

प्रोफेसर गुरमीत सिंह
अध्यक्ष, रसायन शास्त्र विभाग
दिल्ली विश्वविद्यालय
दिल्ली - ११० ००७



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DELHI - 110 007

**Complaints / Queries regarding MCQ of the M.Sc.
Chemistry Entrance Examination 2015**

1. Complaint/Queries regarding MCQ must be submitted till 5.00 p.m. on 22-06-2015. Any query submitted after stipulated time and date will not be entertained.
2. All queries may be submitted by email at admission@chemistry.du.ac.in & addressed to The Convener, M.Sc. (Chemistry) Entrance Examination 2015.
3. Hard copy of the complaint may be submitted to Mr. Rakesh Kumar, Department of Chemistry, University of Delhi, Delhi - 110 007

A handwritten signature in black ink, appearing to read 'Gurmeet Singh', written over a horizontal line.

**Professor Gurmeet Singh
Head of the Department**

**Head, Chemistry Department
University of Delhi, Delhi-110007**

SECTION A

- (1) $\text{As}(\text{OH})_3$, (2) Na_3AsO_4 (3) AsH_3 (4) As_2O_3

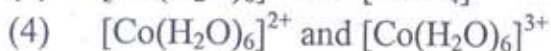
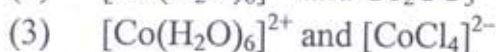
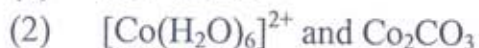
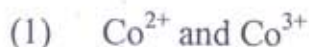
2. Of the following nuclides, the one most likely to be radioactive is

- (1) $^{14}_6\text{C}$, (2) $^{14}_7\text{N}$ (3) $^{31}_{15}\text{P}$ (4) $^{66}_{30}\text{Zn}$

3. Arrange the following metal-carbonyl complexes in the increasing order of the carbonyl stretching frequency: $[\text{Fe}(\text{CO})_4]^{2-}$, $[\text{Mn}(\text{CO})_6]^+$, and $[\text{Cr}(\text{CO})_6]$.



4. The self-indicating silica gel (impregnated with cobalt chloride) turns pink on absorbing moisture and becomes blue on heating. The pink and blue colors are respectively due to



5. Which one of the following molecules doesn't obey the 18 e⁻ rule

- (1) $[\text{Mn}(\text{CO})_6]^+$ (2) $[\text{Fe}(\text{CO})_5]$ (3) $[\text{Cr}(\text{CO})_5]^{2-}$
 (4) $[\text{Mn}(\text{CO})_4\text{Cl}_2]^{2-}$

6. The calculated magnetic moment (B.M.) of Eu^{3+} system will be

- (1) 0 (2) 3.42 (3) 7.91 (4) 3.61

7. The acidic strength of the following oxo-acid is in order

- (1) $\text{HOF} < \text{HOCl} < \text{HOBr} < \text{HOI}$
 (2) $\text{HOCl} < \text{HOF} < \text{HOBr} < \text{HOI}$
 (3) $\text{HOI} < \text{HOBr} < \text{HOCl} < \text{HOF}$
 (4) $\text{HOI} < \text{HOBr} < \text{HOF} < \text{HOCl}$

8. Identify the correct IUPAC nomenclature for the given complex:
 $[\text{Pt}(\text{py})_4][\text{Pt}(\text{Cl}_4)]$

- (1) Tetrapyridineplatinum(II) tetrachloroplatinate (II).
 (2) Tetrachloropaltinate(II) tetrapyridineplatinum (II)
 (3) Tetrachloro-tetrapyridine bis platinum (II)
 (4) Platinum(II)tetrapyridinyl platinum(II)tetrachlorate

9. A solution containing 2.675 g of $\text{CoCl}_2 \cdot 6\text{NH}_3$ (M.wt = 267.5) is passed through a cation exchanger. The chloride ions obtained in solutions were treated with excess of AgNO_3 to give 4.78 g of AgCl (M.wt = 143.5). The formula of the complex formed is:

- (1) $[\text{CoCl}_2(\text{NH}_3)_4]\text{Cl}$ (2) $[\text{CoCl}_3(\text{NH}_3)_3]$
 (3) $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ (4) $[\text{CoCl}(\text{NH}_3)_5]\text{Cl}_2$

