Test Booklet Code & Serial No.
प्रश्नपत्रिका कोड व क्रमांक

D

Paper-II
CHEMICAL SCIENCE

Signature and Name of Invigilator

1. (Signature) .....

(Name) .....

2. (Signature) .....

(Name) .....

Seat No. | | | | | | |

(In figures as in Admit Card)

Seat No. .....

(In words)

OMR Sheet No. | | | | | | |

(To be filled by the Candidate)

JUN - 33219

Time Allowed : 2 Hours] **[Maximum Marks : 200**

Number of Pages in this Booklet : **36** Number of Questions in this Booklet : **100**

Instructions for the Candidates

1. Write your Seat No. and OMR Sheet No. in the space provided on the top of this page.
2. This paper consists of **100** objective type questions. Each question will carry *two* marks. *All* questions of Paper II will be compulsory.
3. At the commencement of examination, the question booklet will be given to the student. In the first 5 minutes, you are requested to open the booklet and compulsorily examine it as follows :
   (*i*) To have access to the Question Booklet, tear off the paper seal on the edge of this cover page. Do not accept a booklet without sticker-seal or open booklet.
   (*ii*) Tally the number of pages and number of questions in the booklet with the information printed on the cover page. Faulty booklets due to missing pages/questions or questions repeated or not in serial order or any other discrepancy should not be accepted and correct booklet should be obtained from the invigilator within the period of 5 minutes. Afterwards, neither the Question Booklet will be replaced nor any extra time will be given. The same may please be noted.
   (*iii*) After this verification is over, the OMR Sheet Number should be entered on this Test Booklet.
4. Each question has four alternative responses marked (A), (B), (C) and (D). You have to darken the circle as indicated below on the correct response against each item.
   Example : where (C) is the correct response.

   (A) (B) ● (D)

5. Your responses to the items are to be indicated in the **OMR Sheet given inside the Booklet only.** If you mark at any place other than in the circle in the OMR Sheet, it will not be evaluated.
6. Read instructions given inside carefully.
7. Rough Work is to be done at the end of this booklet.
8. If you write your Name, Seat Number, Phone Number or put any mark on any part of the OMR Sheet, except for the space allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means, you will render yourself liable to disqualification.
9. You have to return 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 the Test Booklet and duplicate copy of OMR Sheet on conclusion of examination.
10. Use only Blue/Black Ball point pen.
11. Use of any calculator or log table, etc., is prohibited.
12. There is no negative marking for incorrect answers.

विद्यार्थ्यांसाठी महत्त्वाच्या सूचना

1. परिक्षार्थींनी आपला आसन क्रमांक या पृष्ठावरील वरच्या कोपऱ्यात लिहावा. तसेच आपणांस दिलेल्या उत्तरपत्रिकेचा क्रमांक त्याखाली लिहावा.
2. सदर प्रश्नपत्रिकेत 100 बहुपर्यायी प्रश्न आहेत. प्रत्येक प्रश्नास **दोन** गुण आहेत. या प्रश्नपत्रिकेतील **सर्व** प्रश्न सोडविणे अनिवार्य आहे.
3. परीक्षा सुरू झाल्यावर विद्यार्थ्याला प्रश्नपत्रिका दिली जाईल. सुरुवातीच्या 5 मिनीटांमध्ये आपण सदर प्रश्नपत्रिका उघडून खालील बाबी अवश्य तपासून पहाव्यात.
   (*i*) प्रश्नपत्रिका उघडण्यासाठी प्रश्नपत्रिकेवर लावलेले सील उघडावे. सील नसलेली किंवा सील उघडलेली प्रश्नपत्रिका स्विकारू नये.
   (*ii*) पहिल्या पृष्ठावर नमूद केल्याप्रमाणे प्रश्नपत्रिकेची एकूण पृष्ठे तसेच प्रश्नपत्रिकेतील एकूण प्रश्नांची संख्या पडताळून पहावी. पृष्ठे कमी असलेली/कमी प्रश्न असलेली/प्रश्नांचा चुकीचा क्रम असलेली किंवा इतर त्रुटी असलेली सदोष प्रश्नपत्रिका सुरुवातीच्या 5 मिनिटातच पर्यवेक्षकाला परत देऊन दुसरी प्रश्नपत्रिका मागवून घ्यावी. त्यानंतर प्रश्नपत्रिका बदलून मिळणार नाही तसेच वेळही वाढवून मिळणार नाही याची कृपया विद्यार्थ्यांनी नोंद घ्यावी.
   (*iii*) वरीलप्रमाणे सर्व पडताळून पाहिल्यानंतरच प्रश्नपत्रिकेवर ओ.एम.आर. उत्तरपत्रिकेचा नंबर लिहावा.
4. प्रत्येक प्रश्नासाठी (A), (B), (C) आणि (D) अशी चार विकल्प उत्तरे दिली आहेत. त्यातील योग्य उत्तराचा रकाना खाली दर्शविल्याप्रमाणे ठळकपणे काळा/निळा करावा.
   उदा. : जर (C) हे योग्य उत्तर असेल तर.

   (A) (B) ● (D)

5. या प्रश्नपत्रिकेतील प्रश्नांची उत्तरे **ओ.एम.आर. उत्तरपत्रिकेतच दर्शवावीत.** इतर ठिकाणी लिहिलेली उत्तरे तपासली जाणार नाहीत.
6. आत दिलेल्या सूचना काळजीपूर्वक वाचाव्यात.
7. प्रश्नपत्रिकेच्या शेवटी जोडलेल्या कोऱ्या पानावरच कच्चे काम करावे.
8. जर आपण ओ.एम.आर. वर नमूद केलेल्या ठिकाणा व्यतिरीक्त इतर कोठेही नाव, आसन क्रमांक, फोन नंबर किंवा ओळख पटेल अशी कोणतीही खूण केलेली आढळून आल्यास अथवा असभ्य भाषेचा वापर किंवा इतर गैरमार्गाचा अवलंब केल्यास विद्यार्थ्याला परीक्षेस अपात्र ठरविण्यात येईल.
9. परीक्षा संपल्यानंतर विद्यार्थ्याने मूळ ओ.एम.आर. उत्तरपत्रिका पर्यवेक्षकांकडे परत करणे आवश्यक आहे. तथापि, प्रश्नपत्रिका व ओ.एम.आर. उत्तरपत्रिकेची द्वितीय प्रत आपल्याबरोबर नेण्यास विद्यार्थ्यांना परवानगी आहे.
10. फक्त निळ्या किंवा काळ्या बॉल पेनचाच वापर करावा.
11. कॅलक्युलेटर किंवा लॉग टेबल वापरण्यास परवानगी नाही.
12. चुकीच्या उत्तरासाठी गुण कपात केली जाणार नाही.

Chemical Science

Paper II

Time Allowed : 120 Minutes] **[Maximum Marks : 200**

Note : This Paper contains **Hundred (100)** multiple choice questions. Each question carrying **Two (2)** marks. Attempt *All* questions.

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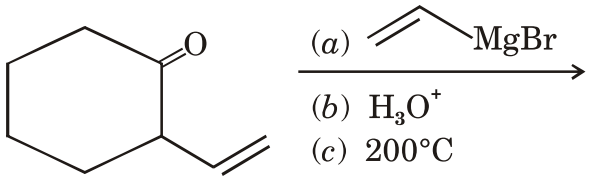
1. Major product in the following reaction sequence is :



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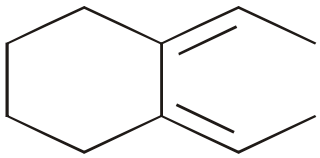

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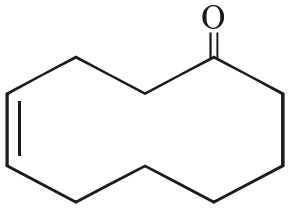

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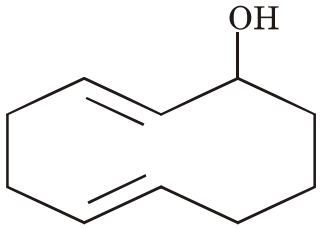

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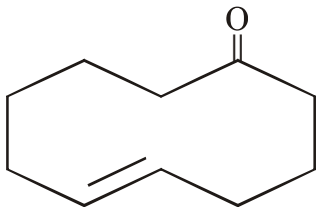

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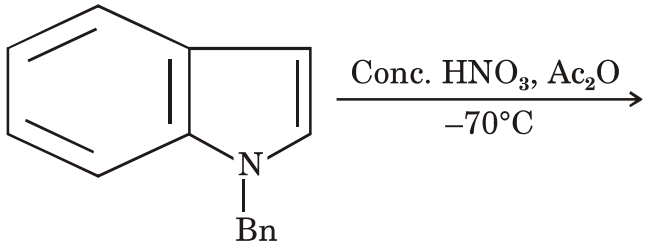
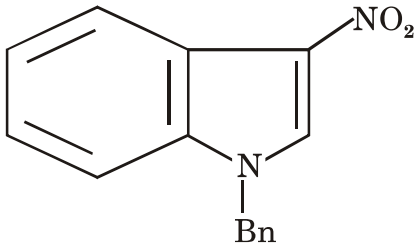
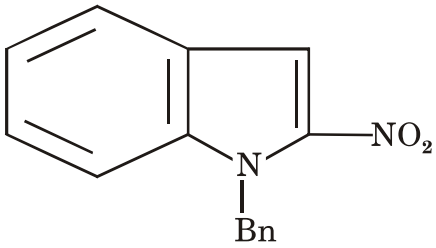
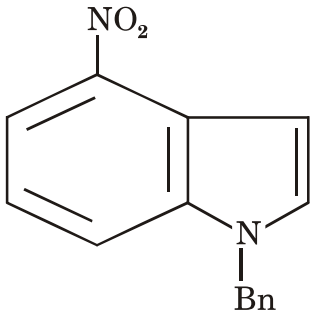
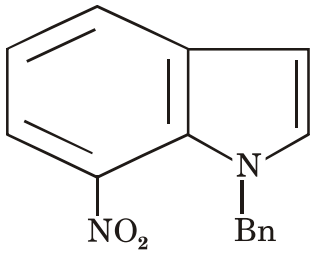


