SOLUTIONS & ANSWERS FOR KERALA ENGINEERING ENTRANCE EXAMINATION-2017
VERSION – A

[PHYSICS & CHEMISTRY]

1. Ans: 250π

Sol: $\ell = r\theta = 3000 \times 15 \times \frac{\pi}{180}$

$= 250\pi$ m

2. Ans: can be decreased by increasing the number of reading and averaging them.

Sol: Basic concept

3. Ans: 5.0 s

Sol: Basic idea

4. Ans: No correct answer

5. Ans: 160 km/h^2

Sol: For P, $t = \sqrt{\frac{2S}{a}} = \sqrt{\frac{40}{40}} = 1$ h

For Q, $20 = \frac{1}{2}a_2\left(\frac{1}{2}\right)^2$

$a_2 = 160$ km/h^2

6. Ans: No correct answer

7. Ans: $20\sqrt{3}$ m

Sol: $R = \frac{u^2 \sin 2\theta}{g} = \frac{20^2 \sin 120}{10}$

$= 40 \sin 60° = 20\sqrt{3}$

8. Ans: The person can catch the ball when it comes down, if the truck continues to move with a constant speed of 60 km/h

Sol: Basic concept

9. Ans: 8/9 of its initial kinetic energy.

Sol: $v_1 = \frac{m_1 - m_2}{m_1 + m_2}.v_1 + \frac{2m_2u_2}{m_1 + m_2}$

$= \left(\frac{2m - m}{3m}\right)v = \frac{v}{3}$

$KE_1 = \frac{1}{2}2mv^2 = mv^2$

$KE_2 = \frac{1}{2} \times 2m\left(\frac{v}{3}\right)^2 = \frac{mv^2}{9}$

Loss = $KE_1 - KE_2 = \frac{8}{9}mv^2$

10. Ans: 8 J

Sol: $x = 2t^2$
$v = 4t$
$a = 4$
$W = Fs$
$= mas$
$= 1 \times 4 \times 2 = 8$ J

11. Ans: $g\sqrt{\frac{m}{k}}$

Sol: $x_{max} = \frac{mg}{k}$

$a = \frac{mg}{k}$

$a\omega = \frac{mg}{k}\sqrt{\frac{k}{m}}$

$= g\sqrt{\frac{m}{k}}$

12. Ans: Increasing uniformly with time

Sol: $P = F \times v = Fat$

$P = F.\frac{F}{m}t$

$= \frac{F^2}{m}.t$

13. Ans: 0.001 m/s

Sol: $J = \frac{16}{2 \times 10^{-6}} = 8 \times 10^6$

$v_d = \frac{J}{ne} = \frac{8 \times 10^6}{5 \times 10^{28} \times 1.6 \times 10^{-19}}$

$= 10^{-3}$ m s^{-1}

14. Ans: 192 Ω

Sol: $R = \frac{V^2}{P} = \frac{120 \times 120}{75}$

$= \frac{24 \times 120}{15} = 192$

15. Ans: $I_1 = 2$ A, $I_2 = -3$ A, $I_3 = -1$ A

Sol: $14 + 4I_2 + 10 - 6I_1 = 0$
$10 - 6I_1 - 2I_3 = 0$
$14 + 4I_2 + 2I_3 = 0$
$I_1 = 2$ A, $I_2 = -3$ A, $I_3 = -1$ A

16. Ans: $10.8\ \Omega$

Sol: $R_t = R_0(1 = \alpha t)$

$$\frac{R_1}{R_2} = \frac{1+\alpha t_1}{1+\alpha_2}$$

$$\frac{10}{R} = \frac{1+4\times10^{-3}\times20}{1+4\times10^{-3}\times40} = \frac{1.08}{1.16}$$

$$R = \frac{10\times1.16}{1.08} = \frac{11.6}{1.08} = 10.74$$

17. Ans: Zero

Sol: Basic concept

18. Ans: $\frac{pR^3}{3\varepsilon_0 r^2}$

Sol: $q = \frac{4}{3}\pi R^3\rho$

$$E = \frac{kq}{r^2} = \frac{1}{4\pi\varepsilon_0}\cdot\frac{4}{3}\frac{\pi R^3\rho}{r^2}$$

$$= \frac{\rho R^3}{3\varepsilon_0 r^2}$$

19. Ans: 99 V

Sol: $V = \frac{1}{4\pi\varepsilon_0}\sum\frac{q}{r}$

$$= \frac{1\times10\times10^{-9}}{4\pi\varepsilon_0}\left[\frac{1}{2}+\frac{1}{4}+\frac{1}{5}+\frac{1}{10}+\frac{1}{20}\right]$$

