

**SOLUTIONS & ANSWERS FOR KERALA ENGINEERING
ENTRANCE EXAMINATION-2009
VERSION – A1**

[PHYSICS & CHEMISTRY]

1. Ans: 5%

Sol: $T = 2\pi\sqrt{\frac{\ell}{g}} \Rightarrow g = 4\pi^2 \frac{\ell}{T^2}$
 $\frac{\Delta g}{g} \times 100 = 1\% + 2(2\%) = 5\%$

2. Ans: $MT^{-3}K^{-4}$

Sol: $E = \sigma T^4 \cdot t$
 $\sigma = \frac{E}{T^4 \cdot t} = \frac{MT^{-2}}{K^4 T}$
 $= MT^{-3}K^{-4}$

3. Ans: 1 : 3 : 5

4. Ans: $\frac{40}{3}$ cm

Sol: $\frac{v^2}{4} - v^2 = 2aS_1 \Rightarrow -\frac{3}{4}v^2 = 2aS_1$
 $0 - v^2 = 2aS_2$
 $\frac{3}{4} = \frac{S_1}{S_2} \Rightarrow S_2 = \frac{4}{3}S_1$
 $S_2 - S_1 = \frac{4}{3}S_1 - S_1 = \frac{1}{3}S_1 = \frac{40}{3}$ cm

5. Ans: u

6. Ans: 5 cm above the target

Sol: $t = \frac{200}{2000} = 0.1$ s
 $S = \frac{1}{2}gt^2 = 5 \times (0.1)^2 = 0.05$ m = 5 cm

7. Ans: Q

Sol: $(2Q)^2 = P^2 + R_1^2$ (From right angled triangle)
 $4Q^2 = P^2 + R_1^2 \rightarrow R_1^2 = 4Q^2 - P^2$ ----- (i)
 $R_1^2 = P^2 + (2Q)^2 + 4PQ\cos\theta$ ----- (ii)

8. Ans: 5 ms^{-2}

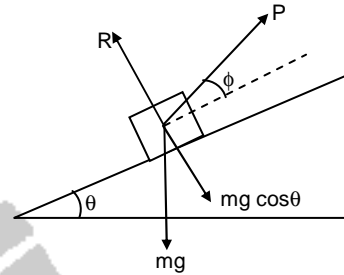
Sol: $a_r = \frac{v^2}{R} = \frac{400}{100} = 4 \text{ ms}^{-2}$
 $a_T = 3$
 $a = \sqrt{4^2 + 3^2} = 5 \text{ ms}^{-2}$

9. Ans: $-(3\hat{i} + 4\hat{j}) \times 10^4$

Sol: $P_z = -(3\hat{i} + 4\hat{j})$
 $F = \frac{\Delta P}{t} = \frac{-(3\hat{i} + 4\hat{j})}{10^{-4}} = -(3\hat{i} + 4\hat{j})10^4$ N

10. Ans: 17.32 N

Sol: For minimum force $m = \tan\theta = \tan\phi$
 $= \tan 60 = \sqrt{3}$



$$P = \frac{mg \cos \theta + mg \sin \theta}{m \sin \phi + \cos \phi}$$

$$= \frac{\sqrt{3} \times 1 \times 10 \times \frac{1}{2} + 1 \times 10 \times \frac{3}{2}}{\sqrt{3} \times \frac{\sqrt{3}}{2} + \frac{1}{2}}$$

$$= \frac{10\sqrt{3}}{2} = 5\sqrt{3} = 8.66 \text{ N}$$

No correct answer among options. If the force is applied parallel to the I.P the minimum force required
 $= mg \sin\theta + mg \cos\theta$
 $= mg(\sin\theta + \mu\cos\theta) = 17.32$ N

11. Ans: $\frac{7}{8}F$

Sol: $T = \left(m + \frac{m}{6}\right)a = \frac{7m}{6} \cdot \frac{3F}{4m} = \frac{7}{8}F$

12. Ans: 45 J

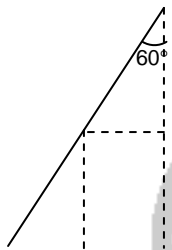
Sol: $W = \Delta KE = 20$ J (Area of F – S graph)
 $KE_2 = KE_1 + \Delta KE = 25 + 25 = 45$ J

13. Ans: $\frac{E}{2}$

Sol: $U = \frac{1}{2} kx^2 = \frac{1}{2} \frac{F^2}{k}$
 $\frac{E_P}{E_Q} = \frac{k_Q}{k_P} = \frac{1}{2} \Rightarrow$
 $E_P = \frac{E_Q}{2} = \frac{E}{2}$

