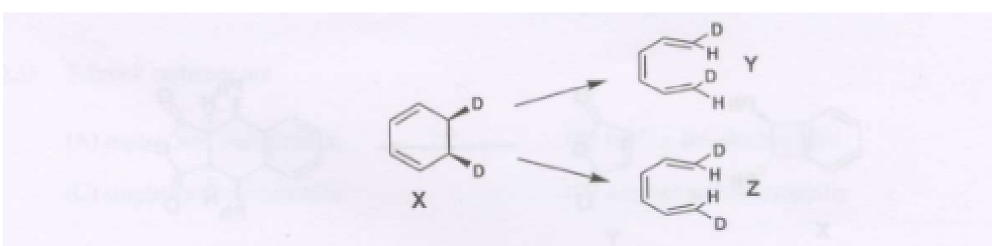
(a) 

(b) 

(c) 

(d) 

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



(a) $h\nu$, conrotatory opening and Δ, disrotatory opening

(b) $h\nu$, disrotatory opening and Δ, conrotatory opening

(c) Δ, conrotatory opening and $h\nu$, disrotatory opening

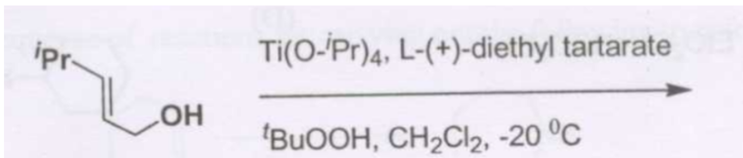
(d) Δ, disrotatory opening and $h\nu$, conrotatory opening

(GATE CY 2008)

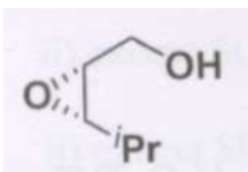
41. *o*-Bromophenol is readily prepared from phenol using the following conditions:

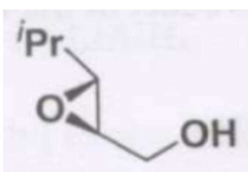
(a) i) $(CH_3CO)_2O$; ii) Br_2; iii) HCl–H_2O, Δ
(b) i) H_2SO_4, 100°C; ii) Br_2; iii) H_3O^+, 100°C
(c) N-Bromosuccinimide, dibenzoyl peroxide, CCl_4, Δ
(d) $Br_2/FeBr_3$ (GATE CY 2008)

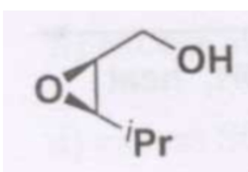
42. The major product of the following reaction is

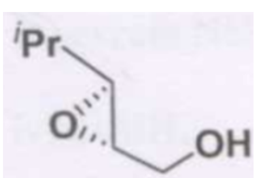


(GATE CY 2008)

(a) 

(b) 

(c) 

(d) 

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

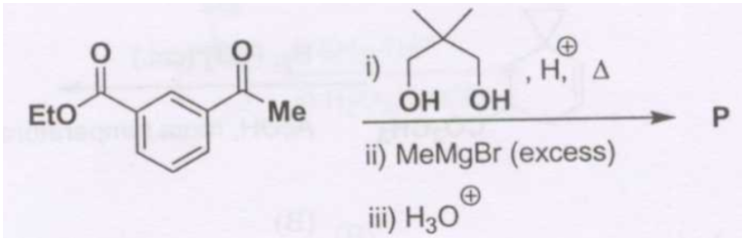
(a) 14 : 86
(b) 50 : 50

(c) 1 : 9

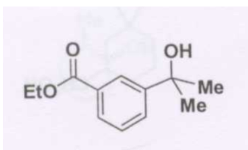
(d) 99 : 1

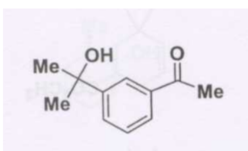
(GATE CY 2008)

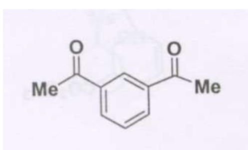
44. The major product *P* of the following reaction is

