

TEST SERIES FOR GATE

BOOKLET SERIES **D**

Paper Code: **CY**

Test Type: **TEST SERIES**

Duration: **3:00 Hours**

CHEMISTRY-CY

Date: **23-01-2016**

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 alternative from the options given below to complete the following sentence:
It is hard to _____ why people kept their weapons in the kitchen as revealed from the latest excavations.
(a) Decipher (b) Divulge (c) Deluge (d) Amplify
- Which of the following options is closest in meaning to the word given below?
FAD:
(a) Apathetic (b) Expensive (c) Vogue (d) Benevolent
- Oct 02, 2001 is a palindrome when written in the format of MMDDYYYY (a string that reads the same forwards as it does backwards, example 10/02/2001 10022001. When was the latest century before Oct. 02, 2001 that is also a palindrome.
(a) 13th century (b) 14th century (c) 17th century (d) 20th century
- The difference between the squares of two consecutive odd integers is always divisible by which of the following numbers.
(a) 6 (b) 8 (c) 12 (d) 16
- Consider the equation : $(7526)_8 - (Y)_8 = (4364)_8$, where $(X)_N$ stands for X to the base N. Find Y.
(a) 1634 (b) 1737 (c) 3142 (d) 3162

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

- Choose the word from the options that is most nearly same in meaning of **Ostensible**.
(a) Apparent (b) Acclaimed (c) Profound (d) Genuine.
- Given below is a pair of words. Choose the most appropriate and related alternative from the options given below:
MENDACIOUS: TRUTHFUL
(a) Gelid: Icy (b) Scorching: Hot
(c) Cognisance: Recognition (d) Capricious: Constant
- The gross domestic product (GDP) in rupees grew at 7% during 2012-2013. For international comparison, the GDP is compared in US dollars (USD) after conversion based on the market exchange rate. During the period 2012-13 the exchange rate for the USD increased from Rs. 50/USD to Rs. 60/USD. India's GDP in USD during the period 2012-13.
(a) increased by 5% (b) decreased by 13%
(c) decreased by 20% (d) decreased by 11%
- What will come in place of ? mark?
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5		8
	126	
9		6

4		9
	78	
6		7

4		12
	?	
11		5

- (a) 240 (b) 336 (c) 180 (d) none of these
- The table below has question wise data on the performance of students, in an examination. The mark for each questions are also listed. There is no negative or partial marking in the exam.

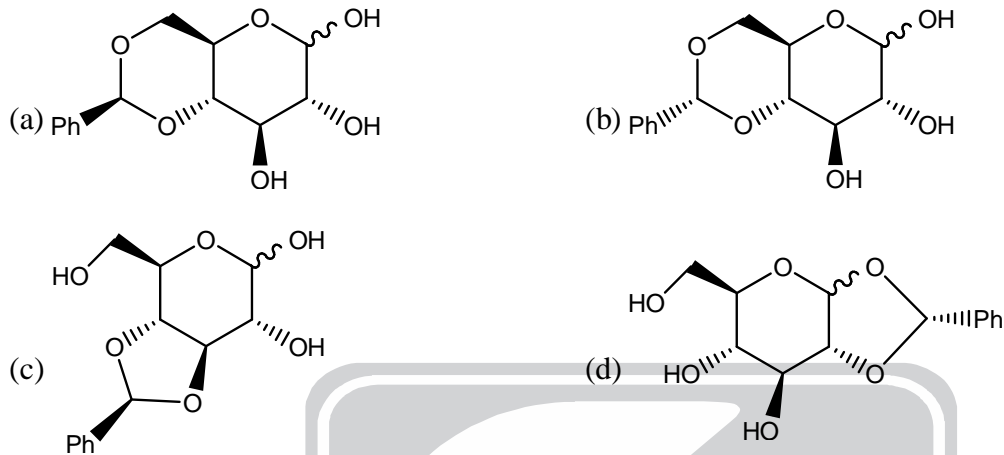
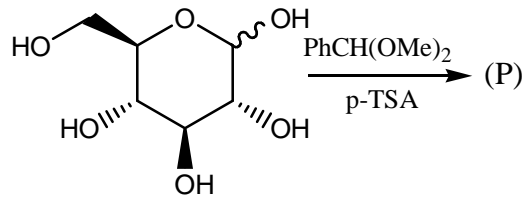
Q.No.	Marks	Answered correctly	Answered wrongly	Not attempted
1.	2	21	17	6
2.	3	15	27	2
3.	2	23	18	3

What is the average of the marks obtained by the class in the examination _____

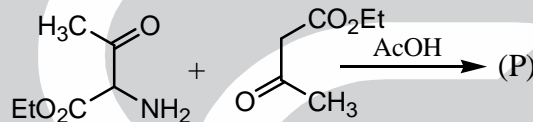


Q.11-Q.35 carry one mark each.

