

# TEST SERIES CSIR-NET/JRF DEC. 2018

BOOKLET SERIES **D**

Full Length Test – 1

Paper Code **01**

Test Type: **TEST SERIES**

## CHEMICAL SCIENCES

Duration: 3:00 Hours

Date: 02-12-2018

Maximum Marks: 200

Read the following instructions carefully:

\* Single Paper Test is divided into three Parts.

**Part - A:** This part shall carry 20 questions. The candidate shall be required to answer any 15 questions. Each question shall be of **2 marks**.

**Part - B:** This part shall contain 40 questions. The candidate shall be required to answer any 35 questions. Each question shall be of **2 Marks**.

**Part - C:** This part shall contain 60 questions. The candidate shall be required to answer any 25 questions. Each question shall be of **4 marks**.

\* Darken the appropriate bubbles with HB pencil/Ball Pen to write your answer.

\* There will be negative marking @25% for each wrong answer.

\* The candidates shall be allowed to carry the Question Paper Booklet after completion of the exam.

\* For rough work, blank sheet is attached at the end of test booklet.



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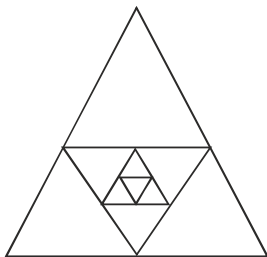
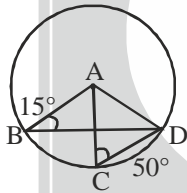


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## PART – A

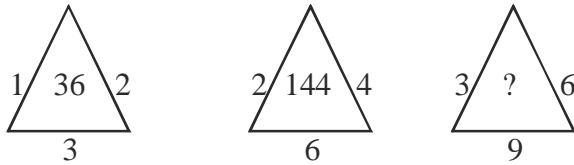
- On a cloth a shopkeeper gives 52% discount to Ram and to Hari he gives Successive discount of 30% and 30% respectively. The customer getting better discount is \_\_\_\_\_.  
(a) Ram (b) Hari (c) both equal (d) can't be determined
- Income Ratio of A, B, C, D are  
A : B = 1 : 2  
B : C = 2 : 3  
C : D = 3 : 4  
and difference of income of A and D is 3,000 Rs. What is the income of C.  
(a) 3,000 Rs (b) 24,00 Rs (c) 36,00 Rs (d) 2,000 Rs
- Rohan keeps 12,000 Rs in two banks in a certain Ratio. bank I gives 10 % interest where as bank II gives 30% interest. After one year Rohan gets 2400 Rs as interest. What was the amount in bank I.  
(a) 6,000 Rs. (b) 4,000 Rs. (c) 8,000 Rs. (d) 9,000 Rs.
- A right circular cone of height 'h' is divided in two parts of equal height. What is the ratio of weight of lower part to the upper part ?  
(a) 8 : 1 (b) 7 : 1 (c) 9 : 2 (d) 4 : 1
- If  $x + \frac{1}{x} = 2$ , then what is the value of  $x^{13} + \frac{1}{x^{13}}$   
(a) 0 (b) 1 (c) 2 (d) 13
- What is the probability of being the sum of 9 from the throw of two unbiased dice  
(a)  $\frac{1}{4}$  (b)  $\frac{1}{9}$  (c)  $\frac{1}{12}$  (d)  $\frac{1}{6}$
- In the below figure, A is the centre of the circle and  $\angle ACD = 50^\circ$ , and  $\angle ABD = 15^\circ$ , then what is the value of  $\angle BAC$  ?  
(a)  $100^\circ$   
(b)  $70^\circ$   
(c)  $80^\circ$   
(d)  $75^\circ$
- Two cylinders have radius in the ratio 3 : 1 and heights in the ratio 1 : 3. Ratio of their volumes is -  
(a) 1 : 3 (b) 2 : 1 (c) 3 : 1 (d) 1 : 4
- Find the angle of elevation of the sun, if the shadow of a tower is  $\sqrt{3}$  times the length of the tower.  
(a)  $60^\circ$  (b)  $30^\circ$  (c)  $45^\circ$  (d)  $0^\circ$
- If in a certain code 'STUDENT' is coded 'TVXHJTA', then what will be the code for 'TEACHER'  
(a) UGHXYMK (b) UGDGYNK (c) UGDGMKY (d) SGDGMKY
- Pointing to a Photograph of Ram, vimal said, "The father of his sister is the husband of my wife's mother". How is vimal related to Ram.  
(a) Brother in law (b) Son in law (c) Cousin (d) Father
- What is the total number of triangles in the figure given below ?



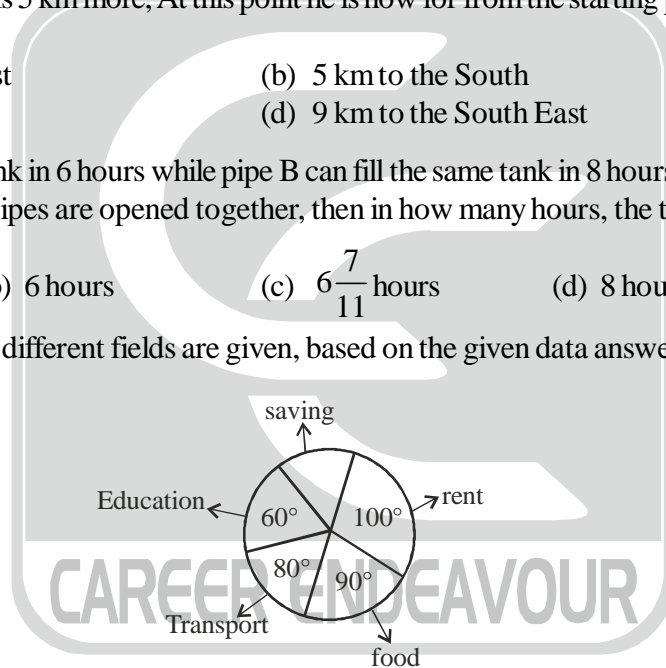
- (a) 12 (b) 13 (c) 16 (d) 10

13. *Statements*  
 (i) all A are B                      (ii) all B are C                      (iii) all C are D                      (iv) all D are E  
*Conclusions*  
 (i) all C are B                      (ii) all D are C                      (iii) Some E are A.  
 Now based on the statements find out which conclusions is right  
 (a) only (i)                      (b) (i) and (ii)                      (c) only (iii)                      (d) none

14. What should come in place of question mark.

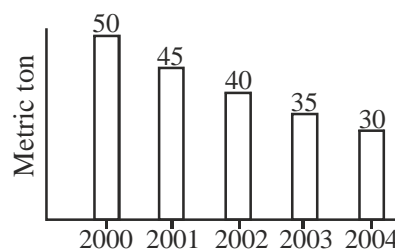


- (a) 343                      (b) 324                      (c) 256                      (d) 288
15. Gagan is taller than sita but not shorter than Ram. Ram and Ravi are of same height. Gagan is shorter than parul. Who is the tallest among all of them ?  
 (a) Gagan                      (b) Parul                      (c) Ram                      (d) Sita
16. Ram starting from a point moves 1 km towards North then he turns to his right and walks for 3 km. again turning to his right he walks 5 km more. At this point he is how far from the starting point and in which direction from the starting point.  
 (a) 5 km to the South East                      (b) 5 km to the South  
 (c) 9 km to the East                      (d) 9 km to the South East
17. Pipe A can fill an empty tank in 6 hours while pipe B can fill the same tank in 8 hours. Pipe C can empty the half tank in 8 hours. If all the pipes are opened together, then in how many hours, the tank will be full ?  
 (a)  $4\frac{4}{11}$  hours                      (b) 6 hours                      (c)  $6\frac{7}{11}$  hours                      (d) 8 hours
18. A person's expenditure in different fields are given, based on the given data answer the question below.



If his saving is 3,000 then what is his total income.

- (a) 30,000 Rs.                      (b) 36,000 Rs.                      (c) 24,000 Rs.                      (d) 18,000 Rs.
19. Wheat production of a country over a number of years is shown. Which year recorded highest percent reduction in production over the previous year ?



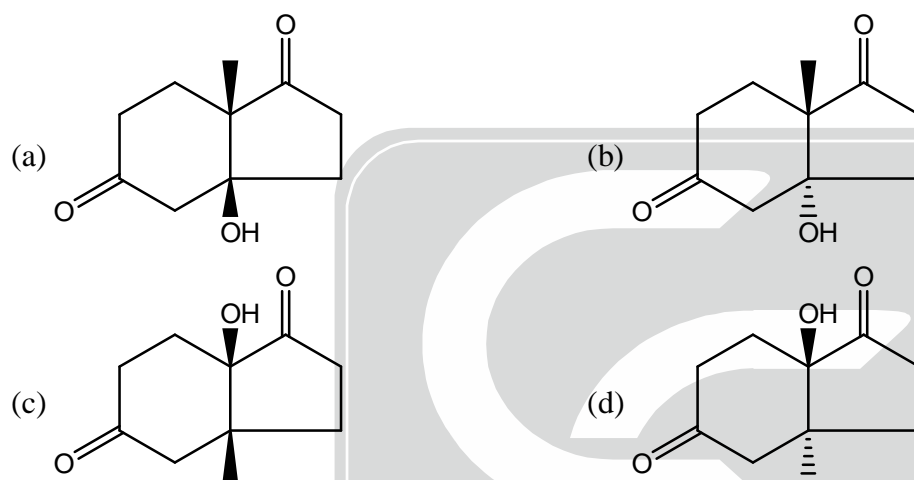
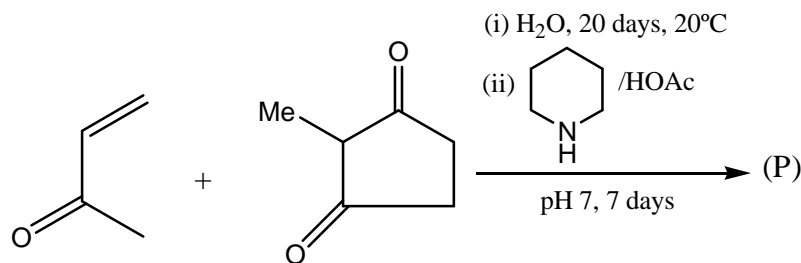
- (a) 2001                      (b) 2002                      (c) 2003                      (d) 2004

20. Consider a circle of radius  $r$ . Fit the largest possible square inside it and the largest possible circle inside the square. What is the radius of the innermost circle ?

- (a)  $\frac{r}{\sqrt{2}}$       (b)  $\frac{\pi r}{\sqrt{2}}$       (c)  $\frac{r}{2\pi\sqrt{2}}$       (d)  $\frac{r}{2}$

### PART – B

21. The major product (P) is



22. The increasing order of band gap for the following semiconductor is

- (a)  $\text{Si} < \text{GaN} < \text{GaAs} < \text{InN}$       (b)  $\text{Si} < \text{InN} < \text{GaAs} < \text{GaN}$   
 (c)  $\text{InN} < \text{Si} < \text{GaAs} < \text{GaN}$       (d)  $\text{InN} < \text{Si} < \text{GaN} < \text{GaAs}$

23. The relative thermal stability of lead oxides follows the order

- (a)  $\text{PbO}_2 > \text{PbO} > \text{Pb}_3\text{O}_4$       (b)  $\text{PbO}_2 > \text{Pb}_3\text{O}_4 > \text{PbO}$   
 (c)  $\text{Pb}_3\text{O}_4 > \text{PbO}_2 > \text{PbO}$       (d)  $\text{Pb}_3\text{O}_4 > \text{PbO} > \text{PbO}_2$

24. The two isomers (A) and (B) of molecular formula  $\text{Pt}(\text{NH}_3)_2\text{Cl}_2$ , react with thiourea and produce  $[\text{Pt}(\text{tu})_4]^{2+}$  and  $[\text{Pt}(\text{NH}_3)_2(\text{tu})_2]^{2+}$ . Isomers A and B are

- (a) cis isomers      (b) trans isomers  
 (c) trans and cis isomers respectively      (d) cis and trans isomers respectively

25. One barn is equal to

- (a)  $10^{-28} \text{ cm}^2$       (b)  $10^{-28} \text{ m}^2$       (c)  $10^{-30} \text{ m}^2$       (d)  $10^{-30} \text{ cm}^2$

26. Match the **column-I** with **column-II**

#### Column-I

- (P)  $\text{Ni}^{2+}$   
 (Q)  $\text{Co}^{2+}$   
 (R)  $\text{Mn}^{2+}$   
 (S)  $\text{Cu}^{2+}$

#### Column-II

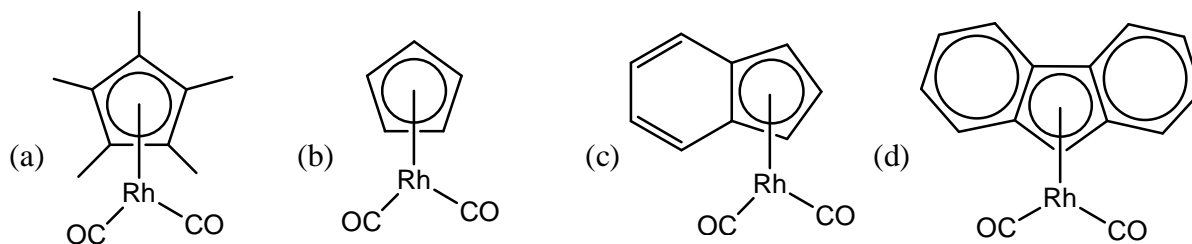
- (I) alkyl group transfer  
 (II) electron transfer  
 (III) dioxygen storage  
 (IV) photosynthesis  
 (V) dehydrogenase  
 (VI) hydrogenase  
 (b) P-V, Q-I, R-IV, S-II  
 (d) P-VI, Q-II, R-V, S-III

(a) P-VI, Q-I, R-IV, S-II

(c) P-V, Q-I, R-IV, S-III



27. Among the following complex the fastest ligand substitution occurs



28. The pair of molecules having  $\pi_g$  as HOMO is

- (a)  $N_2$  and  $C_2$  (b)  $Cl_2$  and  $N_2$  (c)  $O_2^{2-}$  and  $Cl_2$  (d)  $C_2$  and  $B_2^{2-}$

29. Select the correct statement(s) regarding  $LaC_2$  ion is/are

- (1) It show metallic conductivity  
 (2) It contain  $C_2^{3-}$  ion  
 (3) On hydrolysis it produces  $C_2H_2$  and  $H_2$   
 (4) On hydrolysis it produces  $C_2H_2$  only like  $CaC_2$ .

