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

[CHEMISTRY & PHYSICS]

1. Ans: 5 : 2

Sol: $\frac{\lambda_A}{\lambda_B} = \frac{m_B . v_B}{m_A . v_A} = \frac{5 \times 0.05}{0.1} = 5 : 2$

2. Ans: Paschen series

Sol: $\bar{\upsilon} = R_H \left[\frac{1}{n_1^2} - \frac{1}{n_2^2} \right]$

$12186.3 = 109687 \times \frac{1}{n_1^2}$

$n_1 = 3$

3. Ans: 6

Sol: Total no. of digits = 6

4. Ans: N_2

Sol: Bond order of $B_2 = 1$, $F_2 = 1$
$C_2 = 2$, $O_2 = 2$, $N_2 = 3$

5. Ans: Trigonal planar

Sol: BF_3 is sp^2 hybridised

6. Ans: sp^3, sp^2, sp, sp^2, sp^3

Sol: Total number of sigma bonds around the carbons are in the order – 4, 3, 2, 3, 4

7. Ans: $\frac{\text{Average kinetic Energy}}{H_2 = N_2}$

$\frac{\text{Average molecular speed}}{H_2 > N_2}$

Sol: Kinetic energy remains constant at constant temperature and molecular speed varies inversely with the molecular mass.

8. Ans: 2

Sol: Effective no. of atoms per unit cell of bcc = $\frac{1}{8} \times 8 + 1 = 2$

9. Ans: methane

Sol: Solid methane is a molecular solid.
CaF_2, NaCl – Ionic solids
SiC, SiO_2 – Covalent solids

10. Ans: Be

Sol: Be does not react with water even at red hot condition.

11. Ans: Halogens

Sol: Element 117 belongs to group 17 of the periodic table.

12. Ans: The ortho isomer has zero nuclear spin where as para isomer has one nuclear spin.

Sol: The resultant spin of ortho hydrogen is one whereas that of para hydrogen is zero.

13. Ans: K

Sol: Potassium forms the super oxide KO_2 with oxygen.

14. Ans: Argentite

Sol: Argentite is concentrated by leaching with NaCN

15. Ans: Hg

Sol: Mercury is obtained by roasting Cinnabar. It undergoes self reduction.

16. Ans: Si can extend its co–ordination number beyond four.

Sol: Since Si can co–ordinate water molecules with the help of available d–orbitals, $SiCl_4$ is easily hydrolysed.

17. Ans: 60

Sol: Buckminster fullerene consists of 60 carbon atoms per molecule.

18. Ans: Beryl

Sol: Beryl is $Be_3\ Al_2Si_6O_{18}$

19. Ans: Silver metal

Sol: When heated to 980 K $AgNO_3$ forms metallic silver as solid residue.

20. Ans: +7

Sol: Maximum oxidation state exhibited by Mn in its compounds is +7.

21. Ans: 5

Sol: Misch metal is an alloy of 95% lanthanoid elements & 5% iron.

22. Ans: 0.9375 g

Sol: Process is β – emission

$$^{198}_{79}Au \xrightarrow[-\beta]{} {}^{198}_{80}Hg$$

$$1g \xrightarrow{4t_{1/2}} \frac{1}{16}g(Au)$$

Amount of Hg = $\frac{15}{16}$ g

23. Ans: 1 to 100 kg

Sol: Critical mass of U – 235 is in the range of 1 kg to 100 kg

24. Ans: $\frac{143}{91}$

Sol: $^{238}_{92}U \rightarrow {}^{4}_{2}He + {}^{234}_{90}Th \rightarrow {}^{0}_{-1}e + {}^{234}_{91}Pa$

25. Ans: ΔH is positive and ΔS is negative

Sol: $\Delta G = \Delta H - T\Delta S$
When ΔH is positive and ΔS is negative, ΔG becomes positive.

26. Ans: 213

Sol: P – P bond energy = $1485 - \frac{953}{3} \times 4$

$= 213 \text{ kJ mol}^{-1}$

27. Ans: A process that leads to increase in free energy will be spontaneous.

Sol: A process will be spontaneous when it is accompanied by a decrease in free energy.

28. Ans: lime water

Sol: Lime water is strongly alkaline

29. Ans: Temperature change

Sol: Equilibrium constant varies with temperature.

30. Ans: 10^{-4} M Ag^+ and 10^{-2} M CrO_4^{2-}

Sol: Precipitation occurs when I.P > K_{sp}

I.P of $Ag_2CrO_4 = [Ag^+]^2 [CrO_4^{2-}]$

$$= \frac{10^{-8}}{4} \times \frac{10^{-2}}{2}$$

$= 1.25 \times 10^{-11}$

31. Ans: 300 mm of Hg

Sol: $P_A^0 \times \frac{1}{3} + P_B^0 \times \frac{2}{3} = 500$

$P_A^0 \times \frac{1}{4} + P_B^0 \times \frac{3}{4} = 525$

On solving P_A^0 = 300 mm of Hg

32. Ans: Molality and mole fraction

Sol: Weight dependant concentration terms are temperature independent.

