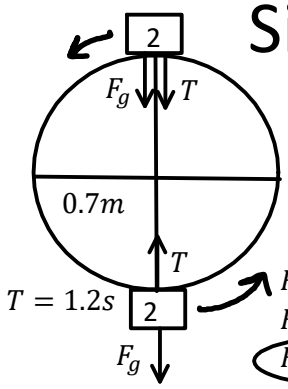
P12 - 7.6 - Ball String Circle Notes

F_g: *Straight down*
T: *Towards centre*
F_n : *Away from ground*

A 2 kg mass on a 0.7 m string is spun around a circle with a period T of 1.2 s. Find the T in the string at the top and bottom of path.



Side View

$$F_c = \frac{m4\pi^2 r}{T^2}$$

$$F_c = \frac{(2)(4)(\pi^2)(0.7)}{1.2^2}$$

$$F_c = 38.38\ N$$

$$F_g = mg$$

$$F_g = 2(9.8)$$

$$F_g = 19.6\ N$$

Top

$$F_c = T + F_g$$

$$T = F_c - F_g$$

$$T = 38.38 - 19.6$$

$$T = 18.78\ N$$

Bottom

$$F_c = T - F_g$$

$$T = F_c + F_g$$

$$T = 38.38 + 19.6$$

$$T = 57.98\ N$$

What is the minimum v of the object at the top of the circular path to remain in circular motion? $T = 0$

$$F_c = T + F_g$$

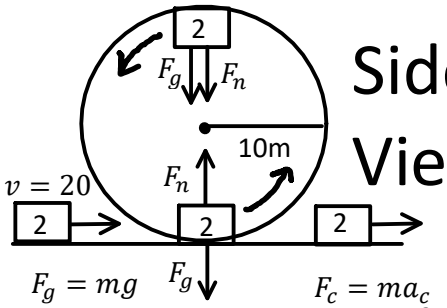
$$\frac{mv^2}{r} = mg$$

$$v = \sqrt{gr}$$

$$v = \sqrt{9.8(0.7)}$$

$$v = 2.62\frac{m}{s}$$

A 2 kg cart follows a circular path $r = 10m$ with $v = 20\frac{m}{s}$. Find F_n at the top and bottom.



Side View

$$F_g = mg$$

$$F_g = 2(9.8)$$

$$F_g = 19.6\ N$$

$$F_c = ma_c$$

$$F_c = \frac{mv^2}{r}$$

$$a_c = \frac{v^2}{r}$$

$$F_c = \frac{2(20)^2}{10}$$

$$F_c = 80N$$

Top

$$F_c = F_n + F_g$$

$$F_n = F_c - F_g$$

$$F_n = 80 - 19.6$$

$$F_n = 60.4N$$

Bottom

$$F_c = F_n - F_g$$

$$F_n = F_c + F_g$$

$$F_n = 80 + 19.6$$

$$F_n = 100.6N$$

What is the minimum velocity required for a cart not to fall off the circular path. $F_n = 0$

$$F_c = T + F_g$$

$$F_c = F_g$$

$$\frac{mv^2}{r} = mg$$

$$\frac{v^2}{r} = g$$

$$v = \sqrt{gr}$$

$$v = \sqrt{9.8(0.7)}$$

$$v = 2.62\frac{m}{s}$$