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: $E = \sigma T^4.t$

$\sigma = \frac{E}{T^4.t} = \frac{MT^{-2}}{K^4 T}$

$= MT^{-3}K^{-4}$

3. Ans: 1 : 3 : 5

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

Sol: $\frac{v^2}{4} - v^2 = 2a\,S_1 \Rightarrow -\frac{3}{4}v^2 = 2aS_1$

$0 - v^2 = 2a\,S_2$

$\frac{3}{4} = \frac{S_1}{S_2} \Rightarrow S_2 = \frac{4}{3}S_1$

$S_2 - S_1 = \frac{4}{3}S_1 - S_1 = \frac{1}{3}S_1 = \frac{40}{3}$ cm

5. Ans: u

6. Ans: 5 cm above the target

Sol: $t = \frac{200}{2000} = 0.1s$

$S = \frac{1}{2}gt^2 = 5 \times (0.1)^2 = 0.05$ m = 5 cm

7. Ans: Q

Sol: $(2Q)^2 = P^2 + R_1^2$ (From right angled triangle)

$4Q^2 = P^2 + R_1^2 \to R_1^2 = 4Q^2 - P^2$ ----- (i)

$R_1^2 = P^2 + (2Q)^2 + 4\,PQ\cos\theta$ ----- (ii)

8. Ans: 5 ms^{-2}

Sol: $a_r = \frac{v^2}{R} = \frac{400}{100} = 4\ ms^{-2}$

$a_T = 3$

$a = \sqrt{4^2 + 3^2} = 5\ ms^{-2}$

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

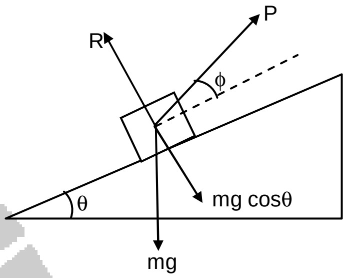
Sol: $P_z = -\left(3\hat{i} + 4\hat{j}\right)$

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

10. Ans: 17.32 N

Sol: For minimum force m = tanθ = tanϕ

$= \tan 60 = \sqrt{3}$



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

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

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

No correct answer among options. If the force is applied parallel to the I.P the minimum force required

= mg sinθ + mgcosθ

= mg(sinθ + μcosθ) = 17.32 N

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

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

12. Ans: 45 J

Sol: W = ΔKE = 20 J (Area of F – S graph)

$KE_2 = KE_1 + \Delta KE = 25 + 25 = 45$ J

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

Sol: $U = \frac{1}{2}kx^2 = \frac{1}{2}\frac{F^2}{k}$

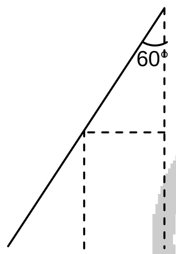
$\frac{E_P}{E_Q} = \frac{k_Q}{k_P} = \frac{1}{2} \Rightarrow$

$E_P = \frac{E_Q}{2} = \frac{E}{2}$

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

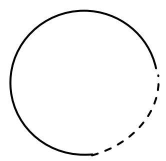
Sol: $PE = mgh = mg.\frac{\ell}{2}\cos 60$

$= mg\frac{\ell}{2}.\frac{1}{2} = \frac{mg\ell}{4}$



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: $\frac{m_1x_1 + m_2x_2 + m_3x_3}{m_1 + m_2 + m_3}$

$= \frac{6\,m}{3\,m} = 2$ 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: $\frac{h_e}{h_p} = \frac{g_p}{g_e} = \frac{\rho_p R_p}{\rho_e R_e}$

$h_p = h_e.\frac{\rho_e R_e}{\rho_p.R_p} = 1.5 \times \frac{4}{5} \times \frac{2}{3}$

$= \frac{12}{15} = \frac{4}{5} = 0.8$ m

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

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

$= \frac{2mgR}{3}$

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/m^3

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

Sol: $\Delta U = nC_V\Delta T = n\Delta T\left(\frac{R}{\gamma - 1}\right)$ --- (1)

$PV = nRT_1$ $P.2\ V = nRT_2$

$\Rightarrow PV = nR(T_2 - T_1) \Rightarrow n\Delta T = \frac{PV}{R}$

Sub. In (1)

$\Delta U = \frac{PV}{\gamma - 1}$

26. Ans: 16.8×10^6 J

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

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

Sol: Q = ΔU + 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°C

29. Ans: 1.79 Hz

Sol: $\frac{T}{4} = 0.14\ s$

$f = \frac{1}{T} = \frac{1}{4 \times 0.14} = 1.79$ Hz

30. Ans: 0.314 s

Sol: $T = 2\pi\sqrt{\frac{m}{K}} = 2\pi\sqrt{\frac{40}{16000}}$

$= \frac{2\pi}{20} = \frac{\pi}{10} = \frac{3.14}{10} = 0.314$ 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: $\frac{\upsilon'}{\upsilon} = \frac{v - v_\ell}{v - v_s} = \frac{5}{4}$

