CSIR-UGC-NET (Chemical Sciences) June - 2021 **(16/02/22)**

www.csircoaching.com

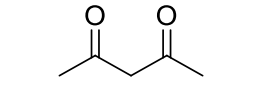
- ✓ CSIR-NET & SLET| SET Chemistry Coaching
- ✓ GATE Chemistry Coaching
- ✓ CUET-PG & JAM Chemistry Coaching
- ✓ PG | Polytechnic TRB Chemistry Coaching

Features

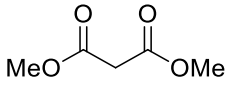
- ➢ 300 ++ Live Classes
- ➢ 600 ++ Concept Wise Tests
- ➢ 50 ++ Chapter Wise Tests
- ➢ 50 ++ Model Tests
- ➢ 2000 ++ Problem Discussions
- ➢ Recorded Videos
- ➢ A Well-Defined Curriculum
- ➢ A Strong Subject Foundation
- ➢ A Refined Learning Methodology
- ➢ Updated Study materials
- ➢ Freshers Can easily understand
- ➢ Question banks

Q.21 – Q.60 MCQ, carry TWO marks each (for each wrong answer: –0.5).
You are required to Answer Maximum 35 Questions.

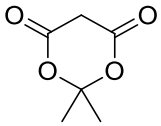
21. **The pK_a values for the following compounds are in the order**



P



Q



R

(a) Q > R > P (b) P > Q > R

(c) R > Q > P (d) Q > P > R

22. **Of the following statements regarding dissociative substitution in an octahedral transition metal complex,**

[P] **High steric hindrance between ligands in the metal complex favors fast dissociation of ligand**

[Q] **Increased charge on the metal atom/ion of the complex favours the acceptance of electron pair of the entering ligands**

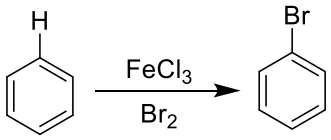
[R] **A pentacoordinated intermediate is observed**

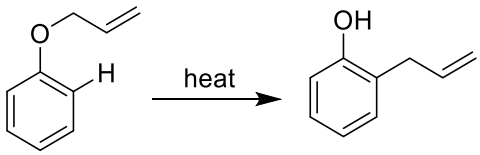
[S] **Nature of the entering ligand significantly influences the reaction**

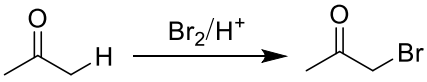
Which are correct?

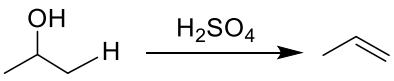
(a) P and S (b) P and R (c) P, R and S (d) P, Q, R and S

23. **The reaction that is expected to show a primary kinetic isotope effect for the indicated H-atom (C-H) is**

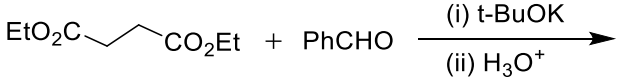
(a) 

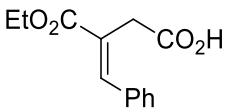
(b) 

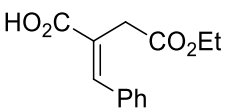
(c) 

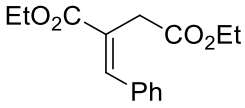
(d) 

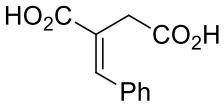
24. **The major product formed in the following reaction**



(a) 

(b) 

(c) 

(d) 

25. **For a person weighing 70 kg the minimal volume (in mL) of a fatal dose of a compound with $LD_{50} = 80\ mg.kg^{-1}$, and density $= 1.45\ g.mL^{-1}$ is**

(a) 5.6 (b) 3.9 (c) 0.8 (d) 0.4

26. **For the ligand-to-metal charge-transfer (LMCT) transitions in the oxo-anions given below, the wavelength of the transitions are in the order**

(a) $VO_4^{3-} < CrO_4^{2-} < MnO_4^{-}$ and $WO_4^{2-} < MoO_4^{2-} < CrO_4^{2-}$

(b) $VO_4^{3-} < CrO_4^{2-} < MnO_4^{-}$ and $WO_4^{2-} > MoO_4^{2-} > CrO_4^{2-}$

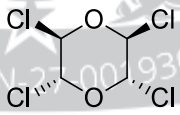
(c) $VO_4^{3-} > CrO_4^{2-} > MnO_4^{-}$ and $WO_4^{2-} < MoO_4^{2-} < CrO_4^{2-}$

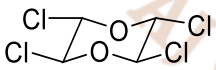
(d) $VO_4^{3-} > CrO_4^{2-} > MnO_4^{-}$ and $WO_4^{2-} > MoO_4^{2-} > CrO_4^{2-}$

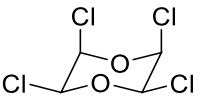
27. **When three of the phases of a two component system are simultaneously in equilibrium the number of degrees of freedom is**

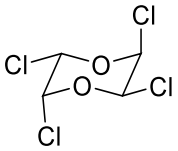
(a) 0 (b) 1 (c) 2 (d) 3

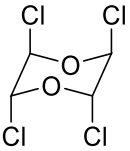
28. **The structure that corresponds to the most stable conformation of the following compound is**



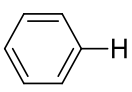
(a) 

(b) 

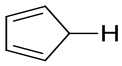
(c) 

(d) 

29. **The correct match for the Bond Dissociation Energies (BDE) of the C-H bonds of compounds in Column-I, with the values in Column-II is (As an example, the BDE for Me-H is 105.0 kcal/mol)**

	Column-I		Column-II BDE (kcal/mol)
P.		i.	110.9
Q.		ii.	71.1

P	Q	R	S

R.		iii.	132.0
S.	HC≡C–H	iv.	90.6

(a) iii ; iv ; i ; ii
(b) i ; iii ; ii ; iv
(c) iii ; i ; iv ; ii
(d) iv ; i ; ii ; iii

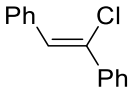
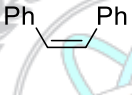
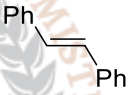
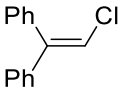
30. **The reactive cross section is expected to be the largest for the reaction**

(a) $Li + Cl_2 \longrightarrow LiCl + Cl$ (b) $Na + Cl_2$ (c) $K + Cl_2$ (d) $Rb + Cl_2$

31. **The rate of decomposition of a gas is $10\ mM\ s^{-1}$ when 10% is reacted and it is $5\ mM\ s^{-1}$ when reacted 40% is reacted. The order of the reaction is:**

(a) 2 (b) 1.71 (c) 0 (d) 2.15

32. **The major product formed in the following reaction**

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

33. **The volume of nitrogen gas adsorbed at STP to form a monolayer on a porous solid surface is $22.4\ cm^3g^{-1}$. If the area occupied by one nitrogen gas molecule is $16.2\ Å^2$, then the surface area (in $cm^2\ g^{-1}$) of the solid is close to:**

