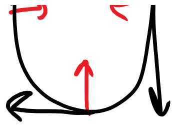


$\frac{v^2}{r} = \mu g$

A nickel of mass 1.0 g is placed on a record of radius 12 cm, if the record rotates at 30 rpm (revolutions per minute) what minimum coefficient of friction is necessary to prevent the coin from sliding off?

$m = 1.0\,g \quad r = 12\,cm \quad 30 = rpm \quad \mu = ?$

$30\,rpm = \frac{30\,cycles}{60\,seconds} = .5\,Hz \rightarrow f$

$$\mu g = 4\pi^2 r f^2$$

$$\mu = \frac{4\pi^2(12\times10^{-2})(.5)^2}{9.8} = .12$$

A lamborghini of mass 1000 kg travels through a corner of radius 50 m, at what maximum speed can it travel if the coefficient of friction is 0.85 between the tires and road?

$m = 1000\,kg \quad r = 50\,m \quad \mu = .85 \quad v = ?$

$F_c = F_f$

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

$v = \sqrt{\mu g r}$

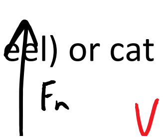
$= \sqrt{.85(9.8)(50)}$

$= 20.4\,m/s$

Vertical Circles:

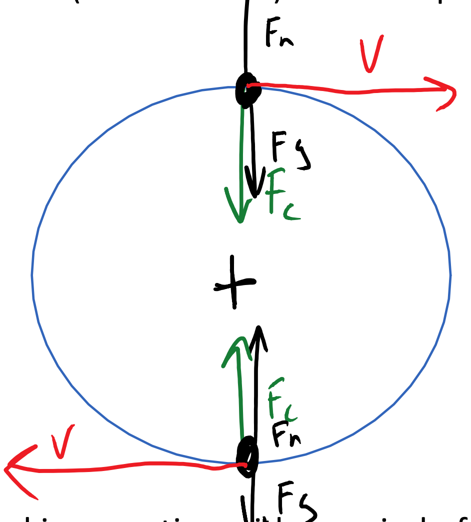
Draw the free body diagram, if you don't, you are choosing to get it wrong.

Rigid Structures (Ferris Wheel) or cat on pole:



Top $F_c = F_g - F_n$ away from

Rigid Structures (Ferris Wheel) or cat on pole:



Top $F_c = F_g - F_n$ — away from center

$F_{net} = W - L$ — toward center

Bottom $F_c = F_n - F_g$

A ferris wheel is operating with a period of 60 seconds and radius 15 m, calculate the normal force on a 70 kg mass at the top and bottom of the path.

$T = 60$ $r = 15m$ $F_n = ?$ (top/bottom) $m = 70$

$F_{c_{top}} = F_g - F_n$

$ma_c = ma - F_n$

$70(4\pi^2 r f^2) = 70(9.8) - F_n$

$$\frac{70(4)\pi^2 r}{T^2}$$

$F_n = 674\ N$

$F_{c_{Bot}} = F_n - F_g$

ma_c

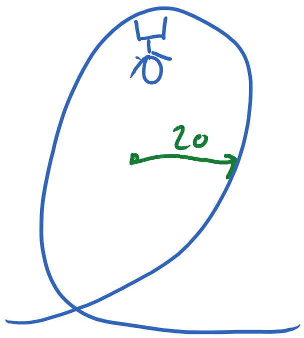
$70(4\pi^2 r f^2) = F_{n_{Bot}} - 70(9.8)$

$F_{n_{Bot}} = 698\ N$

What minimum speed must riders have so that

What minimum speed must riders have so that upside down riders don't fall out?

The upside down ride: top point only



$F_c = F_g - F_n \rightarrow F_n = 0$

$\cancel{m} a_c = \cancel{m} g$

$\frac{v^2}{r} = g$ $\quad v = 14\ m/s$

$\frac{v^2}{20} = 9.8$

~~Alex~~ = Kyle 66 kg = mass

vomit comet

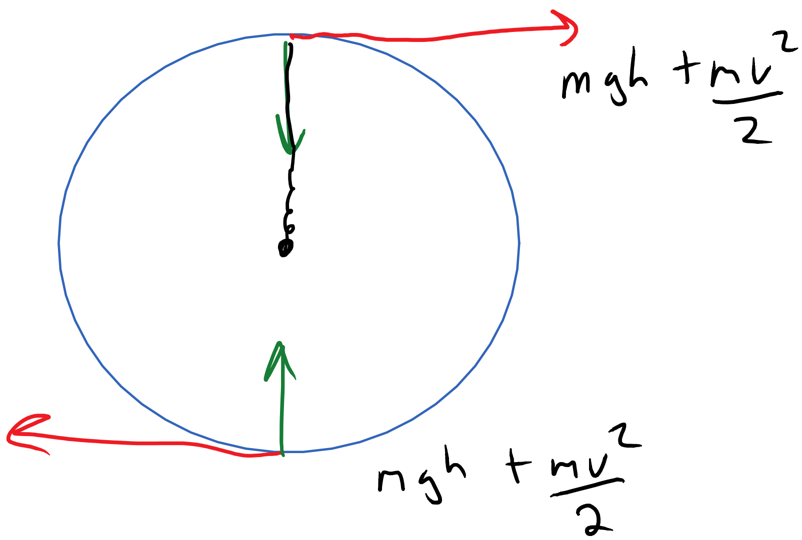
ok go.

Weight = Fg

Weightless = $F_n = 0$

Objects (cats) swung on a rope:

The velocity of an object in vertical circle on a rope is usually NOT constant. It changes from the top to the bottom using the Law of Conservation of Energy.



The slowest you can be at the top; $F_T = 0$

Top: there is a minimum speed
At the top of the circle and at that
Speed F_T = 0 N

What minimum speed must you swing a 5kg cat on a 1.0 m leash to go through the circle?

$F_c = F_g + F_T$ → set equal to zero.

$\cancel{m}a_c = \cancel{m}g$

$\frac{v^2}{r} = g$ → $v = 3.13$ m/s

What is the F_T when the cat reaches the bottom?

1) Use conservation of energy to find v @ bottom.

$$\cancel{5}(9.8)(2) + \frac{\cancel{5}(3.13)^2}{2} = 0 + \frac{\cancel{5}\,V_f^2}{2}$$

$V_f = 7.0$ m/s

2) F = W - L

$F_c = F_T - F_g$

$ma_c = F_T - mg$

$5\left(\frac{7.0^2}{\,}\right) = F_T - 5(9.8)$

$F_T = 294 N$