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

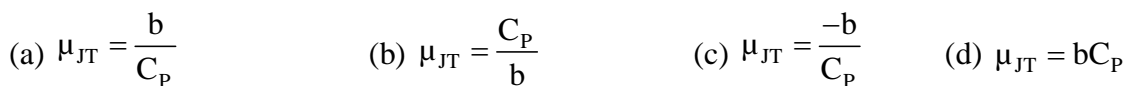


12. The major product (P) formed in the following reaction

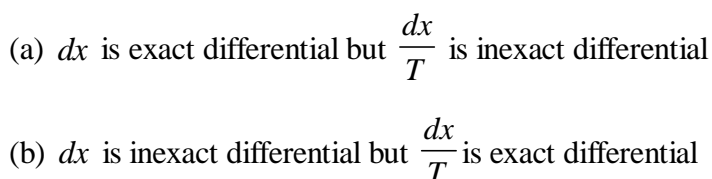


13. The decreasing amount of ortho-isomers of the following compounds on nitration is
 (I) $\text{C}_6\text{H}_5\text{-F}$ (II) $\text{C}_6\text{H}_5\text{-Cl}$ (III) $\text{C}_6\text{H}_5\text{-Br}$ (IV) $\text{C}_6\text{H}_5\text{-I}$
 (a) $\text{I} > \text{II} > \text{III} > \text{IV}$ (b) $\text{IV} > \text{III} > \text{II} > \text{I}$ (c) $\text{II} > \text{I} > \text{III} > \text{IV}$ (d) $\text{II} > \text{IV} > \text{III} > \text{I}$

14. For a gas obey the equation $P(\bar{V} - b) = RT$, the Joule-Thomson coefficient (μ_{JT}) is defined by



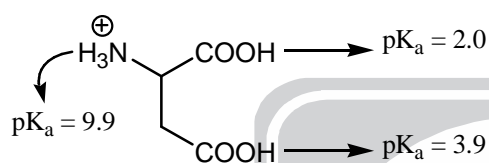
15. If $dx = C_v(T)dT + \frac{nRT}{V}dV$ then



- (c) dx and $\frac{dx}{T}$ both are exact differential.
- (d) dx and $\frac{dx}{T}$ both are inexact differential.
16. The temperature at which the $v = 1$ level of I_2 have the same population as the ground level is (vibrational wave number = 214.6 cm^{-1} for I_2)
 (a) 100K (b) 2.98K (c) 0 K (d) ∞
17. If molecular partition function, $f = AVe^{BT}$ then pressure of the system is (where A and B are constant)
 (a) $\frac{1}{V}$ (b) $\frac{k_B}{V}$ (c) $\frac{TNk_B}{V}$ (d) $\frac{Nk_B}{VT}$
18. Which one commutation relation is correct.
 (a) $[\sigma_x, \sigma_y] = i\hbar\sigma_z$ (b) $[\sigma_x, \sigma_y] = i\sigma_z$ (c) $[\sigma_x, \sigma_y] = 0$ (d) $[\sigma_x, \sigma_y] = 2i\sigma_z$
19. If the equation of state for a gas with internal energy U is $PV = \frac{1}{3}U$, then the equation for an adiabatic process is :
 (a) $PV^{1/3} = \text{constant}$ (b) $PV^{2/3} = \text{constant}$
 (c) $PV^{4/3} = \text{constant}$ (d) $PV^{3/5} = \text{constant}$
20. If a gas that obeys the equation of state

$$P(\bar{V} - b) = RT$$
 then $C_p - C_v$ is
 (a) R (b) $\frac{R}{2}$ (c) $\frac{R}{2p}$ (d) R^2
21. Which one of the following statements for Hb (Haemoglobine) is not **TRUE**?
 (I) the binding with O_2 is weaker in comparison with Myoglobin
 (II) Iron is five co-ordinated
 (III) Iron is coplaner with porphyrin ring in absence of oxygen
 (IV) the oxidation state of iron is +2
 (a) I, IV (b) I, II (c) I, III (d) III only
22. Number of $B-H-B$ and B unit in B_5H_9 are respectively.
 (a) 4, 2 (b) 4, 1 (c) 4, 0 (d) 3, 2
23. $[Co(C_5H_5)_5]$ metallocene is
 (1) air sensitive (2) paramagnetic
 (3) 19 electron complex (4) have HOMO e_{1g}^*
 The correct one is
 (a) 1, 2, 3 (b) 2, 3, 4 (c) 1, 2, 3, 4 (d) 1, 2, 4

24. A chemist prepare 1.0 gm of pure ^{11}C . This isotopes has half life of 21 min. How much of this isotopes is left after 24 hour of its preparation?
- (a) 2.28×10^{-18} gm (b) 3.28×10^{-22} gm (c) 2.28×10^{-21} gm (d) 3.28×10^{-18} gm
25. 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.
26. The Miller indices of plane having all direction, [100], [011] and [111] are
- (a) (111) (b) (011) (c) (100) (d) $((0\bar{1}1))$
27. The standard electrode potentials of $\text{Cu}^{+2}/\text{Cu}^+$ and Cu^+/Cu electrodes are $+0.18\text{V}$ and $+0.50\text{V}$ respectively. The value of standard potential of Cu^{+2}/Cu electrode is
- (a) 0.34V (b) 0.10V (c) 0.16V (d) 0.40V
28. Calculate the pI of the following salt of aspartic acid given below

