Hall Ticket Number

Q.B. No. 100249

Booklet Code : A

Marks : 100

JL-417-CHEM

Time : 120 Minutes

Paper-III

Signature of the Candidate

Signature of the Invigilator

INSTRUCTIONS TO THE CANDIDATE
(Read the Instructions carefully before Answering)

1. Separate Optical Mark Reader (OMR) Answer Sheet is supplied to you along with Question Paper Booklet. Please read and follow the instructions on the OMR Answer Sheet for marking the responses and the required data.
2. The candidate should ensure that the **Booklet Code printed on OMR Answer Sheet and Booklet Code supplied are same.**
3. **Immediately on opening the Question Paper Booklet by tearing off the paper seal, please check for (*i*) The same booklet code (A/B/C/D) on each page. (*ii*) Serial Number of the questions (1-100), (*iii*) The number of pages and (*iv*) Correct Printing.** In case of any defect, please report to the invigilator and ask for replacement of booklet with same code within five minutes from the commencement of the test.
4. Electronic gadgets like Cell Phone, Calculator, Watches and Mathematical/Log Tables are not permitted into the examination hall.
5. **There will be 1/4 negative mark for every wrong answer.** However, if the response to the question is left blank without answering, there will be no penalty of negative mark for that question.
6. Record your answer on the OMR answer sheet by using Blue/Black ball point pen to darken the appropriate circles of (1), (2), (3) or (4) corresponding to the concerned question number in the OMR answer sheet. Darkening of more than one circle against any question automatically gets invalidated and will be treated as wrong answer.
7. Change of an answer is **NOT** allowed.
8. Rough work should be done only in the space provided in the Question Paper Booklet.
9. **Return the OMR Answer Sheet and Question Paper Booklet to the invigilator before leaving the examination hall.** Failure to return the OMR sheet and Question Paper Booklet is liable for criminal action.

This Booklet consists of **33** Pages for **100** Questions +**2** pages of Rough Work +**1** Title Page i.e. Total **36** pages

1. Which one of the following molecules is *not* having lone pair of electrons on central atom ?

(1) $SnCl_2$ (2) XeF_2

(3) SCl_2 (4) $CdBr_2$

2. Which of the following order is *correct* with respect to polars character ?

(1) $NH_3 < H_2O < HF < H_2S$ (2) $H_2S < NH_3 < H_2O < HF$

(3) $H_2O < NH_3 < H_2S < HF$ (4) $HF < H_2O < NH_3 < H_2S$

3. In which of the following compounds formation, *d* orbitals are not involved in hybridization ?

(1) XeF_2 (2) XeO_2F_2

(3) XeF_4 (4) XeO_4

4. The hybridization of central atom in ClF_5, $[SbF_5]^{2-}$, ICl_4 respectively is :

(1) sp^3d, sp^3d^2, sp^3d (2) sp^3d^2, sp^3d, sp^3

(3) sp^3d, sp^3d, sp^2d (4) sp^3d^2, sp^3d^2, sp^3d^2

5. Among the following reactions, which one differs from other reactions ?

(1) $CO_2 + H_2O \rightarrow H_2CO_3$ (2) $Na_2O + H_2O \rightarrow 2NaOH$

(3) $P_2O_3 + 3H_2O \rightarrow 2H_3PO_3$ (4) $Cl_2O_7 + H_2O \rightarrow 2HClO_4$

6. Oxygen is *not* evolved when ozone reacts with :

(1) KI (2) Hg

(3) H_2O_2 (4) SO_2

7. Which pair of ions has same colour ?

(1) Cr^{3+}, Mn^{3+} (2) Ti^{3+}, Fe^{3+}

(3) V^{3+}, Co^{3+} (4) Fe^{3+}, Co^{3+}

8. Which of the following statements are *correct* ?

(*i*) The +IV state is the predominant oxidation state for Ce.

(*ii*) Sm^{3+}, Eu^{3+} and Yb^{3+} can be easily reduced by $CaCl_2$.

(*iii*) Gd^{3+} is intensely coloured.

(*iv*) La^{3+} is paramagnetic.

(1) (*i*), (*ii*), (*iii*), (*iv*) (2) (*i*) and (*ii*) only

(3) (*iii*) and (*iv*) only (4) (*i*) and (*iii*) only

9. Which one of the following represents calcination process ?

(1) $CaO + SiO_2 \rightarrow CaSiO_3$

(2) $Ag_2S + 2NaCl \xrightarrow{\Delta} 2AgCl + Na_2S$

(3) $2Cu_2S + 3O_2 \xrightarrow{\Delta} 2Cu_2O + 2SO_2$

(4) $Al_2O_3 \cdot 2H_2O \xrightarrow{\Delta} Al_2O_3 + 2H_2O\uparrow$

10. Observe the following :

	Mineral	**Type of Mineral**
(A)	Covellite	Sulphide
(B)	Hydroxy apatite	Phosphate
(C)	Anglesite	Sulphate
(D)	Corundum	Oxide

Which of the pairs are *correctly* matched ?

(1) A, B and C only (2) B and D only

(3) A, B, C and D (4) C and D only

11. Which of the following statements are *correct* ?

(*i*) Zinc spelter contains some impurities such as Cd and Pb.

(*ii*) Cupellation is a method used to refine metals having oxidisable impurities.

(*iii*) Barite is berylium ore.

(1) (*i*), (*ii*) and (*iii*) (2) (*i*) and (*ii*) only

(3) (*ii*) and (*iii*) only (4) (*i*) and (*iii*) only

12. The following reactions represent concentration of ore by leaching :

$Ag_2S + NaCN \rightarrow A$

$A + Zn \rightarrow B + Ag$

A and B are respectively :

(1) $Na_3[Ag(CN)_3]$, $Na_2[Zn(CN)_4]$ (2) $Na[Ag(CN)_2]$, $Na[Zn(CN)_3]$

(3) $Na_2[Zn(CN)_4]$, $Na_2[Ag(CN)_4]$ (4) $Na[Ag(CN)_2]$, $Na_2[Zn(CN)_4]$

13. Which of the following metals can be refined by cupellation ?

(1) Ag (2) Ti

(3) Al (4) Mn

14. Which of the following statements is *true* about the magnetic behaviour of the complexes, $Ni(CO)_4$, $\left[Ni(CN)_4\right]^{2-}$ and $NiCl_4^{2-}$?

(1) $Ni(CO)_4$ and $NiCl_4^{2-}$ are diamagnetic and $\left[Ni(CN)_4\right]^{2-}$ is paramagnetic

(2) $[NiCl_4]^{2-}$ and $\left[Ni(CN)_4\right]^{2-}$ are diamagnetic and $Ni(CO)_4$ is paramagnetic

(3) $Ni(CO)_4$ and $\left[Ni(CN)_4\right]^{2-}$ are diamagnetic and $[NiCl_4]^{2-}$ is paramagnetic

(4) $Ni(CO)_4$ is diamagnetic and $[NiCl_4]^{2-}$ and $\left[Ni(CN)_4\right]^{2-}$ are paramagnetic

15. Which of the following configurations, for an octahedral first row d-block metal ions is expected to show orbital contribution to magnetic moment ?

(1) t_{2g}^2 (2) t_{2g}^3

(3) $t_{2g}^6 e_g^1$ (4) $t_{2g}^6 e_g^2$

16. Choose the *correct* order of energies of d orbitals in linear geometry :

(1) $d_{xy} \approx d_{xz} \approx d_{yz} < d_{x^2-y^2} < d_{z^2}$

(2) $d_{xy} \approx d_{x^2-y^2} < d_{xz} \approx d_{yz} < d_{z^2}$

(3) $d_{xy} < d_{x^2-y^2} < d_{xz} \approx d_{yz} < d_{z^2}$

(4) $d_{z^2} < d_{xz} \approx d_{yz} \approx d_{xy} \approx d_{x^2-y^2}$

17. The octahedral complex/complex ion which exists as facial and meridional isomers is :

(1) Tris (ethylenediamine) cobalt (III)

(2) Dichlorodiglycinato cobalt (III)

(3) Triglycinato cobalt (III)

(4) Trioxalato cobaltate (III)

18. Term symbol for an empty or completely filled subshell is :

(1) $^1S_0$ (2) $^1D_2$

(3) $^3P_0$ (4) $^1P_0$

19. Which of the following trends has a negative correlation with hardness ?

(1) Oxidation state (2) Polarizability

(3) Electronegativity (4) Charge density

20. According to Irving-William series of stability, for a given ligand, the order of stability of complexes formed from depositive metal ions, Ba^{2+}, Sr^{2+}, Fe^{2+} and Cu^{2+} is :

(1) $Ba^{2+} < Fe^{2+} < Cu^{2+} < Sr^{2+}$ (2) $Sr^{2+} < Ba^{2+} < Fe^{2+} < Cu^{2+}$

(3) $Ba^{2+} < Sr^{2+} < Fe^{2+} < Cu^{2+}$ (4) $Ba^{2+} < Fe^{2+} < Cu^{2+} < Sr^{2+}$

21. Match the following :

	Complex		log K value
(A)	$\left[Fe(NH_3)_4(H_2O)_2\right]^{2+}$	(I)	7.7
(B)	$\left[Fe(en)_2(H_2O)_2\right]^{2+}$	(II)	3.7
(C)	$\left[Fe(trien)(H_2O)_2\right]^{2+}$	(III)	8.8

	(A)	(B)	(C)
(1)	(I)	(II)	(III)
(2)	(II)	(I)	(III)
(3)	(III)	(II)	(I)
(4)	(II)	(III)	(I)

22. Identify the *correct* sequence of trans-effect in the substitution reactions involving Pt(II) and the ligands CN^-, Cl^-, OH^- and NO_2^-.

