1. \( \rho = \frac{\Delta P}{\Delta V/\nu} \)

\[ \frac{\Delta V/\nu}{\Delta P} = \frac{1.39}{2.2 \times 10^5} \]

\[ = \frac{3 \times 10^3 \times 10^3 \times 10}{2.2 \times 10^5} \]

\[ = \frac{3 \times 10^7 \times 100}{2.2 \times 10^5} \]

\[ = \frac{3}{2.2} = 1.36 \text{ radian} \]

2. Shear strain \( \varepsilon_s = \frac{\Delta x}{x} \)

\[ = \frac{0.6 \times 10^{-3}}{60 \times 10^{-2}} \]

\[ = 0.001 \text{ radian} \]

3. \( k_1 = \frac{\pi R^2 Y}{2L}, k_2 = \frac{\pi R^2 Y}{L} \)

\[ F = k_1 x = k_2 y \Rightarrow \frac{y}{x} = \frac{k_1}{k_2} = 2 \]
4. (b) : Let \( V_1 \) and \( V_2 \) be the volumes, then
\[ V_1 + V_2 = V, \]
As ball is floating.
Weight of ball = upthrust on ball due to two liquids

\[ V_0g = V_1\rho_1g + V_2\rho_2g \]
\[ \Rightarrow V_0 = V_1\rho_1 + (V - V_1)\rho_2 \]
\[ \Rightarrow V_1 = \left( \frac{\rho_2 - \rho_0}{\rho_1 - \rho_2} \right) V \]

Fraction in upper part = \( \frac{V_1}{V} = \frac{\rho - \rho_2}{\rho_1 - \rho_2} \)

Fraction in lower part = \( 1 - \frac{V_1}{V} \)

\[ 1 - \frac{\rho - \rho_2}{\rho_1 - \rho_2} = \frac{\rho_1 - \rho}{\rho_1 - \rho_2} \]
\[ \therefore \ \text{Ratio of upper and lower parts} = \frac{\rho - \rho_2}{\rho_1 - \rho} \]

5. (d) : Specific gravity

\[ \frac{\text{Weight of block in air}}{\text{loss in weight of block in liquid}} = \frac{60}{20} = 3 \]

6. (a) : From law of floatation, we know that a body will float in liquid, when its weight \( W \) is equal to the weight \( w \) of the liquid displaced by the immersed part of the body. But this does not necessarily indicate that the body will be in equilibrium. A body will be in equilibrium only, if the resultant of all the forces and couples acting on the body is zero. If \( W \) and \( w \) act along different lines, they will from a couple which will tend to rotate the body. Thus, a floating body can be in equilibrium, if no couple acts on it. It will be so, if the line of action of \( W \) and \( w \) is along the same vertical straight line.

Here, in both the situations, as the mass of floating block remains same, hence according to principle of floatation mass of volume of water displaced also remains same. Hence, water level remain same in both the cases.

7. (b) : From Archimedes' principle weight of water displaced is equal to weight of stone. The level will fall because when the large stone was in the boat, volume of water displaced is equal to volume of large stone. But when the stone is dropped in the lake, it displace volume of water equal to its volume which is less than in the previous case.
8. \( d) \quad v \propto r^2 \)

\[
\frac{v_1}{v_2} = \frac{r_1^2}{r_2^2}, \quad 10 = \frac{r_2^2}{8^{2/3} r^2} = \frac{1}{4}, \quad v_2 = 40 \text{ cm/s}
\]

9. \( b) \quad \) For the given situation, liquid of density 2\( \rho \) should be behind that of \( \rho \).

From the right limb, \( P_B = P_{\text{atm}} + \rho gh \)

\[
P_C = P_{\text{atm}} + h(2\rho)g \quad \ldots(i)
\]

\[
P_C - P_B = \rho \left( \frac{l}{2} \right) a + (2\rho) \left( \frac{l}{2} \right) a
\]

\[
h(2\rho)g = \frac{3}{2} \rho la \implies h = \frac{3al}{2g}
\]

10. \( c) \quad \) As \( x = \frac{1}{2} gt^2 \implies t = \sqrt{\frac{2x}{g}} \)

Velocity of efflux \( v = \sqrt{2g(H - x)} \)

Hence, \( R = vt = 2\sqrt{x(3H - x)} \)

For range to be maximum \( \frac{dR}{dx} = 0 \)

which gives \( x = \frac{3}{2} H \)

11. \( b) \quad \) Applying Bernoulli’s theorem at points 1 and 2,

Difference in pressure energy between 1 and 2 = Difference in kinetic energy between 1 and 2.

\[
\rho h_1g + \frac{mg}{A} = \frac{1}{2} \rho v^2
\]

or \( v = \sqrt{2gh + \frac{2mg}{\rho A}} = \sqrt{\left( gh + \frac{mg}{\rho A} \right)} \)

12. \( a) \quad \) Total upward force due to surface tension = \( \sigma(2\pi r_1 + 2\pi r_2) \). This supports the weight of the liquid column of height \( h \).