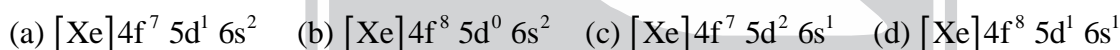


29. The correct form of Sackur Tetrode equation

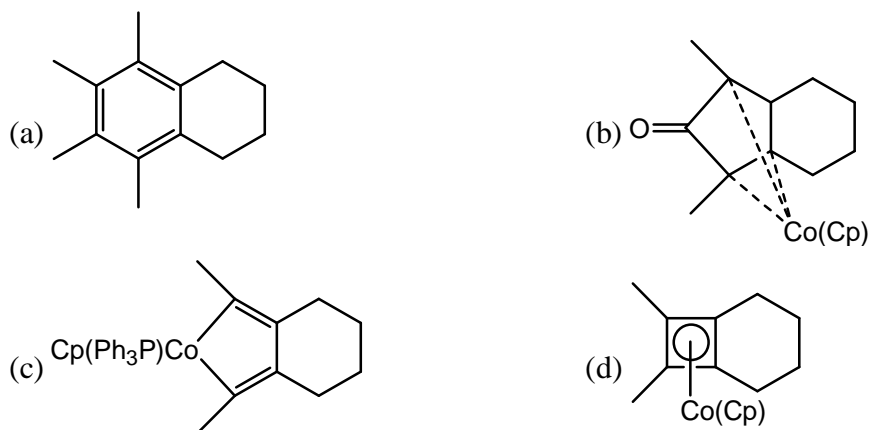
(a) $S = nR \left(\frac{\ln e^{5/2} kT}{p\Lambda^3} \right)$ (b) $nR \left[\ln \left\{ \frac{kT}{p} \left(\frac{2\pi ktm}{h^2} \right)^{3/2} \right\} + \frac{5}{2} \right]$

(c) $S = nR \left(\frac{\ln e^{3/2} kT}{p\Lambda^3} \right)$ (d) Both (a) and (b) are correct.

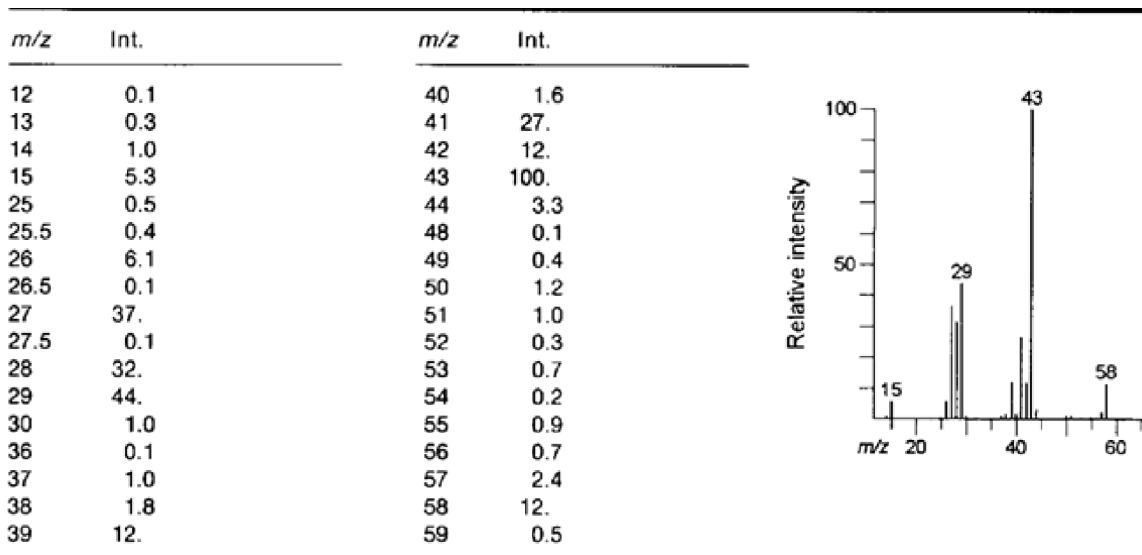
30. Which of the following configuration is correct for Gd?



The major product 'B' in the above reaction is



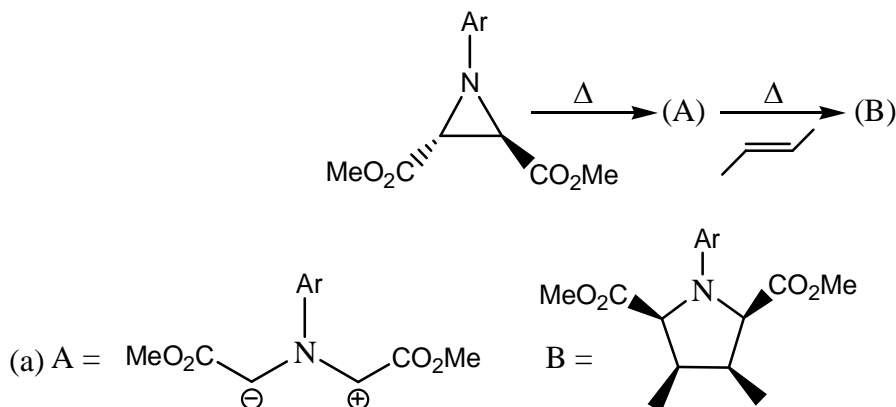
32. The shapes of $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{CuCl}_4]^{2-}$ and $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ are respectively
 (a) square planar, tetrahedral and distorted octahedral
 (b) Tetrahedral, square planar and octahedral
 (c) square planar, square planar and distorted octahedral
 (d) square planar, flattered tetrahedral and distorted octahedral
33. On the basis of above mass spectral data, which is the possible molecular formulae of compound.

