

IIT-JAM-2016

Test Series-7

Full Length Test Series-4

Duration: 3:00 Hours

CHEMISTRY-CY

Date: 27-01-2016

Maximum Marks: 100

Read the following instructions carefully:

- 1 Attempt all questions.
- 2 **Section-A** contains **30** Multiple Choice Questions (MCQ). Each question has 4 choices (a), (b), (c) and (d), for its answer, out of which **ONLY ONE** is correct. From **Q.1 to Q.10** carries 1 Marks and **Q.11 to Q.30** carries 2 Marks each.
- 3 **Section-B** contains **10** Multiple Select Questions (MSQ). Each question has 4 choices (a), (b), (c) and (d) for its answer, out of which **ONE or MORE than ONE** is/are correct. For each correct answer you will be awarded **2 marks**.
- 4 **Section-C** contains **20** Numerical Answer Type (NAT) questions. From **Q.41 to Q.50** carries **1 Mark** each and **Q.51 to Q.60** carries **2 Marks** each. For each NAT type question, the value of answer in between 0 to 9.
- 5 In all sections, questions not attempted will result in zero mark. In Section-A (MCQ), wrong answer will result in negative marks. For all **1 mark** questions, **1/3 marks** will be deducted for each wrong answer. For all **2 marks** questions, **2/3 marks** will be deducted for each wrong answer. In Section-B (MSQ), there is no negative and no partial marking provisions. There is no negative marking in Section-C (NAT) as well.

Name of Student www.careerendeavour.in

College Name

Batch : Weekend Regular Test Series Correspondence



CAREER ENDEAVOUR
ACADEMY PRIVATE LIMITED

North Delhi Centre:

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

South Delhi Centre:

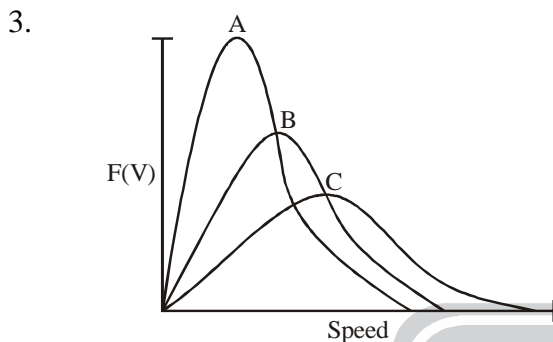
28-A/11, Jia Sarai, Near-IIT, Hauz Khas, New Delhi-16
T : 011-26851008, 26861009

E: info@careerendeavour.in, W : www.careerendeavour.in

Section-A : Multiple Choice Questions (MCQ)

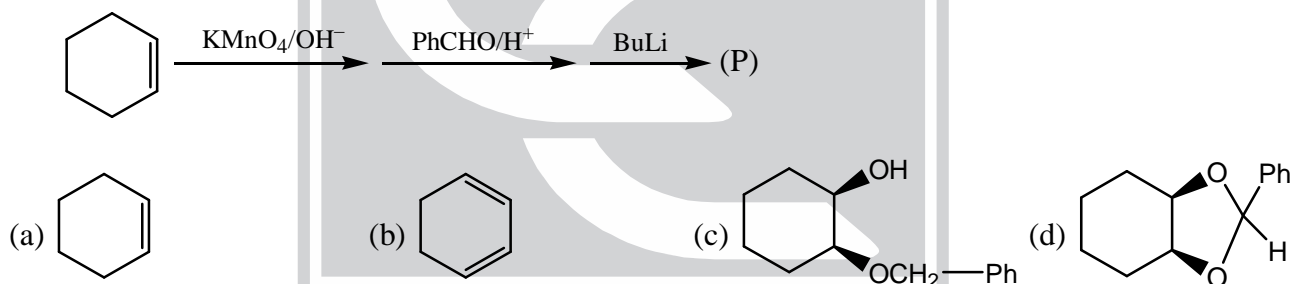
Q.1 to Q.10: Carry 1 Mark each.