(a) 1.2×10^7 (b) 9.8×10^5 (c) 1.2×10^5 (d) 9.8×10^8

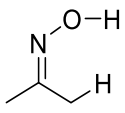
34. **The total π-electron density on the four carbon atoms of trans-butadiene are in the ratio**

(a) 1 : 1 : 1 : 1 (b) 1 : 2 : 2 : 1 (c) $1 : \sqrt{2} : \sqrt{2} : 1$ (d) 1 : 3 : 3 : 1

35. **The penetrating power(R) and ionizing power(I) of α, β and γ rays follow the ordering**

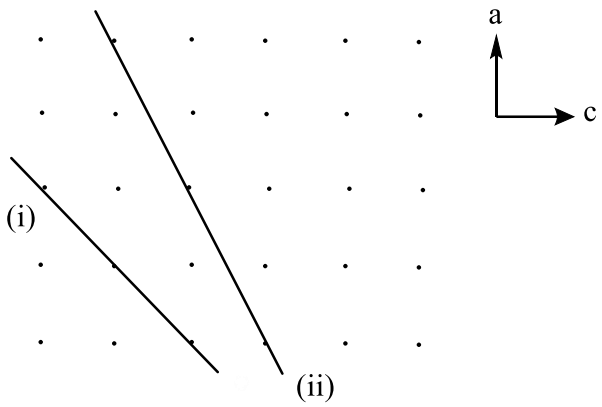
(a) $R_\beta > R_\gamma > R_\alpha$ and $I_\beta > I_\gamma > I_\alpha$
(b) $R_\gamma > R_\beta > R_\alpha$ and $I_\beta > I_\gamma > I_\alpha$
(c) $R_\beta > R_\alpha > R_\gamma$ and $I_\alpha > I_\beta > I_\gamma$
(d) $R_\gamma > R_\beta > R_\alpha$ and $I_\alpha > I_\beta > I_\gamma$

36. **The molecular orbital involved in the interaction of the oxime shown below, with a base is**



(a) σ^* of O–H (b) σ^* of C–H (c) σ of O–H (d) σ of C–H

37. The Miller indices of the planes parallel to the b axis and intersecting the a and c axis, as shown in the figure, are



(a) (i) 101 ; (ii) 102 (b) (i) 102 ; (ii) 101

(c) (i) 100 ; (ii) 101 (d) (i) 100 ; (ii) 102

38. Among the following which set of molecular/ionic species all have a planar structure?

(a) BrF_3 , $FClO_2$ and $[XeF_5]^-$ (b) XeO_3 , $[ClF_4]^-$ and $FClO_2$

(c) $[ClF_4]^-$, BrF_3 and $[XeF_5]^-$ (d) $FClO_2$, $[XeF_5]^-$ and XeO_3

39. Consider an octahedral complex Ma_2b_2cd, where a, b, c and d are monodentate ligands. The number of enantiomeric pairs for the complex is

(a) one (b) two (c) three (d) four

40. When yellow phosphorous is converted to red phosphorous, the entropy and volume of the system do not change. The order of this phase transition is most likely to be

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

41. Match the items of Column-I with the applications given in Column-II

	Column-I		Column-II
P.	Zeolite	i.	Solar cell
Q.	Indium tin oxide	ii.	CO_2 capture
R.	$LiCoO_2$	iii.	Fuel cell
S.	Pt alloy	iv.	Battery

	P	Q	R	S
(a)	iii	iv	i	ii
(b)	i	iii	ii	iv
(c)	ii	i	iv	iii
(d)	iv	ii	iii	i

42. The ozonolysis of a hydrocarbon in the presence of water produced pentanoic acid and carbonic acid. The hydrocarbon is

(a) 1-hexene (b) 1-hexyne (c) 5-decene (d) 5-decyne

43. For a micro-canonical system, the correct probability distribution function for energy is given by

(a) Exponential distribution function (b) Gaussian distribution function

(c) Poisson distribution function (d) Uniform distribution function

44. Consider following statement(s) in the context of NO and CO ligands

P. In the bent mode, NO donates three electrons to the metal center

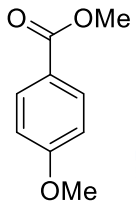
Q. In IR spectrum, the ν_{NO} for the bent nitrosyl ligand typically lies between 1525 and 1690 cm^{-1}

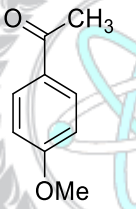
R. The HOMO of NO and CO are π^* and σ orbitals, respectively

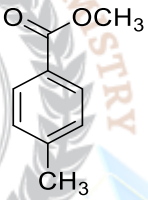
(a) P only (b) Q and R (c) P and R (d) P and Q

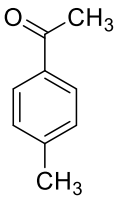
45. Which of the following compound has the ^{1}H-NMR spectrum

^{1}H-NMR (δ in ppm) : δ 2.4(s, 3H), 3.9(s, 3H), 7.25(d, J = 7Hz, 2H), 7.95(d, J = 7Hz, 2H)

(a) 

(b) 

(c) 

(d) 

46. The combination of two reflections, $\sigma_v'\sigma_v''$, about an intersecting mirror plane is equivalent to

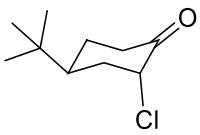
(a) S_n (b) C_n (c) σ_h (d) i

47. For $[Hg_2]^{2+}$, the bond order and the orbitals involved in bonding are, respectively,

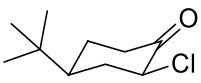
(a) one; s and s (b) two; s and p (c) one; p and p (d) three; s and d

48. The correct order of C=O stretching frequency in IR spectrum for the following compounds is

P



Q



R

(a) P > R > Q (b) Q > R > P

(c) R > Q > P (d) Q > P > R

49. The total number of lone pairs of electrons on all the atoms in cyanogen azide and thiocyanogen respectively are,

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

50. **The correct order of the electron affinity for one-electron gain of the elements is**

(a) F > Cl > Br (b) P > N > As

(c) S > Se > O (d) K > Li > Na

51. **Identify the correct statement for the two reactions given below**

$$Xe + PtF_6 \xrightarrow{SF_6} [Xe]^+[PtF_6]^-$$

$$XeF_4 + Me_4NF \longrightarrow [Me_4N]^+[XeF_5]^-$$

(a) Xe and XeF_4 both act as acids

(b) Xe and XeF_4 both act as bases

(c) Xe acts as an acid and XeF_4 acts as base

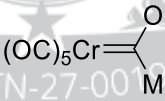
(d) Xe acts as a base and XeF_4 acts as an acid

52. **The hypothetical NMR spectrum of ^1H in $^1H-C-^2H$ would consist of (spin of the ^2H is 1) a**

(a) Singlet (b) Doublet of 1 : 1 ratio

(c) Triplet of 1 : 1 : 1 ratio (d) Triplet of 1 : 2 : 1 ratio

53. **Consider the following statement(s) in the context of given organometallic complex**