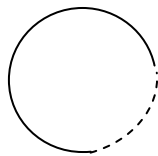
14. Ans: $\frac{mg\ell}{4}$

Sol: $PE = mgh = mg \cdot \frac{\ell}{2} \cos 60$
 $= mg \cdot \frac{\ell}{2} \cdot \frac{1}{2} = \frac{mg\ell}{4}$



15. Ans: $\frac{3}{4}$

Sol:



$MR^2 - \frac{1}{4}MR^2 = \frac{3}{4}MR^2$
 $= k MR^2$
 $k = \frac{3}{4}$

16. Ans: (2, 2)

Sol: $\frac{m_1x_1 + m_2x_2 + m_3x_3}{m_1 + m_2 + m_3}$
 $= \frac{6m}{3m} = 2$ etc.

17. Ans: 5 s

Sol: $I = I\alpha$
 $\alpha = \frac{10}{2.5} = 4$
 $t = \frac{\omega - \omega_0}{\alpha} = \frac{60 - 40}{4} = 5$ s

18. Ans: 0.8 m

Sol: $\frac{h_e}{h_p} = \frac{g_p}{g_e} = \frac{\rho_p R_p}{\rho_e R_e}$
 $h_p = h_e \cdot \frac{\rho_e R_e}{\rho_p R_p} = 1.5 \times \frac{4}{5} \times \frac{2}{3}$
 $= \frac{12}{15} = \frac{4}{5} = 0.8$ m

19. Ans: $\frac{2}{3} mgR$

Sol: $U = \frac{mgh}{1 + \frac{h}{R}} = \frac{mg \cdot 2R}{1 + \frac{2R}{R}}$
 $= \frac{2mgR}{3}$

20. Ans: 10 km

Sol: $2h = d \Rightarrow d = 10$ km

21. Ans: $\frac{v}{2}$

Sol: $mg = 6\pi\eta rv = 6\pi\eta 2rv'$
 $v' = \frac{v}{2}$

22. Ans: 1 : 64

Sol: $\frac{2T}{r_1} = 4 \times \frac{2T}{r_2} \Rightarrow r_2 = 4 r_1$
 Mass ratio = $M_1 : M_2 = r_1^3 : r_2^3 = 1 : 64$

23. Ans: Angle of contact increases

Note: The radius of meniscus changes and not the angle of contact.

24. Ans: 10^6

Sol: $\frac{1}{2} Y(\text{strain})^2 = \frac{1}{2} \times 2 \times 10^{10} (10^{-2})^2$
 $= 10^6$ J/m³

25. Ans: $\frac{PV}{(\gamma-1)}$

Sol: $\Delta U = nC_V \Delta T = n\Delta T \left(\frac{\gamma}{\gamma-1} \right) \dots (1)$
 $PV = nRT_1 \quad P \cdot 2V = nRT_2$
 $\Rightarrow PV = nR(T_2 - T_1) \Rightarrow n\Delta T = \frac{PV}{R}$
 Sub. In (1)
 $\Delta U = \frac{PV}{\gamma-1}$

26. Ans: $16.8 \times 10^6 \text{ J}$

Sol: $T_1 = 927^\circ\text{C}$
 $T_2 = 27^\circ\text{C}$
 $\frac{Q_2}{Q_1} = \frac{T_2}{T_1} = \frac{300}{1200} = \frac{1}{4}$
 $Q_2 = 4 Q_1$
 $Q_2 - Q_1 = 3 Q_1 = 12.6 \times 10^6$
 $Q_1 = 4.2 \times 10^6 \text{ J}$
 $Q_2 = 4 Q_1 = 16.8 \times 10^6 \text{ J}$

27. Ans: Greater in (i) than in (ii)

Sol: $Q = \Delta U + \text{work done}$
 ΔU is same for all three processes
 W is positive for IAF, zero for IBF and negative for ICF

28. Ans: 10°C

Sol: $55 - T \propto mC \frac{10}{10}$
 $46 - T \propto mC \frac{8}{10}$
 Solving $T = 10^\circ\text{C}$

29. Ans: 1.79 Hz

Sol: $\frac{T}{4} = 0.14 \text{ s}$
 $f = \frac{1}{T} = \frac{1}{4 \times 0.14} = 1.79 \text{ Hz}$

30. Ans: 0.314 s

Sol: $T = 2\pi \sqrt{\frac{m}{K}} = 2\pi \sqrt{\frac{40}{16000}}$
 $= \frac{2\pi}{20} = \frac{\pi}{10} = \frac{3.14}{10} = 0.314 \text{ s}$