(1) $OH^- > Cl^- > NO_2^- > CN^-$ (2) $NO_2^- > Cl^- > OH^- > CN^-$

(3) $CN^- > NO_2^- > Cl^- > OH^-$ (4) $Cl^- > OH^- > NO_2^- > CN^-$

23. Which of the following statements is/are *correct* about electron transfer reactions through inner sphere mechanism ?

(*a*) The rate of electron transfer increases if the bridging ligand has unsaturation in the structure.

(*b*) The rate of electron transfer decreases with increase in the nucleophilic character of the bridging ligand.

(*c*) Inner sphere electron transfer reactions are faster than similar reactions occurring through outer-sphere mechanism.

(1) (*a*) and (*b*) (2) (*b*) and (*c*)

(3) (*a*) and (*c*) (4) (*a*) only

24. Conjugate acid of $\left[Ti(OH_2)_5(OH)\right]^{2+}$ is :

(1) $\left[Ti(OH_2)_6\right]^{3+}$

(2) $\left[Ti(OH_2)_4(OH)_2\right]^{+}$

(3) $\left[Ti(OH_2)_5O\right]^{+}$

(4) $\left[(H_2O)_4\,Ti(\mu\text{—}OH)_2\,Ti(OH_2)_4\right]^{4+}$

25. Which of the following complexes have/has thermodynamic stability but is/are kinetically inert ?

(A) $\left[Ni(CN)_4\right]^{2-}$

(B) $\left[Cr(CN)_6\right]^{-3-}$

(C) $\left[Mn(CN)_6\right]^{3-}$

(1) (A) and (B) (2) (B) only

(3) (B) and (C) (4) (A) only

26. Which is isolobal with $-CH_3$?

(1) $Fe(CO)_5$ (2) $Cr(CO)_5$

(3) $Ni(CO)_3$ (4) $Mn(CO)_5$

27. The total number of metal-metal bonds in $Ru_3(CO)_{12}$ and $Co_4(CO)_{12}$ respectively is :

(1) 3 and 6 (2) 4 and 5

(3) Zero and 4 (4) 3 and 4

28. In oxyhemoglobin, the coordinated dioxygen is best described by which of the following ?

(1) Molecular O_2 with linear Fe—O—O

(2) Molecular O_2 with bent Fe—O—O

(3) $[O_2]^-$

(4) $[O_2]^{2-}$

29. In the binding of oxygen to myoglobin, the relationship between the concentration of oxygen and the fraction of binding sites occupied, can be described as :

(1) Sigmoidal (2) Linear with –ve slope

(3) Linear with +ve slope (4) Hyperbolic

30. The oxidation states of the copper ions and of the O_2 ligand in oxyhemocyanin are :

(1) One Cu(I), one Cu(II) and one O^{2-}

(2) Two Cu(II) ions and one O_2^{2-}

(3) Two Cu(II) ions and one O^{2-}

(4) One Cu(I), one Cu(II) and one O_2^{2-}

31. Which of the following statements are *correct* ?

(*i*) HPLC is a liquid-liquid chromatography technique.

(*ii*) GC technique can be used for volatile compounds only.

(*iii*) Silica gel-G is the stationary phase of column chromatography technique.

(1) (*i*) and (*ii*) only (2) (*i*), (*ii*) and (*iii*)

(3) (*ii*) and (*iii*) only (4) (*i*) and (*iii*) only

32. Which of the following is *not* the term related to chromatography ?

(1) Adsorption (2) Retention

(3) Absorption (4) Partition

33. Which one of the following Gas-chromatography detectors uses N_2 as the carrier gas ?

(1) Electron capture detector (2) Flame ionization detector

(3) Thermal conductivity detector (4) Fluorescence detector

34. One of the statements about Henry's law $P = K_H X$ is correct (P = Pressure, K_H = Henry's constant, X = mole fraction) :

(1) Intercept gives Henry's constant K_H

(2) K_H values of all gases are same

(3) K_H is inversely related to solubility of gas

(4) K_H is independent of nature of gas

35. 3% (W/W) aqueous solution of a solute (molar mass 60 g mol^{-1}) is with same boiling point as the 9% aqueous solution of x. Calculate the molecular mass of x in gms mol^{-1} :

(1) 19.186 (2) 191.86

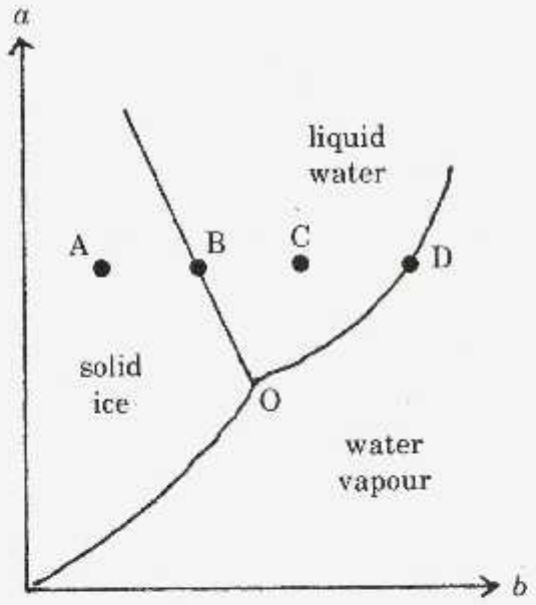
(3) 60 (4) 180

36. At 300 K, 25 g of a non-volatile solute dissolved in 1000 mL of water gave an osmotic pressure of 3 atm. What is the concentration (in mol L^{-1}) of the solution ?

(1) $\frac{1}{8.2}$ (2) $\frac{1}{82}$

(3) $\frac{25}{8.2}$ (4) $\frac{1}{8.2 \times 25}$

37. The phase diagram of water is shown below (a = pressure; b = temperature) :



The number of degrees of freedom at points A, B, C, D is respectively :

(1) 2, 1, 2, 1 (2) 1, 2, 1, 2

(3) 2, 2, 1, 1 (4) 1, 2, 2, 1

38. The average concentration of SO_2 in the atmosphere over a city on a certain day is 10 ppm, when the average temperature is 298 K. Given that the solubility of SO_2 in water at 298 K 1.2 mol litre^{-1} and K_a of H_2SO_3 is 0.012. Estimate the pH of rain on that day.

(Degree of dissociation α = 0.167; log 2 = 0.3010)

(1) 0.1 (2) 0.2

(3) 0.4 (4) 0

39. Calculate pH of a buffer made from 0.2 mol/L $HC_2H_3O_2$ and 0.4 mol/L $C_2H_3O_2^-$. The acid dissociation constant of $HC_2H_3O_2$ is 2.0×10^{-5}. (log 2 = 0.3010)

(1) 4.699 (2) 4.398

(3) 5.301 (4) 5

40. pH of 1.0 M solution of acetic acid is approximately ($K_a = 1.6 \times 10^{-5}$; log 2 = 0.3010) :

(1) 2.4 (2) 0

(3) 1 (4) 4.8

41. The Maxwell's relation :

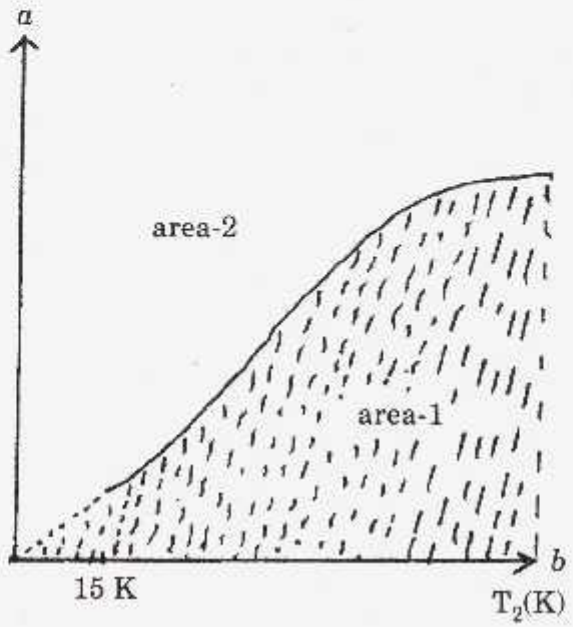
$$\left(\frac{dT}{dV}\right)_S = -\left(\frac{dP}{dS}\right)_V$$

can be derived from :

(1) $dH = TdS - VdP$ (2) $dG = -SdT + VdP$

(3) $dU = TdS - PdV$ (4) $dA = -SdT - PdV$

42. The variation of C_p with temperature (from 15K to T_2(K)) is shown below. The dotted line represents the extrapolation to T(K) = 0. Which one of the following is *correct* ? (a = C_p; b = T(K))



(1) The area under the curve (area-1) gives an estimation of free energy

(2) The area above the curve (area-2) gives an estimation of absolute entropy

(3) The area under the curve (area-1) gives an estimation of absolute entropy

(4) The area under the curve (area-1) gives an estimation of enthalpy

43. Consider the reaction :

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$$

carried out at the constant temperature and pressure. If ΔH and ΔU are the enthalpy and internal energy changes for the reaction, which of the following expressions is *correct* ?