[P] **The carbene ligand donates two electrons to the metal and accepts d electrons to make a π-bond**

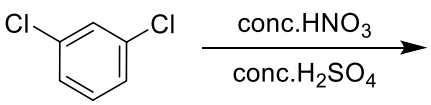
[Q] **The C (carbene) is nucleophilic**

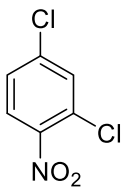
[R] **Rotation around the Cr=C(OMe)Me double bond has low barrier (< 10 kcal/mol)**

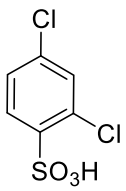
Correct statement(s) is/are:

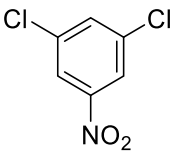
(a) P and Q (b) P only (c) P and R (d) Q and R

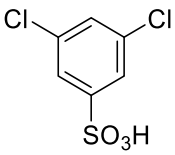
54. **The major product formed in the following reaction is**



(a) 

(b) 

(c) 

(d) 

55. **The commutator, $[\hat{x},\ \hat{p}_x^2]$ is equivalent to**

(a) $-2i\hbar\hat{p}_x$ (b) $2i\hbar\hat{p}_x$ (c) $-i\hbar\hat{p}_x$ (d) $i\hbar\hat{p}_x$

56. **The amount of $Ba(NO_3)_2$ (molecular weight 261.32 amu) required to be added to 500 g of a $0.11\ mol\ kg^{-1}$ solution of KNO_3 in order to raise its ionic strength to 1.00 is approximately:**

(a) 38.8 g (b) 19.4 g (c) 76.2 g (d) 126.5 g

57. **The effective magnetic moment (in BM) for a lanthanide f^{10} ion is approximately**

(a) 10.6 (b) 9.92 (c) 9.59 (d) 7.94

58. **The correct relationship between the following structures is that they are**

(a) identical (b) enantiomers (c) diastereomers (d) constitutional isomers

59. **The following transformation is an example of**

(a) [3n + 2n] cycloaddition (b) [6n + 2n] cycloaddition

(c) [8n + 2n] cycloaddition (d) [8n + 4n] cycloaddition

60. **The number of micro states corresponding to the atomic term symbol ^4F is**

(a) 7 (b) 12 (c) 28 (d) 42

Q.61 – Q.120 MCQ, carry FOUR marks each (for each wrong answer: –1). You are required to Answer Maximum 25 Questions.

61. **For every atom that is not shifted under C_4 and σ symmetry operations, the characters are, respectively,**

(a) $-1, -1$ (b) $0, 0$ (c) $1, 1$ (d) $-1, 1$

62. **The following data is obtained for a light diatomic (AB) molecule from its rotational Raman spectrum. $B = 2\ cm^{-1}$; $x_e = 0.01$; $\bar{\nu}_e = 1600\ cm^{-1}$.**

If the molecule is irradiated by a laser of $20,000\ cm^{-1}$, the expected stokes lines (in cm^{-1}) for this molecules are

(a) 18348 ; 18356 ; 18368 ; 18380 ; 18388

(b) 18412 ; 18420 ; 18432 ; 18444 ; 18452

(c) 18380 ; 18388 ; 18400 ; 18412 ; 18420

(d) 18416 ; 18424 ; 18430 ; 18440 ; 18452

63. **When a hydrogen atom is exposed to a perturbation $v = E.z$, the first order correction to the wave function comes only from the orbital**

(a) 2s (b) $2p_z$ (c) $3p_y$ (d) $3d_z^2$

64. **Choose the correct statement(s) from the following:**

P. The trend in Lewis acidity among silicon halides is $SiI_4 < SiBr_4 < SiCl_4 < SiF_4$

Q. Tin(II) chloride can act as a Lewis acid and not as a Lewis base

R. Aluminosilicates can display Bronsted acidity

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

65. **Match the iron and copper proteins with biological function in the table below:**

	Iron protein		Copper protein		Biological function
P	Hemerythrin	I	Azurin	X	Oxygenase
Q	Cytochrome P450	II	Hemocyanin	Y	Electron transfer
R	Rieske protein	III	Tyrosinase	Z	O_2 transport

(a) P - II - Z ; Q - III - X ; R - I - Y

(b) P - II - Z ; Q - I - X ; R - III - Y

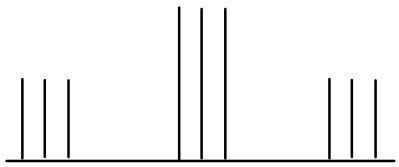
(c) P - III - Y ; Q - I - Z ; R - II - X

(d) P - I - Y ; Q - III - Z ; R - II - X

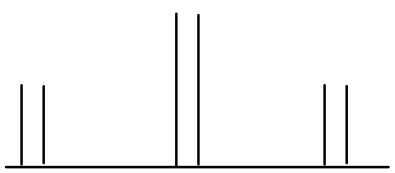
66. **Which of the patterns fits best with the ^{13}C-NMR spectrum of $TiCl_3(CDH_2)$. [Given: $^1J(C-H) > {}^1J(C-D)$]**

(a)

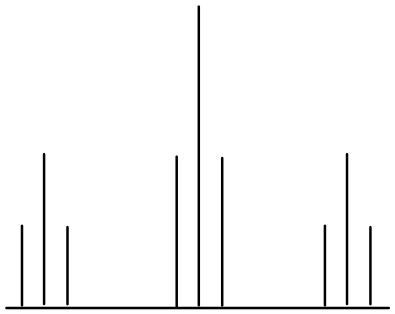
(b)



(c)



(d)



67. **The number of CO bands for isomers from sets (i) and (ii) in their IR spectra**

Set (i) : P. Trigonal bipyramidal isomers, axial-$Fe(CO)_4L$

Q. Equatorial-$Fe(CO)_4L$

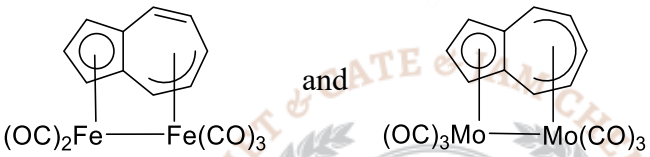
Set (ii) : R. Octahedral isomers, fac-$Mo(CO)_3L_3$

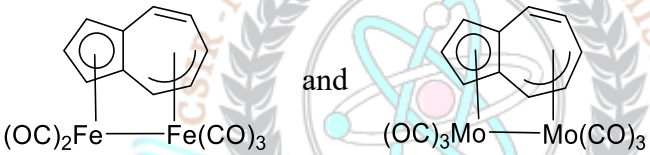
S. mer-$Mo(CO)_3L_3$

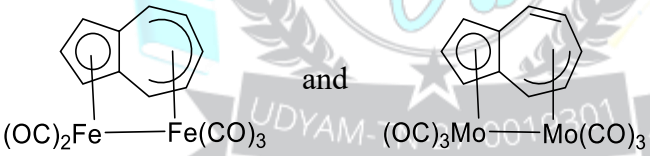
(a) P, 4 and Q, 3 ; R, 3 and S, 2 (b) P, 4 and Q, 3 ; R, 2 and S, 3