The correct answer is

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

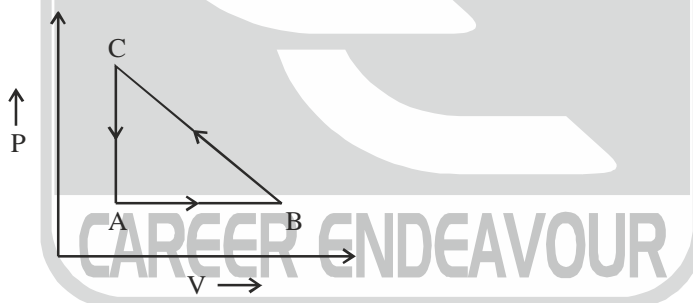
30. The overall activation energy for the rate law

$$k_{overall} = -\frac{2}{3} \left[ \frac{3k_1k_2}{5k_3} \right]^{1/3} \cdot k_4$$

is

- (a)  $\frac{1}{3}[E_1 + E_2 - E_3 + E_4]$  (b)  $E_1 + E_2 - E_3 + E_4$   
 (c)  $\frac{1}{3}[E_1 + E_2 - E_3E_4]$  (d)  $\frac{1}{3}[E_1 + E_2 - E_3] + E_4$

31. Consider the cyclic process ABCA on a sample of 2 mol of an ideal gas as shown in figure



The temperature of gas at A and B are 300K and 500K. A total of 1200 J heat is with drawn from the sample in the process. the work done by the gas in part BC is

- (a) 4520 J (b) 9000 J (c) -4520 J (d) -9000 J

32. The trial wave function of a system is  $\psi_T = c_1\phi_1 + c_2\phi_2$  with  $\langle \phi_1 | H | \phi_1 \rangle = 2 = \langle \phi_2 | H | \phi_2 \rangle$  and  $\langle \phi_1 | H | \phi_2 \rangle = 1 = \langle \phi_2 | H | \phi_1 \rangle$ . The ground state energy using variational principle is

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

33. The molar conductance at infinite dilution of  $Ag^+$  is  $61.92 \times 10^{-4} \text{ Smol}^{-1} \text{ m}^2$  at  $25^\circ\text{C}$ . The velocity of  $Ag^+$  is (electric field applied is  $10 \text{ Vm}^{-1}$ )

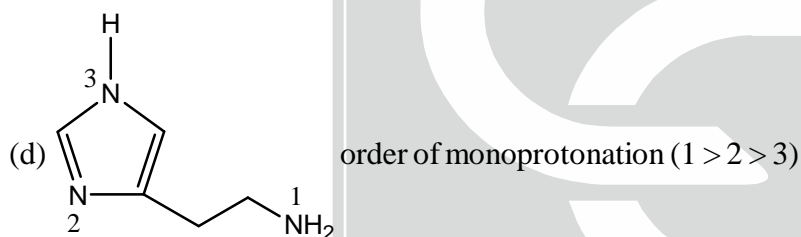
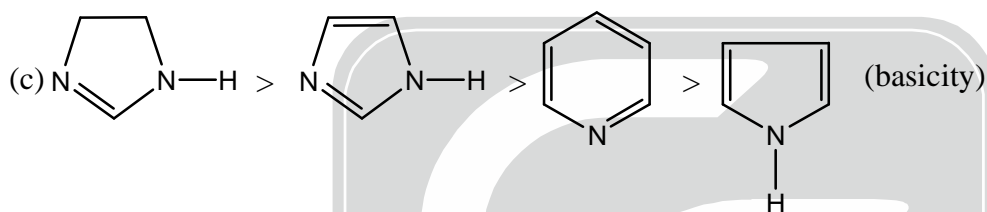
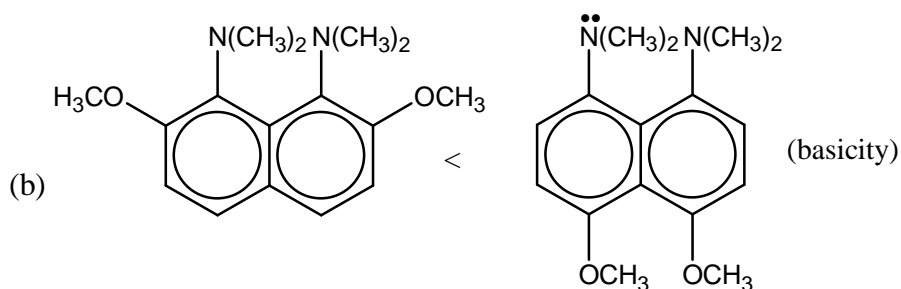
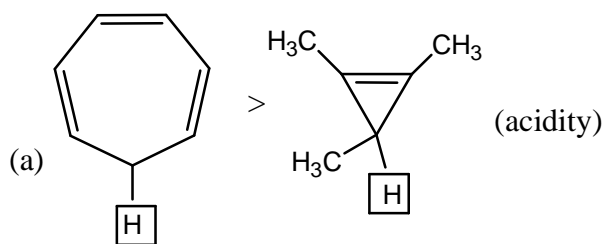
- (a)  $6.41 \times 10^{-8} \text{ ms}^{-1}$  (b)  $6.41 \times 10^{-7} \text{ ms}^{-1}$  (c)  $6.192 \times 10^{-4}$  (d)  $61.92 \times 10^{-3}$

34. Which of the following set of molecule will show a microwave rotational spectrum

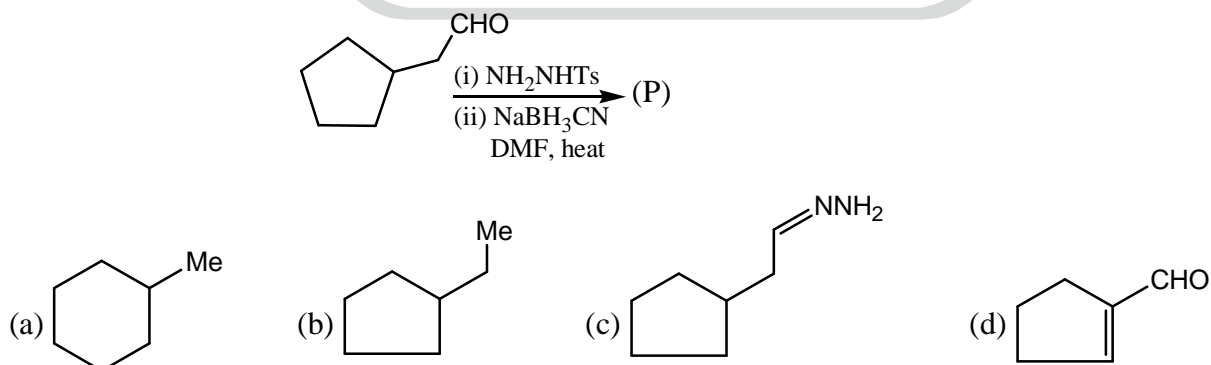
- (a) ( $SF_6, CH_4, HCl, CH_3Cl$ ) (b) ( $HCl, CH_3Cl, CH_2Cl_2, H_2O$ )  
 (c) ( $H_2, SiH_4, CH_3OH$ ) (d) ( $CO_2, HCl, H_2O$ )



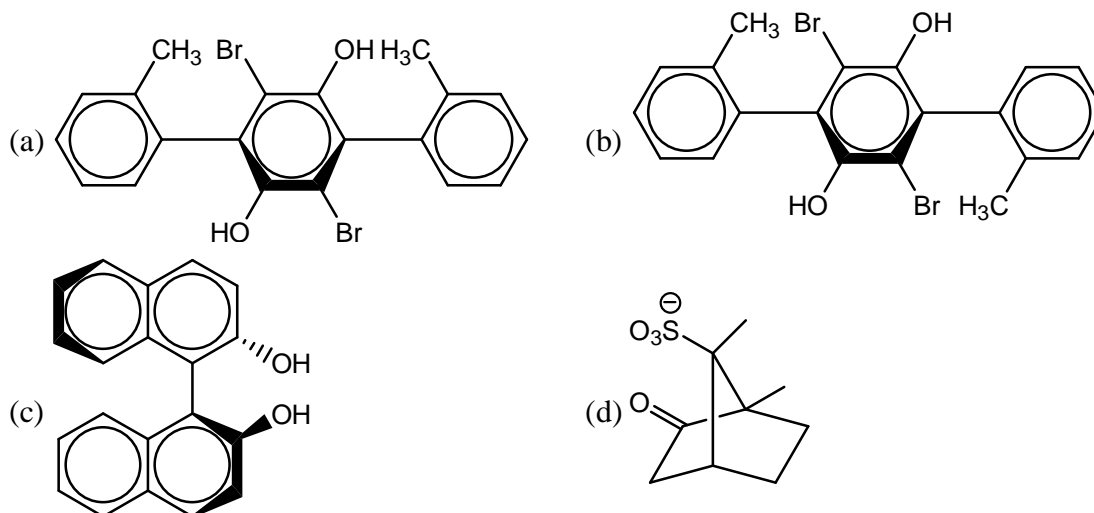
35. Proteins can be denatured under acidic conditions. During this denaturing, the protein molecule  
 (a) Changes shape (b) Is dehydrated (c) Is neutralized (d) Is polymerised
36. Which of the following is *incorrect* regarding given characteristic, respectively



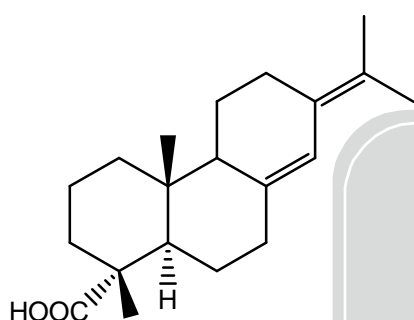
37. Which one of the following is correct when the given acids are arranged in the increasing order of acid strengths?  
 (a)  $\text{HOClO} < \text{HOCl} < \text{HOClO}_3 < \text{HOClO}_2$  (b)  $\text{HOClO}_2 < \text{HOClO}_3 < \text{HOClO} < \text{HOCl}$   
 (c)  $\text{HOClO}_3 < \text{HOClO}_2 < \text{HOClO} < \text{HOCl}$  (d)  $\text{HOCl} < \text{HOClO} < \text{HOClO}_2 < \text{HOClO}_3$
38. The major product in the following reaction are



39. Which of the following molecule is optically inactive



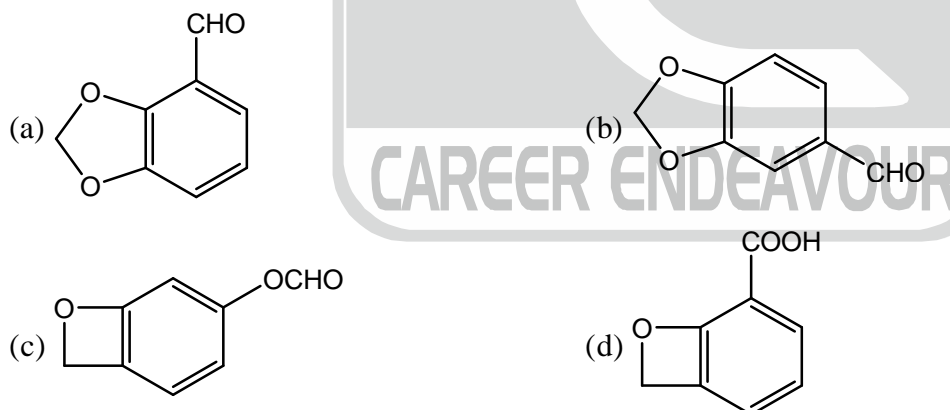
40.



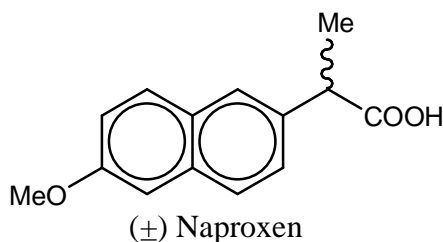
In the UV spectrum of above molecule the  $\lambda_{\max}$  approximate in nm is

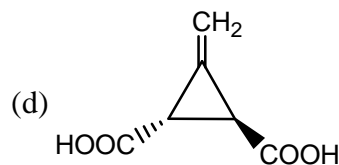
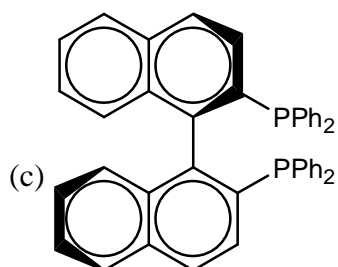
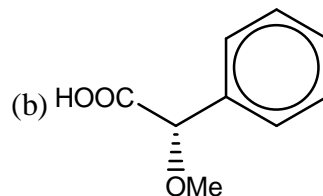
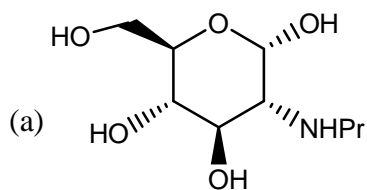
- (a) 247 (b) 275 (c) 253 (d) None of these

41. The compound that exhibits following spectral data is  
 $^1\text{H NMR } \delta$  9.8(s, 1H), 7.5 (dd, 1H,  $J = 8.0, 2.0$ ), 7.4(d, 1H,  $J = 2.0$ ), 6.9(d, 1H,  $J = 8.0$ ), 6.0 (s, 2H).

