

# TEST SERIES GATE 2018

BOOKLET SERIES **B**

Paper Code: CY

Test Type: TEST SERIES

Duration: 3:00 Hours

**CHEMISTRY-CY**

Date: 13-01-2018

Maximum Marks: 100

Read the following instructions carefully:

1. Attempt all the questions.
2. This question paper consists of **2 sections**, General Aptitude (GA) for **15 marks** and the subject specific GATE paper for **85 marks**. Both these sections are compulsory. The GA section consists of **10** questions. Question numbers 1 to 5 are of 1-mark each, while question numbers 6 to 10 are of 2-mark each. The subject specific GATE paper section consists of **55** questions, out of which question numbers 11 to 35 are of 1-mark each, while question numbers 36 to 65 are of 2-mark each.
3. The question paper may consist of questions of **multiple choice type (MCQ)** and **numerical answer type**.
4. Multiple choice type questions will have four choices against (a), (b), (c), (d), out of which only **ONE** is the correct answer.
5. For numerical answer type questions, each question will have a numerical answer and there will not be any choices.
6. All questions that are not attempted will result in zero marks. However, wrong answers for multiple choice type questions (MCQ) will result in **NEGATIVE** marks. For all MCQ questions a wrong answer will result in deduction of  $\frac{1}{3}$  marks for a **1-mark** question and  $\frac{2}{3}$  marks for a **2-mark** question.
7. There is **NO NEGATIVE MARKING** for questions of **NUMERICAL ANSWER TYPE**.
8. Non-programmable type Calculator is allowed

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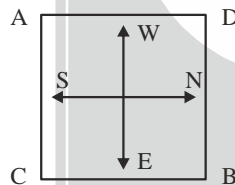


**Q.1-Q. 5 carry ONE mark each.**

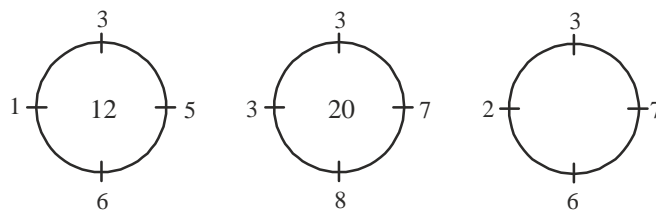
- Choose the most appropriate word from the options given below to complete the following sentence.  
Privacy is \_\_\_\_\_ by laws relating to defamation, under the Indian Penal Code.  
(a) secluded (b) derived (c) protected (d) confined
- Four persons are chosen at random from a group of 3 men, 2 women and 4 children. The chance that exactly 2 of them are children is  
(a)  $\frac{1}{9}$  (b)  $\frac{1}{5}$  (c)  $\frac{1}{12}$  (d)  $\frac{10}{21}$
- A clock is started at noon. By 10 minutes past 5 the hour hand has turned through  
(a)  $145^\circ$  (b)  $150^\circ$  (c)  $155^\circ$  (d)  $160^\circ$
- If every side of a triangle is doubled, the area of the new triangle is k times the area of the old one. K is equal to  
(a)  $\sqrt{2}$  (b) 2 (c) 3 (d) 4
- Find the wrong term of series  
4 9 19 43 90 185 375  
(a) 9 (b) 19 (c) 90 (d) 185

**Q.6-Q. 10 carry TWO marks each.**

- Which one of the following options is the closest in meanings to the word given below?  
**Mitigate:**  
(a) Diminish (b) Divulge (c) Dedicate (d) Denote
- Which of the following options is the closest in meaning to the word below- "Circuitous"  
(a) Cyclic (b) Indirect (c) Confusing (d) Crooked
- Following diagram showing four persons stationed at the four corners of a square piece of plot as shown



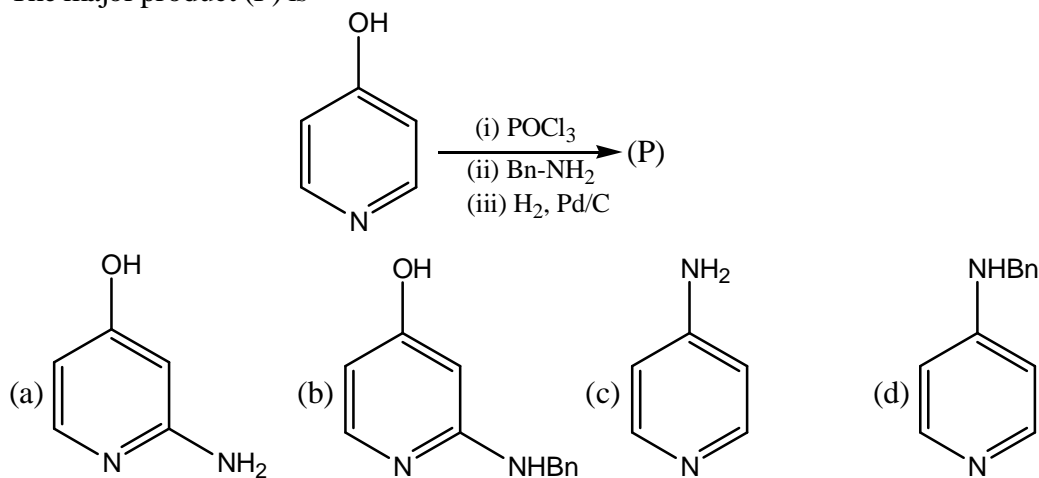
- From the original position, D and B move one and a half length of sides, clockwise and anticlockwise respectively. Which one of the statement is true
- B and D are both at the mid point between A and C
  - D is the mid point between A and C and B is at the corner originally occupied by C
  - B is at the mid point between original position of A and D and D is at the mid point between original positions of B and C
  - B is at the mid point between A and C and D is at the mid point between original positions of B and C
- A is twice as fast as B and B is thrice as fast as C. The journey covered by C in 54 minutes will be covered by B in  
(a) 18 min (b) 27 min (c) 38 min (d) 9 min
  - Find missing number



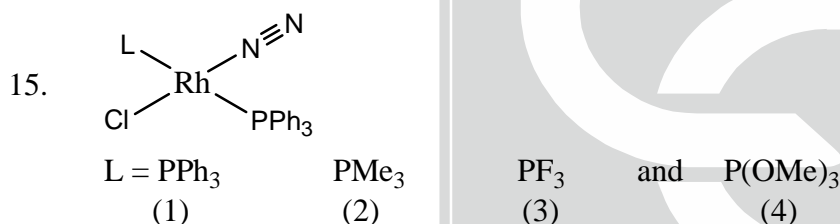
- 10
- 15
- 20
- 25

**Q.11-Q.35 carry one mark each.**

11. Under adiabatic condition to increase the pressure from  $P_1$  to  $P_2$ , the system  
 (a) must loss the energy (b) must gain the energy  
 (c) above process is not possible as  $q = 0$  (d) it can happen by either gain or loss of energy
12. The major product (P) is