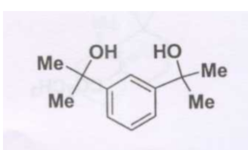


(GATE CY 2008)

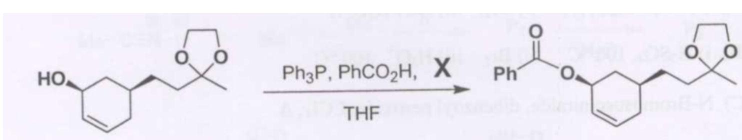
(a) 

(b) 

(c) 

(d) 

45. The reagent **X** in the following reaction is

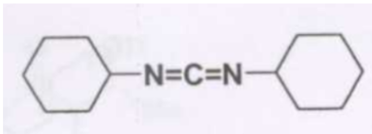


(GATE CY 2008)

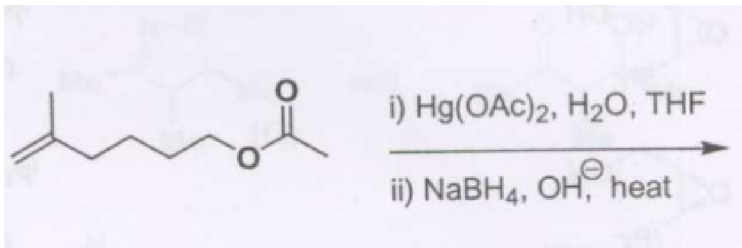
(a) $HO_2CN{=}NCO_2H$

(b) $EtO_2CHC{=}CH\text{-}CO_2Et$

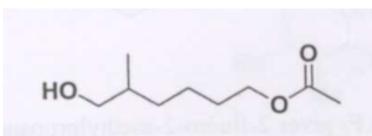
(c) $EtO_2CN{=}NCO_2Et$

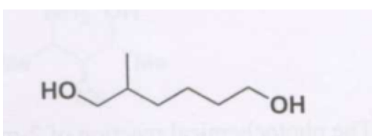
(d) 

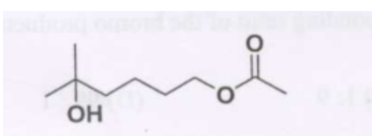
46. The major product of the following reactions is

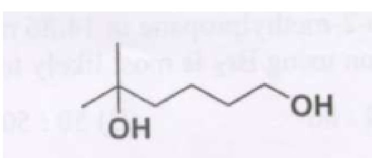


(GATE CY 2008)

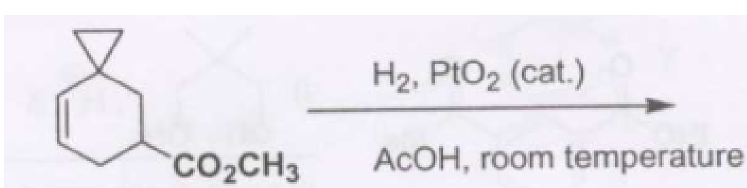
(a) 

(b) 

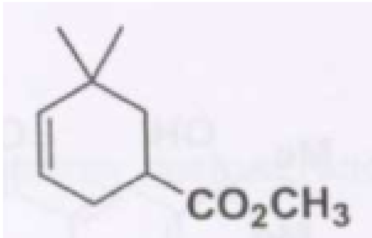
(c) 

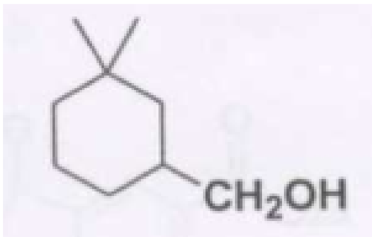
(d) 

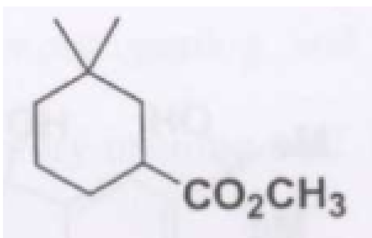
47. The major product of the following reaction is