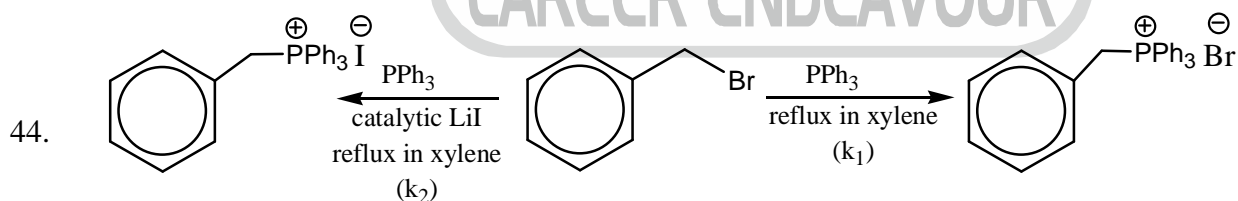
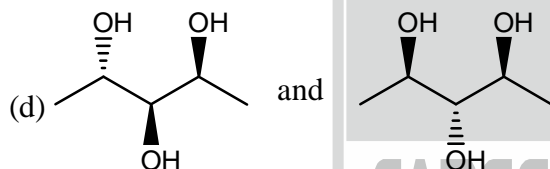
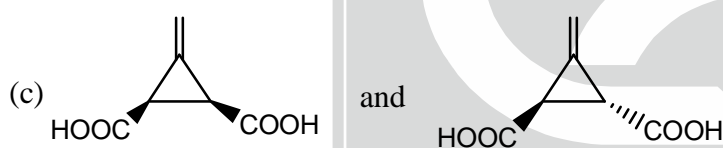
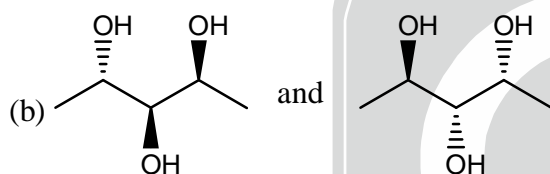
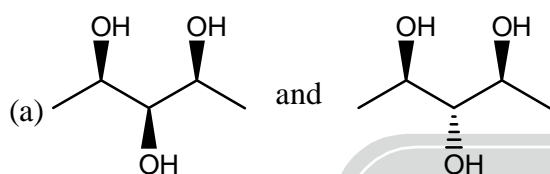


42. Naproxen is a member of a family of a compound known as non-steroidal anti-inflammatory drugs (NSAIDs) which are 2-arylpropionic acid. Naproxine are chiral and drugs is solid as a racemic mixture whereas only (s)-enantiomers of naproxen has anti-inflammatory activity. Racemic Naproxen can be resolved by



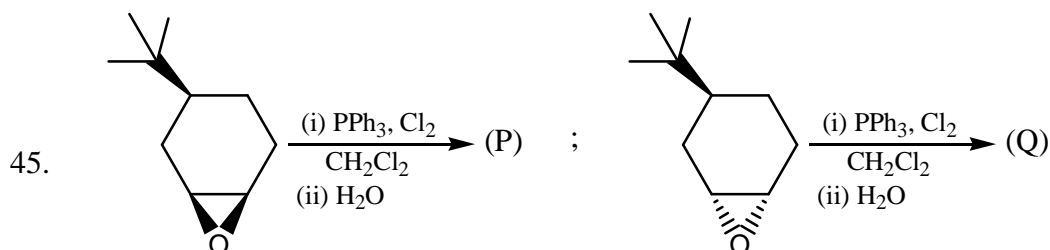


43. Among the following pair, identify the meso pair

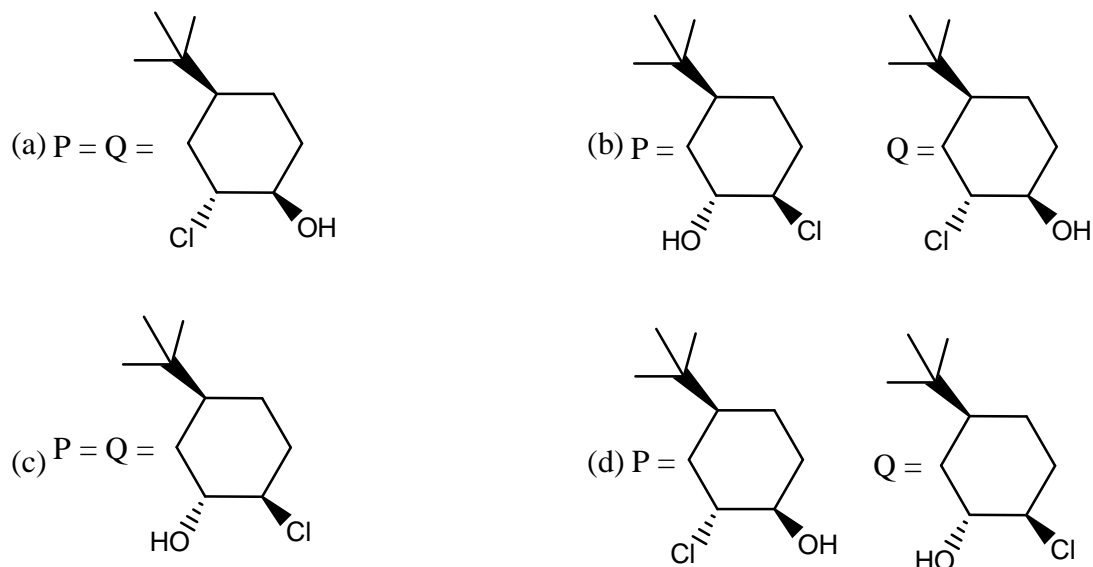


Which of the following statement is true regarding above mentioned  $S_N2$  reaction

- (a)  $k_1 > k_2$       (b)  $k_2 > k_1$       (c)  $k_1 = k_2$       (d) None of these



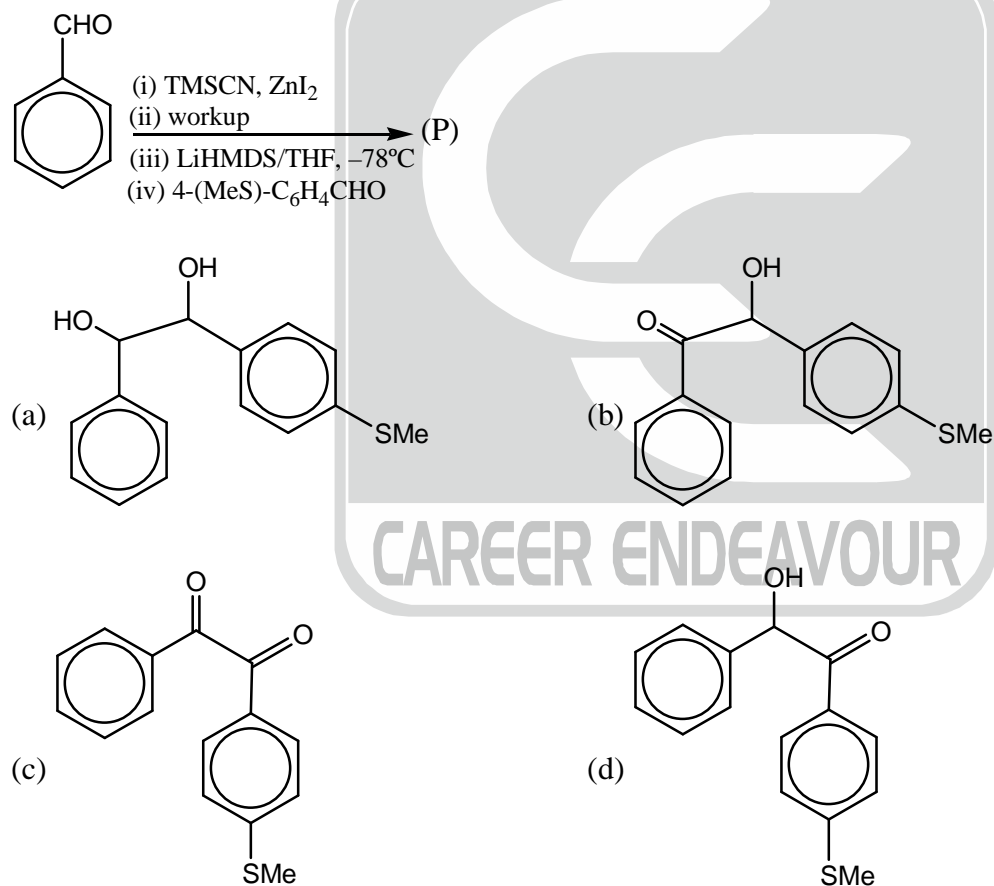




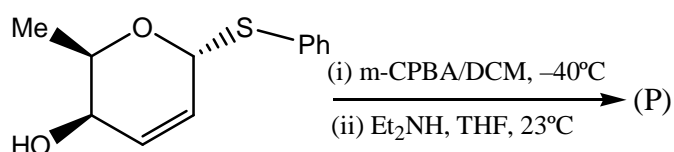
46. In cyclobutadiene the transition can not occur at

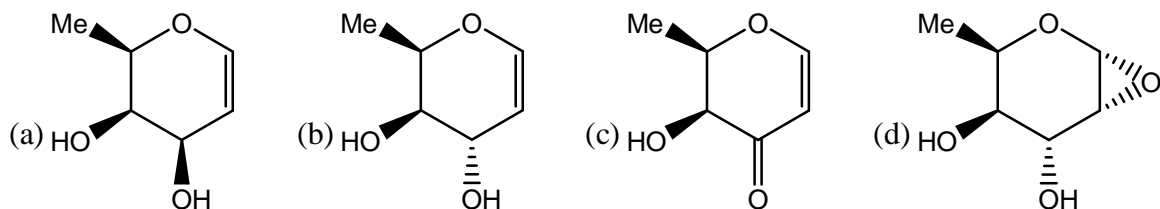
- (a)  $2\beta$  (b)  $3\beta$  (c)  $4\beta$  (d) None of these

47. The major product (P) is

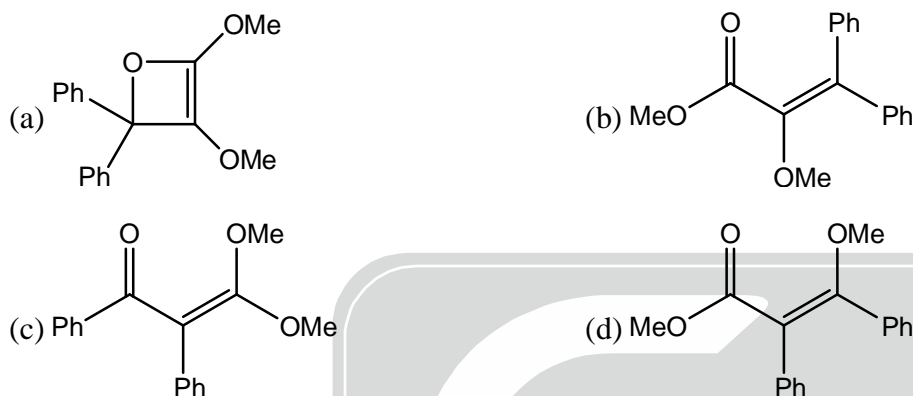
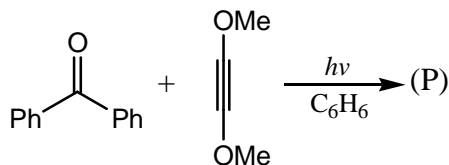


