SOLUTIONS & ANSWERS FOR KERALA MEDICAL ENTRANCE EXAMINATION-2011 – PAPER I
VERSION – A1

[CHEMISTRY & PHYSICS]

1. Ans: 1, 2 and 4

Sol: Beyond a certain wave length, line spectrum becomes band spectrum.
For Balmer series, $n_1 = 2$
For the line of longest wavelength (lowest energy) in this series, $n_2 = 3$

2. Ans: P_2O_3, PH_3, H_2O

Sol: P_2O_3, PH_3 and H_2O illustrates the law of reciprocal proportions. Ratio in the no. of atoms of H and O combining with one P is 3 : 1.5 i.e 2 : 1.

3. Ans: $^{39}K^+$ and $^{40}K^+$

Sol: $^{39}K^+$ and $^{40}K^+$ contain 19 electrons ie, they are isoelectronic and isotopic.

4. Ans: 17 kg

Sol: $N_2 + 3H_2 \rightarrow 2NH_3$
28 g 6 g 34 g
Limiting reactant is H_2
$\therefore$ Wt of NH_3 from 3 kg of H_2 = 17 kg

5. Ans: O – H

Sol: O – H bond length is the shortest among the given set.

6. Ans: Trigonal bipyramidal

Sol: SO_2 – Bent
SF_4 – See – saw
ClF_3 – T–shape
BrF_5 – Square pyramidal
XeF_4 – Square planar

7. Ans: 70 m

Sol: Pressure in the bubble at the bottom of the lake = 8 atm
When it travels 70 m, the pressure inside the bubble becomes 1 atm.

8. Ans: Gases will form homogeneous mixture

Sol: All the gases occupy the available volume.

9. Ans: Surface tension of a liquid decreases with increase in temperature

Sol: As the temperature increases the kinetic energy of the molecules increases and hence intermolecular attraction decreases, which in turn decreases the surface tension.

10. Ans: H_2

Sol: H – H bond enthalpy is the highest.

11. Ans: (II) > (III) > (I) > (IV)

Sol: Electro negativity of
O – 3.5
N – 3.0
Be – 1.5
Mg – 1.2

12. Ans: chlorides and sulphates of calcium and magnesium

Sol: Permanent hardness is due to chlorides and sulphates of calcium and magnesium.

13. Ans: Cr

Sol: Chromium does not exist as sulphide ore.

14. Ans: Li < K < Na < Rb < Cs

Sol: Densities are
Li – 0.53 g/cc
Na – 0.97 g/cc
K – 0.86 g/cc
Rb – 1.53 g/cc
Cs – 1.90 g/cc

15. Ans: LiCl

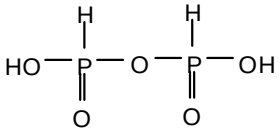
Sol: LiCl is soluble in pyridine.

16. Ans: only I_2 is liberated

Sol: Br_2 liberate I_2 from NaI.

17. Ans: 2

Sol: Pyrophosphorous acid is $H_4P_2O_5$



18. Ans: +5

Sol: Phosphorous is in +5 oxidation state.

19. Ans: Fe^{2+} only

Sol: Fe^{2+} is paramagnetic.

20. Ans: K_2TiO_4

Sol: The oxidation states exhibited by Ti are +2, +3 & +4.

21. Ans: acidic, amphoteric and basic

Sol: Mn_2O_7 is acidic, V_2O_5 is amphoteric and CrO is basic.

22. Ans: F – H ------ F

Sol: Strength of hydrogen bond between H --------- F is the strongest and hence it is the shortest bond.

23. Ans: $\Delta H < 0, \Delta S < 0$

Sol: $\Delta G = \Delta H - T\Delta S$
When $\Delta H < 0$ and $\Delta S < 0$, then ΔG will be negative only at low temperatures.

24. Ans: 6.93 atm

Sol: $K_p = \frac{p_{CO}^2}{p_{CO_2}}$
63 = 100 x
Total eqbm. pressure = 6.3 + 0.63
= 6.93 atm

25. Ans: acetone – chloroform

Sol: Type III solutions form maximum boiling azeotrope
B & D – Type I
A & E – Type II

26. Ans: Two sucrose solutions of the same molality prepared in different solvents will have the same depression of freezing point

Sol: $\Delta T_f = K_f \times m$
K_f values are different for different solvents.

