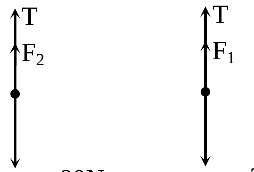
1. (b)

Sol. As the springs are fixed to the horizontal and have the same natural length, hence if one spring is compressed, the other must be expanded. Hence, the compression will be negative.



$m_2g = 80N$ $m_1g = 20N$

F.B.D of m_2 F.B.D of m_1

F.B.D. of m_2 $T + F_2 = 80$ N

and $F_2 = 70 \times 0.5 = 35$ N

$\therefore$ T = 80 – 35 = 45 N

F.B.D. of m_1 $T + F_1 + mg$

or $45 = F_1 + 20$

or $F_1 = 25N$

$\therefore x_1 = \frac{25}{k_1} = \frac{25}{50} = 0.5m$

$\therefore$ Compression in first spring = – 0.5 m

2. (b)

Sol. $a_c = k^2rt^2$

i.e., $\frac{v^2}{r} = k^2rt^2$ or v = krt

Also $a_t \frac{dV}{dt} = kr$

$\therefore F = ma_t = mkr$

Then, power = Fv = mkr(krt) = mk^2r^2t

3. (d)

Sol. Area $= 1.5 \times 1.203 = 1.8045\, cm^2 = 1.8\, cm^2$ (Upto correct number of significant figure).

4. (a)

Sol. Let they meet after time 't' . Distance covered by body A

$= \frac{1}{2}at^2$; Distance covered by body B = vt

and $\frac{1}{2}at^2 = vt$

$\therefore t = \frac{2v}{a}$.

5. (a)

Sol. Using h = ut + at^2, we get

h = 330 × 1 – 1/2 × 9.8 × 1

= (330 – 4.9) m.

6. (c)

Sol. Linear displacement (S) = Radius (r) × Angular displacement (θ)

$\therefore S \propto r$ (if $\theta =$ constant)

$$\frac{\text{Distance travelled by mass } A(x)}{\text{Distance travelled by mass } B(y)} =$$

$$\frac{\text{Radius of pulley concerned with mass } A(r)}{\text{Radius of pulley concerned with mass } B(2r)} = \frac{1}{2}$$

$\Rightarrow y = 2x$.

7. (d)

Sol. Here, m = 5 kg, I = 0.65 kg m^2

$\omega = 10 \text{rad s}^{-1}, R = 0.40\text{m}$

Linear velocity,

$v = R\omega = 0.40 \times 10 = 4\text{m s}^{-1}$

Translation KE,

$= \frac{1}{2}mv^2 = \frac{1}{2} \times 16 = 40J$ Rotational KE,

$= \frac{1}{2}I\omega^2 = \frac{1}{2} \times 0.65 \times 100 = 32.5J$

Total KE = Translational KE + Rotational KE,

$= 40 + 32.5 = 72.5J$

Perecentage of rotational KE,

$= \frac{\text{Rotational KE}}{\text{Total KE}} \times 100$

$= \frac{32.5}{72.5} \times 100 = 44.8\%$

8. (c)

Sol. When the length of wire becomes double, its area of cross section will become half because volume of wire is constant $(V = AL)$.

So the instantaneous stress = $\frac{\text{Force}}{\text{Area}} = \frac{Mg}{A/2} = \frac{2Mg}{A}$.

9. (b)

Sol. Solids are least compressible whereas gases are most compressible. Gases are about a million times compressible than solids.

All other statements are correct.

10. (b)

Sol. $U = U_0V \Rightarrow nC_VT = U_0V \Rightarrow T \propto V$ isobaric process

$\boxed{C = C_V + \frac{P}{n}\frac{dV}{dT}}$ $\frac{dV}{dT}$ = constant

$\frac{P}{n} = \frac{nRT}{V} = \frac{nRT}{\text{constant}T}$

$C = C_V + \frac{R}{\text{constant}}$

$C = C_V + R = \frac{5}{2}R + R = \frac{7}{2}R$

11. (c)

Sol. $A \to B$ and $C \to D$

V = const. $W_{AB} = W_{CD} = 0$

$W_{BC} = P\Delta V = nR(\Delta T)_{BC}$, $W_{DA} = nR(\Delta T)_{DA} = 40kJ$

12. (c)