$= 9\times10^9\times10^{-8}\times1.1$

$= 99$ V

20. Ans: 600π kV/m

Sol: $\frac{\sigma}{\varepsilon_0} = \frac{10\times10^{-9}}{6\times10^{-4}}\times\frac{36\pi}{10^{-9}}$

$= 6\pi\times10^5$

$= 600\pi$ kV/m

21. Ans: 0.8×10^{-13} N

Sol: $F = qv\times B = qvB\sin\theta$

$$= 1.6\times10^{-19}\times5\times10^6\times2\times\frac{1}{2}$$

$$= 8\times10^{-13}\text{ N}$$

22. Ans: $\frac{\mu_0 I_0}{2\pi r}$

Sol: $B.2\pi r = \mu_0 I$

$$B = \frac{\mu_0 I}{2\pi r}$$

23. Ans: 0.334π T

Sol: Cyclotron

$$m = \frac{Bq}{2\pi f}$$

$$B = \frac{2\pi mf}{q}$$

$$= \frac{2\pi\times1.67\times10^{-27}\times16\times10^6}{1.6\times10^{-19}}$$

$= 0.334\pi$

24. Ans: $\frac{1}{\sqrt{\mu_0\varepsilon_0}}$

Sol: Basic concept

25. Ans: Angular momentum

Sol: Basic concept

26. Ans: $V = -2K$

Sol: $KE = \frac{1}{2}m\frac{GM}{r}$

$$PE = -\frac{GMm}{r} = -2KE$$

$V = -2K$

27. Ans: $4\ m/s^2$

Sol: $a_E = \frac{GM_E}{R_E^2}$ $\quad M_E = 10M_M$

$a_M = \frac{GM_m}{R_m^2}$ $\quad R_E = 2R_M$

$\frac{a_M}{a_E} = \frac{M_m R_E^{\ 2}}{R_m^{\ 2} M_E}$ $\quad R_E = 10$

$$\frac{a_M}{a_E} = \frac{M_m R_E^{\ 2}}{R_m^{\ 2} M_E}$$

$$= \frac{M_m 4R_m^{\ 2}}{R_m^{\ 2} 10M_m} = \frac{2}{5}$$

$a_m = \frac{2}{5}\times10 = 4\ m/s^2$

28. Ans: 27 years

Sol: $T \propto R^{3/2}$

$T^2 \propto R^3$, $\quad \frac{T_S^{\ 2}}{T_E^{\ 2}} = \frac{R_S^{\ 3}}{R_E^{\ 3}}$

$$= \frac{9^3 R_E^{\ 3}}{R_E^{\ 3}} = 729$$

$T_S = \sqrt{729}$

$= 27$ years

29. Ans: $\frac{\pi}{2}$

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Sol: $T = 2\pi\sqrt{\frac{m}{K}} = 2\times 3.14\times\sqrt{\frac{3}{48}}$

$= 2\times 3.14\times\sqrt{\frac{1}{16}} = \frac{2}{4}\pi$

$= \frac{\pi}{2}$

30. Ans: 5

Sol: $x = A\sin(\omega t + \delta)$
$v = A\omega\cos(\omega t + \delta)$
At t = 0
$A\sin\delta = 3$;
$A\,2\cos\omega t = 8$
$\Rightarrow \tan\omega t = \frac{3}{4} \Rightarrow \omega t = 37°$
$A\sin 37° = 3$
$A = 3\times\frac{5}{3} = 5$