27. Ans: 1 M KCl solution, 1 M NaCl solution

Sol: Electrolysis of both KCl and NaCl liberates H_2 at the cathode and Cl_2 at the anode. But the resulting solutions will be different.

28. Ans: 2, 1, 0

Sol: 1st and 2nd set of data – No change in rate with the change in concentration of 'C'.
1st and 3rd set of data –On doubling the concentration of 'B' rate becomes double.
1st and 4th set of data – On doubling the concentration of 'A' rate becomes four times.

29. Ans: (c + d)

Sol: Order is the sum of the powers to which the concentration terms are raised in the rate equation.

30. Ans: Pb^{2+}

Sol: Lead is a p–block element.

31. Ans: $\Delta H > 0, \Delta S > 0$ and $\Delta G = 0$

Sol: Since the process is at equilibrium, $\Delta G = 0$

32. Ans: CO_2

Sol: As the solubility increases K_H decreases. Among the given set of gases, CO_2 is the most soluble in water.

33. Ans: 1 : 3

Sol: X^{3+} and Y^{2+}
Atomic masses are in the ratio 1 : 2
$\therefore$ Equivalent masses are in the ratio $\frac{1}{3} : 1$
(or) 1 : 3

34. Ans: 40 min

Sol: $1 \xrightarrow{1} \frac{1}{2} \xrightarrow{2} \frac{1}{4} \xrightarrow{3} \frac{1}{8} \xrightarrow{4} \frac{1}{16}$

$\frac{1}{16}$ is 4 half lives and $\frac{1}{4}$ is 2 half lives.

35. Ans: gel – butter

Sol: Butter is an example for gel.

36. Ans: Potassium hexacyanoferrate(II)

Sol: Maximum number of ions (5) is obtained from $K_4[Fe(CN)_6]$

37. Ans: tetradentate

Sol: $N(CH_2CH_2NH_2)_3$ is a tetradentate ligand.

38. Ans: +788

Sol: (1) $NaCl_{(s)} \rightarrow Na^+_{(aq)} + Cl^-_{(aq)}$
$\Delta H_1 = 4$ kJ mol^{-1}
(2) $Na^+_{(g)} + Cl^-_{(g)} + aq \rightarrow Na^+_{(aq)} + Cl^-_{(aq)}$
$\Delta H_2 = -784$ kJ mol^{-1}
(1) – (2)
$NaCl_{(s)} \rightarrow Na^+_{(g)} + Cl^-_{(g)} = 788$ kJ mol^{-1}

39. Ans: 16%

Sol: $AB_{(g)} \rightarrow A_{(g)} + B_{(g)}$

$$K_p = \frac{\alpha^2 p}{1 - \alpha^2} = 2.56 \times 10^{-2} \text{ atm}$$

$$\frac{\alpha^2 \times 1 \text{ atm}}{1 - \alpha^2} = 2.56 \times 10^{-2} \text{ atm}$$

$\alpha = 0.16$

$= 16\%$

40. Ans: 2×10^{-6} M

Sol: $Hg_2Cl_2 \rightarrow Hg_2^{2+} + 2Cl^-$

$K_{sp} = 4S^3 = 32 \times 10^{-18}$

$S = 2 \times 10^{-6}$ M

41. Ans: a – iv, b – I, c – ii, d – iii

Sol: $V_2O_5 - H_2SO_4$

Ziegler – Natta – HDPE

Peroxide – Polyacrylonitrile

Finely divided Fe – NH_3

42. Ans: 0.2

Sol: $C\alpha = [H^+]$

$$\alpha = \frac{10^{-5}}{5 \times 10^{-3}}$$

$$\% = \frac{1}{5} = 0.2$$

43. Ans: Enthalpy of adsorption is in the range 80 – 240 kJ mol^{-1}

Sol: Enthalpy of physisorption is in the range of 4 – 40 kJ mol^{-1}.

