Uniform Circular Motion

61. (d) $v\sqrt{\mu rg}\sqrt{0.2 \times 100 \times 9.8}_{max}$

62. (d) $F = mg - \frac{mv^2}{r}$

63. (a) $\omega = \frac{2\pi}{T} = \frac{2\pi}{60} = \frac{\pi}{30} rad/s$

64. (b) $\omega = 2\pi n = \frac{2\pi \times 100}{60} = 10.47 rad/s$

65. (d) Work done in circular motion is always zero.

66. (d) In complete revolution total displacement is zero so average velocity is zero

67. (c) $v\sqrt{\mu rg}\sqrt{0.75 \times 60 \times 9.8}_{max}$

68. (a) Distance covered in '*n*' revolution = $n\ 2\pi\ r = n\pi D$

$\Rightarrow 2000\pi D = 9500$ [As *n* = 2000, distance = 9500 *m*]

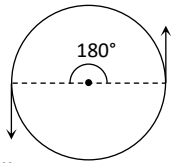
$\Rightarrow D = \frac{9500}{2000 \times \pi} = 1.5m$

69. (c) Centripetal acceleration = $4\pi^2 n^2 r = 4\pi^2 \times (1) \times 0.4 = 1.6\pi^2$

70. (a)

71. (b) Due to centrifugal force.

72. (d) As momentum is vector quantity



$\therefore$ change in momentum

$\Delta P = 2mv\,sin(\theta \rightleftarrows/2)$

$=2mv\,sin(90) = 2mv$

But kinetic energy remains always constant so change in kinetic energy is zero.

73. (a) $\omega = \frac{v}{r} = \frac{100}{100} = 1rad/s$

74. (c) $\alpha = \frac{d\omega}{dt} = 0$ (As ω = constant)

75. (b) $\vec{v} = \vec{\omega} \times \vec{r} = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ 3 & -4 & 1 \\ 5 & -6 & 6 \end{vmatrix} = -18\hat{\imath} - 13\hat{\jmath} + 2\hat{k}$

76. (a) $a = 4\pi^2 n^2 r = 4\pi^2 \left(\frac{1}{2}\right)^2 \times 50 = 493cm/s^2$

77. (c) Maximum force of friction = centripetal force

$\frac{mv^2}{r} = \frac{100\times(9)^2}{30} = 270N$

78. (a) $v = \sqrt{\mu rg} = \sqrt{0.4 \times 30 \times 9.8} = 10.84m/s$

79. (b) $v = r\omega = 0.5 \times 70 = 35m/s$

80. (a) $2\pi r = 34.3 \Rightarrow r = \frac{34.3}{2\pi}$ and $v = \frac{2\pi r}{T} = \frac{2\pi r}{\sqrt{22}}$

Angle of binding $\theta = tan^{-1}\left(\frac{v^2}{rg}\right) = 45°$