SOLUTIONS & ANSWERS FOR KERALA ENGINEERING ENTRANCE EXAMINATION-2019 − Paper - 1 VERSION – A1

[PHYSICS & CHEMISTRY]

1. Ans: $ML^{-1}T^{-2}$

Sol: $[P]=\frac{[F]}{[A]}=\frac{MLT^{-2}}{L^2}$ = $ML^{-1}T^{-2}$

2. Ans: $0.5m/s^2$

Sol: Stopping distance

$$S=\frac{v^2}{2a}$$

$$a=\frac{v^2}{2S}=\frac{10^2}{2\times100}=0.5m/s^2$$

3. Ans: The closeness of the mean of the readings to the true value

Sol: the closeness of the mean of the reading to the true value

4. Ans: v_{15} = 100 m/s and v_{25} = 25m/s

Sol: velocity = Area under v-t graph

$$v_{15}=\frac{1}{2}\times10\times10+5\times10=100m/s$$

$$v_{25}=\frac{1}{2}\times10\times10+5\times10+\frac{1}{2}\times10\times10$$

$$=150m/s$$

5. Ans: 50 J

Sol: v = u + at

= 5 + 1 × 5 = 10m / s

$$=KE=\frac{1}{2}Mv^2=\frac{1}{2}\times1\times10^2=50\,J$$

6. Ans: At time t = 0 s, there is a deceleration of the object

Sol: $v(t)=v_0-5t+5t^2$

$$a(t)=\frac{dv}{dt}=-5+10t$$

At t = 0s

A = –5 + 10 × 0 =–5

7. Ans: 2.5km

Sol: Distance covered across river S_H = 2km

Time = $\frac{S_H}{v_b}=\frac{2}{4}=0.5hrs$

Distance covered along river

$S_V = v_r \times t$

= 3 × 0.5 = 1.5km

$S=\sqrt{S_H^2+S_v^2}=\sqrt{2^2+1.5^2}$

2.5km

8. Ans: $400\pi^2 m/s^2$

Sol: $\omega = 2\pi f = 2\pi \times 10 = 20\pi$

$a_C = r\omega^2 = 1 \times (20\pi)^2 = 400\pi^2 m/s^2$

9. Ans: The wave vector is given $\vec{k}=\frac{2\pi}{3}\hat{z}$

Sol: Theory

10. Ans: The radiation is in the form of an electromagnetic wave which carries momentum but not energy.

Sol: Theory

11. Ans: The magnetic field is directed along the loop L

Sol: Theory

12. Ans: 10^{16}

Sol: Energy emitted per second = power of the source

nhu = p

$$n\times6.63\times10^{-34}\times\frac{1}{6.63}\times10^{16}=10^{-2}$$

$n = 10^{16}$

13. Ans: Devices built using sodium can operate with ultraviolet light.

Sol: Energy associated with these wave

$$E=\frac{hc}{\lambda}=\frac{12400}{\lambda(A^\circ)}=\frac{1.24\times10^{-6}\times\upsilon}{c}eV$$

$$E_1=\frac{1.24\times10^{-6}\times4\times10^{14}}{3\times10^8}$$

$$=1.65eV$$

$$E_2=\frac{1.24\times10^{-6}\times8\times10^{14}}{3\times10^8}$$

$$=3.30eV$$

$E_{infra} < E_1 < E_2 < E_{ultra}$

14. Ans: The image is magnified, real and inverted.

Sol: $u = -9 \quad R = {}^{-}12 \quad f = \frac{R}{2} = -6$

$$\frac{1}{v}+\frac{1}{u}=\frac{1}{f}$$

$$\frac{1}{v}=\frac{1}{-6}-\frac{1}{-9}=\frac{1}{9}-\frac{1}{6}=\frac{-1}{18}$$

$v = -18$

$$m=\frac{-v}{u}=\frac{-(-18)}{-9}=-2$$

15. Ans: 2660 / 17 cm

Sol:
$$\frac{n_{med}}{f_{med}}=(n_2-n_1)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$$

$$\frac{1}{f_{air}}=[n-1]\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$$