Sol. $n_1\left(\frac{3}{2}KT_1\right) + n_2\left(\frac{5}{2}KT_2\right) = n_1\left(\frac{3}{2}KT'\right) + n_2\left(\frac{5}{2}KT'\right)$

$\frac{3n_1T_1 + 5n_2T_2}{3n_1 + 5n_2} = T'$

13. (b)

Sol. $n = \frac{V_{rms}}{2\ell} \Rightarrow 1000 = \frac{\sqrt{\frac{3RT}{2}}}{2\times 0.5} \Rightarrow 10^6 = \frac{3RT}{2}$

$T = 8 \times 10^4 K$

14. (d)

Sol. $\frac{\nu_1}{\nu_2} = \frac{\frac{1}{2\ell}\sqrt{\frac{T_1}{\mu_1}}}{\frac{1}{2\ell}\sqrt{\frac{T_2}{\mu_2}}} = \sqrt{\frac{T_1}{T_2}\frac{\mu_2}{\mu_1}}$

$= \sqrt{\frac{T_1}{T_2}\frac{\rho_2 A_2}{\rho_1 A_1}} = \sqrt{\frac{T_1}{T_2}\frac{\rho_2 \pi r_2^2}{\rho_1 \pi r_1^2}}$

$= \left(\frac{T_1}{T_2}\right)^{1/2}\left(\frac{\rho_2}{\rho_1}\right)^{1/2}\left(\frac{r_2}{r_1}\right)$

15. (a)

Sol. $\frac{T}{4} = 0.170 \Rightarrow T = 4 \times 0.170$, $n = \frac{1}{T}$

16. (c)

Sol. $R = \frac{\delta\ell}{A} = \frac{4\delta\ell}{\pi D^2}$ $\therefore$ $R \propto \frac{\ell}{D^2}$

$\frac{\ell}{D^2}$ is minimum for L/2 & 2D.

17. (a)

Sol. Case I : $mC\Delta T = \frac{(3V_0)^2 t}{R} \Rightarrow \Delta T = \frac{9V_0^2 t}{mCR}$

Case II : $2mC\Delta T = \frac{(NV_0)^2 t}{2R} \Rightarrow \Delta T = \frac{N^2V_0^2 t}{4mCR}$

$\therefore N^2 = 36 \Rightarrow N = 6$

18. (c)

Sol. $I = \frac{M}{V} = \frac{Md}{m} = \frac{8\times 10^{-7}\times 7500}{0.075} = 0.08\,\text{Amp/m}$

19. (d)

Sol. Here, $M = 0.355\,J\,T^{-1}$

$B = 5.0\times 10^{-2}T$

$\upsilon = 2\,Hz$

As $\upsilon = \frac{1}{2\pi}\sqrt{\frac{MB}{I}}$ $\therefore \upsilon^2 = \frac{1}{4\pi^2}\frac{MB}{I}$

$\Rightarrow I = \frac{MB}{4\pi^2\upsilon^2} = \frac{0.355\times 5\times 10^{-2}}{4\times(3.14)^2\times 2^2} = \frac{1775\times 10^{-2}}{157.75}$

$= 1.13\times 10^{-4}\,Kg\,m^2$

20. (b)

Sol. Meniscus will be concave from upside and in soap solution it should decrease.

21. (c)

Sol. Let the rocket reaches a height h form the surface of earth.

Total energy at the surface of the earth is

$E_s = \frac{1}{2}mv^2 - \frac{GM_E m}{R_E}$

Where m and M_E are the masses of rocket and earth respectively.

At highest point, the velocity of the rocket becomes zero.

Total energy at the highest point is

$E_h = -\frac{GM_E m}{(R_E + h)}$

According to law of conservation of energy,

$E_s = E_h$

$\therefore \frac{1}{2}mv^2 - \frac{GM_E m}{R_E} = -\frac{GM_E m}{R_E + h}$

$\frac{1}{2}v^2 = \frac{GM}{R_E} - \frac{GM_E}{R_E + h}$

$= \frac{gR_E^2}{R_E} - \frac{gR_E^2}{R_E + h}$ $\left(\because g = \frac{GM_E}{R_E^2}\right)$

