BPT-03 (NEET) SOLUTIONS

1. (b)

Sol. Apparent coefficient of Volume expansion

$\gamma_{app.} = \gamma_L - \gamma_s = 7\gamma_s - \gamma_s = 6\gamma_s$ (given $\gamma_L = 7\gamma_s$)

Ratio of absolute and apparent expansion of liquid

$\frac{\gamma_L}{\gamma_{app.}} = \frac{7\gamma_s}{6\gamma_s} = \frac{7}{6}$.

2. (b)

Sol. Use heat required ≡ heat released.

3. (a)

Sol. Heat Lost by water = Heat gain by ice cold brass.

4. (b)

Sol. $\frac{H_1}{H_2} = \frac{m_1c_1}{m_2c_2} = \frac{\frac{4}{3}\pi r_1^3.\rho_1.C_1}{\frac{4}{3}\pi r_2^3.\rho_2 C_2} = \frac{r_1^3}{r_2^2} \times \frac{\rho_1}{\rho_2} \times \frac{C_1}{C_2}$

5. (b)

Sol. Heat gain by ice = Heat Lost by water.

6. (b)

Sol. $P = \frac{1}{64} = \frac{mL}{t} \quad \therefore L = \frac{Pt}{m}$

7. (a)

Sol. 5 kg

water $\rightarrow$ water

[20^0C] [100^0C]

$\Delta Q = mC_{gm}\,\Delta T$

8. (c)

Sol. Let T be the same numerical value of temperature on Celsius scales and Farenhe it scale, Then using the relations. $\frac{°C}{100} = \frac{°F - 32}{180}$ According to questions

$°C = °F = T \therefore \frac{T}{100} = \frac{T-32}{180°} \therefore T = -4°C = -40°F$

9. (c)

Sol. $\frac{\Delta L}{L} = 2\% = \frac{2}{100}$

$\alpha = 0.00002°C^{-1}$

As $\Delta L = \alpha L \Delta T$

Or $\Delta T = \frac{\Delta T}{\alpha L} = \frac{2}{100 \times 0.00002} = \frac{1}{0.001}$

$= 10^3 = 1000°C$

10. (b)

Sol. As $\beta = 2\alpha$ and $\gamma = 3\alpha \therefore \frac{\beta}{\gamma} = \frac{2\alpha}{3\alpha} = \frac{2}{3}$

11. (d)

Sol. According to Wien's law

$\lambda_m T = b$ = constant

12. (c)

Sol. The circular plate maximum surface area and as such it cools the fastest. For a given volume (mass in this case), a sphere has the least surface area and accordingly cools the slowest.

13. (c)

Sol. $P_0V_0 = nRT$

If temperature is changed to T without changing the pressure then

$P_o V = nRT$

$\Rightarrow P_0(V - V_0) = nRT(T - T_0) \Rightarrow P_0\, AV = n\,R\,AT$

using $nR = \frac{P_0V_0}{T_0}$

$\frac{\Delta V}{\Delta T} = \frac{V_0}{T_0}$

Now thermal coefficient of volume expansion at constant pressure

$\frac{1}{V_0}\frac{\Delta V}{\Delta T} = \frac{1}{T_0}$

14. (d)

Sol. 150 J of heat has been added to the gas.

15. (d)

Sol. According to an ideal gas equation

$PV = nRT$

Or $V = \frac{nRT}{P}$

$\because P = \frac{a}{T}(Given)$ ….. (i)

$\therefore V = \frac{nRT^2}{a}$

$\Rightarrow dV = \frac{2nRT}{a}dT$ .....(ii)

Work done by the gas, dW = PdV

Or $W = \int_T^{4T} \frac{a}{T}\frac{2nRT}{a}dT \quad (u\sin g\,(i)\,and\,(ii))$

$= [2nRT]_T^{4T} = 6nRT$

16. (d)

Sol. Here, $\eta_1 = 1 - \frac{T_2}{T_1}$ Or $0.25 = 1 - \frac{T_2}{T_1} \Rightarrow \frac{1}{4} = 1 - \frac{T_2}{T_1}$

