Roll No. | | | | | | | | |

(Write Roll Number from left side exactly as in the Admit Card)

Signature of Invigilator

Question Booklet Series **X**

PAPER–II **Question Booklet No.**

Subject Code : 12

CHEMICAL SCIENCES

Time : 2 Hours *Maximum Marks: 200*

Instructions for the Candidates

1. Write your Roll Number in the space provided on the top of this page as well as on the OMR Sheet provided.
2. At the commencement of the examination, the Question Booklet will be given to you. In the first 5 minutes, you are requested to open the booklet and verify it:
   (i) To have access to the Question Booklet, tear off the paper seal on the edge of this cover page.
   (ii) Faulty booklet, if detected, should be got replaced immediately by a correct booklet from the invigilator within the period of 5 (five) minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given.
   (iii) Verify whether the Question Booklet Number is identical with OMR Sheet Number; if not, the full set is to be replaced.
   (iv) After this verification is over, the Question Booklet Series and Question Booklet Number should be entered on the OMR Sheet.
3. This paper consists of One Hundred (100) multiple-choice type questions. All the questions are compulsory. Each question carries *two* marks.
4. Each Question has four alternative responses marked: (A) (B) (C) (D) . You have to darken the circle as indicated below on the correct response against each question.

   Example: (A) (B) ● (D), where (C) is the correct response.
5. Your responses to the questions are to be indicated correctly in the OMR Sheet. If you mark your response at any place other than in the circle in the OMR Sheet, it will not be evaluated.
6. Rough work is to be done at the end of this booklet.
7. If you write your Name, Phone Number or put any mark on any part of the OMR Sheet, except in the space allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means, such as change of response by scratching or using white fluid, you will render yourself liable to disqualification.
8. Do not tamper or fold the OMR Sheet in any way. If you do so, your OMR Sheet will not be evaluated.
9. You have to return the Original OMR Sheet to the invigilator at the end of the examination compulsorily and must not carry it with you outside the Examination Hall. You are, however, allowed to carry question booklet and duplicate copy of OMR Sheet after completion of examination.
10. **Use only Black Ball point pen.**
11. **Use of any calculator, mobile phone, electronic devices/gadgets etc. is strictly prohibited.**
12. **There is no negative marks for incorrect answer.**

The Question Booklet is encrypted with QR code for security purpose.

CHEMICAL SCIENCES

1. A Fe(II) compound which undergoes spin-crossover on varying the temperature, is studied by Mossbauer spectroscopy. Which of the following statements is correct for this study?

(A) It shows six-line spectra below the spin-transition temperature

(B) It shows one-line spectra above the transition temperature

(C) It shows temperature dependent two line spectra below the transition temperature

(D) It shows temperature dependent two line spectra above the transition temperature

2. The results of analysis of a substance X by two persons are given below:

Person 1 : 4·10, 4·12, 4·09 (% of X)

Person 2 : 4·08, 4·20, 4·24 (% of X)

Considering the data given above, which of the following Statements is correct? Content of X is known to be 4·18%

(A) Result of person 1 is more accurate but less precise compared to person 2

(B) Result of person 1 is more accurate and more precise compared to person 2

(C) Result of person 1 is less accurate but more precise compared to person 2

(D) Result of person 1 is less accurate and less precise compared to person 2

3. In cyclic voltammetry, for a reversible reaction, the relationship between peak current (i_p) and scan rate (ν) is:

(A) $i_p \alpha \nu$

(B) $i_p \alpha \nu^2$

(C) $i_p \alpha \sqrt{\nu}$

(D) i_p is independent ν

4. The exchange capacity increases with increase of pH of

(A) cation exchange resin

(B) anion exchange resin

(C) both cation exchange resin and anion exchange resin

(D) exchange capacity does not depend on pH

5. Which of the following statements are correct?

(i) The 3rd ionization energy of Eu is less than that of Gd.

(ii) Ce can exist both in 3+ and 4+ oxidation states.

(iii) Yb can exist both in 3+ and 4+ oxidation states.

(iv) Most stable oxidation state of U is 6+.

(A) (i) and (iv)

(B) (i) and (ii)

(C) (iii) and (iv)

(D) (ii) and (iv)

6. For which of the following pairs of lanthanide, the metallic radii are considerably higher than the others?

(A) Eu, Yb

(B) Eu, Gd

(C) Ce, Eu

(D) Ce, Yb

7. Decomposition temperature of $CaCO_3$ in thermogravimetric analysis will be highest in dynamic atmosphere of

(A) N_2

(B) CO_2

(C) air

(D) O_2

8. Which of the following statements are *true* for Lanthanide?

(i) The observed magnetic moment of Sm^{3+} is higher than that calculated from spin-orbit coupling

(ii) The observed magnetic moment of Gd^{3+} is nearly equal to the calculated spin-only value

(iii) The observed magnetic moment of Eu^{3+} at room temperature is lower than that calculated from spin-orbit coupling

(iv) The observed magnetic moment of Ce^{3+} is nearly equal to the calculated spin-only value

(A) (i) and (iv)

(B) (ii) and (iii)

(C) (i), (ii) and (iv)

(D) (i) and (ii)

9. Which of the following is/are *true* about ferrocene?

(i) It is diamagnetic

(ii) Its dipole moment is zero

(iii) Kealy and Pauson synthesised ferrocene from C_5H_5 MgBr and $FeCl_3$

(iv) Kealy and Pauson synthesised ferrocene from C_6H_6 and freshly reduced Fe at 300°C.

(A) (iii) & (iv)

(B) (i), (ii) & (iv)

(C) (i), (iii) & (iv)

(D) (ii), (iii) & (iv)

10. Rate constants for base hydrolysis of some octahedral complexes follow the order:

(A) $[Co(NH_3)_5\ NO_3]^{2+} > [Co(NH_3)_5I]^{2+} > [Co(NH_3)_5\ Cl]^{2+} > [Co(NH_3)_5F]^{2+}$

(B) $[Co(NH_3)_5\ F]^{2+} > [Co(NH_3)_5Cl]^{2+} > [Co(NH_3)_5I]^{2+} > [Co(NH_3)_5NO_3]^{2+}$

(C) $[Co(NH_3)_5Cl]^{2+} > [Co(NH_3)_5F]^{2+} > [Co(NH_3)_5I]^{2+} > [Co(NH_3)_5NO_3]^{2+}$

(D) $[Co(NH_3)_5NO_3]^{2+} > [Co(NH_3)_5F]^{2+} > [Co(NH_3)_5Cl]^{2+} > [Co(NH_3)_5\ I]^{2+}$

11. The formal charges on $\overset{(a)}{N}$, $\overset{(b)}{N}$ and $\overset{(c)}{N}$ in the azide anion, $[\overset{(a)}{N} = \overset{(b)}{N} = \overset{(c)}{N}]^-$ are respectively

(A) –1, –1, +1

(B) +1, –1, –1

(C) –1, +1, –1

(D) +1, –2, 0

12. Pyrosilicates contain the discrete silicate ion:

(A) $(SiO_3)_n^{2n-}$

(B) $Si_2O_7^{6-}$

(C) $Si_3O_9^{6-}$

(D) $Si_4O_{11}^{6-}$

13. Number of isomeric derivatives possible for the neutral closo-carborane, $C_2B_{10}H_{12}$ are:

(A) 2

(B) 3

(C) 4

(D) 5

14. Select the correct statement(s) related to nuclear reactor:

(1) In fast reactors, the moderator is efficient and needs no enriched fuel

(2) Neutrons in PHWR (Pressurised Heavy Water Reactor) needs no enriched fuel

(3) Water at high pressure is very often used as coolant

(4) No moderator is used as the fission of ^{239}Pu goes on by both the fast and slow neutrons

(A) only (4)

(B) only (1), (2) & (3)

(C) only (2), (3) & (4)

(D) only (3) & (4)

