

Target IIT-JAM-2018

Test Series-7

Full Length Test Series-4

Booklet Code: **G**

Duration: 3:00 Hours

CHEMISTRY-CY

Date: 02-02-2018

Maximum Marks: 100

Read the following instructions carefully:

- 1 Attempt all the 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 is 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.

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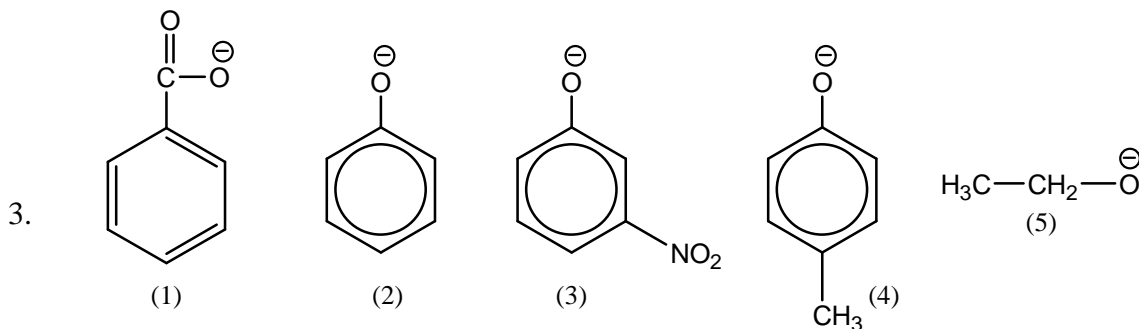
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Section-A : Multiple Choice Questions (MCQ)

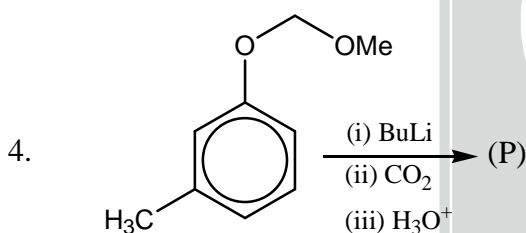
Q.1 to Q.10: Carry 1 Mark each.

- One mole of gas is heated at constant pressure to raise its temperature by 1°C . The work done in joules is
 (a) -4.3 (b) -8.314 (c) -16.62 (d) unpredictable
- The frequency of a photon of radiation having wavelength 6000\AA is
 (a) $5 \times 10^4 \text{\AA}^{-1}$ (b) $3 \times 10^4 \text{\AA}^{-1}$ (c) $3 \times 10^4 \text{sec}^{-1}$ (d) $5 \times 10^{14} \text{sec}^{-1}$