44. Ans: –360

Sol: $C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$

$\Delta H = 30 \times 4 \times 3$ kJ mol^{-1}

$= 360$ kJ mol^{-1}

Combustion reactions are exothermic in nature.

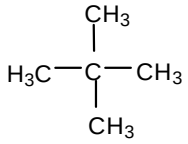
45. Ans: 5, 4 and 6

Sol: $CH_2 = CH - CH = CH - C \equiv CH$

hexa–1, 3–dien–5–yne

46. Ans: 4, 0, 0 and 1

Sol:



neopentane

47. Ans: tropolone

Sol: Tropolone is a non–benzenoid aromatic compound.

48. Ans: CH_3

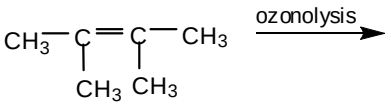
Sol: $C : H = \frac{80}{12} : \frac{20}{1}$

$= 6.66 : 20$

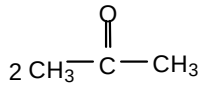
$= 1 : 3$

49. Ans: 2, 3–dimethyl–2–butene

Sol:



2,3-Dimethylbut-2-ene

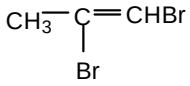


50. Ans: 2–methylpropane

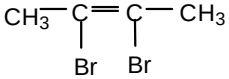
Sol: For the compounds with same molecular mass, boiling point decreases with increase in branching.

51. Ans: 1, 2–dibromopropene or
2, 3–dibromobut–2–ene

Sol:



1,2-dibromopropene



2,3-dibromobut-2-ene

52. Ans: electrophilic addition

Sol: HBr addition to alkene is electrophilic addition.

53. Ans: 2, 2–dimethylpropane

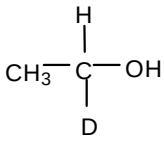
Sol: All hydrogen atoms are equivalent in 2, 2–dimethylpropane.

54. Ans: Fittig reaction

Sol: Reaction of aryl halide with sodium in ether to form diaryl is known as Fittig reaction.

55. Ans: CH_3CHDOH

Sol:



It contains a chiral carbon.

56. Ans: are position isomers

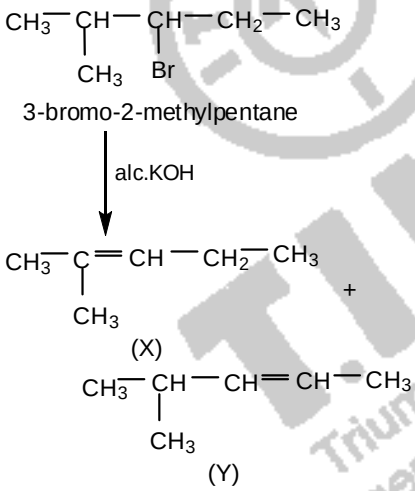
Sol: The two isomers differ in the position of double bond.

57. Ans: will remain constant

Sol: Tertiary alkyl halide undergoes S_N1 mechanism.
rate = k [RX]

58. Ans: 3– bromo–2–methylpentane

Sol:



59. Ans: C_6H_5Cl

Sol: Aryl halides do not undergo hydrolysis by S_N1 mechanism.

60. Ans: triiodomethane

Sol: Triiodomethane or iodoform has antiseptic property.

61. Ans: $CH_3CONHCH_3$

Sol: $CH_3CONHCH_3$ is an amide.

62. Ans: 2–methyl–propan–2–ol

Sol: 2–methyl–propan–2–ol is a 3°alcohol.

63. Ans: 1–pentanol

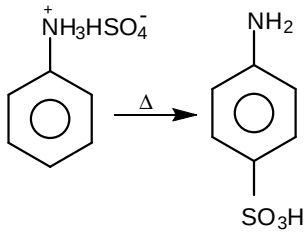
Sol: 1° alcohols readily form ethers when heated with con.H_2SO_4.

64. Ans: CH_3CH_2CHO and CH_3COCH_3

Sol: CH_3COCH_3 gives yellow precipitate of iodoform when heated with NaOI. CH_3CH_2CHO does not give iodoform.

