SOLUTIONS & ANSWERS FOR KERALA MEDICAL ENTRANCE EXAMINATION-2010 – PAPER I VERSION – A1

[CHEMISTRY & PHYSICS]

1. Ans: Hydrogen atom

Sol: He^+ and hydrogen atom are unielectronic species.

2. Ans: 54

Sol: 1.5 moles of oxygen is 3 gram atom. 3 gram atom of oxygen combines with 2 gram atom of aluminium ie. 54 g.

3. Ans: C_3H_8

Sol: Mass of 2.24 dm^3 at STP = 4.4 g
$\therefore$ Molecular mass = 44 g mol^{-1}
The gas is C_3H_8.

4. Ans: dsp^2 hybrid orbitals are equivalent with a bond angle of 90° between any two of them.

Sol: Angle between any two dsp^2 hybrid orbitals can be 90° or 180°.

5. Ans: Cl_2

Sol: Cl_2 is having only σ – bond.

6. Ans: sp^3d^2

Sol: BrF_5 is having 5 σ bonds and one lone pair around the central bromine atom.

7. Ans: The boiling point of a liquid is the same at all external pressures.

Sol: The boiling point of a liquid depends on the external pressure.

8. Ans: 61.575

Sol: Volume of the vessel = $\frac{94}{0.47}$ = 200 ml

$PV = \frac{W}{M}RT$

$M = \frac{0.5 \times 0.0821 \times 300}{1 \times 0.2}$ = 61.575

9. Ans: FeO

Sol: FeO is an example of metal deficiency defect. It has an average composition $Fe_{0.95}O$

10. Ans: Chlorine

Sol: Chlorine has the highest electron affinity among the given elements.

11. Ans: N

Sol: Nitrogen has 3 unpaired electrons.

12. Ans: Sodium aluminium silicate

Sol: Zeolite is hydrated sodium aluminium silicate.

13. Ans: Be

Sol: Berillium does not react with water.

14. Ans: Mg

Sol: All enzymes utilising ATP in phosphate transfer require Mg as cofactor.

15. Ans: KO_2

Sol: KO_2 contain O_2^- which is paramagnetic.

16. Ans: $[BH_2(NH_3)_2]^+ [BH_4]^-$

Sol: $3B_2H_6 + 6NH_3 \rightarrow 3[BH_2(NH_3)_2]^+ [BH_4]^-$

17. Ans: 1 – d; 2 – a; 3 – e; 4 – c; 5 – b

Sol: Borazole – $B_3N_3H_6$
Plaster of paris – $CaSO_4.\frac{1}{2}H_2O$
Boric acid – H_3BO_3
Quartz – SiO_2
Buckminister fullerene – C_{60}

18. Ans: Lewis acid

Sol: Boron in $B(OH)_3$ is electron deficient.

19. Ans: $NH_4^+ < N_2O < NO < NO_2 < NO_3^-$

Sol: Oxidation numbers of nitrogen in
NH_4^+ = –3 N_2O = +1
NO = +2 NO_2 = +4
NO_3^- = +5

20. Ans: II and IV

Sol: V_2O_3 & CrO are basic.
V_2O_5 & Cr_2O_3 are amphoteric.
Mn_2O_7 is acidic.

21. Ans: Fe^{3+}

Sol: Fe^{3+} has five unpaired electrons and hence maximum magnetic moment.
Sc^{3+} – no unpaired electrons
Ti^{3+} – one V^{3+} – two unpaired
Cr^{3+} – three

22. Ans: K_2MnO_4, dark green

Sol: Dark green coloured K_2MnO_4 is formed when MnO_2 is fused with KOH in presence of air.

23. Ans: Raking up leaves into a trash bag.

Sol: Entropy decreases as disorder decreases.

24. Ans: 60.0

Sol: At equilibrium, $\Delta H = T\Delta S$

$$\Delta S = \frac{\Delta H}{T} = \frac{21.3 \times 10^3}{355} = 60 \text{ J K}^{-1} \text{ mol}^{-1}$$

25. Ans: 1

Sol: $\alpha = \sqrt{\frac{K_a}{C}} = \sqrt{\frac{10^{-5}}{0.1}}$; % = 1

26. Ans: Low temperature and high pressure

Sol: $A_{(g)} + 3B_{(g)} \rightleftharpoons AB_{3(g)}$ + heat
Low temperature and high pressure favours the formation of AB_3.