(A) 

(B) 

(C) 

(D) 

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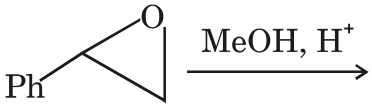
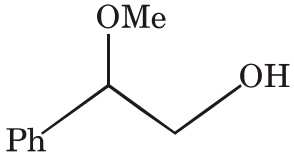
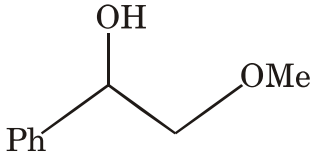
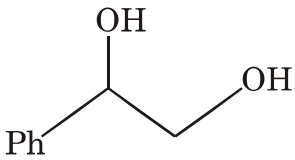
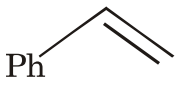


(A) 

(B) 

(C) 

(D) 

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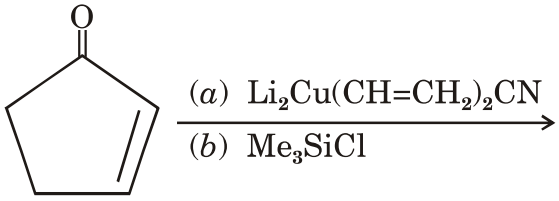

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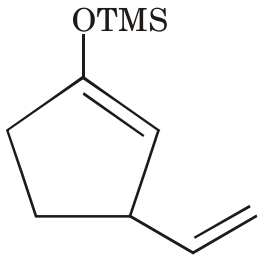

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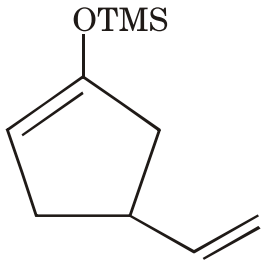

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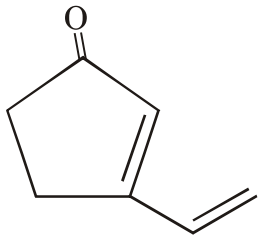

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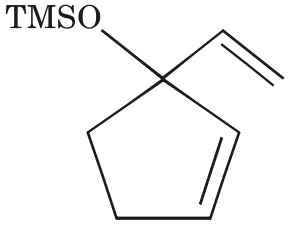

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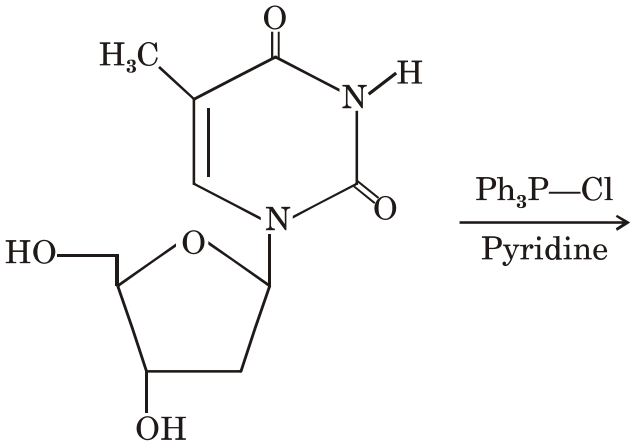
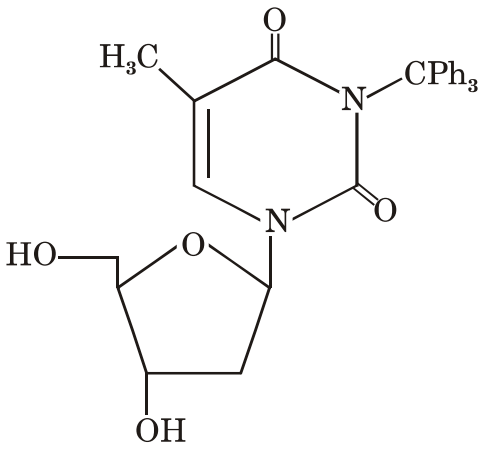


(A)



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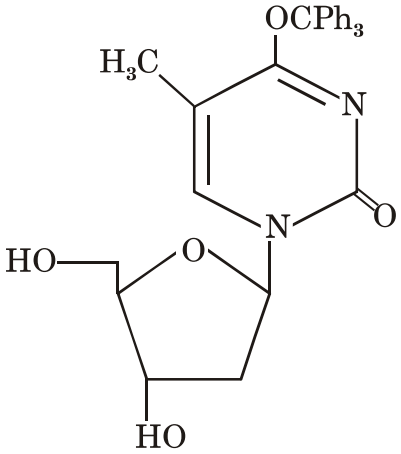

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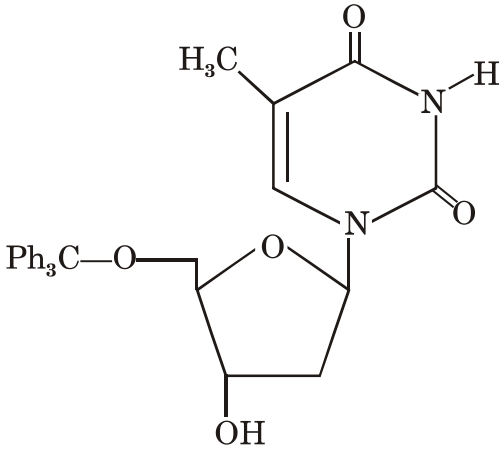

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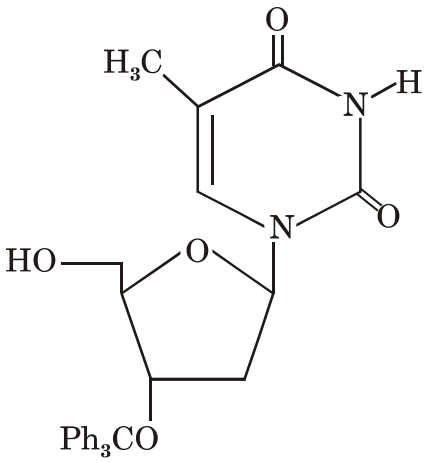

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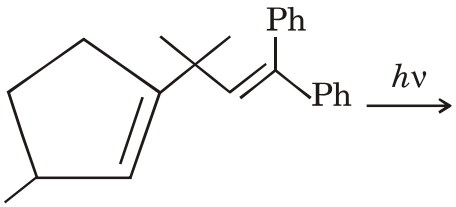
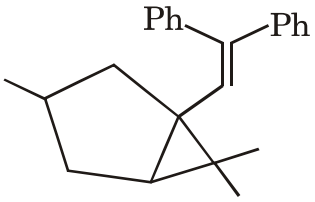
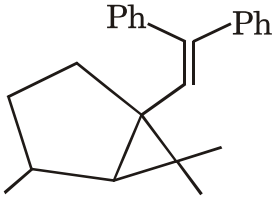
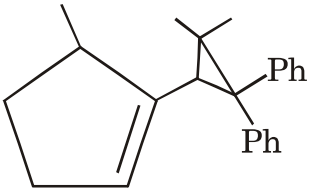
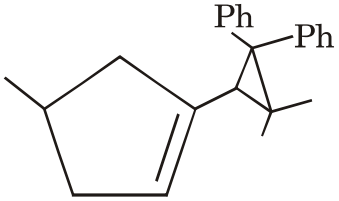


(A) 

(B) 

(C) 

(D) 

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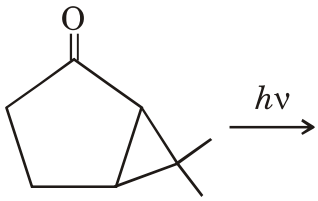
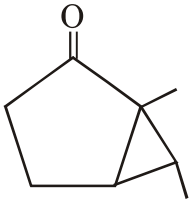
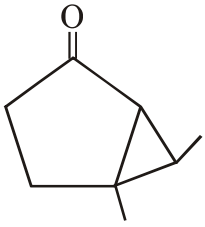
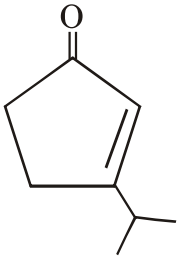
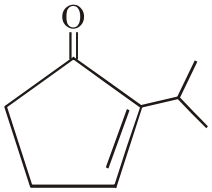


(A) 

(B) 

(C) 

(D) 