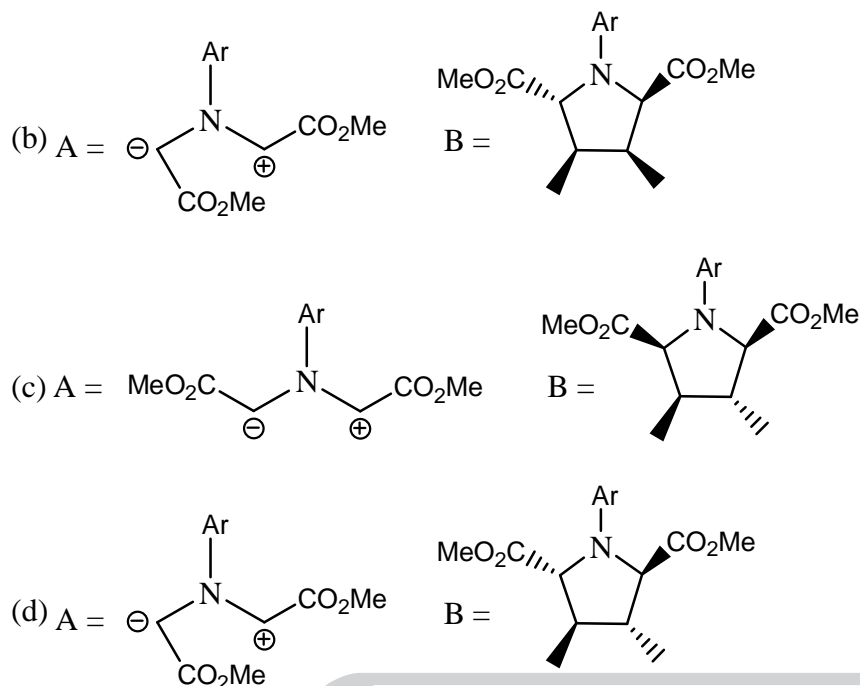


- (a) $\text{C}_3\text{H}_6\text{O}$ (b) $\text{C}_2\text{H}_6\text{N}_2$ (c) C_4H_{10} (d) $\text{C}_2\text{H}_6\text{Si}$
34. For a two-component system $\Delta H_{F,A} = 500 \text{ cal mol}^{-1}$ and $T_{m,A} = 400^\circ\text{C}$. If the eutectic temperature is 350°C . What is the solubility in terms of the fraction of B in A at 350°C
 (a) 0.037 (b) 0.0037 (c) 0.0667 (d) 0.667
35. Which of the following set(s) show(s) substantial Jahn-Teller distortion
 (I) $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{Mn}(\text{H}_2\text{O})_6]^{3+}$ (II) CrF_2 and $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$
 (III) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$ (IV) $[\text{Co}(\text{CN})_6]^{4-}$ and MnF_3
 (a) Only I and II (b) Only I, II and III (c) II, III and IV (d) Only III

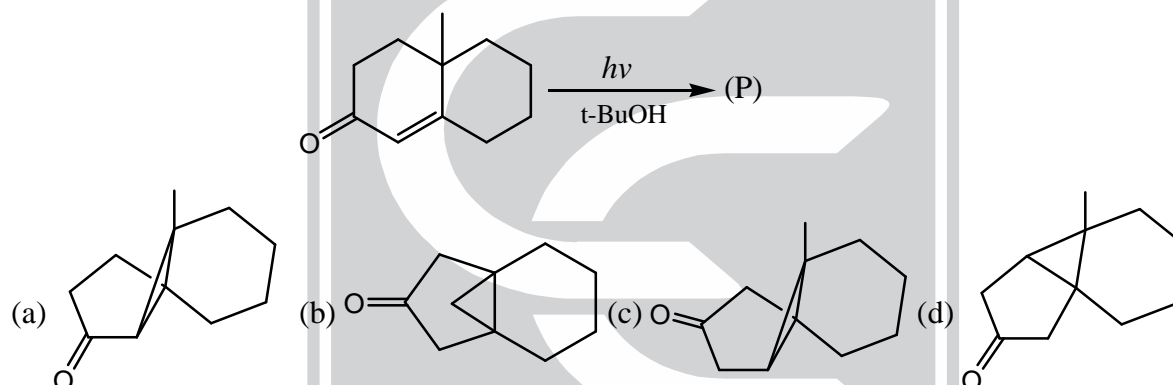
Q.36-Q.65 carry TWO marks each.

36. The major products (A) and (B) formed in the following reaction sequence are

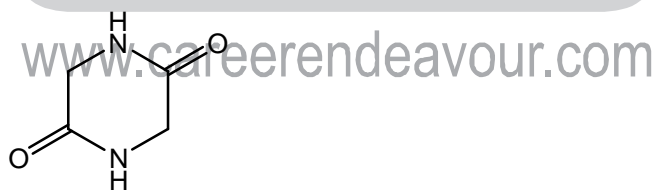




37. The major product (P) formed on the following reaction is



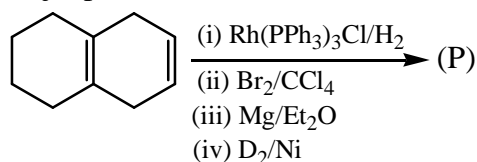
38. A dipeptide on hydrolysis give two amino acids (X) and (Y). If the dipeptide is first treated with nitrous acid and then hydrolysis is carried out, (X) and lactic acid are obtained. (X) on heating give 2, 5-diketopiperazine has shown below. Identify amino acid (X) and (Y) and write there sequence.