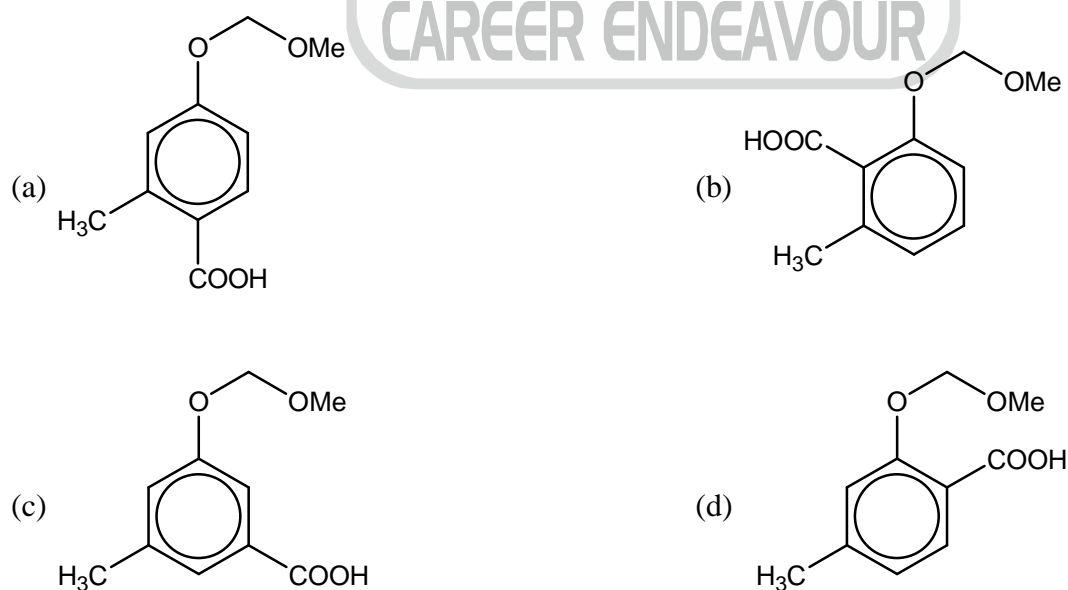


the order of nucleophilicity of above nucleophiles

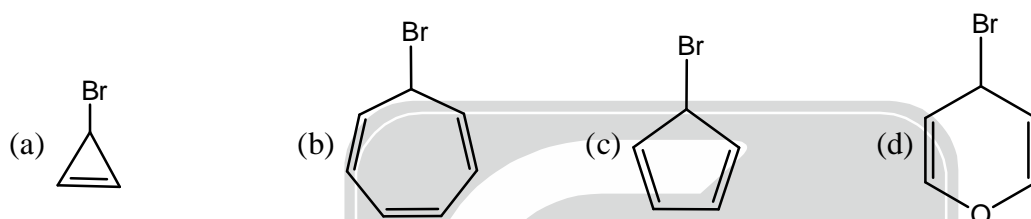
- $1 > 2 > 3 > 4 > 5$
- $3 > 2 > 1 > 5 > 4$
- $5 > 4 > 2 > 3 > 1$
- $5 > 4 > 3 > 1 > 2$



The product in above reaction will be



5. Which one of the following exhibits rotational spectra?
 (a) H_2 (b) N_2 (c) CO (d) CO_2
6. Ni^{2+} ion on treatment with ligand A, B and C give blue, violet, green colour respectively. Correct sequence of ligand with respect to colour respectively is
 (a) H_2O , NH_3 , en (b) NH_3 , H_2O , en (c) en, H_2O , NH_3 (d) NH_3 , en, H_2O
7. The biological function of carbonic anhydrase and cytochrome P-450 are respectively
 (a) Interconversion of carbondioxide \leftrightarrow carbonate and oxidation of alkene
 (b) Hydrolyzing amide linkage and oxidation of alkene
 (c) Electron carrier and O_2 transport.
 (d) Hydrolyzing amide linkage and group transfer reaction
8. Number of $d\pi - p\pi$ bonds in SO_2 and SO_3 respectively are:
 (a) 2, 3 (b) 1, 1 (c) 2, 2 (d) 1 and 2
9. The species that will not given precipitate on warming with aq. $AgNO_3$ will be

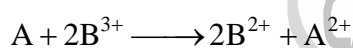


10. Which among the following is a pyrimidine base that is not present in RNA but in DNA
 (a) Adenine (b) Guanine (c) Cytosine (d) Thymine

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

11. The correct statement among the following is
 (a) Half life time decreases with time for second order reaction.
 (b) Phosphorescence and fluorescence are spin forbidden transition.
 (c) In steady state, formation of intermediate is a slower step.
 (d) At constant pressure, addition of inert gas always affect the equilibrium.

12. For the reaction,

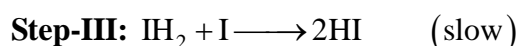
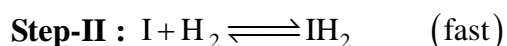
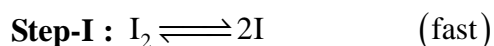


$$E_{A^{2+}|A}^0 = xV \quad E_{B^{3+}|B^{2+}}^0 = yV$$

The E_{cell}^0 is

- (a) $x - 2y$ (b) $x + \frac{y}{2}$ (c) $x - y$ (d) $y - x$
13. The correct statement among the following is
 (a) At constant temperature, u_{rms} is directly proportional to pressure of a gas.
 (b) Solution showing negative deviation from Rault's law form minimum boiling point azeotropes.
 (c) At 298K, u_{mp} of O_2 is smaller than u_{mp} of SO_2 .
 (d) Henry's constant increase with increase in temperature.