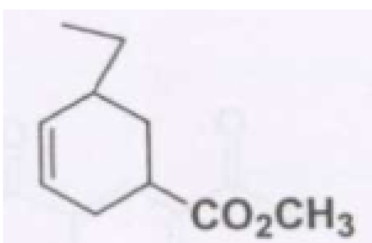


(GATE CY 2008)

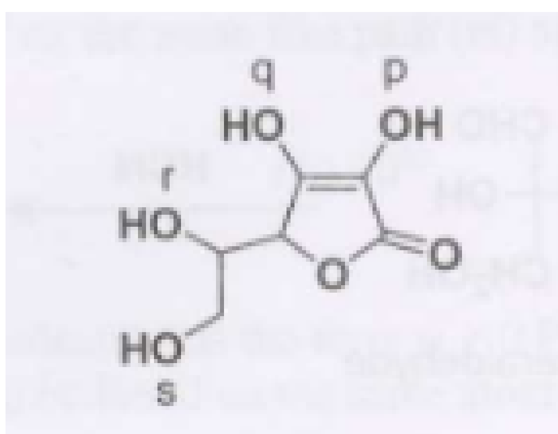
(a) 

(b) 

(c) 

(d) 

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



(a) p

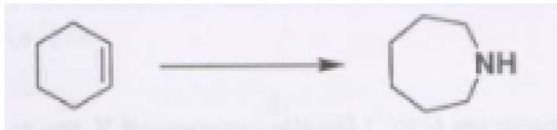
(b) q

(c) r

(d) s

(GATE CY 2008)

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



(a) i) O_3/H_2O_2; ii) excess $SOCl_2$/pyridine; iii) excess NH_3; iv) $LiAlH_4$
(b) i) O_3/Me_2S; ii) excess $SOCl_2$/pyridine; iii) $LiAlH_4$; iv) excess NH_3
(c) i) O_3/H_2O_2; ii) excess $SOCl_2$/pyridine; iii) $LiAlH_4$; iv) excess NH_3
(d) i) O_3/Me_2S; ii) excess $SOCl_2$/pyridine; iii) excess NH_3; iv) $LiAlH_4$

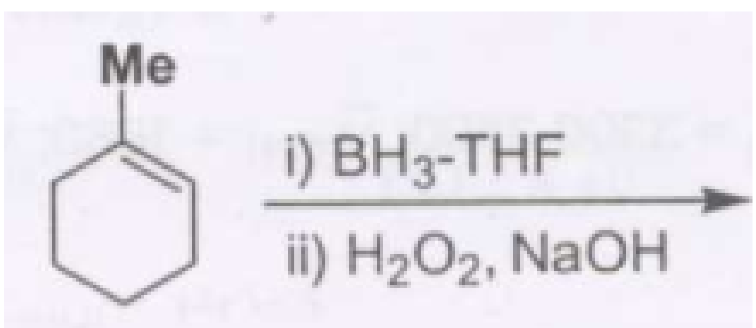
(GATE CY 2008)

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

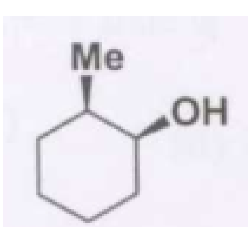
(a) 4
(b) 3
(c) 2
(d) 1

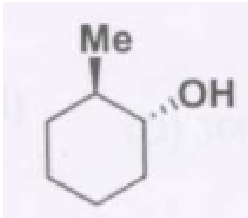
(GATE CY 2008)

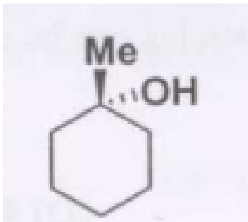
51. The major product of the following reactions is

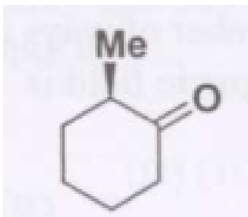


(GATE CY 2008)

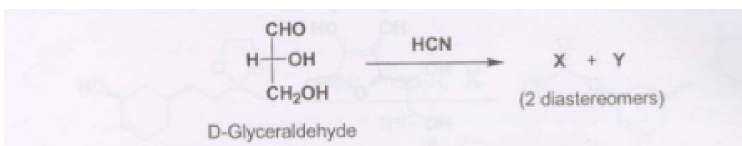
(a) 