Weight of liquid column = \( h[\pi r_2^2 - \pi r_1^2] \rho g \)

Equating, we get \( h\pi (r_2^2 - r_1^2) \rho g = 2\pi \sigma (r_1 + r_2) \)

or \( h(r_2 - r_1) \rho g = 2\sigma \) or \( h = \frac{2\sigma}{(r_2 - r_1) \rho g} \)
When a small drop of water is placed between two glass plates put face to face it forms a thin film which is concave outward along its boundary let \( R \) = radius of curvature of the enclosed film, and \( t \) = distance between two plates, \( T \) = surface tension

\[ \therefore \text{ Pressure difference } = \frac{T}{R} - \frac{T}{t/2} = \frac{2T}{t} \]

Hence, the resultant downward pressure acting or the upper plate is \( \frac{2T}{t} \) and \( A \) be the area of the plate. Then, resultant force will be \( F \)

\[ F = \text{resultant pressure } \times \text{Area} \]

\[ \text{Force } = \frac{2T}{t} A \quad \text{... (i)} \]

But \( V = At \) or \( t = \frac{V}{A} \)

\[ \text{From (i) and (ii) } \therefore \text{ Force } = \frac{2TA^2}{V} \]

(c) : The air pressure is greater inside the smaller bubble \( (4T/r) \). Hence, air flows from the smaller to the larger bubble.

15. 
(1)

Let \( v_r \) be their velocity of approach.

Using in kinetic energy = decrease in potential energy

\[ \frac{1}{2} \mu v^2_r = \frac{GMm}{d} \]

Here, \( \mu \) = reduced mass = \( \frac{Mm}{M + m} \)

\[ \therefore v_r = \sqrt{\frac{2GmM}{d \mu}} = \sqrt{\frac{2G(M + m)}{d}} \]
16. 
\[ V(\text{at centre}) = \frac{kQ}{a} - \frac{2kQ}{1.2a} \]
\[ = \frac{kQ}{a} \left(1 - \frac{1}{0.6}\right) = \frac{2kQ}{3a} \]
\[ V(\text{out side}) = \frac{kQ}{r} - \frac{2kQ}{r} = \frac{-kQ}{r} \]
Comparing we get, \( r = \frac{3a}{2} = 1.5 \ a \)

17. 
\[ E_x = \frac{v(0,0) - v(1,0)}{1-0} = \frac{0 - (-1)}{1} = 1 \]
\[ E_y = \frac{v(1,0) - v(0,1)}{1-0} = \frac{0 - 1}{1} = -1 \]
\[ \vec{E} = E_i + E_j = i - j \]

18. 
(1) 
Potential at the centre of charged conducting spherical shell is \( V_{\text{centre}} = \frac{\sigma \text{(radius of the sphere)}}{\varepsilon_0} \)

Potential at the common centre is 
\[ V = V_{\text{inner}} + V_{\text{outer}} \]
\[ = \frac{\sigma R}{\varepsilon_0} + \frac{\sigma r}{\varepsilon_0} \]
\[ = \frac{\sigma}{\varepsilon_0} (R + r) \]

19. 
\[ V = -5x + 3y + \sqrt{15}z \]
\[ \vec{E} = -\frac{\partial v}{\partial x} i - \frac{\partial v}{\partial y} j - \frac{\partial v}{\partial z} k \]
\[ = 5i - 3j - \sqrt{15}k \]
\[ |\vec{E}| = \sqrt{25 + 9 + 15} = 7 \]

20. 
(2)
21.

\[ V_1 = V_2 \]

\[ \frac{kQ_1}{a} = \frac{kQ_2}{b} \]

\[ \therefore \frac{Q_1}{Q_2} = \frac{a}{b} \]

\[ \frac{E_1}{E_2} = \left( \frac{kQ_1}{a^2} \right) = \frac{Q_1}{Q_2} \cdot \frac{b^2}{a^2} = \frac{b}{a} \]

22. (4)

23.

\[ \phi_{\text{total}} = \oint E \cdot dA \]

\[ \therefore \text{If } \oint E \cdot dA = 0 \]

\[ \phi_{\text{total}} = 0 \]

24.

\[ dV = -E \cdot dr \]

Magnitude of potential difference

\[ |dV| = E \cdot dr = (e_y + e_x + e_yk)(ai + bj) \]

\[ = ae_1 + be_2 \]

Work done \( W = Q|dV| \)

\[ = Q(ae_1 + be_1) \]

25.

\[ \begin{array}{c}
\text{Potential at point } P.
\frac{kQ}{r_1} + \frac{k(-Q)}{r_2} = 0
\end{array} \]

\[ \frac{kQ}{\sqrt{x^2 + y^2}} + \frac{k(-Q)}{\sqrt{(d-x)^2 + y^2}} = 0 \]

\[ \sqrt{(d-x)^2 + y^2} = \sqrt{x^2 + y^2} \]

\[ (d-x)^2 + y^2 = x^2 + y^2 \]

\[ (d-x)^2 = x^2 \]

\[ x = \frac{d}{2} \text{ Hence all the points on perpendicular bisector } \]

\[ \text{will have zero potential.} \]
26. 
\[ W = qE(a)\cos0^\circ + qE(b)\cos90^\circ + qE(a)\cos180^\circ \]
\[ + qE(b)\cos90^\circ \]
\[ W = qEa + 0 - qEa + 0 = 0 \]