14. For the reaction, $\text{H}_2 + \text{I}_2 \longrightarrow 2\text{HI}$



The order of the reaction is

- (a) 0 (b) 1 (c) 2 (d) 1.5

15. The ionisation energy of He^+ is $19.6 \times 10^{-18} \text{ J atom}^{-1}$. The energy of the first stationary state of Li^{++} is

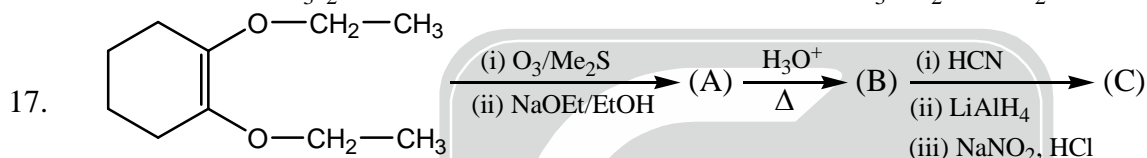
- (a) $-4.41 \times 10^{-17} \text{ J atm}^{-1}$ (b) $-4.41 \times 10^{-18} \text{ J atm}^{-1}$
(c) $-4.9 \times 10^{-18} \text{ J atm}^{-1}$ (d) $-4.9 \times 10^{-17} \text{ J atm}^{-1}$

16. The $^1\text{H-NMR}$ spectrum of a compound with molecular formula $\text{C}_3\text{H}_7\text{NO}$ shows the following features:

δ (ppm)	6.50	2.25	1.10
Shape	broad singlet	quartet	triplet

Which of the following is in agreement with this information?

- (a) $(\text{CH}_3)_2\text{C} = \text{NOH}$ (b) $\text{CH}_3\text{COCH}_2\text{NH}_2$
(c) $\text{HCON}(\text{CH}_3)_2$ (d) $\text{CH}_3\text{CH}_2\text{CONH}_2$

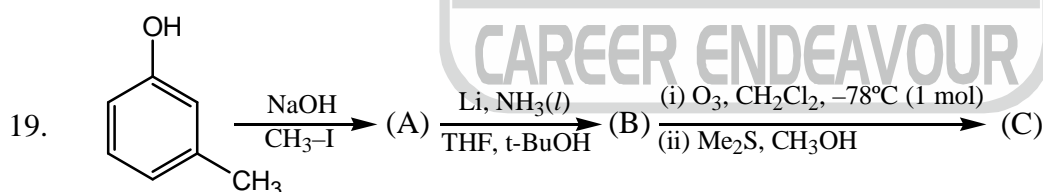


The major product (C) will be

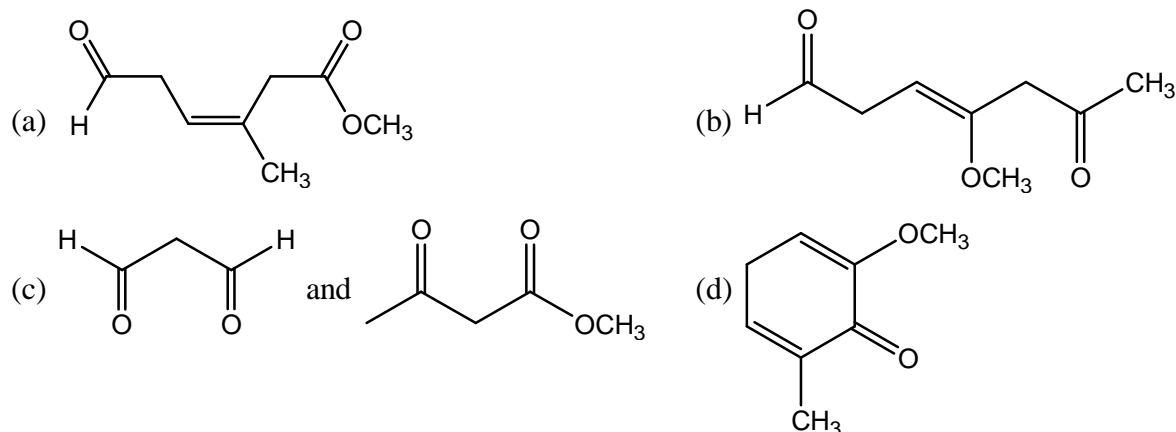


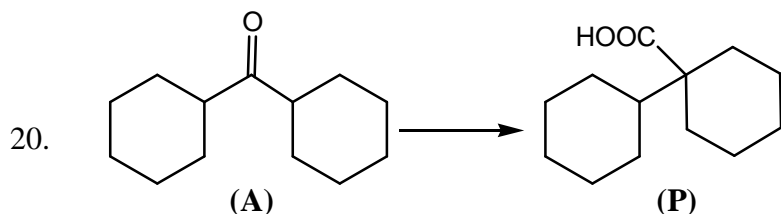
18. Bond length of H-Cl molecule calculated with the help of

- (a) Vibrational spectroscopy (b) Rotational spectroscopy
(c) NMR spectroscopy (d) UV spectroscopy