$$2.5 = [1.5-1.]\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$$

$$2.5=0.5\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$$

$$\frac{1}{R_1}-\frac{1}{R_2}=\frac{2.5}{0.5} \quad \text{----------(1)}$$

$$\frac{1.33}{f_{med}}=[1.5-1.33]\times\frac{2.5}{0.5}$$

$$\frac{1.33}{f_{med}}=0.17\times 5$$

$$f_{med}=\frac{1.33}{0.17\times 5}=\frac{1.33}{0.85}$$

$$=\frac{133}{0.85}=\frac{13300}{0.85}$$

$$=\frac{2660}{17}\text{ cm}$$

16. Ans: $\frac{\lambda}{\alpha}$

Sol: $\theta=\frac{\lambda}{\alpha}$

17. Ans: $\frac{1}{2}I_1$

Sol: $150\text{nm}=\frac{\lambda}{4},\phi=\frac{2\pi}{4}=\frac{\pi}{2}$

$$I_1=4I_0\cos^2\left(\frac{\phi}{2}\right)$$

$$=4I_0\text{Cos}^2\left(\frac{\pi}{4}\right)=2I_0$$

$$200\text{nm}=\frac{\lambda}{3},\ \phi=\frac{2\pi}{3}$$

$$I_2=4I_0\cos^2\left(\frac{\pi}{3}\right)=I_0$$

$$I_2=\frac{I_1}{2}$$

18. Ans: $\tan^{-1}(1.33)$

Sol:
$$\theta_B=\tan^{-1}\left(\frac{n_2}{n_1}\right)$$

$$=\tan^{-1}(1.33)$$

19. Ans: the height of the transmitter and the radius of the earth

Sol: Out of syllabus

20. Ans: 195 kHz to 205 kHz

Sol: $f_C + f_m = 205KH_3$
$f_C - f_m = 195\ KH_3$

21. Ans: To radiate the signal to a large distance using antennas

Sol: Theory

22. Ans: a p-n semiconductor with a forward bias

Sol: Theory

23. Ans: The width of the depletion region depends on the doping level in the p-type and n-type regions

Sol: Theory

24. Ans: $\sqrt{\frac{2(a^5-b^5)}{5(a^3-b^3)}}$

Sol: Moment of inertia of hollow sphere
= MI of outer sphere
− MI of inner sphere

$$=\frac{2}{5}M_0a^2-\frac{2}{5}M_ib^2$$

$$=\frac{2}{5}\rho.\frac{4}{3}\pi a^3a^2-\frac{2}{5}\rho.\frac{4}{3}\pi b^3b^2$$

$$K=\sqrt{\frac{I}{m}}=\sqrt{\frac{\frac{2}{5}\times\frac{4}{3}\pi\rho(a^5-b^5)}{\rho\frac{4}{3}\pi(a^3-b^3)}}$$

$$= \sqrt{\frac{2\left(a^5 - b^5\right)}{5\left(a^3 - b^3\right)}}$$

25. Ans: 0.7 N-m

Sol: $\tau = fR = \left(\frac{mg\sin\theta}{1+\frac{R^2}{K^2}}\right) \times R$

$$\tau = \frac{2}{7} mg\sin\theta \times R$$

$$= \frac{2}{7} \times 1 \times 10\sin 30^\circ \times 0.5$$

$$= \frac{2}{7} \times 10 \times \frac{1}{2} \times 0.5$$

$$= \frac{10 \times 0.5}{7} = 0.7\,Nm$$

26. Ans: 6 hours

Sol: $R_1 = \frac{R}{2}$

According to law of conservation of angular momentum,

$$I_1\omega_1 = I_2\omega_2$$

$$I_1\frac{2\pi}{T_1} = I_2\frac{2\pi}{T_2}$$

$$\frac{I_1}{T_1} = \frac{I_2}{T_2}$$

$$T_2 = \frac{I_2}{I_1} \times T_1$$

$$= \frac{\frac{2}{5}\frac{MR^2}{4} \times 24}{\frac{2}{5}MR^2}$$

$$= \frac{24}{4} = 6\,hours$$

27. Ans: $\therefore \tau_H > \tau_s$

Sol: $\tau = fR$

Where f is the frictional force

$$f_s = \frac{2}{7} mg\sin\theta\,[Solidsphere]$$

$$f_H = \frac{2}{5} mg\sin\theta\,[hollow\ sphere]$$

$$\therefore \tau_H > \tau_s$$

28. Ans: 7 m / s

Sol:

