

TEST SERIES FOR GATE

BOOKLET SERIES **B**

Paper Code: **CY**

Test Type: **TEST SERIES**

Duration: **3:00 Hours**

CHEMISTRY

Date: **13-01-2016**

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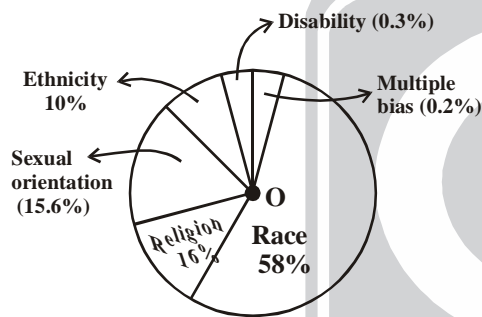
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Q.1-Q. 5 carry ONE mark each.

- If the sum of five consecutive integers is S, what is the largest of those integers in terms of S?
 - $\frac{S-10}{5}$
 - $\frac{S-10}{4}$
 - $\frac{S+10}{5}$
 - $\frac{S-10}{10}$
- If the product of 4 consecutive integers is equal to one of them, what is the largest possible value of one of the integers?
 - 0
 - 3
 - 4
 - 6
- Fill in the blank with appropriate word. He is _____ opponent, you must respect and fear him at all times.
 - A redoubtable
 - A disingenuous
 - C raven
 - An insignificant
- $(0.55)^{150}$ is closest to
 - 0.1
 - 0
 - 10
 - 100
- What is the Missing term in sequence ABC, A²BC, A²B²C, _____, A³B²C².
 - A³B²C
 - A²B²C²
 - A³B³C²
 - A³BC

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

6.

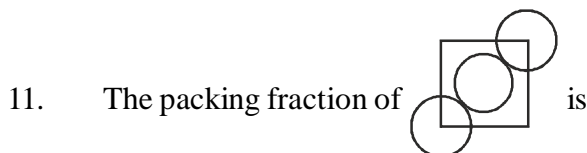


Percent-distribution of Bias – Motivated offenses in 1998 in USA.

If in 1998, there were 10, 000 bias motivated offenses based on ethnicity, how many more offenses were based on religion than on sexual orientation?

- 4
 - 40
 - 400
 - 4000
- A person moves 8 km west, 6 km north, 3 km east, and 6 more km north. How far is this person from his starting place
 - 13
 - 17
 - 19
 - 21
 - Fill in the blank by appropriate words?
The new computer system _____ next month.
 - Is being installed by people
 - Is be installed
 - Is being installed
 - Is been installed
 - Fill in the blank by appropriate words it's _____ disappointing.
 - Very much
 - Very
 - Much
 - Much very
 - If Rout is related to Defeat then which pair is correctly matched
 - Grief : Loss
 - Pathway : Ruin
 - Memory : Oblivion
 - Ovation : Applause

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



- (a) 19.82 (b) 26.28 (c) 34.25 (d) 58.87

12. The unit of Michaelis menton constant in enzyme catalyses



- (a) sec^{-1} (b) $\text{ltr mole}^{-1} \text{ s}^{-1}$ (c) $\text{mole liter}^{-1} \text{ s}^{-1}$ (d) none of these

13. The Hermitian operator is/are

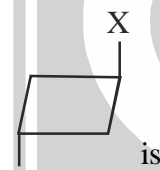
- (I) $A + A^\dagger$ (II) $i(A - A^\dagger)$
 (a) Only I (b) only II (c) both I and II (d) neither I nor II

14. The orbital represented by

$$R_{n\ell} = 2 \left(\frac{Z}{2a_0} \right)^{3/2} \left(e^{-Zr/2a_0} - \frac{Zr}{2a_0} e^{-Zr/2a_0} \right)$$

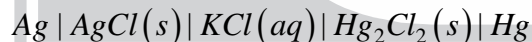
- (a) 1s (b) 2s (c) 2p (d) 3p

15. The point group of



- (a) C_{2h} (b) C_{2v} (c) D_{2h} (d) D_{2d}

16. The emf of the cell



is 0.0455V at 298K and the temperature coefficient is $3.38 \times 10^{-4} \text{ VK}^{-1}$. The enthalpy (ΔH) at 298K is _____ kJ mol^{-1} .

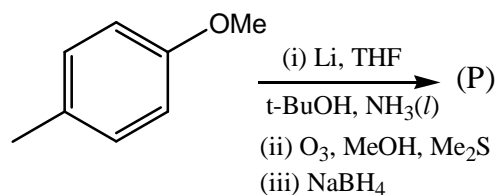
17. An aqueous solution of urea had freezing point of -0.52°C . What is osmotic pressure of the same solution at 37°C . Assume that molar concentration and molality are numerically equal ($K_f = 1.86$)

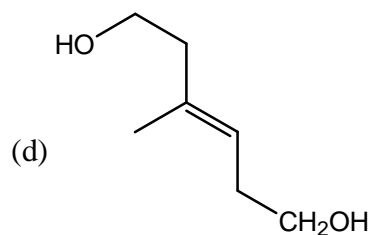
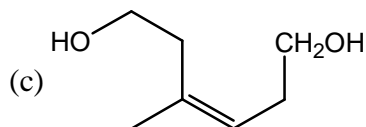
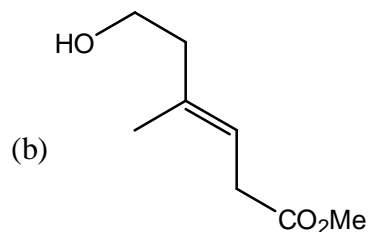
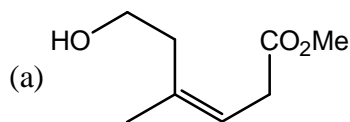
- (a) 7.1 atm (b) 34.1 atm (c) 27.1 atm (d) 5.2 atm

18. What is the maximum work done when pressure on 10g of hydrogen is reduced from 20 atm to 1 atm at constant temperature of 273 K.