27. 
\[ \phi = EA\cos\theta \]

For maximum flux, \(\cos\theta = 1\)

\[ \therefore \phi = EA \]

\[ \phi = E \left( \frac{\pi d^2}{4} \right) \]

\[ E = \frac{4\phi}{\pi d^2} \]

28. 
\[ E_{\text{anis}} = \frac{1}{4\pi \varepsilon_0} \cdot \frac{2 \rho}{r^3} \text{ (along } \overrightarrow{r} \text{)} \]

\[ E_{\text{bisect}\cos} = \frac{1}{4\pi \varepsilon_0} \cdot \frac{\rho}{(2\pi)^3 r^9} \text{ (opposite to } \overrightarrow{r} \text{)} \]

\[ \overrightarrow{E_2} = -\frac{\overrightarrow{E_1}}{16} \]
29. 

\[ \frac{E_2}{E_1} = \frac{1}{2} \frac{1}{x} \left( \frac{qE_1}{m} \right)^2 \quad \text{...(i) in field } E_1 \]

\[ x = \frac{1}{2} \left( \frac{qE_2}{m} \right)(t')^2 \quad \text{...(ii) in field } E_2 \]

From (i) and (ii),

\[ \frac{x}{x} = \frac{\frac{1}{2} \frac{qE_1}{m}}{\frac{1}{2} \frac{qE_2}{m} (t')^2} \]

\[ \Rightarrow E_1 t^2 = E_2 (t')^2 \]

\[ t' = \sqrt{\frac{E_1}{E_2}} t = \sqrt{2} t \]

30. (2)

Area of the rectangular plate is

\[ A = (\ell)(b) = (5 \text{ cm})(2 \text{ cm}) = 10 \text{ cm}^2 \]

\[ A = \ell b \]

\[ \Delta A = \frac{\Delta \ell}{\ell} + \frac{\Delta b}{b} \]

\[ \Delta A = A \left[ \frac{\Delta \ell}{\ell} + \frac{\Delta b}{b} \right] = (10 \text{ cm}^2) \left[ \frac{0.1}{5} + \frac{0.01}{2} \right] = 0.25 \]

\[ A \pm \Delta A = 10 \pm 0.25 \]

31. (3)

\[ \int_0^1 \frac{1}{2} dv = -2 \int_0^t dt \Rightarrow \left[ 2\sqrt{v} \right]_0^4 = -2[t]_0^t \quad \therefore t = 2s \]

32. 

Number \( \propto \) (velocity)²

33. 

\[ 3 \, mg - mg = ma \quad \therefore a = 2g \]

34. 

\[ n \frac{1}{2} mv^2 = 6 \times \frac{1}{2} \times 20 \times 10^{-3} \times (500)^2 = 15 \text{ kW} \]

35. 

\[ \sqrt{v^2 + v^2} = v \sqrt{2} \]
36. \( a = \frac{g \sin \theta}{\frac{k}{r^2} + 1} = \frac{3g \sin \theta}{5} = 3 \text{m/s}^2 \)

38. \( T_{\text{mix}} = \frac{n_1 C_v T_1 + n_2 C_v T_2}{n_1 C_v + n_2 C_v} \)

39. \( V \propto T^4 \implies \frac{\Delta V}{V} = \frac{4 \Delta T}{T} \)

40. \( \text{Here } x = \frac{A}{2} \implies t = \frac{T}{12} = \frac{1}{3} \text{s} \)

41. \( K = K_1 + K_2 \text{ or } \frac{1}{T^2} = \frac{1}{T_1^2} + \frac{1}{T_2^2} \implies T = \frac{T_1 T_2}{\sqrt{T_1^2 + T_2^2}} \)

42. \[ \frac{mv^2}{r} = \frac{G M m}{r^{5/2}} \quad \therefore F \propto \frac{1}{r^{5/2}} \]

\[ v^2 \propto r^{3.5} \quad \text{or} \quad T \propto \frac{2 \pi r}{v} \]

Or \( T^2 \propto r^{7/2} \) or \( T^2 \propto r^{3.5} \)

43. \[ W = \begin{bmatrix} -\frac{G M m}{5 R} & -\frac{G M m}{3 R} \end{bmatrix} \]

\[ = \frac{G M m}{3 R} - \frac{G M m}{5 R} \]

\[ = \frac{G M m}{R} \begin{bmatrix} 1 & 1 \end{bmatrix} = \frac{2 G M m}{15} \]

44. \( X_1 + X_2 = 9R \)

\( MX_1 = 5MX_2 \)

So, \( X_1 = \frac{5}{6}(9R) = 7.5R \)
45. (4)
\[ W_e + W_{nc} = \Delta KE \]
\[ W_e - 10 = 4 \Rightarrow W_e = 14 = -\Delta u = -m(V_B - V_A) \]
\[ 2[V_A - V_B] = 14 \]
\[ \therefore V_B - V_A = -7 \text{ J kg}^{-1} \]

46. For reaction (c), \( \Delta n_g = 2 - 2 = 0 \). Hence, for (c), \( \Delta H = \Delta E \). 

47. 