1. A process is carried out at constant volume and at constant entropy. It will be spontaneous if
 (a) $\Delta G < 0$ (b) $\Delta H < 0$ (c) $\Delta U < 0$ (d) $\Delta A < 0$
2. Two α particles having species S_1 and S_2 have kinetic energies 2 MeV and 4 MeV respectively. The relationship between S_1 and S_2 is
 (a) $S_1 = 2S_2$ (b) $S_2 = S_1$ (c) $S_1 = \sqrt{2}S_2$ (d) $S_2 = \sqrt{2}S_1$

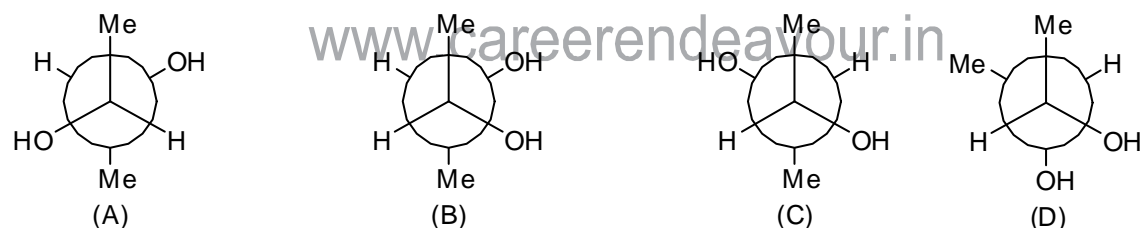


Identify the speed distribution functions of Ne, Ar, and Kr with the curves in the figure above

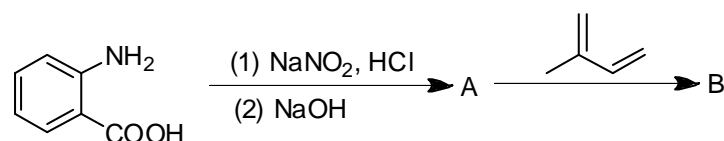
- (a) Ne-A, Ar-B, Kr-C (b) Ne-B, Ar-C, Kr-A
 (c) Ne-C, Ar-B, Kr-A (d) Ne-C, Ar-A, Kr-B
4. The major product (P) formed on the following reaction

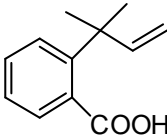
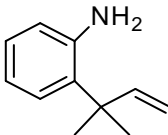
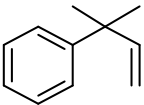
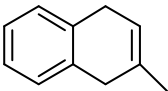


5. Among the following, the Newman projections of meso-2, 3-butanediol are



- (a) A and B (b) A and C (c) C and D (d) B and D
6. The intermediate A and the major product B in the following conversion are



- (a) A is a carbocation and B is  (b) A is a carbocation and B is 
- (c) A is a free radical and B is  (d) A is a benzyne and B is 

7. A π -bond between two p_x orbital containing one unpaired electron each when they approach each other appropriately along
 (a) x -axis (b) y -axis (c) z -axis (d) both (b) and (c)
8. In the cluster $[\text{Co}_3(\text{CH})(\text{CO})_9]$ obeying the 18 electron rule, number of M-M bond and bridging ligands respectively, are
 (a) 3 and 1 CH (b) 0 and 3 CO (c) 3 and 1 CO (d) 6 and 1 CH
9. How many moles of P_4O_{10} will react with one mole of water
 (a) 2 moles (b) 6 moles (c) 1/3 moles (d) 1/6 moles
10. Two isomers are obtained for $\text{Pt}(\text{NH}_3)_2\text{Cl}_2$, while only one isomer is obtained for $\text{Ni}(\text{NH}_3)_2\text{Cl}_2$. This is because
 (a) the two complexes differ in the oxidation state of the metal
 (b) the two complexes differ in the oxidation state of the metal as well as coordination number
 (c) the two complexes differ in their coordination number
 (d) the two complexes differ in their coordination geometry

Q.11 to Q.30: Carry 2 Marks each.