31. Ans: 7

Sol: $y_1 = 4 \sin\left(4\pi t + \frac{\pi}{2}\right) = 4 \cos 4\pi t$
 $y = y_1 + y_2 = 4 \cos 4\pi t + 3 \cos 4\pi t$
 $= 7 \cos 4\pi t$
 Amplitude = 7

32. Ans: 5 : 4

Sol: $\frac{v'}{v} = \frac{v - v_\ell}{v - v_s} = \frac{5}{4}$

33. Ans: $c = \frac{1}{\pi a}$

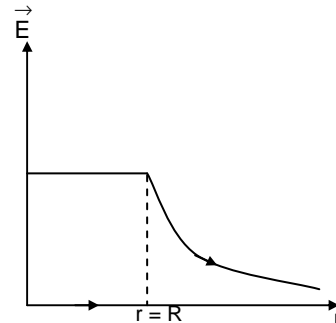
Sol: $a\omega = 2\left(\frac{\omega}{k}\right) \Rightarrow Ak = 2$
 $a \cdot 2\pi c = 2$

$$c = \frac{1}{\pi a}$$

34. Ans: $y = -A \sin(kx + \omega t)$

Sol: Phase reversal takes place on reflection

35. Ans:



36. Ans: $\frac{b}{a}$

Sol: $\frac{Q_a}{4\pi\epsilon_0 a^2} = \frac{Q_b}{4\pi\epsilon_0 r^2 B}$
 $\rho_a = \frac{Q_a}{4\pi\epsilon_0 a^2} = \frac{V_a}{r_a}$
 $\rho_b = \frac{V_b}{r_b}$
 $\frac{\rho_a}{\rho_b} = \frac{r_b}{r_a} = \frac{b}{a}$

37. Ans: The field is non zero but potential is zero

38. Ans: qEy

Sol: $W = F \cdot S = qE \cdot y$

39. Ans: U and Q

Sol: U and Q increase

40. Ans: 20

Sol: $P \times 5 = \frac{P}{4} \times t \Rightarrow t = 20 \text{ s}$

41. Ans: 27 : 32

Sol: $R = \frac{\rho \ell}{a} = \frac{\rho \ell^2}{a \ell} = \frac{\rho \ell^2}{V} = \frac{\rho \ell^2}{m} \cdot d \propto \frac{\ell^2}{m}$
 $\frac{R_1}{R_2} = \frac{9}{16} \div \frac{2}{3} = \frac{27}{32}$ or 27 : 32

42. Ans: $\frac{t_2}{t_1}$

Sol: $R_t = R_0 (1 + \alpha t)$
 $1 + \alpha_1 t_1 = 1 + \alpha_2 t_2$
 $\frac{\alpha_1}{\alpha_2} = \frac{t_2}{t_1}$

43. Ans: 11 A and $3 \mu\text{C}$

Sol: Current = $\frac{6}{1} + \frac{6}{2} + \frac{6}{3} = 11 \text{ A}$
 $Q = CV = 0.5 \times 6 = 3 \mu\text{C}$

44. Ans: 1.2 V

Sol: $I = \frac{15}{60} = 0.25 \text{ A}$
 Potential gradient = $\frac{20 \times 0.25}{10}$
 $= 0.5 \text{ V/m}$
 PD across 240 cm = $0.5 \times 2.4 = 1.2 \text{ V}$

45. Ans: Zero

Sol: $\left| \vec{B}_1 \right| = \left| \vec{B}_2 \right|$

46. Ans: 950Ω and 9000Ω

Sol: $R_s = \frac{V}{I_g} - R_g$
 $R_1 = \frac{1}{10^{-3}} - 50 = 950 \Omega$
 $R_2' = \frac{10}{10^{-3}} - 50 = 9950 \Omega$
 $R_2 = 9950 - 950 = 9000 \Omega$

47. Ans: $\frac{3}{2}$

Sol: $\frac{\mu_0}{4\pi} \times \frac{2}{d} [i_1 - i_2] = 6 \times 10^{-6}$
 $\frac{\mu_0}{4\pi} \times \frac{2}{d} [i_1 + i_2] = 3 \times 10^{-5}$
 $\frac{i_1 - i_2}{i_1 + i_2} = 0.2 = \frac{2}{10}$
 $\frac{i_1}{i_2} = \frac{3}{2}$

48. Ans: 0.05 T

Sol: $M = NIA$
 $\tau = MB \sin\theta$
 $\tau_1 = MB \sin\phi$
 $\tau_2 = MB \cos\phi$
 $\frac{\tau_1}{\tau_2} = \tan\phi$