(c) P, 3 and Q, 4 ; R, 3 and S, 2 (d) P, 3 and Q, 4 ; R, 2 and S, 3

68. **The set of structures showing the correct hapticity of azulene on the basis of the 18-electron rule, is**

(a) 

(b) 

(c) 

(d) 

69. **For a week electrolyte such as acetic acid, the relation among conductance (λ), equilibrium constant (K) and concentration (C) can be expressed as:**

(λ° is the conductance at infinite dilution)

(a) $\frac{1}{\lambda} = \frac{1}{\lambda^\circ} - \frac{C\lambda}{K\lambda^\circ}$ (b) $\frac{1}{\lambda} = \frac{1}{\lambda^\circ} + \frac{C\lambda}{K\lambda^{\circ 2}}$ (c) $\frac{1}{\lambda^\circ} = \frac{1}{\lambda} + \frac{C\lambda}{K\lambda^{\circ 2}}$ (d) $\frac{1}{\lambda} = \frac{C\lambda}{K\lambda^{\circ 2}}$

70. **The equivalent symmetry operations for S_6^3 and S_3^6 are, respectively,**

(a) C_3 and C_2 (b) σ_h and i (c) σ_h and E (d) i and E

71. **The correct geometries for the metal carbonyl clusters, P-R**

$[Ru_6(CO)_{17}B]^-$	$[Os_6(CO)_{18}P]^-$	$[Os_4(CO)_{16}]$
P	**Q**	**R**

(a) P. Pentagonal bipyramidal (b) P. Pentagonal bipyramidal

Q. trigonal prismatic and
R. tetrahedral

Q. octahedral and
R. square

(c) P. octahedral
Q. trigonal prismatic and
R. tetrahedral

(d) P. octahedral
Q. trigonal prismatic and
R. square

72. Consider the following statements regarding EPR spectra:

P. For allowed transitions, $\Delta M_s = \pm 1$ and $\Delta M_I = 0$

Q. For allowed transitions, $\Delta M_s = 0$ and $\Delta M_I = \pm 1$

R. Tetragonally elongated Cu(II) complexes have $g_{\parallel} > g_{\perp}$

S. The orbital considered as ground state for tetragonally compressed Cu(II) complexes is $d_{x^2-y^2}$

The correct statements are

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

73. The correct statements from the following set (I) to (IV) is

(I) If q is the displacement from equilibrium for harmonic motion, the potential energy is proportional to q

(II) If the vibrational frequency ($\bar{\nu}$) of HCl is 2990 cm^{-1}, its zero-point energy will be 1495 cm^{-1}

(III) The correct order of vibrational frequency of O-^{1}H (X_1), O-^{2}H (X_2), and O-^{3}H (X_3), is $X_1 > X_2 > X_3$

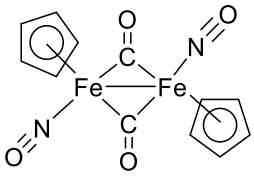
(IV) The fundamental vibrational transition of a diatomic molecule appears at 1880 cm^{-1}. Its first overtone will be at 940 cm^{-1}

(assuming anharmonicity constant as zero).

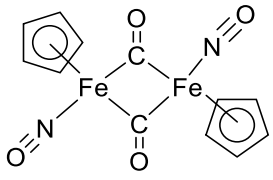
(a) I, II, III only (b) I, II, III and IV (c) II and III only (d) I, II, IV only

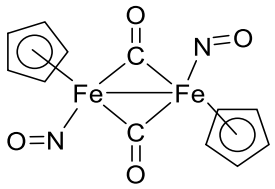
74. Identify the thermodynamically stable structure of $[(\eta^5\text{-}C_5H_5)Fe(\mu_2\text{-}CO)(NO)]_2$

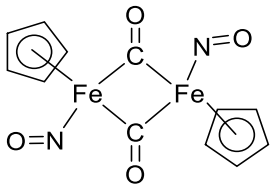
(a)



(b)



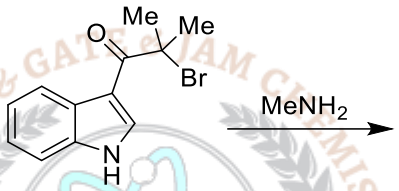
(c) 

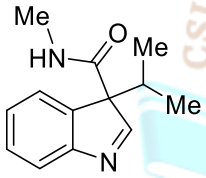
(d) 

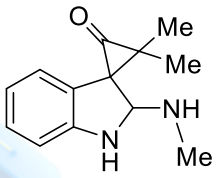
75. **A system consists of N identical distinguishable non-interacting particles, each having only two energy levels 0 and ϵ. The expression of the heat capacity at constant volume(C_v) is given by ($\beta = 1/k_B T$).**

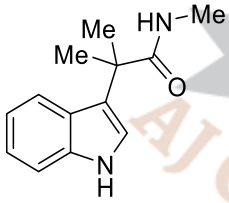
(a) Nk_B (b) $Nk_B\left(\frac{\epsilon\beta}{1+e^{\epsilon\beta}}\right)^2$ (c) $Nk_B\left(\frac{\epsilon\beta e^{\epsilon\beta/2}}{1+e^{\epsilon\beta}}\right)^2$ (d) $Nk_B\left(\frac{\epsilon\beta e^{-2\epsilon\beta}}{1+e^{-\epsilon\beta}}\right)^2$

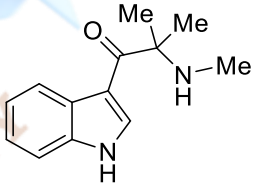
76. **The major product formed in the following reaction is**



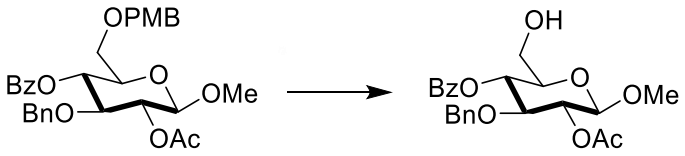
(a) 

(b) 

(c) 

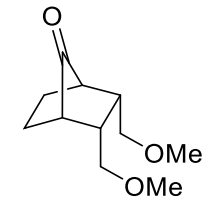
(d) 

77. **The reagent that will effect the following selective conversion is**

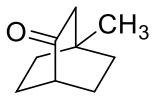


(a) NaOMe, MeOH (b) TBAF, THF (c) DDQ, CH_2Cl_2 (d) Et_3N, MeOH

78. **The correct relationship between the two faces of the C=O group in compounds P and Q is**



P



Q

	P	Q		P	Q
(a)	diastereotopic	enantiotopic	(b)	enantiotopic	enantiotopic
(c)	enantiotopic	diastereotopic	(d)	diastereotopic	diastereotopic