13. The reaction between red phosphorous and  $\text{NaClO}_2$  yield hypophosphoric acid. The molecular formula of hypophosphoric acid is  
 (a)  $\text{H}_5\text{P}_3\text{O}_{10}$  (b)  $\text{H}_4\text{P}_2\text{O}_7$  (c)  $\text{H}_3\text{PO}_4$  (d)  $\text{H}_4\text{P}_2\text{O}_6$
14. The number of P-P and P-O-P bond in hypophosphoric acid is/are respectively  
 (a) 1 and 1 (b) 0 and 1 (c) 1 and 0 (d) 0 and 3



- Arrange the dinitrogen complex in order of their increasing N-N bond length  
 (a)  $1 > 2 > 3 > 4$  (b)  $2 > 1 > 4 > 3$  (c)  $4 > 2 > 1 > 3$  (d)  $3 > 4 > 1 > 2$
16. The I.R. active vibrations in  $\text{ClF}_3$  molecule are  
 (a) 6 (b) 4 (c) 3 (d) 2
17. The electronic energy levels of any hypothetical atom 'X' is determined from spectroscopy, are as follows:

Energy Level	Energy
$^2P_{3/2}$	0
$^2P_{1/2}$	$\frac{kT}{2}$
$^2D_{3/2}$	$2kT$

The electronic partition function ( $q_{el}$ ) for the atom 'x' is:

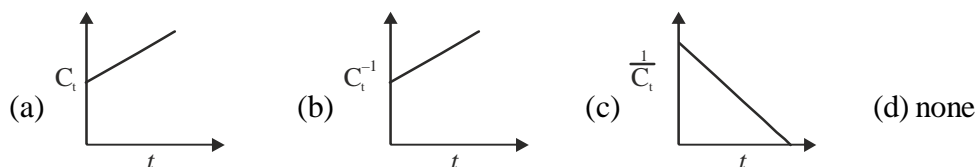
- (a)  $e^{-\frac{1}{2}} + e^{-2}$  (b)  $1 + e^{-\frac{1}{2}} + e^{-2}$  (c)  $4 + 2e^{-\frac{1}{2}} + 6e^{-2}$  (d)  $1 + 2e^{-\frac{1}{2}} + 6e^{-2}$
18. Mass average and viscosity average molar mass become equal for the Mark-Houwink exponent is \_\_\_\_\_

19. The angular nodes corresponding to the angular wave function

$$\frac{5}{2} \sin \theta \cos \theta (7 \cos^2 \theta - 3) \text{ is/are}$$

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

20. The 2nd order reaction is represented by



21. The angle between the planes (100) and (110) is

- (a)  $30^\circ$  (b) more than  $30^\circ$  but less than  $45^\circ$   
(c)  $45^\circ$  (d) more than  $45^\circ$

22. In Freundlich adsorption isotherm, the value of  $\frac{1}{n}$  is

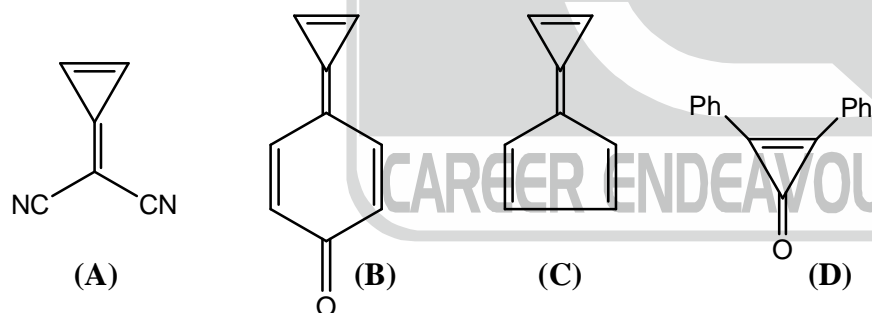
- (a) 1 in case of physisorption (b) 1 in case of chemisorption  
(c) between 0 and 1 in all cases (d) between 2 and 4 in all cases

23. The number of signal for  $^{31}\text{P}$  NMR in  $\text{P}_4\text{S}_9$  molecule is

- (a) doublet and triplet (b) two doublet  
(c) two triplet (d) singlet and doublet

24. Number of chloro ligand coordinate with Cr(III) species formed soon after electron transfer between  $[\text{IrCl}_6]^{-2}$  and  $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$  is/are \_\_\_\_\_