11. A compound containing Zn, Al and S crystallises with a closest packed array of sulphide ions. Zinc ions are found in one-eighth of the tetrahedral holes and aluminium ions in one half of the octahedral holes. The empirical formula of the compound is
 (a) ZnAl_2S_4 (b) $\text{Zn}_2\text{Al}_2\text{S}_4$ (c) ZnAl_4S_2 (d) ZnAlS_4
12. The rate constant for the decomposition of N_2O_5 as $\text{N}_2\text{O}_5 \longrightarrow \text{N}_2\text{O}_4 + \frac{1}{2}\text{O}_2$ are 3.46×10^{-5} and 4.87×10^{-3} at 25°C and 65°C respectively. The value of activation energy is
 (a) 24.8 kcal/mol (b) 20.8 kcal/mol (c) 30 kcal/mol (d) 18.8 kcal/mol
13. Alkali metal super oxides are obtained by the reaction of
 (a) oxygen with alkali metal in liquid ammonia
 (b) water with alkali metal in liquid
 (c) H_2O_2 with alkali metals
 (d) H_2O_2 with alkali metal in liquid ammonia.
14. Match the IR stretching frequency with the given compound

compounds	$\bar{\nu}_{\text{C=O}} \text{ cm}^{-1}$
(I) Heptan-2-one	(A) 1667
(II) Hexanedioic acid	(B) 1710
(III) Paracetamol	(C) 1720

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



15. The internal energy of an ideal gas follows the equation $U = 3.5 PV + k$, where k is a constant. The gas expands from an initial volume of 0.25 m^3 to a final volume of 0.86 m^3 . If the initial pressure is 5 N m^{-2} , the change in internal energy (in joules) is (given $PV^{1.3} = \text{constant}$)
 (a) -1.38 (b) -1.5 (c) 1.38 (d) 1.5
16. The ionisation energy of He^+ is $19.6 \times 10^{-18} \text{ J/atom}$. The energy of first stationary state of Li^{+2} is
 (a) $-4.41 \times 10^{-17} \text{ J/atom}$ (b) $-5.41 \times 10^{-17} \text{ J/atom}$
 (c) $5.41 \times 10^{-17} \text{ J/atom}$ (d) $4.41 \times 10^{-17} \text{ J/atom}$
17. At 18°C , the mobilities of NH_4^+ and ClO_4^- ions are 6.6×10^{-4} and $5.7 \times 10^{-4} \text{ cm}^2 \text{ volt}^{-1} \text{ s}^{-1}$, at infinite dilution. The equivalent conductance of ammonium perchlorate solution at infinite dilution is
 (a) $1.187 \times 10^{-2} \text{ Sm}^2 \text{ eq}^{-1}$ (b) $-1.187 \times 10^{-2} \text{ Sm}^2 \text{ eq}^{-1}$
 (c) $-2.187 \times 10^{-2} \text{ Sm}^2 \text{ eq}^{-1}$ (d) $2.187 \times 10^{-2} \text{ Sm}^2 \text{ eq}^{-1}$
18. Match Column-I with Column-II.

Column-I

- (A) Nucleic acid
 (B) Protein
 (C) Maltose
 (D) Natural rubber
 (a) A-P, B-Q, C-R, D-S
 (c) A-S, B-Q, C-P, D-R

Column-II

- (P) Synthetic polymer
 (Q) Natural polymer
 (R) Glycosidic linkage
 (S) Amide linkage
 (b) A-Q, B-S, C-R, D-P
 (d) A-Q, B-P, C-R, D-S

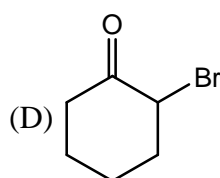
19. Match **List-I** with **List-II** and select the correct answer from the codes given below as Lists.

