46. In order to oxidise a mixture of one mole of each of FeC_2O_4, $Fe_2(C_2O_4)_3$, $FeSO_4$ and $Fe_2(SO_4)_3$ in acidic medium, the number of moles of $KMnO_4$ required is
(a) 2 (b) 1 (c) 3 (d) 1.5

47. Consider a titration of potassium dichromate solution with acidified Mohr's salt solution using diphenylamine as indicator. The number of moles of Mohr's salt required per mole of dichromate is
(a) 3 (b) 4 (c) 5 (d) 6

48. The nodal plane in the π-bond of ethene is located in
(a) the molecular plane
(b) a plane parallel to the molecular plane
(c) a plane perpendicular to the molecular plane which bisects the carbon-carbon σ-bond at right angle
(d) a plane perpendicular to the molecular plane which contains the carbon-carbon σ-bond

49. The size of the iso-electronic species Cl^-, Ar and Ca^{2+} is affected by
(a) azimuthal quantum number of valence shell
(b) electron-electron interaction in the outer orbitals
(c) principal quantum number of valence shell
(d) nuclear charge

50. Among the following, the molecule expected to be stabilised by anion formation is C_2, O_2, NO, F_2.
(a) C_2 (b) F_2
(c) NO (d) O_2

51. If K_{sp} of Ag_2CO_3 is 8×10^{-12}, the molar solubility of Ag_2CO_3 in 0.1 M $AgNO_3$ is
(a) 8×10^{-12} M (b) 8×10^{-13} M
(c) 8×10^{-10} M (d) 8×10^{-11} M

52. When equal volumes of the following solutions are mixed, precipitation of AgCl ($K_{sp}=1.8\times10^{-10}$) will occur only with
(a) 10^{-4} M (Ag^+) and 10^{-4} M (Cl^-)
(b) 10^{-5} M (Ag^+) and 10^{-5} M (Cl^-)
(c) 10^{-6} M (Ag^+) and 10^{-6} M (Cl^-)
(d) 10^{-10} M (Ag^+) and 10^{-10} M (Cl^-)

53. During compression of a spring the work done is 10 kJ and 2 kJ escaped to the surroundings as heat. The change in internal energy, ΔU (in kJ) is
(a) 8 (b) −12 (c) 12 (d) −8

54. Two blocks of the same metal having same mass and at temperature T_1 and T_2 respectively, are brought in contact with each other and allowed to attain thermal equilibrium at constant pressure. The change in entropy, ΔS, for this process is
(a) $^2C_p\ln\left[\frac{(T_1+T_2)^{1/2}}{T_1T_2}\right]$ (b) $^2C_p\ln\left[\frac{T_1+T_2}{4T_1T_2}\right]$
(c) $C_p\ln\left[\frac{(T_1+T_2)^2}{4T_1T_2}\right]$ (d) $^2C_p\ln\left[\frac{T_1+T_2}{2T_1T_2}\right]$

55. A piston filled with 0.04 mole of an ideal gas expands reversibly from 50.0 mL to 375 mL at a constant temperature of 37.0°C. As it does so, it absorbs 208 J of heat. The values of q and W for the process will be
($R = 8.314$ J / mol K, ln 7.5 = 2.01)
(a) $q = +208$ J, $W = -208$ J
(b) $q = -208$ J, $W = -208$ J
(c) $q = -208$ J, $W = +208$ J
(d) $q = +208$ J, $W = +208$ J

56. If a reaction follows the Arrhenius equation, the plot ln$k$ *vs* $1/(RT)$ gives straight line with a gradient $(-y)$ unit. The energy required to activate the reactant is
(a) $\frac{y}{R}$ unit (b) $-y$ unit (c) yR unit (d) y unit

57. For the non-stoichiometric reaction, $2A + B \rightarrow C + D$, the following kinetic data were obtained in three separate experiments, all at 298 K.