(1) $\Delta H = 0$ (2) $\Delta H > \Delta U$

(3) $\Delta H < \Delta U$ (4) $\Delta H = \Delta U$

44. Among the following, the state functions are :

(*a*) Internal energy

(*b*) The work in irreversible expansion of an ideal gas

(*c*) The work in reversible expansion of an ideal gas at constant temperature

(*d*) Molar enthalpy

(1) (*a*), (*c*), (*d*) (2) (*c*), (*d*)

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

45. At 25°C, calculate log K_{eq} for the reaction :

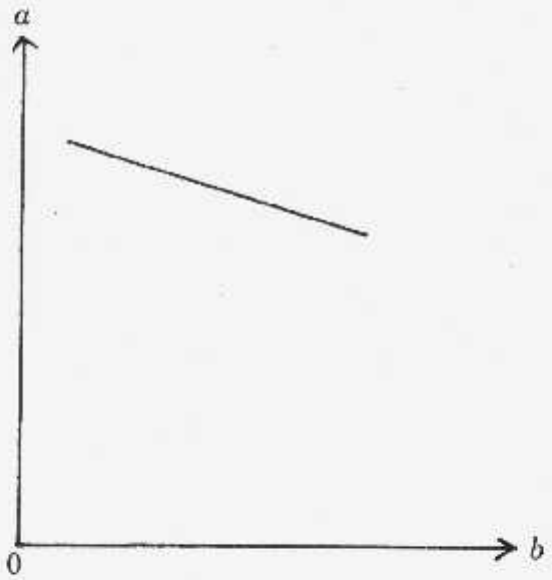
$$A_2(g) + B_2(g) \rightleftharpoons 2A^+(aq) + 2B^-(aq)$$

given that $E^0_{cell} = 1.36$ V :

(1) 460 (2) 4.602

(3) 0.4602 (4) 46.02

46. At 25°C, the following graph is obtained for KCl which obeys Debye-Huckel-Onsager equation :



a and *b* are respectively :

(1) Molar conductance and concentration of KCl

(2) Conductance and square root of concentration of KCl

(3) Molar conductance and square root of concentration of KCl

(4) Conductance and concentration of KCl

47. Match the following :

	List 1		List 2
(I)	Hydrogen electrode	(*a*)	Electrode potential
(II)	Specific conductance	(*b*)	Pt, H_2 (2 bar)/H^+ (0.1) M
(III)	Kohlrausch's law	(*c*)	Oxidation electrode
(IV)	Nernst equation	(*d*)	$\lambda^0 = \lambda^0_+ + \lambda^0_-$
		(*e*)	$\lambda_m = \lambda^0_m - A\sqrt{C}$
		(*f*)	s cm^{-1}

	(I)	(II)	(III)	(IV)
(1)	(*a*)	(*b*)	(*e*)	(*c*)
(2)	(*c*)	(*f*)	(*d*)	(*a*)
(3)	(*b*)	(*c*)	(*d*)	(*a*)
(4)	(*b*)	(*f*)	(*d*)	(*a*)

48. The standard emf of a cell having one electron exchange is found to be 0.591 V at 25°C. The equilibrium constant of the reaction is :

(1) 10^{30} (2) 10^5

(3) 10^{10} (4) 10^8

49. Which of the following statements are correct if $E^\circ_{Cu^{2+}/Cu}$ = 0.34 V and $E^\circ_{Sn^{2+}/Sn}$ = –0.136 V ?

(*a*) Cu can be oxidised by H^+ ions

(*b*) Sn^{2+} can be reduced by $H_2(g)$

(*c*) Cu^{2+} ions can be reduced by $H_2(g)$

(*d*) Sn can be oxidised by Cu^{2+}

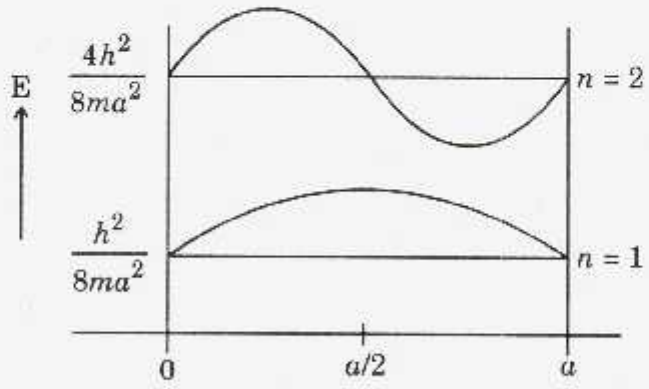
The *correct* answer is :

(1) (*a*), (*b*), (*c*) (2) (*b*), (*c*), (*d*)

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

50. The plots of energy levels and wave functions of a particle in 1-dimensional box with length 'a' and wave function ψ_n are given below.

The wave function for $n = 2$ vanishes at :



(1) 0 and a only (2) 0, $\frac{a}{2}$, a

(3) 0 only (4) a only

51. The operator $\hat{A} = \frac{\partial}{\partial x}$ and $\hat{B} = x$, then the commutator [A, B] turns out to be :

(1) 0 (2) –1

(3) 1 (4) $h/2\pi$

52. The operator $\hat{H}$ of a particle in $\hat{H}\psi = E\psi$ is referred to as :

(1) Hermitian (2) Hamiltonian

(3) Linear (4) Non-linear

53. The time dependent Schrödinger wave equation is :

(1) $-\frac{\hbar^2}{2m}\frac{\partial^2\psi}{\partial x^2} + V\psi = E\psi$ (2) $-\frac{2m}{\hbar^2}\frac{\partial^2\psi(x)}{\partial x^2} = E\psi(x)$

(3) $ih\frac{\partial\psi(x,t)}{\partial t} = E\psi(x,t)$ (4) $-ih\frac{\partial\psi(x,t)}{\partial t} = E\psi(x,t)$

54. Calculate k_f for the given reaction :

$$A \rightleftharpoons B$$

The initial concentration of A is 0.15 M, concentration of B at time 't' equal to 10 seconds is 0.056 M, and equilibrium concentration of B is 0.064 M :

(1) $0.88\ s^{-1}$ (2) $0.088\ s^{-1}$

(3) $0.1182\ s^{-1}$ (4) $0.01182\ s^{-1}$

55. According to collision theory of bimolecular gaseous reactions, the pre-exponential factor (A) is proportional to :

(assume, steric factor (p) = 1; d_{av} = collision diameter; T = temperature)

(1) $A \propto d_{av}\sqrt{T}$ (2) $A \propto d_{av}^2 T$

(3) $A \propto d_{av}^2\sqrt{T}$ (4) $A \propto \sqrt{d_{av}T}$

56. According to thermodynamic formulation of activated complex theory, for the reaction :

$$A + B \overset{K^{\#}}{\rightleftharpoons} (AB)^{\#} \xrightarrow{k_2} \text{products},$$

k_2 is given by :

(constant = $\frac{k_B T}{h}$; $\Delta S^{\#}$ = standard entropy of activation; $(\Delta H^\circ)^{\#}$ = standard enthalpy of activation)

(1) $k_2 = \text{constant} \cdot \exp\left(\frac{\Delta S^{\#}}{RT}\right) \cdot \exp\left(-\frac{(\Delta H^\circ)^{\#}}{R}\right)$

(2) $k_2 = \text{constant} \cdot \exp\left(\frac{\Delta S^{\#}}{R}\right) \cdot \exp\left(\frac{(\Delta H^\circ)^{\#}}{RT}\right)$

(3) $k_2 = \text{constant} \cdot \exp\left(-\frac{\Delta S^{\#}}{R}\right) \cdot \exp\left(-\frac{(\Delta H^\circ)^{\#}}{RT}\right)$

(4) $k_2 = \text{constant} \cdot \exp\left(\frac{\Delta S^{\#}}{R}\right) \cdot \exp\left(-\frac{(\Delta H^\circ)^{\#}}{RT}\right)$

57. The intensity of phosphorescence in the absence $\left(I_P^0\right)$ and presence (I_P) of a quencher (Q) is measured. A plot of $\frac{I_P^0}{I_P}$ (on y-axis) as a function of concentration of Q (on x-axis) gave straight line with intercept. The intercept is equal to : (k_Q = rate constant of phosphorescence; τ_{T_1} = life time of triplet excited state)

(1) $k_Q\tau_{T_1}$ (2) $\frac{1}{k_Q\tau_{T_1}}$

(3) 1.0 (4) Zero

58. In a flash photolysis experiment, the spectrometer is set up such that the light is passing through illuminated reaction cell with λ_{max} of free radical only. A flash of energy (10^5 J) is given for 10 μs. Which one of the following statements is *correct* ?