$\frac{3}{4} = \tan\phi$ gives $\phi = 37^\circ$

$\sin\phi = 0.6$
 Sub. $\tau_1 = MB \sin\phi$ gives
 $B = \frac{\tau_1}{M \sin\phi} = \frac{0.3}{100 \times 2 \times 10^{-2} \times 5 \times 0.6}$
 $= 0.05 \text{ T}$

49. Ans: 10^{-4} T

Sol: $B_v = B \sin\theta$
 $B = \frac{B_v}{\sin\theta} = \frac{6 \times 10^{-5}}{0.6} = 10^{-4} \text{ T}$

50. Ans: Between 1 and 2

Sol: $Z_1 = \sqrt{R^2 + \frac{1}{4\pi^2 f^2 C^2}}$
 $Z_2 = \sqrt{R^2 + \frac{1}{16\pi^2 f^2 C^2}}$
 $\frac{Z_1^2}{Z_2^2} = \frac{R^2 + \frac{1}{4\pi^2 f^2 C^2}}{R^2 + \frac{1}{16\pi^2 f^2 C^2}}$
 $= \frac{1 + \frac{1}{4\pi^2 f^2 R^2 C^2}}{1 + \frac{1}{16\pi^2 f^2 R^2 C^2}} = \frac{1 + \frac{X}{4}}{1 + \frac{X}{16}} > 1 \Rightarrow \frac{Z_1}{Z_2} > 1$
 $\frac{Z_1}{Z_2} = \text{lies between 1 and 2}$

51. Ans: $\frac{10}{\sqrt{2}} \text{ V}$

Sol: Circuit is resonant. Hence supply voltage equals $V_R = 10 \text{ volt}$
 Also $X_C = R$ as the voltage drops are equal across them. When L is shorted

$Z = \sqrt{R^2 + X_C^2} = \sqrt{2} R$
 $\therefore V_C = i X_C = \frac{V}{Z} \cdot X_C = \frac{10}{\sqrt{2}} \cdot R$
 $= \frac{10}{\sqrt{2}} \text{ volt}$

52. Ans: 100Ω

Sol: $P_0 = 0.9 \times 4000 = 3600 \text{ W} = 6 \times V_0 \cos\phi$
 $P = I^2 Z \Rightarrow Z = \frac{P}{I^2} = \frac{3600}{36} = 100 \Omega$

Note: Power factor not given. So calculation now taking power factor 1 is applicable for resistive load only.

53. Ans: 200 V

Sol: $E_0 = NBA\omega$ $\ell = 2\pi rN$
 $100 = 100 B \times \pi \times 1^2 \cdot \omega$
 $\pi\omega B = 1$
 II case $2\pi \times 1 \times 100 = 2\pi \times 2 \times N_2 \Rightarrow$
 $N_2 = 50$
 $E_2 = \omega_B N_2 A_2 = 1 \times 50 \times \pi \times 2^2 = 200 \text{ volt}$

$$\frac{1}{f_3} = \left(\frac{4}{3} - 1\right) \times \left(\frac{1}{20} + \frac{1}{25}\right) \Rightarrow f_3 = \frac{100}{3} \text{ cm}$$

$$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2} + \frac{1}{f_3} = \frac{-1}{50} - \frac{1}{40} + \frac{3}{100}$$

$$\therefore F = \frac{-200}{3} = -66.6 \text{ cm}$$

54. Ans: 100

Sol: Intensity = $\frac{1}{2} \epsilon_0 E_0^2 \cdot C$
 Power = Intensity \times Area
 $= \frac{1}{2} \epsilon_0 E_0^2 \cdot C \cdot 4\pi r^2$
 Given, $E_0 = 100 \text{ Vm}^{-1}$

61. Ans: 4λ

Sol: $\frac{hc}{\lambda} - \frac{hc}{\lambda_0} = 3 \text{ eV} \quad \text{--- (1)}$

$\frac{hc}{2\lambda} - \frac{hc}{\lambda_0} = 1 \text{ eV} \quad \text{--- (2)}$

$$\frac{1}{\lambda} - \frac{1}{\lambda_0} = 3$$

$$\frac{2(\lambda_0 - \lambda)}{\lambda_0 - 2\lambda} = 3$$

$$2\lambda_0 - 2\lambda = 3\lambda_0 - 6\lambda$$

$$\lambda_0 = 4\lambda$$

55. Ans: 6

Sol: $n = \sqrt{\mu_r \epsilon_r}$
 $\epsilon_r = \frac{n^2}{\mu_r} = \frac{n^2 \mu_0}{\mu}$
 $= \frac{(1.5)^2 \times 4\pi \times 10^{-7}}{5 \times 10^{-7}} = 6$