79. **For trigonal bipyramidal coordination complex(ML_5) the correct point group symmetry and the relative order of the energies of the 3d orbitals in that crystal field, respectively are**

(a) D_{3h}; $d_{x^2-y^2} > d_{z^2}$, $d_{xy} > d_{xz}, d_{yz}$ (b) D_{3d}; $d_{z^2} > d_{x^2-y^2}$, $d_{xz} > d_{xy}, d_{yz}$

(c) D_{3d}; $d_{x^2-y^2} > d_{z^2} > d_{xy} > d_{xz}, d_{yz}$ (d) D_{3h}; $d_{z^2} > d_{x^2-y^2}$, $d_{xy} > d_{xz}, d_{yz}$

80. **Which of the following reaction(s) do(es) NOT occur**

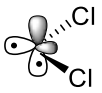
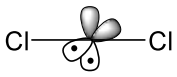
(i) $[NPCl_2]_3 + 6NaF \xrightarrow[\text{reflux}]{MeCN} [NPF_2]_3 + 6NaCl$

(ii) $nPCl_5 + nNH_4Cl \xrightarrow[\text{reflux}]{C_6H_5Cl} [NPCl_2]_n + 4\,nHCl \quad [n = 3,4,5...]$

(iii) $nPF_5 + nNH_4F \xrightarrow[\text{reflux}]{C_6H_5Cl} [NPF_2]_n + 4\,nHF \quad [n = 3,4,5...]$

(a) (i) and (iii) (b) (i) and (ii) (c) (i) only (d) (iii) only

81. **The structure of the reactive intermediate generated by reaction of $CHCl_3$ and KOH is**

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

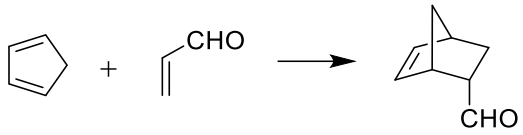
82. **A sample of polystyrene is composed of three weight fraction: 0.20, 0.50 and 0.30. The molecular weight of these fractions are 10,000, 40,000 and 60,000 respectively. The weight average molecular weight(M_w) of this sample is:**

(a) 40000 (b) 55000 (c) 50000 (d) 60000

83. **The reaction that will show a large increase in rate when the reaction medium is changed from a non-polar organic solvent is**

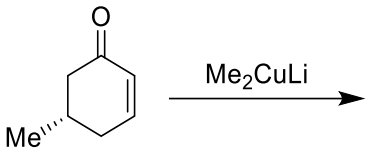
(a) $NMe_3 + Me_3\overset{\oplus}{S}\,\overset{\ominus}{Br} \longrightarrow Me_4\overset{\oplus}{N}\,\overset{\ominus}{Br} + Me_2S$

(b) $Et_3\overset{\oplus}{S}\,\overset{\ominus}{Br} \longrightarrow EtBr + Et_2S$

(c) 

(d) $NMe_3 + MeI \longrightarrow Me_4N^{\oplus}\,I^{\ominus}$

84. The major product formed in the following reaction is



(a) cis-3,5-dimethylcyclohexanone, which is chiral

(b) trans-3,5-dimethylcyclohexanone, which is chiral

(c) cis-3,5-dimethylcyclohexanone, which is achiral

(d) trans-3,5-dimethylcyclohexanone, which is achiral

85. The absorption spectrum of $[Cr(NH_3)_6]^{3+}$ in water shows two bands around 475 and 365 nm. The ground term and the spin-allowed transitions, respectively, are

(a) ^4F ; $^4T_{1g}(F) \rightarrow {}^4T_{2g}$ and $^4T_{1g} \rightarrow {}^4A_{2g}$

(b) ^4F ; $^4A_{2g} \rightarrow {}^4T_{2g}$ and $^4A_{2g} \rightarrow {}^4T_{1g}(F)$

(c) ^2G ; $^2E_g \rightarrow {}^2T_{1g}$ and $^2E_g \rightarrow {}^2T_{2g}$

(d) ^2F ; $^2A_{2g} \rightarrow {}^2T_{2g}$ and $^2A_{2g} \rightarrow {}^2T_{1g}(F)$

86. Consider following statements

P. $PbCl_2$ has low solubility in water

Q. Sulfides of As(III) and Sb(III) are soluble in ammonium sulphide

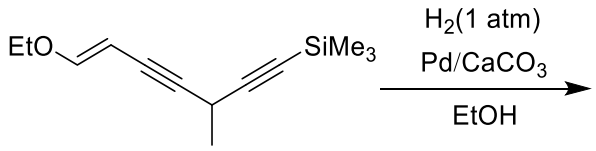
R. SnS is soluble in yellow ammonium sulphide

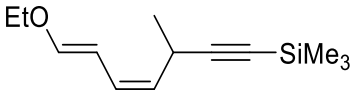
S. MnS is precipitated by passing H_2S through acidic $MnCl_2$

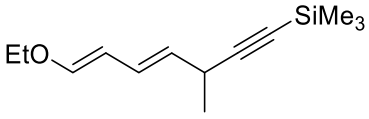
Correct statements are

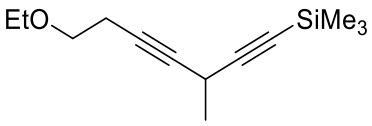
(a) P, Q and R (b) Q, R and S (c) P, R and S (d) P and R only

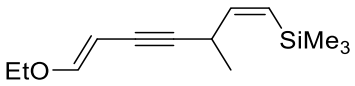
87. The major product formed in the following reaction is



(a) 

(b) 

(c) 

(d) 

88. **A compound shows $[M]^+$ at m/z 84 and has a base peak at 56. It exhibits only one signal in ^{1}H-NMR at δ 1.4 ppm and one signal in ^{13}C-NMR at δ 35 ppm. The compound is**

(a) cyclobutane-1,3-dione (b) dichloromethane

(c) cyclohexane (d) 1, 2, 3-trimethylcyclopropane

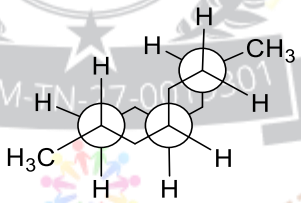
89. **The maximum number of phases that can be simultaneously in equilibrium for a one component system is**

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

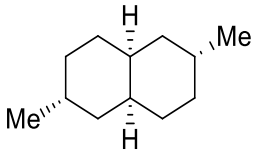
90. **For the cell $Cd\,|CdCl_2\,\|\,AgCl\,|\,Ag$; $E^\circ_{Cell} = 0.675$ V and $\frac{dE^\circ_{Cell}}{dT} = -6.5 \times 10^{-4}$ V K^{-1} at 27 °C. The ΔH(kJ mol^{-1}) value for the reaction $Cd + 2AgCl \longrightarrow 2Ag + CdCl_2$ is closest to:**

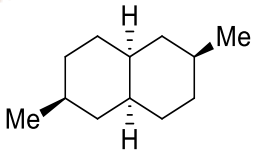
(a) -168 (b) -123 (c) -95 (d) -234

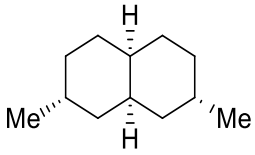
91. **The Newman projection given below**

