



**INDIAN INSTITUTE OF SCIENCE
BANGALORE - 560012**

ENTRANCE TEST FOR ADMISSIONS - 2010

**Program : Research
Entrance Paper : Chemistry
Paper Code : CY**

Day & Date
SUNDAY, 25TH APRIL 2010

Time
9.00 A.M. TO 12.00 NOON

INSTRUCTIONS

1. This question paper consists of only multiple-choice questions. **All** questions carry one mark each.
2. Answers are to be marked in the OMR sheet provided.
3. For each question, darken the appropriate bubble to indicate your answer.
4. Use only HB pencils for darkening the bubble.
5. Mark only one bubble per question. If you mark more than one bubble, the answer will be evaluated as incorrect.
6. If you wish to change your answer, please erase the existing mark completely before marking the other bubble.
7. There will be **NEGATIVE** marking. **NEGATIVE** marking for each wrong answer will be 1/3.
8. A **periodic table** is given at the end.
9. Some useful physical constants:

(A) Universal gas constant

$$R = 8.31451 \text{ J mol}^{-1} \text{ K}^{-1}$$
$$0.08206 \text{ L atm mol}^{-1} \text{ K}^{-1}$$

(B) Planck's constant,

$$h = 6.626 \times 10^{-34} \text{ J.s}$$

(C) Acceleration due to gravity

$$g = 9.8 \text{ m s}^{-2}$$

(D) Speed of light in vacuum

$$c = 2.998 \times 10^8 \text{ m s}^{-1}$$

(E) Avogadro's number

$$N = 6.023 \times 10^{23} \text{ mol}^{-1}$$

(F) Boltzmann constant

$$k = 1.380 \times 10^{-23} \text{ J K}^{-1}$$

(G) Electron charge

$$e = 1.602 \times 10^{-19} \text{ C}$$

(H) Electron mass

$$m_e = 9.109 \times 10^{-31} \text{ Kg}$$

(I) Permittivity of the vacuum

$$\epsilon_0 = 8.854 \times 10^{-12} \text{ F m}^{-1}$$

(J) Faraday constant

$$F = 9.65 \times 10^4 \text{ C mol}^{-1}$$

(K) 1 Calorie

$$= 4.184 \text{ J}$$

(L) 1 atm

$$= 760 \text{ Torr}$$

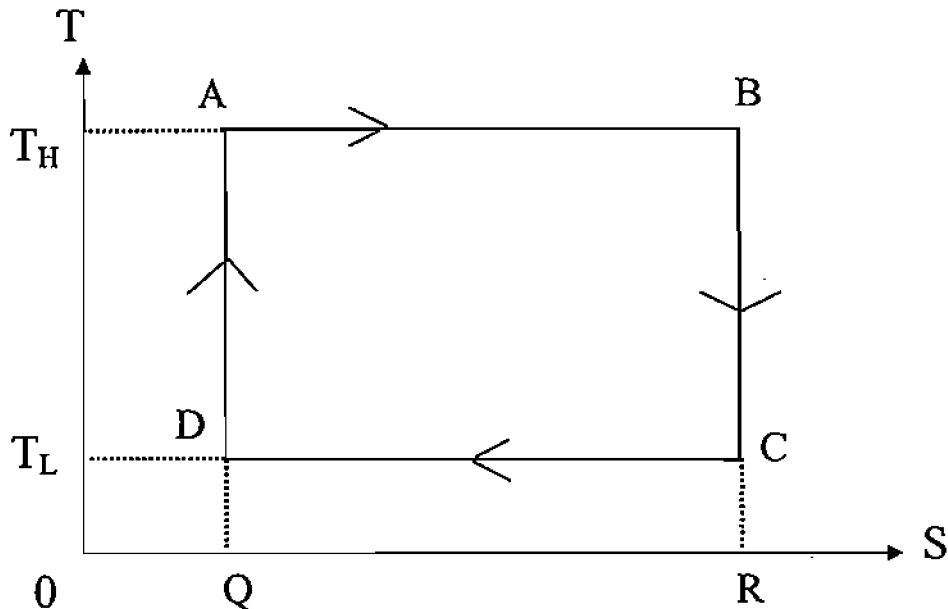
(M) 1 eV

$$= 1.6022 \times 10^{-19} \text{ J}$$

CHEMISTRY

1. Temperature dependence of the rate constant for a reaction obeys the Arrhenius equation: $k = A \times e^{\left(\frac{-E_a}{RT}\right)}$. According to this equation, as T approaches infinity, k will approach:
 - (A) A
 - (B) infinity
 - (C) 1
 - (D) 0
2. Among the following molecules, the one that is **NOT** infrared active is:
 - (A) C_2H_2 , acetylene
 - (B) CH_4 , methane
 - (C) N_2 , nitrogen molecule
 - (D) CO_2 , carbon dioxide
3. The molar entropy of a molecule that can have three distinct **orientations** at absolute zero is approximately:
 - (A) 9.13 J K^{-1}
 - (B) 5.76 J K^{-1}
 - (C) 24.9 J K^{-1}
 - (D) 3.96 J K^{-1}
4. For the reaction of oxygen in equilibrium with ozone: $3O_2(g) \leftrightarrow 2O_3(g)$, the number of intensive variables to be specified to describe the state of the system, is:
 - (A) 1
 - (B) 2
 - (C) 3
 - (D) 4
5. The atomic term symbol for the helium atom in its ground state is
 - (A) 3S_1
 - (B) 3P_2
 - (C) 3S_0
 - (D) 1S_0

6. The operation of a Carnot engine between a high temperature T_H and a low temperature T_L is shown next in terms of temperature T and entropy S of some working fluid.