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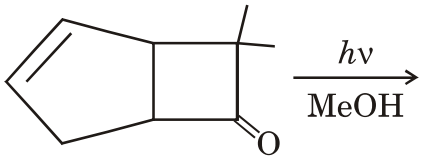
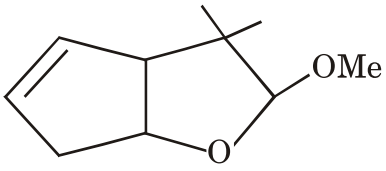
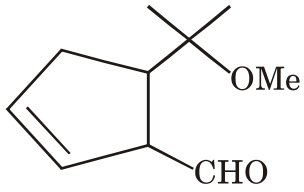
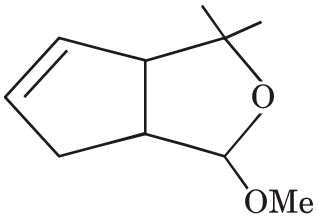
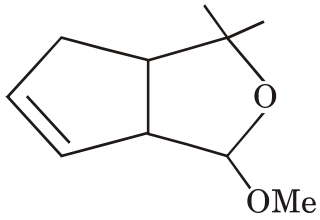


(A) 

(B) 

(C) 

(D) 

9. For the adsorption of N_2 on activated carbon at 77 K :

(A) $\Delta H = 0; \Delta S < 0$ (B) $\Delta H < 0; \Delta S < 0$

(C) $\Delta H > 0; \Delta S < 0$ (D) $\Delta S = 0; \Delta S = 0$

10. The bond energies of $O_2(g)$ and $N_2(g)$ are 941 and 499 kJ/mol respectively. If $\Delta H_{formation}$ of NO is 90 kJ/mol, the bond dissociation energy of NO is :

(A) 810 kJ (B) 630 kJ

(C) 1130 kJ (D) 565 kJ

11. When Uranium –235 (^{235}U) is bombarded with neutron, fission occurs and the fragments formed are :

(A) $^{94}Kr + {}^{140}Ba + 2n$ (B) $^{94}Kr + {}^{139}Ba + 2n$

(C) $^{94}Kr + {}^{139}Xe + 2n$ (D) $^{94}Kr + {}^{140}Ba + 1n$

12. Activity when measured as counts per minute is ..... in case of a mixture of two isotopes.
    (A) Difference between the activities of the two isotopes
    (B) Sum of the activity of each isotope
    (C) Product of activities contributed by each isotope
    (D) Ratio of activities of one isotope to the other

13. The isotope of carbon used for radiating is :
    (A) ^{11}C (B) ^{12}C
    (C) ^{13}C (D) ^{14}C

14. In a grand canonical ensemble, a system X of fixed volume is in contact with a large reservoir Y, then :
    (A) X can exchange only energy with Y
    (B) X can exchange only particles with Y
    (C) X can exchange neither energy nor particles with Y
    (D) X can exchange both energy and particles with Y

15. A scientist attempts to replace a few carbon atoms in 1.0 g of diamond with boron atoms or nitrogen atoms in separate experiments. Which of the following is *correct* ?
    (A) The resulting material with B doping will be an *n*-type semiconductor
    (B) The resulting material with B doping will be a *p*-type semiconductor
    (C) B doping is not possible as B cannot form multiple bonds
    (D) The resulting material with N doping will be a *p*-type semiconductor

16. The DP of a polymer with average molecular weight of 25000 g/mol and monomer weight of 254 g/mol will be :
    (A) 68 (B) 88
    (C) 98 (D) 78

17. The structural regularity of the polymers is often due to :

(A) Racemization

(B) Optical isomerism

(C) Geometrical isomerism

(D) Both optical and geometrical isomerism

18. Burgers vector is a measure of the lattice distortion due to the presence of :

(A) point defect (B) line defect

(C) surface defect (D) volume defect

19. If θ is the fraction of the surface covered at P_A (pressure of the adsorbate A), then :

(A) rate of adsorption is proportional to $\theta \times P_A$

(B) rate of desorption is proportional to $(1 - \theta) \times P_A$

(C) $\theta = \dfrac{V_{ads} \text{ at } P_A}{V_{max}}$

(D) $\theta = \dfrac{V_{max}}{V_{ads} \text{ at } P_A}$

20. Which of the following are state functions ?

(I) $q + w$ (II) q

(III) w (IV) H – TS

(A) (I) and (IV) (B) (I), (II) and (III)

(C) (II), (III) and (IV) (D) (II) and (III)

21. If the radius of the hydrogen atom is 53 pm, the radius of the He^+ ion will be close to :

(A) 75 pm (B) 38 pm

(C) 106 pm (D) 27 pm

22. Enthalpy changes in chemical reactions from the data given below :

$$\frac{1}{2}H_{2(g)} + \frac{1}{2}I_{2(s)} \rightarrow HI_{(g)}; \Delta H = 26.0 \text{ kJ}$$

$$\frac{1}{2}H_{2(g)} + \frac{1}{2}I_{2(g)} \rightarrow HI_{(g)}; \Delta H = -5.0 \text{ kJ}$$

ΔH sublimation of I_2 can be obtained as :

(A) 31 kJ (B) –62 kJ

(C) 62 kJ (D) 21 kJ

23. Work function of Al is 4.2 eV. When light with E = 6.2 eV is incident on an Al surface, maximum kinetic energy of the emitted photo-electrons will be (1 eV = 1.6×10^{-19} J) :

(A) 2.0×10^{-19} J (B) 9.9×10^{-19} J

(C) 3.2×10^{-19} J (D) 6.7×10^{-19} J

24. Which of the following equations corresponds to photoelectric effect ?

(A) $h_\lambda = W_0 + K.E$ (B) $h\nu = W_0 - K.E$

(C) $h\nu = W_0 + K.E$ (D) $h_\lambda = W_0 - K.E$

25. The molecule that has the same symmetry as that of NH_3 is :

(A) BH_3 (B) $CHCl_3$

(C) CH_4 (D) BF_3

26. The momentum operator in one-dimension is .....

(A) $-\hbar\frac{\partial}{\partial x}$

(B) $-i\left(\frac{\hbar\partial}{\partial t}\right)-\hbar\frac{\partial}{\partial t}$

(C) $-i\hbar\frac{\partial}{\partial x}$

(D) $i-\hbar\frac{\partial}{\partial x}$

27. In which of the following pairs both the molecules will give pure rotational spectra ?

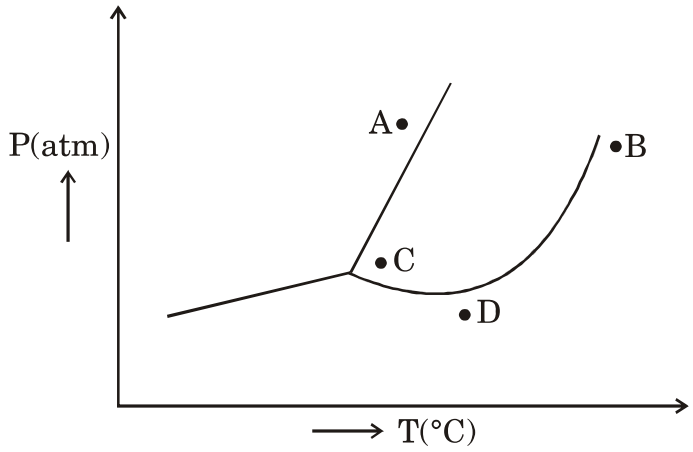
(A) CH_4 and $CHCl_3$

(B) CH_2Cl_2 and CCl_4

(C) CH_2Cl_2 and $CHCl_3$

(D) CH_4 and CCl_4

28. Which point in the phase diagram best represents supercritical condition ?



(A) A

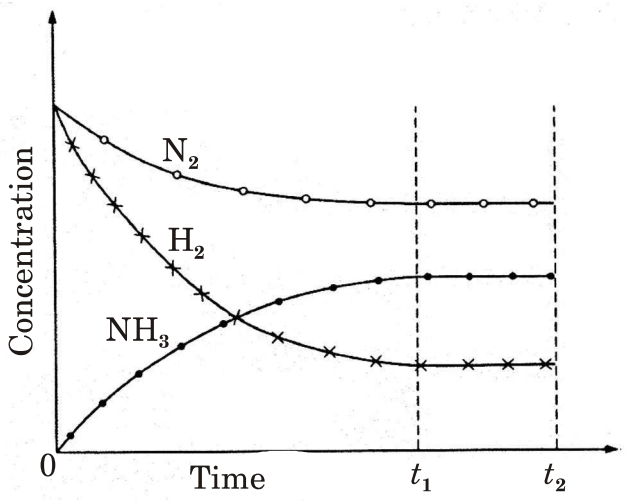
(B) B

(C) C

(D) D

29. $H_{2(g)}$ and $N_{2(g)}$ were placed in a vessel of constant volume and allowed to reach equilibrium according to the following reaction :

$$3H_{2(g)} + N_{2(g)} \rightarrow 2NH_3 \ (\Delta H_{r \times n} = -92 \text{ kJ})$$



Which of the following is/are *true* for the system between $t_1 t_2$?

(I) The temperature of the system will decrease.

(II) The rates of the forward and reverse reactions were equal.

(III) The rate of formation of NH_3 is equal to the rate of disappearance of H.