(b) 

(c) 

(d) 

52. In the folloowing reaction,

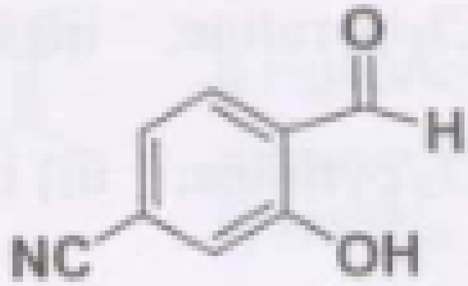


The absolute configurations of the chiral centres in X and Y are

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

(GATE CY 2008)

53. The IR stretching frequencies (cm^{-1}) for the compound X are as follows: 3300–3500 (s, br); 3000 (m); 2225 (s); 1680 (s).



X

The correct assignment of the absorption bands is:

(a) $\bar{\nu}_{OH} = 3300$–3500; $\bar{\nu}_{CH} = 3000$; $\bar{\nu}_{CN} = 2225$; $\bar{\nu}_{CO} = 1680$

(b) $\bar{\nu}_{OH} = 3000$; $\bar{\nu}_{CH} = 3300$–3500; $\bar{\nu}_{CN} = 2225$; $\bar{\nu}_{CO} = 1680$

(c) $\bar{\nu}_{OH} = 3300$–3500; $\bar{\nu}_{CH} = 3000$; $\bar{\nu}_{CN} = 1680$; $\bar{\nu}_{CO} = 2225$

(d) $\bar{\nu}_{OH} = 3000$; $\bar{\nu}_{CH} = 3300$–3500; $\bar{\nu}_{CN} = 1680$; $\bar{\nu}_{CO} = 2225$

(GATE CY 2008)

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

(a) 1 (c) 2

(b) 6 (d) 3 (GATE CY 2008)

55. The total number of ways in which two nonidentical spin $\frac{1}{2}$ particles can be oriented relative to a constant magnetic field is

(a) 1 (c) 3

(b) 2 (d) 4 (GATE CY 2008)

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

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

(GATE CY 2008)

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

(a) 79

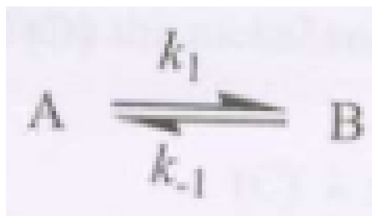
(b) 20

(c) 45

(d) 60

(GATE CY 2008)

58. For the reaction given below, the relaxation time is 10^{-4} s. Given that 10% of A remains at equilibrium, the value of k_1 (s^{-1}) is



(a) 9×10^5

(b) 10^5

(c) 10^6

(d) 9×10^6

(GATE CY 2008)

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

(a) 1

(b) 2

(c) 3

(d) 4

(GATE CY 2008)

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

(a) -1.0

(b) -0.5

(c) -2.0

(d) -4.0

(GATE CY 2008)

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

(a) 2×10^4

(b) 2×10^7

(c) 2×10^2

(d) 0

(GATE CY 2008)

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

(a) 500

(b) 150

(c) 200

(d) 300

(GATE CY 2008)

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

(a) $1/2$

(b) $2/N$

(c) $(1/2)^N$

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

(GATE CY 2008)

64. According to the Debye-Hückel limiting law, the mean activity coefficient of $5{\times}10^{-4}$ mol kg^{-1} aqueous solution of $CaCl_2$ at 25°C is (the Debye-Hückel constant 'A' can be taken to be 0.509)

(a) 0.63

(b) 0.72

(c) 0.80

(d) 0.91

(GATE CY 2008)

65. The operation of the commutator $\left(x, \left(\frac{d}{dx}\right)\right)$ on a function $f(x)$ is equal to

(a) 0

(b) $f(x)$

(c) $-f(x)$

(d) $x\frac{df}{dx}$

(GATE CY 2008)