31. Ans: 2ω

Sol: $\sin^2\theta = 2$
$\cos 2\theta = 1 - 2\sin^2\theta$
$\sin^2\theta = \frac{1-\cos 2\theta}{2}$
$\cos 2\theta = 2\cos^2\theta - 1$
$\cos^2\theta = \frac{1+\cos 2\theta}{2}$
$\sin^2\theta - 2\cos^2\theta = \frac{1-\cos 2\theta}{2} - 1 + \cos 2\theta$
$= \frac{1-\cos 2\theta - 2 + 2\cos 2\theta}{2}$
$= \frac{\cos 2\theta - 1}{2} \Rightarrow 2\omega$

32. Ans: $\sqrt{\frac{5}{2}}$ m / s

Sol: $v = \sqrt{\frac{T}{m}}$
$= \sqrt{\frac{80}{32}} = \sqrt{\frac{5}{2}}$ m/s

33. Ans: 55 Hz

Sol: $\upsilon = \frac{v}{4L}$
$= \frac{330}{4\times 1.5} = \frac{330}{6}$
= 55 Hz

34. Ans: 150 Hz

Sol: $\upsilon = \frac{2v}{L}$ [four nodes
$= \frac{2\times 300}{4}$ = 150 Hz
$\Rightarrow$ fourth mode of vibration]

35. Ans: 750 Hz

Sol: $\upsilon' = \upsilon\left(\frac{v - v_L}{v - v_S}\right)$
$= 700\left[\frac{v}{v-22}\right]$
$= 700\left[\frac{330}{330-22}\right]$
= 750 Hz

36. Ans: The instantaneous velocity is always positive.

37. Ans: The horizontal component of the velocity does not change with time

38. Ans: 360 N

Sol: Apparent weight = m(g – a)
= 360 N

39. Ans: 10 N

Sol: $T = \frac{Mg}{2}$ = 10 N

40. Ans: 0.544 N/m

Sol: $h = \frac{2T\cos\theta}{\rho g r}$
$T = \frac{\rho g r h}{2\cos\theta}$
$= \frac{13.6\times 10^3\times 10\times 0.5\times 10^{-3}\times 0.8\times 10^{-2}}{2\times\cos 120°}$
= 0.544 N/m

41. Ans: Stress is linearly proportional to strain for stress much smaller than at the yield point.

42. Ans: 6×10^{-10}

Sol: $\eta = \frac{F\ell}{Ax}$
$x = \frac{F\ell}{\eta A} = \frac{30\times 20\times 10^{-2}}{4\times 10^{10}\times 50\times 50\times 10^{-4}}$
$= 6\times 10^{-10}$

43. Ans: 30 °C

Sol: Heat lost = Heat gained
$100\times 1\times(90-\theta) = 600\times 1\,[\theta - 20]$
On solving, θ = 30 °C

44. Ans: I-4, II-3, III-2, IV-1

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45. Ans: There is a finite work done by the gas on its environment when its temperature is increased while the pressure remains constant.

46. Ans: Light waves and waves on a string are transverse but sound waves are longitudinal.

47. Ans: Quadrupled

Sol: $\beta' = \frac{\lambda D}{d} = \frac{\lambda 2D}{\frac{d}{2}}$

$\beta' = 4\beta$

48. Ans: $\frac{\omega}{k}$

Sol: Basic knowledge

49. Ans: $\overline{E} \times \overline{B}$

Sol: Basic knowledge

50. Ans: 666 μs and 9.72×10^5 crests per second

Sol: $t = \frac{d}{c} = \frac{200 \times 10^3}{3 \times 10^8}$

$= \frac{2}{3000} = 0.67 \times 10^{-3} = 667\ \mu s$

No. of crests per second is same as frequency

$= 972$ kHz $= 9.72 \times 10^3$/s

51. Ans: $\frac{20}{3}$ nm

Sol: $\lambda = \frac{h}{p}$

$= \frac{6.6 \times 10^{-34}}{m \times v}$

$= \frac{6.6 \times 10^{-34}}{9 \times 10^{-31} \times 1.1 \times 10^5}$

$= \frac{6}{9} \times 10^{-8}$ m

$= \frac{20}{3}$ n m

52. Ans: $f = 300/\pi$ kHz and $v = 6.0 \times 10^7$ m/s

Sol: $E = 10^4 \sin[6 \times 10^5 t - 0.01x]$

Comparing with the equation of a wave

$E = A \sin(\omega t - kx)$

$\omega = 6 \times 10^5$

$2\pi f = 6 \times 10^5$

$f = \frac{6 \times 10^5}{2\pi} = \frac{300}{\pi}$ k Hz

$\frac{2\pi}{\lambda} = 0.01, \ \frac{2\pi}{\lambda} = 0.01, \ \lambda = \frac{2\pi}{0.01}$