48. The major product (P) is

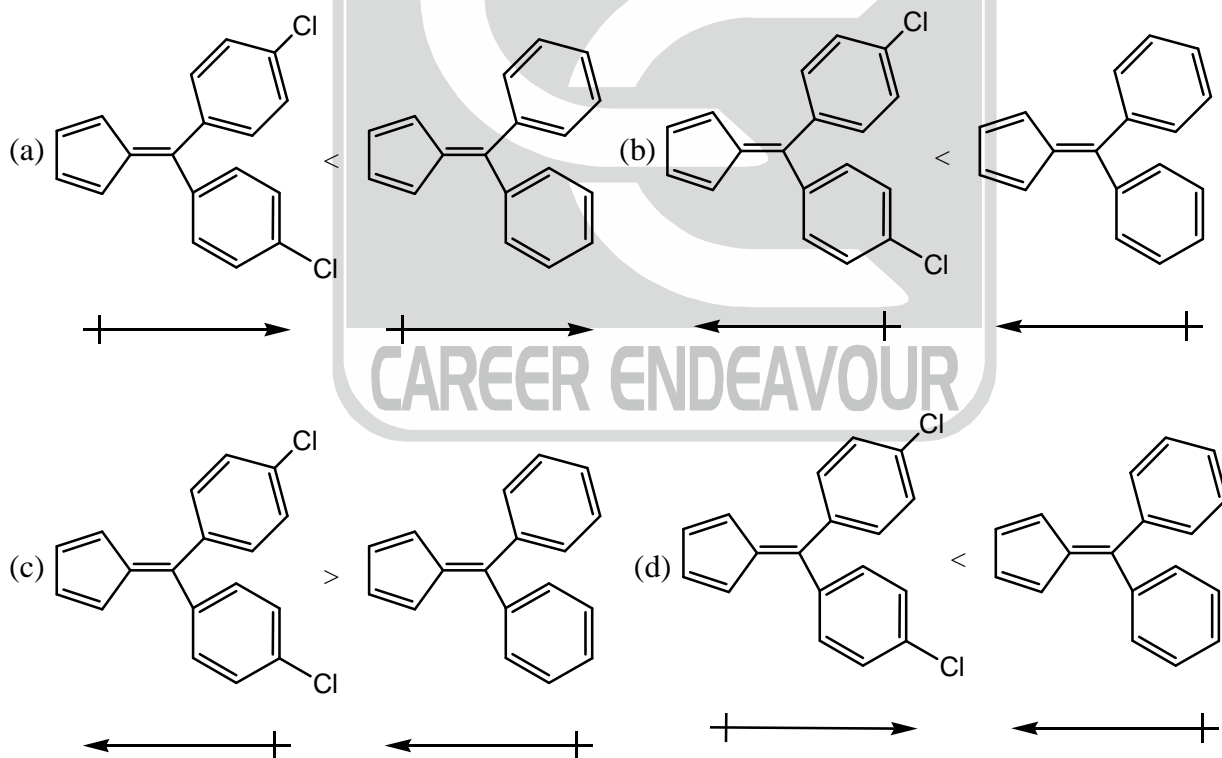




49. The major product (P) is



50. The pair with correct order of magnitude as well as orientation of dipole moment is



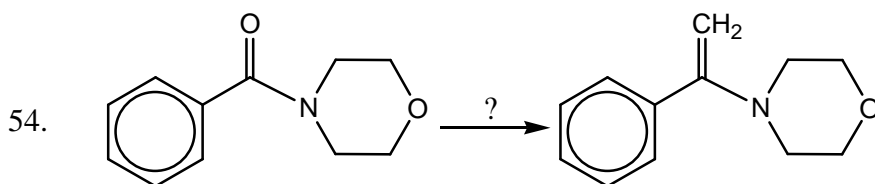
51. The intensity of a light beam decreases by 50% when it passes through a sample of 1 cm path length. The percentage of transmission of the light passing through the same sample, but 4cm path length, would be

- (a) 6.25% (b) 12.5% (c) 25% (d) 50%

52. Which among the following is the correct order of oxidising capability?

- (a)  $\text{O}_3 > \text{H}_2\text{O}_2 > \text{KMnO}_4$  (b)  $\text{O}_3 > \text{KMnO}_4 > \text{H}_2\text{O}_2$   
 (c)  $\text{H}_2\text{O}_2 > \text{O}_3 > \text{KMnO}_4$  (d)  $\text{H}_2\text{O}_2 > \text{KMnO}_4 > \text{O}_3$

53. Which of the following statement is not true regarding the carbene
- Schrock carbene behaves like a phosphorus ylide in some of its reactions
  - The carbene carbon of Schrock carbene is nucleophilic in nature where as metal is electron deficient.
  - The metal-carbon bond of Fischer carbene has a relatively high rotational barrier
  - The metal atom of Fischer carbene is relatively electron rich.

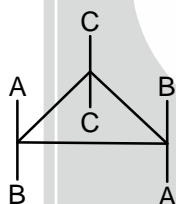


The suitable reagent in the above synthetic transformation is

- $\text{Cp}_2\text{TiCH}_2$ ,  $\text{AlMe}_2\text{Cl}$
  - Grubb's catalyst
  - $\text{Na}_2[\text{PdCl}_4]$
  - $\text{Rh}(\text{PPh}_3)_3\text{Cl}$
55. At 300K, the calorimetric determination of  $\Delta H$  for the reaction,
- $$\text{Zn(s)} + 2\text{AgCl(s)} \longrightarrow \text{ZnCl}_2(\text{aq}) + \text{Ag(s)}$$
- yielded  $-193 \text{ kJ/mol}$ , while the emf of the corresponding cell was  $1.015 \text{ V}$ .  $\left(\frac{\delta E}{\delta T}\right)$  for this cell is

- $5 \times 10^{-5} \text{ VK}^{-1}$
- $8 \times 10^{-5} \text{ VK}^{-1}$
- $2 \times 10^{-3} \text{ VK}^{-1}$
- $4 \times 10^{-3} \text{ VK}^{-1}$

56. The point group of



is

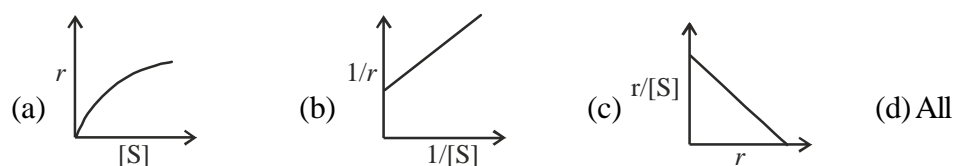
- $\text{C}_{2v}$
- $\text{C}_{2h}$
- $\text{C}_2$
- None of these

57. In Freundlich isothermal equation  $\frac{x}{m} = k P^{1/n}$ . The constant  $n$  is
- Greater than 1
  - Lesser than 1
  - Equal to 1
  - None of these

58. The co-ordination number of Oh Vd in a fcc lattice can never be form
- corner
  - body centre
  - face centre
  - none of these

59. Which of the following is not an addition polymer
- PMMA
  - Nylon-6, 6
  - Polyvinyl chloride
  - Orlon

60. The correct Michaeli's - Menten product is/are



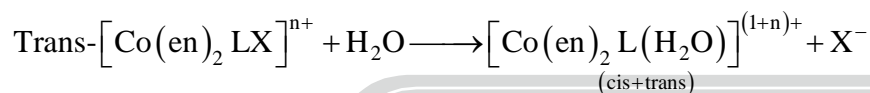
## PART – C

61. The electronegativity difference between N and F is greater than that between N and H. Still the dipole moment of  $\text{NH}_3$  (1.5) is much larger than dipole moment of  $\text{NF}_3$  (0.2). This is because
- In  $\text{NH}_3$  the atomic dipole and bond dipole are in opposite direction while in  $\text{NF}_3$  these are in the same direction.
  - Both in  $\text{NH}_3$  and  $\text{NF}_3$  the atomic dipole and bond dipole are in the same direction.
  - In  $\text{NH}_3$  the atomic dipole and bond dipole are in the same direction while in  $\text{NF}_3$  these are in opposite direction.
  - Both in  $\text{NH}_3$  and  $\text{NF}_3$  the atomic dipole and bond dipole are in opposite direction.

62. Which among the following statement is not true for  $\text{XeO}_3$ ?

- It is formed by the hydrolysis of  $\text{XeF}_6$
- It is formed by the hydrolysis of  $\text{XeF}_4$
- It reacts with  $\text{NaOH}$  giving perxentates ( $\text{Na}_4\text{XeO}_6$ )
- It react with  $\text{H}_2\text{SO}_4$  giving  $\text{XeO}_4$ .

63. Consider the following reaction



select the pairs of ligand (L) which leads to maximum percentage of trans and cis product respectively

- $\text{Cl}^-$  and  $\text{Br}^-$
- $\text{OH}^-$  and  $\text{Br}^-$
- $\text{Cl}^-$  and  $\text{NO}_2^-$
- $\text{NO}_2^-$  and  $\text{OH}^-$

64. Consider the correct statement(s) regarding  $\text{MnO}_4^-$  and  $\text{ReO}_4^-$

- $\text{MnO}_4^-$  is strong oxidising agent than  $\text{ReO}_4^-$ .
- $\text{MnO}_4^-$  is coloured while  $\text{ReO}_4^-$  is colourless
- $\text{MnO}_4^-$  show charge transfer band at lower wavelength than  $\text{ReO}_4^-$
- $\text{MnO}_4^-$  show d-d band at high energy than  $\text{ReO}_4^-$

The correct answer is

- 2, 3
- 1, 2
- 1, 3, 4
- All of these

65. Consider the following statements

- $\text{Zn(II)}$  ion act as a active site of many hydrolytic enzymes because  $\text{Zn(II)}$  does not have accessible redox states.
- Number of inorganic sulfides in ferredoxin are six and they remove by washing with an acid
- In oxyhemerythrin, both the iron centres are hexacoordinated and dioxygen present in the form peroxide.
- The cooperative binding of  $\text{O}_2$  in hemoglobin is due to increase in size of iron followed by changes in the protein conformation.

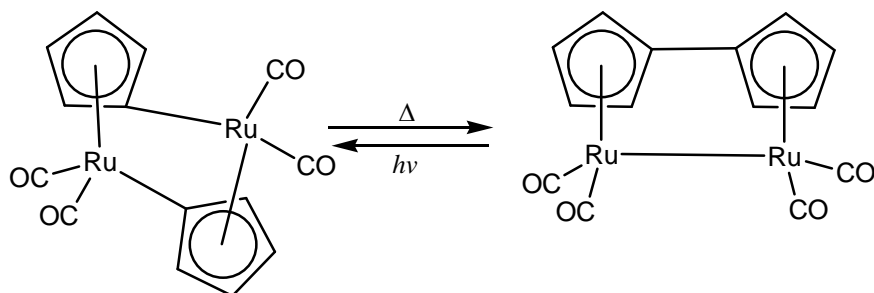
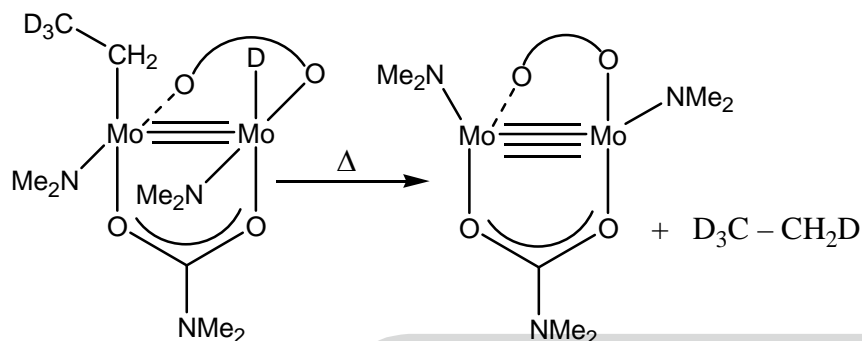
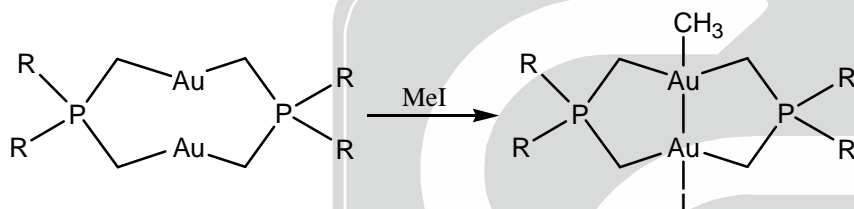
The incorrect statements are

- A, B and C
- A and D
- B and D
- B, C and D

66. Metallic iron upon treatment with excess of  $\text{CO}$  at 100 bar pressure and  $150^\circ\text{C}$  temperature gives a pale yellow compound (A). The compound (A) upon treatment with  $\text{I}_2$  gives a compound (B) with evolution of  $\text{CO}$ . The compound (B) upon treatment with  $\text{NaBH}_4$  in THF gives compound (C). The compound (C) shows one signal in  $^1\text{H NMR}$  spectroscopy. The compound (C) in above sequence of reaction is (All, A, B and C follows 18 electron rule)

- $[\text{Fe}(\text{CO})_4 \text{I}_2]$
- $[\text{Fe}(\text{CO})_5 \text{H}_2]$
- $[\text{Fe}(\text{CO})_4 \text{H}_2]$
- $[\text{Fe}_2(\text{CO})_9]$

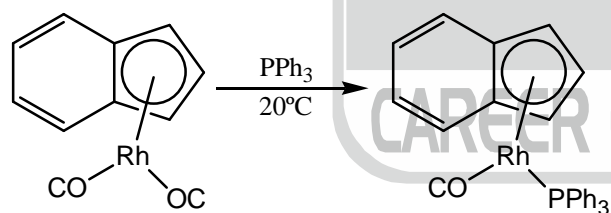


67. **Scheme-A****Scheme-B****Scheme-C**

The correct statement regarding the scheme-A to C is

- (a) Scheme-A is an example of oxidative addition  
 (b) Scheme-B is an example of migratory insertion  
 (c) Scheme-C is an example of  $\beta$ -elimination  
 (d) Scheme-A = reductive elimination, Scheme-B = reductive elimination and Scheme-C = oxidative addition

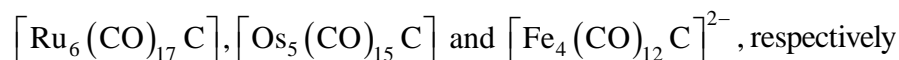
## 68.