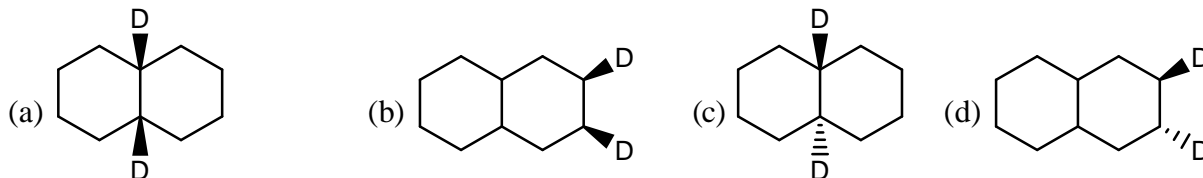


2, 5-diketopiperazine

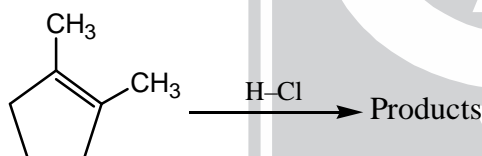
- (a) X = Gly, Y = Ala, Gly-Ala (b) X = Ala, Y = Gly, Ala – Gly
(c) X = Gly, Y = Ala, Ala – Gly (d) X = Ala, Y = Gly, Gly-Ala

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



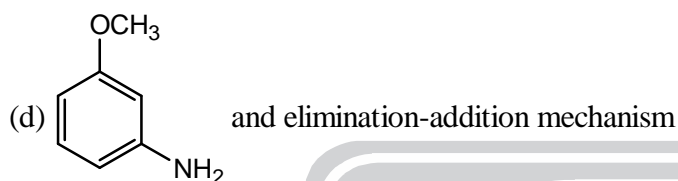
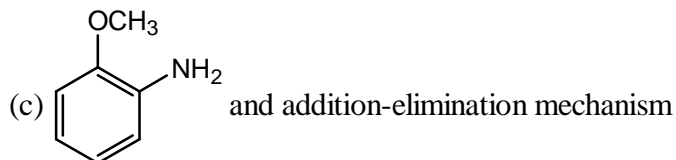
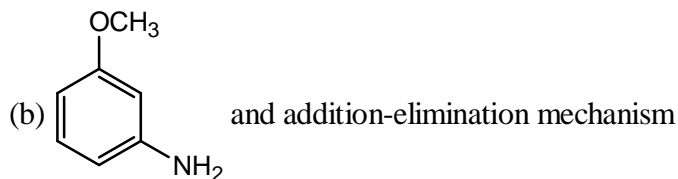
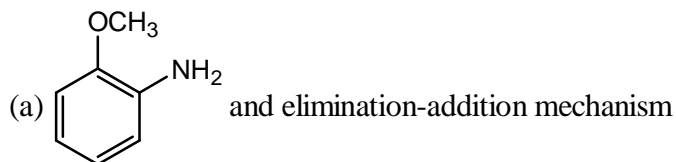


40. Consider the following statements for electrophilic aromatic substitution reaction. The correct are
 (1) C_6H_5-OH is more reactive than C_6H_5-I
 (2) C_6H_5-I is more reactive than C_6H_5-OH
 (3) C_6H_5-NHMe is more reactive than C_6H_5-OMe
 (4) C_6H_5-NHMe is more reactive than C_6H_5-Me
 (a) 1 only (b) 1,3 and 4 (c) 3 and 4 (d) 2 and 3
41. Consider the following statements about elimination reactions the correct are
 (1) the first step in the mechanism of E_1 and S_N1 reaction is identical.
 (2) the rate of E_1 reactions depends on the nature and concentration of base
 (3) In E_1 -elimination, Hoffmanns rule governs the orientation of the double bond.
 (4) E_2 -elimination of adjacent groups on a six membered ring proceeds best when the leaving groups are anti-viz trans diaxial.
 (a) 1, 2 (b) 1 and 3 (c) 1, 3 and 4 (d) 1 and 4
42. The value of $\log K_p$ for the reaction $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ at $25^\circ C$. (The standard enthalpy of formation of $NH_3(g)$ is -46 kJ and standard entropies of $N_2(g)$, $H_2(g)$, $NH_3(g)$ are 191, 130, 182 $JK^{-1} \text{ mol}^{-1}$ respectively) is
43. Consider the following reaction

