1. \[ I_0 = \int_0^{\pi/\omega} I_1 \, d\theta \]

\[ = \omega \int_0^{\pi/\omega} I_0 \sin \theta \, d\theta \]

\[ = \frac{\omega}{\pi} \left[ -\cos \theta \right]_0^{\pi/\omega} \]

\[ = -\frac{\omega}{\pi} \left[ -1 - 1 \right] = \frac{2I_0}{\pi} \]

2. The velocity \( v \) acquired by the parachutist after 10 sec. is:

\[ v = u + gt = 0 + 10 \times 10 = 100 \text{ m/s} \]

Let \( s_1 \) be height of fall for 10 sec. Then,

\[ s_1 = ut + \frac{1}{2}gt^2 = 0 + \frac{1}{2} \times 10 \times 100 = 500 \text{ m} \]

The distance travelled by the parachutist under retardation,

\[ s_2 = 2495 - 500 = 1995 \text{ m} \]

Let \( v' \) be his velocity on reaching the ground

then \( v'^2 - v^2 = -2as_2 \)

or \( v'^2 - (100)^2 = -2 \times 2.5 \times 1995 \)

Solving, we get, \( v' = 5 \text{ m/sec} \)

Kx = 3mg

after cut the string

\[ a = \frac{F_{net}}{2m} = \frac{kx - 2mg}{2m} \]

\[ a = \frac{3mg - 2mg}{2m} = \frac{g}{2} \]
4. \( \mathbf{w} = \int_{(0,0)}^{(2,3)} (2x \mathbf{i} + y^2 \mathbf{j}) \cdot (dx \mathbf{i} + dy \mathbf{j}) = 3 \)

6. \( y = \sqrt{3^2 + 4^2} = 5 \)

7. In the portion OA, slope (= velocity) of the curve is +ve; at the point A, slope of the curve is zero; while in the portion AB, slope of the curve is –ve. Hence \((v - t)\) curve will be as shown in fig.

8. \[ F_{\text{max}} = \frac{\mu mg}{(\cos \theta - \mu \sin \theta)} \]

\[ F_{\text{max}} = \frac{1}{2\sqrt{3}} \times \frac{3 \times 10}{\frac{1}{2} - \frac{1}{2\sqrt{3}} \times \frac{\sqrt{3}}{2}} = 20 \text{ N} \]

9. \[ F_c = N - mg \cos \theta \]

10. \[ N = mg \cos \theta - \frac{mv^2}{R} \]

as \( \theta \downarrow \cos \theta \uparrow N \uparrow \)

11. Here \((2\pi \Delta t/\lambda)\) as well as \((2\pi x/\lambda)\) are dimensionless. So, unit of \( \Delta t \) is same as that of \( \lambda \). Unit of \( x \) is same as that as \( \lambda \).

Since, \[ \left[ \frac{2\pi \Delta t}{\lambda} \right] = \left[ \frac{2\pi x}{\lambda} \right] = [\text{M}^0 \text{L}^0 \text{T}^0] \]

Hence, \[ \frac{2\pi c}{\lambda} = \frac{2\pi r}{\lambda t} \]

In the option (d) is unitless. It is not the case with \( c/\lambda \).

12. \[ H = \frac{1}{2} gt^2 \]

\[ \left( H - \frac{g}{16} H \right) = \frac{1}{2} g(t - 1)^2 \]

\[ \frac{9}{16} H = \frac{1}{2} g(t - 1)^2 \]

Eqn. (1)/(2)

13. \[ t = \sqrt{\frac{2S_{\text{rel}}}{a_{\text{rel}}}} = \sqrt{\frac{2 \times 6}{a_{\text{rel}}}} \]

\[ a_{\text{rel}} = 2a = \frac{2(m_2 - m_1)}{m_1 + m_2} - g \]

\[ = \frac{2 \times 3}{5} \times 10 = 12 \text{ m/s}^2 \]

\[ t = 1 \text{ sec} \]

14. \[ a_c = \frac{4}{r^2} \]

\[ v^2 = \frac{4}{r} \]

\[ v = \frac{2}{\sqrt{r}} \]

\[ P = mv = \frac{2m}{\sqrt{r}} \]

15. Moment of inertia of solid sphere of mass \( M \) and radius \( R \) about an axis passing through the centre of mass is: \( I = \frac{2}{5} MR^2 \). Let the radius of the disc is \( r \).

Moment of inertia of circular disc of radius \( r \) and mass \( M \) about an axis passing through the centre of mass and perpendicular to its plane is \( \frac{1}{2} Mr^2 \).