$v^2(R_E + h) = 2gR_E h$

$v^2 R_E = 2gR_E h - v^2 h$

$R_E v^2 = h(2gR_E - v^2)$

$h = \frac{R_E v_2}{2gR_E - v^2}$

22. (b)

Sol. Here, $r = 2.5\times10^{-5}\,m, S = 7.28\times10^{-2}\,Nm^{-1}$

Angle of contact, $\theta = 0^o, \rho = 10^3\ kg\ m^{-3}$

The maximum height to which the sap can rise by capillary action is,

$$h = \frac{2S\cos\theta}{r\rho g} = \frac{2\times7.28\times10^{-2}\times\cos0^o}{2.5\times10^{-5}\times10^3\times9.8} = 0.59\,m$$

23. (b)

Sol. The water level falls in the vessels

24. (a)

Sol. $(v_P)_{max} = A\omega$,

$= 2\pi n = 2\pi \cdot \frac{v}{\lambda} = 2\pi \times \frac{0.3}{1.5\pi\times10^{-2}}$

25. (b)

Sol. For forced oscillation the time displacement at any

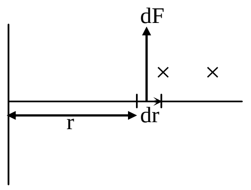
instant is given by

$$x = \frac{F_0}{m(\omega_0^2-\omega^2)}\cos\omega t$$

$$x \propto \frac{1}{m(\omega_0^2-\omega^2)}$$

26. (a)

Sol.



Torque $d\tau = dF \times rb = iBdr \times r \quad \tau = \int_0^L iBrdr = \frac{iBL^2}{2}$

$$\alpha = \frac{\tau}{I} = \frac{\frac{iBL^2}{2mL^2}}{3} = \frac{3}{2}\frac{iB}{m}$$

27. (b)

Sol. The lengths of the two wires are quiet large as compared to the separation between them the two wires may be regarded as infinitely long wires the forces per unit length of wires B due to A,

$$f = \frac{\mu_0 I_1 I_2}{2\pi r} = \frac{4\pi\times10^{-7}\times4\times6}{2\pi\times3\times10^{-2}} = 1.6\times10^{-4}\,Nm^{-1}$$

Force on 15cm or 0.15cm section of B,

$F = fl = 1.6\times10^{-4}\times0.15 = 2.4\times10^{-5}\,N$ (repulsive)

28. (a)

Sol. L will decrease as Bi is diamagnetic

$\therefore I = \frac{V}{X_L}$ will increase

29. (c)

Sol.

$$\lambda = \frac{hc}{E} = \frac{6.6\times10^{-34}\times3\times10^8}{14.4\times10^3\times1.6\times10^{-19}} = 0.8\times10^{-10}\,m = 0.8\,\mathring{A}$$

. This wavelength belongs to X-ray region.

30. (d)

Sol. If AC is the square wave then all these three options are possible

31. (c)

Sol. Pure resistive circuit

32. (b)

Sol. $\frac{f}{f-x} = \frac{3}{1} \Rightarrow \frac{f}{f-(-4)} = \frac{3}{1} \Rightarrow f = -6$

R = – 12 cm

33. (c)

Sol. When object lies between optical centre and focus then image is virtual, erect and larger otherwise it is real.

34. (a)

Sol. $\frac{I_1}{I_2} = \frac{a_1^2}{a_2^2} \Rightarrow \frac{R_{max}}{R_{min}} = \frac{a_1+a_2}{a_1-a_2}$

35. (d)

Sol. Phenomenon of polarization confirmed that light is a transverse waves.

36. (c)

Sol. No. of photons are used for emission of e^-.

37. (a)

Sol. $\frac{H_1}{H_2} = \frac{m_1C_1}{m_2C_2} = \frac{r_1^3}{r_2^3} = \frac{1}{64}$

$\because \rho_1 = \rho_2\ \&\ C_1 = C_2$

38. (b)

Sol. 1 Rydberg = 13.6 eV

39. (a)

Sol. $\lambda_{ph} = \lambda_e$

$\frac{K.E_e}{K.E_{ph}} = \frac{v}{2C} < 1$

$K.E_e < K.E_{ph}$

40. (d)

Sol. Heat is produced, and both X-rays are produced

41. (a)