27. Ans: 1.0×10^{-8}

Sol: For $PbCrO_4$, $K_{sp} = S^2$ (or) $S = \sqrt{K_{sp}}$

28. Ans: 2.5×10^{-3}

Sol: $m = K p$ (or) $m \alpha P$
Wt. dissolved at 250 atms
$= 2.5 \times 4 \times 10^{-3}$ Kg L^{-1}
$= \frac{2.5 \times 4 \times 10^{-3}}{4}$ Kg in 250 ml
$= 2.5 \times 10^{-3}$

29. Ans: 0.4 K

Sol: $\Delta Tf = Kf \times \frac{W_2}{M_2} \times \frac{1000}{W_1}$

$= 5.12 \times \frac{1}{250} \times \frac{1000}{51.2} = 0.4$ K

30. Ans: acetone and chloroform

Sol: Acetone + chloroform mixture shows negative deviation from Raoult's law.

31. Ans: +2.5

Sol: $+2 + 4x - 12 = 0$
$x = 2.5$

32. Ans: 0.20 mol

Sol: $1 \text{ F} \rightarrow \frac{1}{4}$ moles of Pt

$0.8 \text{ F} \rightarrow \frac{0.8}{4} = 0.2$ moles

33. Ans: Q > R > S > P

Sol: $E_{(electrode)} = E^0_{electrode} + \frac{.059}{n} \log [Cu^{2+}]$
Higher the $[Cu^{2+}]$, greater is the electrode potential.

34. Ans: 4 moles

Sol: $A + 2B \rightarrow C$
B is the limiting reactant. Hence the amount of product formed is 4 moles.

35. Ans: No answer.

36. Ans: 2 and 5

Sol: $k = Ae^{-E_a/RT}$ becomes $k = A$ when $E_a = 0$
$\ln k$ Vs $\frac{1}{T}$ graph is a straight line.

37. Ans: decrease in enthalpy and decrease in entropy

Sol: Both ΔH & ΔS are negative for adsorption.
(Or)

38. Ans: Kraft temperature

Sol: Formation of micelle takes place above Kraft temperature.

39. Ans: nitrocellulose

Sol: Colloidion is 4% solution of nitrocellulose in alcohol ether mixture.

40. Ans: $[Cr(NH_3)_6]Cl_3$

Sol: $[Cr(NH_3)_6]Cl_3$ will give a precipitate of AgCl with aqueous $AgNO_3$.

41. Ans: $[Cr(en)_3]^{3+}$

Sol: $[Cr(en)_3]^{3+}$ exhibits optical isomerism.

42. Ans: $[Co(C_2O_4)_3]^{3-}$

Sol: $[Co(C_2O_4)_3]^{3-}$ contain cobalt in +3 oxidation state. It is a diamagnetic, octahedral complex.

43. Ans: 2×10^{-4}

Sol: The average rate $= \frac{-(A_2 - A_1)}{t_2 - t_1}$

$= \frac{0.12\,M}{10 \times 60\,s} = 2 \times 10^{-4}\ Ms^{-1}$

44. Ans: I and IV

Sol: Leclanche cell and mercury cell are primary cells.

45. Ans: 6.0

Sol: No. of milligrams per kg is ppm.

46. Ans: CH_4

Sol: $C : H = \frac{75}{12} : \frac{25}{1} = 6.25 : 25 = 1 : 4$

$\therefore$ Empirical formula CH_4

47. Ans: Phenoxide

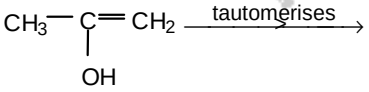
Sol: Phenoxide $(C_6H_5O^{\ominus})$ is more stabilised by resonance than other given ions.

48. Ans: vaccum distillation

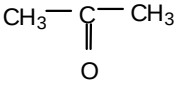
Sol: Since glycerol decomposes at its normal boiling point, it is purified by vaccum distillation or distillation under reduced pressure.

49. Ans: Propanone

Sol: $CH_3 - C \equiv CH + H_2O \xrightarrow[HgSO_4]{H_2SO_4}$

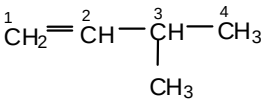


$\xrightarrow{\text{tautomerises}}$



50. Ans: 3–methylbut–1–ene

Sol:



51. Ans: III > II > I

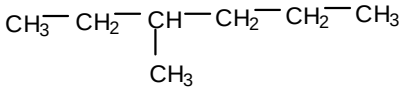
Sol: Since the stability of the carbocation is in the order benzyl > isopropyl > ethyl, the relative reactivity of the given halides in S_N1 reaction follow the order III > II > I.