Using theorem of parallel axes, moment of inertia of disc about its edge is:

\[ I' = \frac{1}{2} Mr^2 + Mr^2 = \frac{3}{2} Mr^2 \]

Given: \( I = \Gamma \)

or \( \frac{2}{5} MR^2 = \frac{3}{2} Mr^2 \)

or \( r^2 = \frac{4}{15} R^2 \)

or \( r = \frac{2R}{\sqrt{15}} \)
16. \[ [v] = [T^{-1}] \\
[\ell] = [L] \\
[F] = [M^1L^1T^{-2}] \\
m = \frac{\rho^2 F}{4v^2\ell^2} \\
[m] = \frac{[F]}{[v^2][\ell^2]} = \frac{[M^1L^1T^{-2}]}{[T^{-2}][L^1]} \\
[m] = [M^1L^{-1}] \\
18. \text{When a spring is cut into two parts each part has spring constant more than that of original spring. If } k \text{ is spring constant & } \ell_0 \text{ is natural length, then for cut parts} \\
\begin{align*}
\frac{2\ell_0^3}{3k/2} & \quad \frac{\ell_0^3}{3k} \\
\text{If they are stretched by same amount then work done in shorter part will be double than that in the case of longer part.}
\end{align*}
19. \text{For equilibrium} \\
\mu \geq \tan \theta \\
\mu \geq \tan \alpha \\
\frac{1}{3} \geq \tan \alpha \\
\frac{1}{3} \geq \frac{1}{\cot \alpha} \\
\cot \alpha \leq 3 \\
20. \text{TE}_i = \text{TE}_f \\
\frac{1}{2} \ell \omega^2 = mgh \\
\begin{align*}
\frac{1}{2} \times \frac{1}{3} m \ell^2 \omega^2 = mgh \\
or \quad h = \frac{\ell^2 \omega^2}{6g}
\end{align*}
21. \text{Percentage error} \\
= \frac{\Delta V}{V} \times 100 = \left( \frac{\Delta L}{L} + \frac{2\Delta d}{d} \right) \times 100 \\
= \left[ \frac{0.1}{5.0} + \frac{2 \times 0.01}{2.00} \right] \times 100 = 3\% \\
23. \text{W} = F \cdot \hat{S} \\
W = R \cdot S \cdot \cos 0^\circ \\
= M(g + a) \times S \times 1 \\
= M(g + a) \times \left( \frac{1}{2} a T^2 \right) \\
24. a_1 = 3 \text{ m/s}^2 \\
a_x = \frac{v^2}{r} = \frac{1600}{400} = 4 \\
a = \sqrt{a_x^2 + a_y^2} = 5 \text{ m/s}^2 \\
25. \text{Total mass} = M, \text{total length} = L \text{ Moment of inertia of OA = OB about Q} \\
= MI_{\text{total}} = 2 \times \left( \frac{M}{2} \right) \times \left( \frac{L}{2} \right)^2 \times \frac{1}{3} = \frac{ML^2}{12} \\
26. \text{Let } \vec{\omega} = 3 \hat{i} + 4 \hat{j} \text{ Now,} \\
(3\lambda)^2 + (4\lambda)^2 = 7^2 + 24^2 \\
\Rightarrow \lambda = 5 \\
\therefore \quad \vec{\omega} = 15 \hat{i} + 20 \hat{j} \\
27. y = 16x \left( 1 - \frac{5x}{64} \right) \\
so, \quad R = \frac{64}{5} = 12.8m \\
28. \therefore \quad W = \vec{F} \cdot \vec{S} \\
\Rightarrow \quad (S) = \frac{W}{F} = \frac{300}{50} = 6 \\
\Rightarrow \quad S = |x| + |y| + |z| \\
& \therefore \quad |x| = |y| = |z| \\
\Rightarrow \quad \text{Final coordinate of point is } (2, 2, 2)
30. For pure translationary motion of object, the force should act at the centre of mass.

\[ Y_{\text{CM}} = \frac{m \times 2\ell + 2m \times \ell}{3m} = \frac{4\ell}{3}. \]

31. \[ \vec{v} = |\vec{v}| \hat{v} \]
\[ = 6 \left( \frac{2\hat{i} + 2\hat{j} - \hat{k}}{3} \right) \]
\[ = 4\hat{i} + 4\hat{j} - 2\hat{k} \]

33. \[ W = (\text{Area})_1 - (\text{Area})_2 \]
\[ W = \frac{1}{2} \times (3 + 1) \times 10 - \frac{1}{2} \times (2 + 1) \times 10 \]
\[ = 5 \text{ J} \]