$$v = \sqrt{2g\sin\theta S - 2\mu g\cos\theta S}$$

From the figure, $\sin 30^\circ = \frac{5}{S}$

$$S = \frac{5}{\sin 30^\circ} = 10m$$

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

$$= \sqrt{100 - \frac{100}{2}} = \sqrt{100-50} = \sqrt{50} \approx 7ms^{-1}$$

29. Ans: 12.6 km/s

Sol: $V_{escape} = \sqrt{\frac{2GM}{R}}$

$$= \sqrt{\frac{2 \times 6 \times 10^{-11} \times 8 \times 10^{24}}{6 \times 10^6}} = 12.6\,km/s$$

30. Ans: 11 years

Sol: $T^2 \propto r^3$

$$T \propto r^{\frac{3}{2}}$$

$$\frac{T_A}{T_B} = \left(\frac{r_A}{r_B}\right)^{\frac{3}{2}} = \left(\frac{1}{5}\right)^{\frac{3}{2}}$$

$$= \frac{1}{5\sqrt{5}}$$

$T_B = 5\sqrt{5}\,T_A = 5\sqrt{5} \times 1 \cong$ 11 years

31. Ans: 0.75 mg

Sol: $M = \frac{M_0}{2^{\frac{t}{t_{\frac{1}{2}}}}}$

$$= \frac{12}{2^{\frac{24}{6}}} = \frac{12}{2^4}$$

$$M = \frac{12}{16} = 0.75mg$$

32. Ans: Heavier nuclei have more neutrons than protons

Sol: Theory

33. Ans: it is a long range force

Sol: Theory

34. Ans: $_{13}Al^{27}$

Sol: isotone = same number of neutrons
$_{8}O^{16}$ = 16 − 8 = 8
$_{7}N^{15}$ = 15 − 7 = 8
$_{6}C^{14}$ = 14 − 6 = 8
$_{13}Al^{27}$ = 27 − 13 = 14
$_{9}F^{17}$ = 17 − 9 = 8

35. Ans: $1.25\,\pi$ mV

Sol:
$$\Delta\phi = BA\left(\cos 0 - \cos\frac{\pi}{3}\right)$$

$$E = \frac{\Delta\phi}{\Delta t} = \frac{BA}{2} = \frac{B\pi r^2}{2}$$

$$= \frac{1\times\pi\times 25\times 10^{-4}}{2}$$

$$= 12.5\pi\times 10^{-4} = 1.25\pi\text{mV}$$

36. Ans: $ML^2\,T^{-2}\,A^{-2}$

Sol:
$$M = \frac{\phi}{i}$$

$$\frac{BA}{i} = \frac{MA^{-1}T^{-2}L^2}{A}$$

$= ML^2\,T^{-2}\,A^{-2}$

37. Ans: $\frac{11}{3\pi}$A

Sol: Given angular frequency = 300Hz, should be frequency =300Hz

$$I_{rms} = \frac{V}{X_L}$$

$$= \frac{220}{L\omega}$$

$$= \frac{220}{0.1\times 2\pi\times 300} = \frac{11}{3\pi}\text{A}$$

L=0.1

V_{rms} = 220V

f=300H_z

38. Ans: $\frac{1}{\sqrt{LC}}$

Sol: Condition of resonance

$$X_L = X_C$$

$$L\omega_0 = \frac{1}{C\omega_0}$$

$$\omega_0^2 = \frac{1}{LC}$$

$$\omega_0 = \frac{1}{\sqrt{LC}}$$

39. Ans: The efficiency of the Carnot cycle is higher for case -III

Sol:
$$\eta_1 = 1-\left(\frac{T_2}{T_1+\Delta T}\right)$$

$$\eta_2 = 1-\left(\frac{T_2+\Delta T}{T_1}\right)$$

$$\eta_3 = 1-\left(\frac{T_2-\Delta T}{T_1}\right)$$

$$\eta_3-\eta_1 = \frac{T_2}{T_1+\Delta T} - \frac{(T_2-\Delta T)}{T_1}$$

$$= \frac{T_2T_1 - T_1T_2 + T_1\Delta T - T_2\Delta T + (\Delta T)^2}{(T_1+\Delta T)(T_1)}$$