33. Ans: 2.24 mg

Sol: $M = k_H . P$

W_B in 100 mL = $\frac{1.4 \times 10^{-3} \times 0.5 \times 32}{10}$

34. Ans: decreases by 30 mV

Sol: $E_{el_1} - E_{el_2} = \frac{.06}{2} \log 10 = 0.03$ V

35. Ans: Li

Sol: Strongest reducing agent is the one with the lowest reduction potential.

36. Ans: 7

Sol: $NO_3^- \rightarrow N_2H_4$

O.N +5 –2

37. Ans: $\frac{2}{3}\log 2$

Sol: $t = \frac{2.303}{k} \log \frac{N_0}{N_t}$

$= \frac{2.303}{6.909} \log \frac{100}{25} = \frac{2}{3}\log 2$

38. Ans: Zero

Sol: 1 – n = 1
n = 0

39. Ans: 3

Sol: Given, $t_{1/2} \propto \frac{1}{a^2}$

1 – n = –2
n = 3

40. Ans: O_2

Sol: Easily liquifiable gases such as NH_3, HCl, CO_2 & SO_2 are adsorbed to greater extent than the permanent gases such as O_2.

41. Ans: Bismuth molybdate

Sol: Propylene, NH_3 & O_2 combine to form Acrylo nitrile in presence of Bismuth molybdate.

42. Ans: Emulsion

Sol: Hair cream is a liquid in liquid colloid.

43. Ans: $\frac{-4}{9}\Delta_0$

Sol: CFSE for tetrahedral complexes Δ_t & that for octahedral complexes Δ_0 are related as $\Delta_t = \frac{-4}{9}\Delta_0$

44. Ans: 0

Sol: The oxidation state of nickel in $Ni(CO)_4$ is zero.

45. Ans: $[Co(NH_3)_3Cl_3]$

Sol: Fac–Mer isomerism is exhibited by complexes of the type Ma_3b_3.

46. Ans: $C_3H_6O_3$ and HCHO

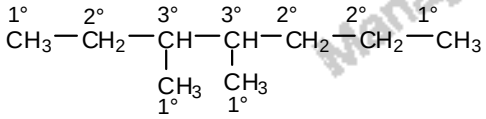
Sol: Relative no. of atoms of C, H, O
$= \frac{6}{12} : \frac{1}{1} : \frac{8}{16} = 1 : 2 : 1$
$\therefore$ E.F is CH_2O

47. Ans: N_2

Sol: In Duma's method, nitrogen of the organic compound is liberated as N_2.

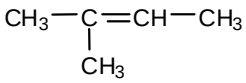
48. Ans: 4, 3 and 2

Sol:



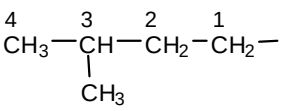
49. Ans: 2-Methyl-2-butene

Sol:



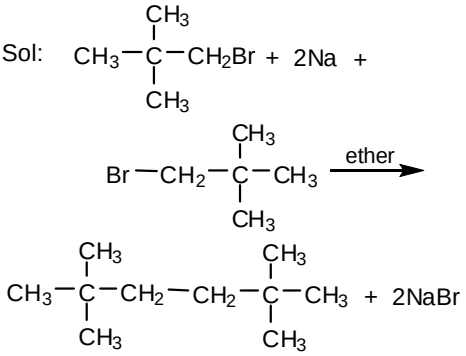
50. Ans: $(CH_3)_2CHCH_2CH_2–$

Sol:



51. Ans: 2, 2, 5, 5–tetramethylhexane

Sol:



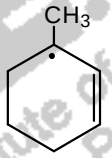
52. Ans: 3 and 4 only

Sol: $–NH_3^+$ and $–CCl_3$ groups are electron withdrawing and they decrease the electron density at ortho and para positions of the benzene ring. Hence preferential electrophilic attack occurs at meta position.

53. Ans: NO_2^+

Sol: NO_2^+ is an electrophile

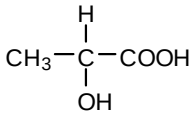
54. Ans:



Sol: (A) is a tertiary allyl free radical.

55. Ans: 2–hydroxypropanoic acid

Sol:



It contains only one chiral carbon atom.

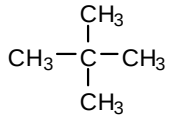
56. Ans: Cyclohexane

Sol: Cyclohexane mainly exists in chair conformation which is free of angular strain.

57. Ans: 3

Sol: n–pentane, isopentane and neopentane are the chain isomers of C_5H_{12}.

