Paper Code: CY

Test Type: TEST SERIES

Duration: 3:00 Hours

CHEMISTRY-CY

Date: 18-01-2018

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 ⅓ marks for a **1-mark** question and ⅔ marks for a **2-mark** question.

7. There is **NO NEGATIVE MARKING** for questions of **NUMERICAL ANSWER TYPE**.
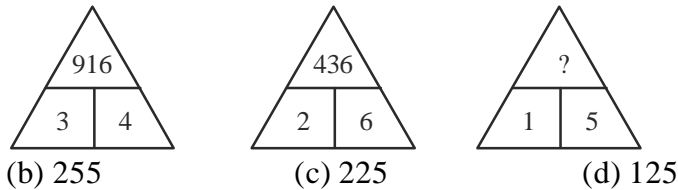
8. Non-programmable type Calculator is allowed

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

1. In an examination, 35% of total students failed in Hindi, 45% failed in English and 20% in both find the percentage of those who passed in both the subjects?
   (a) 60%
   (b) 40%
   (c) 30%
   (d) 20%

2. If $|-x+6|=11$, then the possible value of $|-2x|-x^2$ will be
   (a) 250
   (b) −250
   (c) 255
   (d) −255

3. Find the missing number

916		436		?
3	4	2	6	1	5

   (a) 625
   (b) 255
   (c) 225
   (d) 125

4. Which of the following options is closest in meaning to the word given below?
   FAD :
   (a) Apathetic
   (b) Expensive
   (c) Vogue
   (d) Benevolent

5. Which one of the following options is the closest in meaning to the word given below?
   Cantankerous
   (a) Freedom
   (b) meticulous
   (c) bad tempered
   (d) coercion

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

6. If $\log_2\left[\log_3\left(\log_2 x\right)\right]=1$ then x is equal to
   (a) 0
   (b) 12
   (c) 128
   (d) 512

7. Find the odd one out
   (a) Ring
   (b) Bangle
   (c) Tyre
   (d) Plate

8. The ratio of male to female students in a college for five years in the following line graph. If the number of female students in 2008 and 2009 is equal. What is the ratio of male students in 2009 to male students in 2008?
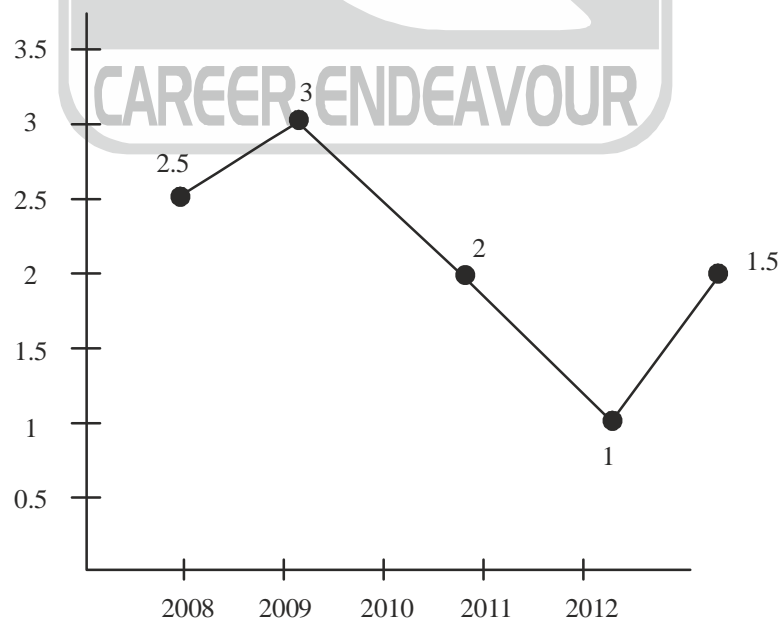
   (a) 6 : 5
   (b) 5 : 6
   (c) 2 : 3
   (d) 1 : 1

9. A cube is coloured red on all of its faces. It is then cut into 64 smaller cubes of equal size. How many smaller cubes have no face coloured?

    (a) 24   (b) 16   (c) 8   (d) 10

10. The question below consists of a pair of related words followed by four pairs of words. Select the pair that best expresses the relation in the original pair:
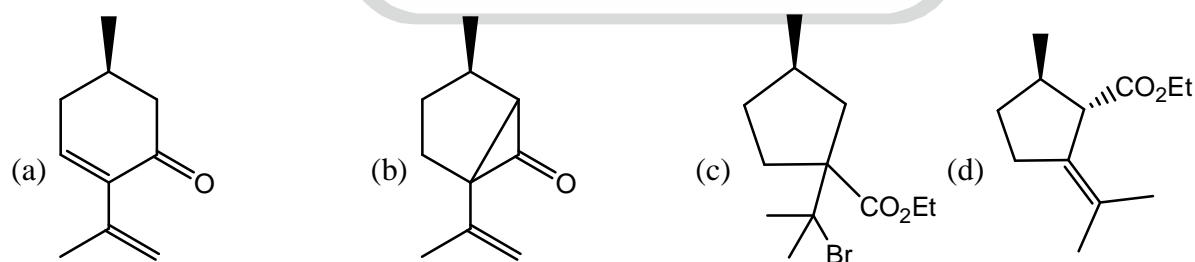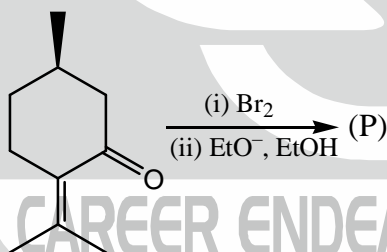
    Exercise: Strong