65. Ans: sulphanilic acid

Sol:

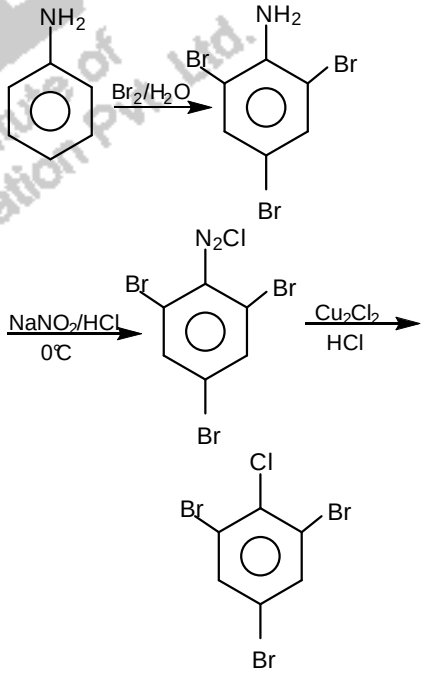


66. Ans: N–Ethylethanamine

Sol: $(C_2H_5)_2NH$ is the most basic amine among the given compounds.

67. Ans: 2, 4, 6–Tribromochlorobenzene

Sol:



68. Ans: C1 of β–D–galactose and C4 of β–D–glucose

Sol: In lactose, β–D–galactose is joined to C4 of β–D–glucose

69. Ans: $NaHSO_3$

Sol: Glucose does not react with $NaHSO_3$

70. Ans: Vitamin D

Sol: Vitamin D is not soluble in water.

71. Ans: methemoglobinemia

Sol: Excess of nitrate in drinking water causes methemoglobinemia

72. Ans: Antihistamine

Sol: Terfenadine is an antihistamine

73. Ans: Spring constant

Sol: Surface tension = N m^{-1}
= same as spring constant

74. Ans: 122.5 m

Sol: $\frac{9h}{25} = \frac{g}{2}[2t-1]$

$\frac{1}{2}gt^2 = h$

$\Rightarrow$ h = 122.5 m

[t = 5 s; x + 3x + 5x + 7x + 9x = h

$\Rightarrow x = \frac{h}{25}; 9x = \frac{9h}{25}$

75. Ans: Displacement

Sol: Area below v-t graph gives displacement.

76. Ans: –5

Sol: $+5\hat{k} = -a\hat{k}$

$\Rightarrow a = -5$

77. Ans: 0°

Sol: F + 2F = 3F

$\Rightarrow \theta = 0°$

($9F^2 = F^2 + 4F^2 + 4F^2 \cos\theta$

$\Rightarrow \cos\theta = 1 \Rightarrow \theta = 0°$)

78. Ans: $\sqrt{gr}$

Sol: $v_{top} = \sqrt{gr}$

79. Ans: $\frac{g}{5}$

Sol: $a = \frac{(m_2 - m_1)g}{(m_2 + m_1)}$

$= \frac{(6-4)\times g}{(6+4)}$

$= \frac{g}{5}$

80. Ans: All the central forces are non-conservative.

Sol: Gravitational force, electrostatic force etc. which are central forces, are conservative force.

81. Ans: 5 : 4

Sol: $\frac{KE_1}{KE_2} = \frac{m_2}{m_1} = \frac{5}{4}$

(Θ $p^2 = 2m(KE)$,
p same for both)

82. Ans: $\sqrt{r}$

Sol: L = mvr

$= m\sqrt{\frac{GM}{r}}.r$

$\propto \sqrt{r}$

[$L \propto n$ and $r \propto n^2$, if we use Bohr model]

83. Ans: Mr^2

Sol: Treating it as a thin cylinder,
M = same as that of a ring
$= Mr^2$

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

Sol: $v_e = \sqrt{\frac{2GM}{R_e}} = \sqrt{2gR_e}$

where g = acceleration due to gravity on surface of Earth.