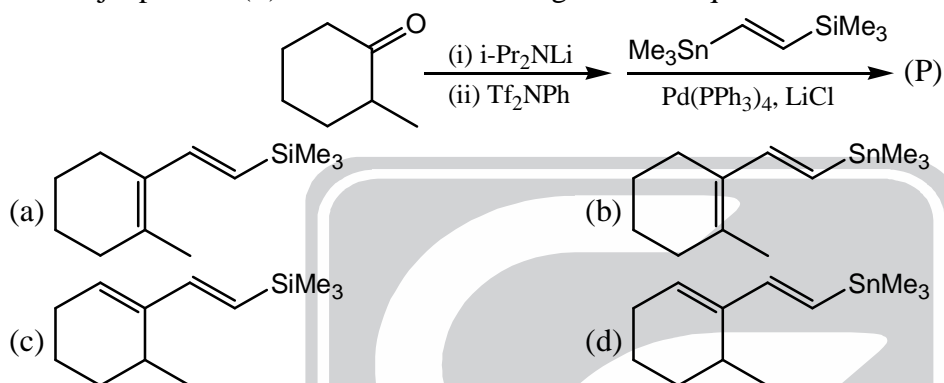
- (a) -81.80 kcal (b) 81.80 kcal (c) 8180 kcal (d) -8180 kcal

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





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

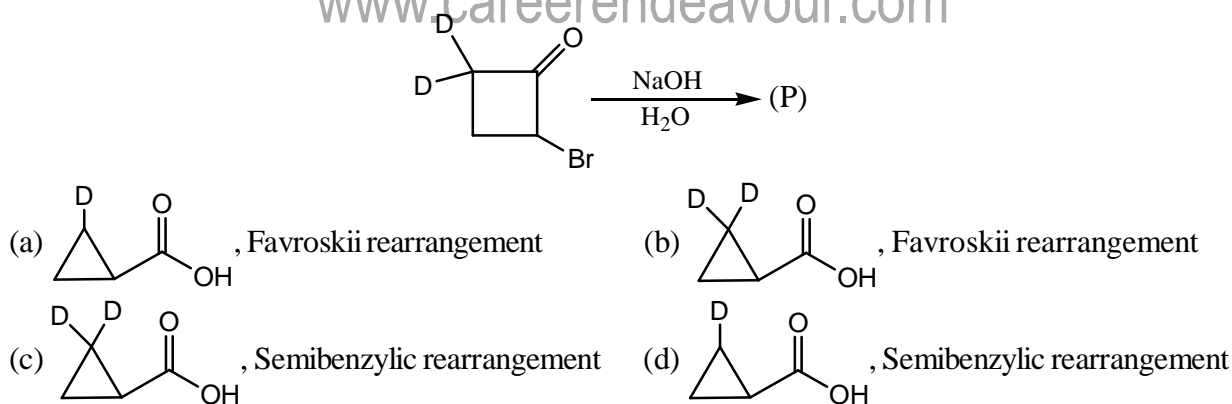


21. What is the configuration and stereochemical relationship between the compounds given below

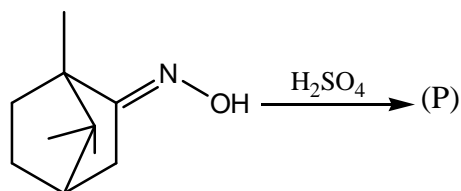


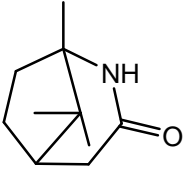
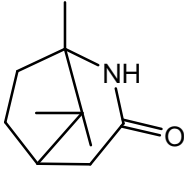
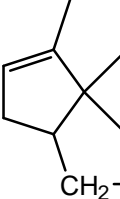
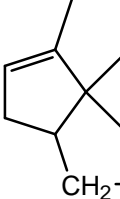
- (a) (i) 3R, 5S (ii) 3S, 5S; and they are diastereomers of each other
 (b) (i) 3S, 5R, (ii) 3R, 5R; they are diastereomers of each other
 (c) (i) 3R, 5R, (ii) 3S, 5S and they are enantiomers of each other.
 (d) (i) 3S, 5S, (ii) 3R, 5R and they are enantiomers of each other.