    (a) Perform: Timid   (b) Guard: Alert   (c) Decide: Shrewd   (d) Read: Knowledgeable
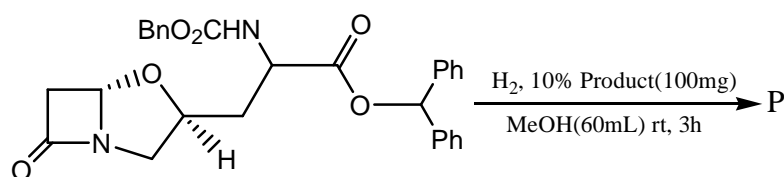
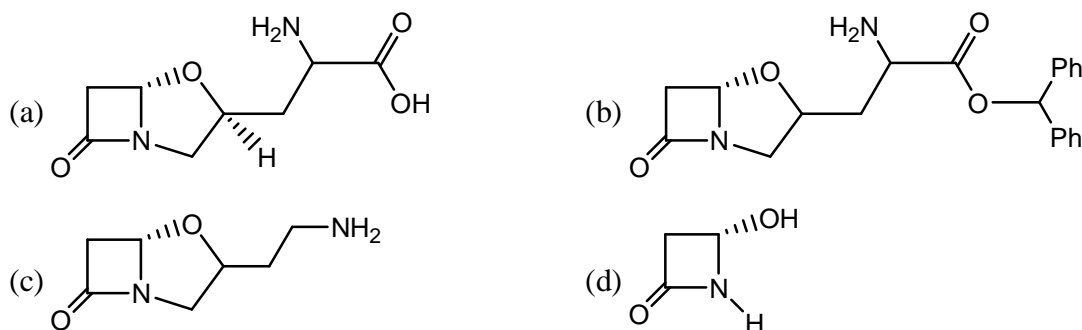**Q.11-Q.35 carry one mark each.**

11. The major product (P) is,
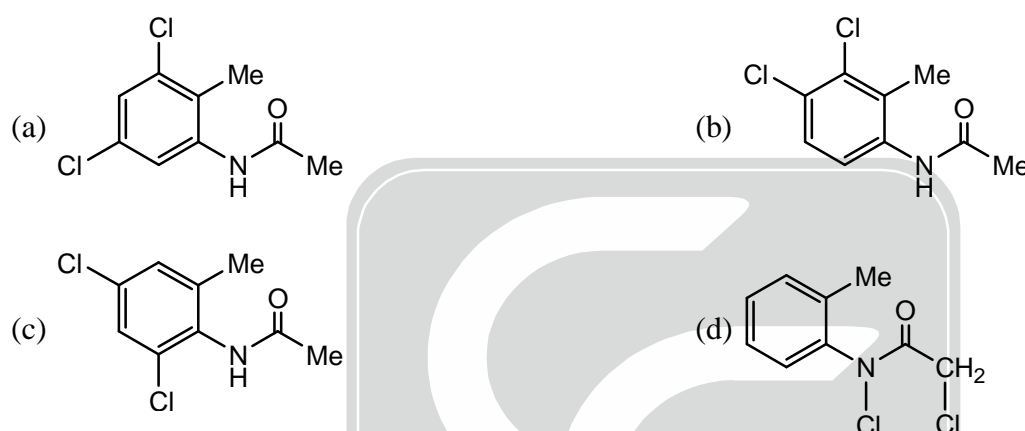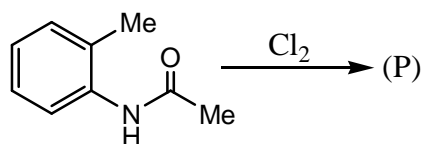
12. The major product (P) is

13. The major product 'P' in the above synthetic transformation is:

(a)

(b)

(c)

(d)

14. When nitrobenzene is treated with Br_2 in presence of $FeBr_3$, the major product formed in m-bromonitrobenzene, statements which are related to obtain the m-isomer is/are

(I) The electron density on meta carbon is more than that on ortho and para positions

(II) The intermediate carbonium ion formed after initial attack of Br^+ at the meta position is less destabilised.

(III) Loss of aromaticity when Br^+ attacks at the ortho and para position and not at meta positions.

(IV) Easier loss of H^+ to regain aromaticity from meta position than from ortho and para positions.

The correct option is

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

15. Total number of possible alkene formed _____
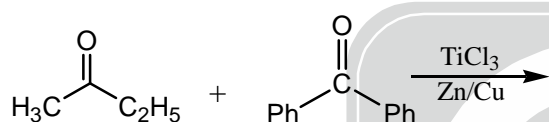
16. The difference in CFSE of $\left[Fe(H_2O)_6\right]^{3+}$ and $\left[Fe(CN)_6\right]^{3-}$ is _____ Δ_0

17. Correct order of rates of exchange of coordinated and solvent H_2O is

(a) $\left[Os(H_2O)_6\right]^{2+} > \left[Ru(H_2O)_6\right]^{2+} > \left[Fe(H_2O)_6\right]^{2+} > \left[Zn(H_2O)_6\right]^{2+}$

(b) $\left[Fe(H_2O)_6\right]^{2+} > \left[Zn(H_2O)_6\right]^{2+} > \left[Ru(H_2O)_6\right]^{2+} > \left[Os(H_2O)_6\right]^{2+}$

(c) $\left[Zn(H_2O)_6\right]^{2+} > \left[Fe(H_2O)_6\right]^{2+} > \left[Ru(H_2O)_6\right]^{2+} > \left[Os(H_2O)_6\right]^{2+}$

(d) $\left[Fe(H_2O)_6\right]^{2+} > \left[Zn(H_2O)_6\right]^{2+} > \left[Os(H_2O)_6\right]^{2+} > \left[Ru(H_2O)_6\right]^{2+}$

18. Match the complexes with correct IR stretching frequency of $\nu(CO)\,cm^{-1}$

| Complexes	$\nu(CO)\,cm^{-1}$
(I) $\left[(dien)Mn(CO)_3\right]^+$	(A) 2090
(II) $\left[Mn(CO)_6\right]^+$	(B) 1960
(III) $\left[(en)Mn(CO)_4\right]^+$	(C) 2000
(IV) $\left[(MeH_2N)Mn(CO)_5\right]^+$	(D) 2043

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

19. Number of sp^3 hybridized boron atom present in borax is/are _____

20. The shape of $[ClF_4]^-$ and $[ClF_2]^-$ ions is respectively.
    (a) see-saw and linear
    (b) see-saw and bent
    (c) tetrahedral and linear
    (d) square planar and linear