The bond moments of para position cancel out each other. The remaining two groups are at meta position to each other and hence the angle between them is 120°. Resultant = 1.5 D.

48. (4)
Number of electrons in \( \text{ClO}_2^- \) = \((17 + 2 \times 8 + 1) = 34 \)
Number of electrons in \( \text{ClF}_2^+ \) = \((17 + 2 \times 9 - 1) = 34 \)
Thus, \( \text{ClO}_2^- \) and \( \text{ClF}_2^+ \) are isoelectronic species.

49. 

50. 
\[ \frac{M_A}{M_B} = \frac{d_A}{d_B} \]
Put \( d_A = 3 d_B \). We get
\[ \frac{M_A}{M_B} = 3 \]
or
\[ M_B = \frac{M_A}{3} = \frac{M}{3} \]

51. Only symmetrical alkanes, \( i.e., \) butane can be prepared in good yield by Wurtz reaction.

52. 

1, 3, 3-Trimethylcyclohex-1-ene
53. The correct structure of PCl₃F₂ is

54. Aromatic compounds *i.e.*, are resonance stabilized.

(a) Pyridine  (c) Benzene  (d) Furan

Although compound (b) is also resonance stabilized but it is less resonance stabilized than aromatic compounds.

55. \[ E_n = -\frac{313.6}{n^2} \text{ kcal mol}^{-1}, \text{i.e., } -78.4 = -\frac{313.6}{n^2}, \text{i.e., } n = 2 \]

56. Only \( \text{OCH}_2\text{CH}_3 \) has different groups on either side of the oxygen atom.

57. 

\[ k_1 = 10^{16} e^{-2000/T}, \quad k_2 = 10^{15} e^{-1000/T} \]

When \( k_1 = k_2, \) \( 10^{16} e^{-2000/T} = 10^{15} e^{-1000/T} \)

or \( 10 e^{-2000/T} = e^{-1000/T}. \)

Taking natural logarithm of both sides, we get

\[ \ln 10 - \frac{2000}{T} = \frac{-1000}{T} \quad \text{or} \quad 2.303 - \frac{2000}{T} = \frac{-1000}{T} \]

or \( \frac{1000}{T} = 2.303 \quad \text{or} \quad T = \frac{1000}{2.303} K \)

58. \((\text{CH}_3)_3\text{CMgCl} + \text{D}_2\text{O} \rightarrow (\text{CH}_3)_3\text{CD} + \text{Mg(OD)}\text{Cl}.

59. For KCN (salt of weak acid (HX) and strong base),

\[ K_b = \frac{K_w}{K_a} = \frac{10^{-14}}{1.3 \times 10^{-9}} = 7.7 \times 10^{-5}. \]
60. Applying Nernst equation to the given cell reaction,

\[ E_{\text{cell}} = E_{\text{cell}}^o - \frac{0.0591}{n} \log \left( \frac{[\text{Ni}^{2+}]}{[\text{Ag}^+]^2} \right) \]

\[ = 1.05 \ V - \frac{0.0591}{2} \log \left( \frac{0.160}{(0.002)^2} \right) \]

\[ = 1.05 - \frac{0.0591}{2} \log (4 \times 10^4) \]

\[ = 1.05 - \frac{0.0591}{2} (4.6021) = 1.05 - 0.14 \ V = 0.91 \ V \]

61. 

\[ k_{uc} = A e^{-E_{uc}/RT} \]
\[ k_c = A e^{-E_c/RT} \]

\[ \frac{k_c}{k_{uc}} = \frac{e^{-E_c/RT}}{e^{-E_{uc}/RT}} = e^{(E_c - E_{uc})/RT} \]

\[ = e^{8.314 \times 10^3 \times 8.314 \times 300} = e^{3.33} \]

\[ \ln \frac{k_c}{k_{uc}} = 3.33 \quad \text{or} \quad \log_{10} \frac{k_c}{k_{uc}} = \frac{3.33}{2.303} = 1.4459 \]

\[ \therefore \frac{k_c}{k_{uc}} = \text{Antilog} \ 1.4459 = 27.92 = 28 \text{ times} \]

62. 

\[ v = 0.921 \ u \]

\[ \therefore \frac{u_1}{v_2} = \frac{u_1}{u_2} = \frac{T_1}{T_2} \quad \therefore \frac{0.3}{0.6} = \frac{300}{T_2} \]

\[ \text{or} \quad \frac{1}{2} = \frac{300}{T_2} \quad \text{or} \quad T_2 = 300 \times 4 = 1200 \ K. \]