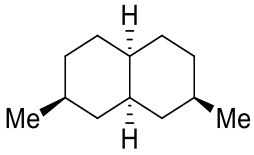


Corresponds to the compound

(a) 

(b) 

(c) 

(d) 

92. **The surface tension of a dilute soap solution is lower than that of pure water because**

(a) soap molecules accumulate more at the surface than in the bulk solution

(b) soap molecules accumulate more in the bulk of the solution than on the surface

(c) the soap molecules aggregate uniformly in the bulk and the surface

(d) soap molecules form micellar structures at low concentration

93. **The type of molecular orbitals in the allyl ligand (CH_2=CH-CH_2^-) that are used for**

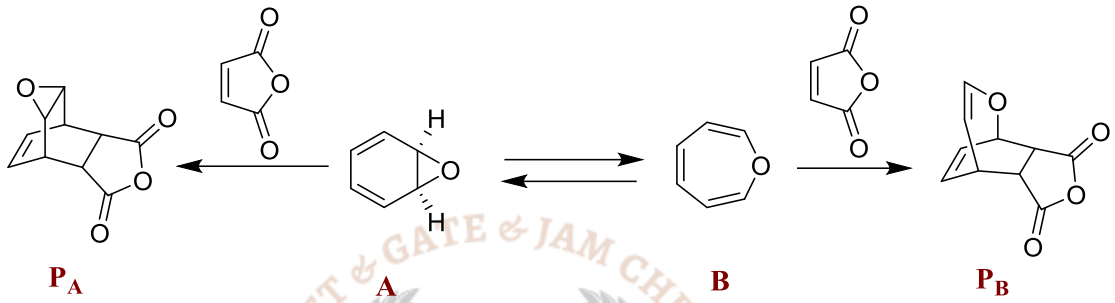
σ-donation and π-back donation with metal d-orbitals, respectively are

(a) 2π and 3π (b) 1π and 3π (c) 3π and 2π (d) 1π and 2π

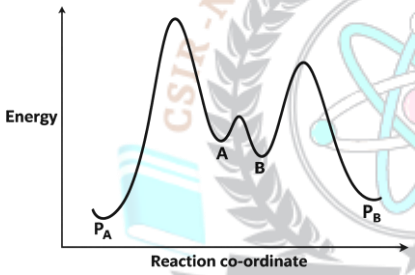
94. The molecule that will not absorb in the microwave region, but will absorb in the infrared is

(a) N_2 (b) C_2H_2 (c) HCl (d) H_2O

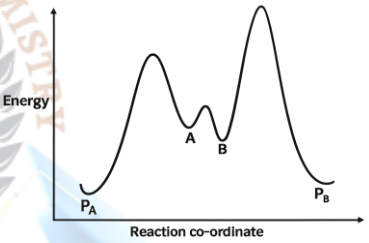
95. The correct energy profile diagram for the given reactions is



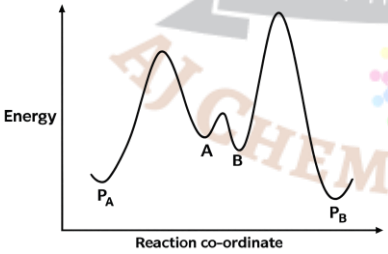
(a)



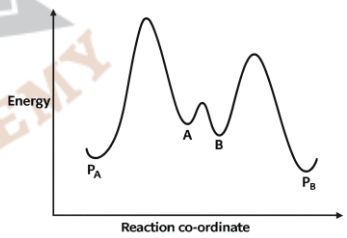
(b)



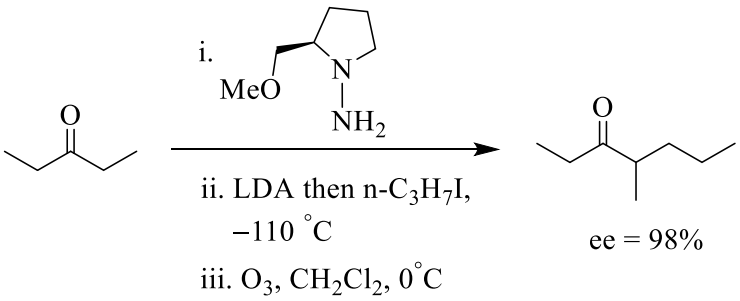
(c)



(d)



96. Given the specific rotation $[\alpha]_D^{20}$ of (S)-4-methyl-3-heptanone in hexane as +22°, the specific rotation $[\alpha]_D^{20}$, in hexane, of the product (ee = 98%) obtained from the following enantioselective alkylation reaction is

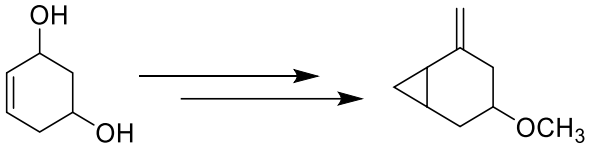


(a) +21.56 (b) +21.12 (c) −21.56 (d) −21.12

97. **Consider an electron ($m_e = 9.1 \times 10^{-31}$ kg) having energy 13.6 eV, confined in an infinite potential well. If the potential energy inside the well is zero, the expectation value for the square of the electron speed, $\langle v^2 \rangle$, is _____ $m^2\ s^{-2}$**

(a) 3×10^{12} (b) 4.3×10^{-18} (c) 4.7×10^{12} (d) 4.7×10^{31}

98. **The correct sequence of reagents that will lead to the formation of the given product in the following transformation is**



(a) P. active MnO_2;
Q. MeI, NaH;
R. $Me_3S(O)I$, NaH;
S. $MePPh_3Br$, NaH

(b) P. MeI, NaH;
Q. active MnO_2;
R. Me_3SI, NaH;
S. $MePPh_3Br$, NaH

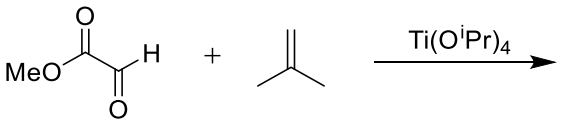
(c) P. CH_2I_2, Zn-Cu;
Q. $MePPh_3Br$, NaH;
R. active MnO_2;
S. MeI, NaH

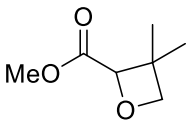
(d) P. $MePPh_3Br$, NaH;
Q. active MnO_2;
R. CH_2I_2, Zn – Cu;
S. MeI, NaH

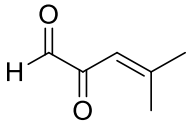
99. **Liquid A has half the surface tension and twice the density of liquid B at 30 °C. The contact angles of A and B are the same. If A rises 10 cm in a capillary then the rise (in cm) of liquid B in the same capillary at the same temperature will be equal to**