21. Choose the correct order of ionic radius from given option
    (a) $Ce^{3+} > Pr^{3+} > Dy^{3+} > Eu^{3+}$
    (b) $Pr^{3+} > Dy^{3+} > Eu^{3+} > Ce^{3+}$
    (c) $Dy^{3+} > Eu^{3+} > Ce^{3+} > Pr^{3+}$
    (d) $Ce^{3+} > Pr^{3+} > Eu^{3+} > Dy^{3+}$
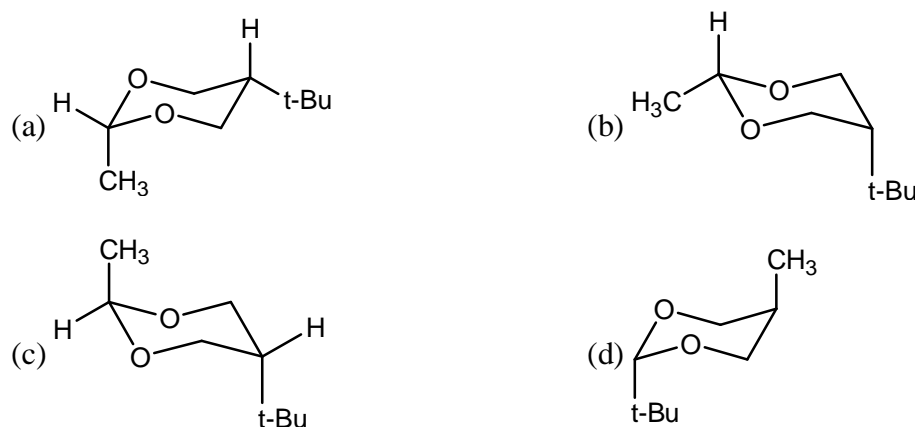
22. The major product formed in the following reaction is
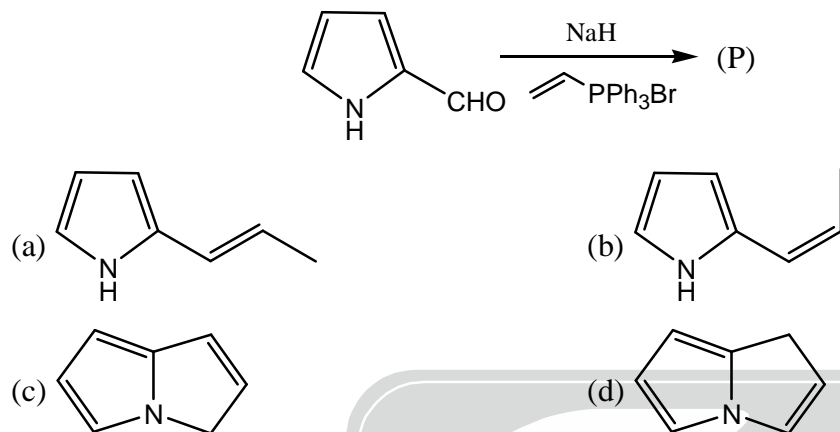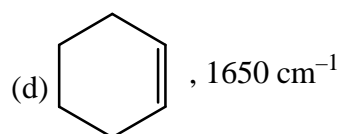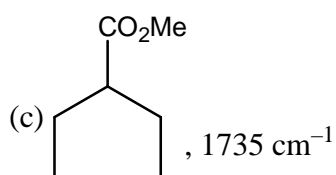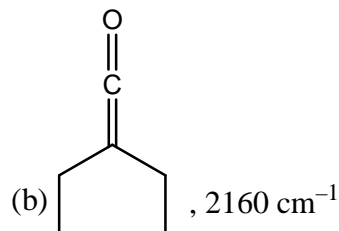

23. In the following reactions sequence
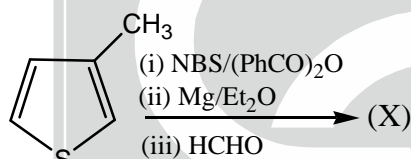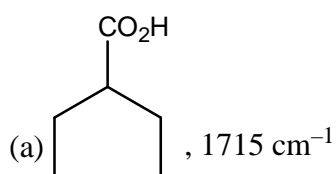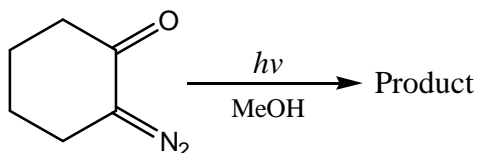

The product (X) is
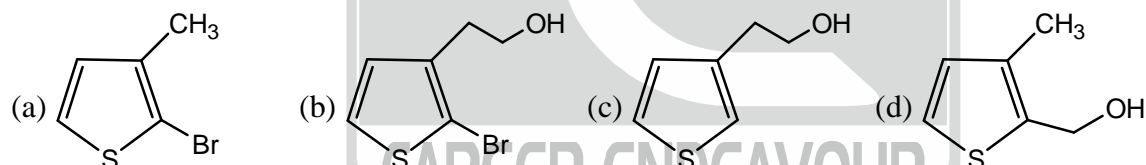
24. The most stable conformation in the following:
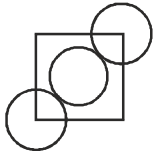
25. In the following reaction, the structure of major product and characteristic IR absorption frequency (cm^{-1}) are respectively.