$\frac{T_2}{T_1} = 1 - \frac{1}{4} = \frac{3}{4}$

According to question

$\eta_2 = 2\eta_1$ and $T_2 = T_2 - 58^\circ C$

$\therefore 2 \times \frac{1}{4} = 1 - \frac{(T_2 - 58^\circ C)}{T_1} \Rightarrow 1 - \frac{1}{2} = \frac{T_2 - 58^\circ C}{T_1}$

$\frac{1}{2} = \frac{T_1}{T_1} = -\frac{58^\circ}{T_1} \Rightarrow \frac{3}{4} - \frac{1}{2} = \frac{58}{T_1} \Rightarrow T_1 = 232^\circ C$

17. (b)

Sol. Here, coefficient of performance $(\beta) = 5$

$T_1 = 27^\circ C$

$= (27 + 273)\,K$

$= 300\,K$

As $\beta = \frac{T_2}{T_1 - T_2} \Rightarrow 5 = \frac{T_2}{300 - T_2}$

Or $1500 - 5T_2 = T_2$ or $6T_2 = 1500$

$\therefore T_2 = \frac{1500}{6} = 250\,K$

18. (b)

Sol. As constant volume,

$dW = PdV = P \times 0 = 0$

$dQ = mC_V\,\Delta T = 5 \times 0.172 \times 4\,cal$

$= 5 \times 0.172 \times 4 \times 4.2\,J$

$= 14.4\,J$

$\therefore dU = dQ - dW = 14.4 - 0$

$= 14.4\,J$

19. (c)

Sol. $\frac{n_1 + n_2}{1.5 - 1} = \frac{n_1}{\frac{5}{3} - 1} + \frac{n_2}{\frac{7}{5} - 1}$

20. (c)

Sol. $1 - \frac{Q_2}{Q_1} = 1 - \frac{T_2}{T_1}$

$\frac{W}{Q_1} = 1 - \frac{300}{600}$

$\Rightarrow \frac{800}{Q_1} = \frac{1}{2}$

$Q_1 = 1600$ J

21. (c)

Sol. $\frac{\Delta W}{(\Delta Q)_P} = \frac{(\Delta Q)_P - (\Delta U)_P}{(\Delta Q)_P} = 1 - \frac{(\Delta U)_P}{(\Delta Q)_P}$

$= 1 - \frac{\frac{5}{2}R}{\frac{7}{2}R} = 1 - \frac{5}{7} = \frac{2}{7}$

22. (a)

Sol. $P_1V_1^\gamma = P_2V_2^\gamma$ ($\gamma = 7/5$), $V_2 = 1.05\,V_1$

$P_1V_1^\gamma = P_2\,(1.05\,V)^\gamma$

$P_2 = \frac{P_1}{(1.05)^\gamma}$ so % change $\frac{P_2 - P_1}{P_1} \times 100$

$= \frac{\frac{P_1}{(1.05)^\gamma} - P_1}{P_1} \times 100 = \frac{1 - (1.05)^\gamma}{(1.05)^\gamma} \times 100 = 7\%$

23. (b)

Sol. VP^3 = constant , $P = \frac{nRT}{V}$

$\therefore V\frac{T^3}{V^3}$ = constant $\Rightarrow \boxed{T^3 \propto V^2}$

24. (b)

Sol. $\Delta Q = \Delta U + \Delta W$; 110 J = 40J + ΔW ; ΔW = 70 J

25. (c)

Sol. V = constant. $\Rightarrow P \propto T \Rightarrow T_2 = \frac{P_2}{P_1} T_1$

$= \frac{2}{1} \times 293$ K = 586 K = 313^0C

26. (c)

Sol. $nC_p\Delta T = 100$ J

$n\left(\frac{\gamma R}{\gamma - 1}\right)\Delta T = 100J$, $nR\Delta T = \left(100 \times \frac{\gamma - 1}{\gamma}\right)$

$W = nR\Delta T = 100 \times \frac{0.4}{1.4}$

27. (c)