58. Ans: neopentane

Sol: 

Since all hydrogen atoms are equivalent, it gives only one monochloro derivative.

59. Ans: ethyne

Sol: $CaC_2 + 2H_2O \rightarrow Ca(OH)_2 + C_2H_2$

60. Ans: 2–Methylprop-1-ene

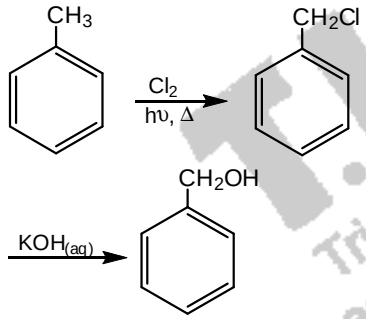
Sol: tert-butyl chloride undergoes mainly elimination when treated with sodium ethoxide (base).

61. Ans: 1–propanol

Sol: $CH_3 - CH_2 - CH_2OH$
(1–propanol)

Compounds containing $CH_3-C(=O)-$ or $CH_3 - CHOH -$ groups will only answer iodoform test.

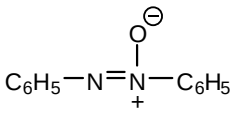
62. Ans: benzyl alcohol

Sol: 

63. Ans: PBr_3, KCN, H_3O^+

Sol: $R - CH_2 - CH_2OH \xrightarrow{PBr_3}$
$R - CH_2 - CH_2Br \xrightarrow{KCN}$
$R - CH_2 - CH_2 - CN \xrightarrow{H_3O^+}$
$R - CH_2 - CH_2 - COOH$

64. Ans: As_2O_3 / NaOH

Sol: $2C_6H_5 - NO_2 \xrightarrow{As_2O_3 / OH^-}$


65. Ans: phenol

Sol: $C_6H_5N_2Cl + H - OH \xrightarrow{\Delta}$
$C_6H_5OH + N_2 + HCl$

66. Ans: benzylamine

Sol: $C_6H_5 - CN \xrightarrow{LiAlH_4} C_6H_5CH_2NH_2$
$C_6H_5 - CO - NH_2 \xrightarrow{LiAlH_4} C_6H_5CH_2NH_2$

67. Ans: 1,3-butadiene

Sol: 1,3-butadiene can undergo polymerization at C_1 and C_2 to give polyvinyl polythene.

68. Ans: insulin

Sol: Insulin is a peptide hormone.

69. Ans: PHBV

Sol: PHBV is a biodegradable polymer used in orthopaedic devices and in controlled drug release.

70. Ans: CO_2

Sol: CO_2 is a green house gas.

71. Ans: mordant dye

Sol: Depending upon the metal ion used, a mordant dye can give different colours to the fabric.

72. Ans: Oxides of nitrogen

Sol: Photochemical smog is due to NO_x.

73. Ans: Surface tension : Newton metre^{-2}

Sol: Surface tension = force / unit length
= N/m

74. Ans: Displacement

75. Ans: 250 m

Sol: $a = 5\ m/s^2$

$S = ut + \frac{1}{2}at^2 = 0 + \frac{1}{2} \times 5 \times (10)^2$

= 250 m

76. Ans: $T_f = 2\ t_m$

77. Ans: $\frac{v^2}{r}$ towards the centre

78. Ans: Linear momentum

79. Ans: Momentum

80. Ans: Energy

81. Ans: Kinetic energy

82. Ans: L is maximum when p is perpendicular to r

Sol: $\vec{L} = \vec{r} \times \vec{p}$

$\left|\vec{L}\right| = rp\sin\theta \Rightarrow L_{max}$ when θ - 90°

83. Ans: $2I_0$

Sol: Mass = $At\rho \Rightarrow \pi R^2 t\rho = \pi r^2 t\frac{\rho}{2}$

$\Rightarrow r = \sqrt{2}\,R$

$I = \frac{Mr^2}{2} = 2\,I_0$

84. Ans: $\sqrt{2gR}$

85. Ans: $\frac{GMm}{12R}$

Sol: $E = \frac{GMm}{4R} - \frac{GMm}{6R} = \frac{GMm}{12R}$

86. Ans: Stress required to produce unit strain

Sol: $Y = \frac{\text{stress}}{\text{strain}}$

87. Ans: Bernoulli's theorem

88. Ans: $\frac{2S}{r}$

89. Ans: Adiabatic

90. Ans: 185%

Sol: $E \propto T^4$

$E' \propto (1.3\,T)^4 = 2.85\,E$

$\therefore$ Increase = 1.85 E

91. Ans: Will overflow in both A and B

Sol: Anomalous expansion of water

92. Ans: Forced oscillations

93. Ans: Loses 864 s

Sol: $T = 2\pi\sqrt{\frac{\ell}{g}}$

$T \propto \sqrt{\ell}$

$\frac{\Delta T}{T} = \frac{1}{2}\frac{\Delta\ell}{\ell} = \frac{1}{2}\times\frac{2}{100}$