15. The ^{19}F NMR spectrum of ClF_3 at low temperature is observed as

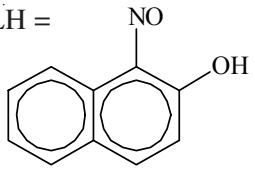
(A) a doublet

(B) a singlet

(C) a doublet and a triplet

(D) a doublet of doublet and a doublet of triplet

16. In principle, how many ^{1}H NMR singals you can expect from the mer-isomer of CoL_3? Where LH =



(A) 6

(B) 7

(C) 18

(D) 21

17. The number of EPR lines observed for napthalene radical and napthalene negative radical are respectively:

(A) 8, 25

(B) 128, 128

(C) 25, 128

(D) 128, 25

18. Which of the following pairs is *not* isolobal?

(A) $Mn(CO)_5$, O

(B) $Mn(CO)_5$, Cl

(C) $Fe(CO)_4$, O

(D) $Mn(CO)_5$, CH_3

19. IUPAC name of

$$\left[Fe_4Cu_4 \left(C_5H_5\right)_4 \left\{ \left[\left(CH_3\right)_2 N \right] C_5H_4 \right\}_4 \right] \text{ is}$$

(A) tetrakis[(dimethylamino) cyclopentadienyl]tetrakis (cyclopentadyenyl) tetra iron tetra copper

(B) tetrakis [(dimethyl amino) cyclo penta dienyl] tetrakis (cyclopentadyenyl) tetra copper tetra iron

(C) tetrakis (cyclopentadyenyl) tetrakis [(dimethyl amino) cyclopentadyenyl] tetra copper tetra iron

(D) tetrakis (cyclopentadyenyl) tetrakis [(dimethyl amino) cyclopentadyenyl] tetra iron tetra copper

20. Regarding the agostic interaction, C—H -----Ir observed in $[Ir(Ph_3P)_3Cl]$, following observations are recorded —

(1) Increased acid character of C—H

(2) ν_{C-H} in IR spectrum shifts to higher wave number

(3) Upfield shift of C—H proton in ^1H NMR

Which of the observation(s) given above is/are correct?

(A) (1) & (2)

(B) (2) & (3)

(C) (1) & (3)

(D) (3) only

21. Which of the following species containing mercury is most toxic?

(A) Hg-metal

(B) Hg_2Cl_2

(C) $HgCl_2$

(D) CH_3Hg^+

22. The ground state term symbol of Mn^{4+} ion is

(A) $^4F_{9/2}$

(B) $^4D_{9/2}$

(C) $^4F_{3/2}$

(D) $^4F_{5/2}$

23. The ionic radii of Y^- and X^+ are 2·35Å and 1.27Å, respectively. The coordination number of X^+ in the ionic compound XY is

(A) 4

(B) 3

(C) 8

(D) 6

24. In which of the following species, sulphur is not sp^3 hybridised?

(A) SO_4^{2-}

(B) H_2S

(C) SF_4

(D) SF_2

25. The correct order of enthalpy of hydration for the fomation of following hexa-hydrate species is

(A) $[V(H_2O)_6]^{2+} > [Cr(H_2O)_6]^{2+} > [Mn(H_2O)_6]^{2+}$

(B) $[Mn(H_2O)_6]^{2+} > [V(H_2O)_6]^{2+} > [Cr(H_2O)_6]^{2+}$

(C) $[V(H_2O)_6]^{2+} > [Mn(H_2O)_6]^{2+} > [Cr(H_2O)_6]^{2+}$

(D) $[Mn(H_2O)_6]^{2+} > [Cr(H_2O)_6]^{2+} > [V(H_2O)_6]^{2+}$

26. The correct electronic configuration of Gd^{2+} is (Atomic number of Gd = 64)

(A) $[Xe]\ 4f^6\ 5d^1\ 6s^1$

(B) $[Xe]\ 4f^7\ 5d^1$

(C) $[Xe]\ 4f^7\ 6s^1$

(D) $[Xe]\ 4f^6\ 6s^2$

27. Example of an inverse spinel among the following is

(A) $MgAl_2O_4$

(B) $ZnFe_2O_4$

(C) $NiFe_2O_4$

(D) $MnCr_2O_4$

28. If M is a transition metal, the correct order of CO stretching frequency is

(A) $CO > [M(CO)_6] > [(Me_3N)_3 M(CO)_3] > M(CO)_6]^-$

(B) $CO > [(Me_3N)_3 M(CO)_3] > [M(CO)_6] > [M(CO)_6]^-$

(C) $CO < [(Me_3N)_3 M(CO)_3] < [M(CO)_6] < [M(CO)_6]^-$

(D) $CO > [(Me_3N)_3 M(CO)_3] > [M(CO)_6]^- > [M(CO)_6]$

29. The metal ions involved in the nitrogenases are

(A) Mg and Mn

(B) Fe and Cu

(C) Fe and Mo

(D) Fe and Zn

30. The reaction

$(dppe)Pt(CH_3)_4 \xrightarrow{165°C} (dppe)Pt(CH_3)_2 + C_2H_6$

is an example of

(A) reductive elimination

(B) insertion

(C) oxidative coupling

(D) oxidative elimination

31. The pH at which $Mg(OH)_2$ will be precipitated from a 10^{-4} M solution of $Mg(ClO_4)_2$ is [given, K_{Sp} of $Mg(OH)_2 = 9\times10^{-12}$] closest to

(A) 13·5

(B) 6·5

(C) 10·5

(D) 4·5

32. Lewis acidity of the following compounds follows the order:

(A) $Me_3SnF < Me_3SnCl < Me_3SnBr$

(B) $Me_3SnCl < Me_3SnF < Me_3SnBr$

(C) $Me_3SnBr < Me_3SnCl < Me_3SnF$

(D) $Me_3SnBr < Me_3SnF < Me_3SnCl$

33. A penta-coordinated complex of Cu(II) has trigonal bipyramidal geometry. The orbital that has an unpaired electron is

(A) $d_{x^2-y^2}$

(B) d_{xz}

(C) d_{yz}

(D) d_{z^2}

34. The shapes of Br_3^+ and I_5^+ are

(A) linear and square pyramidal, respectively.

(B) bent and square planar, respectively.

(C) trigonal planar and tetrahedral, respectively.

(D) angular and see saw, respectively.

35. Plot of kinetic energy of ejected electrons as a function of the wavelength of the incident radiation for the photoelectric effect for sodium metal gives a straight line with slope and intercept respectively as

(A) work function of the metal and Planck's constant.

(B) Planck's constant and wrok function of the metal.

(C) threshold frequency of the metal and Planck's constant.

(D) inverse of Planck's constant and work function of the metal.

36. Commutator $\left[\frac{d}{dx}, x\right]$ is equal to

(A) $(1-x)\frac{d}{dx}$

(B) $\frac{d}{dx}+x\frac{d}{dx}$

(C) $\frac{d}{dx}$

(D) 1

37. Molecular Orbital Theoretic and Valence Bond Theoretic picture of H_2 molecule describes H_2 respectively as

(A) 50-50 ionic and covalent; fully covalent

(B) fully ionic; 50-50 ionic and covalent

(C) fully covalent; 50-50 ionic and covalent

(D) 50-50 ionic and covalent; fully ionic

38. Lattice parameter of an element, stabilized in a FCC structure is a. The atomic radius of the element is

(A) $a/2$

(B) $a/\sqrt{2}$

(C) $\sqrt{2}\,a$

(D) $a/\left(2\sqrt{2}\right)$

39. A compound $A_x B_y$ has a cubic structure with A atoms occupying all corners of the cube as well as all the face centre positions. B atoms occupy all the tetrahedral voids. The value of x and y respectively

(A) 4, 4

(B) 4, 8

(C) 8, 4

(D) 4, 2

40. The molecular partition function for a system in which the energy levels are equispaced by ϵ, is

(A) $\frac{1}{1+e^{\beta\epsilon}}$

(B) $\frac{1}{1-e^{\beta\epsilon}}$

(C) $\frac{1}{1+e^{-\beta\epsilon}}$

(D) $\frac{1}{1-e^{-\beta\epsilon}}$

41. The following statement about a potential energy curve (PEC) for an electronic state of a molecule is WRONG.

(A) PEC results from Born-Oppenheimer approximation.