$\lambda = \frac{2\pi}{0.01} = \upsilon = f\lambda$

$= \frac{300}{\pi} \times 10^3 \times \frac{2\pi}{0.01}$

$= 6 \times 10^7\ m\ s^{-1}$

53. Ans: Diffraction phenomena

54. Ans: $\lambda_e > \lambda_n > \lambda_a$

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

Since $m_e < m_n < m_\alpha$, $\lambda_e > \lambda_n > \lambda_\alpha$

55. Ans: 6.8 eV

Sol: W = 4.6 eV

KE = 2.2 eV

Incident energy = W + KE = 6.8 eV

56. Ans: Copper will increase and silicon will decrease

Sol: Conductor has +ve temperature coefficient and semiconductor has –ve temperature coefficient of resistance. So for copper it increases and for Si decreases/

57. Ans: 5 eV

Sol: Basic knowledge

58. Ans: Forward current is in mA and reverse current is in μA

Sol: Basic knowledge

59. Ans: Both p and n regions are heavily doped

Sol: Basic knowledge

60. Ans: 300 to 3100 Hz frequency

Sol: Basic knowledge

61. Ans: 1000 cm

Sol: $\lambda = \frac{c}{f} = \frac{3 \times 10^8}{30 \times 10^6} = 10$ m

$= 1000$ cm

62. Ans: $2\omega_m$

Sol: Basic knowledge

63. Ans: The time taken to reach the ground is longer than the time taken if the tube was made out of plastic.

Sol: Basic knowledge

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64. Ans: The magnitude of the induced EMF in the loop is maximum when the plane of the loop is perpendicular to $\vec{B}$

Sol: $E \propto \sin\phi = \sin\omega t$
Maximum for $\phi = 90°$

65. Ans: 8.4 A

Sol: $Z = 30 + 20 = 50$

$$I = \frac{420}{50} = \frac{42}{5} = 8.4 \text{ A}$$

66. Ans: Neutron

Sol: $^{65}Cu + {}^{1}_{0}n \rightarrow {}^{66}Cu$

67. Ans: $(KE)_O / (K.E)_C = \frac{16}{12}$

Sol: $$\frac{K_O}{K_C} = \frac{m_O}{m_C} = \frac{16}{12}$$

68. Ans: $\frac{V_0}{\sqrt{2}}$

Sol: Power of both half cycles being passed by full wave rectifier. rms value equals input value = $\frac{V_0}{\sqrt{2}}$

69. Ans: 15 ln(2)/ln(8)

Sol: $15 \times \frac{\ell n2}{3\ell n2}$ = 5 min is half life

70. Ans: Z = A/2

Sol: No. of protons = μ_0g neutron

$$Z = \frac{A}{2}$$

71. Ans: 4π

Sol: $\upsilon = 12$ rev/s
$\omega_0 = 2\pi \times 1$
$\omega_t = 0$ t = 6 s

$$\alpha = \frac{\omega - \omega_0}{t} = \frac{0 - 24\pi}{6} = -4\pi$$

72. Ans: 2

Sol: $\tau = 1$ N m $= I\alpha$

Angular momentum = $\frac{I(\omega - \omega_0)}{t}$

Angular momentum = $\tau \times t$
$= 1 \times 2 = 2$

73. Ans: Proton

Sol: Uncertainty principle is valid only for sub-atomic particles

74. Ans: –1.5 eV

Sol: $$E_{3(H)} = \frac{-13.6}{9}$$
$= -1.51$ eV
3s, 3p and 3d orbitals of hydrogen have the same energy