22. The major product (P) and the rearrangement involved in the following reaction is

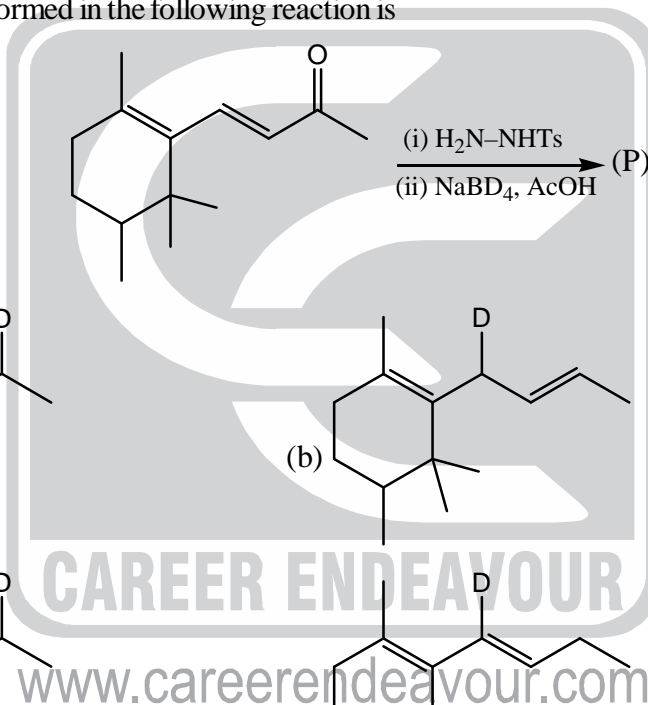


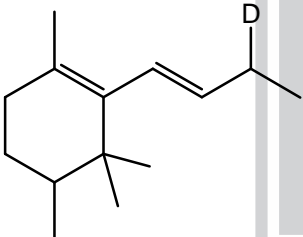
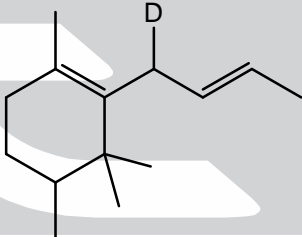
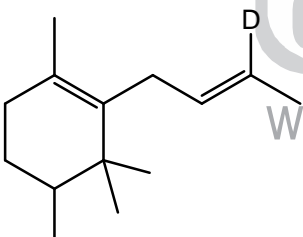
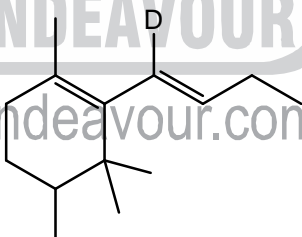
23. The major product (P) and the rearrangement involved in the following reaction is



- (a) , Beckmann rearrangement (b) , Beckmann fragmentation
- (c) , Beckmann rearrangement (d) , Beckmann fragmentation.

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

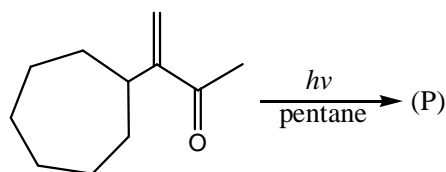


- (a)  (b) 
- (c)  (d) 

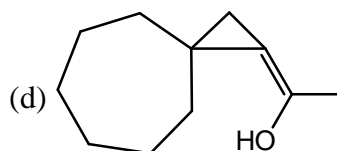
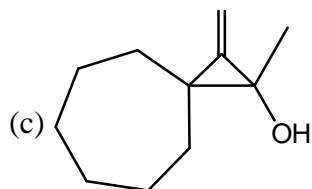
25. How many alditols will be formed in the reduction of D-mannose and D-fructose with NaBH_4 .

- (a) 1 and 2 (b) 2 and 2 (c) 1 and 1 (d) 2 and 1

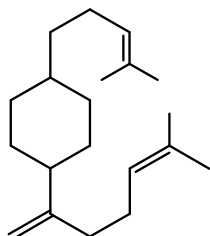
26. The major product (P) formed in the following reaction is



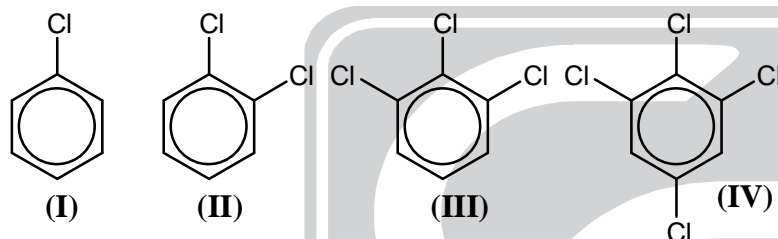
- (a)  (b) 



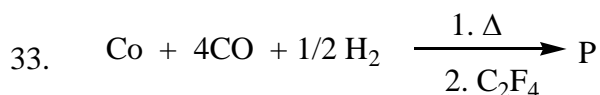
27. Treatment of a tri-peptide Arg-Val-Asp with hydrazine, then subjected to chromatography on a column of a strong cation-exchange resin (Dowex-50). The illution order will be
 (a) Arg > Val > Asp (b) Val > Arg > Asp (c) Asp > Val > Arg (d) Asp > Arg > Val
28. The number of isoprene units in the following terpene is/are _____



29. The correct order of dipole moments of



- (a) III > II > I = IV (b) I > III > II > IV (c) III > IV > II > I (d) II > III > I = IV
30. The basic unit for sheet silicates is:
 (a) $(\text{SiO}_3)_n^{2n-}$ (b) $(\text{Si}_2\text{O}_5)_n^{2n-}$ (c) $(\text{Si}_2\text{O}_7)_n^{2n-}$ (d) $(\text{SiO}_2)_5$
31. Which of the following trivalent lanthanide ions has a relatively stable bivalent oxidation state:
 (a) Nd^{3+} (b) Sm^{3+} (c) Eu^{3+} (d) Tm^{3+}
32. Which of below sentence is **NOT** true?
 (a) EPR is technique for studying chemical species that have one or more unpaired electrons
 (b) In EPR atomic nuclei spins are excited
 (c) Every electron has a magnetic moment and spin quantum moment of $1/2$
 (d) An unpaired electron can move between two energy levels by either absorbing or emitting electromagnetic radiation of energy