(B) Potential in PEC is the potential under which the nuclei move.

(C) Potential in PEC is for electrons.

(D) PECs may cross.

42. A particular reaction may take place with or without catalyst. In comparison to the uncatalysed reaction, for the catalysed reaction at the same temperature

(A) the value of equilibrium constant (K_{eq}) increases

(B) the values of both the forward rate constant (k_f) and the backward rate constant (k_{-f}) increase but (k_f/k_{-f}) remains unchanged

(C) the value of k_{eq} decreases

(D) the values of both k_f and k_{-f} increase, and (k_f/k_{-f}) changes

43. A carnot engine operating between two reservoirs at 27°C and 127°C, for every 1000 J of heat absorbed from the reservoir will produce work to the extent of

(A) –500 J

(B) –1000 J

(C) –250 J

(D) –330 J

44. When 50 ml of ethanol is mixed with 50 ml of water

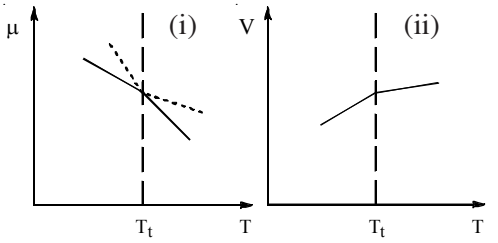
(A) the entropy of the solution increases but the volume contracts

(B) the entropy of the solution increases and the volume expands

(C) the entropy of the solution decreases and the volume contracts

(D) the entropy of the solution decreases but the volume expands

45. Following two figures give the sketches for changes in two thermodynamic properties for phase transitions at temperature $T = T_t$:



Choose the correct option—

(A) Both of (i) and (ii) are for 1st order phase transition

(B) Both of (i) and (ii) are 2nd order phase transition

(C) (i) is for 1st order and (ii) is for 2nd order phase transition

(D) (i) is for 2nd order and (ii) is for 1st order phase transition

46. For the consecutive first order reaction

$$A \xrightarrow{k} B \xrightarrow{k'} C, \text{ if } k' >> k$$

the concentration of C at any time, t can be written as ('A_0' is the initial concentration of 'A')

(A) $A_o\,[1-\exp^{-k't}]$

(B) $A_o \exp^{-k't}$

(C) $A_o \exp^{-kt}$

(D) $A_o\,[1-\exp^{-kt}]$

47. A solution of $K_3\,[Fe(C_2O_4)_3]$ in which Fe^{3+} is reduced and the oxalate ion is oxidited photochemically at 313 nm with a quantum yield of 2, the intensity, Io needed to produce $1{\cdot}2 \times 10^{-5}$ mol of Fe^{3+} over a period of 20 min is

(A) 1×10^{-7} mol s^{-1}

(B) 5×10^{-8} mol s^{-1}

(C) 1×10^{-5} mol s^{-1}

(D) 5×10^{-7} mol s^{-1}

48. The rate constant for a reaction is found to decrease with increase in temperature. Such a reaction

(A) is impossible.

(B) is an elementary reaction.

(C) demonstrates inadequacy of Arrhenius rate law.

(D) is a multistep reaction.

49. Coordinates of a general point (P) of a molecule is $[x_1, y_1, z_1]$. σ_d operation transforms P into P′ (σ_d is a dihedral plane of symmetry which contains Z axis and bisects second and fourth quadrants). The coordinates of P′ is

(A) $[-x_1, -y_1, -z_1]$

(B) $[-y_1, -x_1, z_1]$

(C) $[x_1, -z_1, y_1]$

(D) $[x_1, z_1, -y_1]$

50. $C_n(Z)\,\sigma(xy) = \sigma(xy)\,C_n(Z)$

Above equality holds because,

(A) $C_n(Z)$ transforms coordinates of the general point in xy plane but $\sigma(xy)$ transforms along Z axis

(B) $\sigma(xy)$ transforms coordinates of the general point in yz plane and $C_n(Z)$ transforms along Z axis

(C) $\sigma(xy)$ transforms coordinates of the general point in xy plane and $C_n(Z)$ transforms along Y axis

(D) $C_n(Z)$ transforms coordinates of the general point along Z axis and $\sigma(xy)$ transforms in xy plane

51. Characters of one of the irreducible representations (Γ_i) of T_d cubic group is given below:

T_d	E	$8C_3$	$3C_2$	$6S_4$	$6\sigma_d$
T_i	3	0	–1	1	–1

Dimension of the Γ_i representation is

(A) 1

(B) 5

(C) 3

(D) 2

52. Character table of C_{3v} point group is given below, along with characters of Γ reducible representation:

C_{3v}	E	$2C_3$	$3\sigma_v$	
A_1	1	1	1	Z
A_2	1	1	–1	R_z
E	2	–1	0	(x, y) (R_x, R_y)
Γ	7	1	–3	

Number of times the A_1 irreducible representation appears in Γ reducible representation is

(A) 0

(B) 3

(C) 2

(D) 1

53. The ground state term symbol of the diatomic molecule with electronic configuration, $(1\sigma_g)^2 (1\sigma_u)^2 (2\sigma_g)^2 (2\sigma_u)^2 (1\pi_u)^1 (1\pi_u)^1$, is

(A) ${}^1\Sigma_g^+$

(B) ${}^3\Sigma_g^-$

(C) ${}^1\Sigma_g^-$

(D) ${}^3\Sigma_g^+$

54. In a typical Raman spectra of a molecule both stokes and anti-stokes lines are seen generally.

(A) Stokes lines appear at lower frequencies with higher intensities compared to anti-stokes lines

(B) Stokes lines appear at higher frequencies with lower intensities compared to anti-stokes lines

(C) Anti-stokes lines appear at lower frequencies with lower intensities compared to stokes lines

(D) Anti-stokes lines appear at higher frequencies with higher intensities compared to stokes lines

55. In ethyl iodide the coupling constant between protons of CH_3 and CH_2 is 7·5 Hz. The chemical shifts of CH_3 and CH_2 are 183 Hz and 110 Hz respectively. These values are obtained when recorded in a 60 MHz NMR spectrometer. The coupling constant and the chemical shifts when measured in a 100 MHz spectrometer will respectively, be

(A) 7·5 Hz, 183 Hz, 110 Hz

(B) 7·5 Hz, 305 Hz, 183 Hz

(C) 12·5 Hz, 305 Hz, 183 Hz

(D) 12·5 Hz, 183 Hz, 110 Hz

56. ^{15}O and ^{13}N are produced in air when γ-ray from lightening knocks off

(A) a proton from both ^{16}O and ^{14}N.

(B) a neutron from both ^{16}O and ^{14}N.

(C) an electron from both ^{16}O and ^{14}N.

(D) a proton from ^{16}O and a neutron from ^{14}N.

57. Consider the following equiliberium for water:

$$H_2O \rightleftharpoons H^+ + OH^-$$

If ionic product of water is $1{\cdot}0 \times 10^{-14}$, what is the value of the equilibrium constant of the above process?