85. Ans: $T^2 = \frac{4\pi^2R^3}{GM_m}$

Sol: $T^2 = \frac{4\pi^2R^3}{GMm}$

86. Ans: 16 : 1

Sol: $U = \frac{1}{2}\frac{\sigma^2}{Y}$

$\Rightarrow U \propto \sigma^2 \propto \frac{1}{A^2}$

$\frac{U_1}{U_2} = \frac{A_2^2}{A_1^2} = \frac{d_2^4}{d_1^4} = \frac{16}{1}$

87. Ans: 800

Sol: $\frac{4}{5}h\times\rho_w = h\times\rho_\lambda$

$\therefore \rho_\lambda = \frac{4}{5}\times\rho_w$

$= \frac{4}{5}\times 1000$

$= 800 \text{ kg m}^{-3}$

88. Ans: $12\pi R^2T$

Sol: $E_1 = 4\pi R^2T$

$E_2 = n.4\pi r^2\, T$ (n = 64)

$= n.4\pi \frac{R^2}{16} T \left(\Theta\, r = \frac{R}{n^{1/3}} = \frac{R}{4}\right)$

$= 16\pi R^2T$

$\therefore W = E_2 - E_1 = 12\pi R^2T$

89. Ans: 50 J

Sol: $\Delta Q = \Delta U + W$

$\Rightarrow \Delta U = \Delta Q - W$

$= 35 - (-15)$

$= 35 + 15$

$= 50$ J

(Θ Work is done on system)

90. Ans: Latent heat of fusion is twice the latent heat of vapourization.

Sol: Latent heat of fusion is half the latent heat of vapourization.

91. Ans: $2\alpha\Delta t$

Sol: $I = \frac{M\lambda^2}{12}$

$dI = \frac{M}{12} 2\lambda d\lambda$

$\Rightarrow \frac{dI}{I} = 2\frac{d\lambda}{\lambda} = 2\alpha\Delta t$

92. Ans: Motion of planet around the Sun.

Sol: Motion of planet around Sun is periodic but not SHM.

93. Ans: becomes zero.

Sol: $f = \frac{1}{2\pi}\sqrt{\frac{g_{eff}}{\lambda}} = 0$

($\Theta\, g_{eff} = 0$ for free fall)

94. Ans: 660, 1320, 2640

Sol: $f_0 = \frac{v}{2[L + Z_e]}$

$= \frac{330}{2[0.25 + 2\times 0.3d]}$

$= \frac{330}{2\times 0.262}$

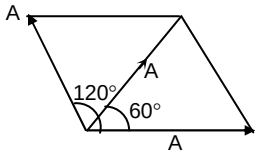
$\cong 630$ Hz with end correction

If e = 0, $f_0 = \frac{330}{2\times 0.25} = 660$ Hz,

$f_1 = 1320$ Hz, $f_2 = 1980$ Hz, 2640 Hz

95. Ans: A

Sol:



$A_R = \sqrt{A^2 + A^2 + 2A^2\cos^2 120^\circ}$

$= A$

96. Ans: $\frac{2e}{\varepsilon_0}$

Sol: $|\phi_E| = \left|\frac{q}{\varepsilon_0}\right| = \left|\frac{-2e}{\varepsilon_0}\right| = \frac{2e}{\varepsilon_0}$

(If e = electronic charge, charge of α-particle is $-2e$)

97. Ans: zero

Sol: The charge is moving along an equipotential line.

98. Ans: Energy stored and potential difference

Sol: $U = \frac{1}{2}\frac{Q^2}{KC} \Rightarrow$ decreases

$V' = \frac{Q}{KC} \Rightarrow$ decreases

99. Ans: 1 : 2

Sol: $v_d = \frac{e\tau}{m}\frac{V}{\lambda} = \left(\frac{e}{m\lambda}\right)\tau V$

If temperatures are not same, τ cannot be same. $\Rightarrow$ no answer. If temperature are same,

$\frac{vd_1}{vd_2} = \frac{v_1}{v_2} = 1 : 2$

100. Ans: Relaxation time decreases

Sol: $R = \frac{m}{ne^2\tau}\frac{\lambda}{A}$

When temperature increases τ decreases $\Rightarrow$ R increases.