The mechanism involved in above synthetic transformation is

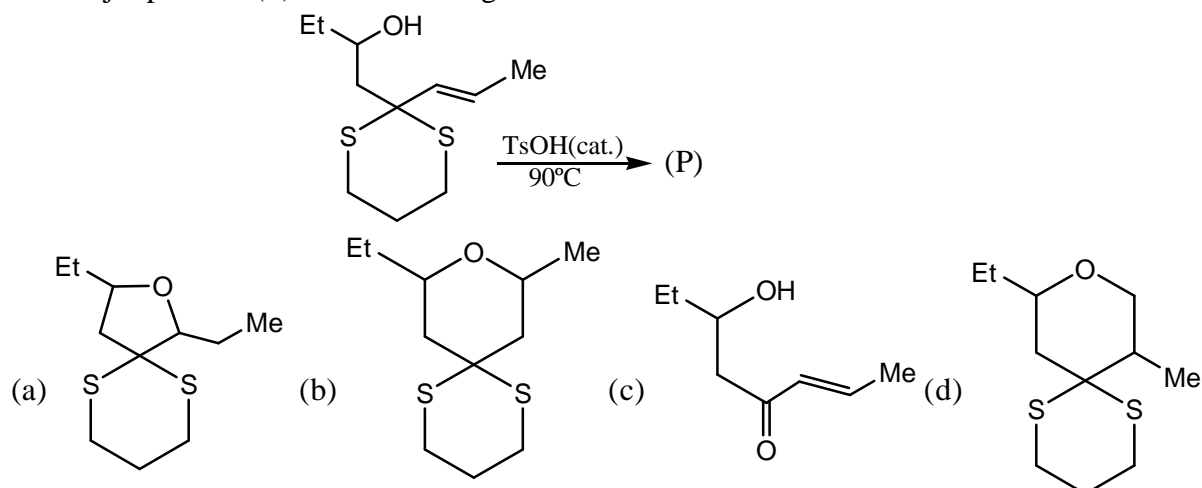
- (a) Dissociation of phosphine followed by addition of phosphine  
 (b) Addition of phosphine followed by dissociation of CO  
 (c) Addition of phosphine, slippage of hapticity from  $\eta^5 \rightarrow \eta^3$ , followed by dissociation of CO.  
 (d) Slippage of hapticity  $\eta^5 \rightarrow \eta^3$ , addition of phosphine dissociation of CO followed by conversion of  $\eta^3 \rightarrow \eta^5$

## 69. Find out the structure of following high nuclearity carbonyl cluster



- (a) closo, nido, nido  
 (b) closo, nido, arachno  
 (c) arachno, nido, closo  
 (d) nido, closo, arachno

70. The major product (P) in the following reaction is



71. Find out the incorrect statement

- (a) Partition function tells about thermally accessible states  
 (b) For homonuclear diatomic molecule, rotational partition function at temperature ( $T$ ) equal to characteristic

rotational temperature  $\left( \theta_r = \frac{h^2}{8\pi^2 Ik} \right)$  is  $\frac{1}{2}$

- (c) For polyatomic molecule, the rotational partition function can not be determined with formula  $q_r = \frac{T}{\sigma\theta_r}$ ,

where  $T$  = temperature,  $\theta_r$  = characteristic rotational temperature

- (d) All the above are incorrect statements

72. Consider the correct statement(s) from following

- (1) Lowest energy state for  $B_2$  is  $^3\Sigma_g^-$   
 (2) More electronegative substituents occupy axial position in Pentagonal bipyramidal geometry  
 (3)  $MgAl_2(CH_3)_8$  molecule has two  $3c-2e^-$  bonds  
 (4)  $Me_3Si(OH)$  is stronger acid than  $Me_3C(OH)$

The correct answer is

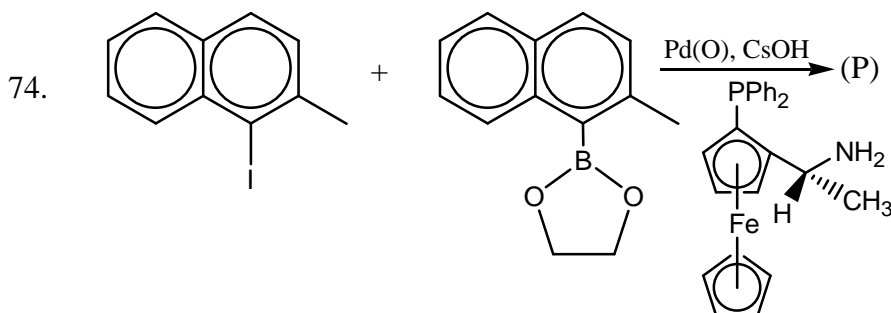
- (a) 1, 3 and 4      (b) 2, 3 and 4      (c) 1, 3      (d) 1, 4

73. Consider the correct change(s) that occurs during conversion of  $I_2$  to  $I_2^+$  (considering  $y$  as internuclear axis)

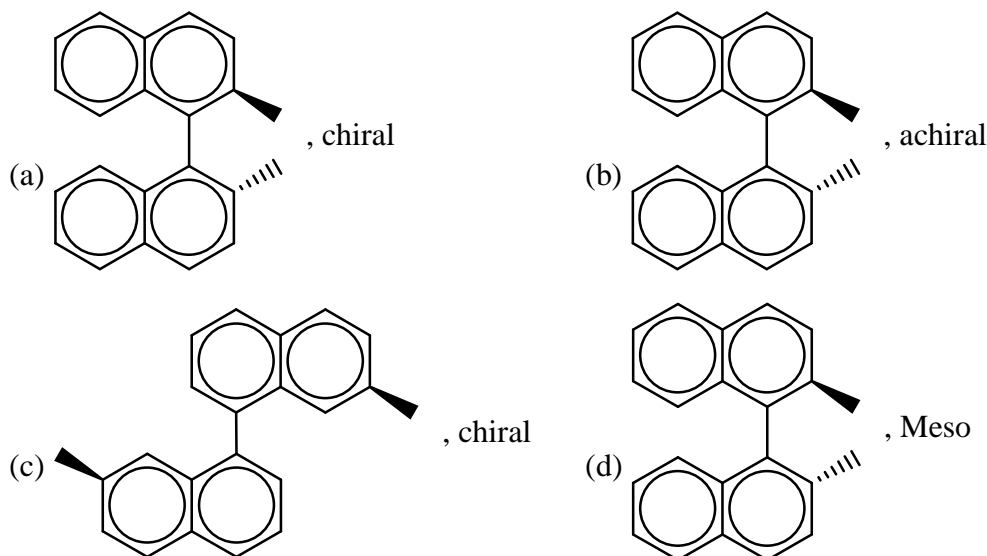
- (1) Removal of electron from  $\pi_{2p_z}^*$  orbital  
 (2) Decrease in  $\pi^* - \sigma^*$  of  $I_2$   
 (3) Change in colour of  $I_2$   
 (4) Change in magnetic behaviour and increase in bond length

The correct answer is

- (a) 2, 3      (b) 1, 2, 3      (c) 1, 4      (d) all of these



The product (P) in the above cross-coupling reaction is

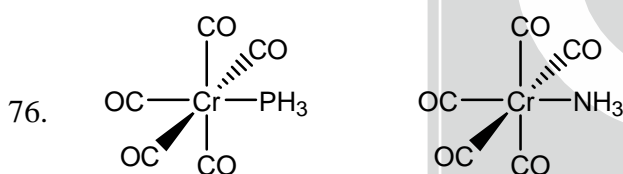


75. Select the correct statement(s) regarding f-block element is/are

- (1)  $\text{UO}_2^{2+}$  ion has linear structure and colour is due to LMCT
- (2) Heavier  $\text{An}^{3+}$  ions show more similarity with absorption spectrum of  $\text{Ln}^{3+}$  ions as compared to lighter  $\text{An}^{3+}$ .
- (3)  $\text{Ln}^{3+}$  ions show little preference in bond direction while  $\text{An}^{3+}$  ions show more preference in bond direction.
- (4) Complexes of  $\text{Ln}^{3+}$  ions show rapid ligand exchange while in case of transition metal ion exchange of ligands is slow.
- (5) Aqueous solution of  $\text{Eu}^{2+}$ ,  $\text{Yb}^{2+}$  and  $\text{Sm}^{2+}$  has been prepared. They all reduce water and order of reducing power is  $\text{Sm}^{2+} > \text{Yb}^{2+} > \text{Eu}^{2+}$

The correct answer is

- (a) 1, 2, 4      (b) 1, 3, 4      (c) 1, 3, 4, 5      (d) All of these



Consider the statement(s)

- (I) When the compounds are oxidised the C–O bond strength increases
- (II) When the compounds are oxidised the metal carbonyl bond strength increases
- (III) When the compounds are oxidised the Cr–P bond strength increases
- (IV) When the compounds are oxidised the Cr–N bond strength increases

The correct answer is

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

77. Consider the following statements

- (I) The Mn–O bond distance in  $[\text{MnO}_4]^{2-}$  is longer than in  $[\text{MnO}_4]^-$
- (II)  $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$  is a strong oxidizing agent that will oxidize water  $[\text{Co}(\text{NH}_3)_6]^{3+}$  is stable in aqueous solution
- (III)  $\text{cis} - [\text{Pt}(\text{bpy})_2 \text{BrCl}]^{2+}$  is optically active
- (IV) The ground state term for  $d^9$  (square planar) is  $^2D_{3/2}$

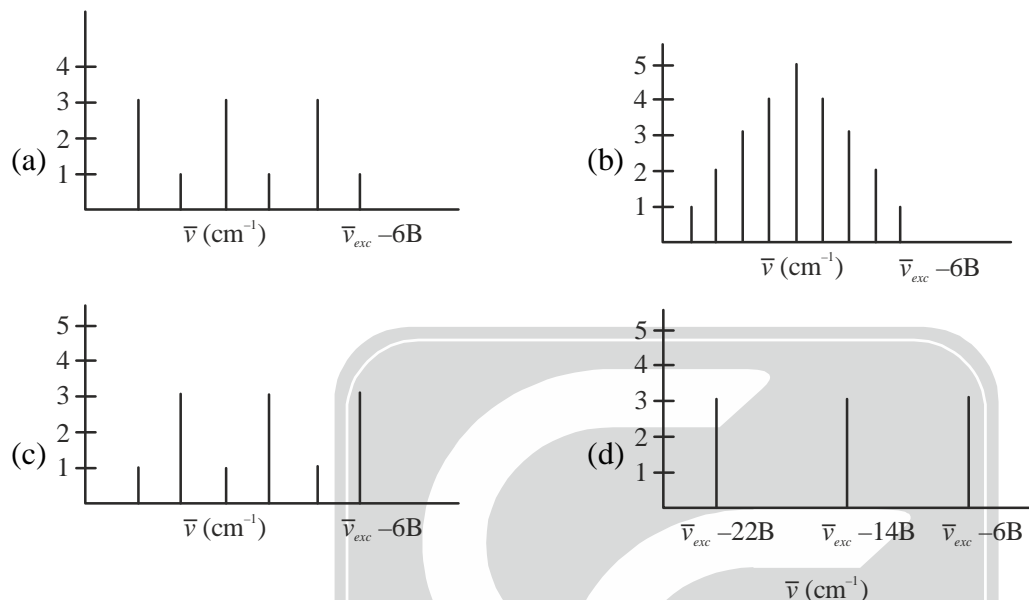
The correct answer is

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

78. Boltzmann formula for entropy is given by  $S = k \ln w$ . If probability of finding a molecule in a state is defined by  $p_i = \frac{n_i}{N}$ , the relation between probability and entropy per molecule will be given by (assuming distinguishable particles)

(a)  $S = k \ln p_i$       (b)  $\frac{S}{N} = \sum p_i \ln p_i$       (c)  $\frac{S}{N} = k \sum p_i \ln p_i$       (d)  $\frac{S}{N} = k \sum p_i \ln p_i^{-1}$

79. The correct intensity pattern which  $H_2$  molecule show in rotational RAMAN spectrum (only stokes lines are shown)



80. For a process,  $A(l) \rightleftharpoons A(g)$ , the volume change is  $30 \text{ dm}^3 \text{ mol}^{-1}$ . The change in pressure of the system if temperature increased from 300K to 350K is (Given: change in entropy is  $300 \text{ JK}^{-1} \text{ mol}^{-1}$ )
- (a) 500 bar      (b) 50 bar      (c) 5 bar      (d) 0.5 bar

81. On carrying out adiabatic process over gases A and B, they found out to have a slope of  $-1.49$  and  $-2.5$  for a plot of  $\log V$  vs  $\log T$ . Which gas will have smaller temperature if volume is increased from  $V_1$  to  $V_2$  considering both have the same initial temperature.
- (a) A      (b) B  
(c) both have same temperature      (d) cannot be predicted

82. At the beginning of polarography, the current observed was  $0.1 \mu\text{A}$ . At half wave cell potential, the total current observed was  $1.5 \mu\text{A}$  and  $1.8 \mu\text{A}$  two experiments. If total current of  $1.5 \mu\text{A}$  corresponds to a solution of  $0.002 \text{ M}$ , then the concentration of solution corresponds to  $1.8 \mu\text{A}$  is
- (a)  $2.43 \times 10^{-3} \text{ M}$       (b)  $2.40 \times 10^{-3} \text{ M}$       (c)  $2.41 \times 10^{-3} \text{ M}$       (d)  $2.47 \times 10^{-3} \text{ M}$

83.  $M^{2+} + 2e^- \longrightarrow M$        $E^0 = 0.34$   
 $M^+ + e^- \longrightarrow M$        $E^0 = 0.12$

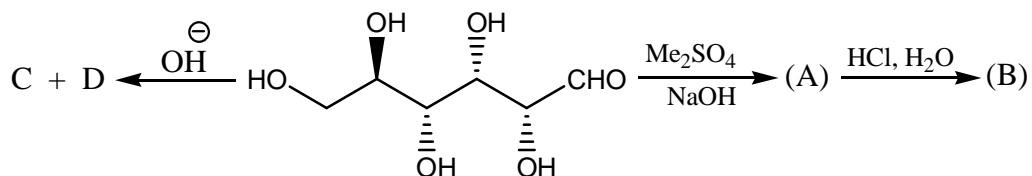
The standard cell potential of  $M^{2+} \longrightarrow 2M^+$  is