52. Ans: Free radical

Sol: Homolytic fission of a covalent bond produces free radicals.

53. Ans: 3–Methylhexane

Sol:



3-Methylhexane

It can give seven different structural isomers of the monochloro derivative.

54. Ans: –Cl

Sol: –Cl is deactivating and ortho–para directing when attached to benzene ring.

55. Ans: 2

Sol: Among the monochloro derivatives of n–pentane, only 2–chloropentane contains a chiral carbon atom. Hence it can give 2 optically active isomers.

56. Ans: Sucrose

Sol: Sucrose is optically active and the naturally occuring sucrose is dextrorotatory.

57. Ans: 0°

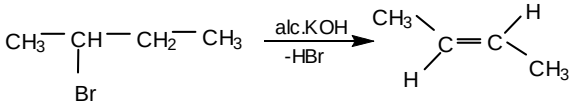
Sol: The dihedral angle between the H atoms of adjacent methyl groups in the eclipsed conformation is 0°.

58. Ans: C_6H_5Cl

Sol: Since chlorine is directly attached to the sp^2 hybridised carbon of the benzene ring in chlorobenzene, it is the least reactive compound.

59. Ans: Trans–2–butene

Sol:



(major product)

60. Ans: Phosgene

Sol: Chloroform undergoes oxidation to form poisonous carbonyl chloride (phosgene).

61. Ans: Swarts reaction

Sol: Reaction of alkyl halide with inorganic fluorides such as AgF to form alkyl fluoride is known as Swarts reaction.

62. Ans: IV < I < III < II

Sol: The relative acidity depends on the relative stability of the anion formed by ionisation.

63. Ans: Isobutyric acid – 2–Methyl butanoic acid

Sol: The IUPAC name of isobutyric acid is 2–methyl propanoic acid.

64. Ans: Coupling reaction

Sol: Benzene diazonium chloride undergoes coupling reaction with phenol to form p–hydroxyazobenzene.

65. Ans: Benzyl amine

Sol: $C_6H_5NH_2 \xrightarrow[O^0C]{NaNO_2/HCl} \underset{(X)}{C_6H_5N_2Cl} \xrightarrow{CuCN} \underset{(Y)}{C_6H_5CN} \xrightarrow{H_2/Ni} \underset{(Z)}{C_6H_5 - CH_2 - NH_2}$

66. Ans: p–toluidine

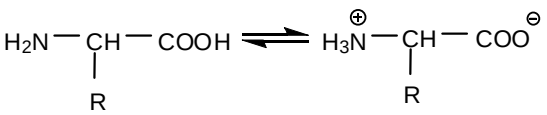
Sol: p–toluidine is more basic because of the electron donating nature of $-CH_3$ group.

67. Ans: Hydrogen bonds

Sol: Secondary structure of protein is stabilised by hydrogen bonding.

68. Ans: Zwitter ion

Sol:



Zwitter ion

69. Ans: $C_6H_5 - CH = CH_2$

Sol: The monomer of polystyrene is styrene ($C_6H_5 - CH = CH_2$)

70. Ans: Salvarsan

Sol: Salvarsan is an antibiotic.

71. Ans: Salvarsan

Sol: Salvarsan is an arsenic containing antibiotic used in the treatment of syphilis.

72. Ans: O_3 and PAN

Sol: O_3 and PAN are secondary precursors of photochemical smog.

73. Ans: Moment of inertia and moment of force.

Sol: $I = MR^2 \Rightarrow ML^2T^\circ$
Moment of force = ML^2T^{-2}

74. Ans: Displacement of the particle.

Sol: $S = \int v\,dt$ = distance = area under v – t graph

75. Ans: Square of the initial velocity.

Sol: $W = F.S = \frac{1}{2}mv^2$ where v is the initial velocity.

76. Ans: 2

Sol: $\frac{\left(2\hat{i}+3\hat{j}+\hat{k}\right).\left(3\hat{i}+4\hat{k}\right)}{|3\hat{i}+4\hat{k}|} = \frac{10}{5} = 2$

77. Ans: Not a constant vector.

Sol: Theoretical

78. Ans: Mv

Sol: Change in momentum / second = M.v

79. Ans: Impulse

Sol: Impulse = Force $\times$ time

80. Ans: x = 1.5 m

Sol: $F = \frac{dV}{dx} = 0$ (for equilibrium)

$\therefore 2x - 3 = 0 \Rightarrow x = \frac{3}{2}$

81. Ans: 2400 kcal

Sol: Experimental data.