(a) , 1715 cm^{-1}

(b) , 2160 cm^{-1}

(c) , 1735 cm^{-1}

(d) , 1650 cm^{-1}

26. The number of compound behave as acid in liquid HF is/are _____

$ClF_3, BF_3, SbF_5, SiF_4$

27. For the following two reactions A and B, the correct statement is

(a) A gives , B gives

(b) A gives , B gives

(c) Both A and B

(d) Both A and B
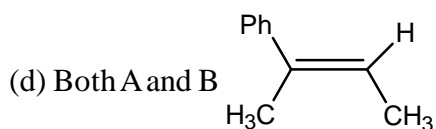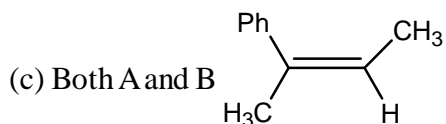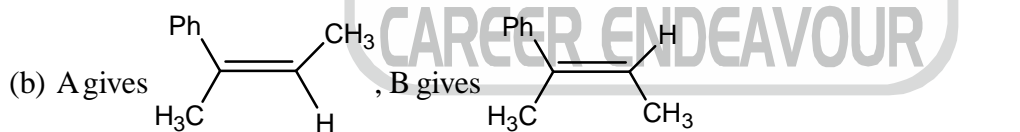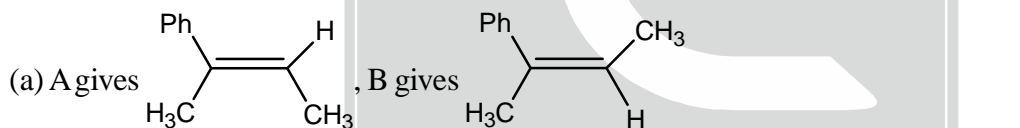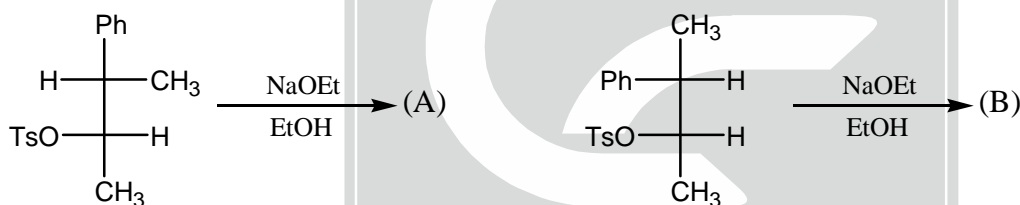
28. The packing fraction of [figure] is

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

29. The unit of Michaelis menton constant in enzyme catalyses

$$E + S \underset{k_2}{\overset{k_1}{\rightleftharpoons}} ES \xrightarrow{k_3} E + P \text{ is}$$

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

30. The Hermitian operator is/are

(I) $A + A^{\dagger}$ (II) $i\left(A - A^{\dagger}\right)$

(a) Only I   (b) only II   (c) both I and II   (d) neither I nor II

31. The orbital represented by $R_{n\ell} = 2\left(\dfrac{Z}{2a_0}\right)^{3/2}\left(e^{-Zr/2a_0} - \dfrac{Zr}{2a_0}e^{-Zr/2a_0}\right)$ is
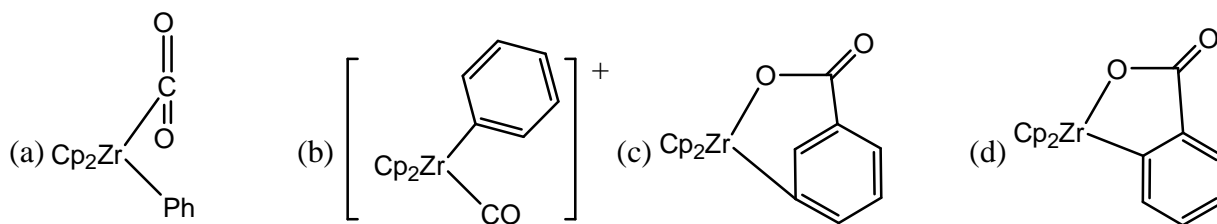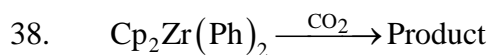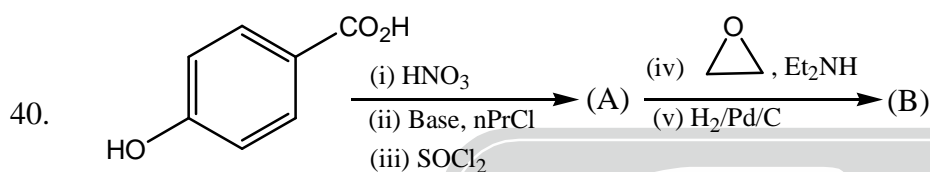
(a) 1s   (b) 2s   (c) 2p   (d) 3p

32. The point group of [figure] is

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

33. The emf of the cell, $Ag\ |\ AgCl(s)\ |\ KCl(aq)\ |\ Hg_2Cl_2(s)\ |\ Hg$ is 0.0455V at 298K and the temperature coefficient is $3.38 \times 10^{-4}\ VK^{-1}$. The enthalpy (ΔH) at 298K is _____ kJ mol^{-1}.

34. An aqueous solution of urea had freezing point of –0.52ºC. What is osmotic pressure of the same solution at 37ºC. Assume that molar concentration and molality are numerically equal $\left(K_f = 1.86\right)$

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

35. 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

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

36. Predict the order of reactivity of the following in oxidative addition reaction of HCl

$$A - IrCl(CO)(PPh_3)_2\ ; \quad B - IrCl(CO)(PMe_3)_2$$

$$C - IrMe(CO)(PMe_3)_2\ ; \quad D - IrPh(CO)(PMe_3)_2$$

(a) $B > C > A > D$ (b) $C > B > D > A$ (c) $C > D > B > A$ (d) $D > A > B > C$

37. The reaction of $CrCl_3$ with liq. NH_3 to give yellow $\left[Cr(NH_3)_6\right]Cl_3$ often has low yield, since the reaction tends to stop with production of pink $\left[Cr(NH_3)_5Cl\right]Cl_2$. On addition of a small piece of Na metal to liq. NH_3 yield of $\left[Cr(NH_3)_6\right]Cl_3$