- (a) 0.32 V      (b) 0.22 V      (c) 0.11 V      (d) 0.46 V

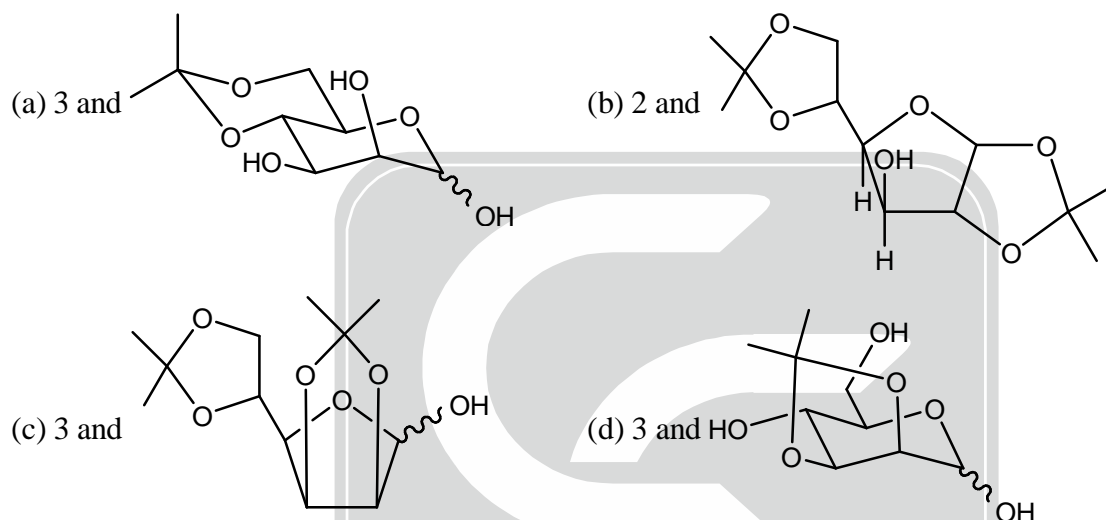




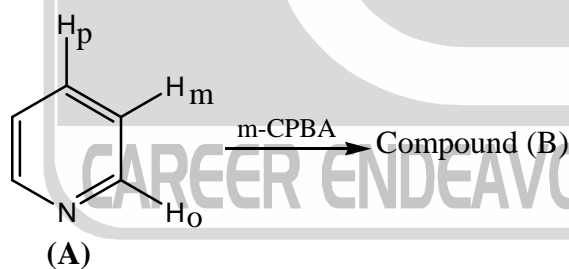
84. Choose the incorrect statement(s) among the following  
 (A) The backbone of the nucleic acids are found on exterior of the DNA in the case of double helical structure  
 (B) Equal energy is required to break all type of hydrogen bonding present among bases  
 (C) Sugar used in nucleic acid may be in  $\alpha$  or  $\beta$  anomeric form  
 (D) The sugar of nucleic acids are connected to one another via 3' to 5' phosphotriester linkages  
 (a) A, B and D only (b) B and C only (c) B, C and D only (d) A only
85. Consider the following reaction sequence



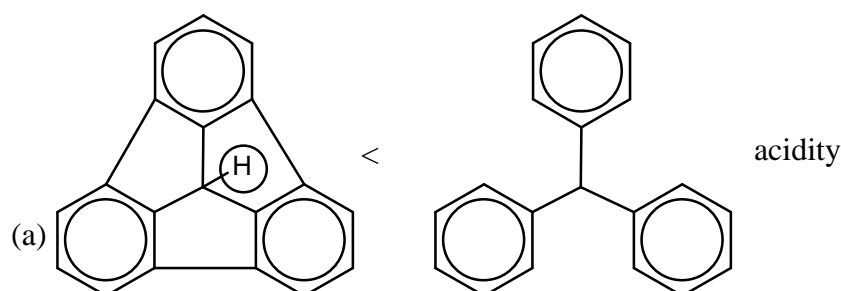
The number of reducing sugar among A, B, C and D, product obtained when D is refluxed, in acetone with  $\text{CuSO}_4$  and  $\text{H}_2\text{SO}_4$  respectively will be (Provided C gives negative Bromine solution test)



86. The correct statement about the  $^1\text{H}$  NMR spectra of compounds A and formed major product (B) is

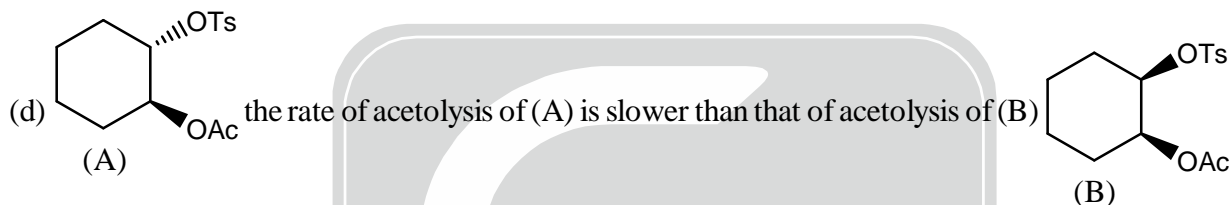
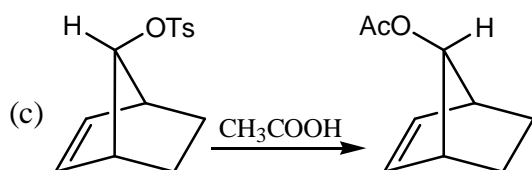
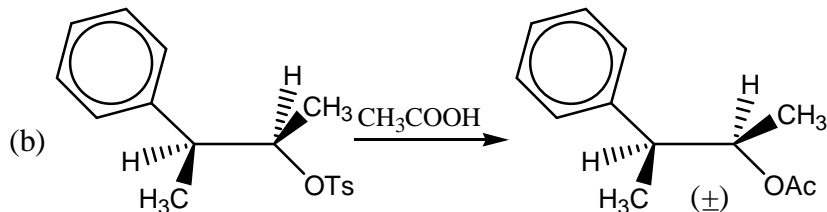
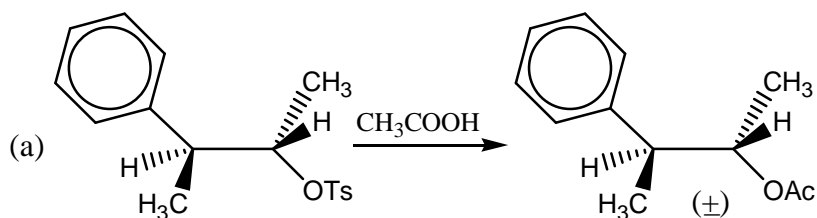


- (a) All  $\text{H}_o$ ,  $\text{H}_m$  and  $\text{H}_p$  in (B) are more upfield than  $\text{H}_o$ ,  $\text{H}_m$  and  $\text{H}_p$  in (A) respectively  
 (b) Only  $\text{H}_o$  and  $\text{H}_p$  in (B) are more upfield than  $\text{H}_o$  and  $\text{H}_p$  in (A)  
 (c) All  $\text{H}_o$ ,  $\text{H}_m$  and  $\text{H}_p$  in (B) are more downfield than  $\text{H}_o$ ,  $\text{H}_m$  and  $\text{H}_p$  in (A)  
 (d)  $\text{H}_m$  in (A) is more downfield than  $\text{H}_m$  in (B)
87. Which of the following statement is correct

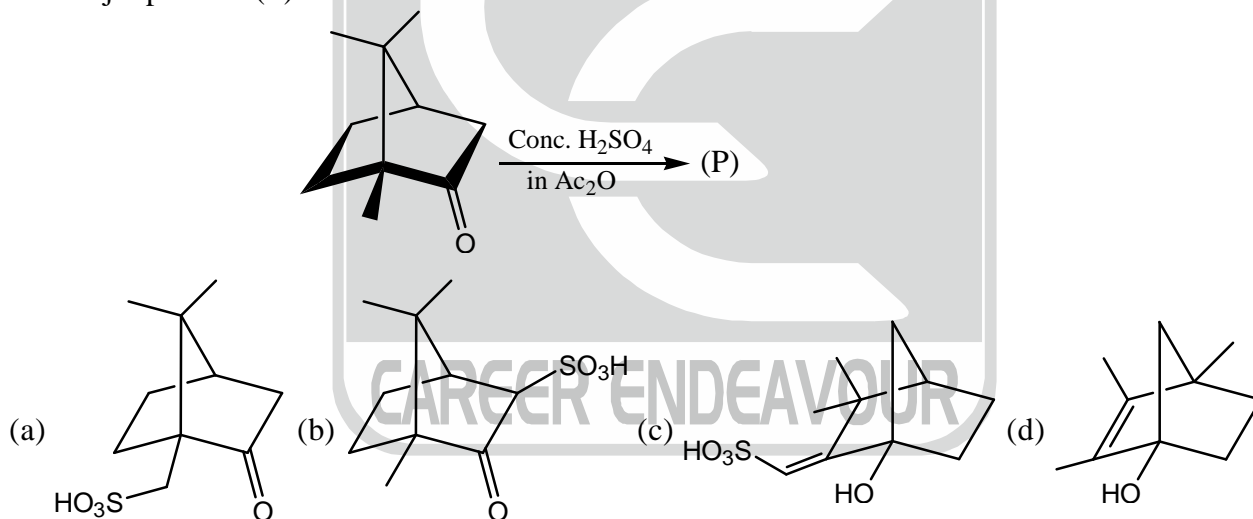




90. The correct statement among the following series of reaction sequence



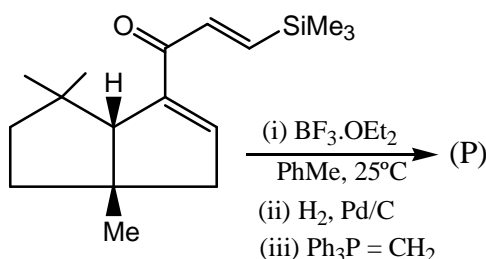
91. The major product (P) is

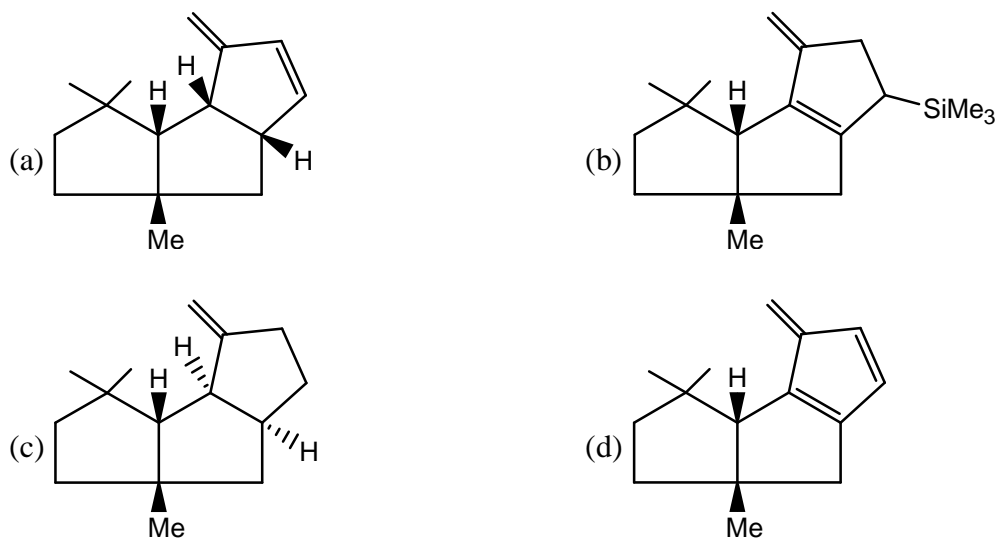


92. What will be the area ratio of singlet, signals obtained in  $^1\text{H}$  NMR for a mixture containing equal quantity of acetyl chloride and acetone

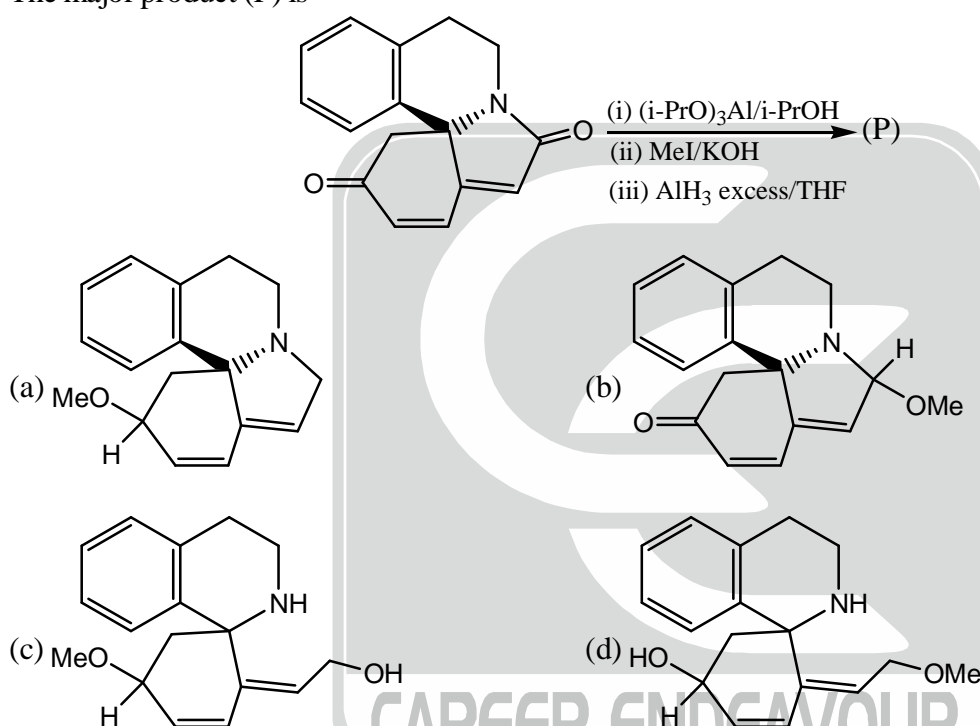
- (a) 6 : 5      (b) 2 : 1      (c) 3 : 8      (d) 4 : 3