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

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

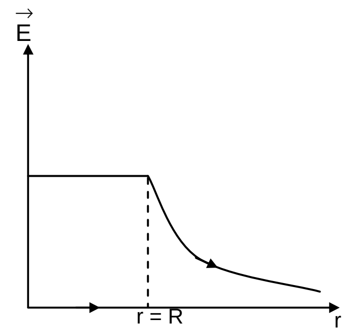
$a.2\pi c = 2$

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

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

Sol: Phase reversal takes place on reflection

35. Ans:



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

Sol: $\frac{Q_a}{4\pi\varepsilon_0 ra^2} = \frac{Q_b}{4\pi\varepsilon_0 r^2 B}$

$\rho_a = \frac{Q_a}{4\pi\varepsilon_0 ra^2} = \frac{V_a}{r_a}$

$\rho_b = \frac{V_b}{r_b}$

$\frac{\rho_a}{\rho_b} = \frac{r_b}{r_a} = \frac{b}{a}$

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

38. Ans: qEy

Sol: W = F.S = qE.y

39. Ans: U and Q

Sol: U and Q increase

40. Ans: 20

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

41. Ans: 27 : 32

Sol: $R = \frac{\rho\ell}{a} = \frac{\rho\ell^2}{a\ell} = \frac{\rho\ell^2}{V} = \frac{\rho\ell^2}{m}.d \propto \frac{\ell^2}{m}$

$\frac{R_1}{R_2} = \frac{9}{16} \div \frac{2}{3} = \frac{27}{32}$ 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 μC

Sol: Current = $\frac{6}{1} + \frac{6}{2} + \frac{6}{3}$ = 11 A

$Q = CV = 0.5 \times 6 = 3\ \mu C$

44. Ans: 1.2 V

Sol: $I = \frac{15}{60} = 0.25$ A

Potential gradient = $\frac{20 \times 0.25}{10}$

= 0.5 V/m

PD across 240 cm = $0.5 \times 2.4 = 1.2$ V

45. Ans: Zero

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

46. Ans: 950 Ω and 9000 Ω

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 $\phi = 37°$

$\sin\phi = 0.6$

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 T

49. Ans: 10^{-4} T

Sol: $B_v = B \sin\theta$

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

50. Ans: Between 1 and 2

Sol: $Z_1 = \sqrt{R^2 + \frac{1}{4\pi^2 f^2 c^2}}$

$Z_2 = \sqrt{R^2 + \frac{1}{16\pi^2 f^2 c^2}}$

$\frac{Z_1^2}{Z_2^2} = \frac{R^2 + \frac{1}{4\pi^2 f^2 c^2}}{R^2 + \frac{1}{16\pi^2 f^2 c^2}}$

$= \frac{1 + \frac{1}{4\pi^2 f^2 R^2 c^2}}{1 + \frac{1}{16\pi^2 f^2 R^2 c^2}} = \frac{1 + X}{1 + \frac{X}{4}} > 1 \Rightarrow \frac{Z_1}{Z_2} > 1$