62. Ans: $2 \times 10^9 \text{ K}$

Sol: $\frac{3}{2} kT = \text{energy}$

$$\frac{3}{2} \times 1.38 \times 10^{-23} \cdot T = 4.14 \times 10^{-14}$$

$$T = 2 \times 10^9 \text{ K}$$

56. Ans: 9 cm^2

Sol: $m = \frac{f}{f-n} = \frac{-15}{-15+20} = -3$
 $m^2 = 9$
 Total area = area of the object \times areal magnification
 $= 9 \text{ cm}^2$

63. Ans: $\frac{A_0}{9}$

Sol: $\frac{A_0}{3}$ in 9 years

$$\frac{1}{3} \left(\frac{A_0}{3}\right) = \frac{A_0}{9} \text{ in next 9 years}$$

57. Ans: 2.5°

Sol: $(\mu_P - 1) A_P + (\mu_Q - 1) A_Q = 0$
 Solving $A_Q = 2.5^\circ$

58. Ans: 0.012 radian

Sol: $d \sin \theta = n\lambda$
 $\sin \theta = \frac{2 \times 6000 \times 10^{-10}}{1 \times 10^{-4}}$
 $= 0.012 \text{ rad}$

64. Ans: $F_1 = F_3 > F_2$

$$\begin{vmatrix} A & B & Y \\ 0 & 0 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{vmatrix}$$

65. Ans:

Sol: The logic circuit is an XOR gate.

59. Ans: 0.27°

Sol: $\theta_{\text{air}} = \theta_{\text{medium}} \times \text{refractive I ndex}$
 $= 0.2^\circ \times \frac{4}{3} = 0.27^\circ$

66. Ans: 0.0075 V and $5 \mu\text{A}$

60. Ans: Concave of focal length 66.6 cm

Sol: $\frac{1}{f_1} = 0.5 \times \frac{1}{-25} \Rightarrow f_1 = -50 \text{ cm}$
 $\frac{1}{f_2} = 0.5 \times \frac{1}{-20} \Rightarrow f_2 = -40 \text{ cm}$

Sol: $\frac{V_0}{V_{gt}} = \beta^2 \frac{R_0}{R_I} \Rightarrow (200)^2 \cdot \left(\frac{2 \times 10^3}{1.5 \times 10^3}\right) = \frac{2}{V_I}$

$$V_I = 0.0075 \text{ V}$$

$$I_b = \frac{I_C}{\beta} = 5 \mu\text{A}$$

67. Ans: Full wave rectified

68. Ans: 5 mA

$$\text{Sol: } I = \frac{5 \text{ V}}{1 \times 10^3} = 5 \text{ mA}$$

69. Ans: $2 \times 10^{12} \text{ m}^{-3}$

$$\begin{aligned} \text{Sol: } v &= 9\sqrt{N_{\text{max}}} \\ \text{i.e., } 9\sqrt{2} \times 10^6 &= 9\sqrt{N_{\text{max}}} \\ \therefore N_{\text{max}} &= 2 \times 10^{12} \text{ m}^{-3} \end{aligned}$$

70. Ans: Radio waves in the frequency range 30 MHz to 60 MHz are called sky waves

71. Ans: 10 kHz

$$\begin{aligned} \text{Sol: } \frac{1}{f_c} &\ll RC \\ f_c &\gg \frac{1}{RC} = \frac{1}{10^3 \cdot 10^{-6}} = 10^3 \text{ Hz} \\ \therefore f_c &\gg 1 \text{ kHz} \\ \therefore \text{Ans} &= 10 \text{ kHz} \end{aligned}$$

72. Ans: 1 million

$$\begin{aligned} \text{Sol: } v &= \frac{c}{\lambda} = \frac{3 \times 10^8}{1200 \times 10^{-9}} \\ &= 25 \times 10^{13} \text{ Hz} \\ \text{Frequency} &= \frac{2}{100} \times 25 \times 10^{13} \\ &= 5 \times 10^{12} \text{ Hz} \\ \therefore \text{No. of channels} &= \frac{5 \times 10^{12}}{5 \times 10^6} \\ &= 1 \text{ million} \end{aligned}$$

73. Ans: $V < I < III < II < IV$

Sol: Electrons with higher $(n + l)$ and higher 'n' values have higher energies.

74. Ans: 2×10^{20}

$$\begin{aligned} \text{Sol: } E &= nh\nu = nh \frac{c}{\lambda} \\ &= \frac{n \times 6.63 \times 10^{-34} \text{ (Js)} \times 3 \times 10^8 \text{ (ms}^{-1}\text{)}}{663 \times 10^{-9} \text{ m}} \\ n &= 2 \times 10^{20} \end{aligned}$$

75. Ans: CN^- & NO^+

Sol: Isoelectronic species have same bond order.