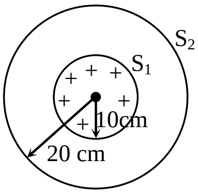
Sol. By using $N = N_0\left(\frac{1}{2}\right)^n$

$\Rightarrow \frac{N_1}{N_2} = \frac{(N_0)_1}{(N_0)_2} \times \frac{(1/2)^{n_1}}{(1/2)^{n_2}} = \frac{2}{1} \times \frac{\left(\frac{1}{2}\right)^{\frac{2\times 24}{12}}}{\left(\frac{1}{2}\right)^{\frac{2\times 24}{16}}} = \frac{1}{1}$

42. (d)

$\frac{\Sigma q}{\epsilon_0} = \phi_{net}$

43. (a)



$\phi_{S_1} = 25$ V-m

$\phi_{S_2} = \phi_{S_1} = 25$ V-m

44. (b)

$q = C_{eq} \times V$

$q = \frac{10\times 20}{30} \times 10^{-6} \times 3\times 10^3$

$q = 2\times 10^4 \times 10^{-6}$, $q = 20{,}000\ \mu C$

45. (c)

Sol. The capacities of two individual condensers are

$C_1 = \frac{K_1\varepsilon_o A}{d_1}$ and $C_2 = \frac{K_2\varepsilon_o A}{d_2}$

The arrangement is equivalent to two capacitors joined in series.

$\therefore$ Equivalent capacitance, $\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2}$

$= \frac{d_1}{K_1\varepsilon_o A} + \frac{d_2}{K_2\varepsilon_o A}$

$= \frac{1}{\varepsilon_o A}\left[\frac{d_1}{K_1} + \frac{d_2}{K_2}\right] = \frac{1}{\varepsilon_o A}\left[\frac{K_2 d_1 + K_1 d_2}{K_1 K_2}\right]$

or, $C_{eq_{(तुल्य)}} = \varepsilon_o A\left(\frac{K_1K_2}{K_2d_1 + K_1d_2}\right)$ ...(i)

Also $C_{eq_{(तुल्य)}} = \frac{K\varepsilon_o A}{d_1 + d_2}$ ...(ii)

From (i) and (ii),

$\varepsilon_o A\left(\frac{K_1K_2}{d_2K_1 + d_1K_2}\right) = \varepsilon_o A\left(\frac{K}{d_1 + d_2}\right)$

$\therefore K = \frac{K_1K_2(d_1 + d_2)}{d_2K_1 + d_1K_2}$

46. (a)

Sol. $[OH^-] = 0.1(M)$

$\therefore [Mg^{2+}] = \frac{4\times10^{-12}}{10^{-2}} = 4 \times 10^{-10}$ (M)

= solubility of $Mg(OH)_2$

47. (a)

Sol. $HCOOH + NaOH \rightleftharpoons HCOONa + H_2O$

t = 0 50 × 0.1=5 150 × 0.02=3 0 0

at end 2 0 3

$pH = pK_a + \log \frac{3}{2}$

$= -\log 1.8 \times 10^{-4} + 0.48 - 0.30$

$= 3.745 + 0.48 - 0.30$

≈ 3.92

48. (c)

Sol. Melting point depends on symmetry so p-dibromobenzene has highest melting point.

49. (c)

Sol. Due to more electronegativity of F.

50. (c)

Sol. Alcohol have H-bonding.

51. (a)

Sol. Malonic acid is having smaller alkyl part so more soluble in water.

52. (a)

Sol. In fcc unit cell $4r = \sqrt{2}a$ [r = radius of Cu atom,

a = edge length]

So $r = \frac{\sqrt{2}a}{4}$

$r = \frac{\sqrt{2}\times361}{4} = 127$ pm.

53. (c)

Sol. Unit cell : Unit cell is the smallest portion of a crystal lattice which, when repeated in different directions, generates the entire lattice.

54. (a)

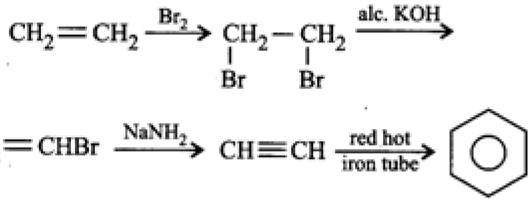
Sol. for rhombohedral system, axial distance and axial angles are $a = b = c, \alpha = \beta = \gamma \neq 90^0$

55. (a)

Sol. The hydrogen atoms attached to triply bonded carbons are acidic and not all the hydrogen atoms of alkynes.