34. \[
\begin{align*}
m &= 3 \text{ m} \\
v &= 15 \text{ m/s} \\
15 \text{ m/s} &\rightarrow 3 \text{ m}
\end{align*}
\]

\[ mv = \sqrt{(3m \times 15)^2 + (3m \times 15)^2} \]
\[ mv = 45m\sqrt{2} \]
\[ v = 45\sqrt{2} \text{ m/s} \]

\[ a = \frac{g \sin \theta}{\beta} = \frac{g \sin \theta}{1 + \frac{1}{MR^2}} \]

For a solid sphere : \[ I = \frac{2}{5} MR^2 \]

\[ a = \frac{g \sin 30^\circ}{1 + \frac{1}{MR^2}} = \frac{10 \times \frac{1}{2}}{\frac{7}{5}} \]
\[ = \frac{5}{7} \times 5 = \frac{25}{7} \text{ m/s}^2. \]

35. The only force which can provide horizontal acceleration to m block is normal force. \[ W = \text{AKE} \]
\[ W = \frac{1}{2}mv^2 = \frac{1}{2}(at)^2 = 50\text{ J} \]

39. \[ \vec{r}_{\text{cm}} = \frac{m_1\vec{r}_1 + m_2\vec{r}_2}{m_1 + m_2} \]

40. Required fraction

\[ \frac{K_R}{K_R + K_T} = \frac{1}{2} \left( I_o^2 + \frac{1}{2} MV^2 \right) \]
\[ = \frac{1}{2} \left( MR^2 \omega^2 + \frac{1}{2} MV^2 \right) \]
\[ = \frac{MR^2 \left( \frac{v^2}{R^2} \right)}{MR^2 \left( \frac{v^2}{R^2} \right) + MV^2} \]
\[ = \frac{MV^2}{MV^2 + MV^2} = \frac{1}{2} \]

41. \[ s = kt^{1/2} \]
\[ \frac{d^2s}{dt^2} = -\frac{1}{4} kt^{-3/2} \]
As \( t \) increases, the retardation decreases.

42. 2T \( (a_A)_x = T (a_B)_y \)
\( (a_B)_y = 10 \text{ m/s}^2 \)

\[ \begin{array}{c}
\text{B} \\
\downarrow 5\text{ m/s}^2 \\
10\text{ m/s}^2 \\
\end{array} \]
\[ a_B = \sqrt{5^2 + 10^2} = 5\sqrt{5} \text{ m/s}^2 \]

43. \[ \frac{1}{2} MV^2 - M\frac{L}{2} = -\frac{M}{2} g \frac{L}{4} \text{ (energy conservation)} \]

44. \[ \vec{v}_{\text{cm}} = \frac{m_1\vec{v}_1 + m_2\vec{v}_2}{m_1 + m_2} \]
48. For ideal solution
\[ \Delta H_{\text{mix}} = 0, \Delta V_{\text{mix}} = 0 \]

52. \[ K_p = \frac{\alpha^2}{1 - \alpha^2} P \approx \alpha^2 P. \]

so, \[ \alpha \approx \sqrt{\frac{K_p}{P}}. \]

53. \[ \text{pH} = 2 \]
\[ (H^+) = 0.01 \text{ M} = C\alpha = 0.1 \times \alpha \]
\[ \alpha = 0.1 \]
\[ i = 1 - \alpha + n\alpha \]
\[ = 1 - 0.1 + 2 \times 0.1 \]
\[ = 1.1 \]
\[ \pi = i \times \text{CRT} \]

54. \[ M_1 V_1 + M_2 V_2 = M_3 (V_1 + V_1) \]
\[ 0.1V + 0.5 \times 200 = 0.25(200 + V) \]
\[ V = 333.33 \text{ ml} \]

61. \[ \overset{-5^\text{th}}{\rightarrow} \text{Excited state} \]
\[ \downarrow \]
\[ \downarrow \]
\[ \downarrow \]
\[ \downarrow \]
\[ 6 \quad 5 \quad 4 \quad 3 \quad 2 \quad 1 \quad \text{Ground state} \]

62. \[ K_p = K_c (RT)^{\Delta n} \quad \Delta n = -1 \quad \therefore K_p = \frac{K_c}{RT} \]

65. For tetrahedral void \[ \frac{r^t}{r} = 0.225 \]
For octahedral void \[ \frac{r^o}{r} = 0.414 \]

67. \[ K_c = [H_2O]^2. \] Solid phases are not to be reported.