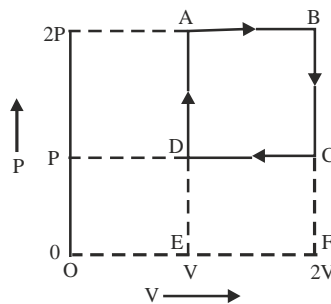
The major product 'P' in the above reaction is:

- (a) $\text{HCo}(\text{CO})_4$ (b) $\text{HCo}(\text{CO})_3$ (c) $(\text{CO})_4\text{Co}(\text{C}_2\text{HF}_5)$ (d) $(\text{CO})_3\text{Co}(\text{C}_2\text{HF}_5)$
34. The lowest energy visible spectra band of an octahedral nickel (II) complex is due to the transition
 (a) ${}^3\text{T}_{2g} \leftarrow {}^3\text{T}_{1g}$ (b) ${}^3\text{A}_{2g} \leftarrow {}^3\text{T}_{1g}$ (c) ${}^3\text{T}_{2g} \leftarrow {}^3\text{A}_{2g}$ (d) ${}^3\text{T}_{1g} \leftarrow {}^3\text{A}_{2g}$
35. Which of the following is the least powerful oxidizing agent?
 (a) HClO_4 (b) HClO_3 (c) HClO_2 (d) HOCl

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

36. Select the correct statements from following?
- (A) In haemocyanin, $\nu_{O-O} \approx 750 \text{ cm}^{-1}$
 (B) Haemerythrin contain two different Fe atom
 (C) Vitamin B_{12} is naturally occurring organometallic compounds
 (D) Oxyhaemoglobin contain low spin Fe^{3+} and O_2^-
- (a) A and B only (b) C and D only (c) B, C and D only (d) All of these
37. Select the correct statements regarding the transition metal.
- (A) $TiO > VO > CrO > MnO$ (order of lattice energy)
 (B) $PtF_6 > OsF_6 > WF_6$ (oxidising power)
 (C) $FeO_4^{2-} > MnO_4^{2-} > CrO_4^{2-}$ (oxidising power)
 (D) $MnO < FeO < CoO < NiO$ (increasing order of heat temperature)
- (a) B, C and D only (b) B and C only (c) C and A only (d) B and D only
38. The equilibrium constant for the successive reaction of ethylene diamine with Co^{2+} , Ni^{2+} and Cu^{2+} are as follows
- $$[M(H_2O)_6]^{2+} + en \rightleftharpoons [M(en)(H_2O)_4]^{2+} + 2H_2O \quad k_1 \approx$$
- $$[M(en)(H_2O)_4]^{2+} + en \rightleftharpoons [M(en)_2(H_2O)_2]^{2+} + 2H_2O \quad k_2 \approx$$
- $$[M(en)(H_2O)_4]^{2+} + en \rightleftharpoons [M(en)_3]^{2+} + 2H_2O \quad k_3 \approx$$
- Select the correct statement from following regarding above reaction:
- (A) $(k_1)_{Cu} > (k_1)_{Ni} > (k_1)_{Co}$ (B) $(k_3)_{Cu} > (k_2)_{Cu} > (k_1)_{Cu}$
 (C) $(k_3)_{Ni} > (k_3)_{Co} > (k_3)_{Cu}$ (D) $(k_2)_{Cu} > (k_2)_{Co} > (k_2)_{Ni}$
- (a) A, B, C only (b) A and C only (c) A, C, D (d) all of the above
39. Activation energy graph are represented regarding transeffect, select the correct set of graph corresponding to nature of ligands.
-
- (1) I and II corresponds to weak σ -donor and stronger σ -donor respectively.
 (2) II and III corresponds to weak σ donor and strong π -acceptor respectively
 (3) I and II corresponds to strong and weak weak σ donor respectively
 (4) I and III corresponds to weak σ donor and strong π -acceptor
- (a) 1 and 2 (b) 1 and 4 (c) 2 and 3 (d) none of these
40. The number of atoms per unit cell of diamond cubic crystal are _____