(1) The rate of disappearance of radicals is equal to the rate of increase of transmitted light.

(2) The rate of disappearance of radicals is equal to the rate of decrease of transmitted light.

(3) The rate of formation of radicals is equal to the rate of decrease of scattered light.

(4) The rate of formation of radicals is equal to unity.

59. Match the following :

(I)	$A^* + A \rightarrow 2A$ + heat	(A)	$\frac{1}{k_{IC} + k_{ISC} + k_f}$
(II)	Fluorescence quantum yield ϕ_f	(B)	$\frac{1}{k}$
(III)	Natural radiative life time τ°	(C)	Self-quenching
(IV)	$A^* \rightarrow A$ + heat	(D)	$\frac{k_f}{k_{IC} + k_{ISC} + k_f}$
		(E)	Internal conversion

	(I)	(II)	(III)	(IV)
(1)	(C)	(A)	(B)	(E)
(2)	(E)	(A)	(B)	(C)
(3)	(C)	(D)	(B)	(E)
(4)	(C)	(A)	(B)	(E)

60. Fluorescence efficiency decreases due to one of the following factors in polynuclear aromatic hydrocarbons :

(1) Increase with increasing number of condensed rings

(2) Planarity of the ring

(3) Steric hinderance due to substituents

(4) Large energy separation between excited singlet S_1 and triplet T_1

61. Calculate the triplet life time Γ_p of phosphorescence decay of 1-Iodonaphthalene in seconds :

(K_p = 350 s^{-1}; ϕ_p = 0.70 at 77 K; $\phi_f = 10^{-4}$ at 77 K)

(1) 0.002 (2) 0.02

(3) 500 (4) 5

62. The magnetic susceptibility of a material is found to be -1.4×10^{-6} emu. The material is :

(1) Paramagnetic (2) Ferromagnetic

(3) Antiferromagnetic (4) Diamagnetic

63. The number of Bravais Lattices present in cubic and orthorhombic lattices is respectively :

(1) 3, 3 (2) 4, 4

(3) 3, 4 (4) 4, 3

64. Which one of the following is an intrinsic semiconductor ?

(1) Diamond (2) Arsenic doped silicon

(3) Indium doped silicon (4) Germanium

65. A solid crystallizes in primitive cubic lattice. It has cubic close packing. The total number of octahedral and tetrahedral voids present per unit cell is respectively :

(1) 2, 2 (2) 1, 2

(3) 2, 1 (4) 1, 1

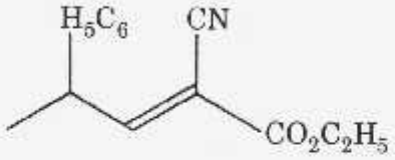
66. According to Langevin's theory of diamagnetism, the correct relationship between atomic radius (R) and atomic susceptibility (χ_A) is :

(z = atomic number)

(1) $R^2 = 0.35 \times 10^{-10} \frac{\chi_A}{Z}$ (2) $R^2 = -0.35 \times 10^{-10} \frac{\chi_A}{Z}$

(3) $R^2 = -0.35 \times 10^{-10} \frac{Z}{\chi_A}$ (4) $R^2 = 0.35 \times 10^{-10} \frac{Z}{\chi_A}$

67. The IUPAC name of the following compound is :



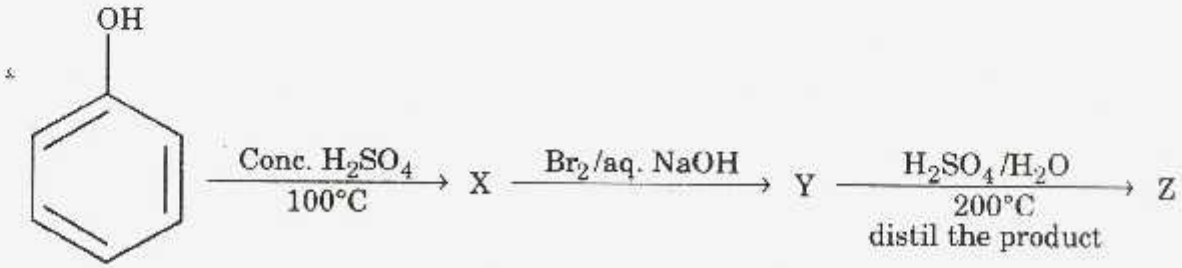
(1) (Z)-2-ethoxycarbonyl-4-phenylpent-2-enenitrile

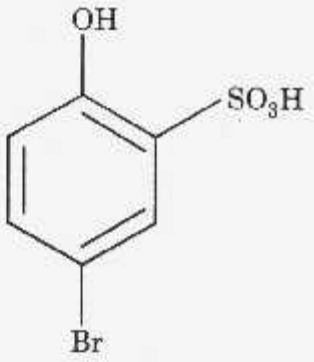
(2) (E)-ethyl-2-cyano-4-phenylpent-2-enoate

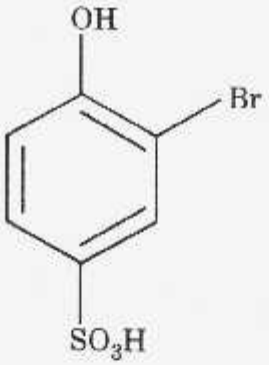
(3) (E)-2-ethoxycarbonyl-4-phenylpent-2-enenitrile

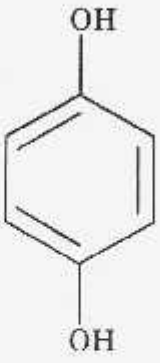
(4) (Z)-ethyl-2-cyano-4-phenylpent-2-enoate

68. In the following reaction sequence the 'Z' is :



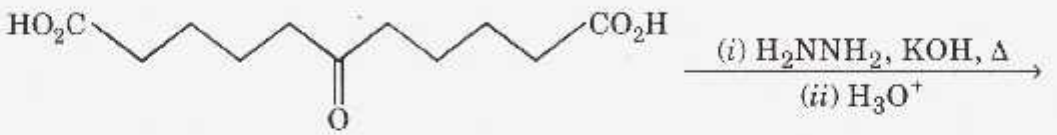
(1) 

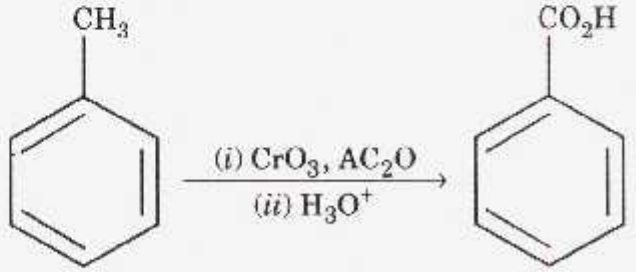
(2) 

(3) 

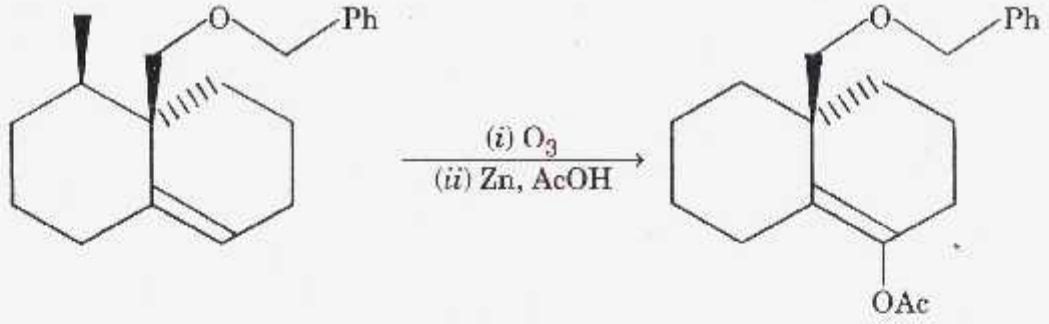
(4) 

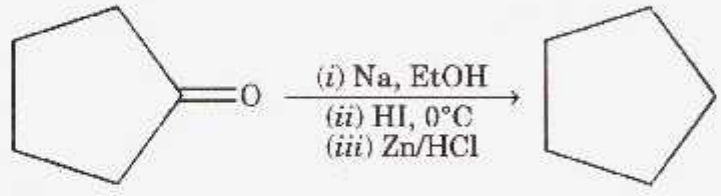
69. Which one of the following reactions is *correct* ?