List-I

- (A) $\text{CH}_2=\text{CH}-\text{CH}_2-\text{Br}$
 (B) $\text{C}_6\text{H}_5\text{OCOCH}_3$
 (C) $\text{C}_6\text{H}_5-\text{NH}-\text{NH}-\text{C}_6\text{H}_5$

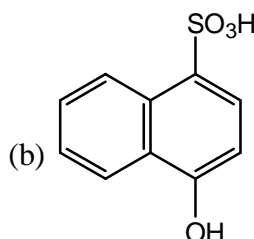
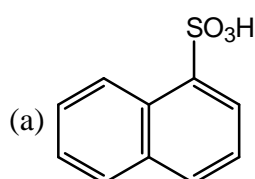
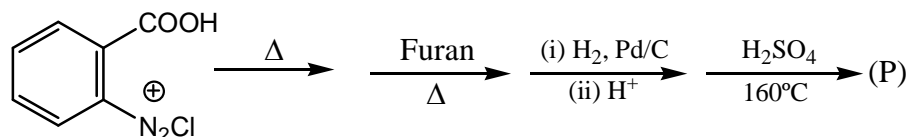
List-II

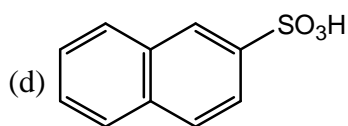
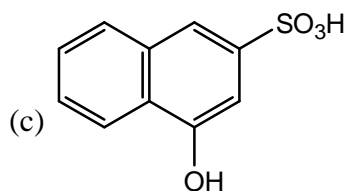
- (1) Benzidine
 (2) Allylic rearrangement
 (3) Fevorski rearrangement
 (4) Fries rearrangement



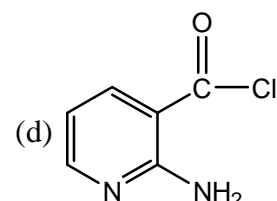
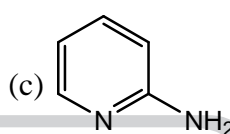
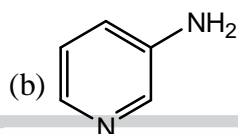
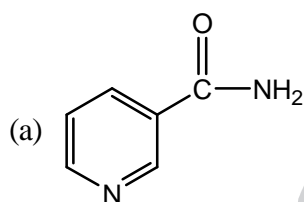
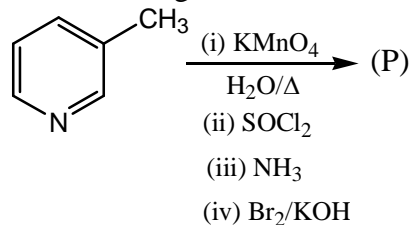
- (a) A-2, B-4, C-3, D-1 (b) A-2, B-4, C-1, D-3
 (c) A-1, B-2, C-3, D-4 (d) A-2, B-1, C-3, D-4