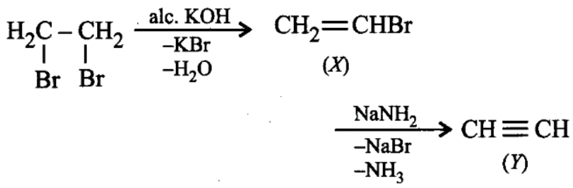
56. (d)

Sol.



57. (c)

Sol.

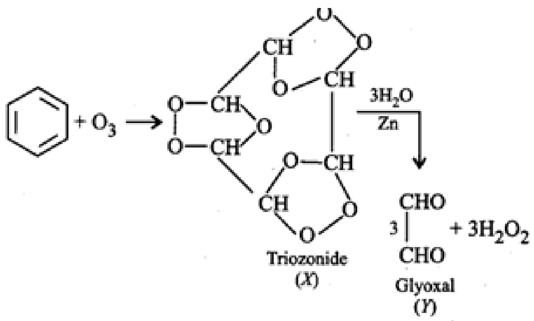


58. (d)

Sol. (A)→(ii), (B)→(iv), (C)→(i), (D)→(iii)

59. (a)

Sol.



60. (a)

Sol. Ox. No. of each element on two sides is same.

61. (c)

Sol. Sum of oxidation no. of atoms in it is zero.

62. (a)

Sol. Factor of FeC_2O_4 is 3.

63. (d)

Sol. $S_2O_3^{2-} \rightarrow 2S + 3H_2O$

$+ 6H^+$

$+ 4e^-$

64. (c)

Sol. $2\underset{}{\overset{(+4)}{N}}O_2 \longrightarrow \overset{(+4)}{N_2}O_4$

65. (a)

Sol. $\frac{r_A}{r_B} = 4 = \sqrt{\frac{M_B}{M_A}} \Rightarrow \frac{M_B}{M_A} = 16$

$\therefore \frac{M_A}{M_B} = 1/16$

66. (c)

Sol. V_{rms} (H_2 at 50 K) = $\sqrt{\frac{3R \times 50}{2 \times 10^{-3}}}$

V_{rms} (O_2 at 800K) = $\sqrt{\frac{3R \times 800}{32 \times 10^{-3}}}$

$$\frac{V_{rms}(H_2)}{V_{rms}(O_2)} = \frac{\sqrt{\frac{3R \times 50}{2 \times 10^{-3}}}}{\sqrt{\frac{3R \times 800}{32 \times 10^{-3}}}} = \frac{\sqrt{25 \times 10^3}}{\sqrt{25 \times 10^3}} = 1$$

67. (b)

Sol. $P_C = \frac{a}{27b^2}$, $T_C = \frac{8a}{27Rb}$

$\Rightarrow \frac{P_C}{T_C} = \frac{R}{8b}$ $\Rightarrow b = 0.04$ L/mol.

68. (d)

Sol. Press. of the gas = 749 + 292 = 1041 mm Hg.

69. (a)

Sol. On moving from left to right in a period, the acidic character of hydrides increases. NH_3 is basic, H_2O is neutral and HF is acidic.

70. (b)

Sol.

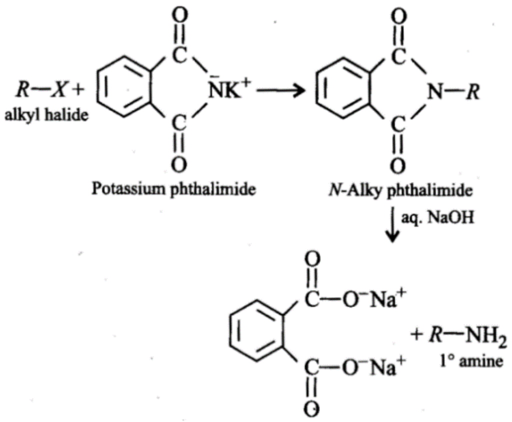
$BaO_2,8H_2O_{(s)} + H_2So_{4(aq)} \rightarrow BaSO_{4(s)} + H_2O_{(aq)} + 8H_2O_{(l)}$

71. (d)

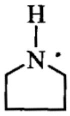
Sol. (A)$\rightarrow$(iii),(B) $\rightarrow$(ii), (C) $\rightarrow$(i), (D) $\rightarrow$(iv)

72. (b)

Sol. :



73. (d)

Sol. :  is the strongest bronsted base as there is no delocalization of lone pair of electrons of N atom which is possible in aniline and in pyrrole.