$\frac{Z_1}{Z_2}$ = lies between 1 and 2

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

Sol: Circuit is resonant. Hence supply voltage equals V_R = 10 volt

Also $X_C = R$ as the voltage drops are equal across them. When L is shortened

$Z = \sqrt{R^2 + X_C^2} = \sqrt{2}R$

$\therefore V_C = i X_C = \frac{V}{Z}.X_C = \frac{10}{\sqrt{2}R}.R$

$= \frac{10}{\sqrt{2}}$ volt

52. Ans: 100 Ω

Sol: $P_0 = 0.9 \times 4000 = 3600\ W = 6 \times V_0 \cos\phi$

$P = I^2 Z \Rightarrow Z = \frac{P}{I^2} = \frac{3600}{36} = 100\ \Omega$

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

53. Ans: 200 V

Sol: $E_0 = NBA\omega \quad \ell = 2\pi rN$

$100 = 100\, B \times \pi \times 1^2.\omega$

$\pi\omega B = 1$

II case $2\pi \times 1 \times 100 = 2\pi \times 2 \times N_2 \Rightarrow$

$N_2 = 50$

$E_2 = \omega_B B N_2 A_2 = 1 \times 50 \times \pi \times 2^2 = 200$ volt

54. Ans: 100

Sol: Intensity = $\frac{1}{2}\varepsilon_0 E_0^2.C$

Power = Intensity × Area

$= \frac{1}{2}\varepsilon_0 E_0^2.C.4\pi r^2$

Given, $E_0 = 100\ Vm^{-1}$

55. Ans: 6

Sol: $n = \sqrt{\mu_r \varepsilon_r}$

$\varepsilon_r = \frac{n^2}{\mu_r} = \frac{n^2 \mu_0}{\mu}$

$= \frac{(1.5)^2 \times 4\pi \times 10^{-7}}{5 \times 10^{-7}} = 6$

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 × areal magnification

$= 9\ cm^2$

57. Ans: 2.5°

Sol: $(\mu_P - 1)\, A_P + (\mu_Q - 1)\, A_Q = 0$

Solving $A_Q = 2.5°$

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 rad

59. Ans: 0.27°

Sol: $\theta_{air} = \theta_{medium} \times$ refractive I ndex

$= 0.2° \times \frac{4}{3} = 0.27°$

60. Ans: Concave of focal length 66.6 cm

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

$\frac{1}{f_2} = 0.5 \times \frac{1}{-20} \Rightarrow f_2 = -40$ cm

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

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

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

61. Ans: 4λ

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

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

$\frac{\frac{1}{\lambda} - \frac{1}{\lambda_0}}{\frac{1}{2\lambda} - \frac{1}{\lambda_0}} = 3$

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

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

$\lambda_0 = 4\lambda$

62. Ans: 2×10^9 K

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

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

$T = 2 \times 10^9$ K

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

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

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

64. Ans: $F_1 = F_3 > F_2$

65. Ans:

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	0

Sol: The logic circuit is an XOR gate.

66. Ans: 0.0075 V and 5 μA

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

$V_I = 0.0075$ V

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

67. Ans: Full wave rectififed

68. Ans: 5 mA

Sol: $I = \frac{5\,V}{1\times10^3} = 5$ mA

69. Ans: 2×10^{12} m^{-3}

Sol: $\upsilon = 9\sqrt{N_{max}}$

i.e., $9\sqrt{2}\times10^6 = 9\sqrt{N_{max}}$

$\therefore N_{max} = 2 \times 10^{12}$ m^{-3}

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

71. Ans: 10 kHz

Sol: $\frac{1}{f_C} << RC$

$f_C >> \frac{1}{RC} = \frac{1}{10^3.10^{-6}} = 10^3$ Hz

$\therefore f_C >> 1$ kHz

$\therefore$ Ans = 10 kHz

72. Ans: 1 million

Sol: $\upsilon = \frac{c}{\lambda} = \frac{3\times10^8}{1200\times10^{-9}}$

$= 25 \times 10^{13}$ Hz

Frequency = $\frac{2}{100}\times25\times10^{13}$

$= 5 \times 10^{12}$ Hz

$\therefore$ No. of channels = $\frac{5\times10^{12}}{5\times10^6}$

= 1 million

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

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

74. Ans: 2×10^{20}

Sol: $E = nh\nu = nh\frac{c}{\lambda}$

60(J s^{-1})

$= \frac{n \times 6.63 \times10^{-34}\ (Js) \times 3 \times 10^8\ (ms^{-1})}{663 \times 10^{-9} m}$

$n = 2 \times 10^{20}$

75. Ans: $C\bar{N}$ & 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

Sol: Total vapour pressure

$= P_A^0.X_A + P_B^0.X_B$

$= 80 \times \frac{3}{5} + 60 \times \frac{2}{5}$

= 72 Torr

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: $B\bar{r}$ 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 g mol^{-1}
Heat required to raise the temperature of 200 g of water by 5°C = m × s × Δt
= 200 g × 1(cal g^{-1}) × 5 = 1kcal
0.2 g of 1–butanol liberates 1 kcal of heat

$\therefore$ Enthalpy of combustion = $1 \times \frac{74}{0.2}$
= 370 kcal mol^{-1}
ΔH = –370 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: HCl = 0.01 N and NaOH = 0.01 N
Milliequivalence of NaOH left
= 300 × 0.01 – 200 × 0.01
= 1

$[OH^-] = \frac{1}{500}$ g ions/L
= 2×10^{-3} g ions/L
pOH = 3 – 0.3 = 2.7
pH = 11.3

92. Ans: 0.01 M

Sol: $[H^+] = \sqrt{Ka.C}$
Given,
$Ka_1 . C_1 = Ka_2 . C_2$
$1.8 \times 10^{-5} \times C_1 = 1.8 \times 10^{-4} \times 10^{-3}$
$C_1 = 10^{-2}$

93. Ans: III < IV < I < II

Sol: $\pi \, \alpha$ i.n

For KCl, $\pi \, \alpha \, 2 \times \frac{1}{74.5}$ (I)