66. If a gas obeys the equation of state $P(V-nb)=nRT$, the ratio $(C_P-C_V)/(C_P-C_V)_{\text{ideal}}$ is

(a) >1

(b) <1

(c) 1

(d) $(1-b)$

(GATE CY 2008)

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

(a) 8×10^{-10}

(b) 8×10^{-11}

(c) 2×10^{-9}

(d) 1×10^{-12}

(GATE CY 2008)

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

(a) 9

(b) 30

(c) 16

(d) 0

(GATE CY 2008)

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

$$\mathrm{E+S} \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} [\mathrm{E\,S}] \underset{k_{-2}}{\overset{k_2}{\rightleftharpoons}} \mathrm{E+P}\ ; \qquad \frac{-d[\mathrm{S}]}{dt} = \frac{k_1k_2[\mathrm{S}]-k_{-1}k_{-2}[\mathrm{P}]}{k_1[\mathrm{S}]+k_{-2}[\mathrm{P}]+k_{-1}+k_2}[\mathrm{E}]_0$$

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

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

(GATE CY 2008)

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

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

(GATE CY 2008)

Common Data Questions

Common Data for Questions 71, 72 and 73: An electron accelerated through a potential difference of φ volts impinges on a nickel surface, whose (100) planes have a spacing $d = 351.8 \times 10^{-12}$ m ($351.8pm$).

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

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

(GATE CY 2008)

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

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

(GATE CY 2008)

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

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

(GATE CY 2008)

Common Data for Questions 74 and 75: An iron complex $[FeL_3]^{2+}$ (L = neutral monodentate ligand) catalyses the oxidation of $(CH_3)_2S$ by perbenzoic acid.

74. The formation of the organic product in the above reaction can be monitored by:

(a) gas chromatography
(b) cyclic voltammetry
(c) electron spin resonance
(d) fluorescence spectroscopy

(GATE CY 2008)

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

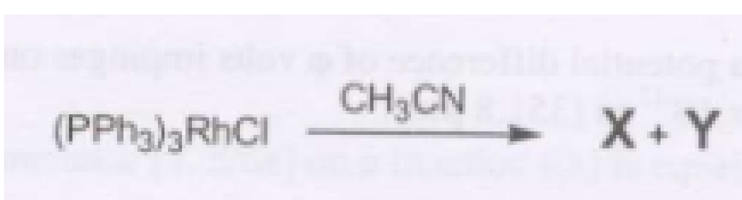
(a) atomic absorption spectroscopy
(b) Mössbauer spectroscopy
(c) HPLC
(d) gas chromatography

(GATE CY 2008)

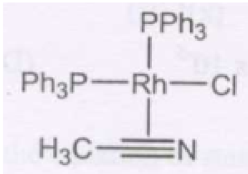
1 Linked Answer Questions: Q.76 to Q.85 carry two marks each

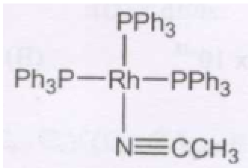
Linked Answer Questions 76 and 77:

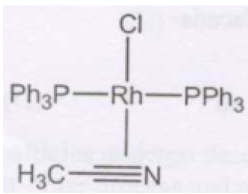
In the reaction,

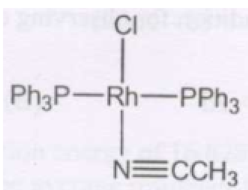


76. Compound *X* is

(a) 

(b) 

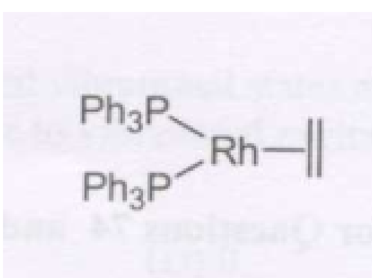
(c) 

(d) 

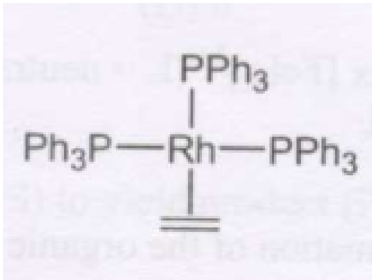
(GATE CY 2008)