	Initial concentration $[A]$	Initial concentration $[B]$	Initial rate of formation of C (mol $L^{-1}s^{-1}$)
(i)	0.1 M	0.1 M	1.2×10^{-3}
(ii)	0.1 M	0.2 M	1.2×10^{-3}
(iii)	0.2 M	0.1 M	2.4×10^{-3}

The rate law for the formation of C is
(a) $\frac{dC}{dt}=k[A][B]$ (b) $\frac{dC}{dt}=k[A]^2[B]$
(c) $\frac{dC}{dt}=k[A][B]^2$ (d) $\frac{dC}{dt}=k[A]$

58. If I is the intensity of absorbed light and C is the concentration of AB for the photochemical process. $AB + h\nu \rightarrow AB^*$, the rate of formation of AB^* is directly proportional to
(a) C (b) I
(c) I^2 (d) $C \cdot I$

59. A catalyst
(a) increases the average kinetic energy of reacting molecules
(b) decreases the activation energy
(c) alters the reaction mechanism
(d) increases the frequency of collisions of reacting species

60 . A gas undergoes physical adsorption on a surface and follows the given Freundlich adsorption isotherm equation

$\frac{x}{m} = Kp^{0.5}$

Adsorption of the gas increases with

(a) increase in p and increase in T
(b) increase in p and decrease in T
(c) decrease in p and decrease in T
(d) decrease in p and increase in T

61 . The element that does not show catenation is

(a) Ge (b) Sn (c) Si (d) Pb

62 . The highest possible oxidation states of uranium and plutonium, respectively, are

(a) 7 and 6 (b) 6 and 7
(c) 6 and 4 (d) 4 and 6

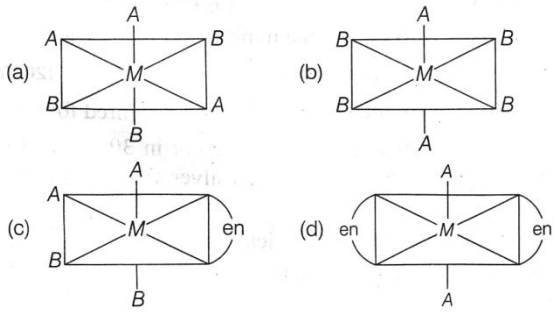
63 . The geometries of the ammonia complexes of Ni^{2+}, Pt^{2+} and Zn^{2+}, respectively, are

(a) octahedral, square planar and tetrahedral
(b) square planar, octahedral and tetrahedral
(c) tetrahedral, square planar and octahedral
(d) octahedral, tetrahedral and square planar

64 . Which of the following dissolves in concentrated NaOH solution?

(a) Fe (b) Zn (c) Cu (d) Ag

65 . The one that will show optical activity is (en = ethane-1, 2-diamine)



66 . The IUPAC name of $[Ni(NH_3)_4][NiCl_4]$ is

(a) Tetrachloronickel (II)-tetraamminenickel (II)
(b) Tetraamminenickel (II)-tetrachloronickel (II)
(c) Tetraamminenickel (II)-tetrachloronickelate (II)
(d) Tetrachloronickel (II)-tetraamminenickelate (0)

67 . Among the following, the coloured compound is

(a) CuCl
(b) $K_3[Cu(CN)_4]$
(c) CuF_2
(d) $[Cu(CH_3CN)_4]BF_4$

The coordination number of Ni^{2+} is 4.

$NiCl_2$ + KCN (excess) $\longrightarrow$ A (cyano complex)
$NiCl_2$ + conc. HCl (excess) $\longrightarrow$ B (chloro complex)

68 . Predict the magnetic nature of A and B.

(a) Both are diamagnetic
(b) A is diamagnetic and B is paramagnetic with one unpaired electron
(c) A is diamagnetic and B is paramagnetic with two unpaired electrons
(d) Both are paramagnetic

69 . Match the refining methods Column I with metals Column II.

	Column I (Refining Methods)		**Column II** (Metals)
I.	Liquation	(A)	Zr
II.	Zone refining	(B)	Ni
III.	Mond process	(C)	Sn
IV.	van Arkel method	(D)	Ga

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

70 . The ore that contains both iron and copper is

(a) malachite (b) azurite
(c) dolomite (d) copper pyrites

71 . Electrolytic reduction of alumina to aluminium by Hall-Heroult process is carried out

(a) in the presence of NaCl
(b) in the presence of fluorite
(c) in the presence of cryolite which forms a melt with lower melting temperature
(d) in the presence of cryolite which forms a melt with higher melting temperature

72 . In Carius method of estimation of halogens 250 mg of an organic compound gave 141 mg of AgBr. The percentage of bromine in the compound is (atomic mass Ag = 108, Br = 80)