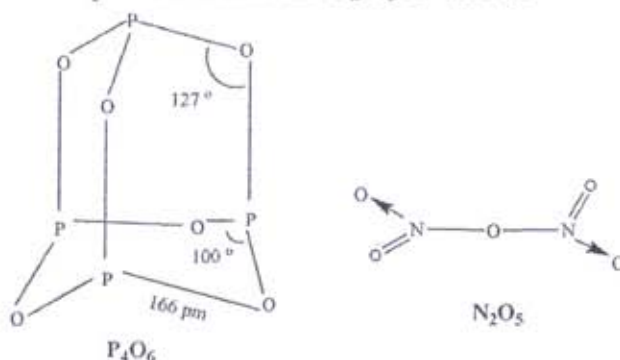
10. The empirical formula of Layered silicate structures in clays is:

- (1) SiO_4^{4-} (2) $\text{Si}_2\text{O}_5^{2-}$ (3) $\text{Si}_2\text{O}_7^{6-}$ (4) $(\text{SiO}_3)_n^{2n-}$

11. Predict the extrinsic semiconducting properties of WO_3 and CdO .

- (1) Both *p*-type semiconductor
 (2) Both *n*-type semiconductor
 (3) WO_3 is *n*-type and CdO is insulator
 (4) WO_3 is *n*-type and CdO is *p*-type semiconductor

12. N_2O_5 have open structure, whereas P_4O_6 has closed cage structure as shown in figure, the formation of open structure in N_2O_5 is due to



- (1) d_π - p_π mixing (2) d_π - d_π mixing (3) p_π - p_π mixing (4) none of these

13. When XeF_6 reacts with silica or glass, it gives a colourless liquid of the following composition

- (1) SiXeO_2F_6 (2) XeO_3 (3) XeO_4F_2 (4) XeOF_4

14. Waker's process uses the catalyst:

- (1) $[\text{PdCl}_4]^{2-}$
 (2) $[\text{Rh}(\text{CO})_2\text{I}_2]^-$
 (3) $\text{Pt}(\text{C}_2\text{H}_4)\text{Cl}_3^-$
 (4) $\text{Cp}_2\text{TiCl}_2-\text{Al}(\text{C}_2\text{H}_5)_3$

15. Metal function needed in photosynthesis and respiration are:

- (1) Zn, Ga and Ca (2) Zn, Mg, and Ca
 (3) Al, Ga and In (4) Mn, Fe, Co and Cu

16. Term symbols for d^2 configuration are 3F , 3P , 1D , 1S , 1G and the Ground state term is

- (1) 3F_4 (2) 3F_2 (3) 1G_4 (4) 3P_0

17. How many vibrational modes are present in NH_3 ?

- (1) 4 (2) 6 (3) 5 (4) 12

21. Bromination of toluene gives

- (1) Only 3-bromotoluene as product
- (2) Only 4-bromotoluene as product
- (3) Mixture of 2-bromotoluene and 4-bromotoluene as products
- (4) Mixture of 3-bromotoluene and 4-bromotoluene as products

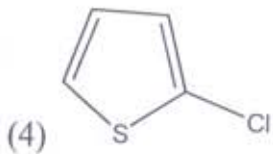
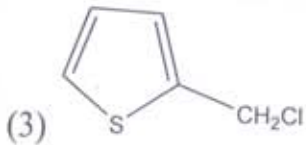
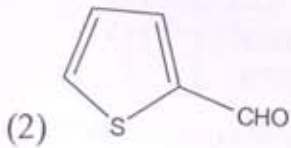
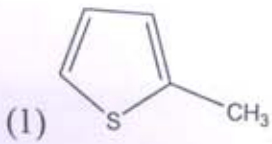
22. S_N^1 reaction on optically active substrate mainly gives

- (1) Racemic product
- (2) Inversion of configuration
- (3) Retention of configuration
- (4) No product