76. Ans: ion-dipole interaction

Sol: Hydration of ions in aqueous solution is due to ion dipole interactions.

77. Ans: The gas behaves non ideally

Sol: At constant temperature, pressure becomes 4 times and volume becomes $\frac{1}{3.7}$ times.

78. Ans: 72 Torr

$$\begin{aligned} \text{Sol: Total vapour pressure} &= P_A^0 \cdot X_A + P_B^0 \cdot X_B \\ &= 80 \times \frac{3}{5} + 60 \times \frac{2}{5} \\ &= 72 \text{ Torr} \end{aligned}$$

79. Ans: Copper and conc. nitric acid

Sol: Copper with conc. HNO_3 produces NO_2 gas.

80. Ans: Groups 7, 8 and 9

Sol: Hydride gap refers to group 7, 8, 9

81. Ans: Ca and CaH_2

Sol: Both Ca & CaH_2 produce H_2 gas with water

82. Ans: Siderophiles

Sol: Elements present in the core of earth are collectively known as siderophiles.

83. Ans: Square planar and sp^3d^2

Sol: XeF_4 has sp^3d^2 hybridisation with two lone pair electrons, hence the geometry is square planar.

84. Ans: NaBr

Sol: Br^- is oxidised by H_2SO_4 to Br_2 .

85. Ans: 4 and 3

Sol: It is Mn^{3+} having four unpaired electrons in the 3d level.

86. Ans: CO_3^{2-}

Sol: No oxidation for CO_3^{2-}

87. Ans: 9×10^9 years

Sol: 4 moles \rightarrow 2 moles \rightarrow 1 mole
2 half lives = $2 \times 4.5 \times 10^9$
= 9×10^9 years

88. Ans: 208 MeV

Sol: Mass defect
= $(143.881 + 89.947 + 1.009) - 235.06$
= 0.223 amu
Energy released = 0.223×931
= 208 MeV

89. Ans: -370

Sol: Molar mass of $C_4H_{10}O = 74 \text{ g mol}^{-1}$
Heat required to raise the temperature of 200 g of water by $5^\circ\text{C} = m \times s \times \Delta t$
= $200 \text{ g} \times 1(\text{cal g}^{-1}) \times 5 = 1\text{kcal}$
0.2 g of 1-butanol liberates 1 kcal of heat

\therefore Enthalpy of combustion = $1 \times \frac{74}{0.2}$
= $370 \text{ kcal mol}^{-1}$
 $\Delta H = -370 \text{ kcal mol}^{-1}$

90. Ans: $dH = TdS + VdP$

Sol: $H = E + PV$
 $dH = dE + PdV + VdP$
= $TdS - PdV + PdV + VdP$
= $TdS + VdP$

91. Ans: 11.3

Sol: $\text{HCl} = 0.01 \text{ N}$ and $\text{NaOH} = 0.01 \text{ N}$
Milliequivalence of NaOH left
= $300 \times 0.01 - 200 \times 0.01$
= 1
 $[\text{OH}^-] = \frac{1}{500} \text{ g ions/L}$
= $2 \times 10^{-3} \text{ g ions/L}$
 $\text{pOH} = 3 - 0.3 = 2.7$
 $\text{pH} = 11.3$

92. Ans: 0.01 M

Sol: $[\text{H}^+] = \sqrt{K_a \cdot C}$
Given,
 $K_{a1} \cdot C_1 = K_{a2} \cdot C_2$
 $1.8 \times 10^{-5} \times C_1 = 1.8 \times 10^{-4} \times 10^{-3}$
 $C_1 = 10^{-2}$

93. Ans: III < IV < I < II

Sol: $\pi \propto i \cdot n$
For KCl, $\pi \propto 2 \times \frac{1}{74.5}$ (I)
NaCl, $\pi \propto 2 \times \frac{1}{58.5}$ (II)
 BaCl_2 , $\pi \propto 3 \times \frac{1}{208.4}$ (III)

Urea, $\pi \propto 1 \times \frac{1}{60}$ (IV)

Values follow the order, III < IV < I < II

94. Ans: 72 g

Sol: $(100 + \Delta T_b) - (0 - \Delta T_f) = 105$

$\Delta T_b + \Delta T_f = 5$

$m(k_b + k_f) = 5$

$m = \frac{5}{2.37}$

i.e., $\frac{5}{2.37}$ moles in 1000 g water

(or) $\frac{5}{2.37 \times 10}$ moles in 100 g water

\therefore Wt. of sucrose = $\frac{5}{2.37 \times 10} \times 342$
= 72 g

95. Ans: 3

Sol: $5M^{x+} + 2MnO_4^- \rightarrow MO_3^- + Mn^{2+}$

O.N x +7 +5 +2

n = 2 n = 5

Increase in O.N is by 2

$\therefore x$ is 3

96. Ans: 5

Sol: $4Zn + NO_3^- + 10H^+ \rightarrow 4Zn^{2+} + NH_4^+ + 3H_2O$

5 moles of HCl are required to reduce half a mole of NaNO_3 .