(a) increases   (b) decreases   (c) remain constant   (d) can not predicted

38. $Cp_2Zr(Ph)_2 \xrightarrow{CO_2}$ Product

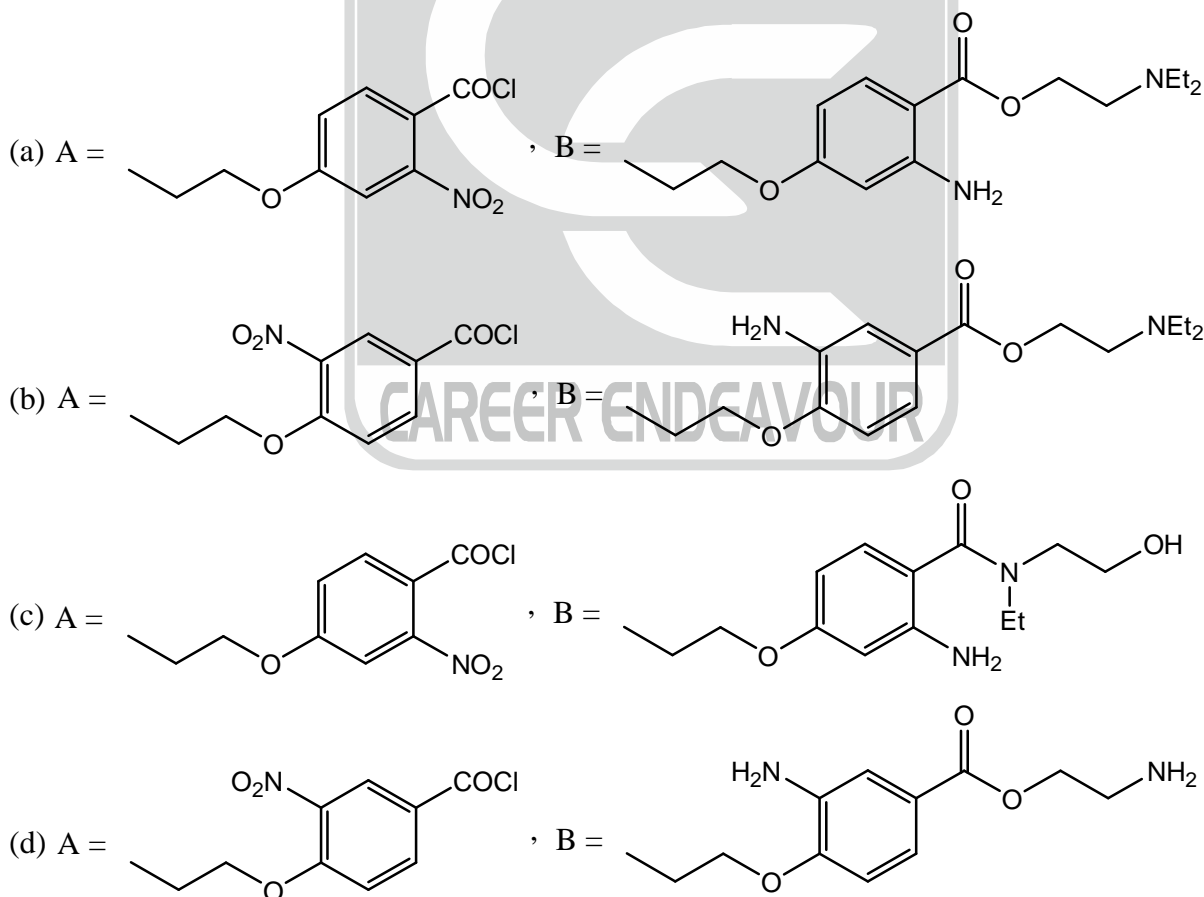(a) Cp₂Zr structure (b) [Cp₂Zr structure]+ (c) Cp₂Zr structure (d) Cp₂Zr structure

39. When graphite is treated with alkali metal which of the following change(s) occur

(1) electrical conductivity of graphite increase

(2) distance between layer of graphite increases

(3) conductivity of graphite decreases with increase in temperature

(4) paramagnetic character in graphite increases

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

40.

(i) HNO_3
(ii) Base, nPrCl → (A)
(iii) $SOCl_2$

(iv) epoxide, Et_2NH
(v) $H_2/Pd/C$ → (B)

The major product (A) and (B) formed respectively are

(a) A = structure with COCl, NO₂, propoxy ; B = structure with ester NEt₂, NH₂, propoxy

(b) A = structure with O₂N, COCl, propoxy ; B = structure with H₂N, ester NEt₂, propoxy

(c) A = structure with COCl, NO₂, propoxy ; B = structure with amide N-Et-ethanol, NH₂, propoxy

(d) A = structure with O₂N, COCl, propoxy ; B = structure with H₂N, ester NH₂, propoxy

41. Select the incorrect option with appropriate R/S configuration

Compound	Configuration
(a)	'S'
(b)	'S'
(c)	'R'
(d)	'S'
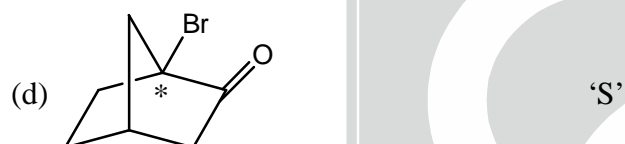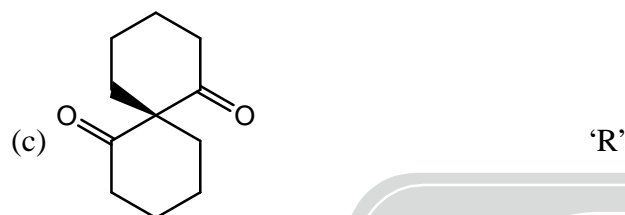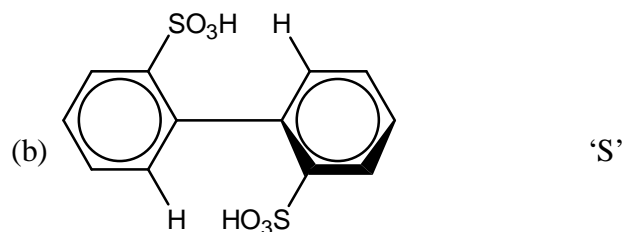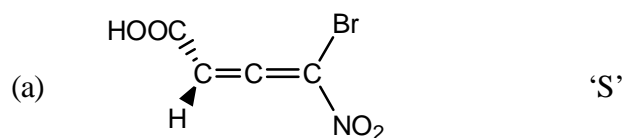
42. **Incorrect** possible synthesis of the products with appropriate reaction

(a)

(b)

(c)

(d)

