Uniform Circular Motion

81. (c)

82. (a) $T = m\omega^2 r \Rightarrow \omega \propto \sqrt{T} \therefore \frac{\omega_2}{\omega_1} = \sqrt{\frac{1}{4}} \Rightarrow \omega_2 = \frac{\omega_1}{2} = 5rpm$

83. (d) $\theta = tan^{-1}\left(\frac{v^2}{rg}\right) = tan^{-1}\left[\frac{(14\sqrt{3})^2}{20\sqrt{3}\times 9.8}\right] = tan^{-1}[\sqrt{3}] = 60°$

84. (c) Centripetal acceleration= $4\pi^2 n^2 r = 4\pi^2\left(\frac{1}{2}\right)^2 \times 4 = 4\pi^2$

85. (b) Centripetal force = breaking force

$\Rightarrow m\omega^2 r$ =breaking stress × cross sectional area

$\Rightarrow m\omega^2 r = p \times A \Rightarrow \omega = \sqrt{\frac{p\times A}{mr}} = \sqrt{\frac{4.8\times 10^7 \times 10^{-6}}{10\times 0.3}}$

$\therefore\ \omega = 4rad/sec$

86. (a) Because velocity is always tangential and centripetal acceleration is radial.

87. (c) *T* = tension, *W* = weight and *F* = centrifugal force.

88. (c) $\mu = \frac{v^2}{rg} = \frac{(4.9)^2}{4\times 9.8} = 0.61$

89. (d) As body covers equal angle in equal time intervals. its angular velocity and hence magnitude of linear velocity is constant.

90. (b) $\omega = \frac{v}{r} = \frac{10}{100} = 0.1rad/s$

91. (a) $F = \frac{mv^2}{r} \Rightarrow v = \sqrt{\frac{rF}{m}}$

92. (d) Electrostatic force provides necessary centripetal force for circular motion of electron.

93. (a) Acceleration= $\omega^2 r = \frac{v^2}{r} = \omega v = \frac{2\pi}{T} v$

94. (b) $v = \sqrt{\mu r g} = \sqrt{0.6 \times 150 \times 10} = 30 m/s$

95. (b)

96. (c) $F = \frac{mv^2}{r} \Rightarrow F \propto v^2$ *i.e.* force will become 4 times.

97. (d) $v = \sqrt{\mu r g} = \sqrt{0.25 \times 40 \times 10} = 10 m/s$

98. (d) Time period = 40 *sec*

No. of revolution= $\frac{\text{Total time}}{\text{Time period}} = \frac{140 sec}{40 sec = 3.5 Rev}$.

So, distance= $3.5 \times 2\pi R = 3.5 \times 2\pi \times 10 = 220 m$.

99. (a) $m 4\pi^2 n^2 r = 4 \times 10^{-13} \Rightarrow n = 0.08 \times 10^8 cycles/sec$.

100. (b) Momentum changes by 2*mv* but kinetic energy remains same.