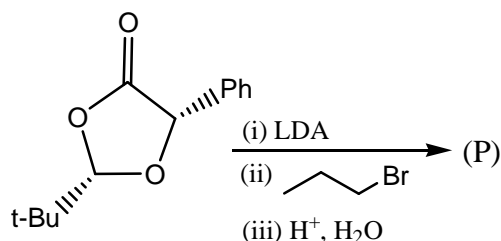
25. Consider the given four entities

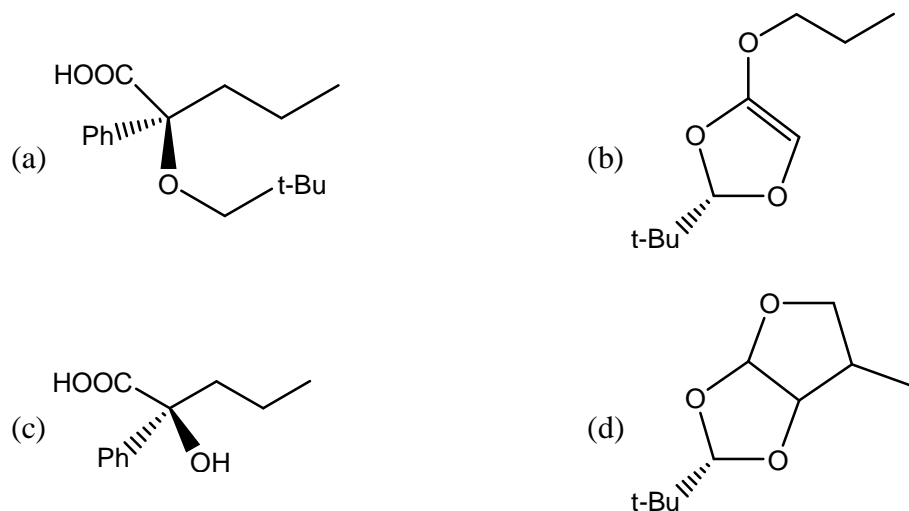


Which of the following above compounds exhibit aromaticity

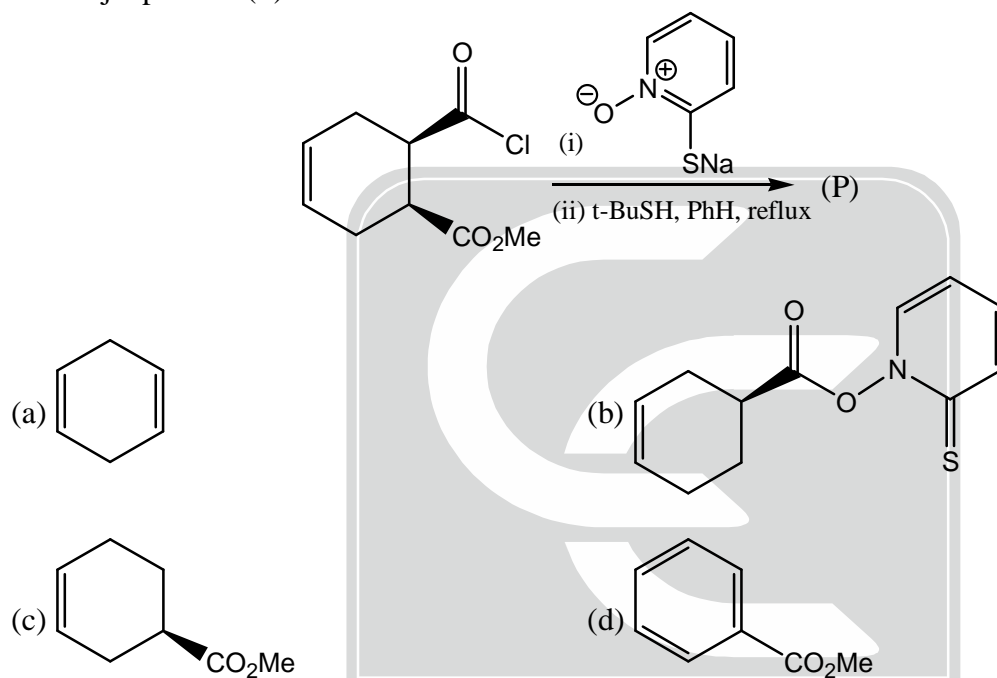
- (a) A and D only (b) A, B and D only (c) B, C and D only (d) All of the above

26. The major product (P) is

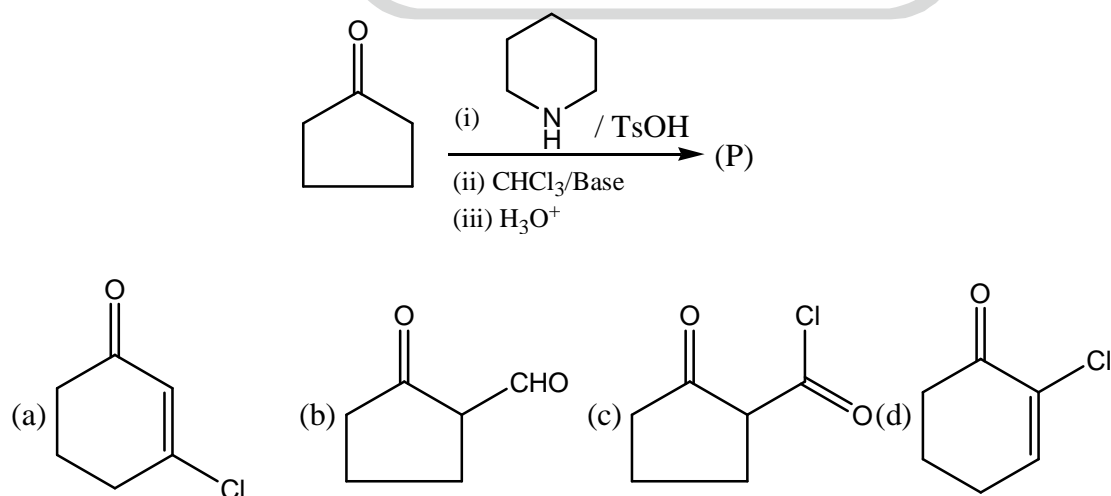




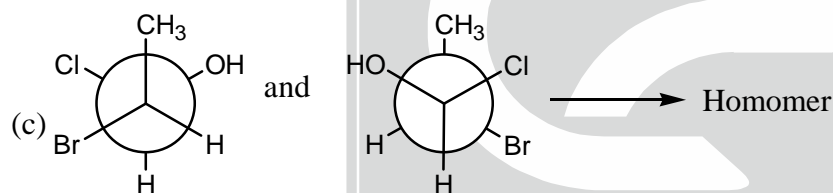
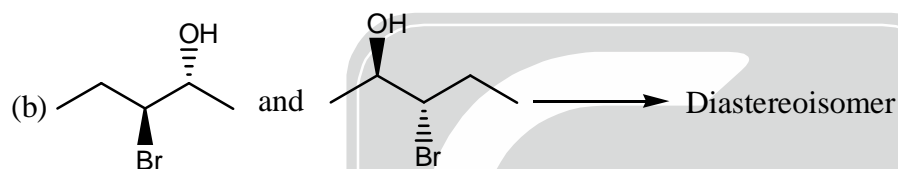
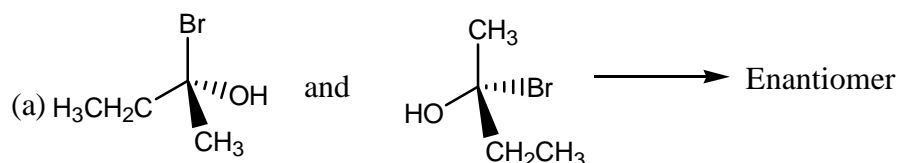
27. The major product (P) is