75. Ans: HF

Sol: μ decreases in the order
$HF > HCl > HBr > HI > H_2$

76. Ans: CN^- and NO^+

Sol: CN^- and NO^+ have the same number of electrons and hence the same bond order

77. Ans: High temperature and low pressure

Sol: Real gases approach ideal behaviour at high temperature and low pressure

78. Ans: 0 and 0

Sol: Absolute zero is the temperature at which pressure of a gas (ideal or real) theoretically reduces to zero

79. Ans: $\Delta G = 0$ and ΔS = +ve

Sol: The system is in equilibrium between liquid and its vapour
$\therefore \Delta G = 0$ and ΔS = +ve

80. Ans: $\Delta H = 0$, $\Delta S_{surroundings} = 0$, $\Delta S_{system} > 0$ and ΔG = –ve

Sol: Mixing of gases is a spontaneous process
ΔG = –ve
The product is an ideal gas mixture
$\Delta H = 0$
ΔS_{system} = +ve
$\Delta S_{surrounding} = 0$

81. Ans: Mechanism of the reaction in presence and absence of catalyst could be different

Sol: A catalyst does not affect the reaction mechanism

82. Ans: $-|\Delta H°|$

Sol: $-(\Delta G°) = RT \ln K$ $\Delta G°$ is –ve

$$\frac{-\Delta G°}{RT} = \ln K$$

$$\frac{-\Delta H°}{RT} + \frac{T\Delta S°}{RT} = \ln K$$

$$\ln K = \frac{-\Delta H°}{RT} + \frac{\Delta S°}{R}$$

$\ln K$ vs $\frac{1}{T}$ Slope $\propto -\Delta H°$

Slope = $-|\Delta H°|$

83. Ans: reverse direction because Q > K

Sol: $\Delta G° = -2.303\ RT \log K$

$K \cong 10^{-28}$

$Q = \frac{1}{(10^4)^{3/2}} = 10^{-6}$

Q > K

Favours the reverse reaction

84. Ans: $(0.45 \times 10^{-4})^{1/3}$ mol dm^{-3}

Sol: For $PbCl_2$, $K_{sp} = 4s^3$

$S = \left(\frac{K_{sp}}{4}\right)^{1/3}$

$= (0.45 \times 10^{-4})^{1/3} M$

85. Ans: D-fructose

Sol: $\Delta T_f \alpha\ i\ m$

Highest F.P is for a solution with the lowest $i \times m$ value

D-fructose has i = 1

86. Ans: 3.73

Sol: 3 moles methanol in 1000 mL

Solution $\Rightarrow$ 3 M

3×32 g methanol in 900 g solution

$\therefore m = \frac{3 \times 1000}{804}$

= 3.73

87. Ans: 2×10^6 s

Sol: No. of moles of H_2 consumed = 1

$\therefore$ Current produced = 2F

$t = \frac{2 \times 96500}{96.5 \times 10^{-3}}$

$= 2 \times 10^6$ s

88. Ans: Zn(Hg) electrode potential is equal to HgO electrode potential

Sol: When a cell reaction is at equilibrium,

$E_{cell} = 0$

89. Ans: 84%

Sol: $MgCO_3 \longrightarrow MgO + CO_2$

84 g 40 g 1 mole

8.4 g 4 g 0.1 mol

% purity = 84%

90. Ans: 6

Sol: $Na_2CO_3.xH_2O$ with 50% H_2O $\Rightarrow$

106 g Na_2CO_3 + 106 g H_2O

$\therefore x = \frac{106}{18} = 5.88$

$\cong 6$

91. Ans: sp^3

Sol: 

$3\sigma + 1\ell p = sp^3$

92. Ans: No Answer

Sol: Bond order of

CO = 3

CN^- = 3

NO_2^+ = 2

(NO^+ = 3)

Note: If it would have been NO^+ instead of NO_2^+, then the answer is option (A)

93. Ans: $BeCl_2$

Sol: $BeCl_2$ is covalent in nature

94. Ans: CaH_2

Sol: $CaH_2 + 2H_2O \longrightarrow Ca(OH)_2 + \underset{\text{readily combustible gas}}{2H_2}$

$Ca(OH)_2 + CO_2 \longrightarrow \underset{\text{(white turbidity)}}{CaCO_3} + H_2O$

95. Ans: KO_2

Sol: $K + O_2 \longrightarrow KO_2$

96. Ans: Hoope's process

Sol: Purification of aluminium by electrolytic refining is called Hoope's process

97. Ans: B–F bond has partial double bond character

Sol: B–F bond has partial double bond character due to back bonding effect.