Among the following statements about this figure, the one that is **NOT TRUE** is:

- (A) The network done by the system is the area $ABRQ - DCRQ$.
 - (B) The step $C \rightarrow D$ corresponds to an isothermal expansion of the working fluid.
 - (C) The heat deposited by the system in the thermal reservoir at T_L is the area $DCRQ$.
 - (D) Both the steps $D \rightarrow A$ and $B \rightarrow C$ describe adiabatic processes.
7. Among the following forms of carbon, the thermodynamically **most** stable one is:

- (A) Carbon nanotube
- (B) Fullerene
- (C) Diamond
- (D) Graphite

8. One mole of an ideal gas expands from 5 atm against a constant pressure of 1 atm at 298 K. The magnitude of work done by the gas is:

- (A) 1981 J
- (B) 3988 J
- (C) 991 J
- (D) 7282 J

9. The total degeneracy for a d^1 ion in spherical symmetry is:

- (A) 2
- (B) 3
- (C) 5
- (D) 10

10. A molecule has two C_2 axes perpendicular to each other. Hence,

- (A) the molecule would have a non-zero dipole moment which may point either along one of the two axes.
- (B) the molecule would have a non-zero dipole moment, which would point in the direction midway between the two axes, i.e. making an angle of 45° to each axis.
- (C) the molecule has a non-zero dipole that would point in a direction perpendicular to the two axes.
- (D) the molecule would have zero dipole moment.

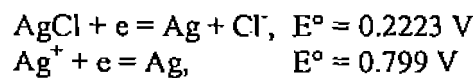
11. Twenty four grams of zinc metal is dissolved in 1M HCl solution. The charge produced by the oxidation process is:

- (A) 96500 Coulombs
- (B) 70836 Coulombs
- (C) 48250 Coulombs
- (D) 35418 Coulombs

12. The pH of 80 % ionised 0.01N acid solution is:

- (A) 2.0969
- (B) 0.2096
- (C) 20.09
- (D) 0.0269

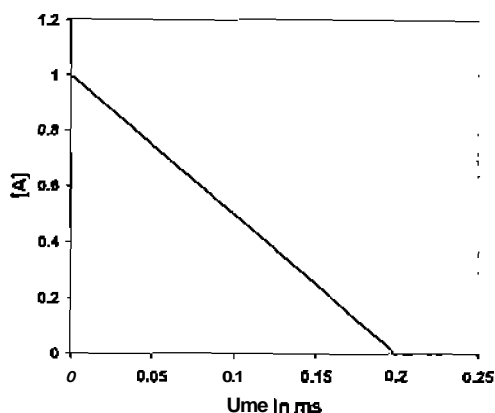
13. Given the standard cell potentials as below:



The solubility product for the reaction; $\text{AgCl} = \text{Ag}^+ + \text{Cl}^-$ is:

- (A) 2.80×10^{-10}
- (B) 0.80×10^{-10}
- (C) 28.0×10^{-10}
- (D) 1.80×10^{-10}

14. Concentration of the reagent A, [A], varies with time according to the graph shown next:



The order of the reaction is:

- (A) not defined
- (B) 1
- (C) 2
- (D) 0

15. The point group symmetry for the molecule NH_3 is:

- (A) D_{3h}
- (B) C_3
- (C) C_{3v}
- (D) C_{3h}

16. Among the following statements, the one that is NOT true for a catalyzed reaction is:

- (A) The concentration of the catalyst does not enter into the expression for equilibrium.
- (B) The enthalpy of reaction does not change in the presence of a catalyst.
- (C) The activation energy does not change in the presence of a catalyst.
- (D) Without the catalyst, the reaction can still proceed.

17. For the reaction: $2 \text{NH}_3(\text{g}) \rightarrow 3 \text{H}_2(\text{g}) + \text{N}_2(\text{g})$, $\Delta H^\circ = 92.22 \text{ kJ mol}^{-1}$ and $\Delta S^\circ = 198.75 \text{ J K}^{-1} \text{ mol}^{-1}$. With all reactants and products in their standard state, this reaction will be spontaneous at:

- (A) temperatures below 464 K
- (B) temperatures above 464 K
- (C) no temperature.
- (D) all temperatures.

18. Among the following groups of metals, the one having the lowest melting points is:

- (A) alkaline earth
- (B) transition
- (C) alkali
- (D) lanthanide

19. The composition of a sample of iron oxide is $\text{Fe}_{0.93}\text{O}$. The percentage of Fe in the +3 oxidation state in this sample is approximately:

- (A) 0.07 %
- (B) 7.0 %
- (C) 30.0 %
- (D) 15.1 %

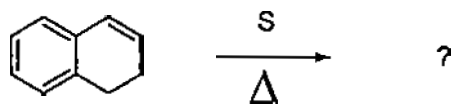
20. For the reaction $2\text{P} + 3\text{Br}_2 \rightarrow 2\text{PBr}_3$, the heat evolved is -243 kJ (ΔH). Hence, the enthalpy change when 2.63 g of P reacts with an excess of Br_2 will be:

- (A) 10.3 kJ
- (B) 24.3 kJ
- (C) 1.03 kJ
- (D) 20.6 kJ

21. The product of the reaction of anisole with sodamide is:

- (A) *m*-anisidine
- (B) *p*-anisidine
- (C) 1,2-diaminobenzene
- (D) 1,3-diaminobenzene

22. The major product in the following reaction is:

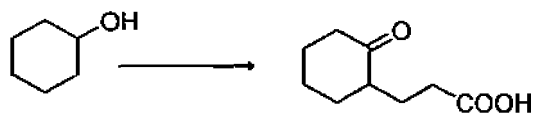


- (A)
- (B)
- (C)
- (D)

23. Number of signals expected in proton decoupled ^{13}C NMR spectrum of 1,4-dihydroxynaphthalene and 1,8-dihydroxynaphthalene are:

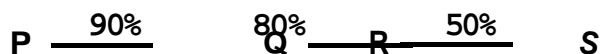
- (A) 5 and 5
- (B) 5 and 6
- (C) 5 and 10
- (D) 10 and 6

24. The reagents that can effect the following conversion are:



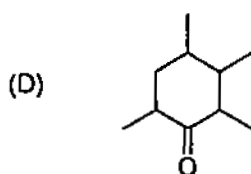
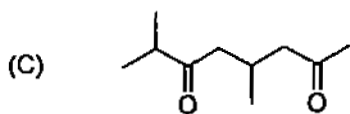
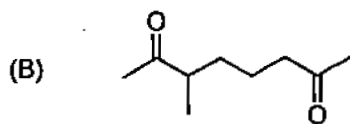
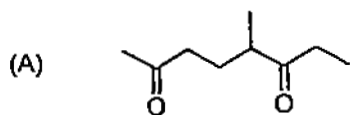
- (A) (i) CrO_3 , (ii) methyl acrylate, (iii) $\text{H}_2\text{O}/\text{H}^+$
(B) (i) O_2 , (ii) methyl acrylate
(C) (i) CrO_3 (ii) pyrrolidine (iii) methyl acrylate, (iv) $\text{H}_2\text{O}/\text{H}^+$
(D) (i) H_2O_2 , (ii) methyl acrylate,