Sol. $\Delta T = \frac{Q}{m.s} = \frac{420/4.2}{10} = 10^0C$

28. (b)

Sol. 80 × m = 80 × 30 × 1

m = 30 gm

29. (c)
Sol. Q = 1 × 80 + 1 × 1 × 100 + 1 × 540
= 720 cal

30. (b)
Sol. Here, $C_V = \frac{3}{2}R$

Since $C_p - C_V = R$

$\therefore C_p = C_V + R = \frac{3}{2}R + R = \frac{5}{2}R$

31. (c)
Sol. According to Mayer's relation

$C_p - C_V = R$ or $1 - \frac{C_V}{C_p} = \frac{R}{C_p}$

Or $1 - \frac{1}{\gamma} = \frac{R}{C_p}$ $\left(\therefore \gamma = \frac{C_p}{C_V}\right)$

or $\frac{\gamma - 1}{\gamma} = \frac{R}{C_p}$ or $C_p = \frac{\gamma R}{\gamma - 1}$

Specific heat capacity $= \frac{\textit{molar heat capacity}}{\textit{molecular weight}}$

Specific heat capacity at constant pressure $= \frac{\gamma R}{M(\gamma - 1)}$

32. (b)
Sol. As 32 gm O_2 means 1 mole therefore 8 gm O_2 means 1 / 4mole i.e. $\mu = \frac{1}{4}$

So from $PV = \mu RT$ we get $PV = \frac{1}{4}RT$ or $PV = \frac{RT}{4}$

33. (a)
Sol. $\mu = \frac{\text{Mass of water}}{\text{Molecular wt. of water}} = \frac{4.5\,kg}{18 \times 10^{-3}\,kg} = 250$,

T = 273 K and $P = 10^5\ N/m^2$ (STP)
From $PV = \mu RT$

$\Rightarrow V = \frac{\mu RT}{P} = \frac{250 \times 8.3 \times 273}{10^5} = 5.66\,m^3$.

34. (a)
Sol. Specific gas constant

$r = \frac{\text{Universal gas constant } (R)}{\text{Molecular weight of gas } (M)} = \frac{8.3}{2} = 4.15$

Joule/mole-K.

35. (c)
Sol. From ideal gas equation $PV = \mu RT$ we get

$\frac{T_2}{T_1} = \left(\frac{P_2}{P_1}\right)\left(\frac{V_2}{V_1}\right) = \left(\frac{2P_1}{P_1}\right)\left(\frac{3V_1}{V_1}\right) = 6$

$\therefore\ T_2 = 6T_1 = 6 \times 300 = 1800\ K = 1527\,°C.$

36. (c)
Sol. From $PV = \mu RT$ we get

$\frac{P_2}{P_1} = \left(\frac{T_2}{T_1}\right)\left(\frac{V_1}{V_2}\right) = \left(\frac{T_1/2}{T_1}\right)\left(\frac{V_1}{2V_1}\right) = \frac{1}{4} \Rightarrow P_2 = \frac{P_1}{4}$

37. (a)
Sol. Root means square velocity

$v_{rms} = \sqrt{\frac{3RT}{M}} = 1930\ m/s$ (given)

$\therefore\ M = \frac{3RT}{(1930)^2} = \frac{3 \times 8.31 \times 300}{1930 \times 1930} = 2 \times 10^{-3}\ kg = 2\,gm$

i.e. the gas is hydrogen.

38. (c)
Sol. Root mean square velocity does not depends upon the quantity of gas. For a given gas and at constant temperature it always remains same.

39. (c)
Sol. $E \propto T \quad \therefore \frac{E_2}{E_1} = \frac{T_2}{T_1} \Rightarrow \frac{2E_1}{E_1} = \frac{T_2}{(20 + 273)}$

$\Rightarrow T_2 = 293 \times 2 = 586\ K = 313\,°C$.