98. Ans: Ar

Sol: Argon is the most abundant element among noble gases in the atmosphere

99. Ans: K_2MnO_4, green

Sol: $2MnO_2 + 4KOH + O_2 \longrightarrow \underset{\text{(green)}}{2K_2MnO_4} + 2H_2O$

100. Ans: SO_2 gas bubbled through an acidic solution of $Cr_2O_7^{2-}$

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Sol: $Cr_2O_7^{2-} + 2H^+ + 3\overset{+4}{S}O_2 \longrightarrow \overset{+6}{Cr_2}(SO_4)_3 + H_2O$

101. Ans: Passing steam over red hot coke

Sol: $C + H_2O \longrightarrow \underset{\text{water gas}}{CO + H_2}$

102. Ans: 300 mL

Sol: 20 volume H_2O_2 means
1 mL H_2O_2 sample $\Rightarrow$ 20 mL O_2 at STP
$\because$ 15 mL H_2O_2 sample
$\Rightarrow 15 \times 20 = 300$ mL O_2 at STP

103. Ans: Oxide

Sol: Corundum is Al_2O_3

104. Ans: Na_2SO_4

Sol: $K_2CO_{3(aq)} + Na_2SO_{4(aq)} \longrightarrow Na_2CO_{3(aq)} + K_2SO_{4(aq)}$

105. Ans: fractional distillation

Sol: Fractional distillation

106. Ans: soluble in water

Sol: AgF is soluble in water

107. Ans: amino acids

Sol: Proteins are formed from α-amino acids

108. Ans: configuration

Sol: The letter D and L refer to the configuration

109. Ans: antiseptic

Sol: 0.2% solution of phenol is an antiseptic.

110. Ans: Kolbe-Schmitt

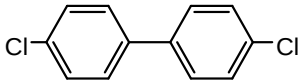
Sol: It is Kolbe-Schmitt reaction

111. Ans: $SOCl_2$ and C_6H_5CHO

Sol: $C_6H_5CO_2H \xrightarrow{SOCl_2} C_6H_5COCl \xrightarrow[\text{quinoline}]{H_2, Pd/BaSO_4} C_6H_5CHO$

112. Ans: $H_3C - \overset{\bullet}{C}H - CH_2Br$

Sol: $\overset{\bullet}{Br}$ adds first to form $CH_3 - \overset{\bullet}{C}H - CH_2Br$

113. Ans: 

Sol: Phenyl group is ortho, para directing

114. Ans: I < III < II < IV

Sol: Presence of groups having –I effect near the carboxyl group considerably increases the acid strength of aliphatic acids

115. Ans: non-benzenoid and aromatic

Sol: Huckel's rule of aromaticity

116. Ans: III < I < IV < II

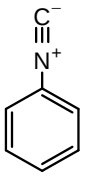
Sol: Reactivity order of alkyl halides towards S_N2 is 3° < 2° < 1°

117. Ans: amide ion

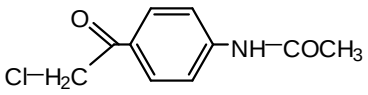
Sol: $\overset{\ominus}{N}H_2$ is the strongest base

118. Ans: dibenzylideneacetone

Sol: $2C_6H_5CHO \xrightarrow[\text{NaOH / heat}]{CH_3-\overset{O}{\overset{\|}{C}}-CH_3} C_6H_5-CH=CH-\overset{O}{\overset{\|}{C}}-CH=CH-C_6H_5$

119. Ans: 

Sol: It is carbylamine reaction

120. Ans: 

Sol: Acetylation of aniline followed by Friedel-Crafts acylation occurs

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