(A) $1{\cdot}0 \times 10^{-14}$

(B) $1{\cdot}8 \times 10^{-16}$

(C) $1{\cdot}8 \times 10^{-7}$

(D) $1{\cdot}0 \times 10^{-16}$

58. The Langmuir theory of unimolecular adsorption of a gas on solid surface is valid at

(A) low pressures and low temperatures

(B) low pressures and high temperatures

(C) high pressures and low temperatures

(D) high pressures and high temperatures

59. The observed optical rotation value, when plane polarized sodium D light passes through a solution of an optically active compound in chloroform $\left([\alpha]_{\lambda}^{T} = +37{\cdot}5°\right)$ containing 15g per 100 ml, placed in a polarimeter cell of length 10 cm is:

(A) 5·6°

(B) 56°

(C) 28°

(D) 11·2°

60. For ideally dilute solution

(A) both the solute and solvent obey Henry's law

(B) both the solute and solvent obey Raoult's law

(C) the solute obeys Raoult's law and the solvent obeys Henry's law

(D) the solute obeys Henry's law and the solvent obeys Raoult's law

61. Variationally optimized ground state wave function and the corresponding energy are such that

(A) their accuracy is to the same extent

(B) the wave function is more accurate in comparison to the energy

(C) the energy is more accurate in comparison to the wave function

(D) the energy is as accurate as the other properties

62. ICN dissociates at 306 nm with a quantum yield of 0.1. If 1% of the incident light is absorbed by the gas and the number of photons incident is 2×10^{14}, the number of ICN molecules dissociated will be

(A) 2×10^{10}

(B) 2×10^{12}

(C) 2×10^{11}

(D) 2×10^{13}

63. The selection rule for a rotational transition in a symmetric top molecule is

(A) $\Delta J = 0, \pm 1, \Delta M = \pm 1, \Delta K = 0$

(B) $\Delta J = \pm 1, \Delta M = 0, \pm 1, \Delta K = 0$

(C) $\Delta J = 0, \pm 1, \Delta M = 0, \pm 1, \Delta K = 1$

(D) $\Delta J = \pm 1, \Delta M = \pm 1, \Delta K = 1$

64. The potential difference between two hydrogen electrodes of the following cell is 0.056V at 25°C. $Pt \mid H_2 (1\ atm), H^+ (m = 0 \cdot 01) \mid\mid H^+ (m = 0{\cdot}1) \mid H_2 (1\ atm) \mid pt$

The activity coefficient (γ) of 0·01 m HCl is 0·9. The γ for 0·1m HCl is

(Given, 56/59 = log 8·89)

(A) 0·8

(B) 1·0

(C) 0·7

(D) 1·1

65.

C_{2v}	E	C_2	$\sigma_v(xz)$	$\sigma_v'(yz)$	
A_1	1	1	1	1	Z
A_2	1	1	–1	–1	R_z
B_1	1	–1	1	–1	x, R_y
B_2	1	–1	–1	1	y, R_x

The ground state of NO_2 is of A_1 Symmetry. The component of transition dipolemoment integral will not vanish if following conditions prevail. Identify the WRONG statement:

(A) x polarized light causes transition to B_1 state

(B) y polarized light causes transition to B_2 state

(C) z polarized light causes transition to A_1 state

(D) Unpolarized light causes transition to A_2 state

66. The critical micelle concentration (CMC) of a surfactant, cetyltrimethyl ammonium bromide (CTAB) in aqueous medium is 0·80 mM at 25°C. What will be the concentrations of cetyltrimethyl ammonium ions (CTA^+) and bromide ions in solution if CTAB concentration is increased to 1·60 mM at same temperature?

(A) CTA^+ : 1·6 mM; Br^- : 1·6 mM

(B) CTA^+ : < 1·6 mM; Br^- : < 0·8 mM

(C) CTA^+ : > 0·8 mM; Br^- : > 0·8 mM

(D) CTA^+ : 0·8 mM; Br^- : > 0·8 mM

67. For the reaction $C(s) + CO_2(g) \rightarrow 2CO(g)$ given $\Delta H = 200$ kJ mol^{-1}, $\Delta S = 200$ Jk^{-1} mol^{-1}, is this reaction spontaneous at 300 K? What is the value of free energy change?

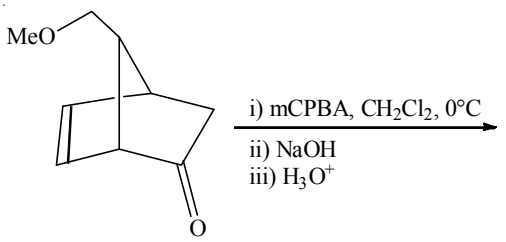
(A) yes, – 140 kJ mol^{-1}

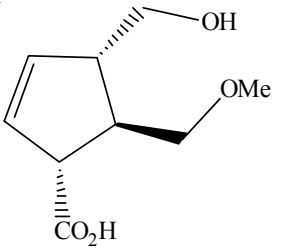
(B) no, 140 kJ mol^{-1}

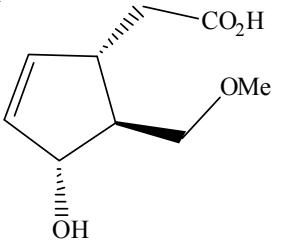
(C) no, 0 kJ mol^{-1}

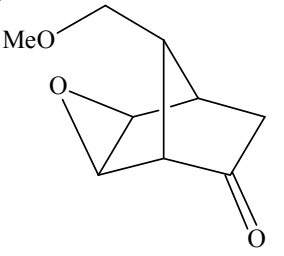
(D) yes, –400 kJ mol^{-1}

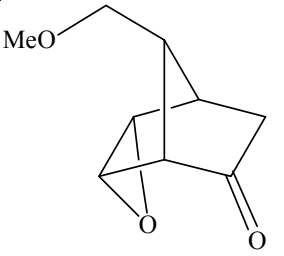
68. The major product formed in the following reaction sequence is



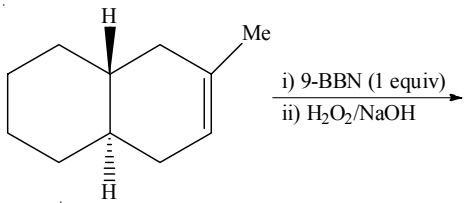
(A)


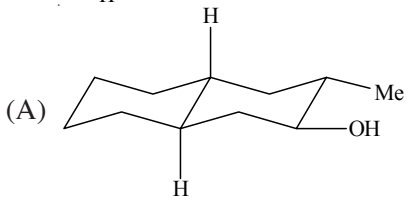
(B)


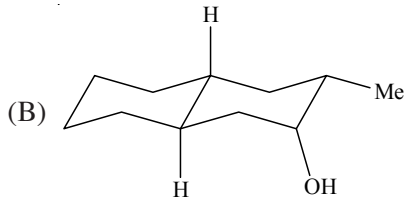
(C)


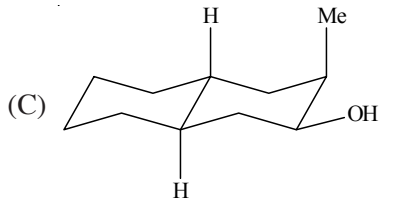
(D)


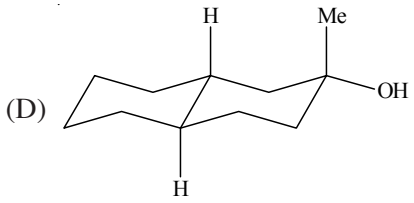
69. The major product of the following reaction sequence is



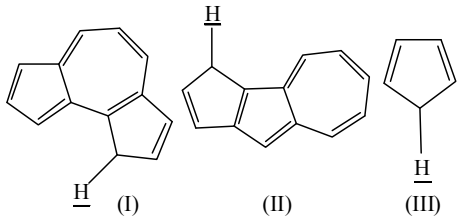
(A)


(B)


(C)


(D)


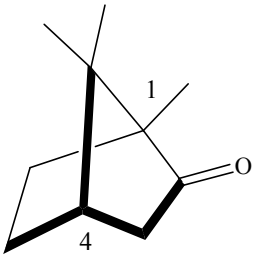
70. Increasing order of acidity of the marked 'H' of the following compound is