25. In the multi-step synthesis given below, the overall yield for the formation of S from P is:



- (A) 72 %
(B) 40 %
(C) 36 %
(D) 50 %

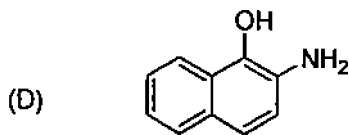
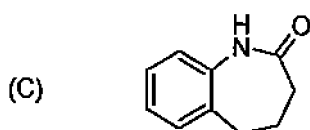
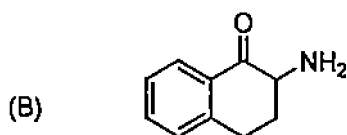
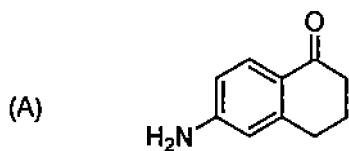
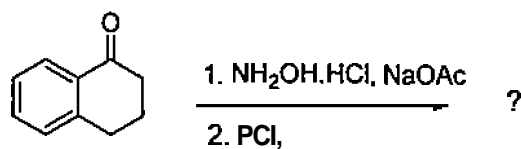
26. Among the following molecules, the one that yields 2,3,6-trimethylcyclohex-2-enone on treatment with dil. KOH is:



27. On heating, 1,3-butadiene reacts with elemental sulfur to yield:

- (A) thiophene
- (B) 2,5-dihydrothiophene
- (C) 2,3-dihydrothiophene
- (D) tetrahydrothiophene

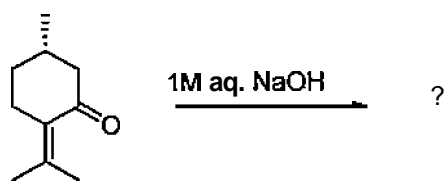
28. The major product in the following reaction is:

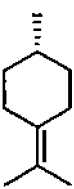
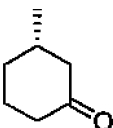
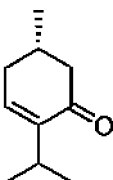
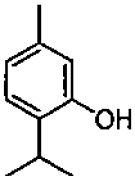


29. The reagent of choice for the selective reduction of ketones in presence of an ester is:

- (A) lithium aluminium hydride
- (B) sodium hydride
- (C) hydrogen and palladium on carbon
- (D) sodium borohydride

30. The major product obtained in the following reaction is:

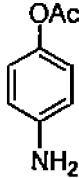
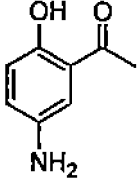
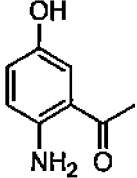



- (A) 
- (B) 
- (C) 
- (D) 

31. The biogenetic precursor for cholesterol is:

- (A) mevalonic acid
(B) cyclopentaphenanthrene
(C) acetyl CoA
(D) fatty acid

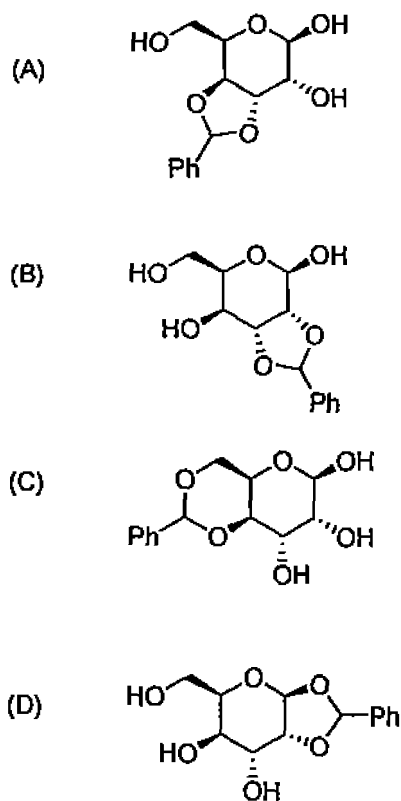
32. Reaction of 4-aminophenol with one equivalent of acetylchloride in the presence of pyridine yields:

- (A) 
- (B) 
- (C) 
- (D) 

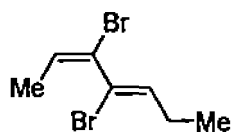
33. An organic compound of molecular formula C_4H_8 exhibits only a singlet at δ 1.9 ppm with reference to tetramethylsilane in 1H NMR spectrum. The compound is:

- (A) 1-butene
(B) cis-2-butene
(C) cyclobutane
(D) trans-2-butene

34. Reaction of D-glucose with benzaldehyde in presence of acid yields:

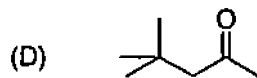
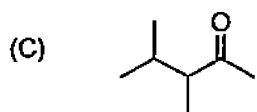
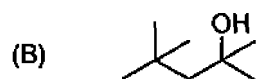
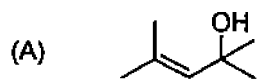
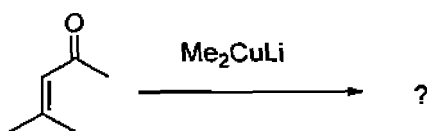


35. The IUPAC name for the following molecule is:



- (A) (2E,4Z)-3,4-dibromo hepta-2,4-diene
 (B) (2Z,4E)-3,4-dibromo hepta-2,4-diene
 (C) (2Z,4Z)-3,4-dibromo hepta-2,4-diene
 (D) (2E,4E)-3,4-dibromo hepta-2,4-diene

36. The product formed in the following reaction is:



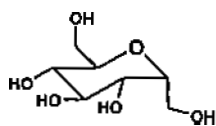
37. Among the following aldehydes, the one that does NOT undergo Cannizzaro reaction is:

- (A) formaldehyde
- (B) acetaldehyde
- (C) benzaldehyde
- (D) pivalaldehyde (trimethylacetaldehyde)

