**35.** A nucleus splits into two nuclear parts which have their velocity ratio equal to 2 : 1. What will be the ratio of their nuclear radius?
(a) $2^{1/3} : 1$
(b) $1 : 2^{1/3}$
(c) $3^{1/2} : 1$
(d) $1 : 3^{1/2}$

36. A charge $+q$ is at a distance $L/2$ above a square of side L. Then what is the flux linked with the surface?
(a) $\dfrac{q}{4\varepsilon_0}$
(b) $\dfrac{2q}{3\varepsilon_0}$
(c) $\dfrac{q}{6\varepsilon_0}$
(d) $\dfrac{6q}{\varepsilon_0}$

37. A plane electromagnetic wave is incident on a plane surface of area A, normally and is perfectly reflected. If energy E strikes the surface in time t then average pressure exerted on the surface is (c = speed of light)
(a) zero
(b) E/Atc
(c) 2E/Atc
(d) E/c

38. There are two wire of same material and same length while the diameter of second wire is two times the diameter of first wire, then the ratio of extension produced in the wires by applying same load will be
(a) $1 : 1$
(b) $2 : 1$
(c) $1 : 2$
(d) $4 : 1$

**39.** Determine the current in 2Ω resistor.
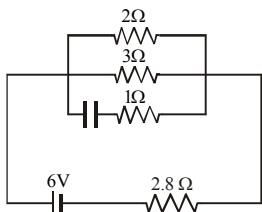
(a) 1 A
(b) 1.5 A
(c) 0.9 A
(d) 0.6A

40. The potential energy of a satellite of mass m and revolving at a height R_e above the surface of earth where R_e = radius of earth, is
(a) $-m\,g\,R_e$
(b) $\dfrac{-m\,g\,R_e}{2}$
(c) $\dfrac{-m\,g\,R_e}{3}$
(d) $\dfrac{-m\,g\,R_e}{4}$

PART - II : CHEMISTRY

41. If 0.2 gram of an organic compound containing carbon, hydrogen and oxygen on combustion, yielded 0.147 gram carbon dioxide and 0.12 gram water. What will be the content of oxygen in the substance ?
(a) 73.29%
(b) 78.45%
(c) 83.23%
(d) 89.50%

42. The Lassaigne's extract is boiled with dil. HNO_3 before testing for halogens because
(a) silver halides are soluble in HNO_3
(b) Na_2S and NaCN are decomposed by HNO_3
(c) Ag_2S is soluble in HNO_3
(d) AgCN is soluble in HNO_3

43. What is X in the following conversion ?
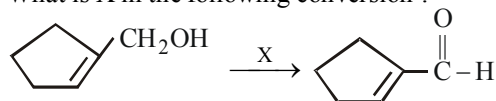
(a) $K_2Cr_2O_7$, H_2SO_4/H_2O
(b) HIO_4
(c) PCC/CH_2Cl_2
(d) OsO_4, $(CH_3)_3C.COOH$, $(CH_3)_3COH$, OH^-

44. Maleic acid and fumaric acids are
(a) Chain isomers
(b) Functional isomers
(c) Tautomers
(d) Geometrical isomers

45. For which one of the processes represented by the following equations the enthalpy (heat) change is likely to be negative
(a) $Cl^-(g) + aq \rightarrow Cl^-(aq)$
(b) $Cl(g) \rightarrow Cl^+(g) + e^-$
(c) $1/2\,Cl_2(g) \rightarrow Cl(g)$
(d) $Cl_2(l) \rightarrow Cl_2(g)$

46. A cyclic process ABCD is shown in P–V diagram for an ideal gas. Which of the following diagram represents the same process?
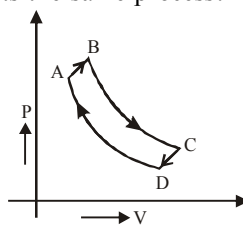
**47.** In a monoclinic unit cell, the relation of sides and angles are respectively:
(a) $a = b \neq c$ and $\alpha = \beta = \gamma = 90°$
(b) $a \neq b \neq c$ and $\alpha = \beta = \gamma = 90°$
(c) $a \neq b \neq c$ and $\beta = \gamma = 90° \neq \alpha$
(d) $a \neq b \neq c$ and $\alpha \neq \beta \neq \gamma \neq 90°$

48. Phosphine is not obtained by which of the following reaction?
(a) White P is heated with NaOH.
(b) Red P is heated with NaOH.
(c) Ca_3P_2 reacts with water.
(d) Both (a) and (c).