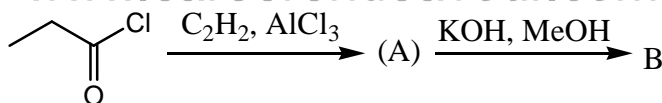


The number of stereoisomers formed during this reaction will be

44. A $y \text{ cm}^{-1}$ laser line was used to excite oxygen molecules (mode of ^{16}O only) to obtain the rotational Raman spectrum. The resulting rotational Raman spectrum of oxygen molecule has the first Stokes line at $z \text{ cm}^{-1}$. The next rotational Stokes line is expected at
 (a) $\frac{9z-4y}{5}$ (b) $\frac{8z-5y}{3}$ (c) $\frac{7z-4y}{3}$ (d) $\frac{6z-y}{4}$
45. The anharmonic potential (Morse potential) is given by $U(r) = D_e \left(1 - e^{-\beta(r-r_e)}\right)^2$ then force constant of HCl molecule is, [where, $D_e = 7.31 \times 10^{-19} \text{ joule-molecule}^{-1}$ and $\beta = 1.83 \times 10^{10} \text{ m}^{-1}$ for HCl] Nm^{-1} .
46. A rigid rotator in a plane is acted on by a perturbation represented by $H' = \frac{V_0}{2} (\cos^2 \phi - 1)$, $V_0 = \text{constant}$. Then the first-order correction of energy for ground state energy is
 (a) $-V_0$ (b) $-\frac{V_0}{2}$ (c) $-\frac{V_0}{4}$ (d) none of these

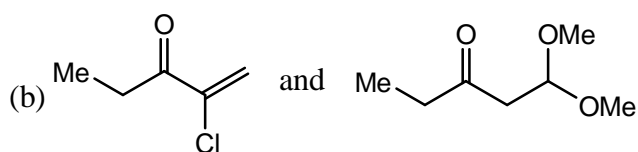
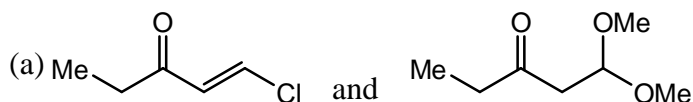


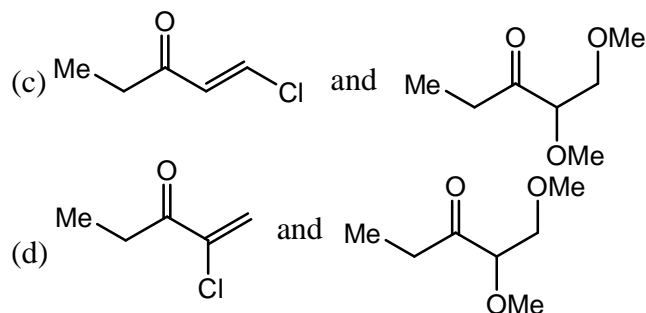
53. In the following statement, the correct statement is
 (1) Transport number is independent of temperature
 (2) the unit of molar conductance Λ_m is $\text{Sm}^2\text{mol}^{-1}$.
 (3) $\text{Li} < \text{Na}^+ < \text{K}^+ < \text{Rb}^+ < \text{Cs}^+$ (increasing order of ionic mobility)
 (4) the correct term of Hückel Onsager equation $\Lambda_m = \Lambda_m^0 - A\sqrt{c}$ (where A is a constant depending on the nature of the solvent and temperature).
 (a) 2, 3 and 4 (b) 1, 2 (c) 2 and 4 (d) 3 and 4
54. The rate of effusion of an unknown gas X at 480 K is 1.60 times. The rate of effusion of sulphur dioxide gas at 300K. The molecular weight of X is
55. At 273 K and 20 bar the Langmuir adsorption of a gas on a solid surface gave the fraction of surface coverage as 0.02. The Langmuir adsorption isotherm constant is bar^{-1} .
56. 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)





57. 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) $1 + 2e^{-\frac{1}{2}} + 6e^{-2}$

58. The increasing order of thermal stability of the carbonates of alkaline earth metals is:

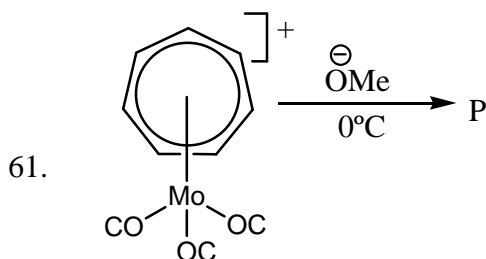
- (a) $\text{BeCO}_3 < \text{BaCO}_3 < \text{MgCO}_3 < \text{CaCO}_3 < \text{SrCO}_3$
 (b) $\text{BeCO}_3 < \text{MgCO}_3 < \text{CaCO}_3 < \text{SrCO}_3 < \text{BaCO}_3$
 (c) $\text{MgCO}_3 < \text{BeCO}_3 < \text{CaCO}_3 < \text{SrCO}_3 < \text{BaCO}_3$
 (d) $\text{BaCO}_3 < \text{SrCO}_3 < \text{CaCO}_3 < \text{MgCO}_3 < \text{BeCO}_3$

59. If the displacement vectors of all atoms in chlorobenzene are taken as the basis vectors, the characters of reducible representation of E , C_2 , σ_{xz} (molecular plane) and σ_{yz} are