(IV) If more $NH_{3(g)}$ is added to the system at time t_2 while the temperature is held constant, total pressure in the container will decrease.

(A) (I) and (II) (B) (II) and (IV)

(C) (III) only (D) (II) only

30. Which of the following are *correct* ?

(I) Henry's law is applicable for the dissolution of O_2 in water.

(II) Henry's law is applicable for the dissolution of HCl in water.

(III) Dissolution of gases in liquids increases with pressure.

(IV) Unit of Henry's law constant is atm^{-1}.

(A) (I), (II), (III) (B) (I), (III)

(C) (II), (III), (IV) (D) (I), (III), (IV)

31. August 21, 1986, a cloud of CO_2 gas suddenly erupted from a lake in cameroon. Which of the following account for this incident ?

(I) Over the years CO_2 has saturated in the upper layers of lake water.

(II) Over the years large quantities CO_2 has dissolved in the bottom layers of water.

(III) Heavy winds could have overturned the lake water.

(IV) This event is a natural phenomenon explained by Raoult's law.

(A) (II), (III) and (IV)
(B) (I), (III)
(C) (I), (II) and (IV)
(D) (II), (III)

32. During the electrolysis of an aqueous solution of KCl which susbtance is formed at the ..... cathode.

(A) Chlorine
(B) Hydrogen
(C) Oxygen
(D) Potassium

33. When a drop of liquid at the tip of a capillary is balanced by surface tensional forces, its weight is equal to :

(A) $\pi r^2\gamma$
(B) $2\pi r\gamma$
(C) $\gamma/2\pi r$
(D) $\frac{4}{3}\pi r^3\gamma$

34. The pressure difference across a curved interface can be written as :

(A) $\Delta P = r\left[\frac{1}{R_1} + \frac{1}{R_2}\right]$
(B) $\Delta P = r\left[\frac{1}{R_1} - \frac{1}{R_2}\right]$
(C) $\Delta P = \frac{1}{r}\left[\frac{1}{R_1} + \frac{1}{R_2}\right]$
(D) $\Delta P = \frac{1}{r}\left[\frac{1}{R_1} - \frac{1}{R_2}\right]$

35. From the given below :

$NaCl_{(s)} \longrightarrow Na^{+}_{(g)} + Cl^{-}_{(g)}$; $\Delta H^{0}_{1} = -786$ kJ/mole

$H_2O_{(l)} + Na^{+}_{(g)} + Cl^{-}_{(g)} \longrightarrow Na^{+}_{(aq)} + Cl^{-}_{(aq)}$;

$$\Delta H^{\circ}_{hyd} = \Delta H^{\circ}_{2} + \Delta H^{\circ}_{3} = -783 \text{ kJ/mole}$$

It can be inferred that :

(A) Enthalpy of hydration of NaCl is –3 kJ/mol

(B) Enthalpy of hydration of NaCl is –1569 kJ/mol

(C) Entropy change for dissolution of NaCl must be positive

(D) Enthalpy of hydration of NaCl is 1.5 kJ/mol

36. At high temperatures NO reacts with H_2 to produce nitrous oxide N_2O, a green-house gas. According to the following stoichiometric equation :

$$2NO_{(g)} + H_{2(g)} \rightarrow N_2O_{(g)} + H_2O_{(g)}$$

The following experimental data was obtained at 820°C :

Exp.	Initial pressure torr.		Initial rate of production of N_2O, torr/s
	P_{NO}	P_{H_2}	
1.	120.0	60.0	8.66×10^{-2}
2.	60.0	60.0	2.17×10^{-2}
3.	60.0	180.0	6.62×10^{-2}

Which of the following is *correct* ?

(A) $\frac{2d[NO]}{dt} = k[NO][H_2]$

(B) $-\frac{d[H_2O]}{dt} = k[NO]^2[H_2]$

(C) $\frac{d[H_2O]}{dt} = 1 \times 10^{-7}[NO]^2[H_2]$

(D) $\frac{d[H_2O]}{dt} = 1 \times 10^{7}[NO]^2[H_2]$

37. The reaction between tert-butyl bromide and azide ions in an aqueous solution is proposed to proceed through the following mechanism :

$$(CH_3)_3CBr_{(aq)} \rightleftharpoons (CH_3)_3C^+_{(aq)} + Br^-_{(aq)}$$

$$(CH_3)_3C^+_{(aq)} + N_3^- \rightarrow (CH_3)_3CH_{3(aq)}$$

Assuming $(CH_3)_3\ C^+$ to be under steady state, which of the following is *correct* ?

(I) Rate = $k_1k_2[(CH_3)_3CBr][N_3^-]/K_{-1}[Br^-]$

(II) Rate = $k_1k_2[(CH_3)_3CBr][N_3^-]/k_{-1}[Br^-] + k_2[N_3^-]$

(III) If $k_2 >>> k_{-1}$ plot of $[(CH_3)_3Br]$ *Vs.* '*t*' will be straight line

(IV) If $k_2 >>> k_{-1}$ unit of experimental rate constant will be time^{-1}

(A) (I) and (II) (B) (II) only

(C) (II) and (IV) (D) (II) and (III)

38. Point group of cyclohexane in :

(A) Chair form is D_{3d}

(B) Boat form is C_{3V}

(C) Both chair and boat form is C_{2V}

(D) Boat form is D_{3d}

39. The kinetic chain length of a polymer is defined as the :

(A) Number of monomer units consumed per active center

(B) Number of monomer units consumed per unit time

(C) Number of monomer units consumed per unit concentration

(D) Number of monomer units consumed per active center per unit concentration

40. The number average molecular weight of a polymer can be determined by :

(A) Vapour pressure osmometry

(B) Sedimentation equilibrium method

(C) Light scattering method

(D) Viscosity method

41. The total number of lone pairs for the ion I_3^- is :

(A) 0 (B) 3

(C) 6 (D) 9

42. The hybridization for the complex ion $[FeF_6]^{3-}$ and $[Fe(CN)_6]^{3-}$ is :

(A) d^2sp^3 and sp^3d^2 (B) d^2sp^3 and d^2sp^3

(C) sp^3d^2 and sp^3d^2 (D) sp^3d^2 and d^2sp^3

43. Which of the following diatomic molecules is paramagnetic ?

(A) B_2 (B) C_2

(C) N_2 (D) F_2

44. Size of the *d* orbitals for Si, P, S and Cl follow the order :

(A) Si > P > S > Cl (B) Cl > P > S > Si

(C) Cl > S > P > Si (D) P > S > Si > Cl

45. The molecules P_4 and CH_4 exhibit the same :

(A) Color (B) Geometry

(C) Boiling point (D) Physical state at 300 K

46. The bond order for O_2 and the hypothetical molecules N_2^- and O_2^+ will follow the trend :

(A) $O_2 = N_2^- < O_2^+$ (B) $N_2^- < O_2 < O_2^+$

(C) $N_2^- = O_2^+ < O_2$ (D) $N_2^- < O_2^+ < O_2$

47. According to CFT, Ni^{2+} can have two unpaired electrons in :

(A) Octahedral geometry

(B) Tetrahedral geometry

(C) Both octahedral and tetrahedral geometry

(D) Square planar geometry

48. Which of the following complexes will NOT exhibit ideal octahedral geometry ?

(A) $[Ti(H_2O)_6]^{3+}$ (B) $[Ni(H_2O)_6]^{2+}$

(C) $[Mn(H_2O)_6]^{2+}$ (D) $[Cr(H_2O)_6]^{3+}$

49. The carbonyl stretching frequency (ν_{CO}) for the complexes (*i*) $[Co(CO)_4]^-$ (*ii*) $[Ni(CO)_4]$ and (*iii*) $[Fe(CO)_4]^{2-}$ will follow the trend :

(A) (*ii*) > (*iii*) > (*i*) (B) (*i*) > (*iii*) > (*ii*)

(C) (*iii*) > (*ii*) > (*i*) (D) (*ii*) > (*i*) > (*iii*)

50. The spin only magnetic moment for the complex $H_g[Co(SCN)_4]$ is :

(A) $\sqrt{3}$ (B) $\sqrt{15}$

(C) $\sqrt{8}$ (D) $\sqrt{24}$

51. The molecular formula for sodium bis (thiosulphato) argentate (I) is :

(A) $Na_2[Ag(S_2O_3)_2]$ (B) $Na_3[Ag(S_2O_3)_2]$

(C) $Na[Ag(S_2O_3)_2]$ (D) $Na_3[Ag(S_2O_3)]$

52. The number of terminal carbonyl ligands in the complex $[\eta^5 - C_PRh(CO)]_3$ (where C_P is cyclopentadienide anion) such that each Rhodium centre satisfies the 18 electron rule is :