63. The starred carbon atom in all the three compounds are electrophilic centres because they will have partial positive charge due to polarity of the covalent bond.

\[
\begin{align*}
\text{CH}_3&^*\text{CH}=O & \text{CH}_3&^*\equiv\text{N} & \text{CH}_3&^*\equiv\text{I} \\
\delta^+ &\delta^- & \delta^+ &\delta^- & \delta^+ &\delta^- 
\end{align*}
\]
64.

\[
k = \frac{2 \cdot 303}{t} \log \frac{a}{a-x}
\]

or

\[
\log \frac{a}{a-x} = \frac{kt}{2 \cdot 303} = \frac{2 \cdot 10^{-5} \times 60 \times 90}{2 \cdot 303} = 0.0516.
\]

Hence,

\[
\frac{a}{a-x} = \text{Antilog (0.0516)} = 1.127
\]

or

\[
\frac{a-x}{a} = 0.887
\]

or

\[
\frac{1-x}{a} = 0.887 \quad \text{or} \quad \frac{x}{a} = 0.113 = 11.3%.
\]

65.

Azide ion is a linear. It is a pseudohalide ion. The formal oxidation state of N in \(N_3^-\) ion is -1 because in any of the resonating structure, the net charge on the ion is -1.

\[
\begin{align*}
\text{N} & \equiv \text{N} \\
\text{N} & \equiv \text{N} \\
\text{N} & \equiv \text{N}
\end{align*}
\]

66. Eqn. Shifts backward by Le-Chatelier’s principle

67. As the process is in equilibrium at 373 K, \(\Delta G = 0\). Also, as liquid changes into vapour, \(\Delta S = +ve\).

68. As the vessel is closed, \(V = \text{constant} \). Hence,

\[
\frac{1 \text{ atm}}{(27 + 273) \text{ K}} = \frac{P_2}{(327 + 273) \text{ K}} \quad \text{or} \quad P_2 = \frac{600}{300} \text{ atm} = 2 \text{ atm}
\]

69. The required reaction is obtained by adding the first three given reactions. Hence its equilibrium constant = \(K_1K_2K_3\).

70. The stability of the carbanion decreases as the electropositivity of the carbon carrying the -ve charge decreases or the hybridization of carbon carrying the -ve charge changes from \(sp\) to \(sp^2\) to \(sp^3\). Thus, \(RC \equiv C^-\) is the most stable while \(R_3C-CH_2^-\) is the least stable carbanion. Out of \(C_6H_5^-\) and \(R_2C = CH^-\), \(R_2C = CH^-\) is less stable due to + I-effect of the two \(R\) groups. Thus, the overall stability decreases in the order:

\[
RC \equiv C^- > C_6H_5^- > R_2C = CH^- > R_3C-CH_2^- , \text{i.e., option (d)}
\]

is correct.

71. 2-Hydroxypropane- 1, 2, 3-tricarboxylic acid. Refer to page 14/8.
72. We know that for a reaction of $n$th order
t_{1/2} \propto C^{1-n}
\therefore \left(\frac{t_{1/2}}{t_{1/2}}\right) = \left(\frac{C_1}{C_2}\right)^{1-n} \quad \text{or} \quad \frac{50}{25} = \left(\frac{C}{4C}\right)^{1-n} \quad \text{or} \quad \left(\frac{1}{4}\right)^{1-n} = 2
\text{or} \quad (4)^{n-1} = 2 \quad \text{or} \quad (2)^{2(n-1)} = 2 \quad \text{or} \quad 2(n-1) = 1
\text{or} \quad 2n = 3 \quad \text{or} \quad n = \frac{3}{2}

73. $P_1V_1 + P_2V_2 = P_3V_3$, $(200 \times 720) + (400 \times 750) = P_3 \times 600$ or $P_3 = 740$ mm.

74. Staggered conformation ($c$) is the most stable.

75. Oxidation state of $P$ in $\text{Ba(H}_2\text{PO}_2\text{)}$

\[2 + 2 (2 + x - 4) = 0 \quad \text{or} \quad 2 + 4 + 2x - 8 = 0\]
\[2x = +8 - 2 - 4 = +2 \quad \therefore \quad x = +1\]

76. Lower the electronegativity, higher is the tendency of the atom/group to donate its pair of electrons and hence higher is its nucleophilicity. Now among $F$ ($4$-$0$), $O$ ($3$-$5$), $N$ ($3$-$0$) and $C$ ($2$-$5$), $C$ has the lowest electronegativity and hence $\text{CH}_3^-$ has the highest nucleophilicity.

77. $\text{Mg} + 2 \text{HCl} \longrightarrow 2 \text{MgCl}_2 + \text{H}_2$

$24 \text{ g} \quad 22.4 \text{ dm}^3 \text{ at NTP}$
\[\therefore \quad 12 \text{ g of Mg will give } \text{H}_2 = 11.2 \text{ dm}^3 \text{ at NTP}\]

78. $C_3 - C_2$ bond is shorter than $C_4 - C_3$ due to hyperconjugation while $C_2 - C_1$ being a double bond is the shortest.