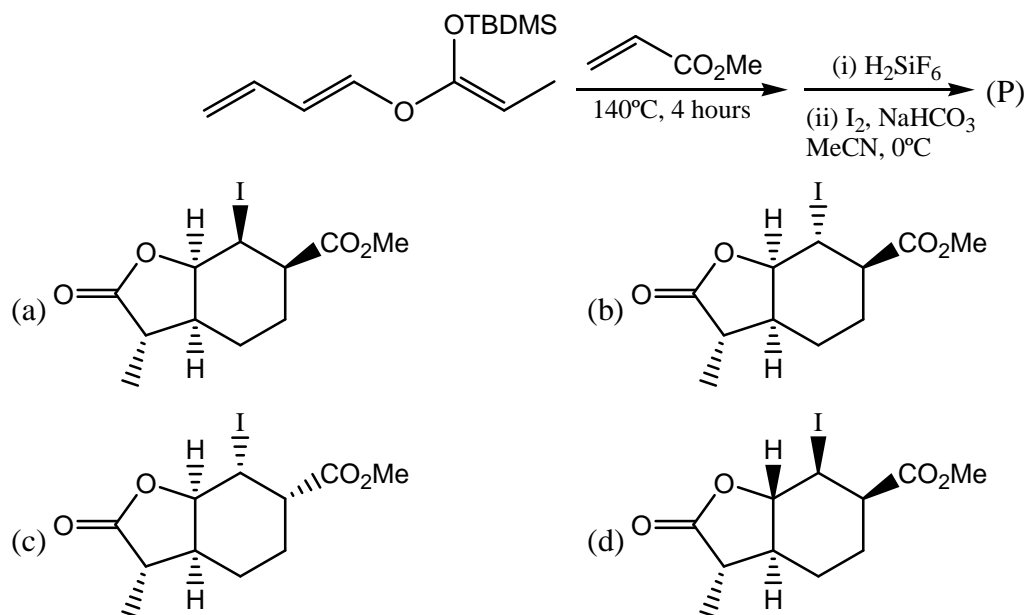
41. Consider a reaction, $A \longrightarrow P$ with rate law, $k_{\text{overall}} = \frac{3k_1k_2}{2k_3}$
and $E_1 = 100 \text{ kJ mole}^{-1}$, $E_2 = 50 \text{ kJ mole}^{-1}$, $E_3 = 20 \text{ kJ mole}^{-1}$
The overall activation energy is
(a) 195 kJ mole^{-1} (b) 180 kJ mole^{-1} (c) 150 kJ mole^{-1} (d) 130 kJ mole^{-1}
42. Consider langmuir adsorption of a gas onto a solid surface with slope = 2.5 Pa cm^{-3} , and $k = 1 \text{ Pa}^{-1}$. The value of monolayer formation volume is _____ cm^3 .
43. The spherical harmonics regarding H-atom, $P_3(x)$ is given by
(a) x (b) $\frac{1}{2}(3x^2 - 1)$ (c) $\frac{1}{2}(5x^2 - 3x)$ (d) 0
44. The angular momentum operator \hat{L}_x is given by
(a) $-i\hbar \left[-\sin\phi \frac{\partial}{\partial\theta} - \cot\theta \cos\phi \frac{\partial}{\partial\phi} \right]$ (b) $-i\hbar \frac{\partial}{\partial\phi}$
(c) $-i\hbar \left[\sin\phi \frac{\partial}{\partial\theta} - \cot\theta \cos\phi \frac{\partial}{\partial\phi} \right]$ (d) $i\hbar \left[\sin\phi \frac{\partial}{\partial\theta} - \cot\theta \sin\phi \frac{\partial}{\partial\phi} \right]$
45. The expectation value of $\frac{1}{r^2}$ regarding 1s orbital of H atom is (in units of $\frac{1}{a_0^2}$) _____
46. The molar conductivity of 0.05M solution of MgCl_2 is $100 \text{ Scm}^2 \text{ mol}^{-1}$ at 25°C . A cell with electrodes that are 2 cm^2 in surface area and 1.0 cm apart is filled with 0.05M MgCl_2 solution. How much current will flow when potential difference between the two electrodes is 5.0V ?
(a) 0.005A (b) 0.05A (c) 0.5A (d) 5A
47. At 25°C , will precipitate of $\text{Mg}(\text{OH})_2$ from in a 0.0001M solution of $\text{Mg}(\text{NO}_3)_2$. If pH of the solution is adjusted to 9.0, $[K_s(\text{Mg}(\text{OH})_2) = 8.9 \times 10^{-12} \text{ M}^3]$. At what minimum value of pH will precipitation start?
[Given, $[\text{H}_3\text{O}^+] = 1 \times 10^{-9} \text{ M}$ and $[\text{OH}^-] = 1.0 \times 10^{-5} \text{ M}$]
(a) 7.46 (b) 10.46 (c) 8.46 (d) 9.46
48. The efficiency of the carnot engine is $\frac{1}{6}$. On decreasing the temperature of the sink by 65K , the efficiency increases to $\frac{1}{3}$. The temperature of source is _____ K.
49. The state of a mole of an ideal gas changed from state A($2P, V$) through four different processes and finally returns to initial state A reversibly as shown below



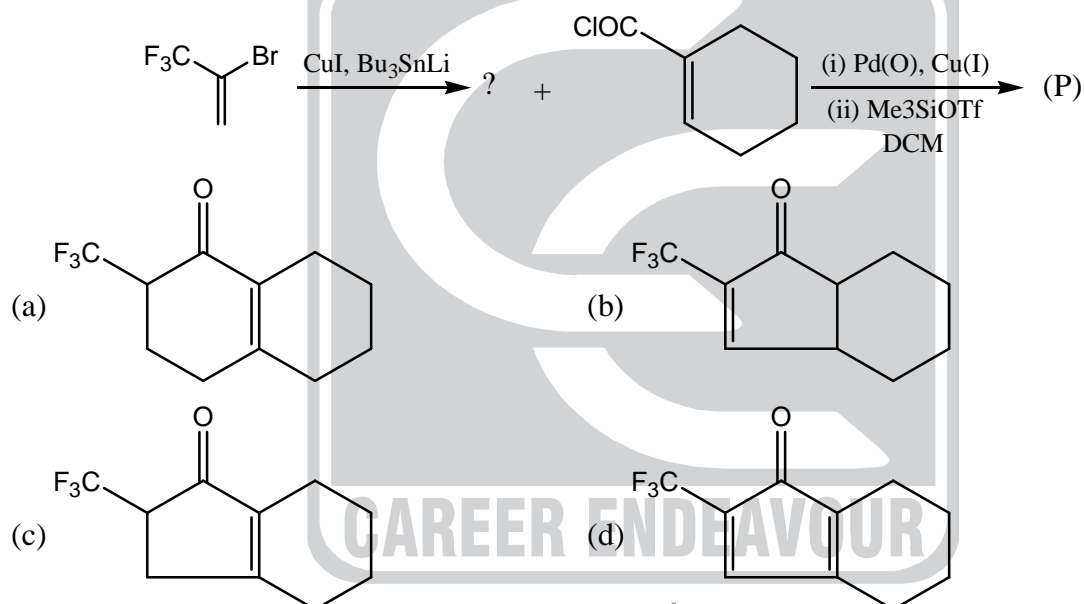
What is the total work done by the system