(A) 1 (B) 2

(C) 3 (D) 0

53. The ^{31}P {H} NMR spectrum of complex $(Rh(PPh_3)_3Cl]$ will exhibit :

(A) Two triplets

(B) Two doublets

(C) Doublet of doublet and doublet of triplet

(D) Triplet of doublet and triplet of triplet

54. Which of the following molecules will NOT exhibit a temperature dependent ^{19}F NMR spectrum ?

(A) PF_5 (B) ClF_3

(C) PCl_2F_3 (D) SF_6

55. MnO_4^- is coloured in aqueous medium while ReO_4^- is colorless because :

(A) The energy required for LMCT is higher for ReO_4^- than MnO_4^-

(B) MnO_4^- is colored due to MLCT

(C) $d - d$ transition are forbidden in ReO_4^-

(D) The energy of $d - d$ transition in ReO_4^- is much higher than MnO_4^-

56. The number of EPR lines observed in AlH_3 radical (^{27}Al, nuclear spin = 5/2) will be :

(A) 6 (B) 4

(C) 24 (D) 18

57. The EPR spectrum of *p*-benzosemiquinone radical anion consists of :

(A) a quintet with intensity 1 : 2 : 3 : 2 : 1

(B) a quartet with intensity 1 : 3 : 3 : 1

(C) a quintet with intensity 1 : 1 : 1 : 1 : 1

(D) a quintet with intensity 1 : 4 : 6 : 4 : 1

58. The Mössbauer spectra of $K_3[Fe(CN)_6]$ and $K_4[Fe(CN)_6]$ respectively will exhibit :

(A) 1 line each (B) 2 lines each

(C) 2 and 1 lines (D) 1 and 2 lines

59. The ion $[Ni(Pyridine)_4(H_2O)_2]^{2+}$ has $d - d$ absorption bands at 27000, 16500 and 10150 cm^{-1}. The 10 Dq value of Ni^{2+} ion is :

(A) 10150 cm^{-1} (B) 10500 cm^{-1}

(C) 16500 cm^{-1} (D) 6350 cm^{-1}

60. The electric dipole allowed transition in a d^3 atomic system is :

(A) $^4F \rightarrow {}^2D$ (B) $^3F \rightarrow {}^3P$

(C) $^4F \rightarrow {}^4P$ (D) $^4F \rightarrow {}^2G$

61. In which of the following numbers all zeros are significant ?

(A) 0.0007 (B) 0.0700

(C) 70.000 (D) 0.0070

62. The ground term symbol of Pr^{3+} ion is (At. No. Pr = 59)

(A) $^3H_6$ (B) $^3H_4$

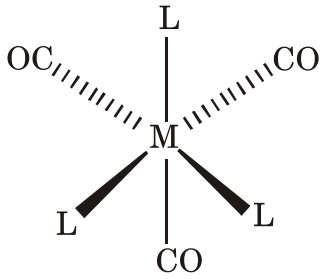
(C) $^6H_{15/2}$ (D) $^6H_{5/2}$

63. The β-diketonato complexes of which metal ion is used as shift reagent in NMR spectroscopy :

(A) Ce^{3+} (B) La^{3+}

(C) Eu^{3+} (D) Ho^{3+}

64. The symmetry and number of carbonyl stretching bands in the complex are :



(A) C_2V, four (B) C_2V, three

(C) C_3V, two (D) C_3V, three

65. The overall charge '*x*' on the stable complex $[\eta^5 - C_PFe(CO)_3]^x$ should be (C_P = cyclopentadienide anion) :

(A) 0 (B) +2

(C) +1 (D) –1

66. The total number of M – M bonds in the stable complex $[(\mu - Cl)(\mu - CH_2)Os_3(CO)_{10}]^-$ are :

(A) 2 (B) 1

(C) 0 (D) 3

67. The reaction $[Co(NH_3)_5Cl]^{2+} + [Cr(H_2O)_6]^{2+} \xrightarrow{5H^+} [Co(H_2O)_6]^{2+} + [Cr(H_2O)_5Cl]^{2+} + 5NH_4^+$ is an example of :
    (A) Ligand transfer process only
    (B) Ligand exchange process only
    (C) Outer sphere electron transfer process
    (D) Inner sphere electron transfer process

68. Which of the following complexes will have the highest spin only magnetic moment ?
    (A) $[VCl_6]^{4-}$
    (B) $[Ni(CN)_4]^{2-}$
    (C) $[Co(NH_3)_6]^{3+}$
    (D) $[(\eta^5 - C_5H_5)_2Cr]$

69. The respective enzymes involved in CO and CN^- poisoning are :
    (A) deoxyhemoglobin and oxidized cytochrome C oxidase
    (B) deoxyhemoglobin and reduced cyctochrome C oxidase
    (C) oxyhemoglobin and oxidized cytochrome C oxidase
    (D) oxyhemoglobin and reduced cytochrome C oxidase

70. The reaction $CO_2 + H_2O \rightarrow H_2CO_3$ catalysed by the zinc containing enzyme cationic anhydrase at physiological pH is facile due to :
    (A) decrease in nucleophilicity of H_2O on coordination to Zn
    (B) decrease in nucleophilicity of CO_2 on coordination to Zn
    (C) increase in nucleophilicity of H_2O on coordination to Zn
    (D) increase in nucleophilicity of CO_2 on coordination to Zn

71. Oxyhemoglobin is diamagnetic due to electron spin coupling between :
    (A) Low spin Fe^{2+} and oxygen molecule
    (B) High spin Fe^{3+} and superoxide radical
    (C) High spin Fe^{2+} and oxygen molecule
    (D) Low spin Fe^{3+} and superoxide radical

72. Among the following alkaline earth metal ions the exchange rates for the water molecules from the first coordination sphere at 25°C will be :

(A) $Be^{2+} > Mg^{2+} > Ca^{2+}$ (B) $Mg^{2+} > Be^{2+} > Ca^{2+}$

(C) $Ca^{2+} > Mg^{2+} > Be^{2+}$ (D) $Mg^{2+} > Ca^{2+}\ Be^{2+}$

73. Which pair of catalyst and its application is *incorrect* ?

(A) Cis—$[Rh(CO)_2I_2]^-$; acetic acid synthesis

(B) $[Rh(PPh_3)_3Cl]$; alkene hydrogenation

(C) $[H\ Rh(PPh_3)_3]$; asymmetric hydrogenation

(D) $[HCo(CO)_4]$; hydroformylation of alkenes

74. The most abundant transition metal ion in sea water and earth's crust is :

(A) Molybdenum (B) Copper

(C) Iron (D) Zinc

75. The oxidation state of molybdenum in $[(\eta^7\text{-tropylium})\ Mo(CO)_3]^+$ is :

(A) +2 (B) +1

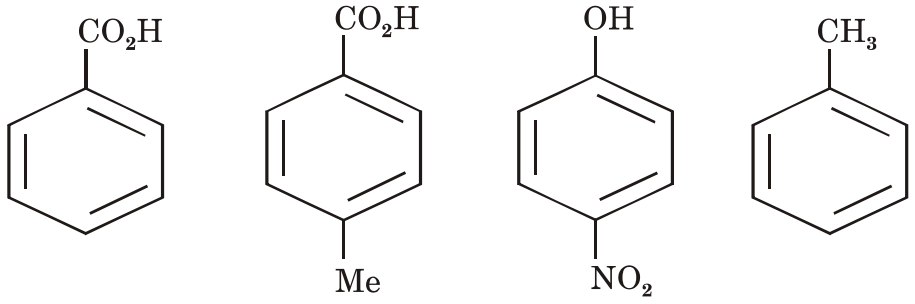
(C) 0 (D) –1

76. The product of the reaction between 2 Cl^- and cis-$(Pt(NH_3)_2(Py)_2]^{2+}$ will be :

(A) cis-$[PtCl_2(NH_3)(PY)]$ (B) cis-$[Pt(NH_3)_2Cl_2]$

(C) trans-$[PtCl_2(Py)(NH_3)]$ (D) cis-$[PtCl_2(Py)_2]$

77. The *correct* order of acidity of the following molecules is :

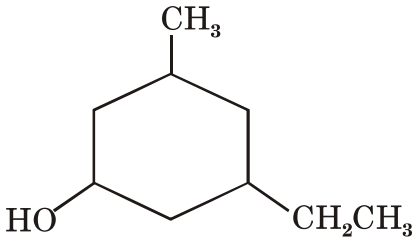


(I) (II) (III) (IV)

(A) (IV) < (III) < (II) < (I) (B) (III) < (IV) < (II) < (I)

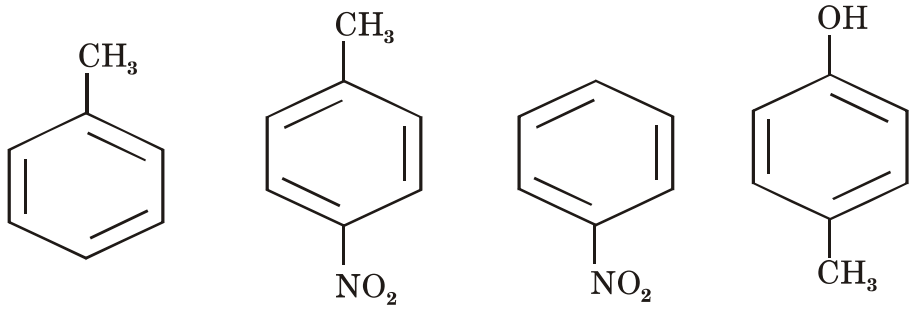
(C) (IV) < (II) < (I) < (III) (D) (IV) < (I) < (III) < (II)

78. The *correct* IUPAC name of the following compound is :



(A) 3-ethyl-5-hydroxy-1-methyl cyclohexane
(B) 5-ethyl-3-methyl cyclohexanol
(C) 1-ethyl-3-methyl-5-hydroxy-cyclohexane
(D) 3-ethyl-5-methyl cyclohexanol