79. $H^+ + e^- \longrightarrow \frac{1}{2}H_2$

\[E = E^\circ - \frac{0.059}{1} \log \frac{p_{H_2}^{1/2}}{[H^+]} = -0.059 \log \frac{p_{H_2}^{1/2}}{[H^+]}
E \text{ will be negative when } \frac{p_{H_2}^{1/2}}{[H^+]} \text{ is greater than 1.}
\]
\[i.e., \text{ when } p_{H_2} = 2 \text{ atm and } [H^+] = 1 \text{ M.}\]

80. \[\left[H^+\right] = \sqrt{K_w} = \sqrt{2.7 \times 10^{-14}} = 1.643 \times 10^{-7} \text{ M}\]
\[pH = -\log \left[H^+\right] = -\log (1.643 \times 10^{-7}) = 7 - 0.2156 = 6.78\]
81.

\[
\begin{align*}
\text{CH}_3 & \quad \text{CH}_3 \\
\text{CH}_3 & \quad \text{C} \quad \text{CH}_3 \\
\text{CH}_3 & \quad \text{C} \quad \text{CH}_3 \\
\text{CH}_3 & \quad \text{C} \quad \text{CH}_3 \\
\text{CH}_3 & \quad \text{CH}_3
\end{align*}
\]

3, 3-Di-tert-butyl-2, 2, 4, 4-tetramethylpentane

82.

\[
\text{Given } \log k = 6 - \frac{2000}{T}
\]

Comparing with \( \log k = \log A - \frac{E_a}{2 \cdot 303 \cdot RT} \)

\[
\log A = 6, \text{ i.e., } A = 10^6 \quad \text{and} \quad \frac{E_a}{2 \cdot 303 \cdot R} = 2000
\]

or \( E_a = 2000 \times 2 \cdot 303 \times 8 \cdot 314 \text{ J mol}^{-1} \)

\[
= 38294 \text{ J mol}^{-1} = 38.3 \text{ kJ mol}^{-1}
\]

83. Maximum \( m = +2 \) means \( l = 2 \) which can be so when \( n = 3 \).

When \( l = 2, m = -2, -1, 0, +1, +2 \).

84. Boiling points and densities decrease as the branching increases.

85. The enol forms of all of them are aromatic in nature.

86. \( C + B^+ \rightarrow C^+ + B \) shows that reducing power of \( C > B \)

\( D + B^+ \rightarrow D^+ + B \) shows that reducing power of \( D > B \)

\( A^+ + D \rightarrow \) No reaction shows that reducing power of \( A > D \)

\( C^+ + A \rightarrow \) No reaction shows that reducing power of \( C > A \)

Combining all these, we conclude that reducing powers will be in the order \( C > A > D > B \).

87.

Aim: \( C_2H_6 + \frac{7}{2} O_2 \rightarrow 2 CO_2 + 3 H_2O \)

\[
\Delta H^\circ = [2 \times \Delta_f H^\circ (CO_2) + 3 \times \Delta_f H^\circ (H_2O)]
\]

\[
= 2 \times (-941) + 3 \times (-68.3) = -188.2 - 204.9 + 21.0 = -372.1 \text{ k cal}
\]

\[
\]
88.

All the carbon atoms in benzen ring are $sp^2$ hybridized and hence diphenyl is a planar molecule.

89.

\[ T_1 = 27 + 273 = 300 \text{ K}, \quad T_2 = 273 - 3 = 270 \text{ K} \]

\[ k_2 = k, \quad k_1 = 10k \quad \text{(Higher the temperature, greater is the value of k)} \]

\[
\log \frac{k_2}{k_1} = \frac{-E_a}{2.303 R} \left( \frac{1}{T_1} - \frac{1}{T_2} \right)
\]

or

\[
\log \frac{1}{10} = \frac{-E_a}{2.303 R} \left( \frac{300}{300} - \frac{1}{270} \right)
\]

or

\[
-1 = \frac{-E_a}{2.303 R} \left( \frac{300 \times 270}{300 \times 270} \right)
\]

or

\[
E_a = 2.303 R \times 2700 \text{ J mol}^{-1} = 2.303 \times 2.7 \text{ kJ mol}^{-1}
\]

90. Electron gain enthalpy of $M^+ = -IE_1$ of $M$. Therefore, the value of electron gain enthalpy of Na$^+ = -5.1$ eV = $-IE_1$ of Na.