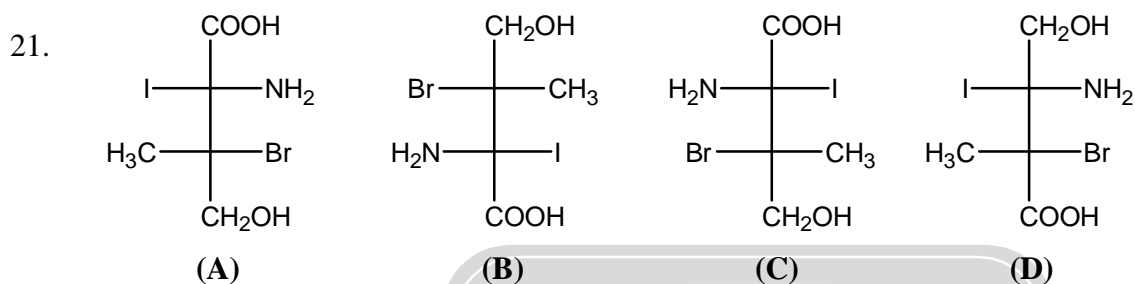
Product (C) will be





Compound (A) can be converted into (P) by the use of which set of reactions?

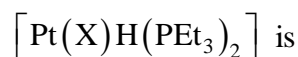
- (a) α -halogenation in basic medium followed by nucleophilic addition.
 (b) α -halogenation in acidic medium followed by favroski rearrangement
 (c) α -hydroxylation by SeO_2 , followed by semipinacol rearrangement
 (d) all of those



The correct option regarding compound (A), (B), (C) and (D)

- (I) Compound (A) and (B) are Homomer
 (II) Compound (B) and (C) are enantiomers
 (III) Compound (A) and (D) are constitutional isomers
 (IV) Compound (A) and (C) are enantiomers
 (a) I, II (b) II, IV (c) III, I (d) all of the above

22. Correct order of ligand (X) with respect to increasing order of $\bar{\nu}_{(P-H)}$ in square planar complex trans-



- (a) $\text{CN}^- < \text{Br}^- < \text{Cl}^- < \text{I}^-$ (b) $\text{Cl}^- < \text{I}^- < \text{CN}^- < \text{Br}^-$
 (c) $\text{Cl}^- < \text{Br}^- < \text{I}^- < \text{CN}^-$ (d) $\text{CN}^- < \text{I}^- < \text{Br}^- < \text{Cl}^-$

23. $\text{B}_4\text{H}_{10} + 2\text{NH}_3 \longrightarrow \text{A} + \text{B}$, (A) and (B) are respectively

- (a) $[\text{BH}_3 \cdot \text{NH}_3]$ and $[\text{B}_3\text{H}_7 \cdot \text{NH}_3]$ (b) $[\text{BH}_2 \cdot (\text{NH}_3)_2]^+$ and $[\text{B}_3\text{H}_8]^-$
 (c) $[\text{BH}_4]^-$ and $[\text{B}_3\text{H}_6 \cdot 2\text{NH}_3]^+$ (d) $\text{BH}_3 \cdot (\text{NH}_3)_2$ and B_3H_7

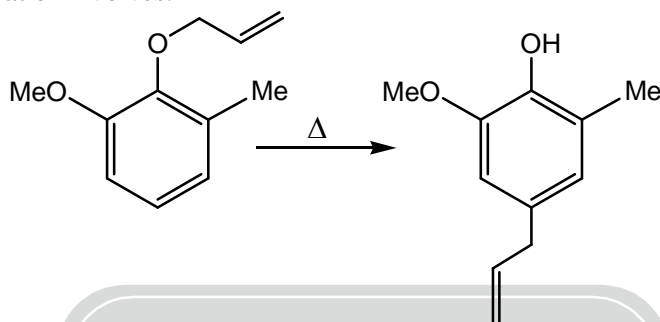
24. Which of the following molecular orbital is bonding one:

- (a) Lowest σ_u (b) Second lowest σ_u
 (c) Lowest π_g (d) Lowest π_u

25. Which of the following pairs has square planar shape?

- (a) SO_4^{2-} and XeF_4 (b) XeO_4 and XeF_4
 (c) $[\text{Ni}(\text{CN})_4]^{2-}$ and XeF_4 (d) $[\text{NiCl}_4]^{2-}$ and $[\text{Ni}(\text{CN})_4]^{2-}$