49. An ideal gaseous mixture of ethane (C_2H_6) and ethene (C_2H_4) occupies 28 litre at 1 atm and 273 K. The mixture reacts completely with 128 g O_2 to produce CO_2 and H_2O. Mole fraction at C_2H_6 in the mixture is:
(a) 0.6 (b) 0.4 (c) 0.5 (d) 0.8

50. What is the maximum wavelength line in the Lyman series of He^+ ion?
(a) $3R$ (b) $\dfrac{1}{3R}$
(c) $\dfrac{1}{R}$ (d) None of these

51. The correct order of acidic strength :
(a) $Cl_2O_7 > SO_2 > P_4O_{10}$
(b) $K_2O > CaO > MgO$
(c) $CO_2 > N_2O_5 > SO_3$
(d) $Na_2O > MgO > Al_2O_3$

52. In the reaction $2PCl_5 \rightleftharpoons PCl_4^+ + PCl_6^-$, the change in hybridisation is from
(a) sp^3d to sp^3 and sp^3d^2
(b) sp^3d to sp^2 and sp^3
(c) sp^3d to sp^3d^2 and sp^3d^3
(d) sp^3d^2 to sp^3 and sp^3d

53. Arrange the following ions in the order of decreasing X – O bond length, where X is the central atom
(a) $ClO_4^-, SO_4^{2-}, PO_4^{3-}, SiO_4^-$
(b) $SiO_4^{4-}, PO_4^{3-}, SO_4^{2-}, ClO_4^-$
(c) $SiO_4^{4-}, PO_4^{3-}, ClO_4^-, SO_4^{2-}$
(d) $SiO_4^{4-}, SO_4^{2-}, PO_4^{3-}, ClO_4^-$

54. Two vessels of volumes 16.4 L and 5 L contain two ideal gases of molecular existence at the respective temperature of 27 °C and 227 °C and exert 1.5 and 4.1 atmospheres respectively. The ratio of the number of molecules of the former to that of the later is
(a) 2 (b) 1 (c) $\dfrac{1}{2}$ (d) $\dfrac{1}{3}$

55. For the combustion reaction at 298 K
$$2Ag(s) + 1/2O_2(g) \longrightarrow 2Ag_2O(s)$$
Which of the following alternatives is correct?
(a) $\Delta H = \Delta U$
(b) $\Delta H > \Delta U$
(c) $\Delta H < \Delta U$
(d) ΔH and ΔU has no relation with each other

56. The ratio $\dfrac{K_p}{K_c}$ for the reaction
$$CO(g) + \frac{1}{2}O_2(g) \rightleftharpoons CO_2(g) \text{ is:}$$
(a) $\dfrac{1}{\sqrt{RT}}$ (b) $(RT)^{1/2}$
(c) RT (d) 1

57. A solution of NH_4Cl and NH_3 has pH = 8.0. Which of the following hydroxides may be precipitated when this solution is mixed with equal volume of 0.2 M of metal ion.
(a) $Ba(OH)_2 (K_{sp} = 1.1 \times 10^{-4})$
(b) $Mg(OH)_2 (K_{sp} = 3.5 \times 10^{-4})$
(c) $Fe(OH)_2 (K_{sp} = 8.1 \times 10^{-16})$
(d) $Ca(OH)_2 (K_{sp} = 2.1 \times 10^{-5})$.

58. Which of the following is not a disproportionation reaction?
(a) $P_4 + 5OH^- \longrightarrow H_2PO_2^- + PH_3$
(b) $Cl_2 + OH^- \longrightarrow Cl^- + ClO$
(c) $2H_2O_2 \longrightarrow 2H_2O + O_2$
(d) $PbO_2 + H_2O \longrightarrow PbO + H_2O_2$

59. The amount of H_2O_2 present in 1 litre of 1.5 N H_2O_2 solution, is :
(a) 25.5 g (b) 3.0 g (c) 8.0 g (d) 2.5 g

60. BeF_2 is soluble in water whereas fluorides of other alkaline earth metals are insoluble because of
(a) ionic nature of BeF_2.
(b) covalent nature of BeF_2.
(c) greater hydration energy of Be^{2+} ion as compared to its lattice energy.
(d) none of these.