(1) 

(2) 

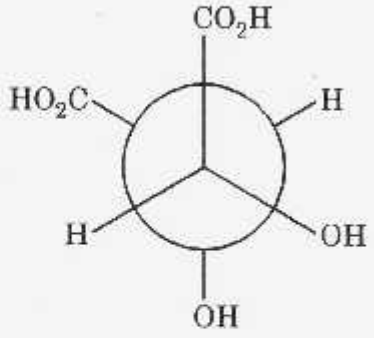
Major

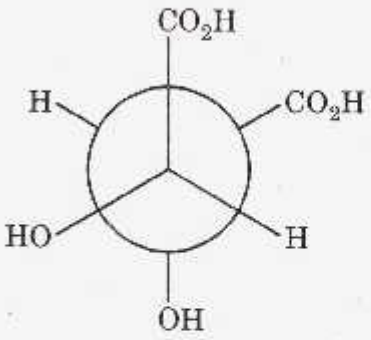
(3) 

(4) 

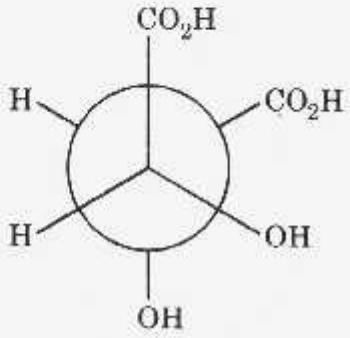
70. Which of the following pairs is the *correct* projections of meso-tartaric acid ?

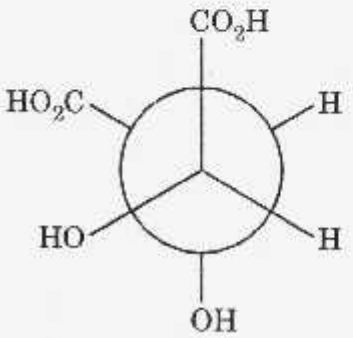
(1)



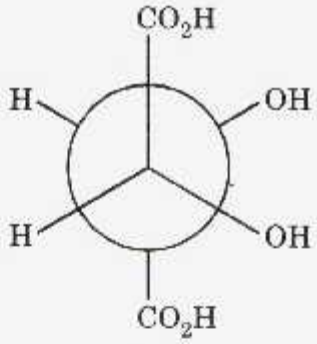


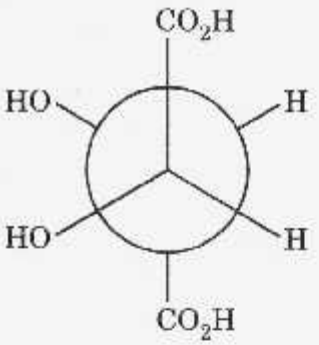
(2)



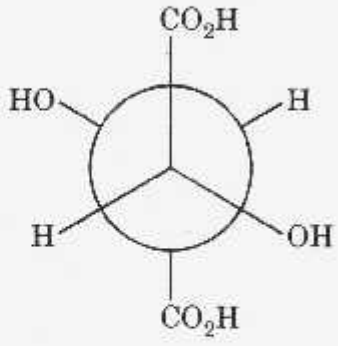


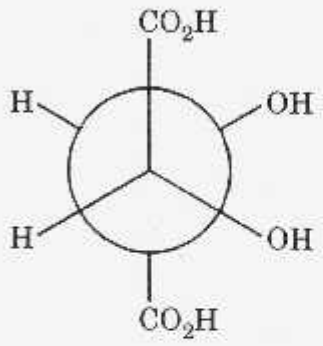
(3)





(4)





71. An optically active oxime on treatment with Lewis acid followed by complete hydrolysis gave (R)-3-phenylbutanoic acid and methyl amine. The configuration of optically active oxime is :

(1) (S), E (2) (S), Z

(3) (R), E (4) (R), Z

72. When the polymethylene bridge having $-(CH_2)_8-$ is incorporated into 2-bromohydroquinone, the resulting derivative is :

(1) Optically active due to planar chirality

(2) Always optically inactive due to racemic form

(3) Optically active due to axial chirality

(4) Optically active due to helicity

73. Which one of the following statements is *correct* ?

(1) Homomeric conformations always give structural isomeric products with different rates of reactivity.

(2) Enantiomeric conformers under achiral medium give enantiomeric products and diastereomeric products with different rates of reactivity.

(3) Diastereomeric conformers under achiral medium give identical products and diastereomeric products with same rates of reactivity.

(4) Enantiomeric conformers under chiral medium give enantiomeric products with different rates of reactivity.

74. The stereochemical relationship between pairs of (+)AC, (–)AP and (–)SC and (+)SC of *n*-butane are respectively :

(1) Conformational diastereomers and conformational enantiomers

(2) Configurational diastereomers and configurational enantiomers

(3) Configurational enantiomers and configurational diastereomers

(4) Conformational enantiomers and conformational diastereomers

75. Which one of the following statements is *not correct* ?

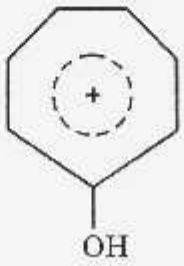
(1) Hydroxytropylium chloride is an antiaromatic molecule.

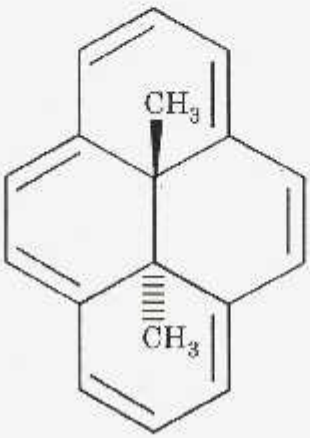
(2) Increase of hyperconjugation in olefins lowers the heat of hydrogenation.

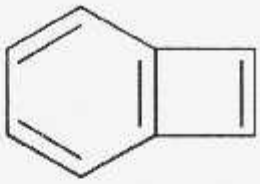
(3) Resonance stabilization occurs more in carboxylate ion than in the parent acid.

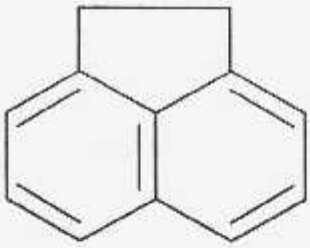
(4) 3-methylene-1, 4-pentadiene is a cross conjugated molecule.

76. Which one of the following is *not* aromatic ?

(1) 

(2) 

(3) 

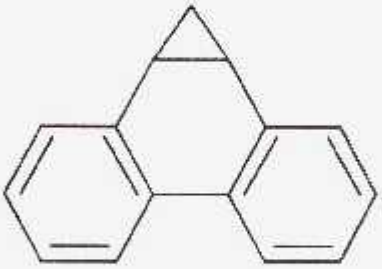
(4) 

77. Which of the following is *not* the source of carbene ?

(1) $CHCl_3/KOH$

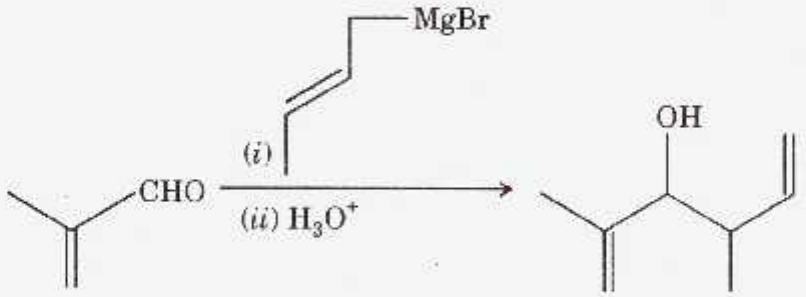
(2) $H_2C = C = O$, $h\nu$

(3) H_2CN_2, Δ

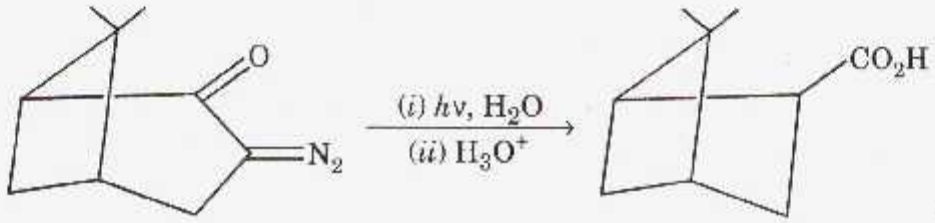
(4)  , $h\nu$

78. Which of the following reactions involves Wagner-Meerwein rearrangement ?

(1) Camphene hydrochloride $\xrightarrow{H^{\oplus}}$ Isobornyl chloride

(2) 