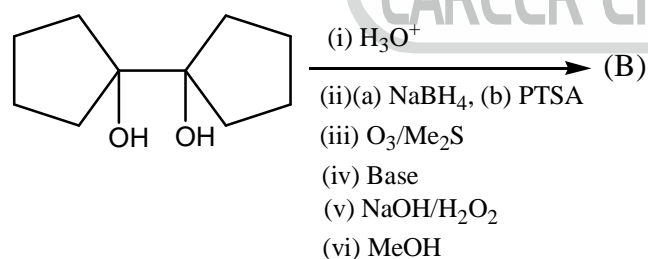


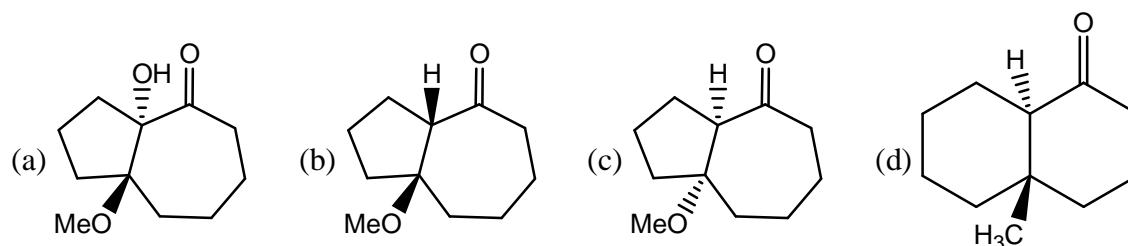
28. The major product (P) is



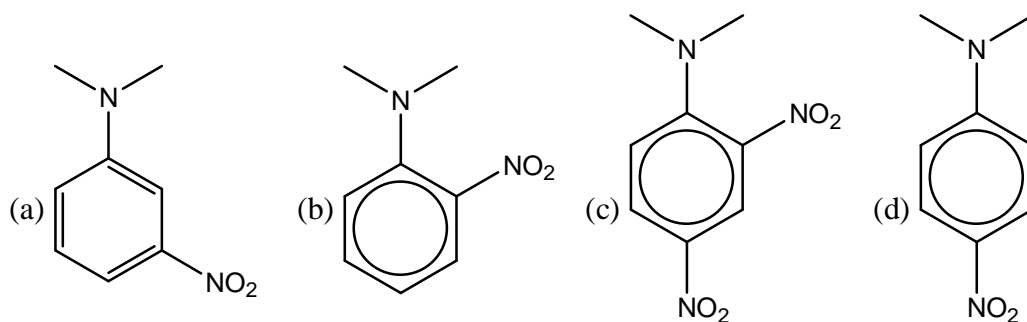
29. The incorrect order of acids and bases is
- (a)  $\text{CH}_3\text{NH}_2 > \text{NH}_3 > \text{H}_2\text{N}-\text{NH}_2 > \text{NH}_2\text{OH}$  (bases)
- (b)  $\text{SiF}_4 > \text{SiCl}_4 > \text{SiBr}_4 > \text{SiI}_4$  (acids)
- (c)  $\text{SnF}_4 > \text{CH}_3\text{SnF}_3 > (\text{CH}_3)_2\text{SnF}_2 > (\text{CH}_3)_3\text{SnF}$  (acids)
- (d)  $\text{BH}_3 < \text{BMe}_3 < \text{BF}_3 < \text{BCl}_3$  (acids)
30. The number of neutron emitted when  ${}^{235}_{92}\text{U}$  undergoes controlled nuclear fission to  ${}^{142}_{54}\text{Xe}$  and  ${}^{90}_{30}\text{Sr}$  is \_\_\_\_\_
31. The total number of Alkene possible by dehydrobromination of 3-bromo-3-cyclopropylhexane using alcoholic KOH is \_\_\_\_\_
32. Match the *incorrect* relationship with appropriate statement



33.  (B)



34. The major product formed on nitration of N, N-dimethyl aniline with conc.  $\text{H}_2\text{SO}_4$  and conc.  $\text{HNO}_3$ ?



35. When a reduced cytochrome transfer an electron from its Fe (II) to the bound  $\text{O}_2$

- (a) the bond order of  $\text{O}_2$  is reduced by one and  $\nu_{\text{O}_2}$  decreases  
 (b) A metal bound super oxide is formed and  $\nu_{\text{O}_2}$  decreases  
 (c) A metal bound super oxide is formed and  $\nu_{\text{O}_2}$  increases  
 (d) the bond order of  $\text{O}_2$  is reduced by one and  $\nu_{\text{O}_2}$  increases

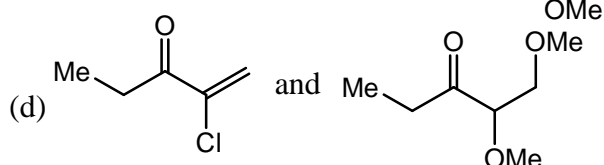
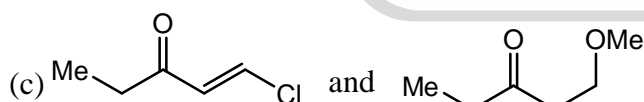
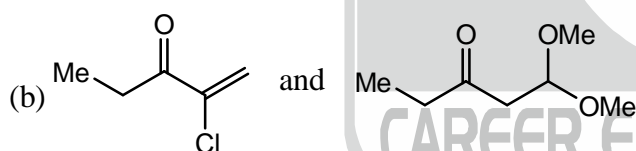
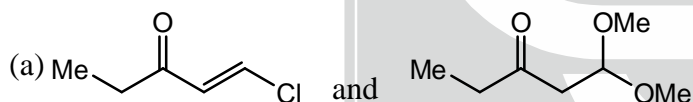
**Q.36-Q.65 carry TWO marks each.**

36. Identify intermediate A and product B for given reaction. The spectroscopic data are given



**A** :  $^1\text{H NMR}$  : 0.96(t, J 7.0 Hz, 3H), 2.40(q, J 7.0 Hz, 2H), 6.31(d, J 14.0 Hz, 1H), 7.11(d, J 14.0 Hz, 1H)

**B** :  $^1\text{H NMR}$  : 0.99(t, J 7.0 Hz, 3H), 2.39(q, J 7.00 Hz, 2H), 2.57(d, J 5.0 Hz, 2H), 3.28(s, 6H), 4.68(t, J 5.0 Hz, 1H)



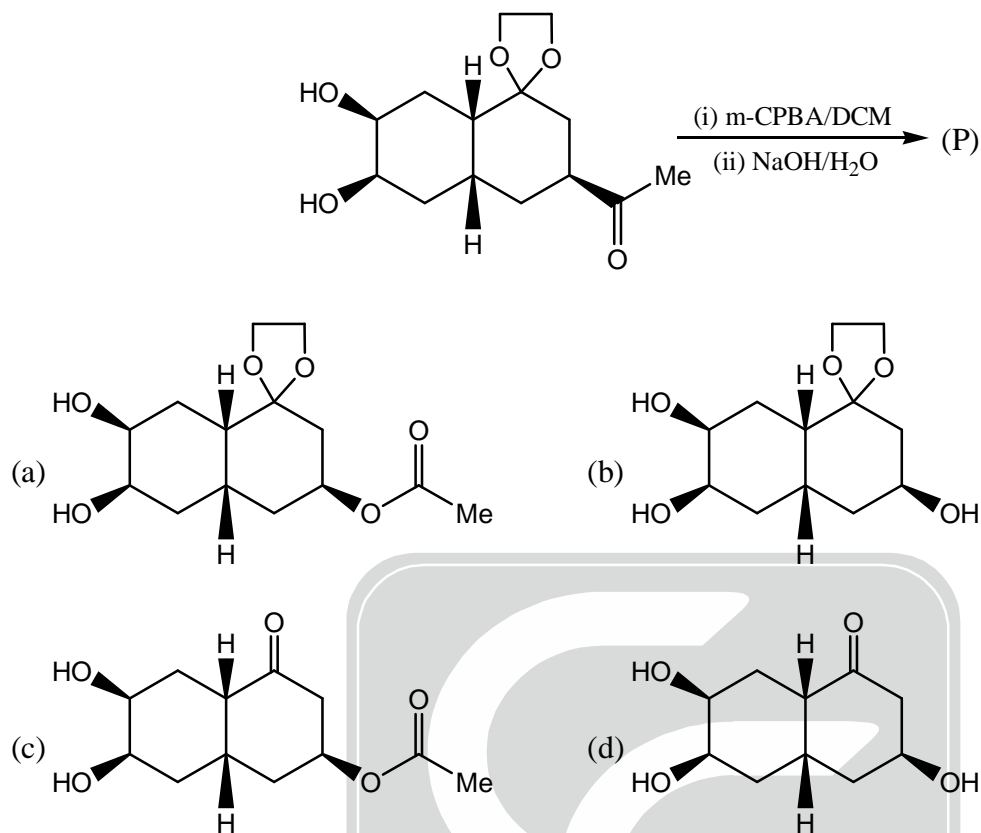
37. The temperature of reservoirs are maintained at 300K and 500K. The work done required to transfer 90 kJ of energy from reservoir at lower temperature to reservoir at high temperature is \_\_\_\_\_ kJ