101. Ans: $\frac{5}{3}$ V

Sol: $\frac{E_1r_2 + E_2r_1}{r_1 + r_2} = E_{eff}$

$\Rightarrow E_{eff} = \frac{(2\times 2) + (1\times 1)}{(2+1)}$

$= \frac{4+1}{3} = \frac{5}{3}$ V

102. Ans: Voltage sensitivity of a moving coil galvanometer is directly proportional to the magnetic induction.

Sol: $\frac{\theta}{V} = \frac{\theta}{IR} = \frac{BNA}{CR}$

$\Rightarrow \frac{\theta}{V} \propto B$

103. Ans: $\frac{4}{9}$

Sol: $r = \frac{\sqrt{2mqV}}{qB} = \sqrt{\frac{2mV}{qB^2}}$

$\Rightarrow \frac{r_1}{r_2} = \sqrt{\frac{m_1}{m_2}}$

$\Rightarrow \frac{m_1}{m_2} = \frac{r_1^2}{r_2^2} = \frac{4}{9}$

104. Ans: Biot-Savart law

Sol: Knowledge based.

105. Ans: $2B\lambda v$

Sol: $\frac{\Delta\phi_m}{\Delta t} = -2B\lambda v$

$\therefore \mathcal{E} = -\frac{\Delta\phi_m}{\Delta t} = 2B\lambda v$

106. Ans: 1 : 2

Sol: $L = \frac{\mu_0 N^2 \pi r^2}{\lambda}$

$\frac{L_1}{L_2} = \left(\frac{\lambda_2}{\lambda_1}\right)\left(\frac{r_1}{r_2}\right)^2 = \frac{2}{1} \times \left(\frac{1}{2}\right)^2$

$= \frac{1}{2}$

107. Ans: The energy stored in a conductor of capacitance C having a charge q is $\frac{1}{2}Cq^2$

Sol: Energy = $\frac{1}{2}\frac{q^2}{C}$

108. Ans: γ-rays

Sol: λ shortest $\Rightarrow$ Maximum frequency $\Rightarrow$ maximum energy $\Rightarrow \gamma$ rays.

109. Ans: $\sin^{-1}\left(\frac{3}{4}\right)$

Sol: $C = \sin^{-1}\left(\frac{v_1}{v_2}\right)$

$= \sin^{-1}\left(\frac{1.8\times10^8}{2.4\times10^8}\right)$

$= \sin^{-1}\left(\frac{3}{4}\right)$

110. Ans: 1.732

Sol: $A + \delta = i + e$

$30° + 30° = 60° + e$

$\Rightarrow e = 0 \Rightarrow r_2 = 0$

$\Rightarrow r_1 = A = 30°$

$\therefore \mu = \frac{\sin i}{\sin r_1} = \frac{\sin 60°}{\sin 30°} = \sqrt{3}$

111. Ans: d

Sol: $\beta = \frac{\lambda D}{d}$

112. Ans: Momentum of electron = momentum of proton

Sol: $\lambda = \frac{h}{p} = \frac{h}{\sqrt{2mKE}}$

λ same $\Rightarrow$ p same

113. Ans: 91,234

Sol: ${}_{92}U^{238} \xrightarrow{\alpha} {}_{90}X^{234} \xrightarrow{\beta} {}_{91}Y^{234}$

114. Ans: To slow down the neutrons to thermal energies.

Sol: Knowledge based.

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

Sol: $\lambda_{max} = \frac{12422}{2.5}$

$= 4969 \overset{0}{A}$

$\Rightarrow \lambda$ smaller than 4969 $\overset{0}{A}$ can be detected

$\Rightarrow 4000 \overset{0}{A}$

116. Ans: Low for all low inputs.

Sol: Knowledge based.

117. Ans: 1.0 A

Sol: $i = \frac{E}{R_{eff}}$

$= \frac{10}{(5+5)} = 1$ A

118. Ans: 1125 m

Sol: $h = \frac{d^2}{2R}$

$= \frac{(120\times1000)^2}{2\times6400\times1000}$

= 1125 m

119. Ans: Modulation index μ is kept ≥ 1, to avoid distortion.

Sol: $\mu \leq 1$ is correct. μ cannot be greater than 1.

120. Ans: 800 – 950 MHz

Sol: Knowledge based.