$$\frac{(T_1-T_2)\Delta T + (\Delta T)^2}{(T_1+\Delta T)(T_1)} > 0$$

$\eta_3 > \eta_1 > \eta_2$

40. Ans: 10^{-6} times the average speed of an air molecule

Sol:
$$V_{avg}\ \alpha\ \frac{1}{\sqrt{M}}$$

$$\frac{V_{smoke}}{V_{air}} = \sqrt{\frac{M_{air}}{M_{smoke}}} = \sqrt{\frac{1}{10^{12}}} = 10^{-6}$$

41. Ans: $\pm 0.1^\circ$C

Sol: Maximum error permitted $= \frac{1}{10^6}$m

$\alpha\,\Delta T = 10^{-6}$

$1\times 1\times 10^{-5}\times\Delta T = 10^{-6}$

$\Delta T = 0.1^\circ$C

42. Ans: 682 K

Sol:
$$V_1 = \frac{V}{20}$$

P_1 = 50 atm, T = 273K, P=1 atm

$$\frac{PV}{P_1V_1} \propto \frac{T}{T_1}$$

$$T_1 = \frac{P_1V_1T}{PV}$$

$$= \frac{50\times\frac{V}{20}\times 273}{1\times V}$$

$$= \frac{5}{2}\times 273$$

= 682 K

43. Ans: 5 m/s

Sol: K = 50N/m

$$\frac{1}{2}mv^2 = \frac{1}{2}k(\Delta x)^2$$

$$v = \sqrt{\frac{k}{m}(\Delta x)^2}$$

$$= \sqrt{\frac{50}{20\times10^{-3}}\times(10\times10^{-2})^2}$$

$$= \sqrt{\frac{50\times100\times10^{-4}}{20\times10^{-3}}}$$

$$= \sqrt{25} = 5ms^{-1}$$

44. Ans: $F_L = F_A$

Sol: Buoyant force V σ g
V − volume of block
σ − density of liquid

45. Ans: 100 N / m^2

Sol: Excess pressure of a bubble = $\frac{4T}{R_1}$

Excess pressure of a drop = $\frac{2T}{R_2}$

$$R_2 = \frac{R_1}{2}$$

∴ Excess pressure of a drop

= $\frac{2T\times2}{R_1} = \frac{4T}{R_1}$

Therefore the pressure difference between the inside and outside of the droplet is 100 N/m^2,

46. Ans: a linear combination of terms involving h and h^2

Sol: $\frac{1}{2}mv^2 = mg(h-h') + \frac{1}{2}k(x^2 - x'^2)$

47. Ans Positive and negative with power integrated over a period being positive

Sol: Theory

48. Ans: Ratio of energy stored per cycle to the energy dissipated per cycle

Sol: Theory

49. Ans: dependent on the direction of projection

Sol: Theory

50. Ans: 66 m

Sol: $S = ut + \frac{1}{2}at^2$

$$= 5\times6 + \frac{1}{2}\times2\times6^2$$

= 30 + 36 = 66 m

51. Ans: 2×10^4 N

Sol: $v^2 = 2aS$

$$a = \frac{v^2}{2S} = \frac{10^2}{2\times5} = \frac{100}{10} = 10$$

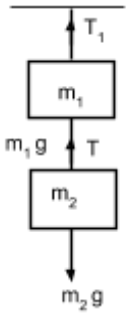
$F = ma = 2000 \times 10 = 2 \times 10^4$ N

52. Ans: 20 kg, 20 kg

Sol: Conceptual

53. Ans: $(m_1+m_2)g$

Sol:



$m_2g = T$
$T' = T - m_1g = 0$
$T' = T + m_1g$
$= (m_1 + m_2)g$

54. Ans: $\frac{1}{e}$ N/C, F and E against each other

Sol: $E = \frac{F}{e} = \frac{1}{e}N/C$

F and E are against each other

55. Ans: 5 cm

Sol:

$$\frac{k2}{x^2} = \frac{k8}{(15-x)^2}$$

$$\frac{1}{x^2} = \frac{4}{(15-x)^2}$$

$$\frac{1}{x} = \frac{2}{15-x}$$

2x = 15 − x
15 = 3x, x = 5 cm

56. Ans: 0V and $\frac{\sqrt{2}}{5}k\frac{V}{m}$

Sol: V at the centre = 0

Electric field at the centre

$= \frac{\sqrt{2}\times 2\times k\times 5}{\left(5\sqrt{2}\right)^2} = \frac{\sqrt{2}}{5}k\frac{V}{m}$

57. Ans: The force on the dipole is zero while torque rotates the dipole on the xy -plane

Sol: Field is uniform, so F = 0

But $\vec{\tau} = \vec{P}\times\vec{E} = P_0E_0\left(2\hat{j}-3\hat{i}\right)$

Note :- This is in the direction of torque

58. Ans: 1.5nF, 9nC

Sol: C_{eff} = 3nF series 3n F

$= \frac{3}{2} = 1.5nF$

$Q = C_{eff}\times V = \frac{3}{2}\times 10^{-9}\times 6 = 9nC$

59. Ans: $\frac{1}{3}\Omega$,27 A

Sol: $R_{eff} = 1 \parallel 1 \parallel 1$

$= \frac{1}{3}\Omega$

I = (27 × 3)A

$\Rightarrow I_3$ = 27A

60. Ans: 2V, 1mA

Sol: No current through

10pF$\Rightarrow R_{eff}$ =3kΩ

$V_2 = \frac{3\times 2}{3} = 2V$

$i_2 = \frac{3}{3\times 10^3} = 1mA$

61. Ans: 8000J

Sol: $H = \frac{20\times 20}{3}\times 60 = 8000J$

62. Ans: +π / 2

Sol: Conceptual

63. Ans: Driving frequency is the same as the natural frequency of the oscillator

Sol: Conceptual

64. Ans: 0.4 Seconds

Sol: $a_{max} = 8\pi = \omega^2 A$

$v_{max} = 1.6 = \omega A$

$\omega = \frac{8\times\pi}{1.6} = \frac{2\pi}{T}$

$\Rightarrow T = \frac{2\times 1.6}{8} = 0.4s$

65. Ans: 16.5m

Sol: $t = \frac{2L}{v} = \frac{2\times L}{330}$

$= \frac{2L}{330} = 0.1$

$L = \frac{33}{2} = 16.5m$

66. Ans: amplitude = 0.05 m, frequency = 4.456Hz and wavelength = 3.518m

Sol: A = 0.05m

ω= 28 =2πf

$7 = \frac{28}{2\times 3.14} \approx 4.456HZ$

$= \frac{2\pi}{\lambda} = 2-0$

$= \lambda = 3.14m$

Given as 3.518m

67. Ans: E

Sol: And logic

$216 = \left(\frac{v}{v-v_s}\right)f$

$184 = \left(\frac{v}{v+v_s}\right)f$

$\Rightarrow (v-v_s)216 = (v+v_s)184$

$\Rightarrow 216v - 216v_s = 184v + 184v_s$

$\Rightarrow 32v = 400v_s$

$\Rightarrow \frac{v}{v_s} = \frac{400}{32} = \frac{100}{8} = \frac{25}{2}$

$f = \left(\frac{v+v_s}{v}\right)184$

$= \left(\frac{v+v_s}{v}\right)184 = \left(1+\frac{2}{25}\right)184$

$\frac{27}{25}\times 184 = 198.72 \approx 200HZ$

68. Ans: No answer

Sol: If any one of the input is zero out is zero. The combination should be AND logic

69. Ans: make helical motion if $\vec{v}$ is neither parallel nor orthogonal to $\vec{B}$

Sol: Conceptual

70. Ans: $\frac{\mu_0}{2R} I\hat{z}$

Sol: $\frac{\mu_0}{2R} I\hat{z}$ using right hand thumb rule

71. Ans: Current flowing in same direction will lead to attraction and opposite directions will lead to repulsion

Sol: Conceptual

72. Ans: Its valence electrons are more tightly bound to their parent nuclii

Sol: Conceptual

73. Ans: 3

Sol: NO^+ has 14 electrons
$\therefore$ Bond order = 3

74. Ans: PH_3

Sol: Boiling point of group 15 hydrides increases in the order
$PH_3 < AsH_3 < NH_3 < SbH_3 < BiH_3$