23. The electrophilic aromatic substitution proceeds through

- (1) free radical
- (2) sigma complex
- (3) benzyne
- (4) carbene

24. Thiophene reacts with HCHO in presence of aqueous HCl to give



25. Aldose and ketose are differentiated by

(1) Tollen's reagents

(2) Fehling's solution

(3) Br₂ water

(4) HIO₄



26. Rearrange the following in the order of acid strength

(I) benzoic acid, (II) 4-methoxybenzoic acid and (III) 2-methoxybenzoic acid


(1) I < II < III

(2) III < I < II

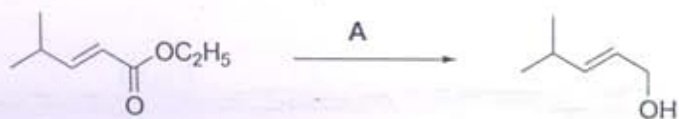
(3) II < I < III

(4) III < II < I



27. Which one of the following reactions will not result in formation of anisole
- (1) Phenol + dimethyl sulfate in presence of base
 - (2) Sodium phenoxide treated with methyl iodide
 - (3) Reaction of diazomethane with phenol
 - (4) Reaction of methyl magnesium iodide with phenol
28. 2-Phenylethanol may be prepared by the reaction of phenyl magnesium bromide with
- (1) HCHO
 - (2) CH₃CHO
 - (3) CH₃COCH₃
 - (4) 
29. 2-Acetoxy benzoic acid is known as:
- (1) Aspirin
 - (2) Paracetamol
 - (3) Ibuprofen
 - (4) Wintergreen oil

30. For the following reaction

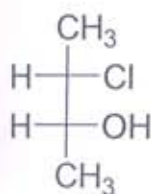


Reagent A is

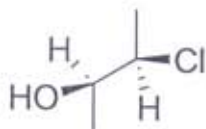
- (1) LiAlH_4
- (2) NaBH_4
- (3) KBH_4
- (4) Borane



31. Correct relation between compounds I and II is



I

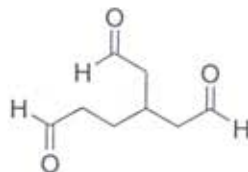


II

- (1) I and II are identical
- (2) I and II are diastereomer
- (3) I and II are enantiomer
- (4) I and II are *meso* compounds



32. The correct IUPAC name of the below given compound is



- (1) (4-formylmethyl)-hexane-1,6-dial
 (2) (3-formylethyl)-pentane-1,5-dial
 (3) (2-formylethyl)-pentane-1,5-dial
 (4) (3-formylmethyl)-hexane-1,6-dial

33. The number of signals observed in $^1\text{H-NMR}$ of 1,3-dibromobenzene

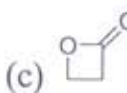
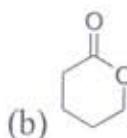
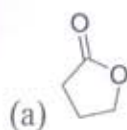
- (1) 3 (2) 4
 (2) 2 (4) 6

34. The Fisher projection of *meso*-tartaric acid represents:

- (1) Skew form
 (2) Staggered form
 (3) Eclipsed form
 (4) Gauche form

35. Match the compounds (List I) with correct IR frequency of C=O stretching (List II)

List I



List II

(i) 1840 cm^{-1}

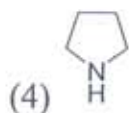
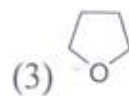
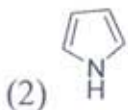
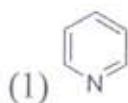
(ii) 1740 cm^{-1}

(iii) 1770 cm^{-1}

- (1) (a)→(i), (b)→(ii), (c)→(iii)
(2) (b)→(i), (a)→(iii), (c)→(ii)
(3) (a)→(iii), (b)→(ii), (c)→(i)
(4) (c)→(iii), (b)→(i), (a)→(ii)

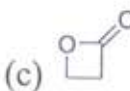
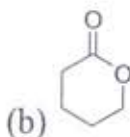
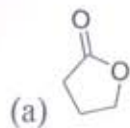


36. Among the following compounds, the most basic compound is



35. Match the compounds (List I) with correct IR frequency of C=O stretching (List II)

List I



List II

(i) 1840 cm^{-1}

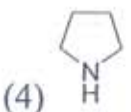
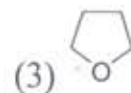
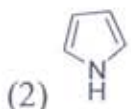
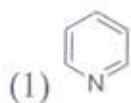
(ii) 1740 cm^{-1}

(iii) 1770 cm^{-1}

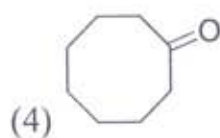
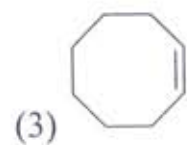
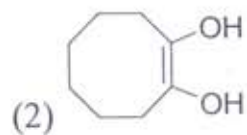
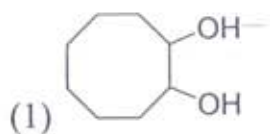
- (1) (a)→(i), (b)→(ii), (c)→(iii)
 (2) (b)→(i), (a)→(iii), (c)→(ii)
 (3) (a)→(iii), (b)→(ii), (c)→(i)
 (4) (c)→(iii), (b)→(i), (a)→(ii)