82. Ans: $\frac{1}{4}MR^2$

Sol: Using perpendicular axes theorem,

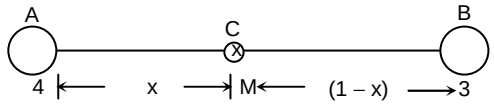
$$I = \frac{MR^2}{4}$$

83. Ans: Angular momentum

Sol: When J = 0, L is constant.

84. Ans: $\frac{2}{3}$ m

Sol:



$$\frac{G.4.M}{x^2} = \frac{1}{3}\frac{G.3.M}{(1-x)^2}$$

$$\frac{4}{x^2} = \frac{1}{(1-x)^2} \Rightarrow \frac{2}{x} = \frac{1}{1-x}$$

$x = 2(1 - x)$

$\therefore x = \frac{2}{3}$

85. Ans: The surface of the earth

Sol: $g = \frac{GM}{R^2}$ maximum at R (radius of earth)

86. Ans: 3

Sol: Theoretical

87. Ans: 0.5×10^{-3} N m^{-2}

Sol: $\frac{dv}{dx} = \frac{5}{10} = 0.5$

$F = \eta A \frac{dv}{dx} = 0.5 \times 10^{-3}$

88. Ans: $P_a + \rho gh$

Sol: $p = p_{atm} + h\rho g$

89. Ans: 4 °C

Sol: Copper – $ms\theta = 0.1 \times 400 \times 21 = 840$

Water – $ms\theta = 0.05 \times 4200 \times \Delta T = 840$

$\Rightarrow \Delta T = 4$ °C

90. Ans: Maximum density at 4 °C

Sol: Most appropriate answer is "maximum density at 4 °C".

91. Ans: 3×10^8 m s^{-1}

Sol: Velocity of all radiation is velocity of light.

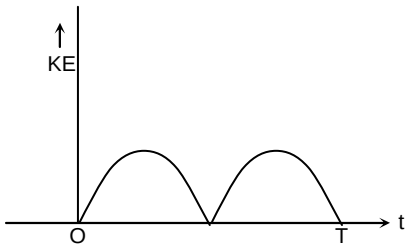
92. Ans: 2 Hz

Sol: $\omega^2 = \frac{k}{m} = \frac{8\pi^2}{0.5} = 16\,\pi^2$

$2\pi f = 4\pi \Rightarrow f = 2$ Hz

93. Ans: $\frac{T}{2}$

Sol:



Frequency is twice that of SHM

$\therefore$ time period is $\frac{T}{2}$

94. Ans: 300 Hz

Sol: $f_1 = 1.015\,f$

$f_2 = 0.975\,f$

$\Delta f = (1.015 - 0.975)f = 0.04\,f$

$\therefore$ beats $= 0.04\,f = 12$

$\therefore f = 300$

95. Ans: Adiabatic

Sol: Theoretical

96. Ans: (i) and (iii) are correct and (ii) is wrong

Sol: $U = -\vec{p}.\vec{E}$

97. Ans: 1

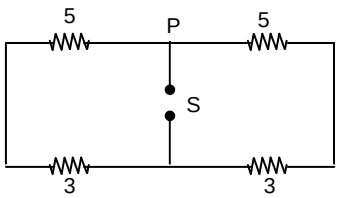
Sol: Three identical capacitors in series on the right extreme gives the resultant 1 μF. In parallel with 2 μF this gives 3 μF.
Repeating to the left resultant is 1 μF

98. Ans: The electrostatic field at the surface of the charged conductor must be tangential to the surface at any point.

Sol: Electrostatic field at the surface of a conductor is normal to the surface.

99. Ans: 4 Ω

Sol:



R across PS is $8 \|^{\lambda} 8 = 4\ \Omega$

100. Ans: 36 °C

Sol: Assuming current flows for the same duration.
$I_1^2Rt = ms\Delta T$
$I_2^2Rt = (3\ I_1)^2\ Rt = 9\ ms\Delta T$
$\Delta T = 4$; $\therefore\ 9\ \Delta T = 36°$

101. Ans: 0.24

Sol: $P_1 = \dfrac{P_A\ P_B}{P_A + P_B} = \dfrac{60\times 40}{100} = 24$ W
$P_2 = P_A + P_B = 100$
$\dfrac{P_1}{P_2} = 0.24$

102. Ans: Zero

Sol: Currents are in opposite directions in the upper and lower parts. Therefore field is cancelled.