26. The total valence electrons and the number of M-M bonds in the following complexes are
- (I) $[(\eta^5 - \text{Cp})\text{Mo}(\text{CO})_2]_2$ (II) $[(\eta^4 - \text{C}_4\text{H}_4)\text{Fe}(\text{CO})_3]_2$
- (a) (I) 30 and 3, (II) 34 and 1 (b) (I) 30 and 3, (II) 30 and 3
- (c) (I) 32 and 2, (II) 32 and 2 (d) (I) 30 and 3, (II) 36 and 0
27. The correct order of reactivity of following compound towards electrophilic aromatic substitution reaction is
- (a) Furan > Thiophene > Pyrrole > Benzene > Pyridine
- (b) Furan > Pyrrole > Thiophene > Pyridine > Benzene
- (c) Pyrrole > Furan > Thiophene > Benzene > Pyridine
- (d) Pyrrole > Furan > Thiophene > Pyridine > Benzene
28. The following transformation involves:



- (a) cope-rearrangement followed by Claisen-rearrangement
- (b) Claisen-rearrangement followed by cope-rearrangement
- (c) Cope-rearrangement followed by oxy-cope-rearrangement
- (d) Oxy-cope rearrangement followed by Claisen rearrangement.
29. The Langmuir adsorption isotherm is given by $\theta = \frac{kP}{1+kP}$. The Langmuir adsorption isotherm for a diatomic gas A₂ undergoing dissociative adsorption is
- (a) $\theta = \frac{kP^2}{1+kP}$ (b) $\theta = \frac{2kP}{1+kP^2}$ (c) $\theta = \frac{(kP)^2}{1+(kP)^{1/2}}$ (d) $\theta = \frac{(kP)^{1/2}}{1+(kP)^{1/2}}$
30. An organic compound exhibited the following ¹H-NMR spectra data:
 7.80(2H, d, J = 8Hz), 6.80(2H, d, J = 8Hz)
 4.10(2H, q, J = 7.2 Hz), 2.4(3H, s)
 1.25(3H, t, J = 7.2 Hz)

The compound among the choice given below is



Section-B : Multiple Select Questions (MSQ)

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

31. Which of the following options is/are correct

(a) For a gas, $\left(\frac{\partial G}{\partial T}\right)_P = \left(\frac{\partial A}{\partial T}\right)_V$

(b) For a gas obeying equation $P(V-b) = RT$, the value of $\left(\frac{\partial U}{\partial V}\right)_T$ is equal to zero

(c) For ideal gas $\left(\frac{\partial U}{\partial P}\right)_T = \left(\frac{\partial H}{\partial P}\right)_T$

(d) If $w < 0$ it implies work is done on the system

32. The incorrect statements among the following is/are

(a) For $\Delta G^0 > 0$, the value of $K < 0$

(b) Transmittance value is proportional to the length of tube

(c) Internal conversion is non-radiative relaxation process

(d) Order more than 4 is seldom observed

33. The correct statement in the following is/are

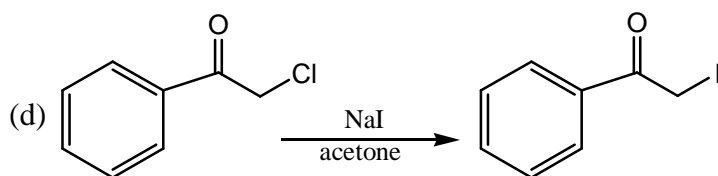
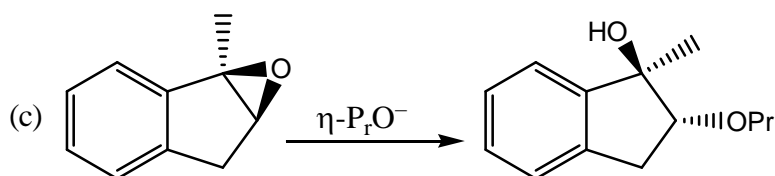
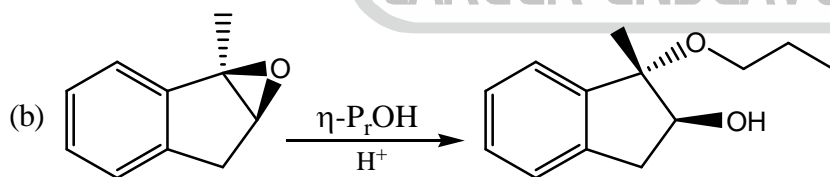
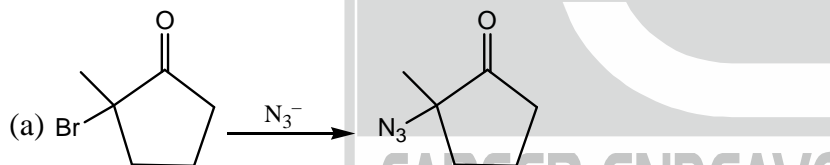
(a) The number of IR inactive band in H_2O molecule is 2