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

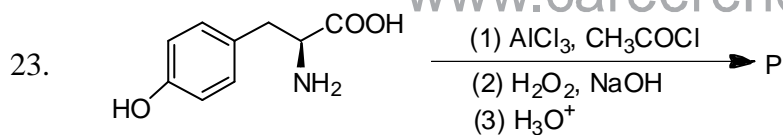
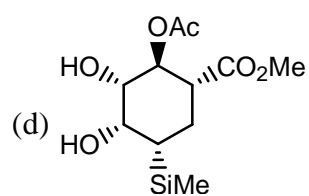
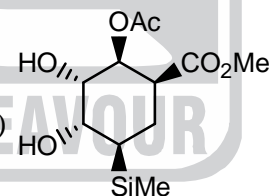
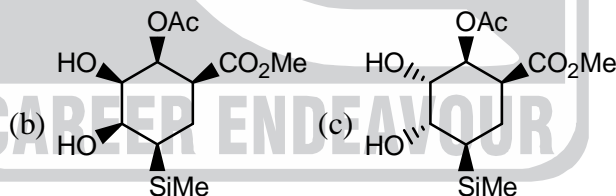
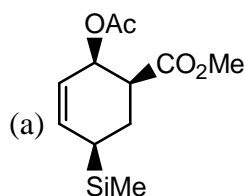
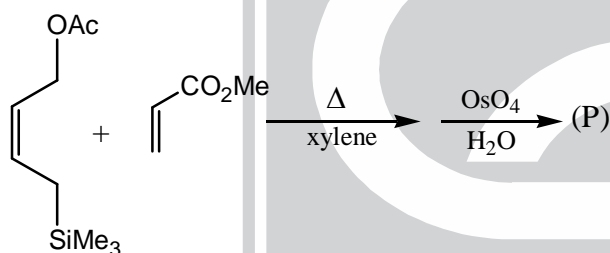




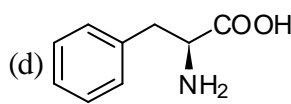
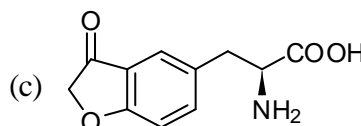
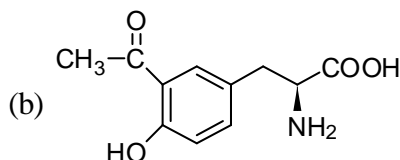
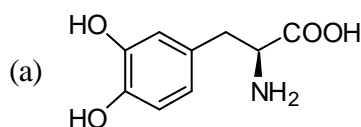
21. The major product (P) formed in the following reaction



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



Product P is

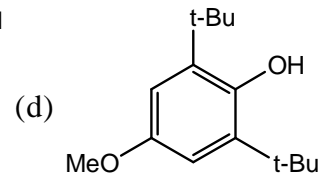
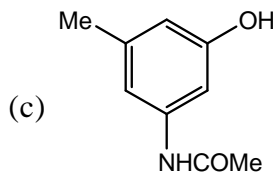
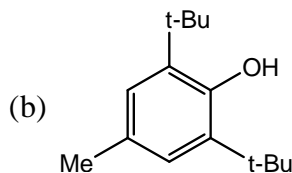
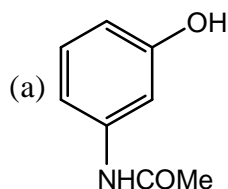