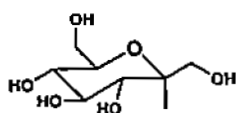
38. *R*-2-octyl tosylate is solvolyzed in 80% aqueous acetone under ideal $\text{S}_{\text{N}}1$ conditions. The product(s) will be:

- (A) *R*-2-octanol and *S*-2-octanol in a 1:1 ratio
- (B) *R*-2-octanol and *S*-2-octanol in a 2:1 ratio
- (C) *R*-2-octanol only
- (D) *S*-2-octanol only

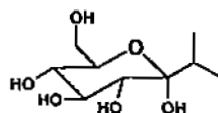
39. Among the following molecules, the conformation is stabilized only by anomeric effect for:



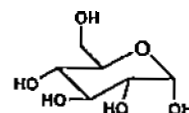
a)



b)



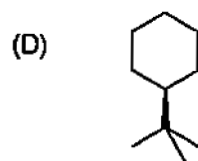
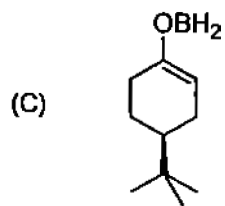
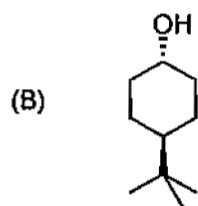
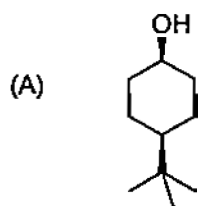
c)



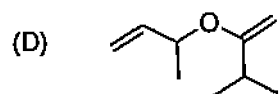
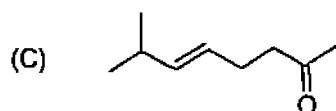
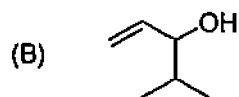
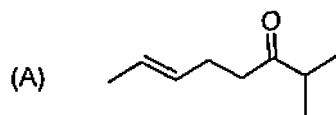
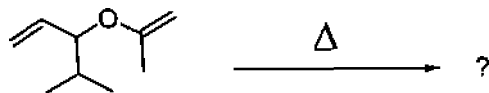
d)

- (A) a
 (B) b
 (C) c
 (D) d

40. Major product obtained in the reduction of 4-*tert*-butyl cyclohexanone with NaBH_4 is:



41. The product obtained in the following conversion is:



42. For the preparation of 1 litre each of 1 M NaOH and 1 M KOH solutions, the quantities of NaOH and KOH required are, respectively:

- (A) 40 g and 47.6 g
- (B) 40 g and 56 g
- (C) 20 g and 56 g
- (D) 40 g and 28 g

43. Zinc selenide crystallizes in zincblende structure. The numbers of atoms of Zn and Se present in its unit cell are:

- (A) 8
- (B) 6
- (C) 4
- (D) 12

44. The role of Br_2 in the reaction $\text{H}_2\text{O} + \text{Br}_2 \rightarrow \text{HOBr} + \text{HBr}$ is:

- (A) reducing agent
- (B) oxidizing agent
- (C) neither oxidizing nor reducing agent
- (D) both oxidizing and reducing agents

45. Among the following complexes, the one that undergoes Z_{in} distortion is:

- (A) $[\text{Ni}(\text{CO})_4]$
- (B) $[\text{CuCl}_4]^{2-}$
- (C) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$
- (D) $[\text{Cu}(\text{NH}_3)_6]^{2+}$

46. The ground state for the V^{3+} ion in a tetrahedral environment is:

- (A) ${}^3\text{T}_1$
- (B) ${}^3\text{T}_2$
- (C) ${}^3\text{A}_2$
- (D) ${}^3\text{E}$

47. Treatment of $\text{Mo}(\text{CO})_6$ with $\text{Na}^+\text{C}_5\text{H}_5^-$ results in:

- (A) $\text{Na}[\text{Mo}(\eta^1\text{-C}_5\text{H}_5)(\text{CO})_4] + 2\text{CO}$
- (B) $\text{Na}[\text{Mo}(\eta^5\text{-C}_5\text{H}_5)(\text{CO})_3] + 3\text{CO}$
- (C) $\text{Na}[\text{Mo}(\eta^3\text{-C}_5\text{H}_5)(\text{CO})_2] + 4\text{CO}$
- (D) $\text{Na}[\text{Mo}(\eta^5\text{-C}_5\text{H}_5)(\text{CO})] + 5\text{CO}$

48. The reaction:



is an example for:

- (A) oxidative addition
- (B) substitution
- (C) insertion
- (D) reductive elimination

49. The smallest cation among Na^+ , Mg^{2+} , Al^{3+} , Si^{4+} is:

- (A) Mg^{2+}
- (B) Na^+
- (C) Al^{3+}
- (D) Si^{4+}

50. The two main isotopes of potassium are ${}^{39}\text{K}$ and ${}^{41}\text{K}$. The atomic mass of potassium may be used as 39.1. The abundances of the isotopes are:

- (A) 95% ${}^{39}\text{K}$ and 5% ${}^{41}\text{K}$
- (B) 90% ${}^{39}\text{K}$ and 10% ${}^{41}\text{K}$
- (C) 5% ${}^{39}\text{K}$ and 95% ${}^{41}\text{K}$
- (D) 10% ${}^{39}\text{K}$ and 90% ${}^{41}\text{K}$

51. The metal ions that have the highest mobility in biological media are:

- (A) Zn(II) and Ni(II)
- (3) Fe(II) and Cu(II)
- (C) Na(I) and K(I)
- (D) Mg(II) and Ca(II)

52. Hemerythrin belongs to the group of:

- (A) non-heme iron protein
- (B) binuclear copper protein
- (C) heme-iron protein
- (D) non-heme non-iron protein

53. Among the following bonds, the least stable one is:

- (A) S-S
- (B) C=C
- (C) P-P
- (D) S=S

54. The number of isomers possible for octahedral $[\text{CrCl}_2(\text{H}_2\text{O})_4]^+$ and octahedral $[\text{CoCl}_2(\text{en})_2]^+$ are, respectively,:

- (A) two and two
- (B) three and three
- (C) two and three
- (D) three and two

55. The cis-platin is:

- (A) diamagnetic.
- (B) paramagnetic.
- (C) ferromagnetic.
- (D) anti-ferromagnetic.