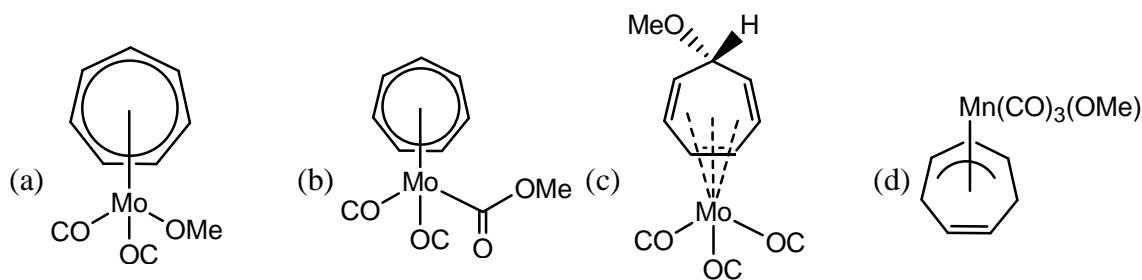
- (a) 36, 4, 12, 4 (b) 36, -4, 12, 4
 (c) 21, -3, 7, 3 (d) 36, -4, 36, 4

60. If the value of Mark-Houwink exponent is equal to unity, then viscosity average molar mass becomes equal to

- (a) \bar{M}_n (number average molar mass) (b) \bar{M}_m (mass average molar mass)
 (c) \bar{M}_z (z-average molar mass) (d) equal to all of these

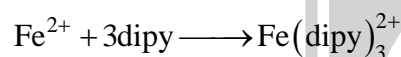


The major product 'P' in the above reaction is:



62. Nucleophilic addition of MeO^- to free chlorobenzene is negligibly slower under conditions for which the reaction with $(\eta^6\text{C}_6\text{H}_5\text{Cl})\text{Cr}(\text{CO})_3$ is fast the latter reaction is accelerated due to
- Electron withdrawing nature of chlorine present on the benzene nucleus.
 - σ -donor ability of carbonyl ligand
 - π -accepting ability of carbonyl ligands which enhances the electron density on the metal which inturns on the benzene nucleus.
 - π -accepting ability of carbonyl ligands which reduces electron density a from benzene nucleus and enhances the rate of nucleophile substitution reactions.

63. The complexation of Fe^{2+} with the chelating agent dipyriddy has been studied kinetically in both forward and reverse directions.



$$\text{Rate (forward)} = (1.45 \times 10^{13})$$

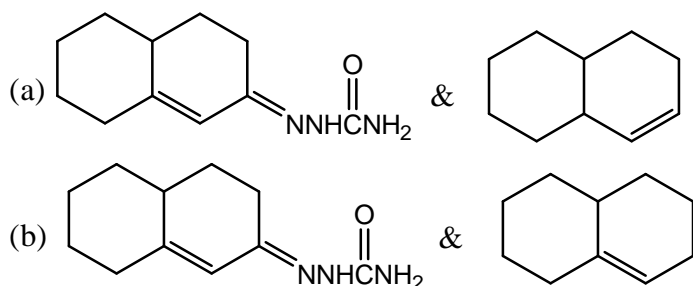
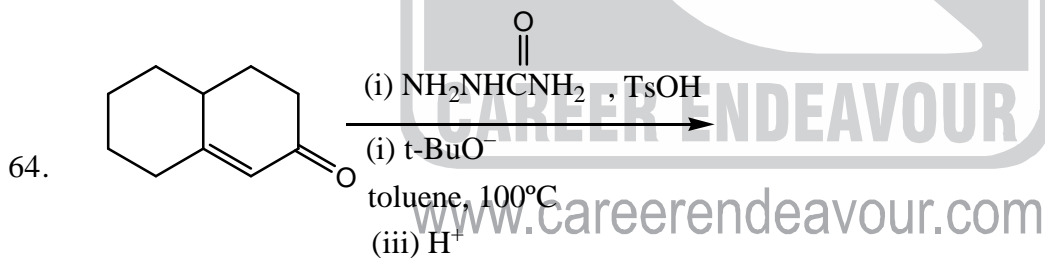
$$[\text{Fe}^{2+}][\text{dipy}]^3$$

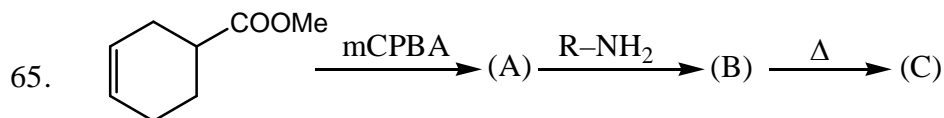
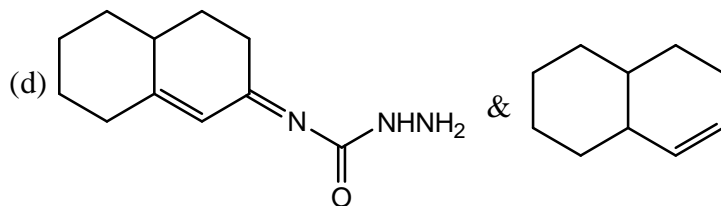
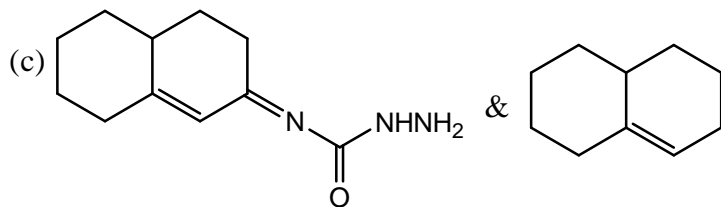
$$\text{Rate (reverse)} = (1.22 \times 10^{-4})$$