24. Select the correct pair of inverse and normal spinel respectively from following
- (a) MgAl_2O_4 and Mn_3O_4 (b) FeCr_2O_4 and NiAl_2O_4
 (c) CoFe_2O_4 and FeCr_2O_4 (d) Fe_3O_4 and CoFe_2O_4
25. Consider the following statements about carbohydrate. The **CORRECT** option is
- (I) Bromine water can be used to differentiate between aldoses and ketoses.
 (II) All monosaccharides, whether aldoses or ketoses are reducing sugars.
 (III) Osazone formation destroys the configuration about C_2 of an aldose, but does not affect the configuration of the rest of the molecule.
 (IV) A pair of diastereomeric aldoses which differ only in configuration about C_2 is termed as pair of anomers.
- (a) I, II, IV (b) I, II, III (c) II, III, IV (d) all of these
26. Which statement(s) are **INCORRECT**?
- (1) High spin complexes are always paramagnetic
 (2) Low spin complexes are always diamagnetic
 (3) H_2O is more likely to form a low spin complex than CN^- .
 (4) Tetrahedral complexes are more likely to be low spin than high spin
- (a) 1, 2 and 3 (b) 2, 3 and 4 (c) 1 and 3 (d) all of these
27. Which of the following statement(s) is **INCORRECT**?
- (a) The electronic configuration of Cr is $[\text{Ar}] 3d^5 4s^1$
 (b) The magnetic quantum number may have a negative value
 (c) In silver atom, 23 electrons have a spin of one type and 24 of the opposite type
 (d) The oxidation state of nitrogen in HN_3 is -3 .
28. Valence bond theory, magnetic measurements indicates that $[\text{Co}(\text{OH}_2)_6]^{2+}$ has 3 unpaired electrons. Therefore, the hybridization of metal's orbital in $[\text{Co}(\text{OH}_2)_6]^{2+}$ is
- (a) sp^3 (b) sp^2d (c) sp^3d^2 (d) d^2sp^3
29. We have two complexes $[\text{Mn}(\text{H}_2\text{O})_6]^{3+}$ and $[\text{Re}(\text{H}_2\text{O})_6]^{3+}$ ion. Their CFSE and pairing energy are given below:
- $[\text{Mn}(\text{H}_2\text{O})_6]^{3+}$: $10Dq = 250 \text{ kJ/mol}$; pairing energy = 300 kJ/mol
 $[\text{Re}(\text{H}_2\text{O})_6]^{3+}$: $10Dq = 400 \text{ kJ/mol}$; pairing energy = 180 kJ/mol
- predict from their data, the complexes are
- (a) Mn-high spin and Re-low spin (b) both high spin
 (c) both low spin (d) Mn-low spin, Re-high spin
30. The correct order of acidic strength is
- (a) $\text{Cl}_2\text{O}_7 > \text{SO}_2 > \text{P}_4\text{O}_{10}$ (b) $\text{CO}_2 > \text{N}_2\text{O}_5 > \text{SO}_3$
 (c) $\text{Na}_2\text{O} > \text{MgO} > \text{Al}_2\text{O}_3$ (d) $\text{K}_2\text{O} > \text{CaO} > \text{MgO}$

Section-B : Multiple Select Questions (MSQ)


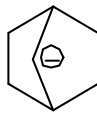
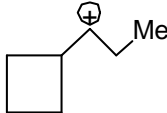
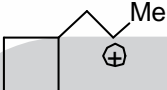
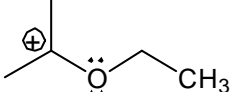
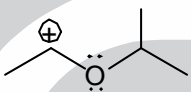
Q.31 to Q.40: Carry 2 Marks each.

31. Which of the following compounds having four ^1H NMR signal and O—H stretching frequency nearly 3600 cm^{-1} in their spectra.



32. An operator A is defined as $A = -\frac{d}{dx} + x$. Which one of the following statement is *incorrect*.
- (a) A is Hermitian operator (b) A^\dagger is an Hermitian operator
 (c) both AA^\dagger and $A^\dagger A$ are Hermitian (d) AA^\dagger is Hermitian but $A^\dagger A$ is anti-Hermitian
33. The **CORRECT** statements is/are
- (a) The average value of r in H-atom for 1s orbital is a_0 .
 (b) The average value of r^2 in H-atom for 1s orbital is $3a_0^2$.
 (c) The average value of x and p_x in SHO for ground state is '0'.
 (d) The value of $\frac{1}{r}$ in H-atom for 1s orbital is $\frac{1}{a_0}$
34. The **CORRECT** statement(s) is/are
- (a) Langmuir theory of adsorption is first order at low P.
 (b) Langmuir theory of adsorption is second order at high P.
 (c) Langmuir theory of adsorption is zero order at high P.
 (d) Langmuir theory of adsorption is zero order at low P.
35. Given the following two relations, $x_1 d\mu_1 + x_2 d\mu_2 = 0$ (A)
 and $x_1 d\bar{V}_1 + x_2 d\bar{V}_2 = 0$ (B)
 for a binary liquid mixture at constant temperature and pressure, the **FALSE** statement is/are that,
- (a) Both the relations are correct
 (b) Relation A is correct, but B is not
 (c) Relation B is correct, but A is not
 (d) Both the relations are incorrect, except for very dilute solutions.
36. Decrease in atomic number is observed during
- (a) alpha emission (b) beta emission
 (c) positron emission (d) electron capture
37. Which of these statements are correct for E_1 reaction.
- (a) reaction is unimolecular reaction.
 (b) the concentration and basicity of the solvent have no effect on the rate of reaction
 (c) polar protic solvent decreases the rate of reaction
 (d) reactivity order $3^\circ > 2^\circ > 1^\circ$.