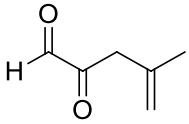
(a) 60 (b) 10 (c) 40 (d) 20

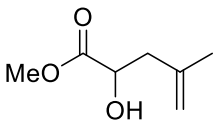
100. **The major product formed in the following reaction is**



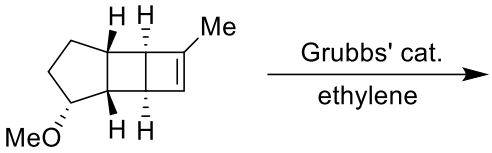
(a)


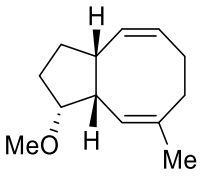
(b)


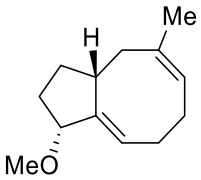
(c)


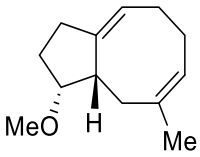
(d)


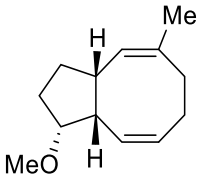
101. The major product formed in the following reaction is



(a) 

(b) 

(c) 

(d) 

102. Which of the statements (P-S) given below are correct for B_2H_6 molecule:

P. Addition of $Et_2O.BF_3$ to $NaBH_4$ in a polyether solvent produces B_2H_6

Q. It has D_{2d} symmetry

R. Reaction of B_2H_6 with NMe_3 gives $Me_3N.BH_3$

S. It is diamagnetic

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

103. Match the following:

	Measurement		Spectroscopic Technique
P.	Binding energy	I	NMR spectroscopy
Q.	Quadrupole splitting	II	Energy-dispersive X-ray spectroscopy(EDS)
R.	Contact shift	III	X-ray photoelectron spectroscopy(XPS)
S	Elemental analysis	IV	Mossbauer spectroscopy

	P		Q		R		S
(a)	II	;	I	;	IV	;	III
(c)	IV	;	III	;	I	;	II

	P		Q		R		S
(b)	III	;	IV	;	I	;	II
(d)	I	;	IV	;	II	;	III

104. The rate constant for the reaction, $A_2B_4O \longrightarrow AB_4 + AO$, is described as,

$$\log k = 14.1 - \frac{10000\ K}{T}.$$

The activation energy for this reaction in ($kJ\ mol^{-1}$) is closest to

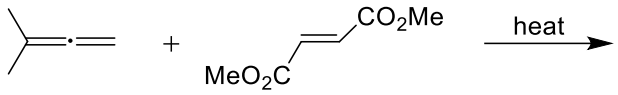
(a) 191.4 (b) 83.14 (c) 382.8 (d) 166.28

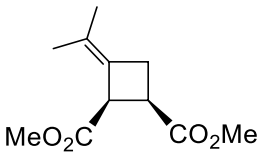
105. The quantum number corresponding to the z-component of the total electronic

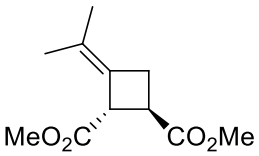
orbital angular momentum in the nitric oxide molecule is

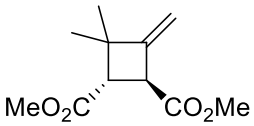
(a) 0 (b) 1 (c) 2 (d) 3

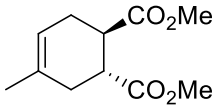
106. The major product formed in the following reaction is



(a) 

(b) 

(c) 

(d) 

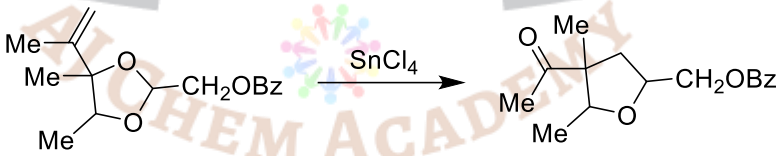
107. Consider the following terms. Identify those which are relevant to d.c. polarography

Thermal current	Supporting electrolyte	Depolarization	Gelatin
P	Q	R	S

Correct answer is

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

108. The correct sequence of mechanistic steps involved in the formation of product in the following reaction is



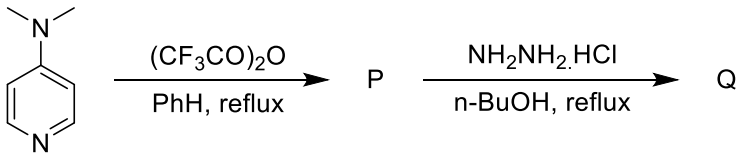
(a) P. Prins cyclization
Q. formation of oxonium ion
R. pinacol rearrangement

(b) P. pinacol rearrangement
Q. Prins cyclization
R. formation of oxonium ion

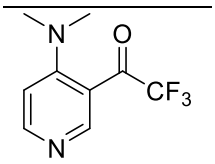
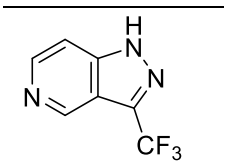
(c) P. formation of oxonium ion
Q. Prins cyclization;
R. pinacol rearrangement

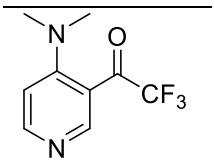
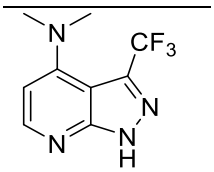
(d) P. pinacol rearrangement
Q. formation of oxonium ion
R. Prins cyclization

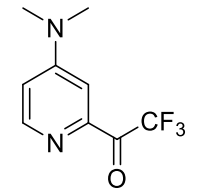
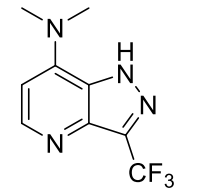
109. The major products P and Q in the following reaction sequence are

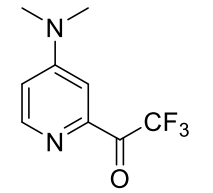
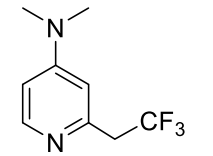


P	Q	P	Q

(a)  ; 

(b)  ; 

(c)  ; 

(d)  ; 

110. **Consider the following statements for the self-exchange electron transfer reaction in $[Cr(H_2O)_6]^{2+/3+}$**

P. σ^*orbitals are only involved in electron transfer

Q. It involves large inner-sphere reorganization energy

R. It involves no change in M-L bond lengths

S. Rate of self-exchange electron transfer is fast

The correct statements are

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

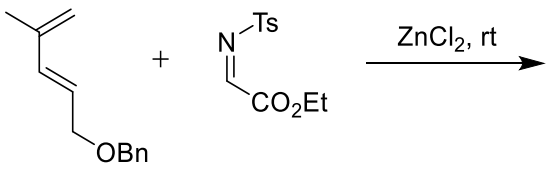
111. **The stopping potential for photoelectrons emitted from a surface illuminated by light of frequency 6.0×10^8 MHz is 0.72 V. When the incident frequency is changed, the stopping potential is found to be 1.44 V. The new frequency is approximately_____MHz** $(e/h = 2.4 \times 10^{14}\ C\ J^{-1}s^{-1})$