56. Among the following organometallic compounds, the one that follows the 18-electron rule is:

- (A) $[\text{Ni}(\eta^5\text{-C}_5\text{H}_5)_2]$
- (B) $[\text{Ru}(\eta^6\text{-C}_6\text{H}_6)_2]$
- (C) $[\text{Cr}(\eta^6\text{-C}_6\text{H}_6)_2]$
- (D) $[\text{Co}(\eta^5\text{-C}_5\text{H}_5)_2]$

57. Among the following oxides, the one having a normal spinel structure is:

- (A) CuO
- (B) Co_3O_4
- (C) Fe_3O_4
- (D) TiO_2

58. Among the following complexes, the one having a metal-metal quadruple bond is:

- (A) $[\text{Re}_2\text{Cl}_8]^{4-}$
- (B) $[\text{Cu}_2(\text{OAc})_4]$
- (C) $[\text{Mo}_2(\text{OR})_6]$
- (D) $[\text{Ru}_2\text{Cl}(\text{OAc})_4]$

59. Among the following complexes, the one that is expected to show three d-d bands in the electronic spectrum is:

- (A) $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$
- (B) $[\text{FeCl}_4]^-$
- (C) $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$
- (D) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$

60. One hundred gram of CaCO_3 contains (N is the Avogadro's number):

- (A) 50N protons
- (B) N protons
- (C) 5N protons
- (D) 25N protons

61. Among the following pairs of ions/molecules, the one having similar shapes is:

- (A) CO_2 and H_2O
- (B) BF_3 and H_3C^+
- (C) CCl_4 and PtCl_4
- (D) NH_3 and BF_3

62. The number of orbitals present in the $n = 4$ atomic shell is:

- (A) 64
- (B) 32
- (C) 16
- (D) 8

63. There are two containers having two moles of Ar each at a temperature of 298 K and a pressure of 1 bar. Both are heated such that they gain 1 KJ of energy each. First container was heated at constant V and the second container was heated at constant P. The final temperatures in the two containers will respectively be:

- (A) 298 K and 350 K
- (B) 350 K and 400 K
- (C) 338 K and 322 K
- (D) 350 K and 350 K

64. The molecular weight of an ideal gas having a density of 1.5 g L^{-1} at 100°C and 600 Torr is:

- (A) 45.9 g/mol
- (B) 4.59 g/mol
- (C) 5.82 g/mol
- (D) 58.2 g/mol

65. According to ideal gas law,:

- (A) molecules have neither attraction between them nor have any finite size, being treated as a point mass.
- (B) molecules do have attraction between them but do not have any finite size, being treated as a point mass.
- (C) molecules have no attraction between them but do have a finite size.
- (D) molecules have both attraction between them and have a finite size.

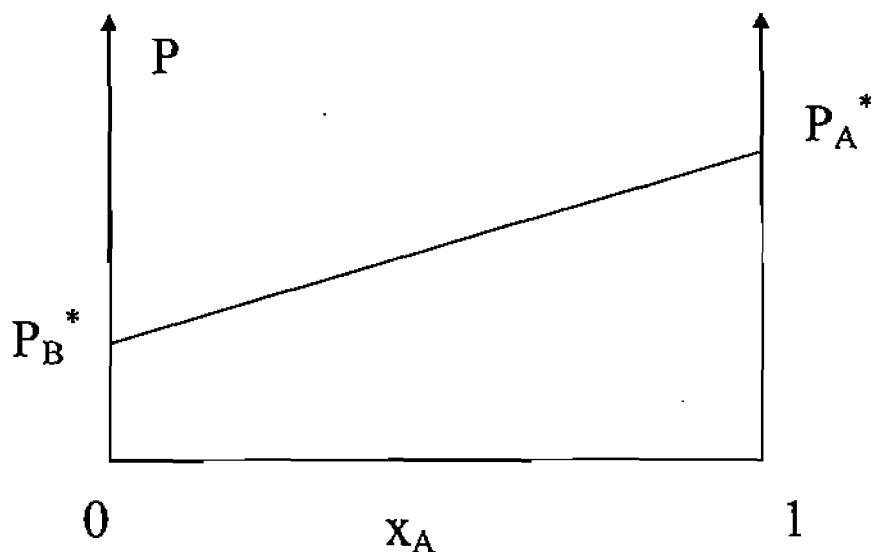
66. For the gas phase reaction: $\text{CO} + \text{NO}_2 \rightarrow \text{CO}_2 + \text{NO}$, the activation energy is found to be 116 kJ mol^{-1} . The enthalpy of formation for CO, NO_2 , CO_2 and NO are -110 , 33 , -394 and 90 kJ mol^{-1} , respectively. The activation energy (in kJ mol^{-1}) for the reverse reaction is:

- (A) 343
- (B) -227
- (C) 227
- (D) 116

67. Factors affecting the average kinetic energy of gas molecules are:

- (A) pressure only
- (B) temperature only
- (C) both temperature and pressure
- (D) neither temperature nor pressure

68. The figure below shows the dependence at some fixed temperature T of the total vapour pressure P of a mixture of two volatile liquids A and B on the mole fraction x_A of component A, with P_A^* the vapour pressure of pure A and P_B^* the vapour pressure of pure B.



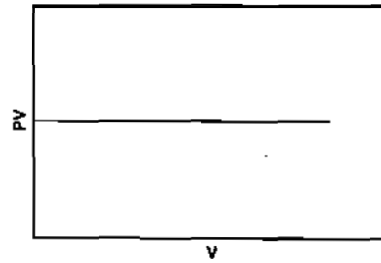
Among the following statement about this figure, the one that is NOT TRUE is:

- (A) The mixture is ideal.
 (B) In the region above the line $P_B^*P_A^*$, the liquid phase of the mixture is the stable phase.
 (C) Along the line $P_B^*P_A^*$, the liquid and vapour phases of the mixture are in equilibrium.
 (D) The vapour pressure of component B, P_B , is given by the relation $P_B = P_A^*(1-x_A)$.
69. The enthalpy of fusion of H_2O at $0^\circ C$ is $1.436 \text{ kcal mol}^{-1}$. The ΔS for the process $H_2O(l) \rightleftharpoons H_2O(s)$ at $0^\circ C$ is:

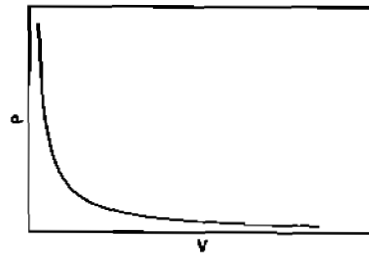
- (A) $52.6 \text{ cal mol}^{-1} \text{ K}^{-1}$
 (B) $-5.26 \text{ cal mol}^{-1} \text{ K}^{-1}$
 (C) $5.26 \text{ cal mol}^{-1} \text{ K}^{-1}$
 (D) $-52.6 \text{ cal mol}^{-1} \text{ K}^{-1}$

70. Among the following graphs, the one that does not correspond to ideal gas behaviour is: (P = pressure, V = volume, T = temperature in K):

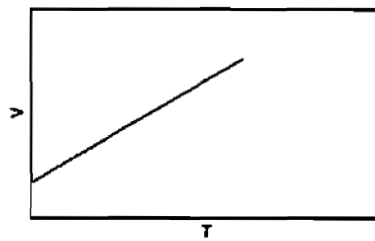
(A) At constant T



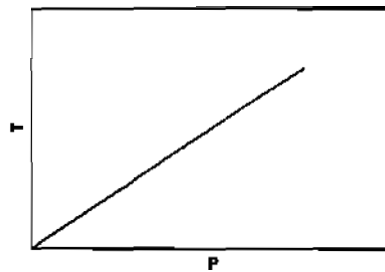
(B) At constant T



(C) At constant P



(D) At constant V



71. A particle is confined to a one dimensional box of length $2a$ extending from $x = -a$ to $x = a$ along the x-axis. The average value of position and momentum, for the particle, if it is sitting in the lowest possible state is:

- (A) $\langle x \rangle = 0$ and $\langle p_x \rangle = 0$
- (B) $\langle x \rangle = a/2$ and $\langle p_x \rangle = 0$
- (C) $\langle x \rangle = 0$ and $\langle p_x \rangle = -i\eta$
- (D) $\langle x \rangle = 0$ and $\langle p_x \rangle = \eta$

72. In the following N denotes a suitable constant that one may choose as desired. Of the following the functions, the only function that is NOT an acceptable wave function for an electron in the Hydrogen atom is:

- (A) $N \exp(-r)$
- (B) $N \exp(r)$
- (C) $Nr \exp(-r) \exp(i\phi)$
- (D) $Nr \exp(-r^2) \exp(i\phi)$

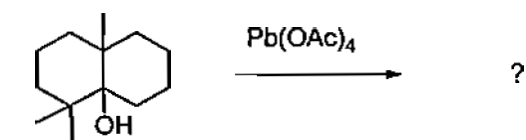
73. In the electromagnetic spectrum, the wavenumber decreases in the order:

- (A) X-ray > microwave > infra-red > ultra-violet
- (B) X-ray > microwave > ultra-violet > infra-red
- (C) X-ray > ultra-violet > infra-red > microwave
- (D) microwave > infra-red > ultra-violet > X-ray

74. The number of electrons (per second) that pass through a cross section of copper wire carrying a current of 10^{-9} A is:

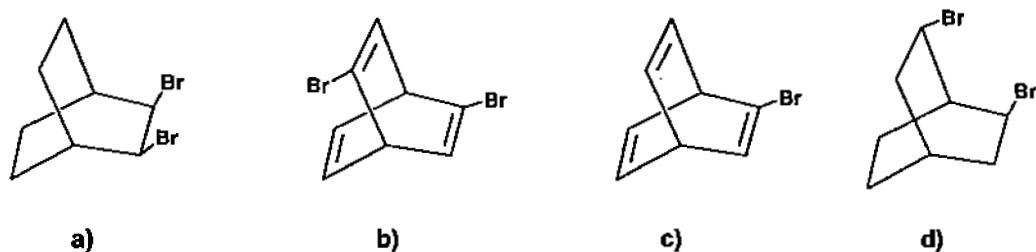
- (A) 62.5×10^{10} e/s
- (B) 120 e/s
- (C) 12000 e/s
- (D) 0.625×10^{10} e/s

75. The major product in the following reaction is:



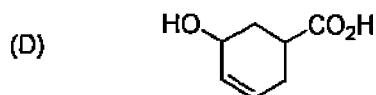
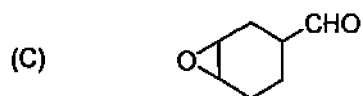
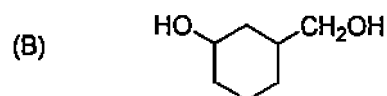
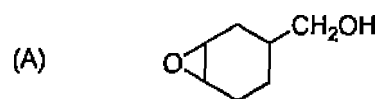
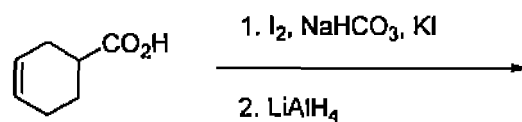
- (A)
- (B)
- (C)
- (D)

76. Among the following molecules, the one that is chiral is:



- (A) a
 (B) b
 (C) c
 (D) d

77. The major product in the following reaction is:



78. Arrange the following in the increasing order of acidity:

(i) Benzoic acid (ii) *p*-Methoxy benzoic acid (iii) *p*-Methyl benzoic acid

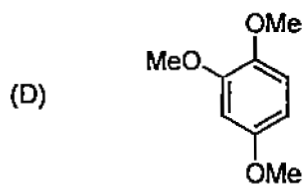
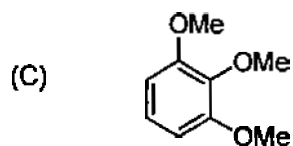
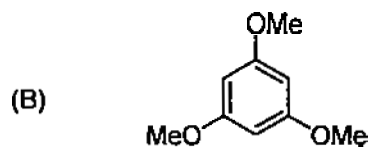
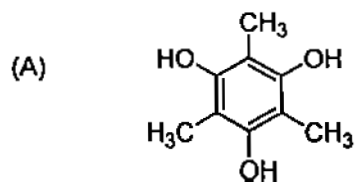
(A) (i) < (ii) < (iii)