40. (d)
Sol. $E = \frac{3}{2}RT = \frac{3}{2} \times 8.31 \times 273 = 3.4 \times 10^3$ Joule

41. (a)
Sol. $P_1 = P$, $T_1 = T$,

$P_2 = P +$ (0.4% of P) $= P + \frac{0.4}{100}P = P + \frac{P}{250}$

$T_2 = T + 1$

From Gay Lussac's law $\frac{P_1}{P_2} = \frac{T_1}{T_2}$

$\Rightarrow \dfrac{P}{P+\dfrac{P}{250}} = \dfrac{T}{T+1}$ [As V = constant for closed vessel]

By solving we get T = 250 K.

42. (b)

Sol. $\gamma = 1 + \dfrac{2}{f} \Rightarrow \gamma - 1 = \dfrac{2}{f} \Rightarrow \dfrac{f}{2} = \dfrac{1}{\gamma - 1}$ or f = $\dfrac{2}{\gamma - 1}$

43. (b)

Sol. $\overline{V}_m^2 = \dfrac{(1)^2 + (2)^2 + (3)^2 + (4)^2}{4}$

44. (c)

Sol. $v_{rms} = \sqrt{\dfrac{3RT}{M}} \quad \therefore \quad \dfrac{v_{N_2}}{v_{O_2}} = \sqrt{\dfrac{M_{O_2}}{M_{N_2}}} = \sqrt{\dfrac{32}{28}} = \sqrt{\dfrac{8}{7}}$

45. (b)

Sol. V = $\sqrt{\gamma P / \rho}$

$330 = \sqrt{\gamma \times \dfrac{1 \times 10^5}{1.3}}$

$\dfrac{(33)^2 \times 100 \times 1.3}{1 \times 10^5} = \gamma$

$\dfrac{1.089 \times 10^3 \times 10^2 \times 1.3}{1 \times 10^5} = \gamma$

$\dfrac{2}{f} + 1 = \gamma = 1.4 = 7/5$

$\dfrac{2}{f} = 2/5$

f = 5

46. (a)

Sol. $K = \frac{\alpha^2 C}{1-\alpha}$; $\alpha = \frac{0.01}{100} \approx 1 \therefore K = \alpha^2 C = \left[\frac{0.01}{100}\right]^2 \times 1$

$= 1 \times 10^{-8}$.

47. (b)

Sol. Mathematical form of Ostwald's dilution law.

48. (b)

Sol. The value of pK_a for strong acid is less.

49. (c)

Sol. Due to common ion effect.

50. (a)

Sol. $Mg(OH)_2 \rightleftharpoons \underset{(X)}{Mg^{++}} + \underset{(2X)^2}{2OH^-}$

$K_{sp} = 4X^3$

51. (c)

Sol. $BaSO_4 \rightleftharpoons \underset{\substack{(S)\\0.01}}{Ba^{++}} + \underset{\substack{(S)\\5}}{SO_4^{--}}$

$K_{sp} = S^2 = S \times S = 0.01 \times S$

$S_{(SO_4^{2-})} = \frac{K_{sp}}{S_{(Ba^{++})}} = \frac{1 \times 10^{-9}}{0.01} = 10^{-7}$ mole/litre.

52. (d)

Sol. K_{sp} for $CaF_2 = 4s^3 = 4 \times [2 \times 10^{-4}]^3 = 3.2 \times 10^{-11}$.

53. (c)

Sol. For the precipitation of an electrolyte, it is necessary that the ionic product must exceed its solubility product.

54. (d)

Sol. $K_{sp} = [Ag^+]^2[Cro_4^{--}] = [2S]^2[0.01]$

$= 4S^2[0.01] = 4[2 \times 10^{-8}]^2 \times 0.01 = 16 \times 10^{-18}$.

55. (c)

Sol. Complex salts contain two different metallic elements but give test for only one of them. e.g. $K_4Fe(CN)_6$ does not give test for Fe^{3+} ions.

56. (b)

Sol. NH_4CN is a salt of weak acid and weak base and thus for it.

57. (d)

Sol. Because CCl_4 is a organic solvent and $AgNO_3$ is insoluble in organic solvent.