(A) III > II > I (B) I > III > II

(C) II > III > I (D) II > I > III

71. The absolute configuration at the two chiral centres of (–) Camphor is



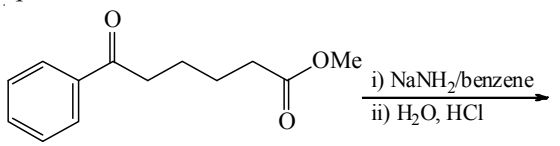
(A) 1R, 4R

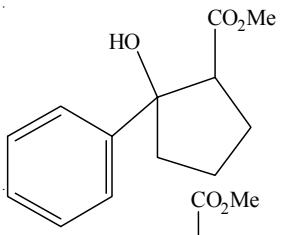
(B) 1R, 4S

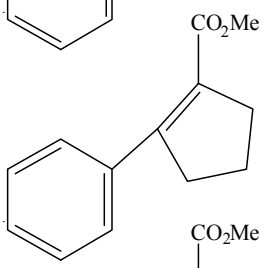
(C) 1S, 4R

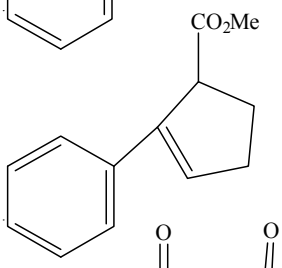
(D) 1S, 4S

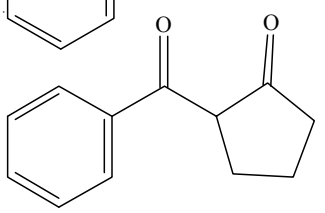
72. The major product of the following reaction sequence is



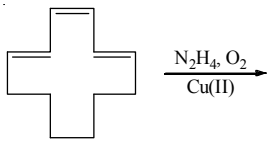
(A)


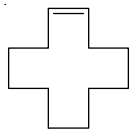
(B)


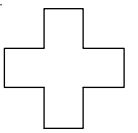
(C)


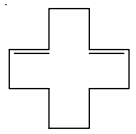
(D)


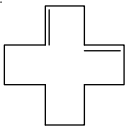
73. The major product formed in the following reaction is



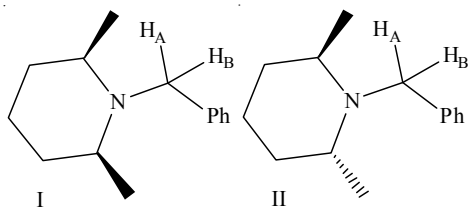
(A) 

(B) 

(C) 

(D) 

74. The two benzylic hydrogens H_A and H_B in the Compounds I and II are



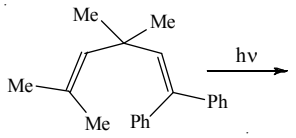
(A) diastereotopic in **I** and enantiotopic in **II**.

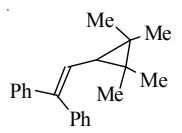
(B) enantiotopic in **I** and diastereotopic in **II**.

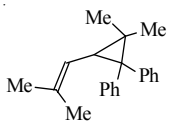
(C) diastereotopic in both **I** and **II**.

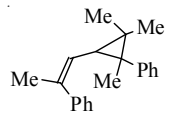
(D) enantiotopic in both **I** and **II**.

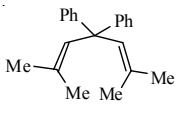
75. The major product of the following photochemical reaction is:



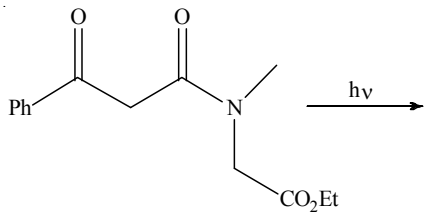
(A) 

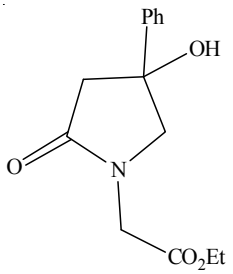
(B) 

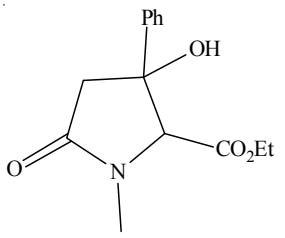
(C) 

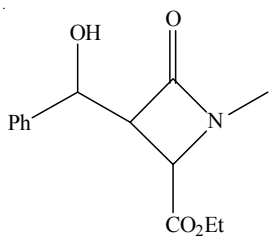
(D) 

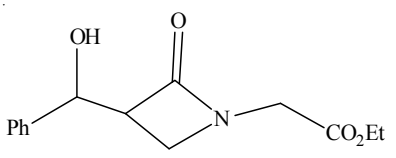
76. The major product of the following photochemical reaction is



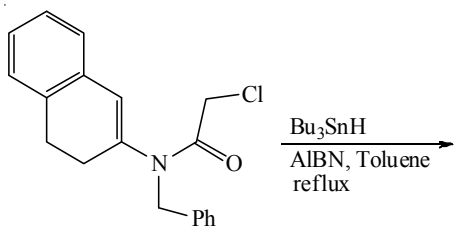
(A) 

(B) 

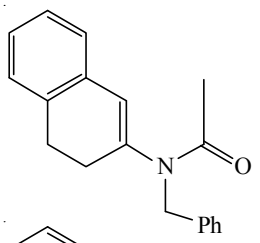
(C) 

(D) 

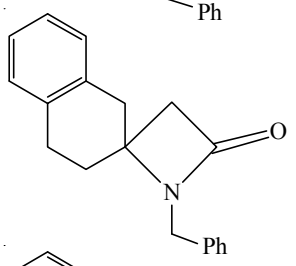
77. The major product of the following reaction is



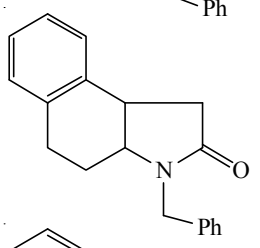
(A)



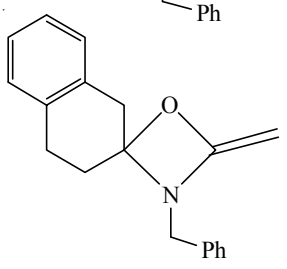
(B)



(C)



(D)



78. An organic compound with molecular formula $C_9H_{11}NO_2$ exhibits the following spectral data:

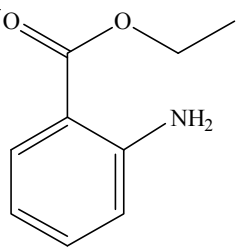
IR (cm^{-1}): 1708

^1H NMR ($CDCl_3$): δ 7·42 (dt, 1H), 7·35 (dd, 1H), 7·19 (t, 1H), 6·84 (dd, 1H), 4·30 (q, 2H), 3·80 (bs, 2H), 1·41 (t, 3H)

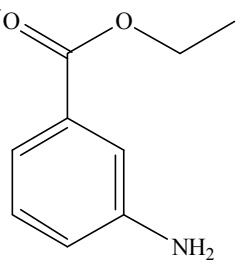
^{13}C NMR ($CDCl_3$): δ 167, 147, 131, 129, 120, 119, 116, 61, 14

The structure of the compound is

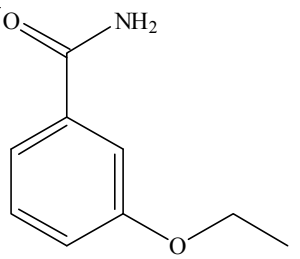
(A)



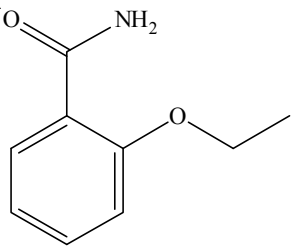
(B)