(3) Isoborneol $\xrightarrow{H^{\oplus}}$ Camphene

(4) 

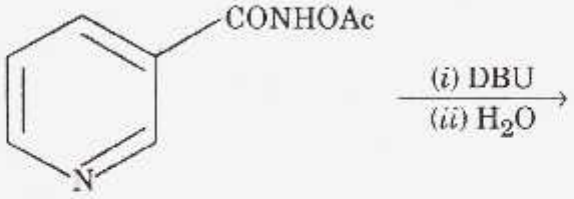
79. Match the following :

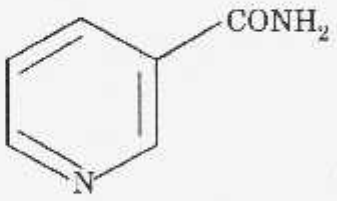
	List-I (Characteristics of Mechanism)		**List-II (Name reaction)**
(I)	2, 3-sigmatropic rearrangement	(A)	Smiles
(II)	Heisenheimer complex is intermediate	(B)	Beckmann
(III)	Cyclopropanone intermediate	(C)	Sommlet-Hauser
(IV)	Nucleophilic intramolecular 1, 2-shift	(D)	Favorski

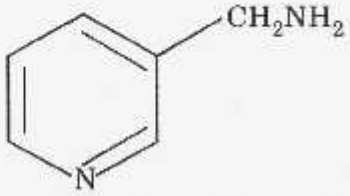
The *correct* answer is :

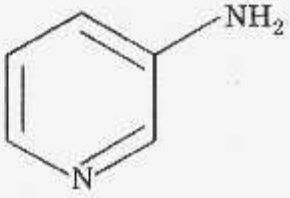
	(I)	(II)	(III)	(IV)
(1)	(C)	(A)	(D)	(B)
(2)	(A)	(C)	(D)	(B)
(3)	(C)	(B)	(D)	(A)
(4)	(C)	(D)	(A)	(B)

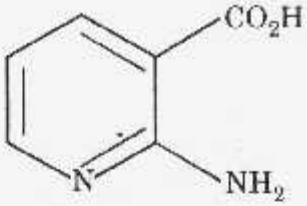
80. The product obtained in the following reaction is :



(1) 

(2) 

(3) 

(4) 

81. Which of the following statements is *not correct* ?

(1) Dehydrobromination of meso-stilbene dibromide yields the cis olefin.

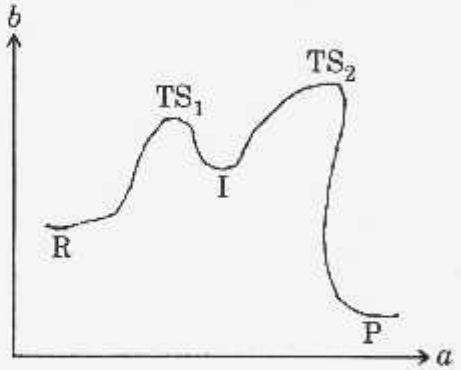
(2) Trans 4-ter-Butylcyclohexyl-1-*p*-toluene sulfonate will not undergo E_2 elimination reaction.

(3) In the presence of $KOBu^t$, 2-bromo-2-methyl-butane gives 2-methylbut-1-ene as major product.

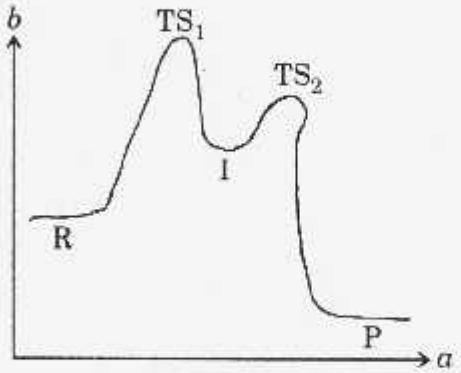
(4) E_2 elimination reaction of trans 2, 3-dichloro-norborane is slower than that of cis isomer.

82. The energy profile diagram which represents the nitration of benzene is :
(b = potential energy; a = reaction coordinate; TS = transition state; R = reactant; P = product; I = intermediate)

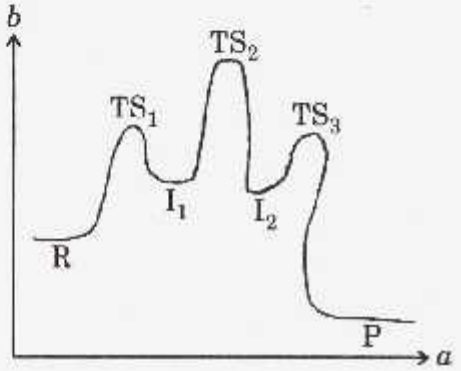
(1)



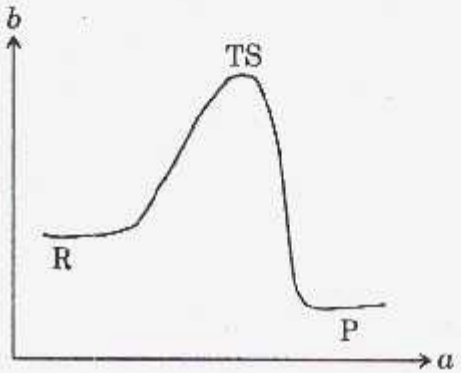
(2)



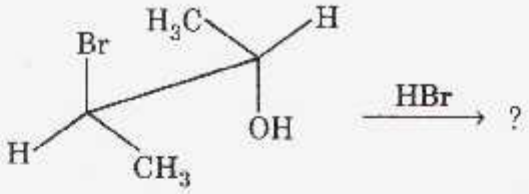
(3)



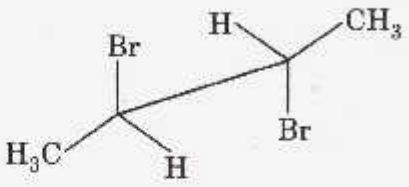
(4)



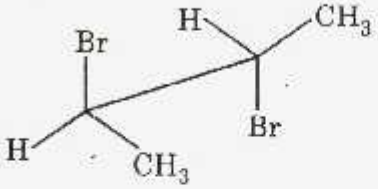
83. The product obtained in the following reaction is :



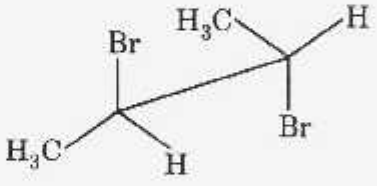
(1)



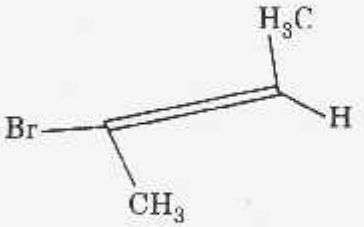
(2)



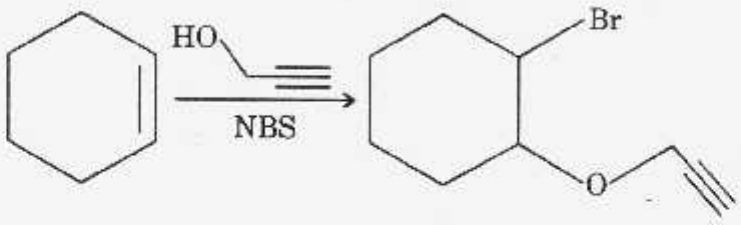
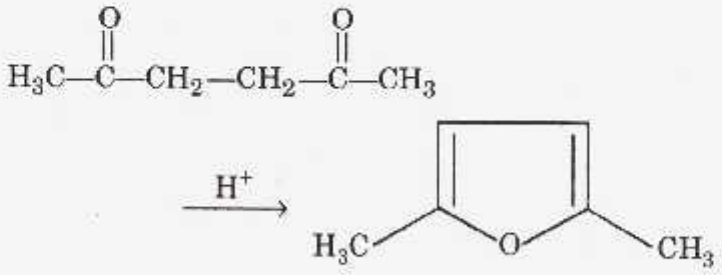
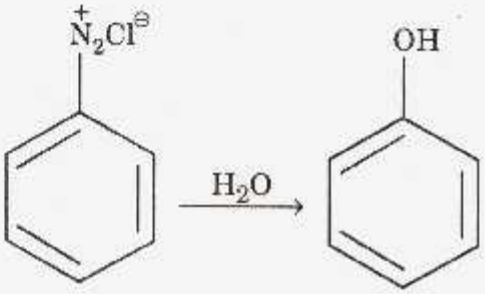
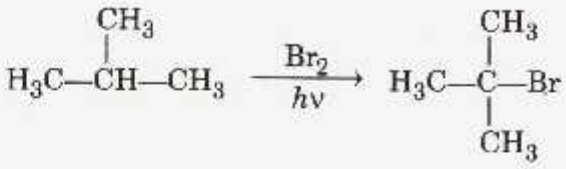
(3)