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

(a) $H_3C\text{-}CH_3$

(b) 

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

(d) 

(GATE CY 2008)

Linked Answer Questions 78 and 79

The reaction of PCl_3 with methanol in the presence of triethylamine affords compound X. EI mass spectrum of X shows a parent ion peak at m/z = 124. Microanalysis of X shows that it contains C, H, O and P. The ^{1}H NMR spectrum of X shows a doublet at 4.0 ppm. The separation between the two lines of the doublet is approximately 15 Hz $\left(J for\,^1\mathrm{H}\ and\,^{31}\mathrm{P} = \frac{1}{2}\right)$.

78. Compound X is:

    (a) $(CH_3O)_2P$
    (b) $(CH_3O)_2PO$
    (c) $(CH_3O)_2P(O)OH$
    (d) $(CH_3O)_2PH$

(GATE CY 2008)

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

    Compound Y is:

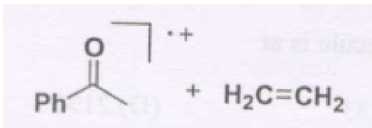
    (a) $(CH_3O)_2P(O)(OH)$
    (b) $(CH_3O)_2P$
    (c) $(CH_3O)(CH_3)P(O)$
    (d) $(CH_3O)(CH_3)P(OH)$

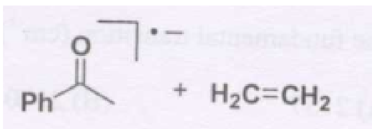
(GATE CY 2008)

Linked Answer Questions 80 and 81

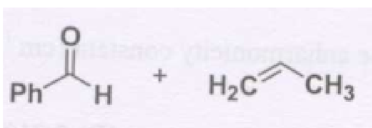
For butyrophenone ($PhCOCH_2CH_2CH_3$),

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

(a) 

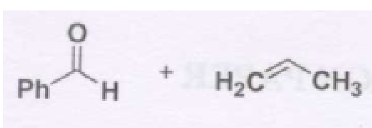
(b) 

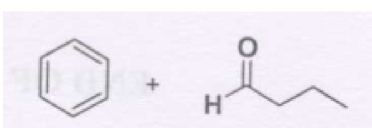
(c) 

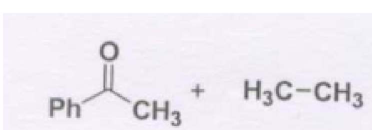
(d) 

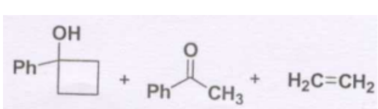
(GATE CY 2008)

81. Photoirradiation leads to the following set of products.

(a) 

(b) 

(c) 

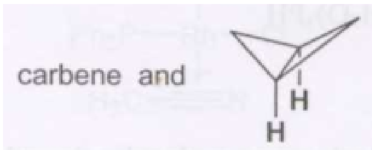
(d) 

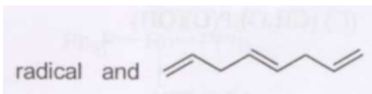
(GATE CY 2008)

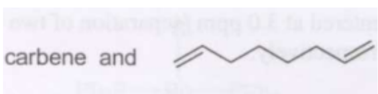
Linked Answer Questions 82 and 83:

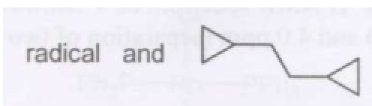
In the following reaction,

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

(a) 

(b) 

(c) 

(d) 

(GATE CY 2008)

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

(a) m= 3 and n = 2

(b) m = 2 and n = 3

(c) m= 2 and n = 2

(d) m = 4 and n = 3 (GATE CY 2008)

Linked Answer Questions 84 and 85:

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

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

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

(GATE CY 2008)

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

(a) 0.018

(b) 0.012

(c) 0.006

(d) 0.003

(GATE CY 2008)

END OF THE QUESTION PAPER