- (a) $2PV$ (b) $-PV$ (c) $-2PV$ (d) PV

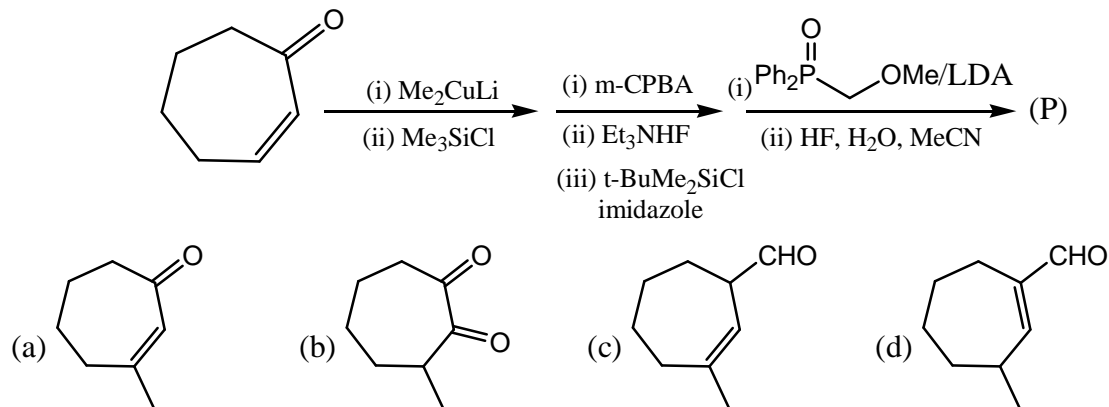
50. The major product (P) formed in the following reaction sequence is



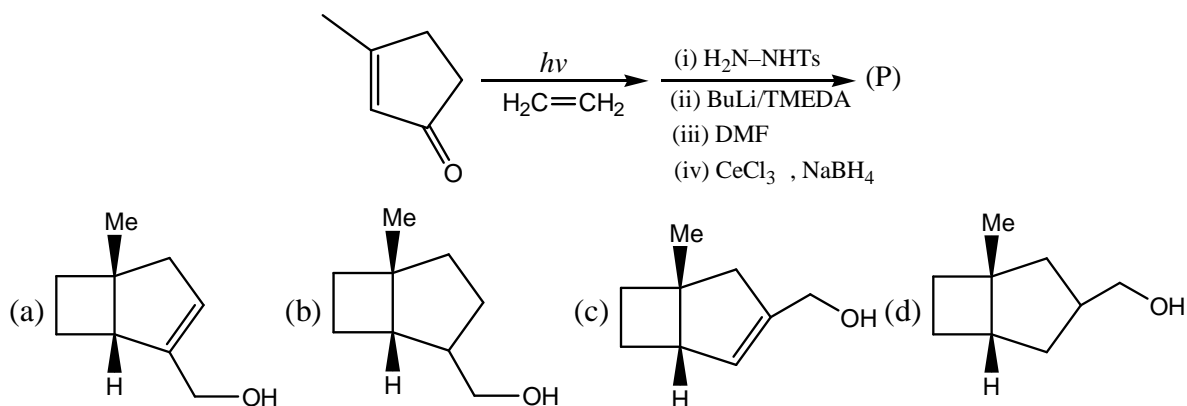
51. The major product (P) formed in the following reaction sequence is



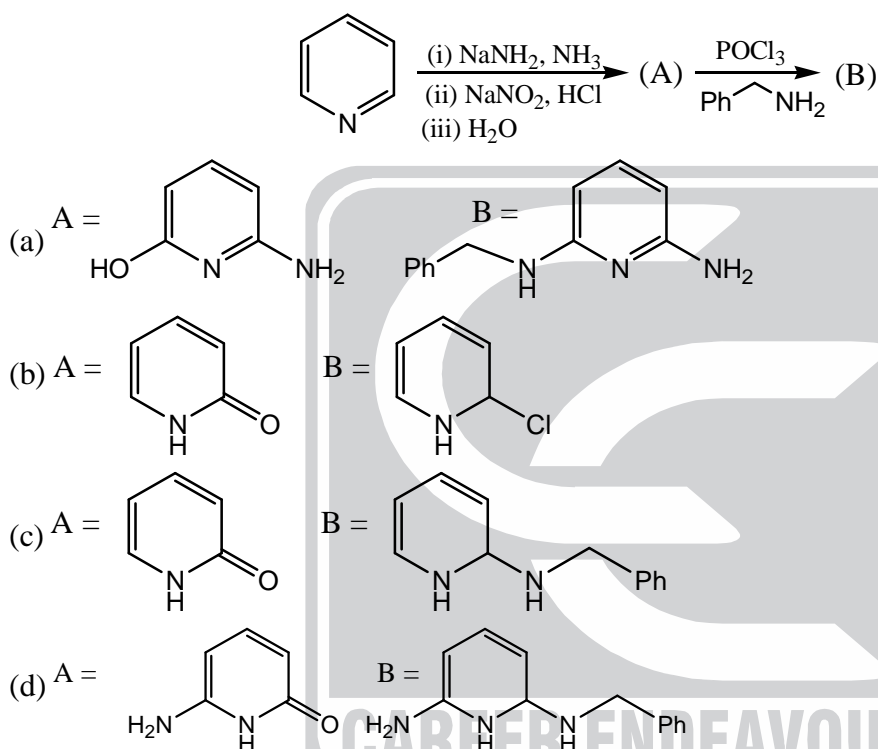
52. The major product (P) formed in the following reaction sequence is