$$[\text{Fe}(\text{dipy})_3^{2+}]$$

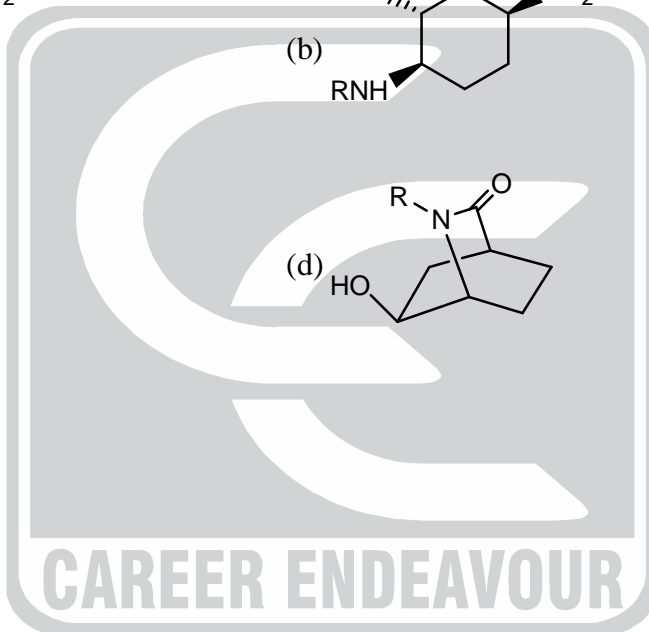
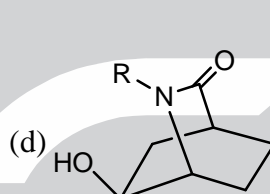
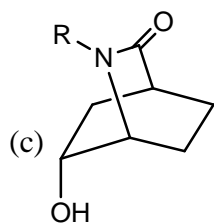
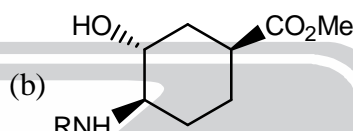
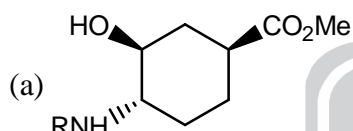
The stability constant for the complex is

- (a) 0.841×10^{-17} (b) 1.19×10^{17} (c) 8.841×10^{-17} (d) 11.9×10^{17}





What is the product-C



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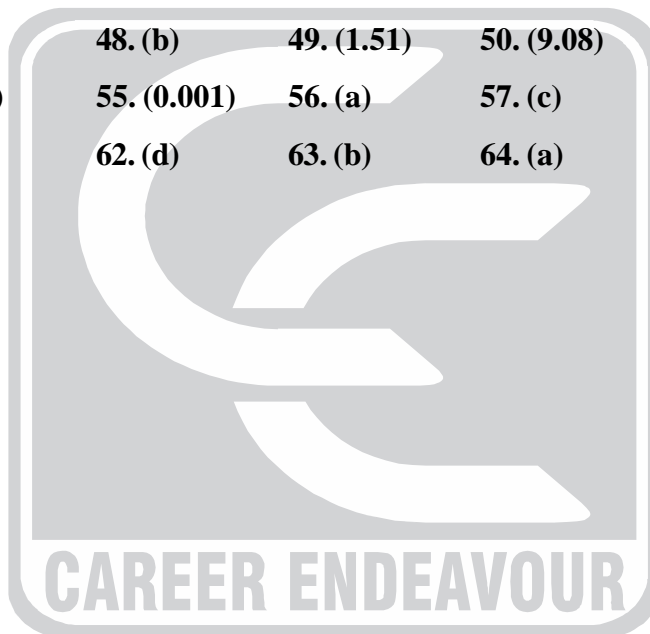
North Delhi : 33-35, Mall Road, G.T.B. Nagar (Opp. Metro Gate No. 3), Delhi-09, Ph: 011-65462244, 65662255

CHEMISTRY-CY

Date: 23-01-2016

GATE TEST SERIES-IV**ANSWER SHEET**

- | | | | | | | |
|---------|----------|-------------|-------------|------------|---------|-----------|
| 1. (a) | 2. (c) | 3. (a) | 4. (b) | 5. (c) | 6. (a) | 7. (d) |
| 8. (d) | 9. (b) | 10. (3.02) | | | | |
| 11. (b) | 12. (b) | 13. (a) | 14. (c) | 15. (b) | 16. (d) | 17. (c) |
| 18. (d) | 19. (c) | 20. (a) | 21. (d) | 22. (b) | 23. (c) | 24. (c) |
| 25. (b) | 26. (d) | 27. (a) | 28. (2.95) | 29. (a) | 30. (a) | 31. (a) |
| 32. (d) | 33. (c) | 34. (c) | 35. (c) | 36. (c) | 37. (a) | 38. (c) |
| 39. (a) | 40. (b) | 41. (d) | 42. (5.845) | 43. (4) | 44. (a) | 45. (490) |
| 46. (c) | 47. (b) | 48. (b) | 49. (1.51) | 50. (9.08) | 51. (c) | 52. (b) |
| 53. (a) | 54. (40) | 55. (0.001) | 56. (a) | 57. (c) | 58. (b) | 59. (b) |
| 60. (b) | 61. (b) | 62. (d) | 63. (b) | 64. (a) | 65. (c) | |



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