61. Identify the incorrect statement :
(a) In $(Si_3O_9)^{6-}$, tetrahedral SiO_4 units share two oxygen atoms.
(b) Trialkylchlorosilane on hydrolysis gives R_3SiOH.
(c) $SiCl_4$ undergoes hydrolysis to give H_4SiO_4.
(d) $(Si_3O_9)^{6-}$ has cyclic structure.

62. The alcohol product(s) of the reduction of 2-methyl-3-pentanone with $LiAlH_4$ is (are)

$$\xrightarrow[\text{(ii) } H_2O]{\text{(i) } LiAlH_4 \text{ diethyl ether}}$$
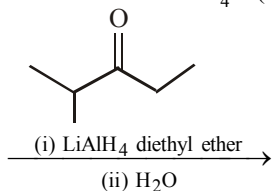
(a) a single enantiomer
(b) racemic mixture
(c) two diastereoisomers
(d) two structural isomers

63.

$+ Br^{\bullet} \longrightarrow$

Br$^{\bullet}$ will abstract which of the hydrogen most readily?
(a) a (b) b (c) c (d) d

64. The vapour pressure of two pure liquids A and B that form an ideal solution, are 400 and 800 mm of Hg respectively at a temperature $t°C$. The mole fraction of A in a solution of A and B whose boiling point is $t°C$ will be

(a) 0.4 (b) 0.8 (c) 0.1 (d) 0.2

65. On reaction with sodium, 1 mol of a compound X gives 1 mol of H_2. Which one of the following compounds might be X?
(a) $CH_3CH_2CH=CH_2$
(b) $CH_3COOCH_2CH_3$
(c) $CH_3CH_2CH_2OH$
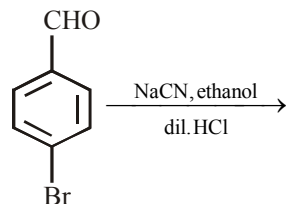(d) $CH_2(OH)CH_2CH_2CH_2OH$

66. The following change can be carried out with
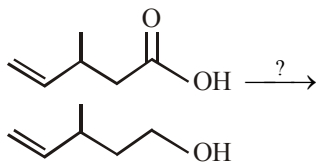
(a) $NaBH_4$ (b) $LiAlH_4$
(c) H_2/Pt (d) PCC/CH_2Cl_2

67. The greenhouse effect is because of the
(a) presence of gases, which in general are strong infrared absorbers, in the atmosphere
(b) presence of CO_2 only in the atmosphere
(c) pressure of O_3 and CH_4 in the atmosphere
(d) N_2O and chlorofluorohydrocarbons in the atmosphere

68. Methylene blue, from its aqueous solution, is adsorbed on activated charcoal at 25°C. For this process, which of the following statement is correct?
(a) The adsorption requires activation at 25°C
(b) The adsorption is accompanied by a decrease in enthalpy
(c) The adsorption increases with increase of temperature
(d) The adsorption is irreversible

69. The final product obtained in the reaction

$$\xrightarrow{\text{Mg / ether}} A \xrightarrow{\text{Heavy water}}$$
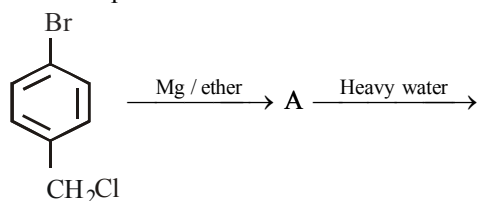
70. What is the product of the following reaction ?


$$\xrightarrow[\text{dil. HCl}]{\text{NaCN, ethanol}}$$

71. The d-electron configurations of Cr^{2+}, Mn^{2+}, Fe^{2+} and Co^{2+} are d^4, d^5, d^6 and d^7 respectively. Which one of the following will exhibit the lowest paramagnetic behaviour?
(Atomic no. Cr = 24, Mn = 25, Fe = 26, Co = 27).
(a) $[Co(H_2O)_6]^{2+}$
(b) $[Cr(H_2O)_6]^{2+}$
(c) $[Mn(H_2O)_6]^{2+}$
(d) $[Fe(H_2O)_6]^{2+}$

72. An organic compound with the formula $C_6H_{12}O_6$ forms a yellow crystalline solid with phenylhydrazine and gives a mixture of sorbitol and mannitol when reduced with sodium. Which among the following could be the compound?
(a) fructose
(b) glucose
(c) mannose
(d) sucrose