58. (a)

Sol. $SnS_2 \rightleftharpoons Sn^{4+} + 2S^{2-}$

$\therefore K_{sp} = [Sn^{4+}]\,[S^{2-}]^2$

59. (a)

Sol. pH of blood does not change because it is a buffer solution.

60. (b)

Sol. $[H^+] = [OH^-]$

$K_w = [H^+]\,[OH^-] = 10^{-14}$

$\therefore [H^+] = 10^{-7}$, $pH = -\log[H^+] = 7$.

61. (d)

Sol. $pH = 5$ means $[H^+] = 10^{-5}$

$pOH = 14 - pH = 14 - 5 = 9$

$[OH^-] = 10^{-pOH} = 10^{-9}$

62. (d)

Sol. $BOH \rightleftharpoons B^+ + OH^-$

Initial C 0 0

At eq. C – Cα Cα Cα

$K_b = \frac{C^2\alpha^2}{C(1-\alpha)} = C\alpha^2$ assuming $\alpha << 1$; $1-\alpha \simeq 1$

$10^{-12} = 10^{-2} \times \alpha^2$; $\alpha^2 = 10^{-10}$; $\alpha = 10^{-5}$

$[OH^-] = C\alpha = .01 \times 10^{-5} = 10^{-7}$

63. (c)

Sol. $pH = 4$ means; $[H^+] = 10^{-4}$ mol

64. (a)

Sol. Buffer solution is a mixture of weak acid and its conjugate base.

65. (d)

Sol. As the solution is acidic, $pH < 7$. This is because $[H^+]$ from $H_2O[10^{-7}M]$ cannot be neglected in comparison to 10^{-10} M

66. (a)

Sol. $[OH^-] = 10^{-2}$ M ; $pOH = 2$

$pH + pOH = 14$; $pH = 14 - pOH$

$pH = 14 - 2 = 12$

67. (b)

Sol. pH of the solution A = 3

$[H^+]_A = 10^{-3}$ M.

pH of the solution B = 2

$[H^+]_B = 10^{-2}$ M

$[H^+] = 10^{-3} + 10^{-2} = 10^{-3} + 10 \times 10^{-3} = 11 \times 10^{-3}$.

pH = – log(11 × 10^{-3}) = 3 – log 11
= 3 – 1.04 = 1.95

68. (a)
Sol. H_3BO_3 is monobasic acid
$H_3BO_3 + H_2O \longrightarrow B(OH)_4^-$

69. (a)
Sol. Old pH = 7
New $[OH^-] = 10^{-2} \times \frac{1}{10} = 10^{-3}$
New pH = 11
Change in pH = 4

70. (b)
Sol. For colour characteristic of H indicator
$pH = pK_{ln} - \log \frac{[H_{ln}]}{[ln^-]}$
$pH = pKln \pm 1$

71. (b)
Sol.
$Zn^{++} + \quad 2H_2 \quad OZn(OH)_2 \quad + \quad 2H^+$
$\therefore K_h = \frac{[Zn(OH)_2 + 2H^+]}{[Zn^{++}]}$ ...1
$Zn(OH)_2 \quad Zn^{++} \quad + \quad 2OH^-$
$\therefore K_b = \frac{[Zn^{++}][OH^-]^2}{[Zn(OH_2)]}$, $K_\omega = [H^+][OH^-] \therefore \frac{K_w^2}{K_b} = K_h$

72. (c)
Sol. H_3O^+ can not take up proton ; $H_2PO_2^-$ can not give up proton, SO_4^{2-} can not give proton

73. (a)
Sol. A solution of $CuSO_4$ is acidic due to hydrolysis of strong conjugate acid Cu^{2+} ions,
$Cu^{2+} + H_2O \rightleftharpoons Cu(OH)^+ + H^+$

74. (c)
Sol. A solution of NaCl is neutral as both Na^+ and Cl^- ions are weak conjugate acid and base respectively.