(B) (iii) < (ii) < (i)

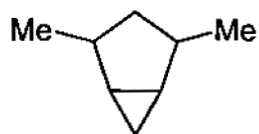
(C) (ii) < (iii) < (i)

(D) (ii) < (i) < (iii)

79. A compound with molecular formula $C_9H_{12}O_3$ exhibited two singlets at δ 6.7 and δ 3.8 in 1H NMR spectrum in 1:3 ratios. The structure of the compound is:

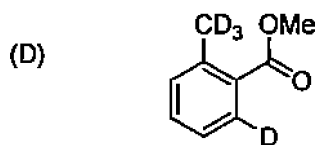
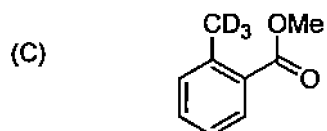
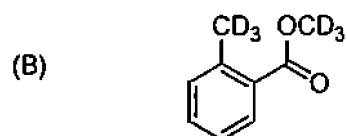
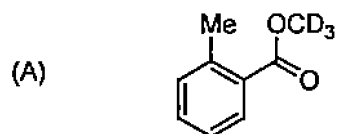
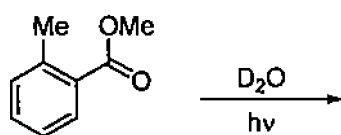


80. The number of diastereomers possible for the following compound is:



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

81. The product formed in the following reaction is:

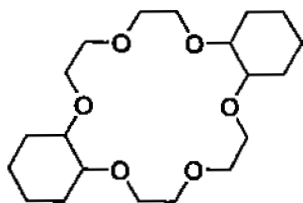


82. Among the following molecules, the one that will NOT undergo a Diels-Alder reaction is:

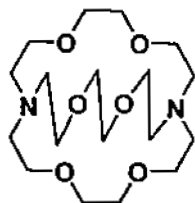
- (A) ethylene
- (B) 2-butene
- (C) maleic anhydride
- (D) succinic anhydride

83. The generic names for the following molecules are, respectively:

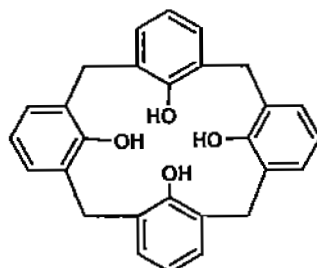
(A)



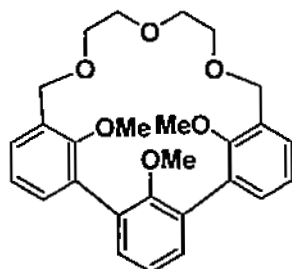
(B)



(C)

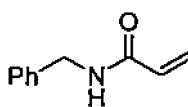
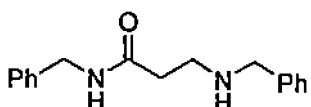
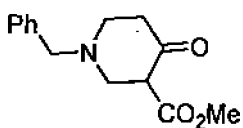


(D)

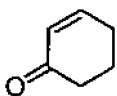
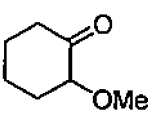
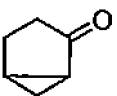
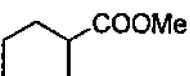


- (A) crown ether, cryptand, calixarene, and hemispherand.
(B) cryptand, calixarene, crown ether and hemispherand.
(C) crown ether, hemispherand, cryptand, and calixarene.
(D) crown ether, calixarene, cryptand, and hemispherand.

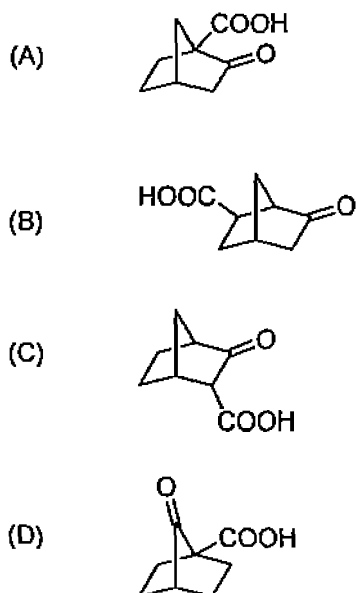
84. The major product in the reaction of methyl acrylate and benzylamine under ambient conditions is:

- (A) 
- (B) 
- (C) 
- (D) Poly-(N-benzylacrylamide)

85. The major product of the reaction of 2-chlorocyclohexanone with NaOMe is:

- (A) 
- (B) 
- (C) 
- (D) 

86. Among the following compounds the one that readily undergoes decarboxylation upon heating is:



87. In the mass spectrum of CH_2Cl_2 , the ratio of peaks at mass values 84, 86 and 88 will respectively be:

- (A) 3:1:1
 (B) 3:2:1
 (C) 4:2:1
 (D) 9:6:1

88. The enthalpy change, ΔH , for the following process are given in kJ/mol: sublimation of $\text{K}(s) = +89$, ionization of $\text{K}(g) = +425$; dissociation of $\text{Cl}_2(g) = +244$, electron gain by $\text{Cl}(g) = -355$, formation of $\text{KCl}(s) = 438$. Using a Born-Haber cycle, the lattice enthalpy of $\text{KCl}(s)$ is calculated to be:

- (A) 719
 (B) 0
 (C) -719
 (D) 1438

89. The absorption maximum of a given sample of cadmium sulfide is 470 nm. The approximate band gap is:

- (A) 200 kJ mol^{-1}
 (B) 250 kJ mol^{-1}
 (C) 100 kJ mol^{-1}
 (D) 150 kJ mol^{-1}

90. For a 6p sub-shell, the most positive value that m_l can have is:

- (A) +1
- (B) +6
- (C) +3
- (D) +7

91. PhMgBr reacts with methanol to give:

- (A) a mixture of anisole and Mg(OH)Br
- (B) a mixture of toluene and Mg(OH)Br
- (C) a mixture of phenol and MeMgBr
- (D) a mixture of benzene and Mg(OMe)Br

92. $C_2B_{n-2}H_n$ is an isoelectronic analogue of:

- (A) B_nH_n
- (B) $B_nH_n^-$
- (C) $B_nH_n^{3-}$
- (D) $B_nH_n^{2-}$

93. The point group symmetry of cis- $[Co(NH_3)_4Cl_2]^+$ is:

- (A) C_{2v}
- (B) Oh
- (C) D_{2h}
- (D) C_{4v}

94. The electron transfer reaction between $[Co(NH_3)_5Cl]^{2+}$ and $[Cr(H_2O)_6]^{2+}$ in acidic medium leads to the formation of a chromium species of formulation:

- (A) $[Cr(NH_3)_5(H_2O)]^{2+}$
- (B) $[Cr(NH_3)_5Cl]^{2+}$
- (C) $[Cr(H_2O)_5Cl]^{2+}$
- (D) $[Cr(NH_3)_6]^{3+}$

95. Among the following molecules, the one that is polar is:

- (A) CH_4
- (B) BF_3
- (C) SF_6
- (D) NH_3

96. The VSEPR model is based on the:
- (A) number of bonded pairs of electrons around the central atom.
 - (B) number of bonded and lone pairs of electrons around the central atom.
 - (C) number of lone pairs of electrons around the central atom.
 - (D) number of protons around the central atom.
97. According to Irving-William series, Cu(II) is more stable than Ni(II) because of:
- (A) Jahn-Teller distortion
 - (B) higher trans effect
 - (C) complexation with labile ligands
 - (D) induction effect
98. Among the hydrogen halides, the one having the highest bond energy is:
- (A) HI
 - (B) HF
 - (C) HBr
 - (D) HCl
99. Among the following ligands, the strongest π acceptor is:
- (A) CN^-
 - (B) CO
 - (C) N_2
 - (D) NO^+
100. Among teflon, water, benzoic acid and protein, hydrogen bonding is not important only in:
- (A) teflon
 - (B) water
 - (C) benzoic acid
 - (D) protein

End of the Question Paper

Hydrogen 1 H 1.00794																	Helium 2 He 4.002602	
Lithium 3 Li 6.941	Beryllium 4 Be 9.0122											Boron 5 B 10.811	Carbon 6 C 12.011	Nitrogen 7 N 14.007	Oxygen 8 O 15.999	Fluorine 9 F 18.998	Neon 10 Ne 20.180	
Sodium 11 Na 22.990	Magnesium 12 Mg 24.305											Aluminum 13 Al 26.982	Silicon 14 Si 28.086	Phosphorus 15 P 30.974	Sulfur 16 S 32.065	Chlorine 17 Cl 35.453	Argon 18 Ar 39.948	
Potassium 19 K 39.098	Calcium 20 Ca 40.078	Scandium 21 Sc 44.956	Titanium 22 Ti 47.88	Vanadium 23 V 50.942	Chromium 24 Cr 51.996	Manganese 25 Mn 54.938	Iron 26 Fe 55.845	Cobalt 27 Co 58.933	Nickel 28 Ni 58.693	Copper 29 Cu 63.546	Zinc 30 Zn 65.38	Gallium 31 Ga 69.723	Germanium 32 Ge 72.61	Arsenic 33 As 74.922	Selenium 34 Se 78.96	Bromine 35 Br 79.904	Krypton 36 Kr 83.798	
Rubidium 37 Rb 85.468	Strontium 38 Sr 87.62	Yttrium 39 Y 88.906	Zirconium 40 Zr 91.224	Niobium 41 Nb 92.906	Molybdenum 42 Mo 95.94	Technetium 43 Tc [98]	Ruthenium 44 Ru 101.07	Rhodium 45 Rh 102.91	Palladium 46 Pd 106.42	Silver 47 Ag 107.87	Cadmium 48 Cd 112.41	Indium 49 In 114.82	Tin 50 Sn 118.71	Antimony 51 Sb 121.76	Te 52 Te 127.6	Iodine 53 I 126.905	Xenon 54 Xe 131.29	
Cesium 55 Cs 132.91	Barium 56 Ba 137.33	57-70 *	Lanthanum 57 La 138.905	Hafnium 72 Hf 178.49	Tantalum 73 Ta 180.948	Tungsten 74 W 183.84	Rhenium 75 Re 186.21	Osmium 76 Os 190.23	Iridium 77 Ir 192.22	Pt 78 Pt 195.08	Au 79 Au 196.967	Hg 80 Hg 200.59	Tl 81 Tl 204.38	Pb 82 Pb 207.2	Bi 83 Bi 208.98	Po 84 Po [209]	At 85 At [210]	Rn 86 Rn [222]
Francium 87 Fr [223]	Radium 88 Ra [226]	89-102 **	Lr 103 [260]	Rf 104 [261]	Db 105 [262]	Sg 106 [263]	Bh 107 [264]	Hs 108 [265]	Mt 109 [266]	Uun 110 [267]	Uuu 111 [268]	Uub 112 [269]	Uuq 114 [270]					

* Lanthanide series

** Actinide series

Lanthanum 57 La 138.91	Cerium 58 Ce 140.12	Praseodymium 59 Pr 140.91	Neodymium 60 Nd 144.24	Europium 61 Eu 151.96	Gadolinium 62 Gd 157.25	Terbium 63 Tb 158.93	Dysprosium 64 Dy 162.50	Ho 65 Ho 164.93	Erbium 66 Er 167.26	Thulium 67 Tm 168.93	Ytterbium 68 Yb 173.05	Lanthanum 57 La 138.91	Cerium 58 Ce 140.12	Praseodymium 59 Pr 140.91	Neodymium 60 Nd 144.24	Europium 61 Eu 151.96	Gadolinium 62 Gd 157.25	Terbium 63 Tb 158.93	Dysprosium 64 Dy 162.50	Ho 65 Ho 164.93	Erbium 66 Er 167.26	Thulium 67 Tm 168.93	Ytterbium 68 Yb 173.05
Actinium 89 Ac [227]	Thorium 90 Th [232]	Protactinium 91 Pa [231]	Uranium 92 U [238]	Neptunium 93 Np [237]	Plutonium 94 Pu [244]	Americium 95 Am [243]	Curium 96 Cm [247]	Berkelium 97 Bk [247]	Californium 98 Cf [251]	Einsteinium 99 Es [252]	Fermium 100 Fm [257]	Mendelevium 101 Md [258]	No 102 [259]										