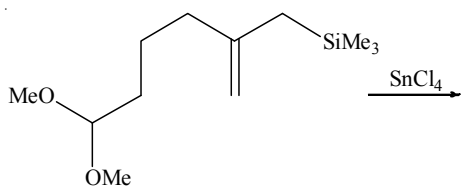
(C)

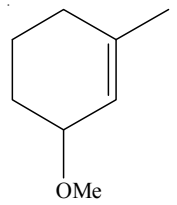


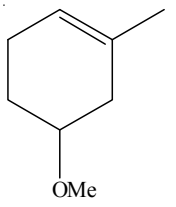
(D)

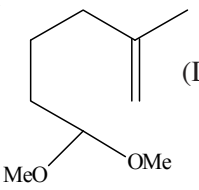


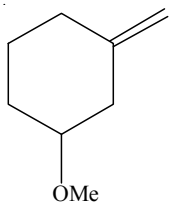
79. The correct product of the following reaction is



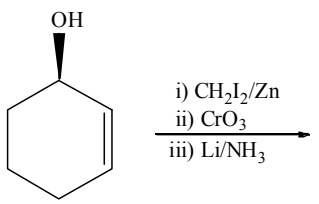
(A)


(B)


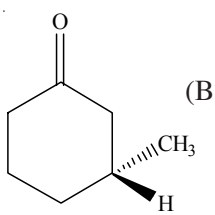
(C)


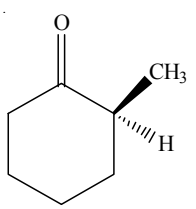
(D)


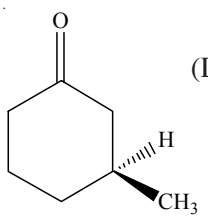
80. The product of the following reaction sequence is

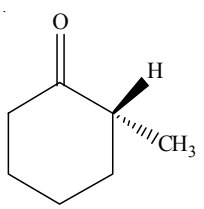


R(+)-Cyclohexenol

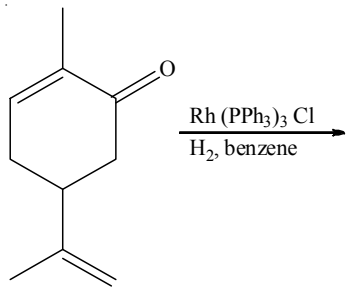
(A)


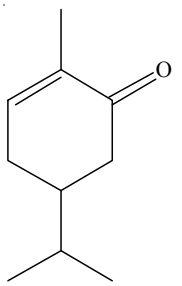
(B)


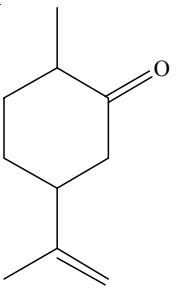
(C)


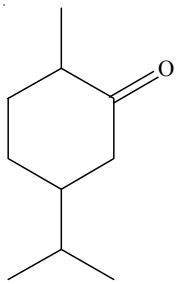
(D)


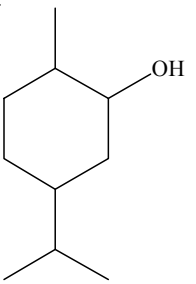
81. The major product of the following reaction is



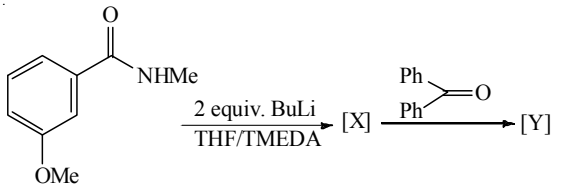
(A)


(B)


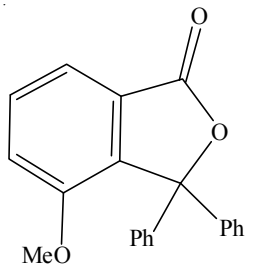
(C)


(D)


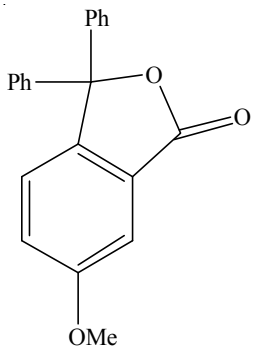
82. The outcome (Y) of the followig reaction sequence is



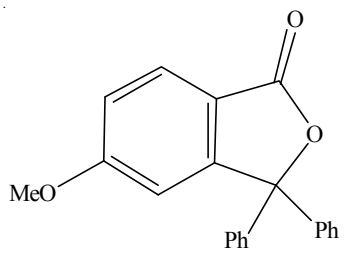
(A)



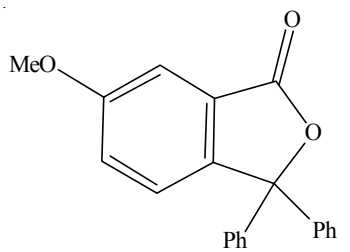
(B)



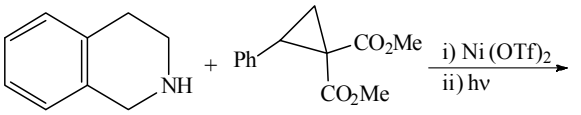
(C)



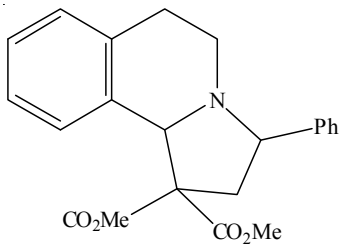
(D)



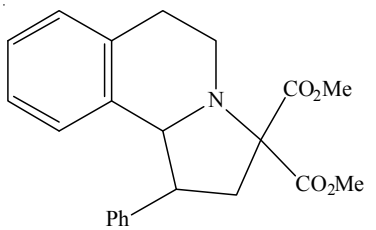
83. The major product of the following reaction sequence is



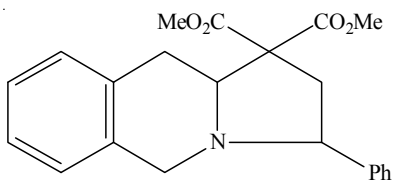
(A)



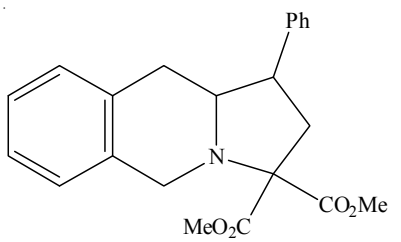
(B)



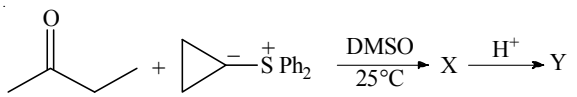
(C)

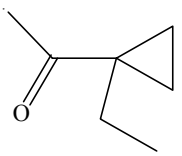


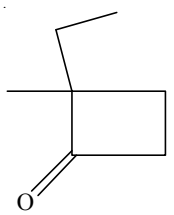
(D)

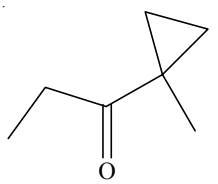


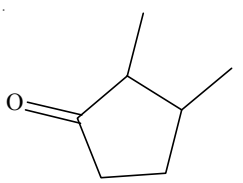
84. The product [Y] of the followig reaction sequence is



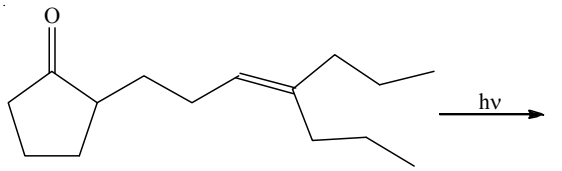
(A) 