75. (c)
Sol. Ba^{2+} is not hydrolysed , CN^- = 1 (M)
$CN^- + H_2O \rightleftharpoons HCN + OH^-$
pH = $\frac{1}{2}$ ($pK_w + pK_a$ + log c)
pH = $\frac{1}{2}$ ($pK_w + pK_a$)   since c = 1(M)
pH = $\frac{1}{2}$ ($2pK_w - pK_b$) = $\frac{1}{2}$ (28 – 9.3)
pH = $\frac{1}{2}$(28 – 9.3) = 9.35

76. (a)
Sol. For forward reaction $[Al(H_2O)_6]^{+3}$ is acid and for backward reaction H_2CO_3 is an acid.

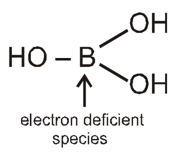
77. (d)
Sol. On adding H_2SO_4, $[H^+]$ increases. Therefore of keep K_w constant, $[OH^-]$ decreases.

78. (c)
Sol. 10^{-3} M NaOH has $[OH^-] = 10^{-3}$
or $[H^+] = 10^{-11}$. Hence pH = 11.

79. (b)
Sol. For pure water, $[H_3O^+] = [OH^-]$
Hence $K_w = 10^{-12}$.

80. (c)
Sol. It is the salt of weak acid and weak base, hence its degree of hydrolysis will be independent of concentration
$h = \sqrt{\frac{K_w}{K_a \times K_b}}$.

81. (a)
Sol. When rain is accompanied by a thunderstorm,
$N_2 + O_2 \quad NO \longrightarrow NO_2 \xrightarrow{H_2O} HNO_2 + HNO_3$

82. (c)
Sol.
H_3BO_3 = 

So it will behave as Lewis acid.

83. (c)
Sol. Ostwald's dilution law is valid for weak electrolysis.

84. (d)
Sol. Factual

85. (d)
Sol. All other can accept electrons. PH_3 in not electron deficient.

86. (b)
Sol.
$HSO_4^- \longrightarrow H_2SO_4$
$\downarrow$
SO_4^{2-}
HSO_4^- can accept or give a proton.

87. (c)

Sol. $K_2CO_3 + 2H_2O \rightleftharpoons \underset{\text{Weak acid}}{H_2CO_3} + \underset{\text{Strong base}}{2KOH}$

$KOH \rightleftharpoons K^+ + OH^-$ (Basic solution),

88. (c)

Sol. $Ba(OH)_2 \rightleftharpoons Ba^{2+} + 2OH^-$

$[OH^-] = 2 \times 1 \times 10^{-3} M$

pOH = - log $[OH^-] = -\log(2 \times 10^{-3}) = 2.7$

$pOH + pH = 14 \Rightarrow pH = 14 - 2.7 = 11.3$

89. (b)

Sol. $H_2SO_4 \rightleftharpoons 2H^+ + SO_4^{2-}$

$[H^+] = 2 \times 1 \times 10^{-4} M$

$pH = -\log(2 \times 10^{-4}) = 3.70$

90. (a)

Sol. Nucleophiles are Lewis bases while electrophiles are Lewis acids.

BIOLOGY ANSWER KEY

Q.No.	Ans.	Q.No.	Ans.	Q.No.	Ans.	Q.No.	Ans.	Q.No.	Ans.
91	B	109	D	127	D	145	A	163	C
92	C	110	D	128	C	146	D	164	D
93	A	111	C	129	C	147	D	165	A
94	D	112	A	130	B	148	D	166	C
95	C	113	A	131	C	149	A	167	A
96	A	114	B	132	A	150	B	168	A
97	B	115	C	133	C	151	A	169	A
98	A	116	A	134	B	152	B	170	C
99	C	117	A	135	D	153	D	171	A
100	B	118	A	136	A	154	A	172	D
101	C	119	C	137	C	155	D	173	B
102	A	120	D	138	C	156	D	174	C
103	C	121	D	139	B	157	A	175	B
104	B	122	B	140	C	158	A	176	A
105	D	123	C	141	D	159	C	177	C
106	C	124	B	142	B	160	B	178	B
107	D	125	D	143	D	161	B	179	C
108	D	126	B	144	B	162	C	180	B