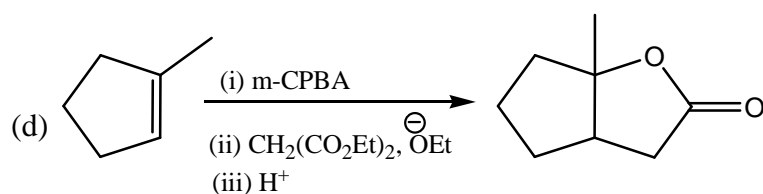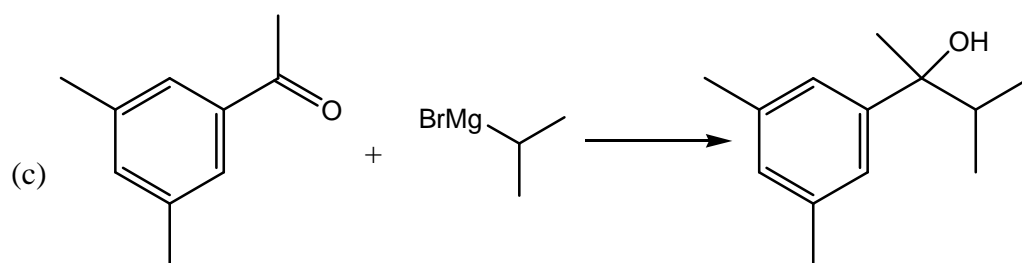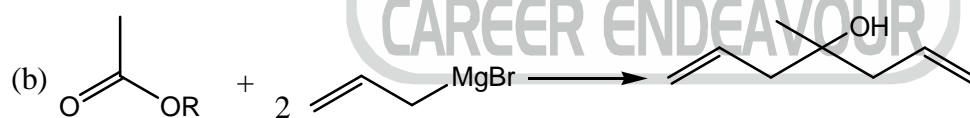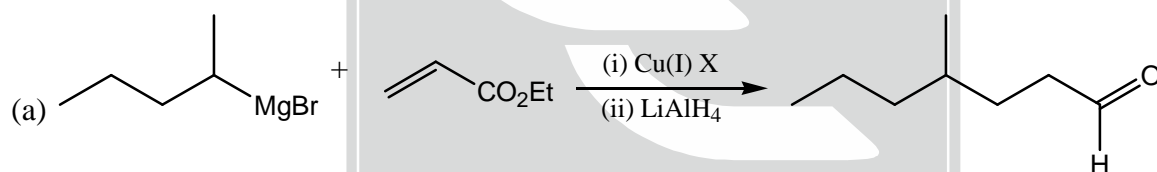43. Sum of the pI value of the following salt of Glu and Lys as shown below
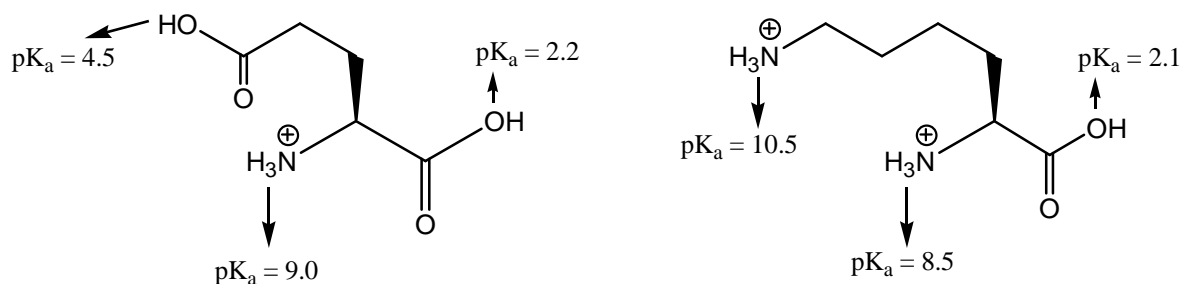
44. The maximum number of isomers (including stereoisomers) that are possible on mono-chlorination of the following compound, is $CH_3CH_2CH(CH_3)CH_2CH_3$

45. The major product formed in the following reaction is

(a)

(b)

(c)

(d)
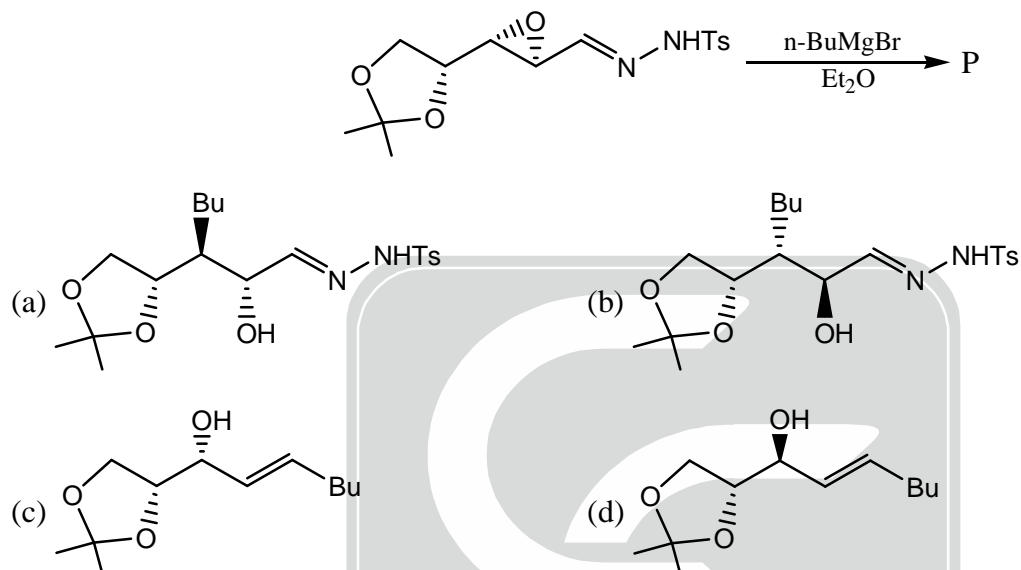
46. The major product and the reaction involved is

(a) P = and N.T(I)

(b) P = and N.T(II)

(c) P = and N.T(II)

(d) P = and N.T(I)

47.

$$\text{Ph-CH=CH-Ph} \xrightarrow[\substack{K_3Fe(CN)_6, K_2CO_3 \\ (DHQD)_2PHAL}]{OsO_4} P$$

The major product P is

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

48.