75. Ans: BF_3, SIF_4, PF_3

Sol: They are electron pair acceptors

76. Ans: One sigma and two π bonds

Sol: CaC_2 contains C_2^{2-} ion

$$\left[\overset{\bullet\bullet}{C} \equiv \overset{\bullet\bullet}{C}\right]^{2-}$$

77. Ans: Pyramidal

Sol: The hybridisation of Cl in ClO_3^- is sp^3 and it contains 3 bond pairs and 1 lone pair

78. Ans: Stronger acid than that in water

Sol: $$CH_3COOH + NH_3 \longrightarrow$$

$$NH_4^+ + CH_3COO^-$$

Acetic acid is almost completely converted to NH_4^+ ion which is a characteristic cation of the solvent
$\therefore$ Acetic acid behaves as a strong acid in NH_3

79. Ans: All the compounds exist

Sol: All the pentafluorides of group 15 elements except nitrogen, does exists

80. Ans: Dipole-induced dipole interaction

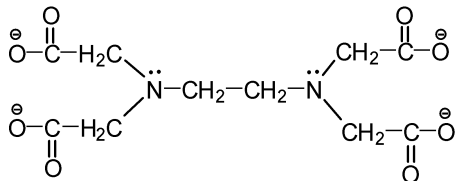
Sol: Water induces a dipole moment in noble gases and thereby they interact with each other

81. Ans: ZnO

Sol: ZnO when heated exhibits metal excess defect

82. Ans: Two N and four O

Sol:



83. Ans: Hard bases

Sol: According to HSAB principle, hard acids prefer to combine with hard bases

84. Ans: CN^-

Sol: CN^- is a pseudo halide

85. Ans: (A) and (C)

Sol: $PCl_3 + 3H_2O \rightarrow H_3PO_3 + 3HCl$
PCl_3 is a yellow fuming liquid

86. Ans: Mg_3N_2

Sol: $$\underset{(A)}{(NH_4)_2Cr_2O_7} \longrightarrow$$

$$\underset{(C)}{N_{2(g)}} + \underset{(B)}{Cr_2O_{3(s)}} + H_2O_{(g)}$$

$$\underset{(C)}{N_{2(g)}} + 3Mg \longrightarrow \underset{(D)}{Mg_3N_{2(s)}}$$

$$\underset{(D)}{Mg_3N_2} + H_2O \longrightarrow Mg(OH)_2 + \underset{(E)}{NH_3}$$

$$NH_3 + HCl \longrightarrow \underset{\text{(dense white fumes)}}{NH_4Cl}$$

87. Ans: 34.4

Sol: Number of moles of O_2 left = $35 - \frac{35 \times 5.5}{100} = 33.075$

Total no. of moles of $O_2 + O_3$

$$= 33.075 + 1.925 \times \frac{2}{3} = 34.36$$

88. Ans: (A) and (C)

Sol: Carnallite is $KCl.MgCl_2.6H_2O$

89. Ans: 1×10^{24}

Sol: Total energy = 100 (V) × 1(A) × 60 × 60 (s)

Energy of a photon, $E = \frac{hc}{\lambda}$

$$= \frac{6.626 \times 10^{-34} \times 3 \times 10^8}{550 \times 10^{-9}}$$

No. of photons =

$$\frac{100 \times 60 \times 60 \times 550 \times 10^{-9}}{6.626 \times 3 \times 10^{-34} \times 10^8}$$