97. Ans: $\frac{k_1^1}{k_1} > \frac{k_2^1}{k_2}$

Sol: $k = Ae^{-E_a/RT}$

$\frac{k_1^1}{k_1} = e^{\frac{E_{a1}}{R}} \cdot e^{\frac{T_2 - T_1}{T_1 T_2}}$

$\frac{k_2^1}{k_2} = e^{\frac{E_{a2}}{R}} \cdot e^{\frac{T_2 - T_1}{T_1 T_2}}$

Since $E_{a1} > E_{a2}$

$\frac{k_1^1}{k_1} > \frac{k_2^1}{k_2}$

98. Ans: Second order, half life = 2 days

Sol: $100 \xrightarrow{2 \text{ days}} 50$

$50 \xrightarrow{4 \text{ days}} 25$

$25 \xrightarrow{8 \text{ days}} 12.5$

$t_{1/2} \propto \frac{1}{a}$

i.e., $1 - n = -1$
 $n = 2$
 Order is 2 and half lives are 2, 4 and 8 days.

99. Ans: Al^{3+}
Sol: As_2S_3 is a negatively charged sol, which is most effectively coagulated by a positively charged ion with highest charge.

100. Ans: Urea
Sol: Impurities in the form of electrolytes can only be removed by electrodialysis.

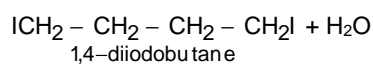
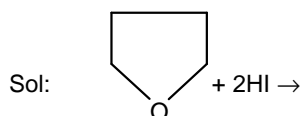
101. Ans: a - 6, b - 4, c - 1, d - 2, e - 3
Sol: $[NiCl_4]^{2-}$ is sp^3 & paramagnetic
 $[Ni(CN)_4]^{2-}$ is square planar and diamagnetic. Chlorophyll contains Mg^{2+}
 Ziegler - Natta catalyst contains Ti^{4+} .
 Deoxyhaemoglobin is nonplanar & oxyhaemoglobin planar.

102. Ans: 2.5×10^{13}
Sol: Stability constant is the same as formation constant of the complex
 $\beta_4 = \frac{[ML_4]^{2-}}{[M(H_2O)_4]^{2+} (L^-)^4}$ which is the equilibrium constant for the formation of $[ML_4]^{2-}$ from the ions.

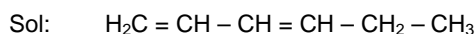
103. Ans: 56
Sol: Milli equivalence of $H_2SO_4 = 10 \times 1 = 10$
 Milli equivalence of $NH_3 = 10$
 \therefore Wt. of nitrogen = $\frac{10 \times 14}{1000}$ g
 $\% N = \frac{10 \times 14 \times 100}{1000 \times 0.25} = 56$

104. Ans: $NH_2 - NH_2.HCl$
Sol: The compound must contain carbon as well as nitrogen for the formation of $NaCN$ in Lassaigne's extract.

105. Ans: 1, 4-diiodobutane



106. Ans: 3, 5



Hexa-1, 3-diene (conjugated diene)
 $CH_2 = C = CH_2$
 Propa-1, 2-diene (cumulative diene)

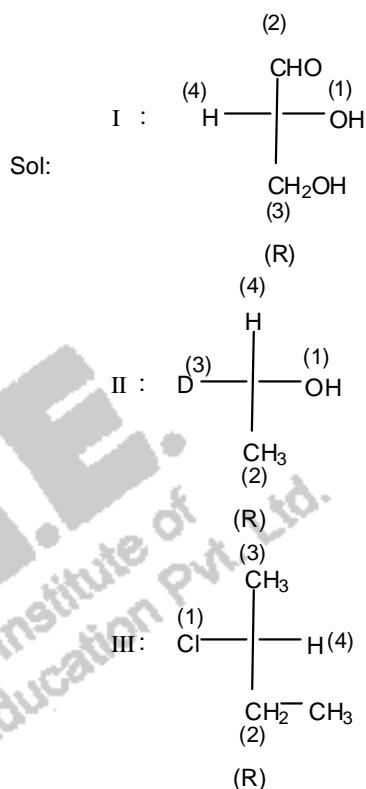
107. Ans: $CH_3C \equiv C - CH_2^+$

Sol: $CH_3 - C \equiv C - CH_2^+$
 $sp^3 \quad sp \quad sp^2$

108. Ans: t-butyl bromide

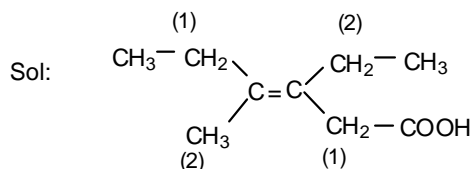
Sol: Tertiary alkyl halides undergo S_N1 reaction most readily.