NaCl, $\pi \, \alpha \, 2 \times \frac{1}{58.5}$ (II)

$BaCl_2$, $\pi \, \alpha \, 3 \times \frac{1}{208.4}$ (III)

Urea, $\pi \, \alpha \, 1 \times \frac{1}{60}$ (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: $k = Ae^{-E_a/RT}$

$\frac{k_1^1}{k_1} = e^{\frac{E_{a_1}}{R}} . e^{\frac{T_2 - T_1}{T_1T_2}}$

$\frac{k_2^1}{k_2} = e^{\frac{E_{a_2}}{R}} . e^{\frac{T_2 - T_1}{T_1T_2}}$

Since $E_{a_1} > E_{a_2}$

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

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

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

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

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

$t_{1/2} \, \alpha \, \frac{1}{a}$

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

$\beta_4 = \dfrac{[ML_4]^{2-}}{[M(H_2O)_4]^{2+}(L^-)^4}$ 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 $NH_3 = 10$

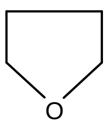
$\therefore$ Wt. of nitrogen $= \dfrac{10 \times 14}{1000}$ g

$\% N = \dfrac{10 \times 14 \times 100}{1000 \times 0.25} = 56$

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

Sol: 

+ 2HI →

$ICH_2 – CH_2 – CH_2 – CH_2I + H_2O$
1,4–diiodobutane

106. Ans: 3, 5

Sol: $H_2C = CH – CH = CH – CH_2 – CH_3$
Hexa–1, 3–diene (conjugated diene)
$CH_2 = C = CH_2$
Propa–1, 2–diene (cumulative diene)

107. Ans: $CH_3C \equiv C – CH_2^+$

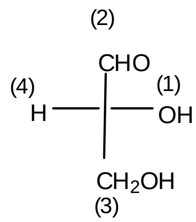
Sol: $CH_3 – C \equiv C – CH_2^+$
sp^3 sp sp^2

108. Ans: t–butyl bromide

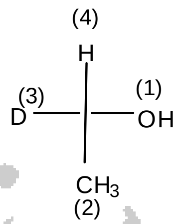
Sol: Tertiary alkyl halides undergo S_N1 reaction most readily.

109. Ans: I, II and III

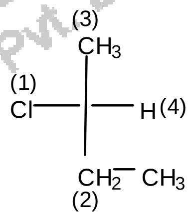
Sol:

I : 

(R)

II : 

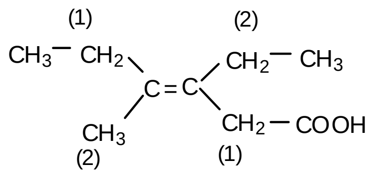
(R)

III : 

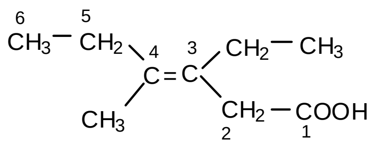
(R)

IV & V have s–configuration.

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

Sol: 

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



111. Ans: $(CH_3)_3CD$

Sol: $(CH_3)_3CMgCl + D_2O \rightarrow (CH_3)_3CD + Mg(Cl)(OD)$

112. Ans: $CH_3(CH_2)_2CH(Br)CH_2CH_3$

Sol:

$$CH_3(CH_2)_2CH(CH_2CH_3)Br + 2Na + BrCH(CH_2CH_3)(CH_2)_2CH_3 \xrightarrow{ether} CH_3(CH_2)_2CH(CH_2CH_3)-CH(CH_2CH_3)(CH_2)_2CH_3$$

113. Ans: $CH_3-CH_2-CH(OH)-CH_2-CH_3$

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 $CH_3-C(=O)-$ group because it does not answer haloform test. Hence compound A must be a secondary alcohol.

$$CH_3-CH_2-CH(OH)-CH_2-CH_3 \xrightarrow{[O]} CH_3-CH_2-C(=O)-CH_2-CH_3$$

114. Ans: B_2H_6/H_3O^+

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

115. Ans: N–methyl ethanamide

Sol:

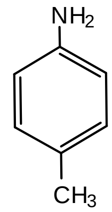
$$CH_3-C(=O)-NH-CH_3 \xrightarrow{LiAlH_4} CH_3-CH_2-NH-CH_3$$

N-methylethanamide

(2°amine)

116. Ans: II > III > I

Sol: $C_6H_5-CH_2-NH_2$ (Benzylamine) is most basic among the given amines because the lone pair on nitrogen is not involved in resonance.



(p–toluidine) is more basic than aniline because of the electron donating nature of $-CH_3$ group.

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 B_{12} – Percicious 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.