(b) Cl_2 molecule is rotationally inactive

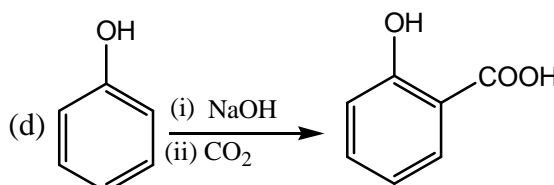
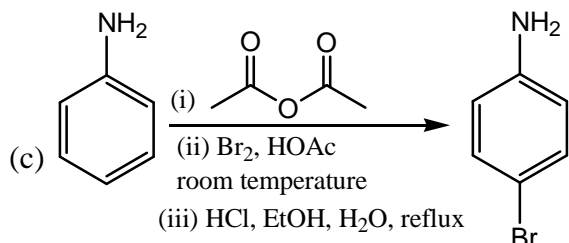
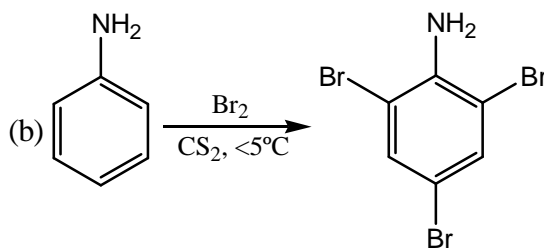
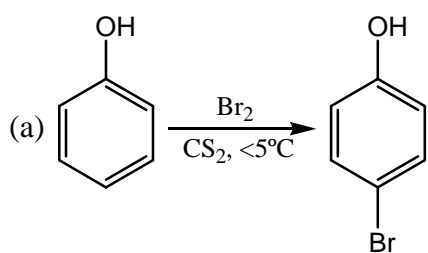
(c) Vibrational frequency is proportional to bond strength

(d) NMR lies in radio frequency region

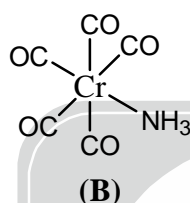
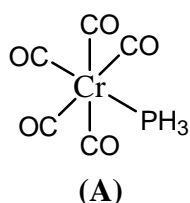
34. Which of the following reaction take place via S_N2 -mechanism?



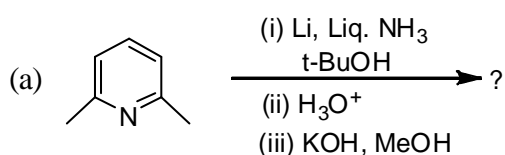
35. Correct major product(s) with appropriate condition

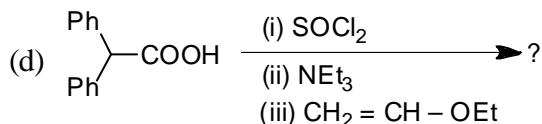
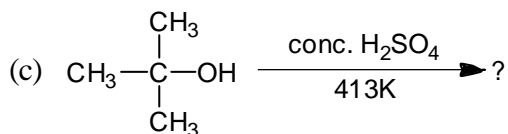
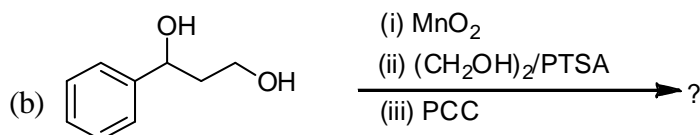