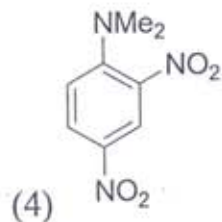
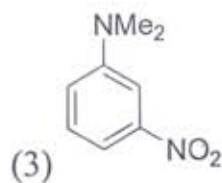
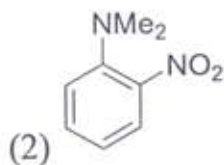
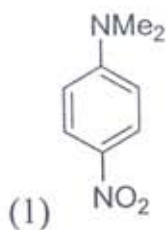
36. Among the following compounds, the most basic compound is



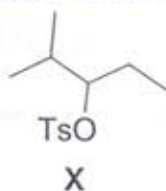
37. The reaction of cyclooctyne with HgSO_4 in the presence of aqueous H_2SO_4 gives



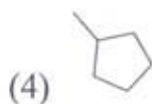
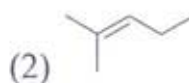
38. The Major product formed on nitration of *N,N*-dimethylaniline with conc. H_2SO_4 - HNO_3 mixture is



39. The major product obtained upon treatment of compound X with H_2SO_4 at $80\text{ }^\circ\text{C}$



is



40. The compound is

- (1) anti-aromatic and has no dipole moment
- (2) non-aromatic and has high dipole moment
- (3) aromatic and has high dipole moment
- (4) aromatic and has less dipole moment



41. Match list I with list II and select the correct answer

List I

List II

A. Critical temperature

1. $\frac{a}{Rb}$

B. Boyle temperature

2. $\frac{2a}{a/Rb}$

C. Inversion temperature

3. $\frac{T}{T_c}$

D. Reduced temperature

4. $\frac{8a}{27Rb}$

- | | A | B | C | D |
|-----|---|---|---|---|
| (1) | 2 | 1 | 4 | 3 |
| (3) | 2 | 3 | 4 | 1 |

- | | A | B | C | D |
|-----|---|---|---|---|
| (2) | 4 | 3 | 2 | 1 |
| (4) | 4 | 1 | 2 | 3 |



42. Which has the maximum value of mean free path?

- (1) CO₂ (2) H₂
(3) O₂ (4) N₂

43. As the supercooled water freezes spontaneously, its temperature rises to 0°C, ΔH for the spontaneous process is equal to



- (1) enthalpy of fusion (2) enthalpy of vaporization
(3) enthalpy of sublimation (4) zero

44. 60 g of urea is dissolved in 1100 g solution. To keep $\Delta T/K_f$ as 1 mol/kg, water separated in the form of ice is:

- (1) 40 g (2) 60 g
(3) 100 g (4) 200 g

45. Relative decrease in vapor pressure of an aqueous NaCl is 0.167. No of moles of NaCl present is 180 g of H₂O is:

- (1) 2 mol (2) 1 mol
(3) 3 mol (4) 4 mol

46. Elevation in boiling point of an aqueous urea solution is 0.52° ($K_b = 0.52^\circ \text{ mol}^{-1} \text{ Kg}$). Hence mole-fraction of urea in this solution is:

- (1) 0.982 (2) 0.0567
(3) 0.943 (4) 0.018



47. Following are the values of E_a and ΔH for three reactions carried out at the same temperature:

I $E_a = 20 \text{ kJ mol}^{-1}$, $\Delta H = -60 \text{ kJ mol}^{-1}$

II $E_a = 10 \text{ kJ mol}^{-1}$, $\Delta H = -20 \text{ kJ mol}^{-1}$

III $E_a = 20 \text{ kJ mol}^{-1}$, $\Delta H = \pm 15 \text{ kJ mol}^{-1}$

If all the three reactions have same frequency factor then fastest and slowest reactions are

Option	Fastest	Slowest
(1)	I	II
(2)	II	III
(3)	I	III
(4)	cannot be predicted	



48. For reaction $2A + B \rightarrow \text{product}$, rate law is $-\frac{d[A]}{dt} = k[A]$. At a time when $t = \frac{1}{k}$, concentration of the reactant is: ($C_0 = \text{initial concentration}$)

- (1) $\frac{C_0}{e}$ (2) $\frac{1}{C_0}$
(3) $\frac{C_0}{e^2}$ (4) $\frac{1}{C_0}$