(4)



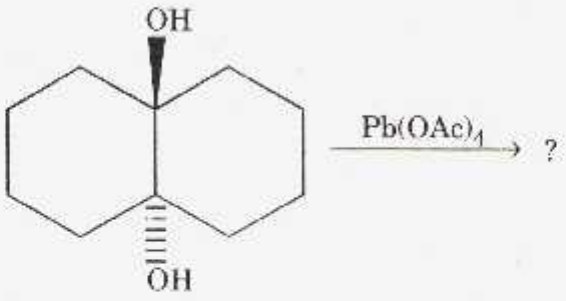
84. Match the following :

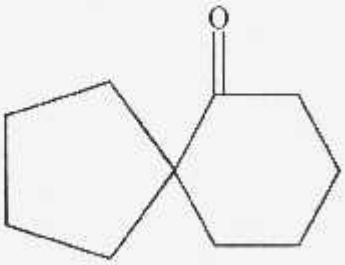
List-I		List-II
(A) 		(I) Nucleophilic addition
(B) 		(II) Electrophilic addition
(C) 		(III) Nucleophilic substitution
(D) 		(IV) Free radical substitution

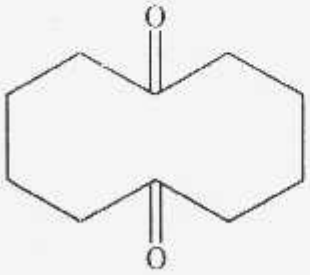
The *correct* answer is :

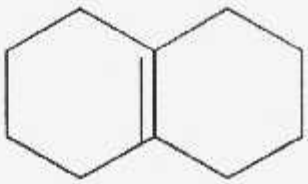
	(A)	(B)	(C)	(D)
(1)	(IV)	(I)	(II)	(III)
(2)	(I)	(II)	(III)	(IV)
(3)	(II)	(I)	(III)	(IV)
(4)	(I)	(III)	(IV)	(II)

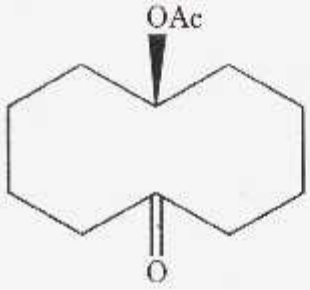
85. What is the product obtained in the following reaction ?

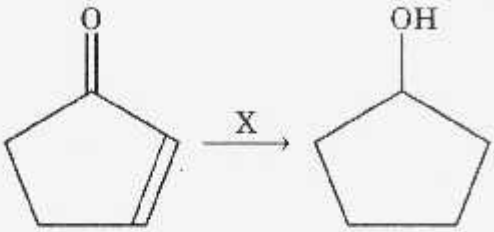


(1) 

(2) 

(3) 

(4) 

86. 

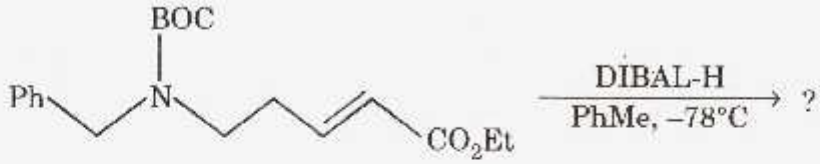
The reagent 'X' is :

(1) BH_3/H_2O_2

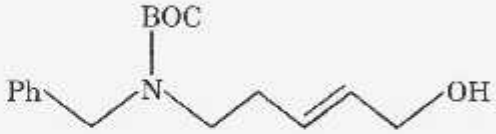
(2) H_2, Pd-C

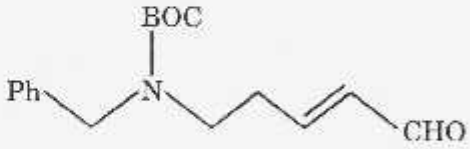
(3) $NaBH_4/CeCl_3$

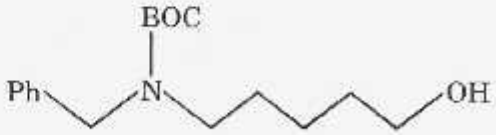
(4) $NaBH_4$, $Li^{\oplus}$ salt

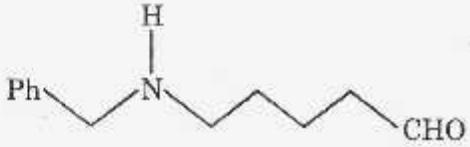
87. 

The product in the above reaction is :

(1) 

(2) 

(3) 

(4) 

88. The reagents which are used in a sequence to convert furan to a mixture of salt of furoic acid and furfuryl alcohol, are :

(1) DMF, $POCl_3$ then H_3O^+; $NaOAc/AC_2O$

(2) AC_2O, BF_3 then H_3O^+; Con. $KOH_{(aq)}$

(3) HCN, HCl then H_3O^+; Con. $KOH_{(aq)}$

(4) n-C_4HgLi, CO_2 then H_3O^+; Con. $KOH_{(aq)}$

89. Which one of the following statements is *not correct* ?

(1) Isoquinoline is a stronger base than quinoline.

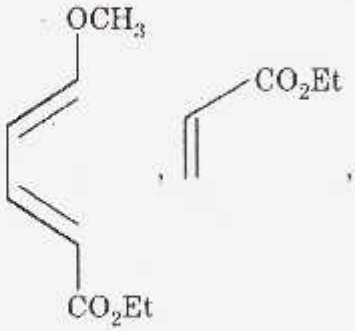
(2) When benzaldehyde is heated with an aminoacetal and further cyclized in presence of acid, quinoline is obtained.

(3) Quinoline treated with $NaNH_2$ forms 2-aminoquinoline.

(4) Pyridine N-oxide reacted with nitrating mixture (Con. HNO_3 and Con. H_2SO_4) and then with PCl_3 in chloroform forms 4-nitropyridine.

90. The reactants and reagents which are used in the synthesis of α-terpineol by making use of Diels-Alder reaction are :

(1) isoprene, methyl vinyl ether, Δ; H_3O^+

(2)  , Δ; CH_3MgBr then H_3O^+

(3) isoprene, methyl acrylate, Δ; H_3CMgBr then H_3O^+

(4) isoprene, methyl vinyl ketone, Δ; H_3CMgBr then H_3O^+

91. Quininic acid on oxidation with chromic acid gives :

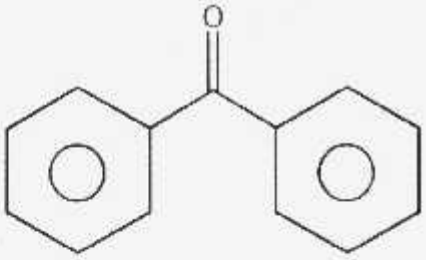
(1) Pyridine-2, 3-dicarboxylic acid

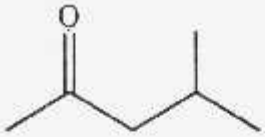
(2) Quinoline-4-carboxylic acid

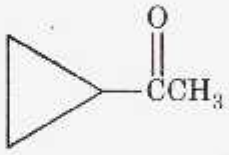
(3) 6-hydroxyquinoline

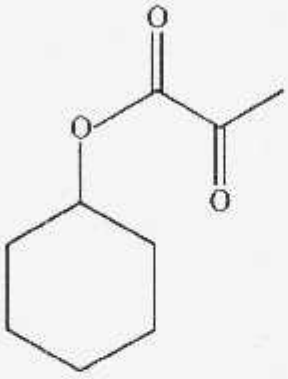
(4) pyridine-2, 3, 4-tricarboxylic acid

92. Which of the following compounds *does not* undergo Norrish type II cleavage ?

(1) 

(2) 

(3) 

(4) 

93. Photochemical irradiation of cis, trans-hexa-2, 4-diene forms a mixture of cis, trans-hexa-2, 4-diene, cis, cis-hexa-2, 4-diene and trans-trans-hexa-2, 4-diene. This reaction involves :