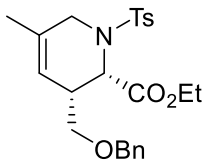
(a) 7×10^8 (b) 4×10^8 (c) 2×10^9 (d) 7×10^{14}

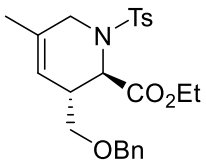
112. **In a Langmuir-type adsorption, a solid adsorbs 0.25 mg of a gas when the pressure of the gas is 50 bar and 0.2 mg of the gas at 20 bar pressure. The percentage of surface coverage at 50 bar is close to:**

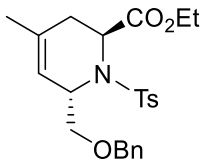
(a) 75 (b) 38 (c) 57 (d) 83

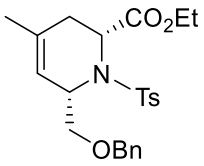
113. **The major product formed in the following reaction is**



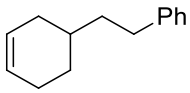
(a) 

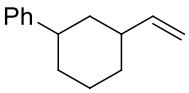
(b) 

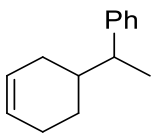
(c) 

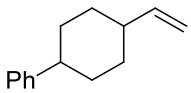
(d) 

114. The major product formed in the following reaction is

(a) 

(b) 

(c) 

(d) 

115. Which of the following statements for Rubredoxin, are correct?

P. Fe^{2+} center has a tetrahedral geometry

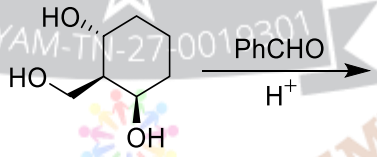
Q. Reduced form of iron is diamagnetic

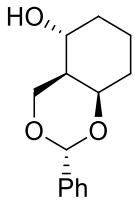
R. Fe^{2+} center undergoes Jahn-Teller distortion

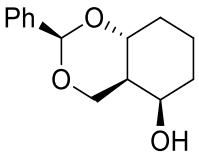
S. It is a [2Fe-2S] cluster

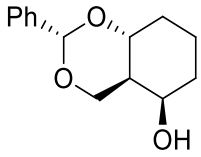
(a) P, Q and R (b) P, R and S (c) R and S only (d) P and R only

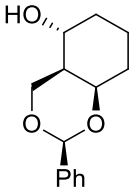
116. The major product formed in the following reaction is



(a) 

(b) 

(c) 

(d) 

117. Plutonium (atomic mass = 244 g mol^{-1}) crystallizes in monoclinic lattice (a = 620 pm; b = 480 pm; c = 1100 pm; β = 102°) with 16 atoms per unit cell. The density in g cm^{-3} will be close to (Use $\sin\beta = 0.98; \sin\beta/2 = 0.78$)

(a) 25.38 (b) 16.12 (c) 12.69 (d) 20.26

118. The ore (X) gives a d-block metal (M) in the elemental form, following a chemical

process, which of the sets X/M/Chemical process below is correct?

(a) Ilmenite/Titanium/$2FeTiO_3 + Mg + O_2 \longrightarrow 2TiO_2 + MgO + Fe_2O_3$ followed by Reduction of TiO_2 with Mg

(b) Rutile/Titanium/$TiO_2 + 2C + 2Cl_2 \longrightarrow TiCl_4 + 2CO$ followed by Reduction of $TiCl_4$ with Na or Mg

(c) Rutile/Titanium/$TiO_2 + 4HCl(conc.) \longrightarrow TiCl_4 + 2H_2O$ followed by electrolytic Reduction of $TiCl_4$

(d) Molybdenite/Molybdenum/$2MoS_2 + 7O_2 \longrightarrow 2MoO_3 + 4SO_2$ followed by Reduction of MoO_3 with carbon

119. In 3-iron ferredoxins, the number of sulfide bridges and cysteinyl ligands, respectively, are:

(a) 3, 3 (b) 4, 3 (c) 3, 4 (d) 4, 4

120. For the reaction,

$$[\text{cis-M(en)}_2(\text{OH})_2]^+ \underset{k_2}{\overset{k_1}{\rightleftharpoons}} [\text{trans-M(en)}_2(\text{OH})_2]^+$$

The equilibrium constant is 0.16 and k_1 is $3.3 \times 10^{-4}\ s^{-1}$. The experiment is started with pure cis form. The time taken for half the equilibrium amount of trans isomer to be formed is about

(a) 290 s (b) 580 s (c) 190 s (d) 480 s

Answer Key

PART - B

Q.No	Ans
21.	d
22.	b
23.	c
24.	a
25.	b
26.	a
27.	b

Q.No	Ans
31.	b
32.	b
33.	b
34.	a
35.	d
36.	a
37.	a

Q.No	Ans
41.	c
42.	b
43.	d
44.	b
45.	c
46.	b
47.	a

Q.No	Ans
51.	d
52.	c
53.	c
54.	a
55.	b
56.	a
57.	a

28.	d
29.	d
30.	d

38.	c
39.	b
40.	b

48.	c
49.	a
50.	c

58.	a
59.	c
60.	c

PART - C

Q.No	Ans
61.	c
62.	b
63.	b
64.	b
65.	a
66.	b
67.	d
68.	a
69.	b
70.	d
71.	d
72.	c
73.	c
74.	b
75.	c

Q.No	Ans
76.	c
77.	c
78.	a
79.	d
80.	d
81.	b
82.	a
83.	d
84.	b
85.	b
86.	a
87.	a
88.	c
89.	c
90.	a

Q.No	Ans
91.	a
92.	a
93.	b
94.	b
95.	c
96.	c
97.	c
98.	a
99.	c
100.	d
101.	d
102.	b
103.	b
104.	a
105.	b

Q.No	Ans
106.	b
107.	c
108.	c
109.	a
110.	b
111.	a
112.	d
113.	d
114.	a
115.	d
116.	c
117.	d
118.	b
119.	b
120.	a

நோக்கத்திற்காகவும் மீண்டும் உருவாக்கப்படவோ, மறுபதிப்பு செய்யவோ அல்லது மொழிபெயர்க்கவோ கூடாது.

© இந்த படைப்பை பிழையின்றி வழங்குவதற்கு சிறந்த முயற்சிகள் எடுக்கப்பட்டாலும், சில தவறுகள் கவனக்குறைவாக ஊடுருவியிருக்கலாம். எனவே அவற்றிற்கு நாங்கள் எந்த சட்டப்பொறுப்பையும் ஏற்கவில்லை. அவற்றை எங்கள் கவனத்திற்கு கொண்டு வந்தால், அடுத்த பதிப்பில் திருத்தங்கள் செய்யப்படும்.