38. The dielectric constant of 0.2M NaCl solution is 144 and 0.2 M  $\text{MgCl}_2$  solution is 225. The relation of temperature at which the Debye-Huckel screening length is same for both solution is

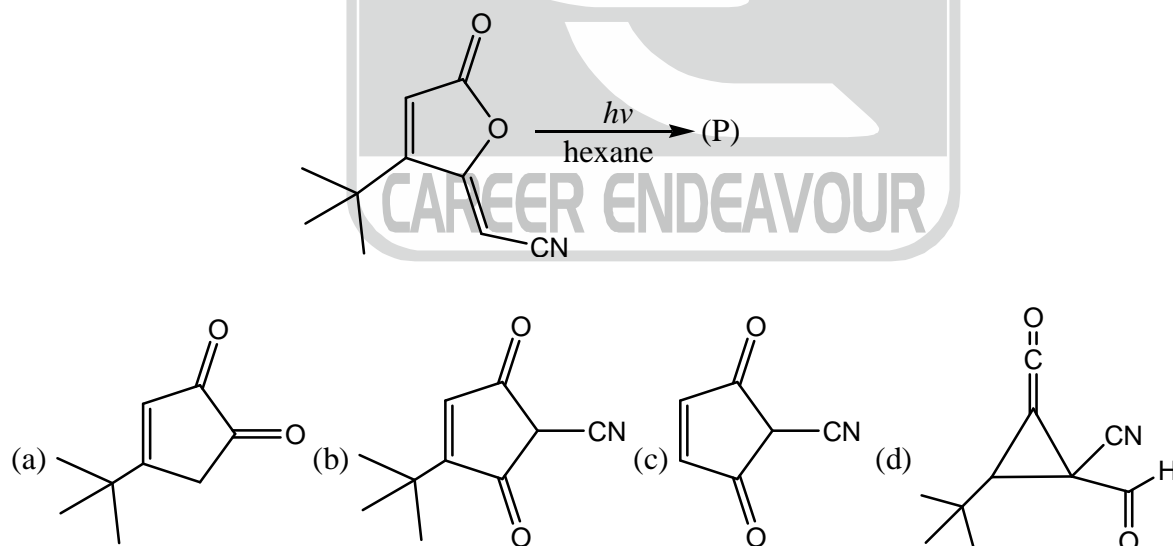
- (a)  $T_{\text{MgCl}_2} = 0.39 T_{\text{NaCl}}$  (b)  $T_{\text{MgCl}_2} = 0.93 T_{\text{NaCl}}$   
 (c)  $T_{\text{NaCl}} = 0.39 T_{\text{MgCl}_2}$  (d)  $T_{\text{NaCl}} = 0.93 T_{\text{NaCl}}$

39. In polarographic experiment, diffusion current was  $10 \mu\text{A}$  with  $10^{-2} \text{M}$  solution of  $\text{MX}_2$ . On doing the experiment with same metal solution of  $0.10 \text{M}$ , the applied voltage was  $-0.72 \text{V}$  when current recorded was  $7 \mu\text{A}$ . The value of  $E_{1/2}$  is \_\_\_\_\_ V.

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



41. The major product (P) is



42. Among the following the incorrect statement(s) about the amino acids is/are

(A) Proline is the amino acid which doesn't undergo diazotization reaction with  $\text{HNO}_2$ .

(B) Phenylisothiocyanate is called an Edmann reagent

(C) Methionine has  $-\text{SMe}$  group

(D) Tyrosine gives the negative phenol test

(a) A and B only

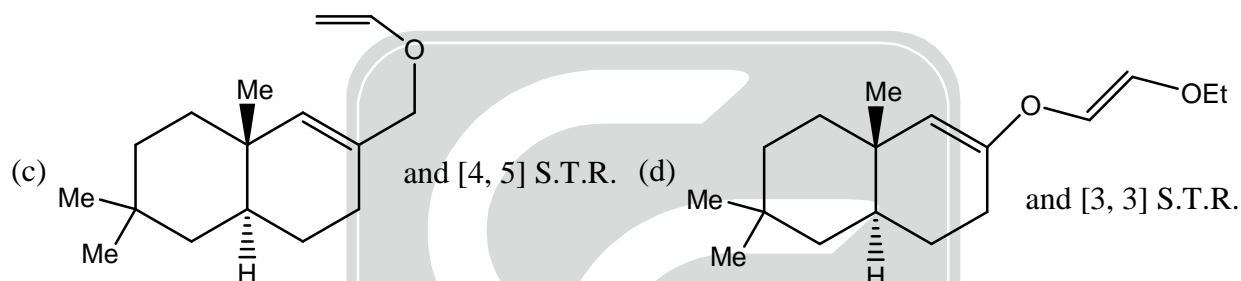
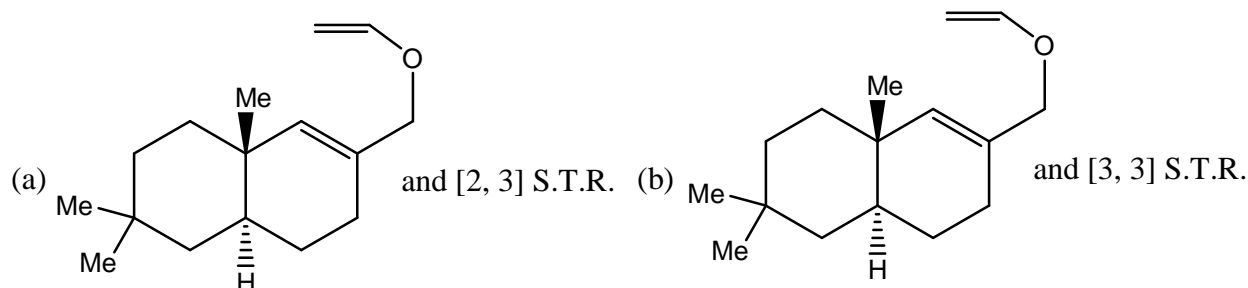
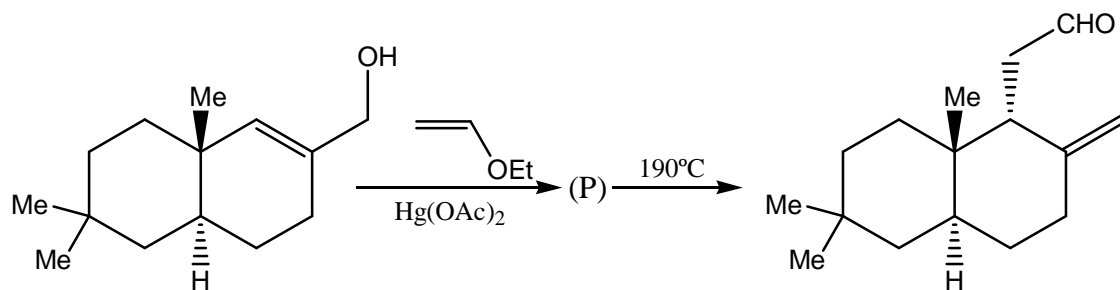
(b) C only