91. Transport in plants (E) Page no. 178, Table 11.1

92. Transport in plants (E) Fact based Page no. 180, 186, 187

93. Transport in plants (Moderate) Page no. 180, 182

In a flaccid cell, there is no flow of water towards the inside or outside. \(\psi_p = 0\)

94. Transport in plants (E) Page no. 186, 11.3.2.1

95. Photosynthesis in higher plants (E) Page no. 216, 217, 218

96. Transport in plants (E) Page no. 184, Fig 11.6

97. Transport in plants (E) Page no. 176, 11.1.2

98. Transport in plants (E) Page no. 177, 11.1.2.1

99. Transport in plants (E) Page no. 186, 11.3.2.1

100. Biological classification (MODERATE) Page no. 20, All eukaryotes have membrane bound organelles.

101. Transport in plants (E) Page no. 184, 11.3.1

102. Respiration in plants (E) Page no. 228, 14.2

103. Anatomy of flowering plants (E) Page no. 86, 6.1.2.1

104. Cell The unit of life (E) Page no. 137 (8.5.8) and Page no. 138 (8.5.9)

105. Morphology of flowering plants (MODERATE)

Page no. 73, 1st paragraph.

106. Mineral nutrition (MODERATE)

Page no. 201, 3rd last paragraph

107. Plant growth and development (E)

Page no. 249, 15.4.3.2

108. Cell cycle and cell division (E)

Page no. 165, 10.2.3

109. Respiration in plants (E)

Page no. 233

110. The living world (E)

Page no. 10, last paragraph

111. Transport in plants (E) Fact based, Page no. 187
112. Transport in plants (E) Fact based, page no. 186
113. Respiration in plants (E) Page no. 232, 1st paragraph
114. Plant kingdom (MODERATE)
   Page no. 42,43
115. Photosynthesis in higher plants (E) Page no. 230
116. Respiration in plants (MODERATE)
   Page no. 236 and 237
117. Photosynthesis in higher plants (E) Fact based
118. Photosynthesis in higher plants (E) Amaranthus in a C₄ plant with dimorphic chloroplast
119. Photosynthesis in higher plants (E) Fact based
120. Photosynthesis in higher plants (E) Fact based
121. Photosynthesis in higher plants (E) Fact based
122. Photosynthesis in higher plants (E) Fact based
123. Photosynthesis in higher plants (E) Fact based
124. Photosynthesis in higher plants (MODERATE) Page no. 218, 3.8
125. Transport in plants (E) Page no. 125, Fig 7.7
126. Respiration in plants (E) Page no. 232, Fig 14.3
127. Respiration in plants (E) Page no. 235, 14.6
128. Respiration in plants (E) Fact based
129. Respiration in plants (MODERATE) Page no. 231, 232 Fact based
130. Respiration in plants (MODERATE) Fact based
131. Respiration in plants (MODERATE) Fact based
132. Respiration in plants (MODERATE) Page no. 231, 232
133. Respiration in plants (E)
134. Photosynthesis in higher plants (E) Fact based
135. Photosynthesis in higher plants (E) Page no. 218, 219, 13.8
136. (XI-NCERT Pg. No. 324)
   The fovea is a thinned-out portion of the retina where only the cones are densely packed. It is the
   point where the visual acuity (resolution) is the greatest.
137. Broca’s area of speech is present in Frontal lobe. It is motor speech area.
138. (XI-NCERT Pg. No. 321)
   The hypothalamus contains a number of centres which control body temperature.
139. (XI-NCERT Pg. No. 320)
   The released neurotransmitters bind to their specific receptors.
140. Pupil of the eye constricts under parasympathetic nervous system whereas dilates under sympathetic
    nervous system.
141. (XI-NCERT Pg. No. 316 & 317)
   Nissl’s granules are present in cytoplasm of cell body.
142. (XI-NCERT Pg. No. 373)
   The inner layer is the retina and it contains three layers of neural cells – from inside to outside –
   ganglion cells, bipolar cells and photoreceptor cells.
143. (XI-NCERT Pg. No. 317 & 318)
144. (XI-NCERT Pg. No. 334)
   Parathyroid hormone (PTH) increases the Ca²⁺ levels in the blood.
145. (XI-NCERT Pg. No. 321)
The hemispheres are connected by a tract of nerve fibres called corpus callosum. Corpus callosum is a mammalian character.

146. (XI-NCERT Pg. No. 320 to 321)

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Diencephalon</td>
<td>4. thalamus</td>
</tr>
<tr>
<td>b. Telencephalon</td>
<td>1. cerebrum</td>
</tr>
<tr>
<td>c. Myelencephalon</td>
<td>2. medulla</td>
</tr>
<tr>
<td>d. Limbic system</td>
<td>3. amygdala</td>
</tr>
</tbody>
</table>

147. (XI-NCERT Pg. No. 326 fig. no. 21.8)

148. (XI-NCERT Pg. No. 334 Paragraph 2 & 3)

149. (XI-NCERT Pg. No. 317)

During resting, the axonal membrane is comparatively more permeable to potassium ions (K⁺) and nearly impermeable to sodium ions (Na⁺)

150. (XI-NCERT Pg. No. 332)

Prolactin regulates the growth of the mammary glands and formation of milk in them.

151. Wernicke’s area is present in temporal lobe it is responsible for comprehension of spoken and written words.

152. (XI-NCERT Pg. No. 332 & 338)

Vasopressin is synthesised by the hypothalamus and transported axonally to neurohypophysis. It is a neuro peptide hormone.