$= 1 \times 10^{24}$

90. Ans: J s

Sol: Angular momentum $= \frac{nh}{2\pi}$

Unit is J s

91. Ans: 3D network of corner shared octahedra

Sol: Formula is MO_3

O^{2-} forms 3D network with M^{6+} at the corners

92. Ans: Density of the structure II is lower than structure I

Sol: Structure I is fcc

Structure II is bcc

$$\frac{d_{bcc}}{d_{fcc}} = \frac{2 \times 3\sqrt{3} \times 4\sqrt{2}}{64} < 1$$

93. Ans: NA

Sol: $\Delta U = q + W$

$q = 0$

$W = 1.33\ L - atm$

$= 1.33 \times 101.3$ J

$= 134.73$ J

$$nR = \frac{PV}{T} = \frac{10^5 \times 10^{-3}}{300} = \frac{1}{3}$$

(assuming pressure to be 1 atm)

$\Delta U = n C_v \Delta T$

$134.83 = n \times \frac{3}{2} R \Delta T$ (assuming monoatomic)

$\Delta T = 269$

Final temperature = 269 + 300 = 569 K

94. Ans: $\frac{3.46}{RT}$

Sol: $H_2O_{(\ell)} \rightarrow H_{2(g)} + \frac{1}{2} O_{2(g)}$

$P_{O_2} + P_{H_2} = P_{total} - P_{N_2}$

$= 2 - 1 = 1$ atm

$PV = nRT \quad \therefore n = \frac{PV}{RT}$

$$n_{H_2} + n_{O_2} = \frac{1 \times 5.2}{RT}$$

1 mol $H_2O_{(+)} \rightarrow 1.5$ mol of gaseous pdts ($H_2 + O_2$)

$\therefore$ No. of moles of H_2O

$$= \frac{5.2}{RT} \times \frac{2}{3} = \frac{3.46}{RT}$$

95. Ans: 16.45

Sol: 100 L solution contains 20 L CH_3OH

$\therefore$ Wt. of solution = d × V

= 0.964 × 100

= 96.4 kg

Wt. of pure CH_3OH

= 0.793 × 20

= 15.86 kg

Wt. % of $CH_3OH = \frac{15.86}{96.4} \times 100$

= 16.45

96. Ans: 1×10^{-5}

Sol: $p_{O_2} = x_{O_2} \times K_H$

$$x_{O_2} = \frac{0.434}{4.34 \times 10^4}$$

$= 1 \times 10^{-5}$

97. Ans: 802 kJ

Sol: $CH_{4(g)} + 2O_{2(g)} \xrightarrow{\Delta_r H} CO_{2(g)} + 2H_2O_{(+)}$

$2H_2O_{(+)} \xrightarrow{\Delta_{vap}H} 2H_2O_{(g)}$

$\therefore$ Total enthalpy change = $\Delta_r H + \Delta_{vap} H$

= [(−394.8 + 2 × −285.82) − (−76.2)] + 2 × 44

= −802 kJ

98. Ans: 1.62 and 98.3

Sol: $i = \frac{60}{117.8} = 0.509$

$\alpha_{ass} = \frac{1-i}{1-\frac{1}{n}} = \frac{1-0.509}{1-0.5}$

= 0.983

$W_B = \frac{\Delta T_b . M_B . W_A}{i . K_b . 1000}$

$= \frac{0.36 \times 60 \times 100}{0.509 \times 2.57 \times 1000}$

= 1.65 g

W % of solute $= \frac{1.65}{101.65} \times 100$

= 1.62 g

99. Ans: 3.3

Sol:

$CO + Cl_2 \rightarrow COCl_2$

Initially	2 mol	4 mol	
Al eqbm	2-x	4-x	x

Given 2 − x = 1 $\therefore$ x = 1

$\therefore [CO]_{eqbm} = \frac{1}{10}$

$[Cl_2]_{eqbm} = \frac{3}{10}$

$[COCl_2]_{eqbm} = \frac{1}{10}$

$K = \frac{[COCl_2]}{[CO][Cl_2]} = \frac{\frac{1}{10}}{\frac{1}{10} \times \frac{3}{10}}$

$= \frac{10}{3} = 3.3$

100. Ans: $K_2 = K_1^2$

Sol: $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)} \rightarrow K_1$

$2N_{2(g)} + 6H_{2(g)} \rightleftharpoons 4NH_{3(g)} \rightarrow K_2$

$\therefore K_2 = K_1^2$

101. Ans: 0.02231 min^{-1}

Sol: $k = \frac{2.303}{t} \log \frac{[R]_0}{[R]}$

$= \frac{2.303}{10} \log \frac{25}{20}$

$= \frac{2.303}{10} \log \frac{5}{4}$

$= \frac{2.303 \times 0.0969}{10}$

= 0.02231 min^{-1}

102. Ans: $\frac{-2.303\,RT}{F}$

Sol:

$E_{cell} = E^\circ_{cell} - \frac{2.303\ RT}{nF} \log \frac{[anode]}{[cathode]}$

$= \frac{-2.303\,RT}{F} \log \frac{1}{10^{-1}}$

$= \frac{-2.303\,RT}{F}$

103. Ans: 0.0186 moles

Sol: During recharging,

$2PbSO_4 + 2H_2O \longrightarrow PbO_2 + Pb + 2H_2SO_4$

$2F \longrightarrow 1 \text{ mol } PbSO_4$

$3600\ C \longrightarrow \frac{3600}{2 \times 96500}$ moles

= 0.0186 moles

104. Ans: Both (A) and (C)

Sol: Anode reaction,

$H_{2(g)} \rightarrow 2H^+ + 2e^-$

Cathode reaction,

$\frac{1}{2} O_{2(g)} + 2H^+ + 2e^- \rightarrow H_2O$

Total cell reaction (acidic medium)

$H_{2(g)} + \frac{1}{2} O_{2(g)} \rightarrow H_2O_{(\ell)}$

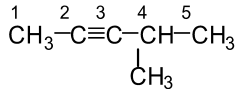
The concentration of electrolyte decrease as the cell reaction proceeds

Open circuit voltage (OCV) is E°_{cell} when $p_{H_2} = p_{O_2} = 1 bar$

E°_{cell} remains as constant

105. Ans:

4-methyl-2-pentyne

Sol: 

106. Ans: Bromine test

Sol: Aniline decolourises bromine water precipitating 2,4,6-tribromoaniline. Cyclohexylamine has no reaction with bromine water

107. Ans: aromatic and anti-aromatic

Sol: Planar cyclooctatetraene does not exist because it is antiaromatic

108. Ans:
1-bromopropane

Sol: $CH_3 - CH = CH_2 \xrightarrow{HBr / H_2O_2}$

$CH_3 - CH_2 - CH_2Br$

109. Ans: Histamine

Sol: Histamine is a potent vasodilator

110. Ans: Laevorotatory

Sol: Invert sugar is laevorotatory. It is an equimolar mixture of D-(+)-glucose and D-(−)-fructose

111. Ans: $CH_3CH_2^-$

Sol: The strongest base is the conjugate base of the weakest acid. The order of acid strength of the conjugate acids is:
H_2O > EtOH > CH≡CH > NH_3 > CH_3-CH_3

112. Ans: steric factor which prevents E2 mechanism

Sol: Due to steric reasons, neopentyl halide cannot undergo elimination by E2 mechanism

113. Ans:
Gabriel-phthalimide synthesis

Sol: Aryl halides do not react with potassium phthalimide in Gabriel phthalimide synthesis

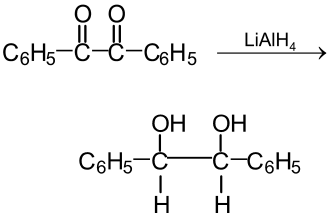
114. Ans:
m-benzenedisulfonic acid

Sol: When heated with excess of fuming sulphuric acid at 473 K, benzene forms benzene-m-disulfonic acid as the main product

115. Ans: Cannizzaro

Sol: Disproportionation occurs. It is an example of intramolecular Cannizzaro reaction

116. Ans: 3

Sol: 

The product contains two similar chiral carbon atoms. So 3 optical isomers are possible

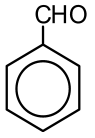
117. Ans: t-butyl benzene

Sol: t-Butyl benzene does not undergo oxidation to form benzoic acid

118. Ans: S-configuration

Sol: Hofmann rearrangement is an intramolecular rearrangement. Retention of conjugation occurs

119. Ans: NH_2OH followed by dehydration with acetic anhydride

Sol: 

120. Ans:

Sol: group is meta directing