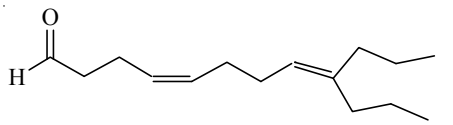
(B) 

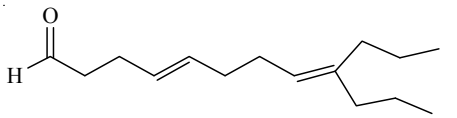
(C) 

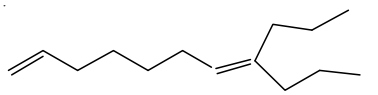
(D) 

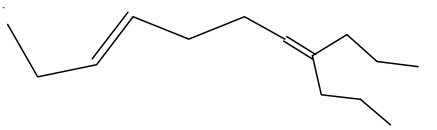
85. The major product formed in the following reaction is



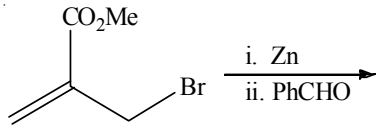
(A) 

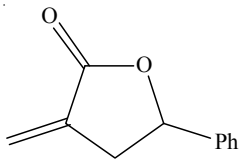
(B) 

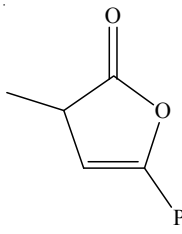
(C) 

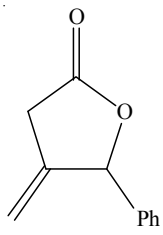
(D) 

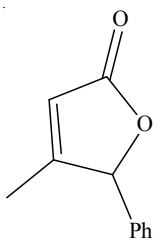
86. The correct structure of the product in the following reaction sequence is



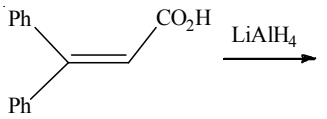
(A) 

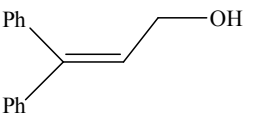
(B) 

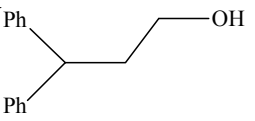
(C) 

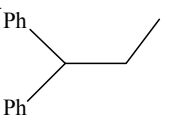
(D) 

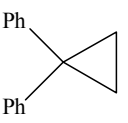
87. The product formed in more than 50% in the following reaction is



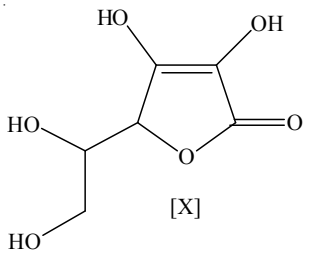
(A) 

(B) 

(C) 

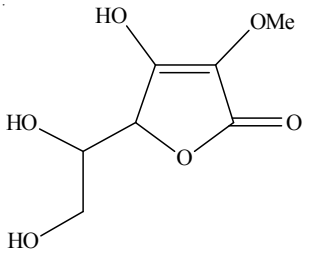
(D) 

88. The reaction of 'X' with diazomethane produces the major product:

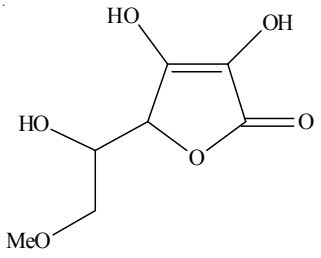


[X]

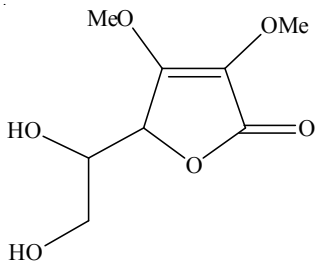
(A)



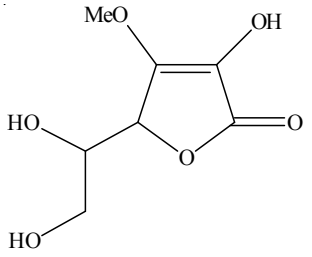
(B)



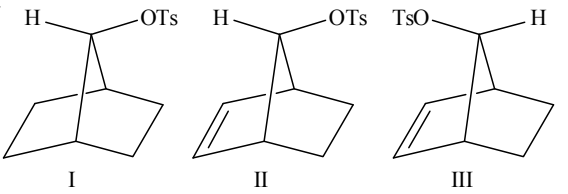
(C)



(D)



89. The relative rates of acetolysis of the following norbornane derivatives are



I II III

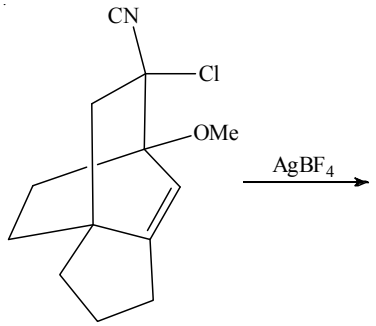
(A) III < II < I

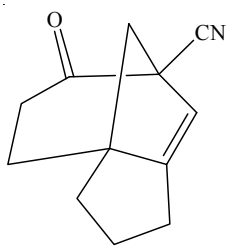
(B) II < I < III

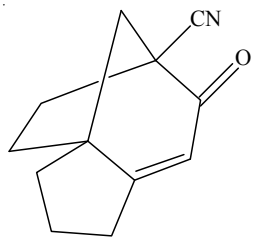
(C) III < I < II

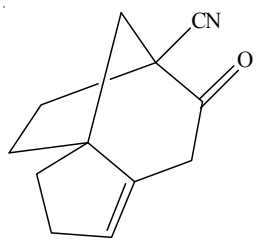
(D) I < III < II

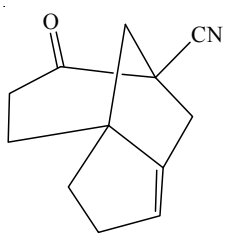
90. The major product formed in the following reaction is



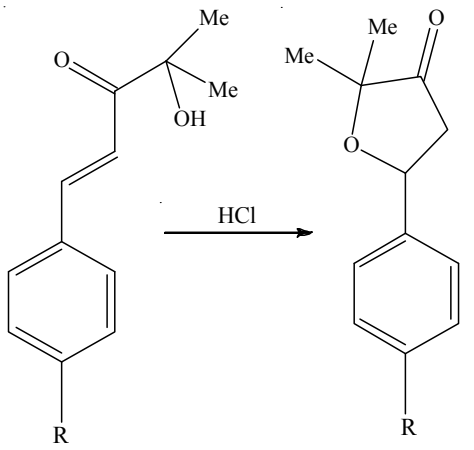
(A)


(B)


(C)


(D)


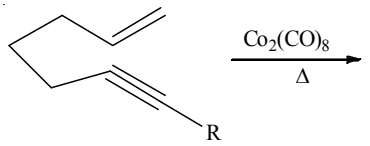
91. The correct order of reactivity of the substrates in the following reaction is

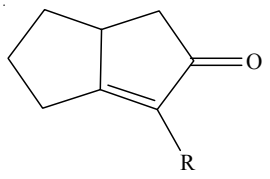


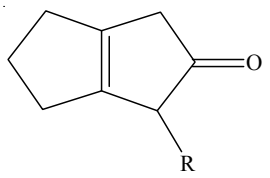
I : R = H
II : R = OMe
III : R = NO_2

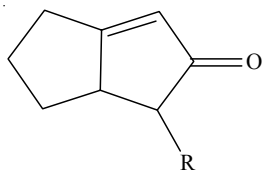
(A) I > II > III
(B) III > II > I
(C) I > III > II
(D) II > I > III

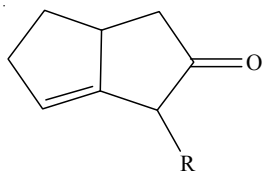
92. The major product in the following reaction is