93. The major product (P) is

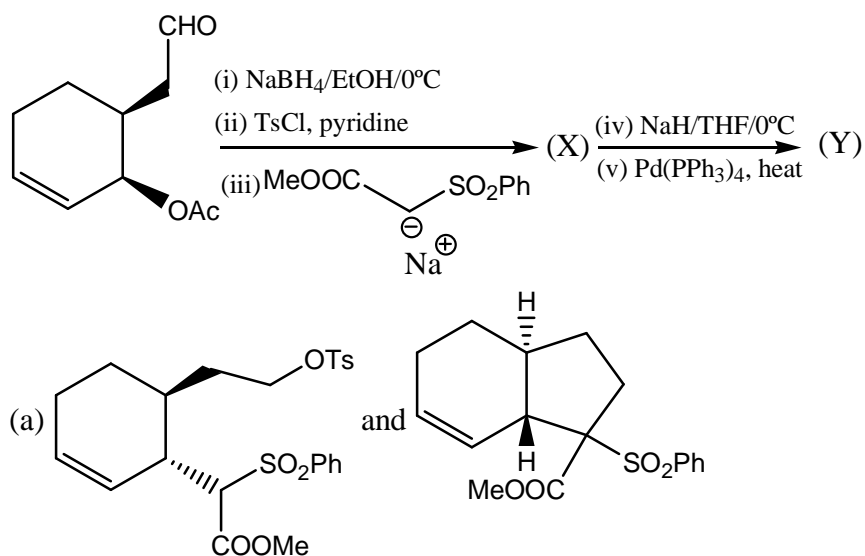


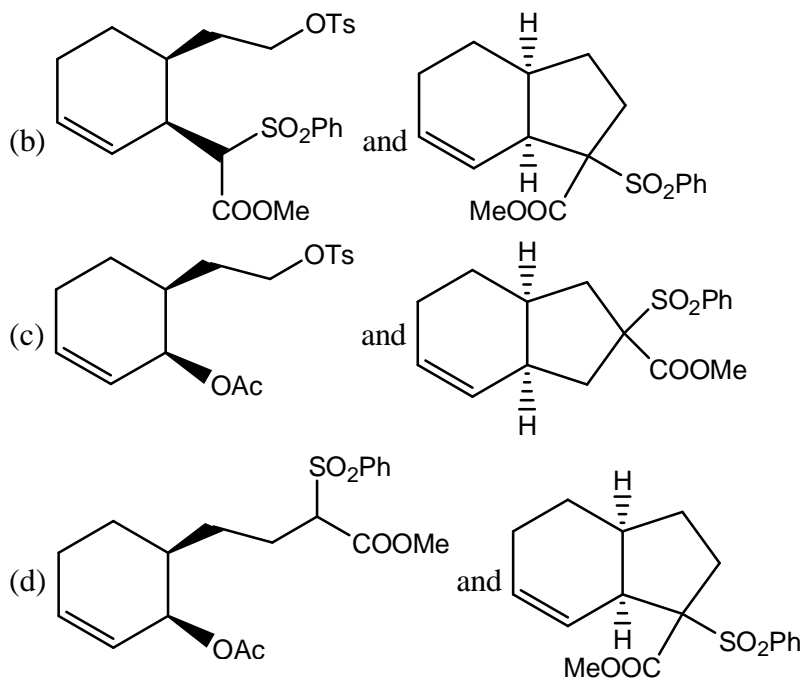


94. The major product (P) is

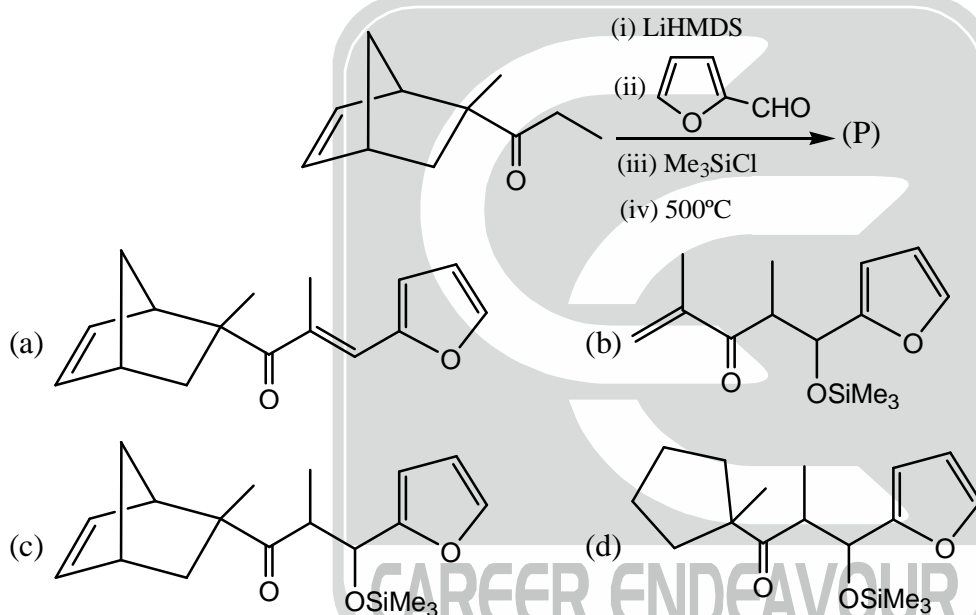


95. The major products (X) and (Y) respectively are

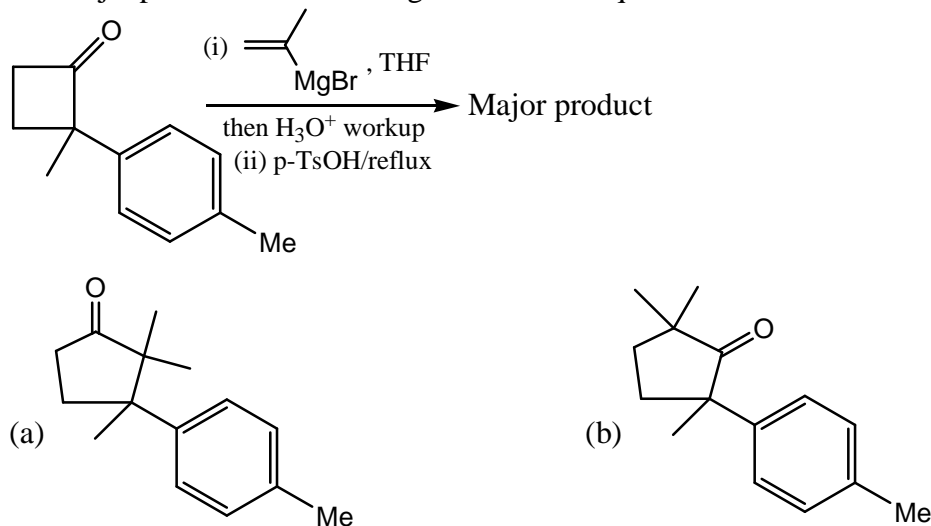


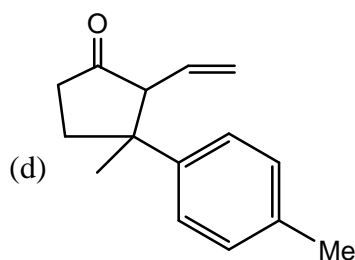
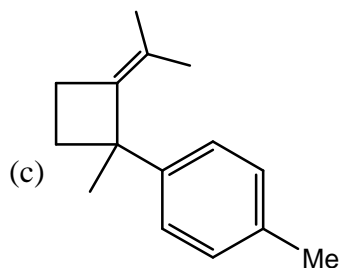


96. Give the final major product (P) in the following reaction sequence

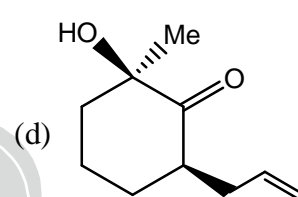
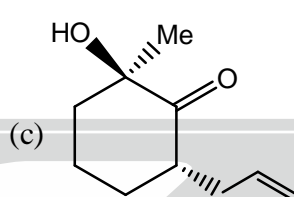
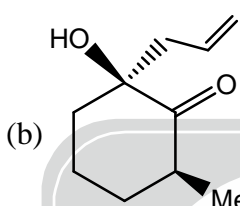
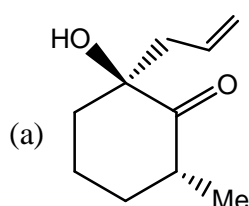
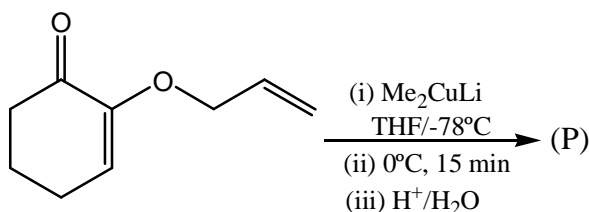


97. The major product formed in the given reaction sequence is

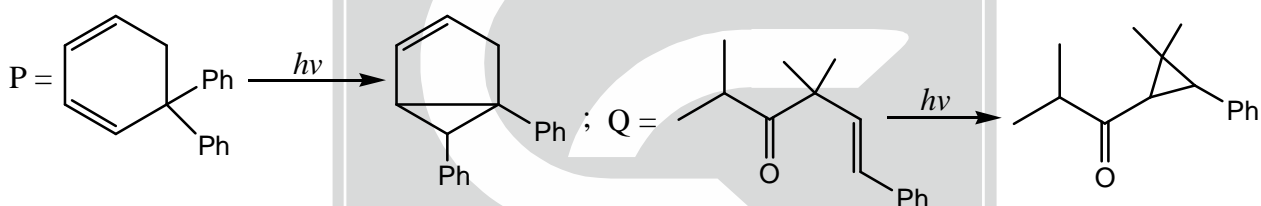




98. The major product (P) is



99. The following conversions are the examples of



(a) P = Oxo - Di -  $\pi$  - methane rearrangement (b) P = Di -  $\pi$  - methane rearrangement

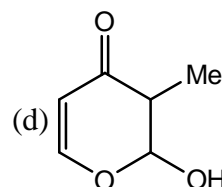
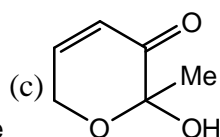
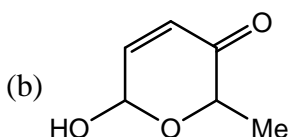
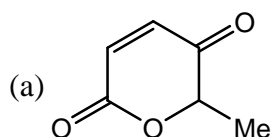
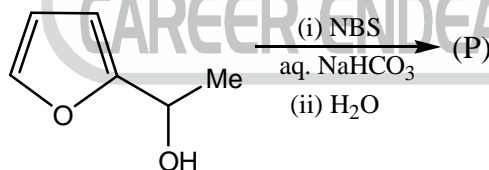
Q = Di -  $\pi$  - methane rearrangement

Q = Oxo - Di -  $\pi$  - methane rearrangement

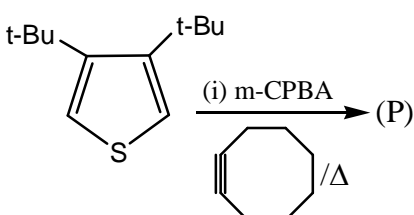
(c) P = Q = Di -  $\pi$  - methane rearrangement

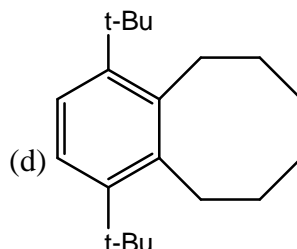
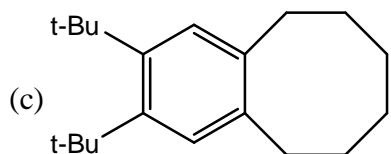
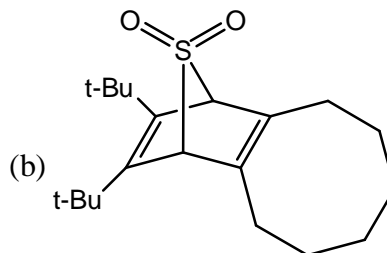
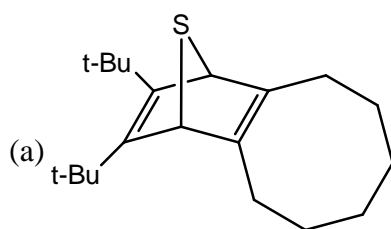
(d) P = Q = Oxo - Di -  $\pi$  - methane rearrangement

100. The major product (P) is



101. The major product (P) is





102. Total number of ESR lines and intensity pattern for given radical molecule  $\dot{\text{C}}\text{F}_2\text{H}$  is [Given:  $A(\text{H}) = 50 \text{ mT}$  and  $A(\text{F}) = 50 \text{ mT}$ ]