Compound A and B are

(a)

(b)

(c)

(d)

49. $S_4N_4 + AgF_2 \xrightarrow{CCl_4(cold)} (X)$

(a) X = NSF
(b) $X = NSF_3$
(c) $X = S_4N_4F_4$
(d) $X = NSF_3$
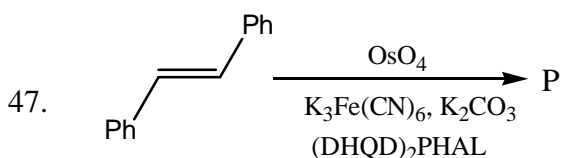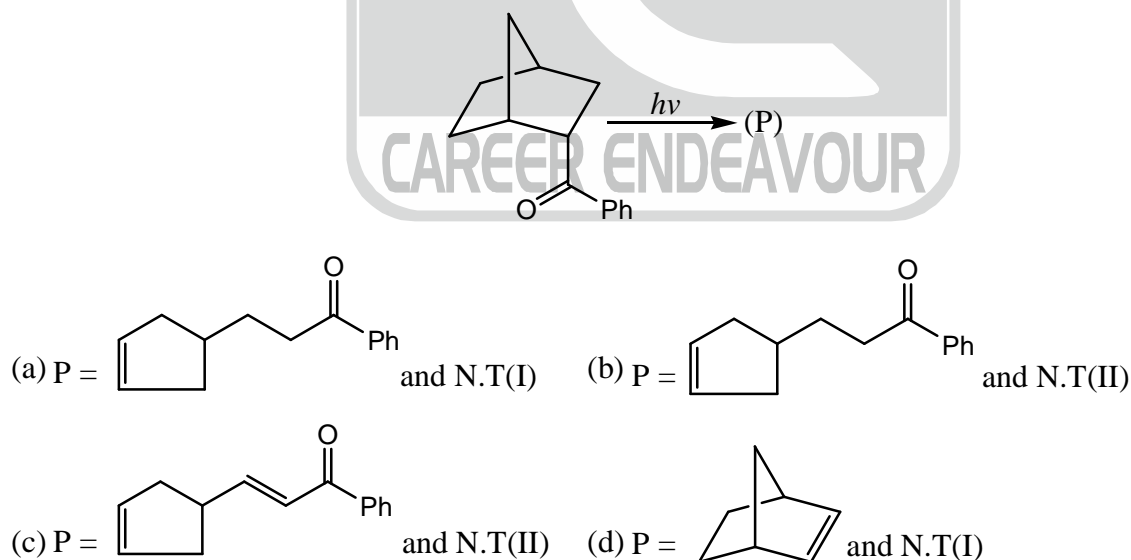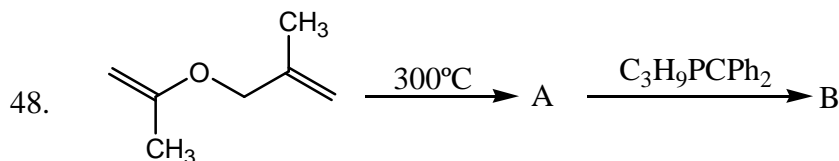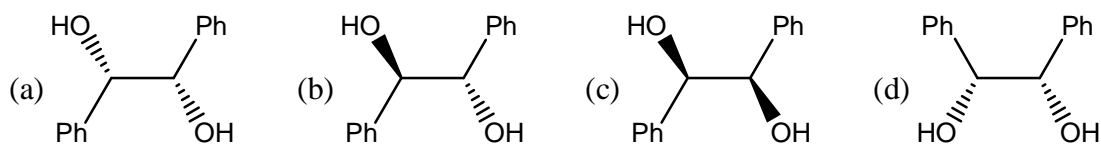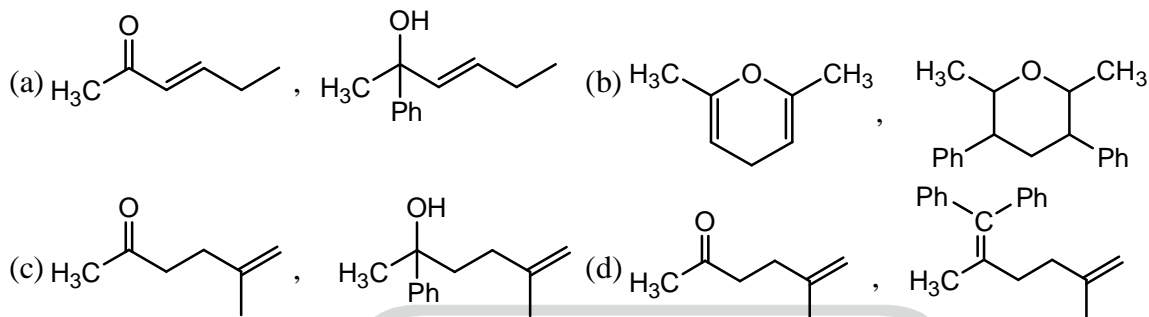
50. The complex formation ability of alkali metal with $\left[P_2O_7\right]^{-4}$ follow order

(a) $Cs^+ > Rb^+ > K^+ > Na^+ > Li^+$
(b) $Li^+ > Na^+ > K^+ > Rb^+ > Cs^+$

(c) $K^+ > Na^+ > Li^+ > Cs^+ > Rb^+$
(d) $Na^+ > Li^+ > K^+ > Rb^+ > Cs^+$

51. Which among the following statement is correct for $F_3C–CF_2–CF_3$?
(a) all C–F bond length are identicle
(b) two C–F bond attached to middle carbon atom are longer as compared to other C–F bond at terminal carbon
(c) Two C–F bond attached to middle carbon atom are shorter as compared to other C–F bond at terminal carbon
(d) none of these

52. Match the Column-I with Column-II

Column-I	Column-II
(P) Feritin	(I) Electron transport
(Q) Vitamin B_{12}	(II) Ionophore
(R) Cytochromes	(III) Oxygen transport
(S) Valinomycin	(IV) Nitrogen fixation
	(V) Organometallic enzyme
	(VI) Ioron storage

(a) P-VI, Q-IV, R-II, S-V
(b) P-I, Q-III, R-VI, S-IV
(c) P-III, Q-V, R-IV, S-VI
(d) P-VI, Q-V, R-I, S-II

53.
$$(B) \xleftarrow[OH^-]{m\text{-}CPBA} \begin{matrix} H & & H \\ & C=C & \\ HOOC & & COOH \end{matrix} \xrightarrow{KMnO_4} (A)$$
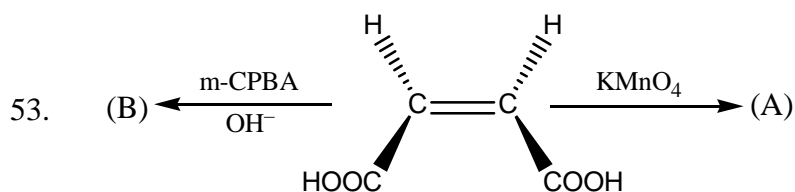
Relation between the major product (A) and (B)

(a) enantiomers   (b) diastereomers   (c) homomers   (d) constitutional isomers

54. The number of atoms per unit cell of diamond cubic crystal are _____

55. The atomic masses of Fluorine and hydrogen are 19.0 a.m.u. and 1.0 a.m.u. respectively. The bond length of HF is 4Å. The moment of inertia of HF is _____10^{-47} kg mtr^2.