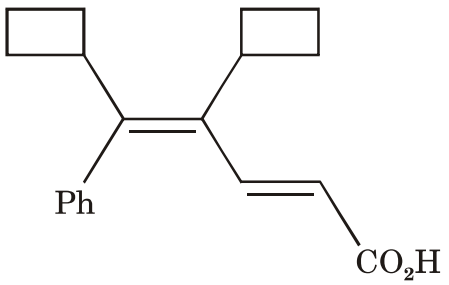
79. The *correct* order of dipole moment for the following compounds is :



(I) (II) (III) (IV)

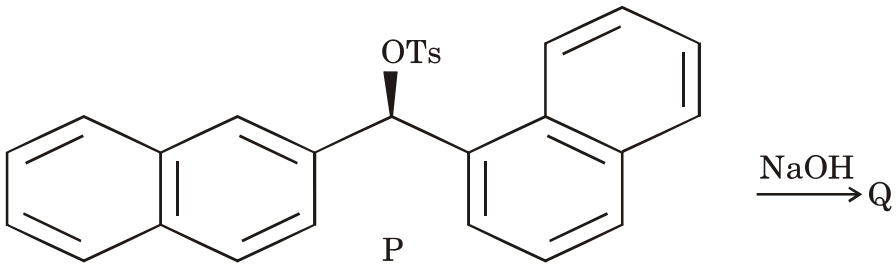
(A) (III) < (I) < (IV) < (II)
(B) (III) < (II) < (I) < (IV)
(C) (I) < (IV) < (III) < (II)
(D) (I) < (II) < (III) < (IV)

80. The configurations of the double bonds in the following molecule are :



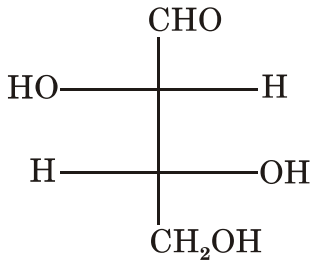
(A) 2E, 4E
(B) 2E, 4Z
(C) 2Z, 4E
(D) 2Z, 4Z

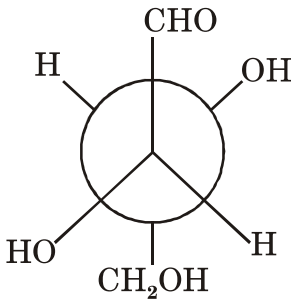
81. Compound P on treatment with NaOH gives major product Q. Predict the *correct* stereochemical descriptor for P and Q :

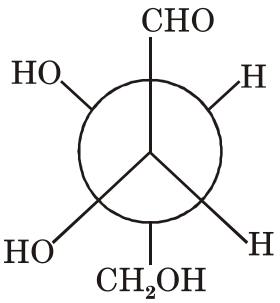


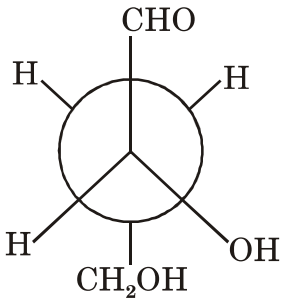
(A) P is 'R' and Q is 'S'
(B) P is 'R' and Q is Racemic
(C) P is 'S' and Q is 'R'
(D) P is 'S' and Q is Racemic

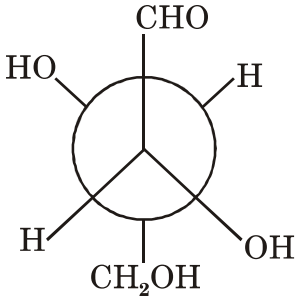
82. The *correct* Newmann projection of (2S, 3R)-D-threose is :



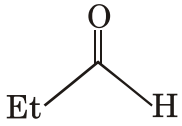
(A)


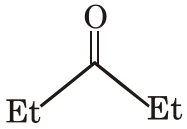
(B)


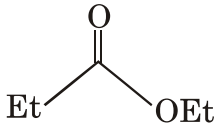
(C)


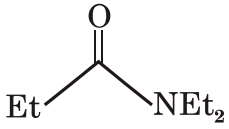
(D)


83. Which of the following will form the most stable complex with $TiCl_4$?

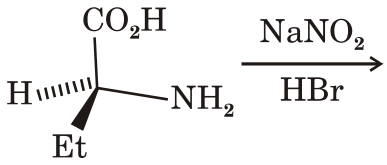
(A) 

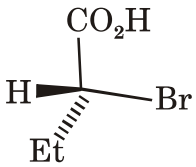
(B) 

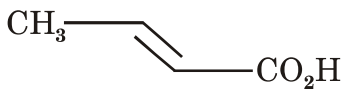
(C) 

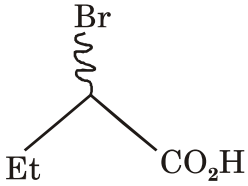
(D) 

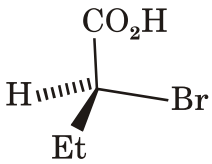
84. The major product of the following reaction is :



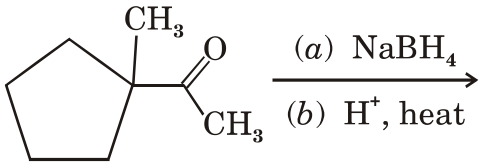
(A) 

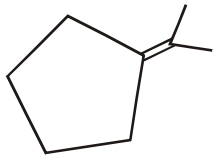
(B) 

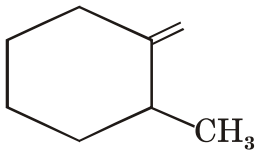
(C) 

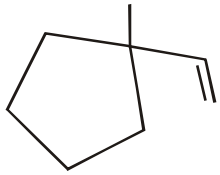
(D) 

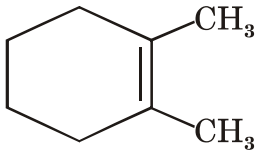
85. Predict the major product of the following reaction :



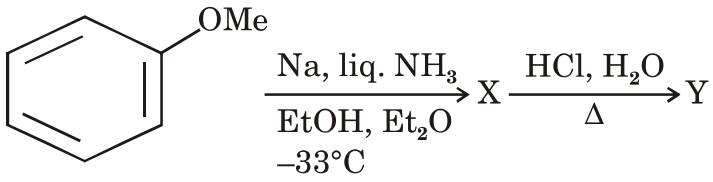
(A) 

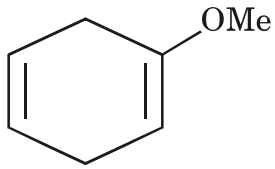
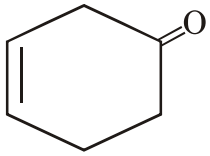
(B) 

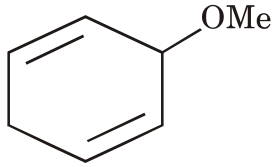
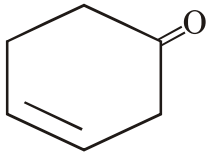
(C) 

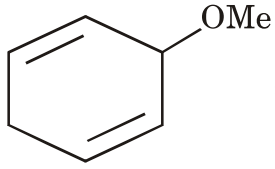
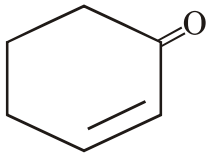
(D) 

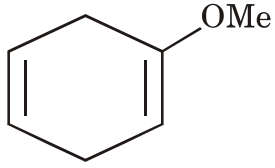
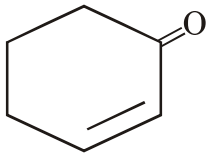
86. The major products X and Y formed in the following reaction sequence are :



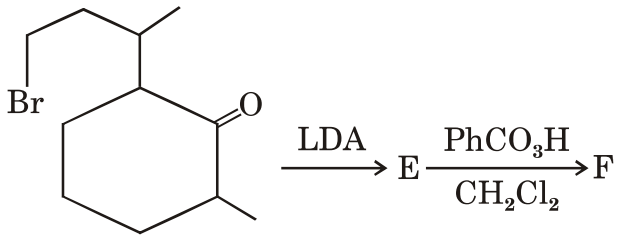
(A) X =  , Y = 

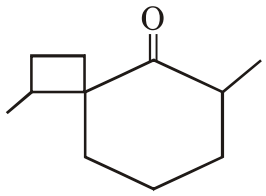
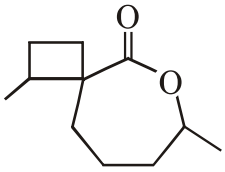
(B) X =  , Y = 

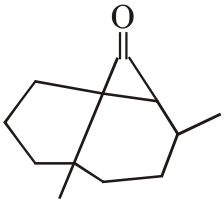
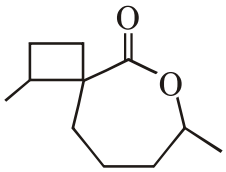
(C) X =  , Y = 

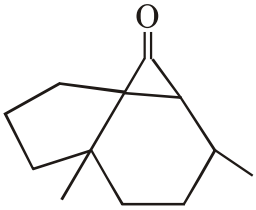
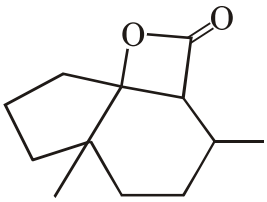
(D) X =  , Y = 