153. (XI-NCERT Pg. No. 338)

Hormone produce their effects on target tissues by binding to specific proteins called hormone receptors located in the target tissues only.

154. Noradrenaline is produced by Adrenal, whereas all the other are released by Pituitary.

155. Arbor vitae is composed of white mater present in Cerebellum of Hindbrain.

156. Cushing’s syndrome occurs due to increased production of cortisol.

157. (XI-NCERT Pg. No. 339 fig. 22.5 (a))

158. (XI-NCERT Pg. No.331 to 337)

<table>
<thead>
<tr>
<th>Gland</th>
<th>Secretion</th>
<th>Effect on Body</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ovary</td>
<td>Oestrogen</td>
<td>Maintenance of secondary sexual characters</td>
</tr>
<tr>
<td>Alpha cells of islets of Langerthans</td>
<td>Glucagon</td>
<td>Raises blood sugar level</td>
</tr>
<tr>
<td>Anterior pitultary</td>
<td>Growth hormone</td>
<td>Oversecretion leads to gigantism</td>
</tr>
</tbody>
</table>

159. (XI-NCERT Pg. No. 337 Paragraph 2, 3 & 4)

160. (XI-NCERT Pg. No. 333)

Pinal secretes a hormone called melatonin. Melatonin plays a very important role in the regulation of a 24-hour (diurnal) rhythm of our body.
161. (XI-NCERT Pg. No. 145 fig. 9.1 amino acids)

162. (XI-NCERT Pg. No. 332)
In females, LH induces ovulation of fully mature follicles graafian follicles.

163. (XI-NCERT Pg. No. 310)
Mammals have seven cervical vertebrae.

164. (XI-NCERT Pg. No. 48 3rd paragraph & Pg. no. 49 fig. 4.4)

165. (XI-NCERT Pg. No. 295)
Mammals have the ability to produce concentrated urine. The Henle’s loop and vasa recta play a significant role in this.

166. (XI-NCERT Pg. No. 103)
Tendons, attach skeletal muscles to bones are examples of dense regular connective tissues. They are specialized connective tissue.

167. (XI-NCERT Pg. No. 279)

<table>
<thead>
<tr>
<th>Column I</th>
<th>Column II</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Fibrinogen</td>
<td>2. Blood clotting</td>
</tr>
<tr>
<td>B. Globulin</td>
<td>3. Defence mechanism</td>
</tr>
<tr>
<td>C. Albumin</td>
<td>1. Osmotic balance</td>
</tr>
</tbody>
</table>

168. (XI-NCERT Pg. No. 149)
N-acetyl glucosamine is found in Exoskeletons of arthropods form a complex polysaccharide called chitin.

169. (XI-NCERT Pg. No. 260 1st paragraph)

170. (XI-NCERT Pg. No. 272)
Viral Capacity (VC): The maximum volume of air a person can breathe in after a forced expiration. This includes ERV, TV and IRV or the maximum volume of air a person can breathe out after a forced inspiration.

171. (XI-NCERT Pg. No. 332)
GnRH is a hypothalamic hormone. It stimulates the anterior lobe of pituitary gland to secrete LH and FSH. These two hormones play important role in menstrual cycle in human female. FSH is also involved in spermatogenesis in human males.

172. The parasympathetic neural signals affect the working of the heart by reducing heart rate and cardiac input through the post-ganglionic fibres. These fibres are very short and are cholinergic in nature.

173. (XI-NCERT Pg. No. 336)
Insulin acts mainly on hepatocytes and adipocytes (cells of adipose tissue), and enhances cellular glucose uptake and utilisation.

174. (XI-NCERT Pg. No. 333)
Myxedema (Gull’s disease) occurs due to the deficiency of thyroxine in adults. It causes low BMR low body temperature, tendency to retain water in tissues, reduced heart rate, pulse rate, blood pressure and cardiac output, low sugar and iodine level in blood, muscular weakness and oedema (accumulation of interstitial fluid that causes the facial tissues to swell and look fluffy).

175. (XI-NCERT Pg. No. 338)
Hormones which interact with intracellular receptors are steroid hormones, iodothyronines.

176. Abducens nerve is a cranial nerve which originates from the ventral surface of medulla oblongata. It innervates the lateral rectus muscle of eyeball. It is a motor nerve and controls the movements of the eyeball. Hence, if abducens nerve is injured in a man, movement of eyeball will be affected.

177. (XI-NCERT Pg. No. 335)
Epinephrine and nor epinephrine bring about similar effects but in different situation so they are not antagonistic.

178. (XI-NCERT Pg. No. 323)
Cornea transplantation is outstandingly successful because it is non-vascular, i.e. no blood supply and is not linked with immune system.

179. (XI-NCERT Pg. No. 322)
Reflex action is mediated via spinal cord.

180. (XI-NCERT Pg. No. 333)
Melatonin maintains the normal rhythms of sleep-wake cycle.