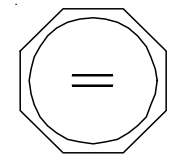
(A) 

(B) 

(C) 

(D) 

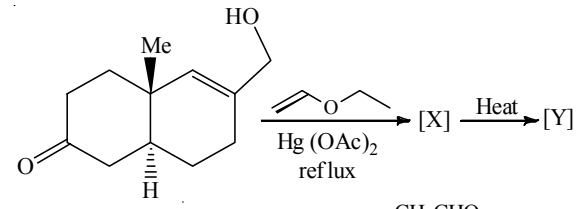
93. The symmetry point group of the following molecule is

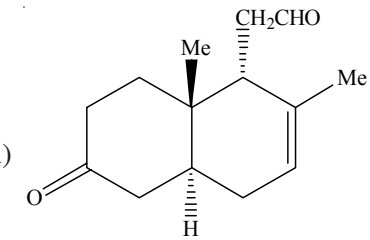


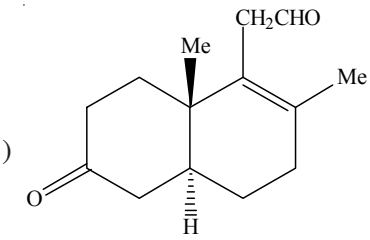
(A) D_{8d} (B) D_{4h}

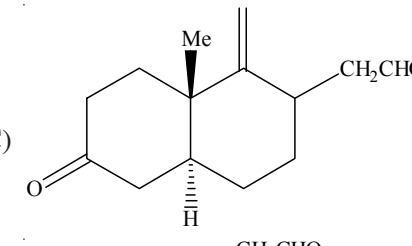
(C) D_{8h} (D) S_4

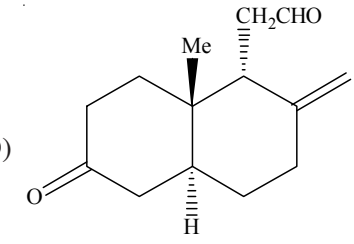
94. The product [Y] formed in the following reaction sequence is



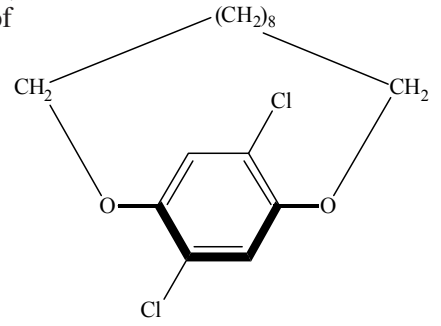
(A) 

(B) 

(C) 

(D) 

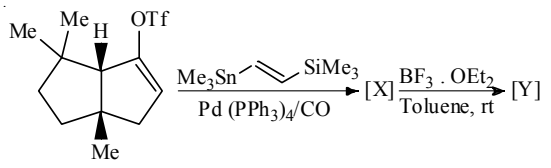
95. The following molecule is chiral due to the presence of



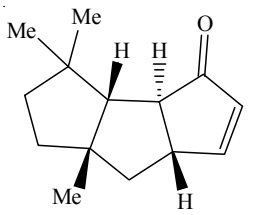
(A) Chiral centre (B) Chiral axis

(C) Chiral plane (D) helicity

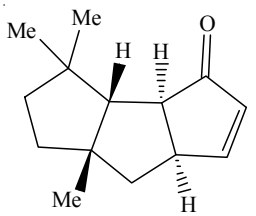
96. The major product [Y] formed in the following reaction sequence is



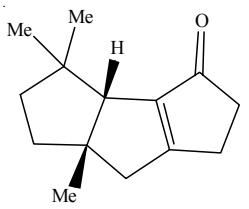
(A)



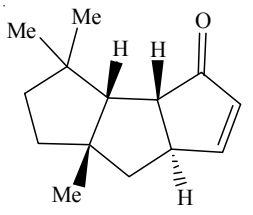
(B)



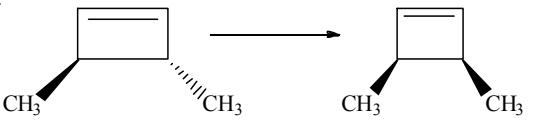
(C)



(D)



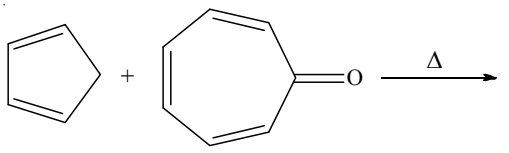
97. The requisite condition to accomplish the following transformation is



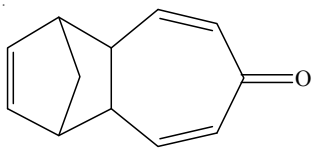
(A) i. Light ii. Heat (B) i. Heat ii. Light

(C) Only Light (D) Only heat

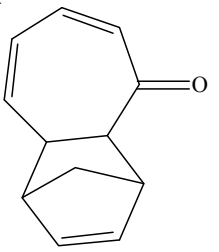
98. The actual product formed in the following cycloaddition reaction is



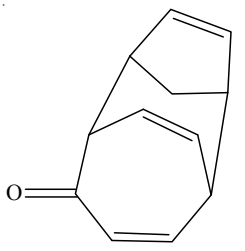
(A)



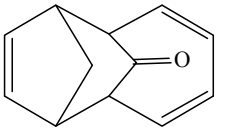
(B)



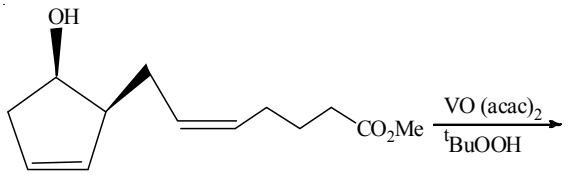
(C)

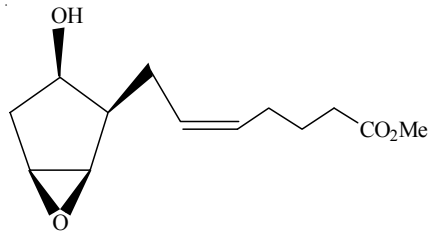


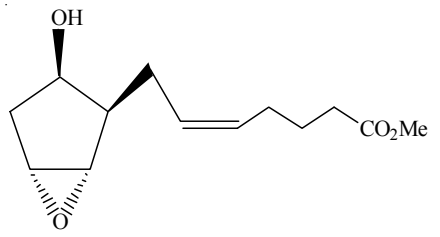
(D)

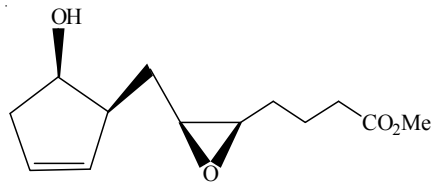


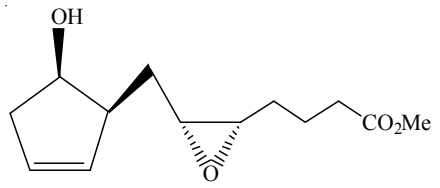
99. The major product formed in the following epoxidation reaction is



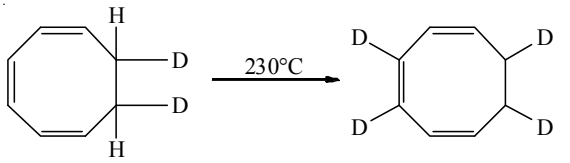
(A)


(B)


(C)


(D)


100. In the following reaction, the scrambling of deuterium occurs due to



(A) [1, 3] – Sigmatropic shift

(B) [1, 5] – Sigmatropic shift

(C) both [1, 3]- and [1, 5] – Sigmatropic shift

(D) [1, 7] – Sigmatropic shift

Space for Rough Work

Space for Rough Work

Space for Rough Work