56. Given that the mean average speed of oxygen is 200 m/s. The most probable speed of oxygen under the same condition is _____m/s.

57. 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

58. 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) $i\hbar\left[\sin\phi\frac{\partial}{\partial\theta}-\cot\theta\sin\phi\frac{\partial}{\partial\phi}\right]$

59. The uncertainty in the NMR frequency of a compound in liquid state (relaxation time = 2s) is 0.002 Hz. The uncertainty in the frequency (in Hz) of a same compound in solid state (relaxation time = 10^{-6} s) is _____

60. The efficiency of the carnot engine is $\frac{1}{6}$. On decreasing the temperature of the sink by 65K, the efficiency increases to 1/3. The temperature of source is _____K.

61. The sum of ^{1}H NMR and ^{13}C NMR signals in the following compound is _____
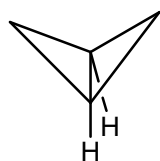
62. An organic compound (molecular formula C_8H_7Br) yields a primary alcohol on hydroboration and gives the following spectral data :

$UV : \lambda_{max}\, 282\,(\varepsilon_{max}\, 450)$

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

	(b)	(c)	(a)	
$^1HNMR : \delta$	5.14(dd)	5.70(dd)	6.70(dd)	7.26 − 7.38
Integration	1 :	1 :	1 :	4

(a)

(b)

(c)

(d)
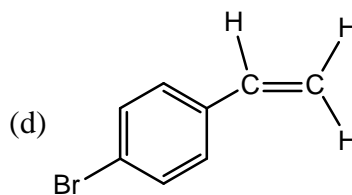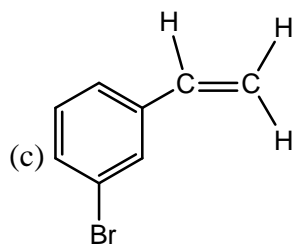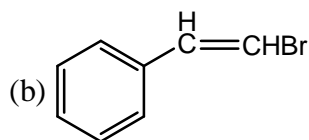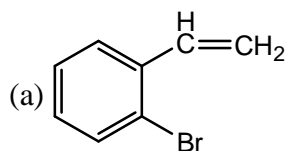
63. The enthalpy of vaporisation of a liquid is 30 kJmol^{-1} and entropy of varpourisation is 75J mol^{-1}k^{-1}. The boiling point of the liqud at 1 atm is _____ K

64. In Langmuir adsorption of a gas onto a solid surface the value of slope and intercept was found to be 0.45 cm^{-3} and 5×10^3 Torr cm^{-3}. The value of distribution coefficient will be _____

65. Given that

$$E^0_{Fe^{3+}|Fe} = -0.04 \text{ V}; E^0_{Fe^{2+}|Fe} = -0.44 \text{ V}$$

The Gibb's free energy for the transformation from Fe^{3+} to Fe^{2+} is :

(a) –38.6 kJ　　　　(b) – 73.34 kJ　　　　(c) 38.6 kJ　　　　(d) 73.34 kJ
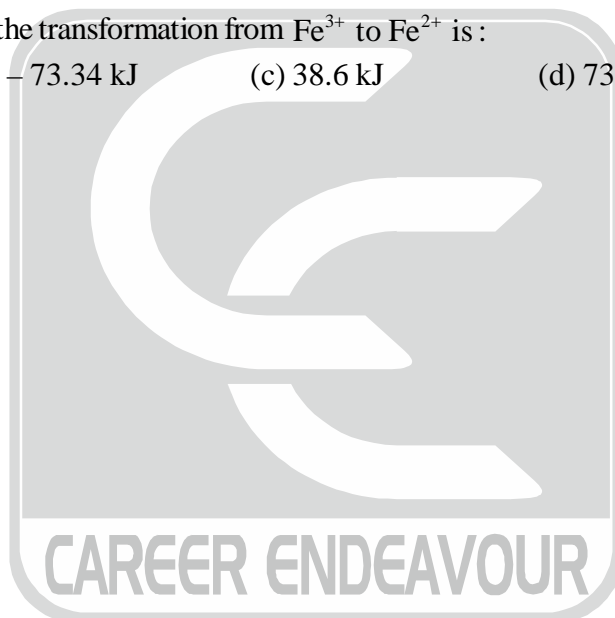
Space for rough work

CHEMISTRY - CY

GATE TEST SERIES-C

Date: 18-01-2018

ANSWER KEY

1. (b)	**2.** (d)	**3.** (d)	**4.** (a)
5. (c)	**6.** (d)	**7.** (d)	**8.** (a)
9. (c)	**10.** (d)	**11.** (c)	**12.** (d)
13. (1)	**14.** (d)	**15.** (4)	**16.** (2)
17. (c)	**18.** (b)	**19.** (2)	**20.** (d)
21. (d)	**22.** (c)	**23.** (c)	**24.** (b)
25. (c)	**26.** (2)	**27.** (d)	**28.** (d)
29. (d)	**30.** (c)	**31.** (b)	**32.** (b)
33. (10.60 to 10.70)	**34.** (a)	**35.** (a)	**36.** (c)
37. (a)	**38.** (d)	**39.** (c)	**40.** (b)
41. (d)	**42.** (a)	**43.** (12.80 to 12.90)	**44.** (8)
45. (c)	**46.** (b)	**47.** (c)	**48.** (d)
49. (c)	**50.** (b)	**51.** (b)	**52.** (d)
53. (b)	**54.** (8)	**55.** (25 to 26)	**56.** (175 to 178)
57. (b)	**58.** (a)	**59.** (4000)	**60.** (390)
61. (5)	**62.** (c)	**63.** (400)	**64.** (90)
65. (d)			