36. Changes that observed when the following compounds are oxidized by one electron



- (a) Cr–C bond length increases in both (A) and (B)
 (b) C–O bond length increases in both (A) and (B)
 (c) Cr–C bond length decreases in both (A) and (B)
 (d) C–O bond length decreases in both (A) and (B)
37. Which of the following statements is *incorrect*?
- (a) B_2 has one sigma, C_2 has one σ and one π bond.
 (b) B_2 has one sigma, one π and C_2 has two π -bonds.
 (c) B_2 has one π bond and C_2 has one σ and one π bond.
 (d) B_2 has only one π bond and C_2 has only two π bonds.
38. Select the correct statement(s) from the following
- (a) Wilkinson's catalyst has square planar geometry and it is diamagnetic in nature
 (b) In Zeise's salt C–C bond length in alkene is longer than free alkene and it is more electrophilic in nature
 (c) If compound $\text{k}_2\text{Ba}[\text{Cu}(\text{NO}_2)_6]$ exhibit tetragonal elongation then unpaired electron will present in $d_{x^2-y^2}$ orbital.
 (d) Intensity of colour of tetrahedral complexes is generally higher than octahedral complexes.
39. The Hermitian operators is/are
- (a) $\frac{\partial}{\partial x}$ (b) $i \frac{\partial}{\partial x}$ (c) $\frac{1}{i} \frac{\partial}{\partial x}$ (d) $-\frac{\partial}{\partial x}$
40. The reaction (s) which gives carbonyl compound is / are



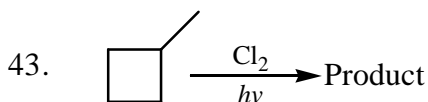


Section-C : Numerical Answer Type (NAT)

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

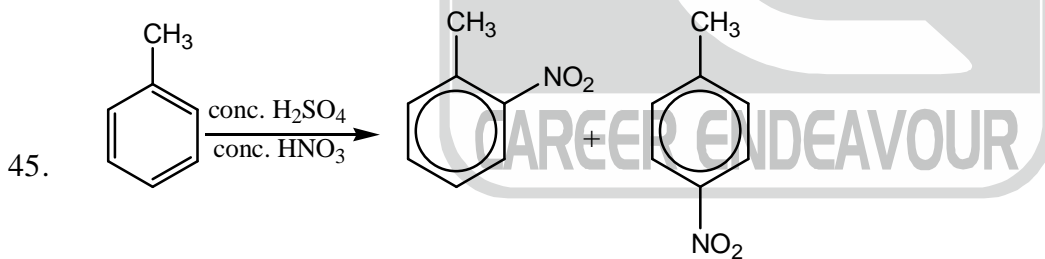
41. At constant temperature, the gas is expanded from 5 atm to 2 atm, the change in entropy is _____ $\text{JK}^{-1}\text{mol}^{-1}$ (Use : $R = 8.3 \text{ JK}^{-1}\text{mol}^{-1}$)

42. Acetic acid associates in benzene to form a dimer. 1.65g of acetic acid when dissolved in 100g of benzene raised the boiling point by 0.36°C . The van't Hoff factor is _____ (k_b for benzene = $2.57^\circ\text{C M}^{-1}$)



How many mono-chlorinated products will be formed in above reaction including stereoisomers?

44. The magnetic field of a proton resonance frequency 540 MHz is close to _____ (in Tesla) [Given: $\gamma(^1\text{H}) = 2.7 \times 10^8 \text{ T}^{-1}\text{s}^{-1}$]



For above electrophilic substitution reaction. How many [T.S] transition state will be formed in energy profile diagram.

46. How many diastereoisomers are possible for the compound 1-Bromo-2-chloro-3-iodocyclopropane is _____

47. The resonance Raman stretching frequency (in cm^{-1}) of the bound O_2 species in oxyhemerythrin are _____

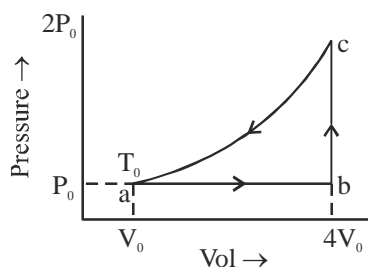
48. The formal oxidation states of $[\text{ReH}_9]^{2-}$ is/are _____