(a) 24 (b) 36 (c) 48 (d) 60

73 . An aqueous solution $FeSO_4 \cdot Al_2(SO_4)_3$ and chrome alum is heated with excess of Na_2O_2 and filtered. The materials obtained are

(a) a colourless filtrate and a green residue
(b) a yellow filtrate and a green residue
(c) a yellow filtrate and a brown residue
(d) a green filtrate and brown residue

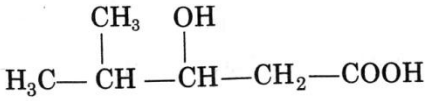
Read the following questions and answer as per the direction given below :

(a) Statement I is correct Statement II is correct Statement II is a correct; explanation of Statement I
(b) Statement I is correct; Statement II is correct Statement II is not the correct explanation of Statement I.
(c) Statement I is correct; Statement II is incorrect.
(d) Statement I is incorrect; Statement II is correct.

74 . **Statement I** A very dilute acidic solution of Cd^{2+} and Ni^{2+} gives yellow precipitate of CdS on passing H_2S.

Statement II Solubility product of CdS is more than that of NiS.

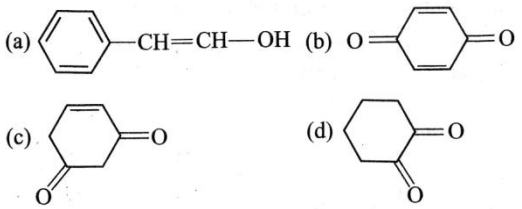
75 . The IUPAC name of the following compound is



(a) 4,4 - dimethyl -3-hydroxybutanoic acid
(b) 2-methyl-3-hydroxypentan-5-oic acid
(c) 3- hydroxy -4- methylpentanoic acid
(d) 4-methyl-3-hydroxypentanoic acid

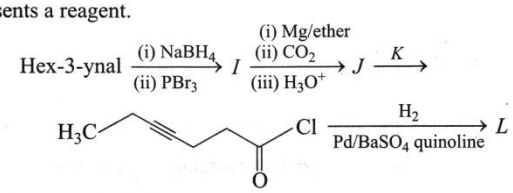
76 . Which of the following compounds will exhibit geometrical isomerism ?
(a) 1-phenyl-2-butene (b) 3-phenyl-1-butene
(c) 2-phenyl-1-butene (d) 1,1-diphenyl-1-propene

77 . Tautomerism is exhibited by (not)

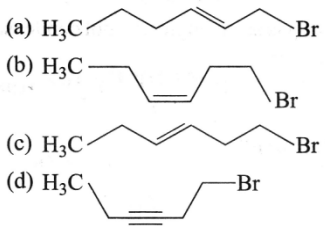


Passage 3

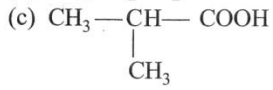
In the following sequence, product I, J and L are formed. K represents a reagent.



78 . The structure of the product I is

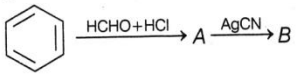


79 . Among the following compounds, which will react with acetone to give a product containing $>C=N-$?
(a) $C_6H_5NH_2$ (b) $(CH_3)_3N$
(c) a & b both (d) $C_6H_5NHNH_2$

80 . An organic compound A upon reacting with NH_3 gives B. On heating, B gives C. C in the presence of KOH reacts with Br_2 to give $CH_3CH_2NH_2$. A is
(a) CH_3COOH
(b) $CH_3CH_2CH_2COOH$
(c) 
(d) CH_3CH_2COOH

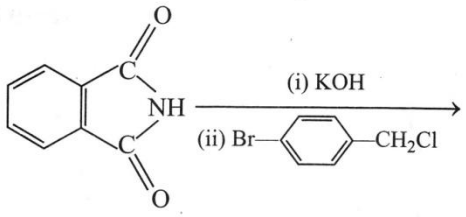
81 . When propionic acid is treated with aqueous sodium bicarbonate, CO_2 is liberated. The C of CO_2 comes from
(a) methyl group
(b) carboxylic acid group
(c) methylene group
(d) bicarbonate group

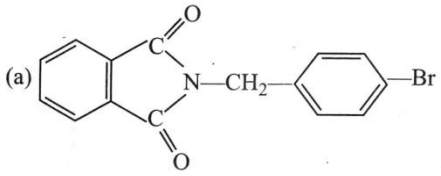
82 . The compounds A and B in the following reaction are, respectively