In one day; $\Delta T = \frac{1}{100}\times 86400$

= 864 s

94. Ans: $\frac{\lambda}{6}$

Sol: $\phi = \frac{2\pi}{\lambda}x$

$x = \frac{\lambda}{2\pi}.\phi = \frac{\lambda}{2\pi}.\frac{\pi}{3} = \frac{\lambda}{6}$

95. Ans: 16 kg

Sol: $f = \frac{1}{2\ell}\sqrt{\frac{Mg}{m}}$

$\Rightarrow \frac{M}{\ell^2}$ = constant

$\Rightarrow \frac{4}{\ell^2} = \frac{M}{(2\ell)^2}$

$\Rightarrow$ M = 16 kg

96. Ans: $\frac{q}{\varepsilon_0}$

Sol: $\frac{1}{8}\left(\frac{8q}{\varepsilon_0}\right) = \phi$

$\therefore \phi = \frac{q}{\varepsilon_0}$

97. Ans: 20 Vm^{-1}

Sol: $W = Fd\cos\theta = qEd\cos\theta$

$\Rightarrow 10 = 0.5.\,E \times 2\cos 60$

$E = \frac{10}{0.5\times 2\times\frac{1}{2}} = 20\ Vm^{-1}$

98. Ans: $\frac{1}{2}QV$

99. Ans: When the temperature of cold junction increases the temperature of inversion also increases.

Sol: When the temperature of cold junction increases the temperature of inversion decreases.

100. Ans: $\frac{48}{11}\Omega$

Sol: $\frac{3}{Q}=\frac{55}{45}$

$\Rightarrow Q=\frac{3\times 45}{55}=\frac{27}{11}\Omega$

$\frac{3+x}{\frac{27}{11}}=\frac{75}{25}$

$3+x=3\times\frac{27}{11}=\frac{81}{11}$

$x=\frac{81}{11}-3=\frac{48}{11}\Omega$

101. Ans: 14 W

Sol: $R_1=\frac{(220)^2}{100}=484\ \Omega$

$R_2=\frac{(220)^2}{60}=806\ \Omega$

$R=R_1+R_2=1290\ \Omega$

$I=\frac{V}{R}=\frac{220}{1290}=0.17\ A$

$\therefore P=(0.17)^2\times 484=14\ W$

102. Ans: 5999

Sol: $\mu_r=1+\chi$

$\Rightarrow \chi=\mu_r-1=5999$

103. Ans: A very small resistance in parallel

104. Ans: $q(v\times B)$

Sol: $\vec{F}=q\left(\vec{v}\times\vec{B}\right)$

In the given option vector notation is not given.

105. Ans: Current lags behind the voltage by $\frac{\pi}{2}$

106. Ans: Either purely inductive or purely capacitive

107. Ans: Having a laminated core

108. Ans: 3×10^{-12} T

Sol: $C=\frac{E}{B}$

$B=\frac{E}{C}=\frac{9\times10^{-4}}{3\times10^{8}}$

$=3\times10^{-12}$ T

109. Ans: $\frac{A}{5}$

Sol: $I\propto\frac{1}{\lambda^4}$

$\frac{I_1}{I_2}=\left(\frac{\lambda_2}{\lambda_1}\right)^4$

$I_2=A.\left(\frac{440}{660}\right)^4=\frac{16}{81}A\cong\frac{A}{5}$

110. Ans: Same deviation as before

111. Ans: 59° 58'

Sol: By vernier I
2A = 39° 21' + 80° 38'
= 119° 59'
By vernier II
2A = 260° 24' – 140° 30'
= 119° 54'
∴ Average 2A = 119° 56'
∴ A = 59° 58'

112. Ans: $\lambda_e>\lambda_P>\lambda_\alpha$

Sol: $\lambda\propto\frac{1}{\sqrt{qm}}$

$\lambda_e:\lambda_P:\lambda_\alpha$

$=\frac{1}{\sqrt{qm_e}}:\frac{1}{\sqrt{qm_P}}:\frac{1}{\sqrt{(2q)(4m_P)}}$

$=\frac{1}{\sqrt{qm_e}}:\frac{1}{\sqrt{qm_P}}:\frac{1}{\sqrt{8qm_P}}$

$\therefore \lambda_e>\lambda_P>\lambda_\alpha$

113. Ans: Becquerel

114. Ans: Safety rods - Carbon

115. Ans: 0.99 and 99

Sol: 1% electrons lost in the base
$\Rightarrow$ 99% reaches the collector
amplification factor = $\frac{I_C}{I_B}=99$

116. Ans: NOT

117. Ans: Zener diode

118. Ans: PWM

119. Ans: 36000 km

120. Ans: Both magnetic and electric fields