(c) B and C only

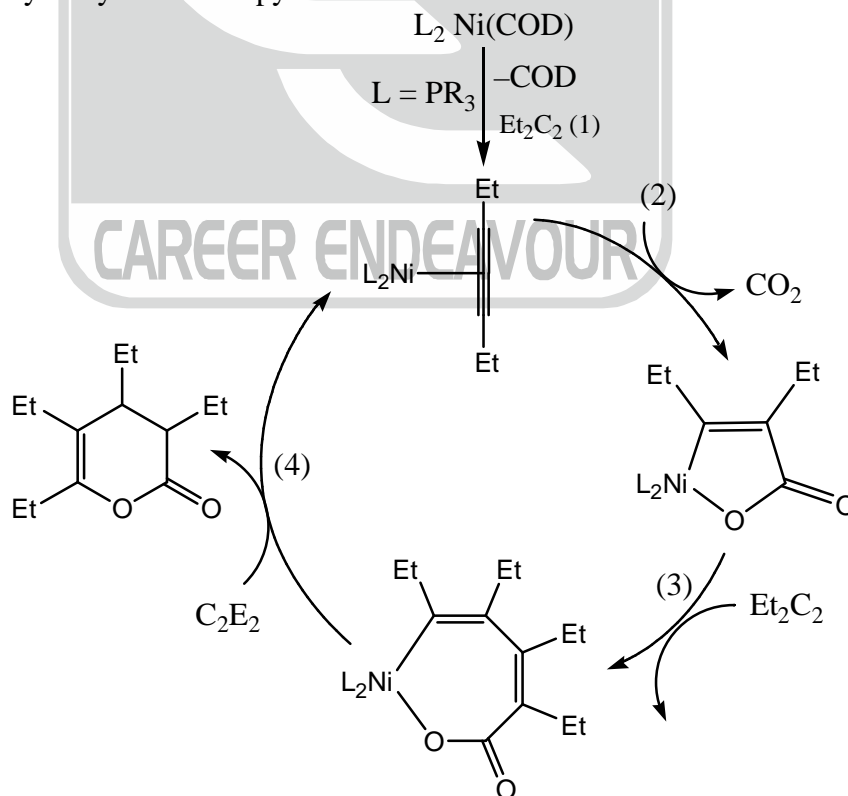
(d) C and D only



43. The intermediate (P) and the rearrangement involved in the following reaction sequence is



44. Consider the Ni(O) catalysed synthesis of 2-pyrone

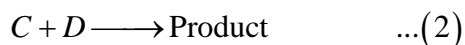
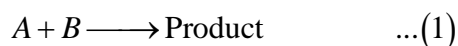


The step (1), (2), (3) and (4) involved in above catalytic cycle are respectively

(a) Coordination of  $\text{Et}_2\text{C}_2$ , insertion of  $\text{CO}_2$ , insertion of  $\text{Et}_2\text{C}_2$  and release of 2-pyrone.

- (c) Coordination of  $\text{Et}_2\text{C}_2$ , insertion of  $\text{CO}_2$  oxidative addition of  $\text{Et}_2\text{C}_2$  and  $\beta$ -elimination  
 (c) Oxidative addition of  $\text{Et}_2\text{C}_2$ , insertion of  $\text{CO}_2$ , oxidative addition of  $\text{Et}_2\text{C}_2$  and reductive elimination of 2-pyrone.  
 (d) Coordination of  $\text{Et}_2\text{C}_2$ , insertion of  $\text{CO}_2$  oxidative addition of  $\text{Et}_2\text{C}_2$  and  $\alpha$ -elimination
45.  $\text{OC} = \text{Mo}(\text{CO})_5 \xleftarrow{\text{O}} \text{OC} = \text{CH}_2$ ;  $\text{Cp}(\text{CO})_2 \text{Mo} \equiv \text{CR} \xleftarrow{\text{O}} \text{Acetylene}$   
 $\{\text{CpRh}(\text{CO})\}_2 (\mu\text{CH}_2) \xleftarrow{\text{O}} \text{Cyclopropane}$   
 Number of complexes with correct isolobal relationship is/are \_\_\_\_\_
46. Identify the correct statement  
 When the ligand donot sterically control the coordination geometry then  
 (a) 4 coordinate complexes of Cu(I) is square planar geometry  
 (b) 4 coordinate complex of Pd (II) is tetrahedral geometry  
 (c) 4 coordinate complex of Zn(II) is square planar geometry  
 (d) 4 coordinate complex of Zn(II) is tetrahedral geometry
47. Arrange the following complex in decreasing wavelength LMCT absorption ( $\lambda_{\text{max}}$  in nm)  
 $\text{A} = \text{ReO}_4^-$ ,  $\text{B} = \text{MoO}_4^{2-}$ ,  $\text{C} = \text{WS}_4^{2-}$ ,  $\text{D} = \text{ReS}_4^{2-}$   
 (a)  $\text{A} > \text{B} > \text{C} > \text{D}$  (b)  $\text{B} > \text{C} > \text{A} > \text{D}$  (c)  $\text{C} > \text{B} > \text{D} > \text{A}$  (d)  $\text{D} > \text{C} > \text{B} > \text{A}$
48. Select the true statement about Fluorescence spectroscopy of the molecules in the UV-visible region  
 (a) Emission usually occurs at energies that are greater than the energies of excitation  
 (b) Emission usually occurs at energies that are less than the energies of excitation  
 (c) Emission usually occurs at the energies that are equal to the energies of the excitation  
 (d) none of the above
49. The symmetry operation  $\text{S}_6^2$  brings some molecule in an orientation that can also be obtained by performing  
 (a) Inversion centre (b) A two-fold axis of symmetry  
 (c) A three fold axis of symmetry (d) A six-fold axis of symmetry
50. The co-ordination number of anion in case of sphalerite and wurtzite structure are respectively  
 (a) 4 and 4 (b) 4 and 8 (c) 8 and 4 (d) none
51. The difference between two consecutive energy levels in a 1-D box of width  $a$  is  
 (a)  $\frac{\pi^2 \hbar^2}{2ma^2} (2n+1)$  (b)  $\frac{\pi^2 \hbar^2}{2ma^2} (2n+1)$  (c)  $\frac{\pi^2 \hbar^2}{4ma^2} (2n+1)$  (d)  $\frac{\pi^2 \hbar^2}{2ma^2} (2n+1)$

52. Consider the reactions,



species	$M$ (g/mole)	Diameter (nm)
A	2	1
B	4	3
C	6	2
D	8	4

The ratio of squares of pre-exponential factors of reaction (1) and (2) is \_\_\_\_\_

53. The rate dependence for a particular reaction at a particular temperature is given by

$$\ln k = 5 - \frac{13000}{T}$$

The activation energy at 130K is ( $R = 2 \text{ cal K}^{-1} \text{ mole}^{-1}$ ) \_\_\_\_\_ kcal mole<sup>-1</sup>

54. In cyclobutadiene molecule, according to Huckel molecular orbital theory the transition leading to electric excitation for **MINIMUM** wavelength corresponds to an energy gap of

- (a)  $1\beta$                       (b)  $2\beta$                       (c)  $3\beta$                       (d)  $4\beta$

55. The chemical shift values for inner and outer-protons in 18-annulene appears respectively at

- (a) 6 Hs at 9 ppm and 12 Hs at  $-1.8$  ppm                      (b) 6 Hs at  $-1.8$  ppm and 12 Hs at 9 ppm  
(c) 8 Hs at 9 ppm and 10 Hs at  $-1.8$  ppm                      (d) 8 Hs at  $-1.8$  ppm and 10 Hs at 9 ppm.