49. The value of d_{111} in a cubic crystal is 325.6 pm. The value of d_{333} (in pm) is _____

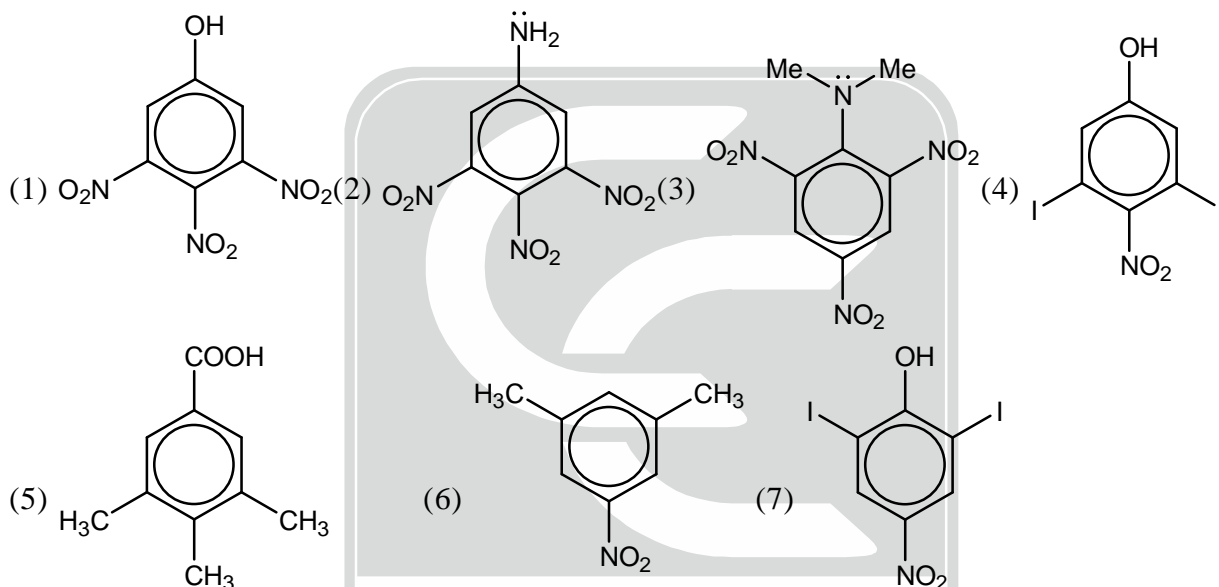
50. The orbital degeneracy of the level of a one electron atomic system with $z = 5$ and energy ≈ -13.6 eV is _____

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

51. One mole of an ideal mono-atomic gas is caused to go through the cycle shown in the figure below. Then the change in internal energy in expanding gas from 'a' to 'c' along path abc is _____ times of RT_0 .



52. The standard EMF of a galvanic cell involving cell reaction with $n = 2$ (number of electrons) is found to be 0.295 V at 25°C. The equilibrium constant of the reaction is _____ $\times 10^9$.
53. The kinetic energy of 64g of O_2 at 300K is _____ kJ.
54. In how many compounds SIR effect will observed?



55. The zero point energy of the vibration of 9F_2 mimicking a harmonic oscillator with a force constant $k = 2200 \text{ Nm}^{-1}$ is _____ $\times 10^{-20} \text{ J}$.
56. A 0.1 M solution of pure chiral compound (X) has an observed rotation (+)-0.2° in a 10 cm cell. The molecular weight of compound is 150. The specific rotation of (-) enantiomer is _____
57. Following the 18 electron rule as guide, x in the complex $[\eta^6-(C_6H_6)Mn(CO)_2CH_3]^x$ is/are _____
58. The interplanar distance (Å) for a (1 0 0) plane in a cubic structure with the lattice parameter of 4 Å is _____
59. Number of framework electron present in $[B_{12}H_{12}]^{2-}$ is/are _____
60. The bond length in HF is 92 pm and the dipole moment is 1.83D. The charge distribution on H atom is/are _____

***** END OF QUESTION PAPER *****

Space for Rough Work





IIT-JAM CHEMISTRY-CY

TEST SERIES - 7

FULL LENGTH TEST - 4

Date : 02-02-2018

Booklet : **G**

ANSWER KEY

Section-A : Multiple Choice Questions (MCQ)

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

Section-B : Multiple Select Questions (MSQ)

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

Section-C : Numerical Answer Type (NAT)

- | | | | |
|----------------------|--------------------|--------------------|----------------------|
| 41. (7.60 to 7.63) | 42. (0.50 to 0.52) | 43. (8 to 8) | 44. (12.4 to 12.8) |
| 45. (2 to 2) | 46. (4 to 4) | 47. (830 to 860) | 48. (+7 to +7) |
| 49. (108.2 to 108.7) | 50. (25 to 25) | 51. (10.3 to 10.7) | 52. (9.54 to 9.57) |
| 53. (7.46 to 7.50) | 54. (4 to 4) | 55. (2.83 to 2.88) | 56. (-13.1 to -13.5) |
| 57. (0 to 0) | 58. (4 to 4) | 59. (13 to 13) | 60. (0.38 to 0.42) |