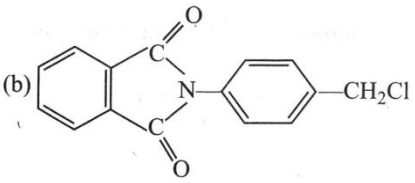


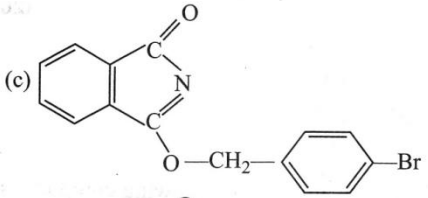
(a) A = Benzyl alcohol, B = Benzyl isocyanide
(b) A = Benzyl alcohol, B = Benzyl cyanide
(c) A = Benzyl chloride, B = Benzyl isocyanide
(d) A = Benzyl chloride, B = Benzyl cyanide

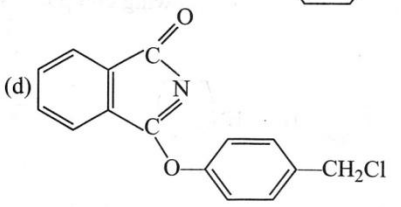
83 . The major product of the following reaction is



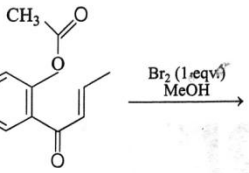
(a) 

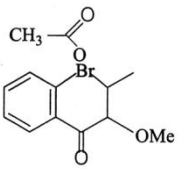
(b) 

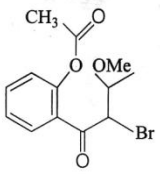
(c) 

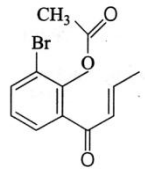
(d) 

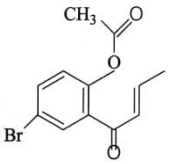
84 . The major product obtained in the following conversion is



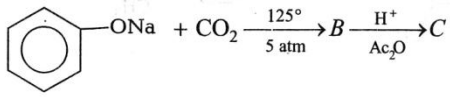
(a) 

(b) 

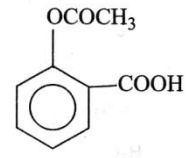
(c) 

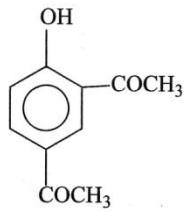
(d) 

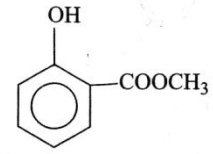
85 . Sodium phenoxide when heated with CO_2 under pressure at 125°C yields a product which on acetylation produces *C*.



The major product *C* would be

(a) 

(b) 

(c) 

(d) 

86 . *m*-chlorobenzaldehyde on reaction with conc. KOH at room temperature gives
(a) potassium *m*-chlorobenzoate and *m*-chlorobenzyl alcohol
(b) *m*-hydroxy benzaldehyde and *m*-chlorobenzyl alcohol
(c) *m*-chlorobenzyl alcohol and *m*-hydroxy benzyl alcohol
(d) potassium *m*-chlorobenzoate and *m*-hydroxy benzaldehyde

87 . Amylopectin is composed of
(a) β-D-glucose, C_1-C_4 and C_2-C_6 linkages
(b) α-D-glucose, C_1-C_4 and C_2-C_6 linkages
(c) β-D-glucose, C_1-C_4 and C_1-C_6 linkages
(d) α-D-glucose, C_1-C_4 and C_1 -C_6linkages

88 . Glucose on prolonged heating with HI gives
(a) *n*-hexane (b) 1-hexene
(c) Hexanoic acid (d) 6-iodohexanal

89 . The regions of the atmosphere, where clouds form and where we live, respectively, are
(a) stratosphere and stratosphere
(b) troposphere and troposphere
(c) troposphere and stratosphere
(d) stratosphere and troposphere

90 . Water filled in two glasses *A* and *B* have BOD values of 10 and 20, respectively. The correct statement regarding them, is
(a) *A* is more polluted than *B*
(b) *A* is suitable for drinking, wherease *B* is not
(c) Both *A* and *B* are suitable for drinking
(d) *B* is more polluted than *A*