103. Ans: 7.2×10^5 A m^{-1}

Sol: Magnetisation = $\dfrac{\text{dipole moment}}{\text{unit volume}}$

$= \dfrac{8\times 10^8\times 9\times 10^{-24}}{10^{-18}}$
$= 7.2\times 10^5$ A m^{-1}

104. Ans: ohm second

Sol: Reactance $\omega L \Rightarrow$ ohm
$\therefore$ L has unit $\dfrac{\Omega}{f}$ = ohm second

105. Ans: $V_2 = 0$

Sol: At resonance $V_L = V_C$
$\therefore\ V_2 = 0$

106. Ans: 6.25 mW

Sol: $F = Bi\lambda = 1.25\times 10^{-3}\times 50\times 0.1$
$= 6.25\times 10^{-3}$ N
$\therefore\ P = Fv = 6.25\times 10^{-3}\times 1 = 6.25$ mW

107. Ans: Magnetic flux is maximum and emf is zero

Sol: $\phi = \overline{B}.\overline{A}$ (maximum when plane of the coil perpendicular to $\overline{B}$.
emf = 0

108. Ans: The energy contribution of both electric and magnetic fields are equal

Sol: Theoretical

109. Ans: 60°

Sol: $n = \dfrac{\sin\left(\dfrac{A+D}{2}\right)}{\sin\left(\dfrac{A}{2}\right)}$

$\Rightarrow \sqrt{3} = \dfrac{\sin\left(\dfrac{60+D}{2}\right)}{\sin 30°}$

$\Rightarrow \dfrac{\sqrt{3}}{2} = \sin\left(\dfrac{60+D}{2}\right) = \sin 60°$

$\Rightarrow \dfrac{60+D}{2} = 60° \Rightarrow D = 60°$

$\theta = \dfrac{(A+D)}{2} = \dfrac{60+60}{2} = 60°$

110. Ans: $\dfrac{3}{2}$

Sol: $P = \dfrac{1}{f} = 10$ D $= 10\ m^{-1}$

$\dfrac{1}{f} = (n-1)\times\dfrac{2}{R}$

$\Rightarrow \dfrac{R}{2f} + 1 = n$ (R = 0.1 m)

$\dfrac{RP}{2} + 1 = n$

$\dfrac{0.1\times 10}{2} + 1 = n$

$n = 1.5 = \dfrac{3}{2}$

111. Ans: 4000 $\overset{0}{A}$

Sol: $\lambda_2 = \dfrac{N_1\lambda_1}{N_2} = \dfrac{16\times 6000}{24} = 4000\ \overset{0}{A}$

112. Ans: Remains constant

Sol: Intensity I = Nhυ, where N is the number of photons / area / time
$\rightarrow N = \dfrac{I}{h\upsilon}$
$\Rightarrow N_0$ = No. of photons / time
$= \dfrac{I\times \text{Area}}{h\upsilon} \propto$ current i
I → 2I and υ → 2 υ,
$\Rightarrow$ no change in $N_0 \Rightarrow$ i = constant.

113. Ans: Li^7

Sol: $R = R_0\ A^{1/3}$
$R = \dfrac{1}{3}\left(R_0\ 189^{1/3}\right) = R_0.\ A^{1/3}$
$A = \dfrac{180}{27} = 7$
$\Rightarrow Li^7$

114. Ans: β^- emission from the nucleus is always accompanied with a neutrino

Sol: β^- emission from the nucleus is always accompanied by emission of antineutrino.

115. Ans: 10 Ω

Sol: $R = \frac{\Delta V}{\Delta I} = \frac{(0.7-0.65)}{5\times10^{-3}}$

$= \frac{0.05\times10^{3}}{5} = 10\ \Omega$

116. Ans: 8 V

Sol: $V_R = V_{AB} - V_Z = 17 - 9 = 8$ V

117. Ans: Infrared rays

Sol: 1.5 eV < energy of visible photon.

118. Ans: Remains constant

Sol: $P \propto \left(\frac{\lambda}{\lambda}\right)^2 \Rightarrow$ No change

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

Sol: $\frac{E_{max}-E_{min}}{E_{max}+E_{min}} = \frac{25-5}{25+5} = \frac{2}{3}$

120. Ans: Modulating and demodulating device

Sol: Modem → modulation & demodulation.