49. Acid hydrolysis of ester is first-order reaction and rate constant is given by

$$k = \frac{2.303}{t} \log \frac{V_{\infty} - V_0}{V_{\infty} - V_t}$$

where V_0 , V_t and V_{∞} are the volumes of standard NaOH to neutralize acid present at a given time; if ester is 50% hydrolysed then:

- (1) $V_{\infty} = V_t$ (2) $V_{\infty} = (V_t - V_0)$
 (3) $V_{\infty} = 2V_t - V_0$ (4) $V_{\infty} = 2V_t + V_0$

50. Temperature of 1 mol of gas is increased by 1° at constant pressure. Work done:

- (1) R (2) 2R
 (3) $\frac{R}{2}$ (4) 3R

51. K_{sp} of $Mg(OH)_2$ is 1.8×10^{-11} at $30^\circ C$. Its molar solubility isat
 pH = 12

- (1) 1.8×10^{-11} M (2) 1.8×10^{-9} M
 (3) 1.34×10^{-54} M (4) 1.8×10^{-7} M

52. For the half cell $Cl^- / Pt(Cl_2)$, the value of $(E - E^0)$:

- (1) increases as $[Cl^-]$ increases
 (2) decreases as $[Cl^-]$ increases
 (3) remains constant as $[Cl^-]$ increases
 (4) cannot be predicted

53. If E_0 is the zero point energy of a harmonic oscillator of frequency ν and h is the planck's constant than its energy in the $n = 2$ state will be

- (1) $(E_0 + h\nu)$ (2) $2 E_0$
 (3) $4 E_0$ (4) $(E_0 + 2h\nu)$

54. The molecules which are IR -inactive but raman active is:

- (1) N_2 (2) HCl
 (3) SO_2 (4) Protein

55. A thermos bottle containing coffee is vigorously shaken and thereby the temp of the coffee rises.

Regard the coffee as system

- (1) $Q = 0$; $W = -ve$; ΔU is +ve
 (2) $Q = 0$; $W = +ve$; ΔU is +ve
 (3) $Q = 0$; $W = -ve$; ΔU is -ve
 (4) $Q = 0$; $W = +ve$; ΔU is -ve

56. Conjugate base of H_2 is:

- (1) H^+ (2) H_3^+
 (3) H^- (4) H_3^-

57. Lithium selenide can be described as a closest-packed array of selenide ions with lithium ions in all the tetrahedral holes. Formula of lithium selenide is:

- (1) Li_2Se (2) Li_2Se
 (3) LiSe_2 (4) Li_3Se

58. The pK_a of an amino acid is 9.15. At what pH amino acid is 5% dissociated?

- (1) 9.15 (2) 4.85
 (3) 9.44 (4) 7.87

59. For the equilibrium $\text{NH}_2\text{COONH}_4(\text{s}) \rightleftharpoons 2\text{NH}_3(\text{g}) + \text{CO}_2(\text{g})$
 $\text{pCO}_2 = 1 \text{ atm}$ at 100°C . Hence equilibrium constant is:

- (1) 1 atm^3 (2) 2 atm^3
 (3) 4 atm^3 (4) 3 atm^3

60. For the following equilibrium $\text{NH}_2\text{CO}_2\text{NH}_4(\text{s}) \rightleftharpoons 2\text{NH}_3(\text{g}) + \text{CO}_2(\text{g})$

K_p is found to be 0.5 at 500 K. hence the partial pressure of NH_3 and CO_2 are respectively:

- (1) 2.0 and 1.0 atm (2) 1.0 and 2.0 atm
 (3) 1.0 and 0.5 atm (4) 0.5 and 1.0 atm

M.Sc. Chemistry Entrance, Exam 2015
Answer key for multiple choice questions

Question No	Answer	Question No	Answer	Question No	Answer
1	3	21	3	41	4
2	1	22	1	42	2
3	2	23	2	43	4
4	3	24	3	44	1
5	4	25	3	45	2
6	1	26	3	46	4
7	3	27	4	47	3
8	1	28	4	48	1
9	3	29	1	49	3
10	2	30	1	50	1
11	2	31	2	51	4
12	3	32	4	52	2
13	4	33	1	53	4
14	1	34	3	54	1
15	4	35	3	55	1
16	2	36	1	56	3
17	2	37	4	57	1 or 2
18	1	38	3	58	4
19	3	39	2	59	3
20	2	40	3	60	3

In case of any discrepancy or query please contact the
Department of Chemistry within 24 hrs

at
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