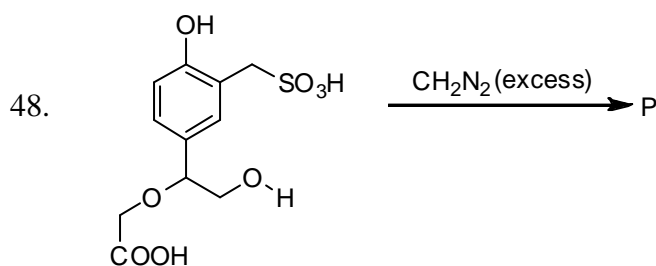


38. Which of the following statements for meso compound is/are correct?
 (a) the meso compound has either a plane or a point of symmetry
 (b) the meso compound has at least one pair of similar stereocentres
 (c) the meso compound is chiral
 (d) the meso compound is formed when equal amounts of two enantiomers are mixed.
39. Which of the following statement(s) is/are correct.
 (a) Protic solvents solvate the nucleophile, lower enthalpy of nucleophiles, increase ΔG , and decrease the reaction rate of S_N2 reaction.
 (b) S_N1 reaction are favoured in protic solvents
 (c) Crown ether increases the reactivity of nucleophile by solvating its cation
 (d) S_N2 reactions are more favoured in protic solvents
40. Consider the correct statement(s)
- (a)  is less stable than 
- (b)  is more stable than 
- (c)  is more stable than 
- (d) $H_2C^+ - N = N^-$ is more stable than $H_2C = N^+ = N^-$

Section-C : Numerical Answer Type (NAT)

Q.41 to Q.50: Carry 1 Mark each.

41. The activation energy of a first order reaction is 104.5 kJ/mol and pre-exponential factor is $5 \times 10^{13} s^{-1}$. The temperature at which the reaction half life of one minute isK
42. The frequency at which a proton NMR spectrometer should be operating under a magnetic field 1.8 Tesla isMHz ($g = 2.7245 \times 2$ and $\mu_N = 5.0504 \times 10^{-27} JT^{-1}$).
43. An aqueous solution containing 5% by weight of urea and 10% by weight of glucose. The freezing point is $^{\circ}C$ (k_f for H_2O is $1.86^{\circ} mol^{-1} kg$).
44. The Packing fraction of FCC unit cell is%.
45. In IR spectrum of $[Co(CN)_5 H]^{3-}$ the Co-H stretch is observed at $1840 cm^{-1}$. The (Co-D) stretch in $[Co(CN)_5 D]^{3-}$ will appear cm^{-1} .
46. The $\lim_{x \rightarrow 0} \frac{\sin \left[\frac{2}{3} x \right]}{x}$ is
47. Total number of enantiomeric pairs are formed in the following compound
- HOH₂C—CHOH—CHOH—CHOH—CH₂OH



Total number of ether functional groups present in the product (P) of the above reaction is

49. The number of total valence electrons in the following complex is



50. The number of possible isomers for the square planer mononuclear complex $[(\text{NH}_3)_2\text{M}(\text{CN})_2]$ of a metal M is

Q.51 to Q.60: Carry 2 Marks each.