56. In a one-dimensional oscillator, two orthonormal states are defined as

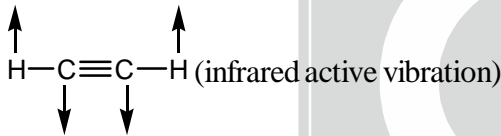



$$\psi_1 = \phi_0 - 2\phi_1 + 3\phi_2$$

$$\psi_2 = \phi_0 - \phi_1 + \alpha\phi_2$$

The expectation value of energy in  $\psi_2$  state is

- (a)  $\frac{1}{2}\hbar\omega$                       (b)  $\frac{3}{2}\hbar\omega$                       (c) 0                      (d) none

57. The correct statement in the following mode of vibrational acetylene molecule is/are

- (1)  (infrared active vibration)                      (2)  (infrared inactive vibration)  
(3)  (infrared inactive vibration)                      (4)  (infrared inactive vibration)
- (a) 1, 3                      (b) 2, 3                      (c) 3, 4                      (d) 1, 2, 4

58. The first rotational absorption of  $^{12}\text{C } ^{16}\text{O}$  is found to occur at  $3.842 \text{ cm}^{-1}$  while that of  $^{13}\text{C } ^{16}\text{O}$  at  $3.6734 \text{ cm}^{-1}$  (assuming the molar masses of  $^{16}\text{O}$  and  $^{12}\text{C}$  as  $15.999 \text{ gmol}^{-1}$  and  $12.000 \text{ g mol}^{-1}$ . The molar mass of  $^{13}\text{C}$  is \_\_\_\_\_ g/mol.

59. Correct statement(s) regarding f-block elements are

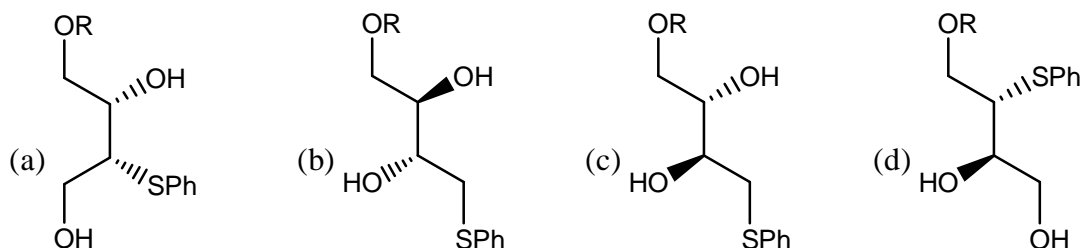
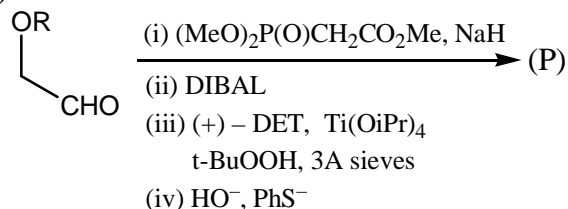
- (I)  $\text{LaI}_2$ ,  $\text{CeI}_2$ ,  $\text{GdI}_2$  show metallic conductivity  
(II)  $\text{An}^{3+}$  ions generally have more intense colour than  $\text{Ln}^{3+}$  ions.  
(III)  $\text{Ce}^{3+}$  and  $\text{Tb}^{3+}$  show broad peak in UV region  
(IV) Reducing power of  $\text{Ln}^{2+}$  follows the order,  $\text{Eu}^{2+} < \text{Yb}^{2+} < \text{Sm}^{2+} < \text{Tm}^{2+}$
- (a) I, III, IV                      (b) I, II, III, IV                      (c) I, II, IV                      (d) II, III, IV

60. Trimeric phosphozenes are usually planar but can be forced out of this geometry. In contrast benzene derivatives are strictly planar. This is due to

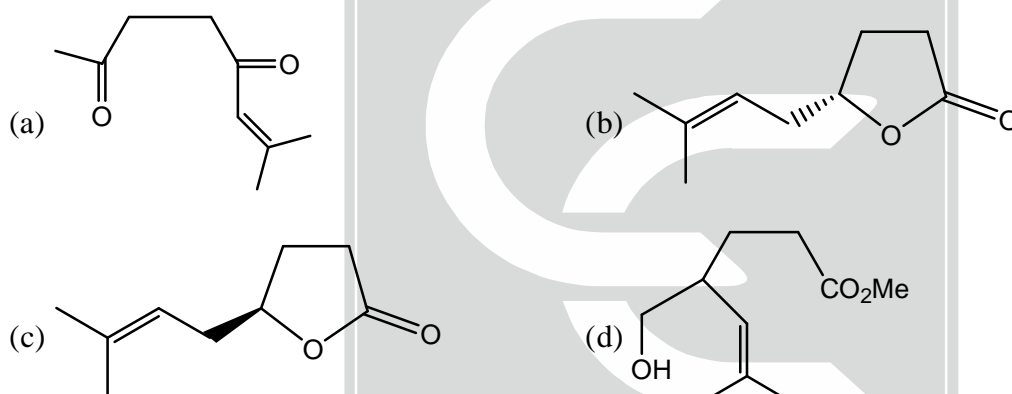
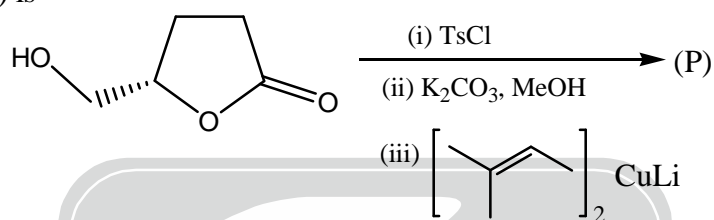
- (a) more diffuse nature of d-orbitals  
(b) more diffuse nature of p-orbital  
(c) strong  $p_\pi - p_\pi$  bonding in phosphazenes in non-planar structure  
(d) weak  $p_\pi - d_\pi$  bonding in phosphazenes in planar structure.