(1) Di-π methane rearrangement

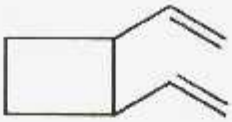
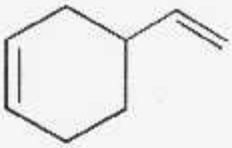
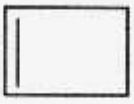
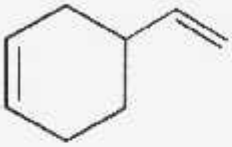
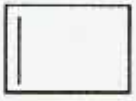
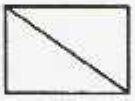
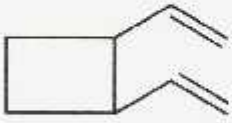
(2) Photoisomerisation

(3) Patterno-Buchi reaction

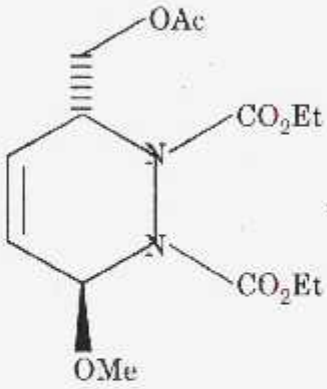
(4) Photo reduction

94. $H_2C = CH—CH = CH_2 \xrightarrow{h\nu} X + Y$

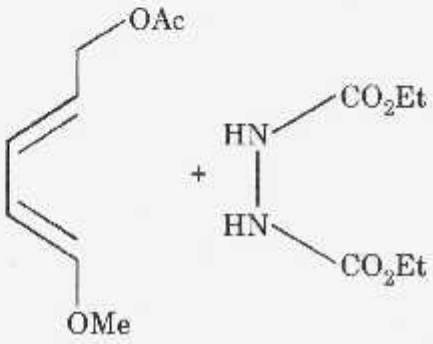
the products 'X' and 'Y' are :

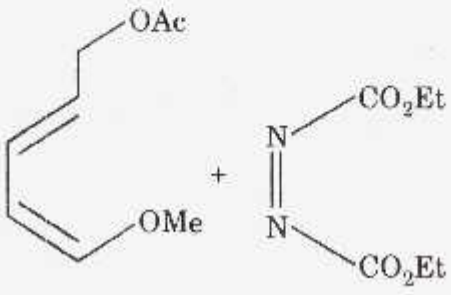
	X	Y
(1)		
(2)		
(3)		
(4)		

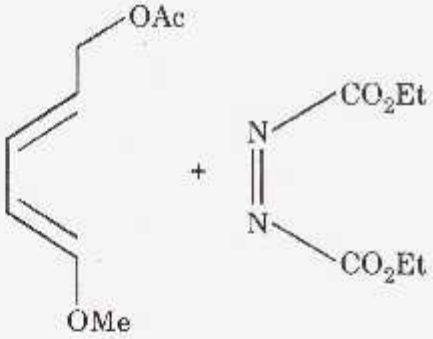
95. Reactants used for the formation of

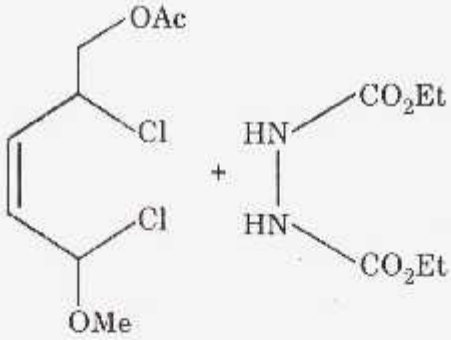


, is :

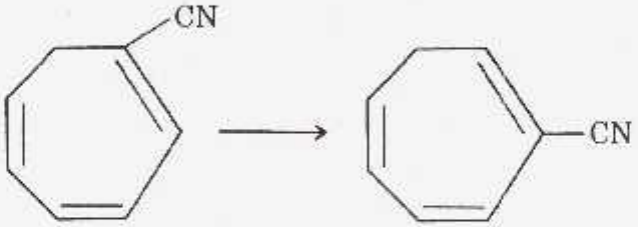
(1) 

(2) 

(3) 

(4) 

96. The reaction condition required and the type of shift involved in the following reaction respectively are :



(1) Δ, [1, 5] suprafacial
(2) $h\nu$, [1, 3] suprafacial
(3) Δ, [1, 7] antarafacial
(4) $h\nu$, [1, 7] suprafacial

97. Which of the following statements is *not correct* ?

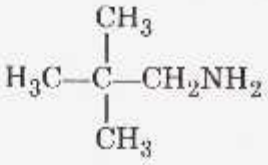
(1) The vibrational frequency of a bond decreases as the bond strength decreases.

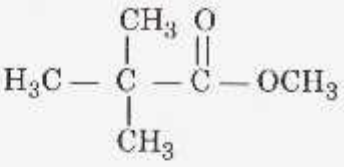
(2) C ≡ C stretching frequency is higher than C = C stretching frequency.

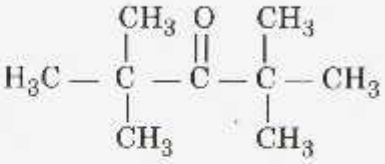
(3) O—H stretching frequency is higher than O—D stretching frequency.

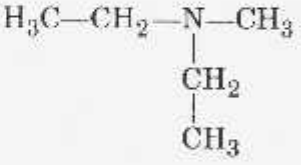
(4) The vibrational frequency of a bond increases as the reduced mass of the molecule increases.

98. Which one the following compounds will *not* show three signals in their corresponding ^{13}C—NMR spectra ?

(1) 

(2) 

(3) 

(4) 

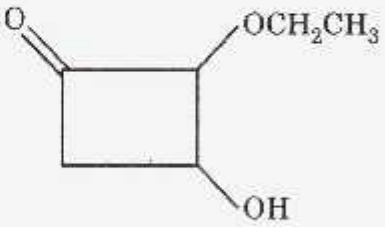
99. An organic compound 'A' with molecular formula $C_6H_{10}O_3$ exhibits the following spectral data :

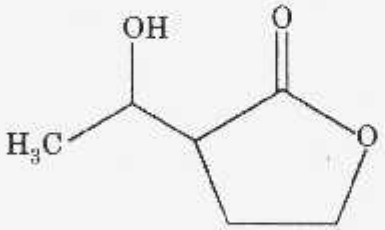
IR($\bar{\nu}$, cm^{-1}) : 2950, 1725, 1705 cm^{-1}

Mass (m/2) : 130, 87, 43, 29

^1H—NMR (δppm) : 4.20(s), 3.5(q), 2.3(s), 1.3(t)

The structure of the compound 'A' is :

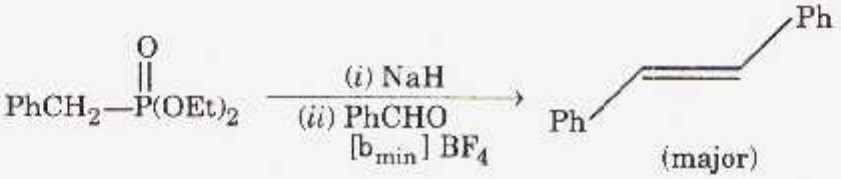
(1) 

(2) 

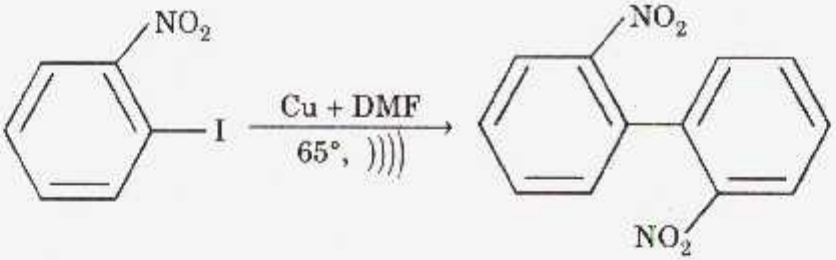
(3) 

(4) 

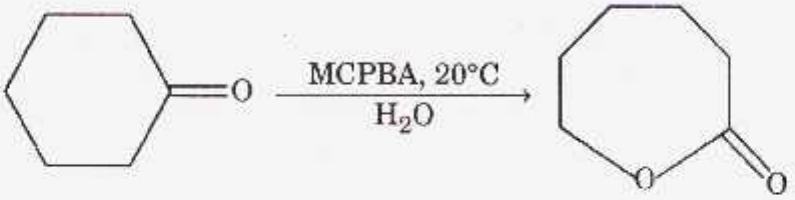
100. Which one of the following is *not* a green reaction ?

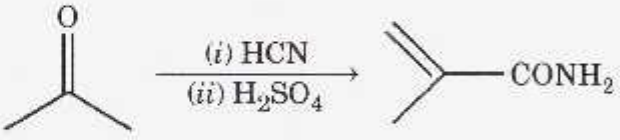
(1) 

(major)

(2) 

(major)

(3) 

(4) 

Space for Rough Work

Space for Rough Work