73.
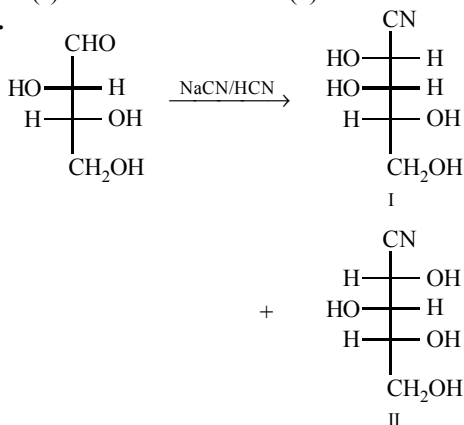
Compounds I and II may be grouped as
(a) diastereomers
(b) epimers
(c) C–2 epimers
(d) all of the three.

74. Which is not the correct statement?
(At. nos. Ce = 58, Lu = 71, La = 57, Yb = 70)
(a) Colour of Yb^{3+} ion is pink.
(b) La^{3+} is diamagnetic.
(c) Ce^{4+} has f^0 configuration.
(d) Lu^{3+} had f^{14} configuration.

75. Which of the following reactions will not give N, N- dimethyl benzamide ?


76. $n(CF_2 = CF_2) \xrightarrow[\text{(NH}_4)_2 S_2O_8]{\text{Benzoyl peroxide or}} X$
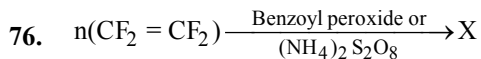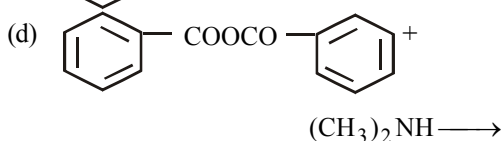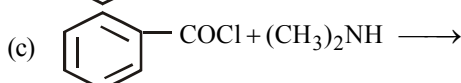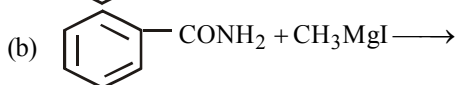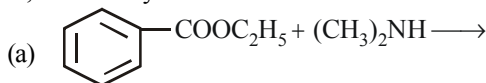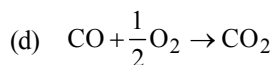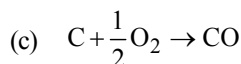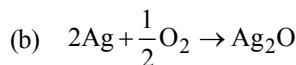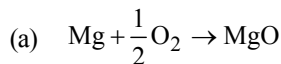
Here, X is :
(a) RMMA
(b) PVC
(c) PAN
(d) None of these

77. Select the incorrect statement.
(a) Equanil is used to control depression and hypertension.
(b) Mifepristone is a synthetic steroid used as "morning after pill".
(c) 0.2 per cent solution of phenol is an antiseptic while its 1.0 per cent solution is a disinfectant.
(d) A drug which kills the organism in the body is called bacteriostatic.

78.
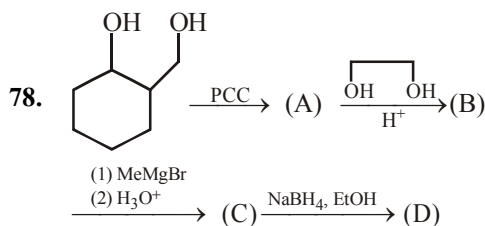
Product (D) in above reaction is:
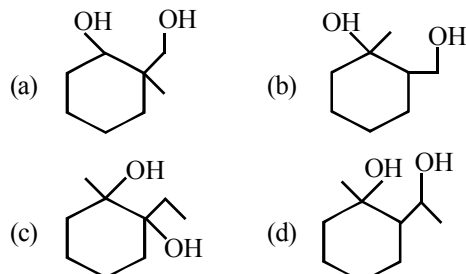
79. $\Delta_f G^-$ vs T plot in the Ellingham diagram slopes downward for the reaction
(a) $Mg + \dfrac{1}{2}O_2 \rightarrow MgO$

(b) $2Ag + \dfrac{1}{2}O_2 \rightarrow Ag_2O$

(c) $C + \dfrac{1}{2}O_2 \rightarrow CO$

(d) $CO + \dfrac{1}{2}O_2 \rightarrow CO_2$

80. A radioactive isotope having a half - life period of 3 days was received after 12 days. If 3g of the isotope is left in the container, what would be the initial mass of the isotope?
(a) 12g
(b) 36g
(c) 48g
(d) 24g