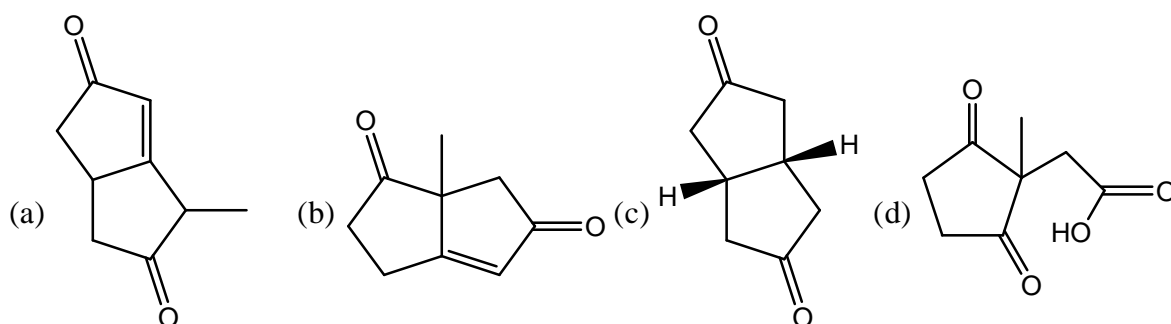
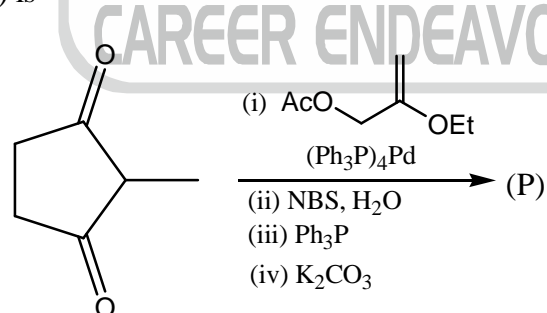
61. The major product (P) is



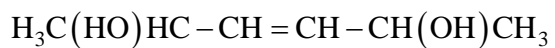
62. The major product (P) is



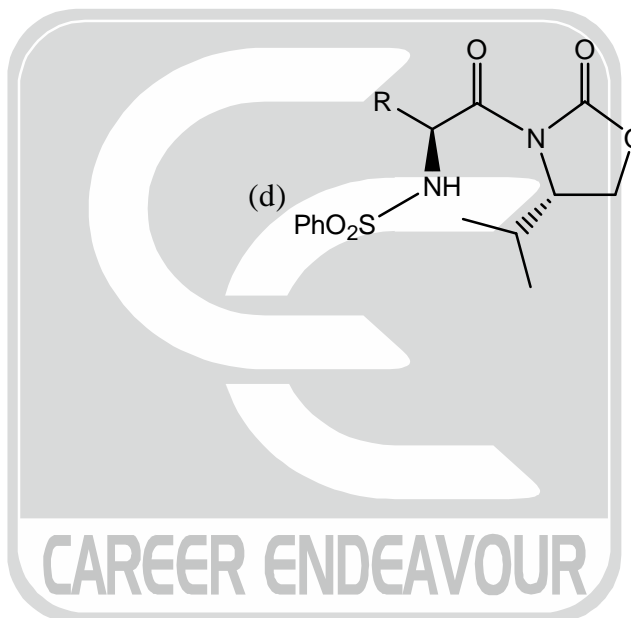
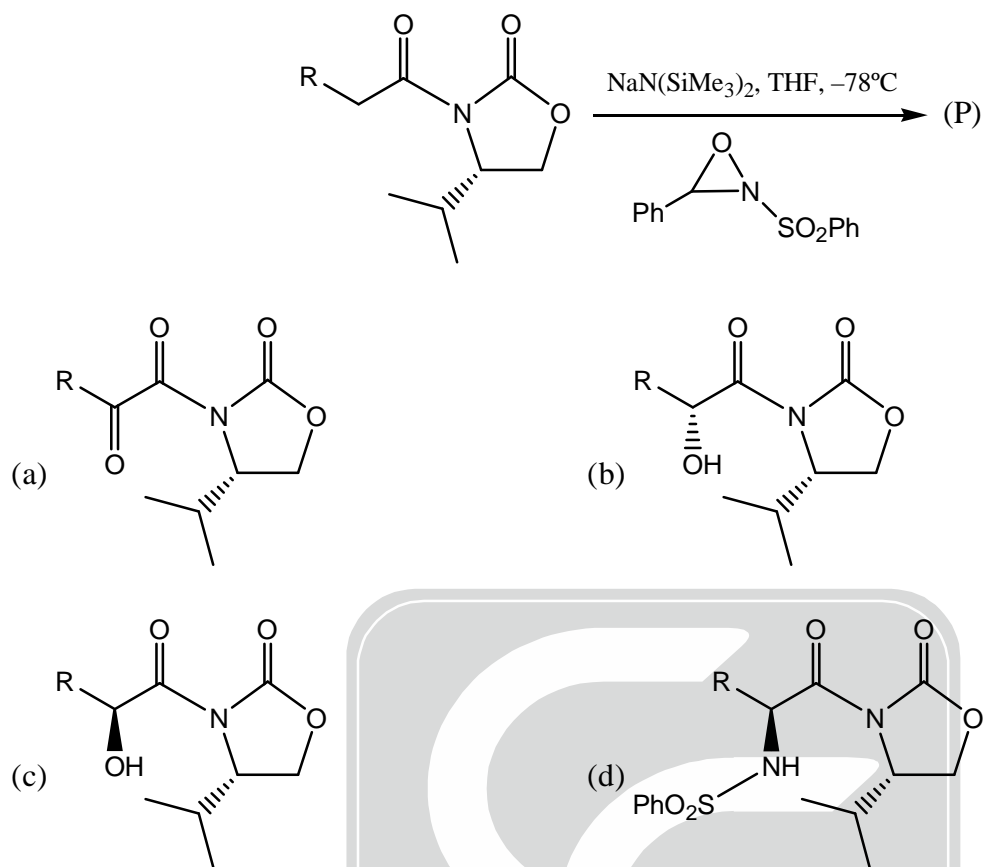
63. The major product (P) is



64. The total number of stereoisomer possible for the given compound \_\_\_\_\_



65. The major product (P) is



*Space for rough work*



**CHEMISTRY - CY****GATE TEST SERIES-B****Date: 13-01-2018****ANSWER KEY**

- |                |                |                      |                    |
|----------------|----------------|----------------------|--------------------|
| 1. (c)         | 2. (d)         | 3. (c)               | 4. (d)             |
| 5. (b)         | 6. (a)         | 7. (b)               | 8. (c)             |
| 9. (a)         | 10. (b)        | 11. (b)              | 12. (c)            |
| 13. (d)        | 14. (c)        | 15. (b)              | 16. (a)            |
| 17. (c)        | 18. (1)        | 19. (d)              | 20. (b)            |
| 21. (c)        | 22. (c)        | 23. (a)              | 24. (0)            |
| 25. (d)        | 26. (c)        | 27. (c)              | 28. (d)            |
| 29. (d)        | 30. (3)        | 31. (5)              | 32. (b)            |
| 33. (a)        | 34. (a)        | 35. (b)              | 36. (a)            |
| 37. (60 to 60) | 38. (c)        | 39. (-0.74 to -0.76) | 40. (b)            |
| 41. (b)        | 42. (d)        | 43. (b)              | 44. (a)            |
| 45. (3)        | 46. (d)        | 47. (d)              | 48. (b)            |
| 49. (b)        | 50. (a)        | 51. (b)              | 52. (0.49 to 0.51) |
| 53. (26 to 26) | 54. (d)        | 55. (b)              | 56. (b)            |
| 57. (d)        | 58. (13 to 13) | 59. (b)              | 60. (a)            |
| 61. (c)        | 62. (b)        | 63. (b)              | 64. (6)            |
| 65. (c)        |                |                      |                    |