74. (c)

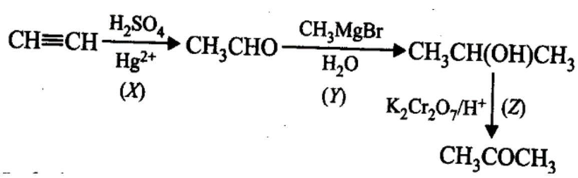
Sol. : (A) $\rightarrow$ (iv), (B) $\rightarrow$ (i), (C) $\rightarrow$ (ii), (D) $\rightarrow$ (iii)

75. (c)

Sol.: (A) $\rightarrow$ (ii), (B) $\rightarrow$ (i),(C)$\rightarrow$(iv), (D)$\rightarrow$(iii)

76. (d)

Sol. :



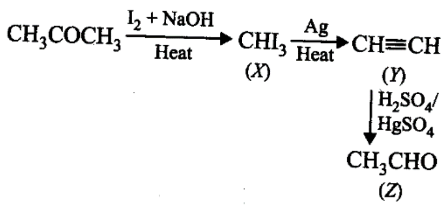
77. (a)

Sol. : $x = CH_5CH = NOH, Y = CH_3CHO,$

$Z = CH_3CH_2CH_2COOH$

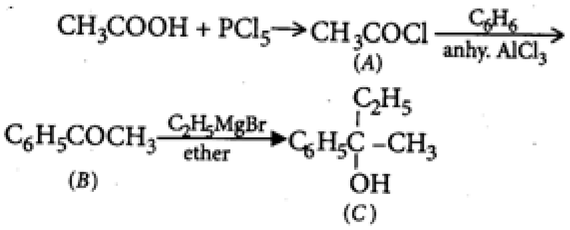
78. (c)

Sol. :



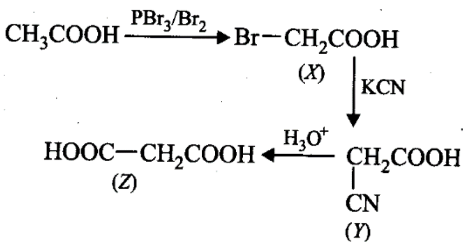
79. (d)

Sol. :



80. (b)

Sol. :



81. (d)

Sol. More the valency of cation greater will be its coagulating power as per hardy schulze rule.

82. (a)

Sol. Adsorption is an exothermic process hence, $\Delta H < 0$.

83. (b)

Sol. At high concentrations of soap in water, soap behave as associated colloid. Micelles are formed above a particular concentrations called critical micelle concentrations (CMC).

84. (b)

Sol. Transition metals due to their small size and variable valency act as efficient catalysts.

85. (c)

Sol. r = K[A][B_2]

86. (d)

Sol. When $k_1 = k_2$,

$10^{15}e^{-2000/T} = 10^{14}e^{-1000/T}$

$10 = e^{1000/T}$

$2.303 \log 10 = \frac{1000}{T}$

T = 434.2 K

87. (a)

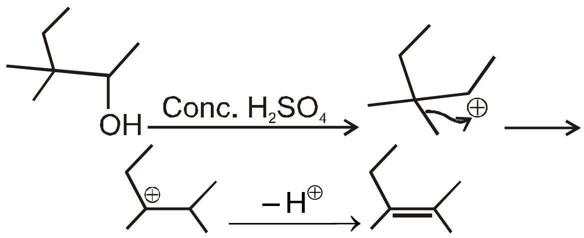
Sol. $AlCl_3$ is electron deficient species thus it is a Lewis acid.

88. (d)

Sol. According to carboction stability

89. (c)

Sol.



90. (a)

Sol. $NH_4NO_3 \xrightarrow{\Delta} N_2O + 2H_2O$

N_2O is a colourless neutral gas. It produces laughter so it is called as laughing gas.

Note : Picrin is tear gas.

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