109. Ans: I, II and III

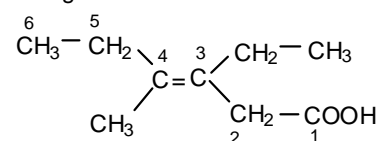


IV & V have s-configuration.

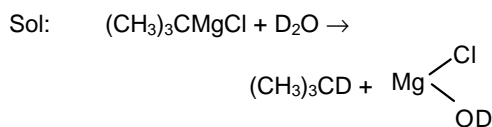
110. Ans: E - 3-ethyl -4 methyl hex-3-en-1-oic acid



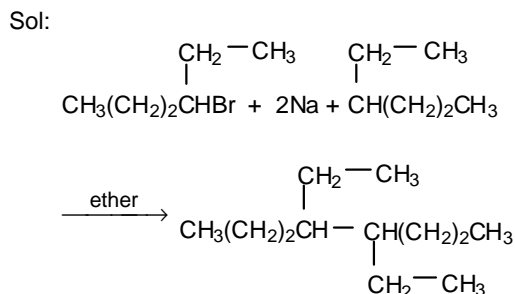
Since groups of highest priority are oriented in the opposite direction, the configuration is E.



111. Ans: $(\text{CH}_3)_3\text{CD}$



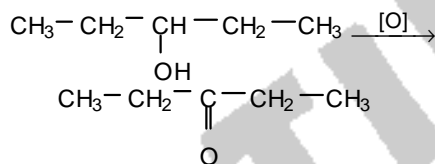
112. Ans: $\text{CH}_3(\text{CH}_2)_2\text{CH}(\text{Br})\text{CH}_2\text{CH}_3$



113. Ans: $\text{CH}_3-\text{CH}_2-\underset{\text{OH}}{\text{CH}}-\text{CH}_2-\text{CH}_3$

Sol: Since compound B gave a derivative with 2, 4-dinitrophenyl hydrazine, it is a carbonyl compound. Since it does not answer silver mirror test, it is a ketone. The ketone does not contain a

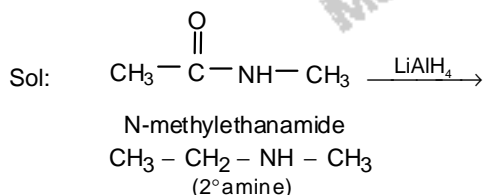
$\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{group}$ because it does not answer haloform test. Hence compound A must be a secondary alcohol.



114. Ans: $\text{B}_2\text{H}_6/\text{H}_3\text{O}^+$

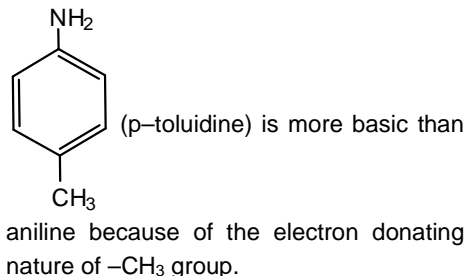
Sol: Reduction of RCOOH to RCH_2OH is carried out with diborane or LiAlH_4 .

115. Ans: N-methyl ethanamide



116. Ans: $\text{II} > \text{III} > \text{I}$

Sol: $\text{C}_6\text{H}_5-\text{CH}_2-\text{NH}_2$ (Benzylamine) is most basic among the given amines because the lone pair on nitrogen is not involved in resonance.



117. Ans: Valium

Sol: Valium is a tranquilizer.

118. Ans: 1 - d, 2 - e, 3 - a, 4 - c, 5 - b

Sol: Vitamin A - Xerophthalmia
Vitamin B₁₂ - Pernicious anaemia
Vitamin C - Scurvy
Vitamin E - Sterility
Vitamin K - Haemorrhage

119. Ans: Nitroglycerine and nitrocellulose

Sol: Double base propellant consists of a mixture of nitroglycerine and nitrocellulose.

120. Ans: Antiseptic

Sol: Bithional is an antiseptic which is added to good quality soaps.