- (a) 6 lines, 1 : 2 : 1 : 2 : 1  
(c) 4 lines, 1 : 4 : 4 : 1

- (b) 4 lines, 1 : 3 : 3 : 1  
(d) 6 lines 1 : 2 : 3 : 3 : 2 : 1

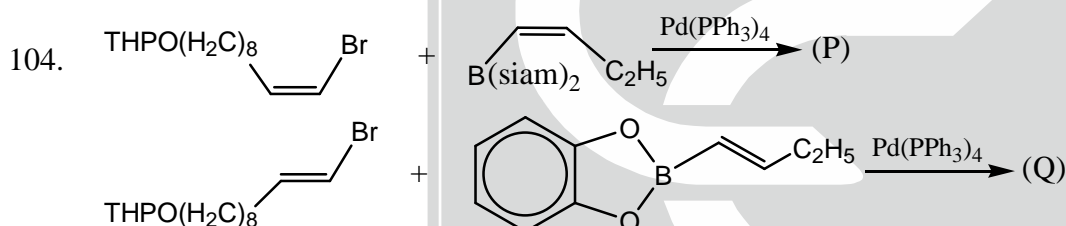
103. For octahedral high spin  $\text{Mn}^{2+}$  complex, zero field splitting result in the following number of Kramers' doublets is/are

(a) 4

(b) 2

(c) 3

(d) 1



The product (P) and (Q) in the above stereospecific synthetic transformation is

(a)  $\text{P} = \text{Q} =$

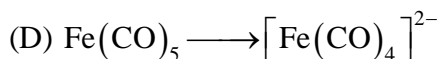
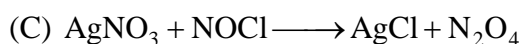
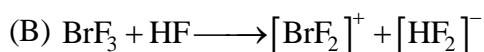
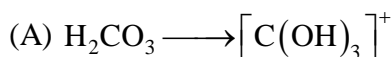
(b)  $\text{P} = \text{Q} =$

(c)  $\text{P} =$  and  $\text{Q} =$

(d)  $\text{P} =$  and  $\text{Q} =$

105. Match items in Column-I with items in Column-II

**Column-I**



**Column-II**

(I) Neutralization reaction

(II)  $[\text{H}_2\text{SO}_3\text{F}]^+$

(III) Lewis base behaviour of  $\text{BrF}_3$

(IV) Na in liq.  $\text{NH}_3$

The correct match is

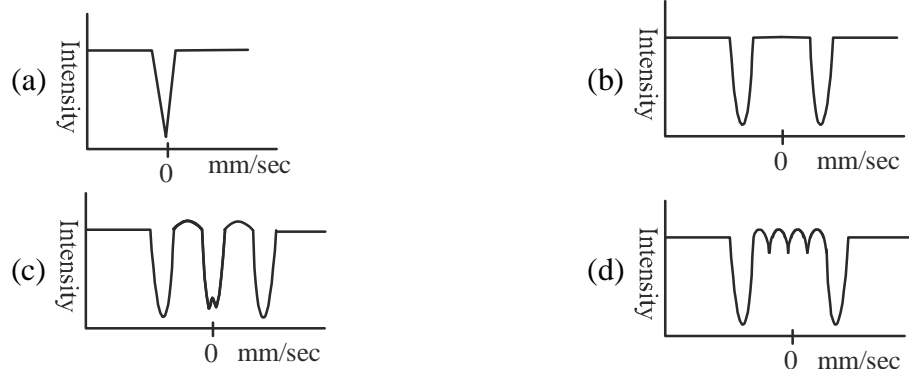
(a) A-II, B-I, C-IV, D-III

(c) A-IV, B-III, C-I, D-II

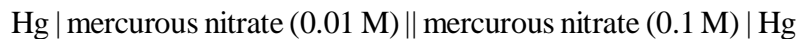
(b) A-II, B-III, C-I, D-IV

(d) A-I, B-III, C-II, D-IV

106. The correct Mossbauer spectrum for ferredoxins ( $\text{Fe}_4\text{S}_4$ ) in oxidised form is



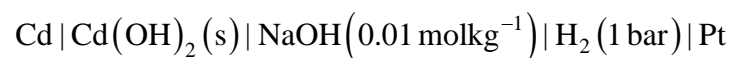
107. The emf of the cell



is found to be 0.0295 V at 25°C. The molecular formula of mercurous nitrate is

- (a)  $\text{HgNO}_2$       (b)  $\text{HgNO}_3$       (c)  $\text{Hg}_2(\text{NO}_3)_2$       (d)  $\text{Hg}(\text{NO}_3)_2$

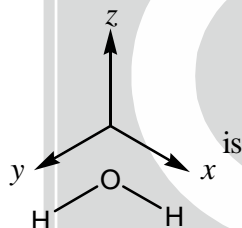
108. Given the cell,



with  $E_{\text{cell}} = 0.0\text{V}$  at 298K. If  $E_{\text{Cd}^{2+}|\text{Cd}}^0 = -0.058$ . The value of  $K_{\text{sp}}$  for  $\text{Cd}(\text{OH})_2$  is

- (a)  $10^{-20}$       (b)  $10^{-24}$       (c)  $10^{-26}$       (d)  $10^{-12}$

109. The reduction formula for stretching vibration for  $\text{H}_2\text{O}$  molecule as given below



- (a)  $2A_1 + B_1$       (b)  $A_1 + 2B_1$       (c)  $A_1 + B_1$       (d) None of these

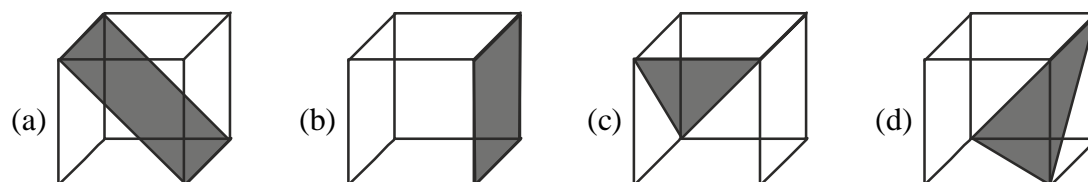
110. The volume of CO adsorbed on charcoal are given at

P	40	80
V	25	40

The reciprocal of slope of  $\frac{1}{V_{\text{ad}}} \text{ vs } \frac{1}{P}$  plot is approximately

- (a) 0.2      (b) 0.4      (c) 0.8      (d) 1

111. The Miller-Indices  $(1\bar{1}1)$  corresponds to the plane



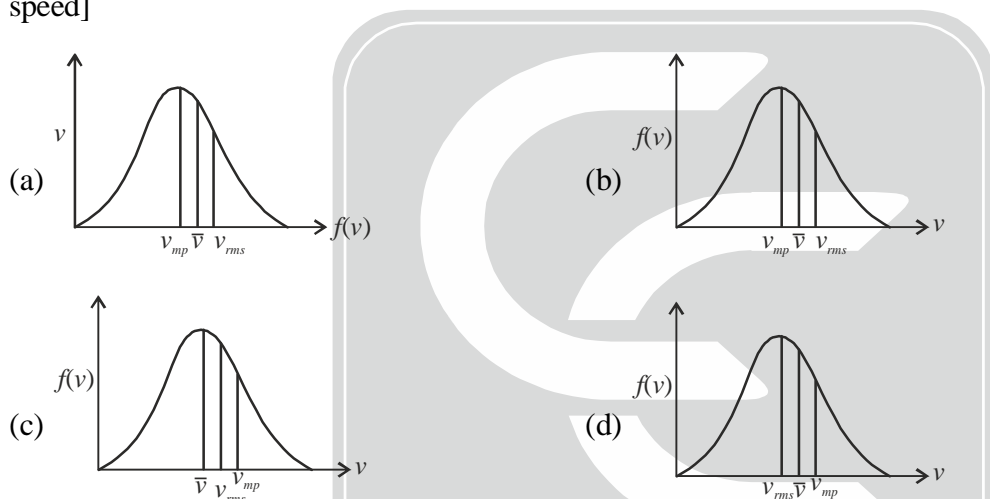


112. The hydrogenic orbital with the form of the radical function  $r^3(\alpha_1 - r)(\alpha_2 - r)(\alpha_3 - r)e^{-\beta r}$ , where  $\alpha_1, \alpha_2$  and  $\beta$  are constants may be identified as a  
 (a)  $4f$  (b)  $5f$  (c)  $6f$  (d)  $7f$
113. Consider the following data for a polymer sample

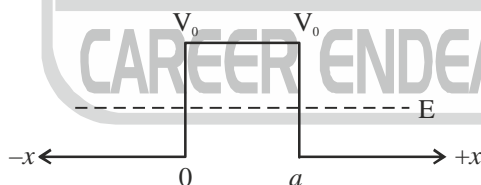
N	M
25	2000
25	2000

The value of P.D.I. (Polydispersity index) is

- (a) ONE (b) 1.5 (c) 4 (d) 2
114. The correlation coefficient between two arbitrary variables  $x$  and  $y$  is non-zero if  
 (1)  $\langle xy \rangle = \langle x \rangle \langle y \rangle$  (2)  $\langle xy \rangle = \langle yx \rangle$  (3)  $\langle x^2 \rangle = \langle x \rangle^2$  (4)  $\langle y^2 \rangle = \langle y \rangle^2$   
 (a) 1, 4 (b) 2, 3, 4 (c) 1, 3 (d) None of these
115. The correct graphical representation for different speed [root mean square, average speed, most probable speed]

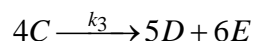
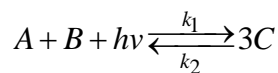


116. The term which is /are NOT acceptable in region III in following Barrier penetration is/are



- (a)  $e^{+kx}$  (b)  $e^{-kx}$  (c) both (a) and (b) (d) None of these
117. Consider the function,  $\psi = c_1\phi_1 + c_2\phi_2$  with energy of  $\frac{3}{2}$  unit. If the energy of  $\phi_1$  is 2 unit and energy of  $\phi_2$  is 1 unit. Then the amplitude of  $\phi_1$  is  
 (a)  $\frac{1}{2}$  (b)  $\frac{1}{\sqrt{2}}$  (c)  $\frac{1}{3}$  (d)  $\frac{1}{\sqrt{3}}$

118. For the reaction scheme given below



The rate of reaction is

(a)  $r = k_3 \left[ \frac{k_1}{3k_2} [A][B] I_a \right]^{4/3}$

(b)  $r = k_3 \left[ \frac{k_1}{k_2} [A][B] I_a \right]^{4/3}$

(c)  $r = k_3 \left[ \frac{k_1}{3k_2} I_a \right]^{4/3}$

(d)  $r = k_3 \left[ \frac{k_1}{k_2} I_a \right]^{4/3}$

119. Consider the wave function,

$$\psi(1,2) = \phi(1,2)\sigma(1,2)$$

$\phi$  is space part and  $\sigma(1,2)$  is spin part. If  $\phi(1,2) = -\phi(2,1)$

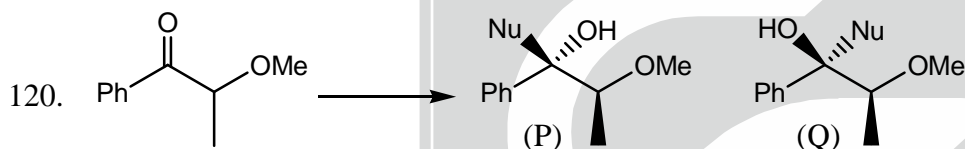
Then the spin part  $\sigma(1,2)$  would be

(a)  $\alpha(1)\beta(2) + \beta(1)\alpha(2)$

(b)  $\alpha(1)\beta(2) - \beta(1)\alpha(2)$

(c) both (a) and (b)

(d) none



The correct statement is

(a) With  $\text{NaBH}_4$  ( $\text{Nu} = \text{H}$ ) Q as a major product

(b) With  $\text{Me}_2\text{Mg}$  ( $\text{Nu} = \text{Me}$ ) P as major product

(c) Both  $\text{NaBH}_4$  and  $\text{Me}_2\text{Mg}$  gives (P) as a major product

(d)  $\text{NaBH}_4$  gives P and  $\text{Me}_2\text{Mg}$  gives Q as a major product

Space for rough work





## CHEMICAL SCIENCES

Date : 02-12-2018

## TEST SERIES-D (FULL LENGTH TEST-1)

## ANSWER KEY

## PART-A

1. (a)	2. (a)	3. (a)	4. (b)	5. (c)	6. (b)	7. (b)
8. (c)	9. (b)	10. (c)	11. (a)	12. (b)	13. (c)	14. (b)
15. (b)	16. (a)	17. (a)	18. (b)	19. (d)	20. (a)	

## PART-B

21. (a)	22. (c)	23. (b)	24. (d)	25. (b)	26. (a)	27. (d)
28. (c)	29. (c)	30. (d)	31. (a)	32. (a)	33. (b)	34. (b)
35. (a)	36. (b)	37. (d)	38. (b)	39. (b)	40. (d)	41. (b)
42. (a)	43. (a)	44. (b)	45. (d)	46. (b)	47. (b)	48. (b)
49. (b)	50. (b)	51. (a)	52. (a)	53. (c)	54. (a)	55. (a)
56. (c)	57. (a)	58. (b)	59. (b)	60. (a)		

## PART-C

61. (c)	62. (d)	63. (d)	64. (b)	65. (c)	66. (c)	67. (d)
68. (d)	69. (b)	70. (b)	71. (b)	72. (d)	73. (b)	74. (a)
75. (d)	76. (d)	77. (a)	78. (d)	79. (a)	80. (c)	81. (a)
82. (a)	83. (b)	84. (c)	85. (c)	86. (b)	87. (c)	88. (c)
89. (a)	90. (b)	91. (a)	92. (c)	93. (c)	94. (a)	95. (d)
96. (b)	97. (a)	98. (b)	99. (b)	100. (b)	101. (c)	102. (b)
103. (c)	104. (c)	105. (b)	106. (a)	107. (c)	108. (c)	109. (c)
110. (c)	111. (d)	112. (d)	113. (d)	114. (b)	115. (b)	116. (c)
117. (b)	118. (d)	119. (a)	120. (d)			