68. \[ H_2O = 2 \text{ mole}; CO = 1 \text{ mole}, \]
\[ C_2H_5OH = 1 \text{ mole}, N_2O_5 = 1/2 \text{ mole} \]

70. for X, \[ 6 \times \frac{1}{8} = \frac{3}{4} \]
for Y, \[ 6 \times \frac{1}{2} = 3 \]
so \[ X_{3/4} Y_{3/4} \quad \text{or} \quad X_3 Y_{12} \quad \text{or} \quad X Y_4 \]

73. \[ A + 2B \longrightarrow C \]
\[ 5 \quad 8 \quad 0 \]
\[ (5 - 4) \quad 0 \quad 4 \]

75. Equal number of cations and anions are missing.

78. Meq. of \[ HNO_3 = 25 \times 3 = 75; \]
Meq. of \[ HNO_3 = 75 \times 4 = 300 \]
\[ \therefore \text{Total Meq.} = 375 \]
Thus \[ 375 = N \times 100 \]
\[ \therefore N = 3.75 \]

83. Meq. of metal = Meq. of oxygen
\[ \frac{60}{E} = \frac{40}{8}; \quad \therefore E = 12 \]

85. For f.c.c. structure.
\[ \text{radius of atom} = \frac{a}{2\sqrt{2}} = \frac{361}{2\sqrt{2}} = 127.56 \text{ pm} \]

87. \[ P_{N_2} = 0.8 \times 5 = 4 \text{ atm} = K_N \times X_{N_2} \]

88. Given that, mass % of \[ H_2SO_4 = 29\% \]
i.e., 100 g solution contains 29 g \[ H_2SO_4 \]

Let the density of solution (in g/mL) is \[ d \]
\[ \therefore \text{Molarity of solution} \]
\[ \text{Moles of } H_2SO_4 = \frac{29/98}{100/d} \times 1000 \]
\[ = \frac{360}{d} \quad (\therefore M = 3.60) \]
or \[ d = 1.22 \text{ g mL}^{-1} \]

90. \[ r_c + r_a = \sqrt[3]{\frac{3a}{2}} \]
\[ \therefore r_c + r_a = \sqrt[3]{\frac{3 \times 4.3}{2}} = 3.72 \text{ Å} \]
<table>
<thead>
<tr>
<th>No.</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>92</td>
<td>NCERT XI page # 56</td>
</tr>
<tr>
<td>93</td>
<td>NCERT XI page # 48</td>
</tr>
<tr>
<td>98</td>
<td>NCERT-XI / Pag. No. 132</td>
</tr>
<tr>
<td>102</td>
<td>NCERT XI Page # 49</td>
</tr>
<tr>
<td>103</td>
<td>NCERT XI page # 54</td>
</tr>
<tr>
<td>113</td>
<td>NCERT XI Page # 53</td>
</tr>
<tr>
<td>114</td>
<td>NCERT Page-38 Para -1</td>
</tr>
<tr>
<td>119</td>
<td>NCERT page # 96</td>
</tr>
<tr>
<td>123</td>
<td>NCERT XI page # 50</td>
</tr>
<tr>
<td>127</td>
<td>NCERT - XI / Pag. No. 165-166</td>
</tr>
<tr>
<td>129</td>
<td>NCERT page # 87</td>
</tr>
<tr>
<td>132</td>
<td>NCERT XI page # 57</td>
</tr>
<tr>
<td>139</td>
<td>NCERT page # 85</td>
</tr>
<tr>
<td>142</td>
<td>NCERT XI page # 55</td>
</tr>
<tr>
<td>144</td>
<td>NCERT Page-32, Para -3.1.2</td>
</tr>
<tr>
<td>147</td>
<td>Tight junctions limits the lateral movements of proteins on the membrane.</td>
</tr>
<tr>
<td>148</td>
<td>NCERT Page - 76</td>
</tr>
<tr>
<td>149</td>
<td>NCERT page # 85</td>
</tr>
<tr>
<td>152</td>
<td>NCERT XI page # 47</td>
</tr>
<tr>
<td>157</td>
<td>NCERT-XI / Pag. No. 165</td>
</tr>
<tr>
<td>159</td>
<td>NCERT page # 86</td>
</tr>
<tr>
<td>162</td>
<td>NCERT XI page # 57</td>
</tr>
<tr>
<td>167</td>
<td>NCERT-XI / Pag. No. 170 (Summary)</td>
</tr>
<tr>
<td>169</td>
<td>NCERT page # 93</td>
</tr>
<tr>
<td>171</td>
<td>NCERT XI Page # 58</td>
</tr>
<tr>
<td>173</td>
<td>NCERT Page-13 Para -1.4.5</td>
</tr>
<tr>
<td>176</td>
<td>NCERT XI page # 50</td>
</tr>
<tr>
<td>180</td>
<td>NCERT XI Page # 107</td>
</tr>
</tbody>
</table>