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



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



55. The correct statements are following

- (1) $\text{CF}_4 > \text{CF}_3\text{H} > \text{CF}_2\text{H}_2 > \text{CH}_3\text{F}$ (increasing order of C-F bond length)
- (2) $\text{T}_2 > \text{D}_2 > \text{H}_2$ (order of boiling point)
- (3) $\text{OCl}_2 > \text{OH}_2 > \text{OF}_2$ (order of bond angle)
- (4) $\text{H}_2 > \text{H}_2^+ > \text{H}_2^-$ (stability order)

(a) 2 and 4

(b) 1, 2 and 3

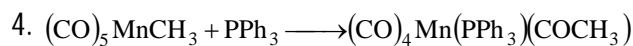
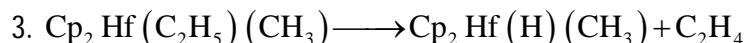
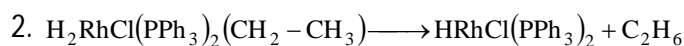
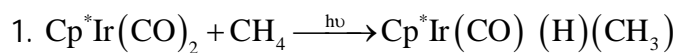
(c) 2, 3 and 4

(d) all of these

56. In 1958, R.L. Mössbauer made the important discovery that:

- (a) When the emitting and absorbing nuclei are bound in a solid, a certain fraction of gamma rays are emitted and absorbed with huge energy loss due to recoil.
- (b) The nucleus can behave as if it is not rigidly bound to the solid such that the entire solid does not take up the recoil
- (c) When the emitting and absorbing nuclei are bound in a solid, there is no recoil when gamma rays are emitted
- (d) When the emitting and absorbing nuclei are bound in a solid, a certain fraction of gamma rays are emitted and absorbed with negligible energy loss due to recoil.

57. The reactions given below represent respectively:-



(a) Oxidative addition, Reductive elimination, Reductive elimination, Migration

(b) Reductive elimination, Oxidative addition, H-elimination, Migratory insertion

(c) Oxidative addition, β -hydrogen, Elimination, Migration, Substitution

(d) Oxidative addition, reductive elimination, β -hydrogen elimination, Migratory insertion.

58. From Boltzmann distribution, the fraction of molecules in state i , is given by

$$P_i = \frac{e^{-\epsilon_i/kT}}{q}$$

where q is molecular partition function and

$$q = \sum_i g_i e^{-\epsilon_i/kT}$$

where g_i = degeneracy of state i .

The molecular partition function for a molecule with an infinite number of equally spaced nondegenerate energy levels is – (ϵ = energy separation between any two levels.)

(a) $\frac{1}{1 + e^{-\epsilon/kT}}$

(b) $\frac{1}{1 - e^{-\epsilon/kT}}$

(c) $1 + e^{-\epsilon/kT}$

(d) $1 - e^{-\epsilon/kT}$

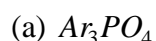
59. When eigen value problem for energy of a rigid rotor is solved, then it is found that its energy is quantized as,

$$E_J = J(J+1)hcB$$

where B is rotational constant, which is generally expressed in cm^{-1} , and J can be 0, 1, 2, 3,.....

If rotational constant (B) for CO molecule is 1.92 cm^{-1} , the bond length in CO is _____ Å.

60. An organic compound X ($\text{C}_8\text{H}_8\text{O}$) when treated with m -CPBA gives compound Y. Compound Y on acid hydrolysis gives compound Z. The compound Z gives an abnormal product H (major) with PCl_5 . Compound X when treated with I_2 in basic medium then gives A and B. The compound H is



61. An organic compound (molecular formula $\text{C}_8\text{H}_7\text{Br}$) yields a primary alcohol on hydroboration and gives the following spectral data :

$$\text{UV} : \lambda_{\text{max}} 282 (\epsilon_{\text{max}} 450)$$

$$\text{IR} : \nu_{\text{max}} (\text{cm}^{-1}) \quad 3033(w), 1646(m), 1602(m), 1582(w), 870(s), 770(s), 710(m)$$

(b)

(c)

(a)

$$^1\text{HNMR} : \delta \quad 5.14(dd)$$

$$5.70(dd)$$

$$6.70(dd)$$

$$7.26 - 7.38$$

Integration

1

:

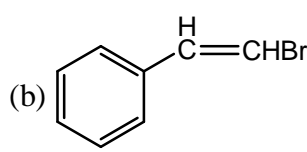
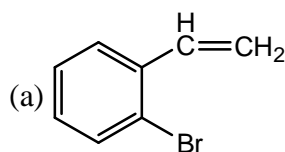
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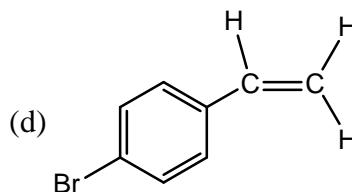
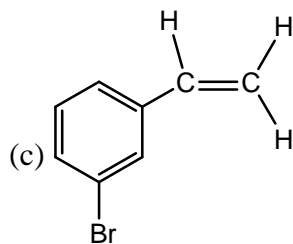
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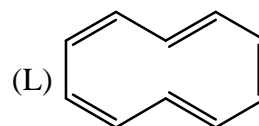
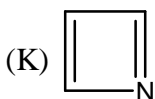
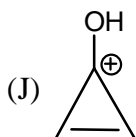
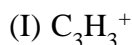
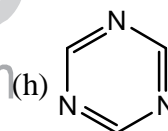
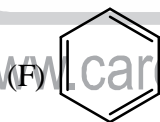
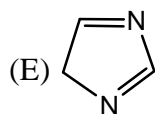
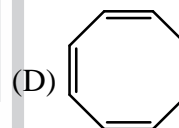
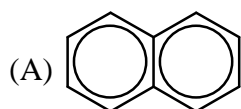
62. Antimony pentafluoride SbF_5 reacts with XeF_4 and XeF_6 to form ionic compounds $\text{XeF}_3^+\text{SbF}_6^-$ and $\text{XeF}_5^+\text{SbF}_6^-$ respectively. The geometries of the cations and anions in these compounds are respectively.
- (a) Trigonal planar, square pyramidal and octahedral
 (b) T-shape, trigonal bipyramidal and octahedral.
 (c) Trigonal planar, trigonal bipyramidal and octahedral.
 (d) T-shape, square pyramidal and octahedral.

63. According to equipartition theory,

$$\overline{\frac{1}{2}mV_x^2} = \frac{1}{2}k_bT$$

then $\left[\langle V_x^2 \rangle - \langle V_x \rangle^2 \right]$ is

- (a) 0 (b) $\frac{k_bT}{m}$ (c) $\sqrt{\frac{k_bT}{m}}$ (d) none
64. The value of $(M+2/M)$ for $\text{C}_2\text{H}_4\text{SO}_2$ (Neglect the impacts of ^1H and ^{13}C) is
- (a) 1: 15 (b) 1: 23 (c) 1: 29 (d) 1: 32
65. Among the following compounds?



The number of antiaromatic compounds is/are _____

Space for rough work

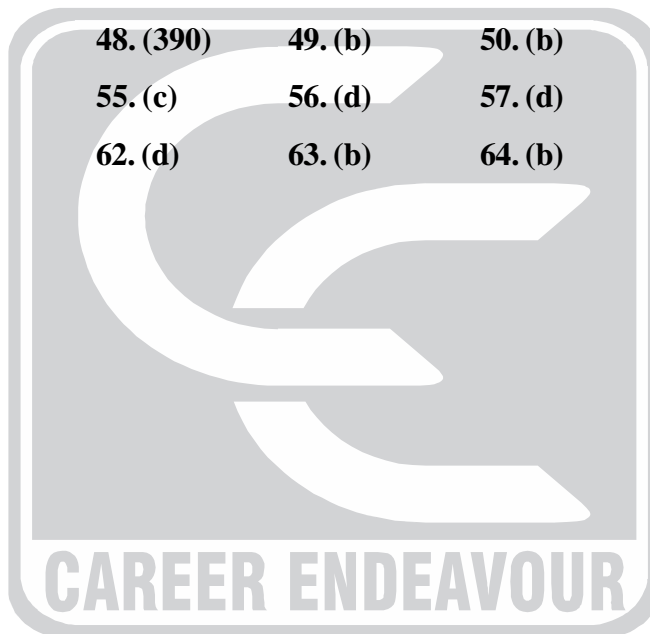


CHEMISTRY-CY

Date: 13-01-2016

GATE TEST SERIES-II**ANSWER SHEET**

- | | | | | | | |
|---------|---------|-----------|-----------|---------|--------------|------------|
| 1. (d) | 2. (c) | 3. (a) | 4. (c) | 5. (a) | 6. (c) | 7. (a) |
| 8. (c) | 9. (a) | 10. (a) | | | | |
| 11. (d) | 12. (d) | 13. (c) | 14. (b) | 15. (b) | 16. (10.650) | 17. (a) |
| 18. (a) | 19. (c) | 20. (c) | 21. (a) | 22. (c) | 23. (d) | 24. (c) |
| 25. (a) | 26. (a) | 27. (c) | 28. (4) | 29. (a) | 30. (b) | 31. (c) |
| 32. (b) | 33. (c) | 34. (c) | 35. (a) | 36. (d) | 37. (a) | 38. (b) |
| 39. (b) | 40. (8) | 41. (d) | 42. (0.4) | 43. (b) | 44. (a) | 45. (2) |
| 46. (a) | 47. (b) | 48. (390) | 49. (b) | 50. (b) | 51. (c) | 52. (b) |
| 53. (a) | 54. (c) | 55. (c) | 56. (d) | 57. (d) | 58. (b) | 59. (1.31) |
| 60. (a) | 61. (c) | 62. (d) | 63. (b) | 64. (b) | 65. (3) | |

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