51. One mole of a substance is heated from 300K to 400K at constant pressure. The C_p of the substance is given by $C_p(\text{J/K-mole}) = 5 + 0.1T$, the change in entropy in J/K-mole of substance is

52. 10 cm long cell filled with 0.002 M KMnO_4 solution absorbance is 20%. The concentration of the KMnO_4 solution that absorbs 80% of the incident light is

53. Lithium boron hydride crystallies in an orthorhombic system with 4 molecules per unit cell. The unit cell dimensions are $a = 6.8\text{\AA}$, $b = 4.4\text{\AA}$ and $c = 7.2\text{\AA}$. If the molar mass is 21.76. The density of crystal is gcm^{-3} .

54. The minimum uncertainties in position and velocity of a particle are 10^{-10} m and 5.27×10^{-24} m/sec. The mass of the particle iskg.

55. The equilibrium constant of the reaction $2\text{C}_3\text{H}_6(\text{g}) \rightleftharpoons \text{C}_2\text{H}_4(\text{g}) + \text{C}_4\text{H}_8(\text{g})$ is found to fit the expression : $\ln K = -1.04 - \frac{1088}{T} + \frac{1.51 \times 10^5}{T^2}$ between 300K and 600K. The standard reaction entropy at 400K isJ/K.

56. Given for the reaction : $2\text{M} + 6\text{H}^+ \rightleftharpoons 2\text{M}^{3+} + 3\text{H}_2$, for which $\Delta H^0 = -3.0$ kcal, the molar entropies are 6.5 cal/K for M, -22.2 cal/K for M^{3+} , 31.2 cal/K for H_2 and -10.0 cal/K for H^+ . The E^0 for the half-cell $\text{M}^{3+} + 3e \rightleftharpoons \text{M}$ is Volt.

57. The half-life of a second order reaction is 400 sec at pressure of 250 torr. If pressure changes to 200 torr, the half life becomes sec.

58. The magnetic moment of $[\text{Mn}(\text{CN})_6]^{3-}$ isB.M.

59. The first ionisation potential of Na is 5.1eV. The value of electron gain enthalpy of Na^+ is (in eV).

60. The total number of lone pair (s) in XeOF_4 is







IIT-JAM CHEMISTRY-CY

Date : 27-01-2016

TEST SERIES - 7
(Full Length Test - 4)

ANSWER KEY

Section-A : Multiple Choice Questions (MCQ)

- | | | | | |
|---------|---------|---------|---------|---------|
| 1. (c) | 2. (b) | 3. (c) | 4. (a) | 5. (b) |
| 6. (d) | 7. (d) | 8. (a) | 9. (d) | 10. (d) |
| 11. (a) | 12. (a) | 13. (a) | 14. (b) | 15. (a) |
| 16. (a) | 17. (a) | 18. (b) | 19. (b) | 20. (d) |
| 21. (b) | 22. (c) | 23. (a) | 24. (c) | 25. (b) |
| 26. (b) | 27. (d) | 28. (c) | 29. (a) | 30. (a) |

Section-B : Multiple Select Questions (MSQ)

- | | | | |
|------------------|-----------------|------------------|------------------|
| 31. (b),(d) | 32. (a),(b),(d) | 33. (b),(c), (d) | 34. (a),(c) |
| 35. (b),(c), (d) | 36. (a),(c),(d) | 37. (a),(b), (d) | 38. (a),(b), (c) |
| 39. (a),(b), (c) | 40. (a),(c) | | |

Section-C : Numerical Answer Type (NAT)

- | | | | |
|--------------|------------|--------------------|-------------|
| 41. (349) | 42. (74.8) | 43. (-3.04) | 44. (34) |
| 45. (1300) | 46. (0.66) | 47. (2) | 48. (2) |
| 49. (19) | 50. (2) | 51. (11.3 to 11.5) | 52. (0.014) |
| 53. (0.6709) | 54. (0.1) | 55. (-16.493) | 56. (-0.23) |
| 57. (500) | 58. (2.9) | 59. (-5.1) | 60. (15) |