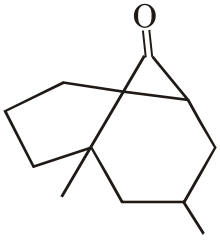
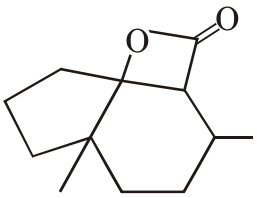
87. The major products of the following reaction sequence are :



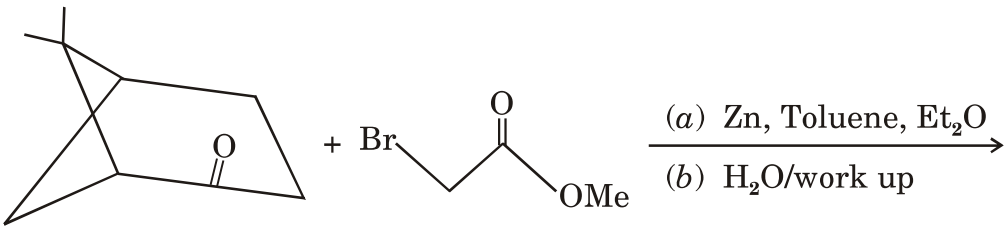
(A) E =  F = 

(B) E =  F = 

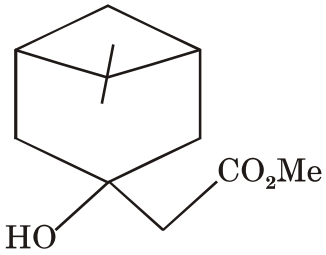
(C) E =  F = 

(D) E =  F = 

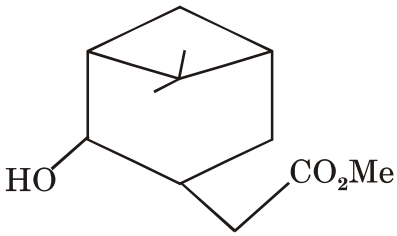
88. The major product of the following reaction is :



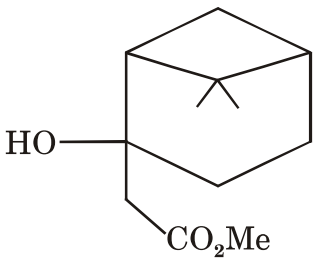
(A)



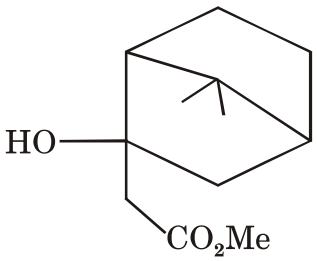
(B)



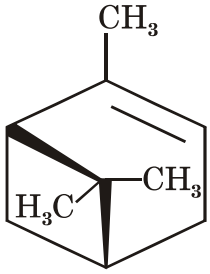
(C)



(D)



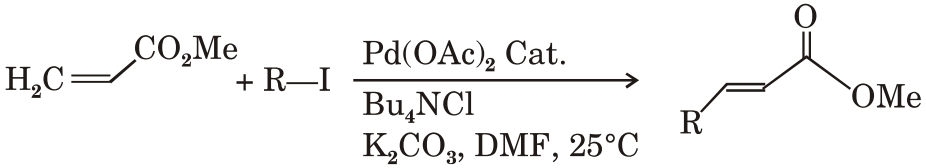
89. The number of chemically non-equivalent protons expected in ^{1}H-NMR spectrum of 2-pinene is :

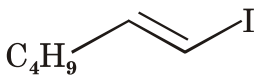


(A) 7 (B) 10

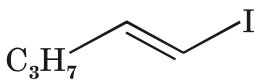
(C) 9 (D) 6

90. Which among the following substractes (R-I) is not suitable for the desired reaction below :



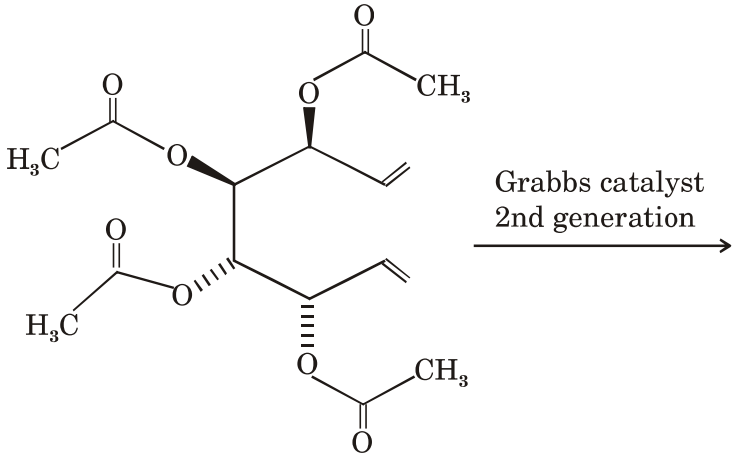
(A) 

(B) Ph—I

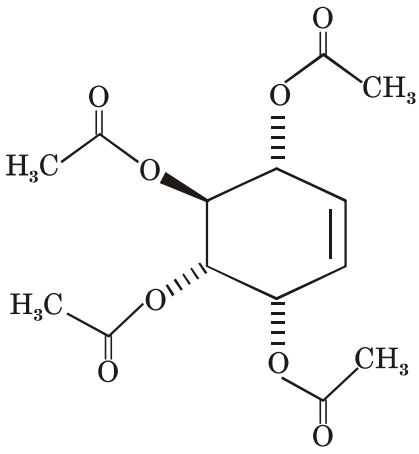
(C) 

(D) H_2C=CH—CH_2—CH_2—I

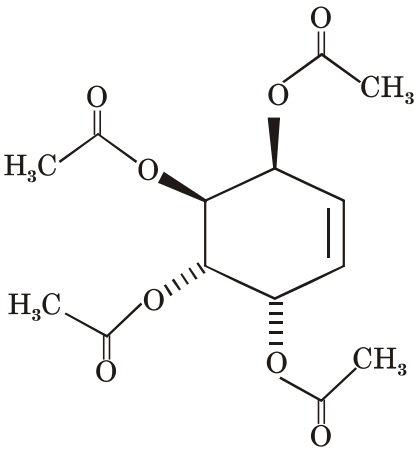
91. The major product of the following reaction is :



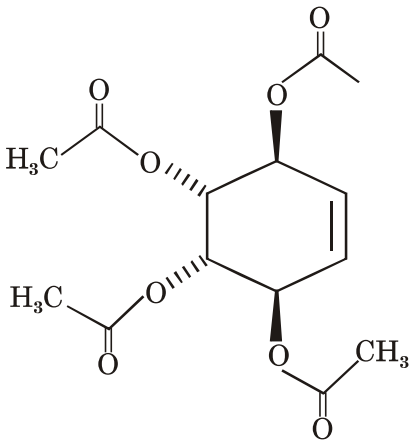
(A)



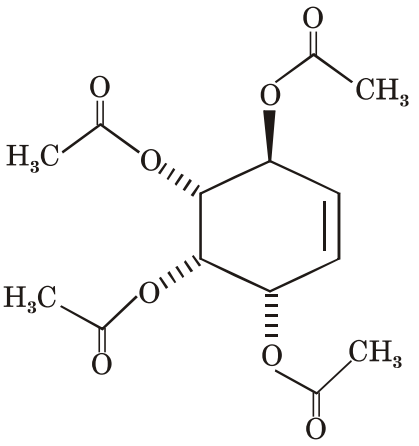
(B)



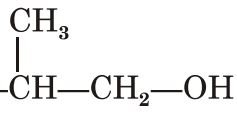
(C)



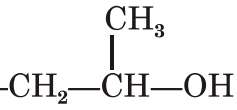
(D)

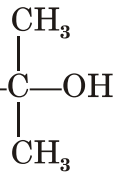


92. An organic compound with molecular formula $C_4H_{10}O$ shows the following spectral data in ^{1}H-NMR is δ : 0.9(*t*, J = 6 Hz, 3H) 1.1 (*d*, J = 6.5 Hz, 3H), 1.5 – 1.6(m, 2H), 3.6 (broad singlet, 1H, Ex. D_2O), 3.9 (Sextet, J = 6.5 Hz, 1H). The correct structure of the compound is :

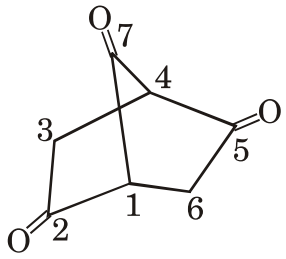
(A) 

(B) 

(C) 

(D) 

93. The *correct* absolute configuration for the following compound is :



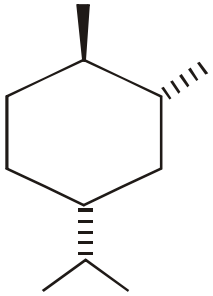
(A) 1R, 4R

(B) 1R, 4S

(C) 1S, 4R

(D) 1S, 4S

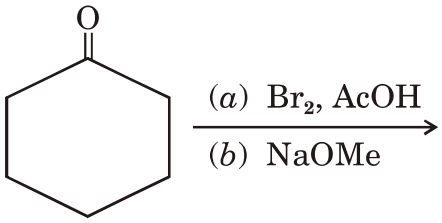
94. In the lowest energy conformation of the compound below, how many alkyl substituents are axial ?

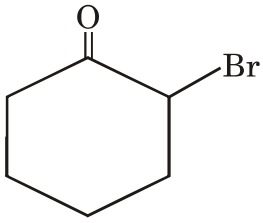


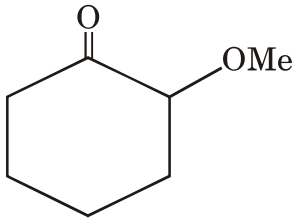
(A) 3 (B) 2

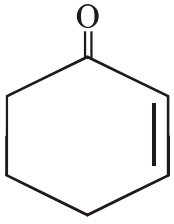
(C) 1 (D) 0

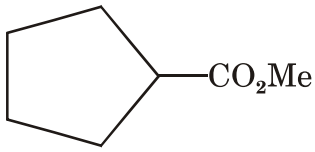
95. The major product of the following reaction is :



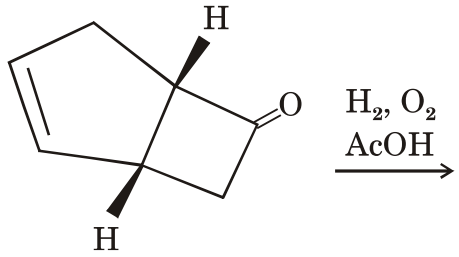
(A) 

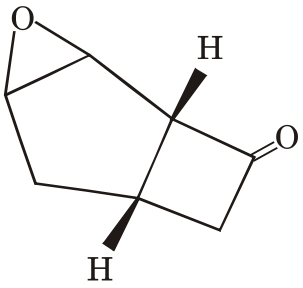
(B) 

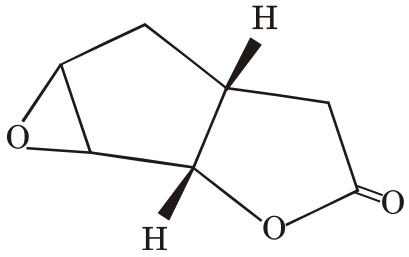
(C) 

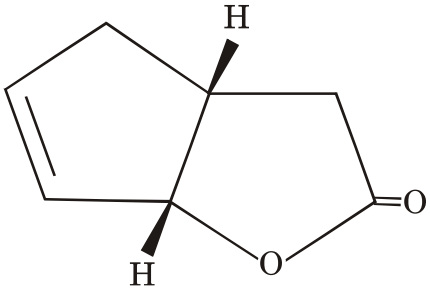
(D) 

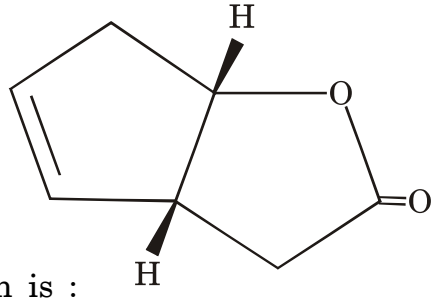
96. The major product of the following reaction is :



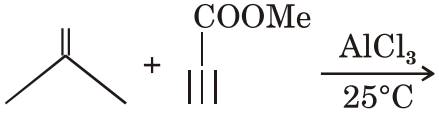
(A) 

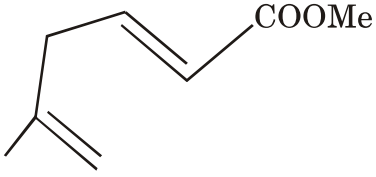
(B) 

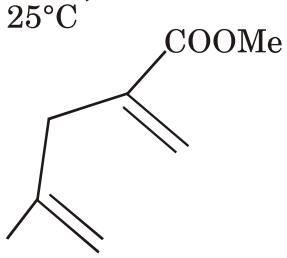
(C) 

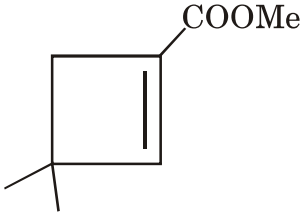
(D) 

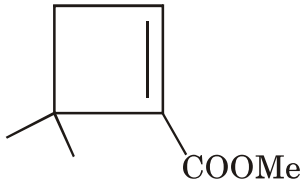
97. The major product of the following reaction is :



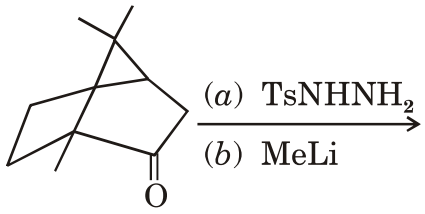
(A) 

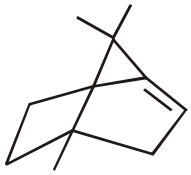
(B) 

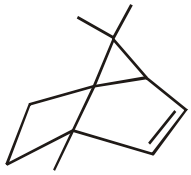
(C) 

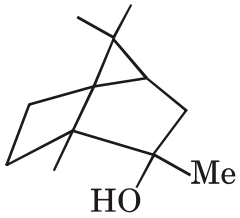
(D) 

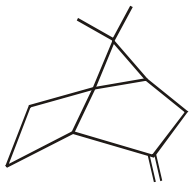
98. The major product of the following reaction is :



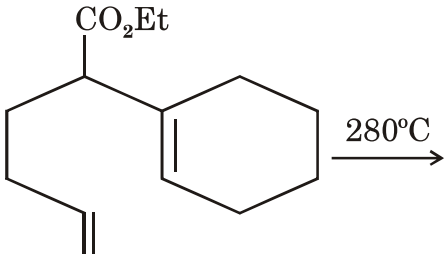
(A) 

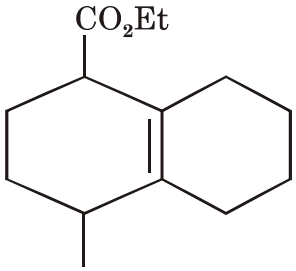
(B) 

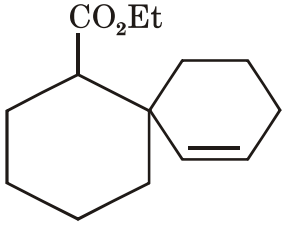
(C) 

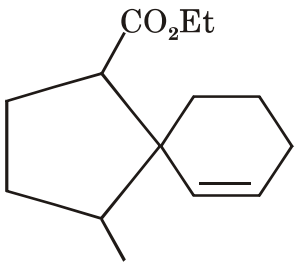
(D) 

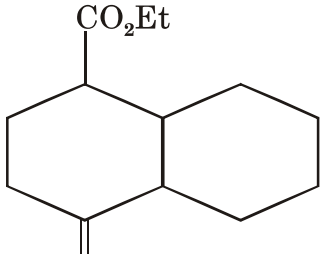
99. The major product in the following reaction is :



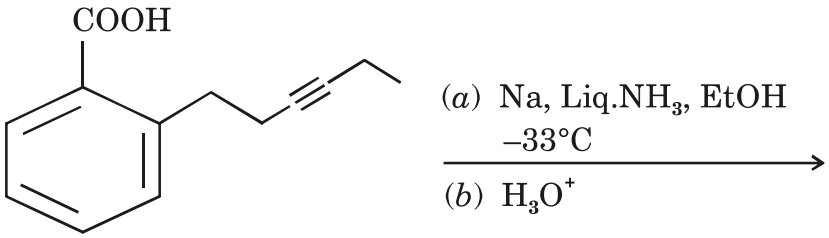
(A) 

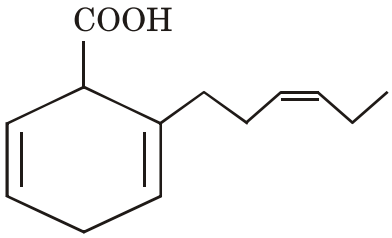
(B) 

(C) 

(D) 

100. The major product of the following reaction is :



(A)


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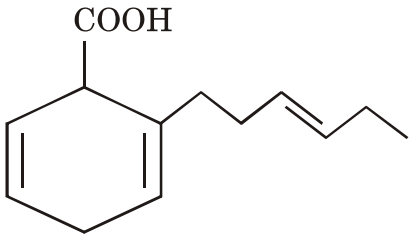

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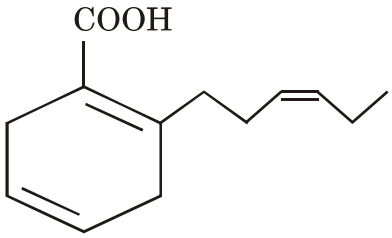

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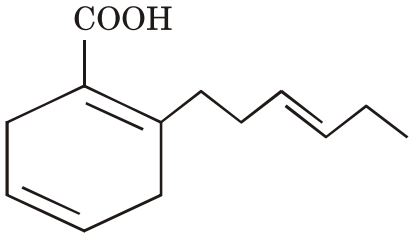

ROUGH WORK