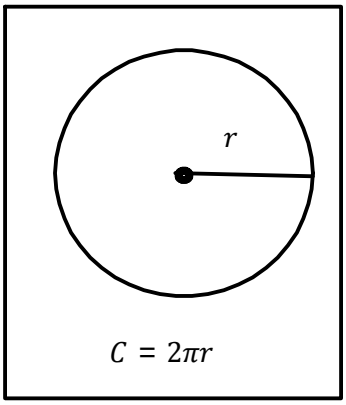
P12 - 7.1 - Circular Motion Notes

Uniform Cirular Motion: Constant Speed!

$$v = \frac{d}{t}$$

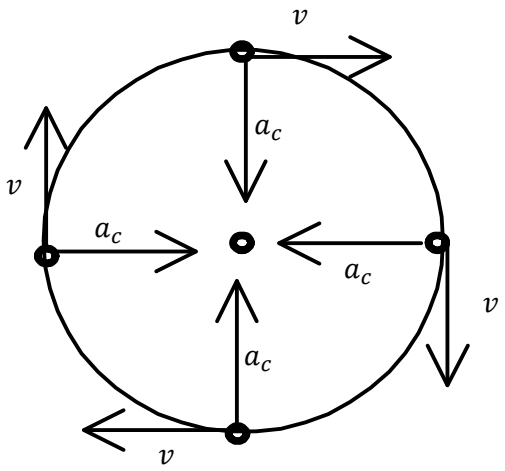
$$\boxed{v = \frac{2\pi r}{T}} \qquad d = 2\pi r \qquad T: Period\ (time\ of\ revolution)$$



$$\boxed{a_c = \frac{v^2}{r}} \qquad Difficult\ Theory$$

$$\boxed{a_c = \frac{4\pi^2 r}{T^2}} \qquad a_c = \frac{\left(\frac{2\pi r}{T}\right)^2}{r} \qquad Substisute\ v\ and\ solve$$

Clockwise Motion



Velocity is tangent to circle

Acceleration is towards centre, perpendicular to velocity.

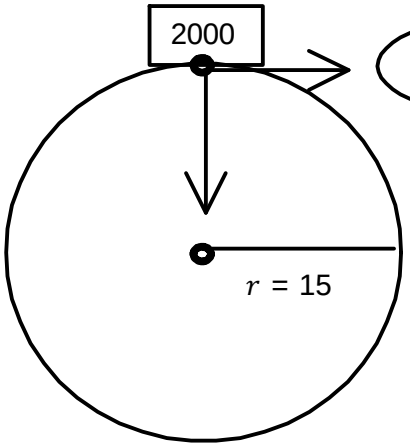
Centripetal Force: Force by acceleration towards centre of circle.

$$\boxed{F_c = ma_c} \qquad \boxed{F_c = \frac{mv^2}{r}}$$

$$\boxed{F_c = m\frac{4\pi^2 r}{T^2}}$$

P12 - 7.1 - Circular Motion Notes

It takes 20 seconds for a car to drive around a circle with a Radius of 15 m.
Find the Velocity of the car.
Find the Acceleration of the car.
If the mass of the car is 2000 kg Find the Centripetal Force on the car.



$v = 4.71\frac{m}{s}$

$T = 20s$

$d = 2\pi r$
$d = 2\pi(15)$
$d = 30\pi\ m$

$d = 94.25\ m$

$v = \frac{d}{t}$

$v = \frac{94.25}{20}$

$v = 4.71\frac{m}{s}$

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

$a_c = \frac{4.71^2}{15}$

$a_c = 1.48\frac{m}{s^2}$

$F_c = ma_c$
$F_c = (2000)(1.48)$

$F_c = 2960.88\ N$

or

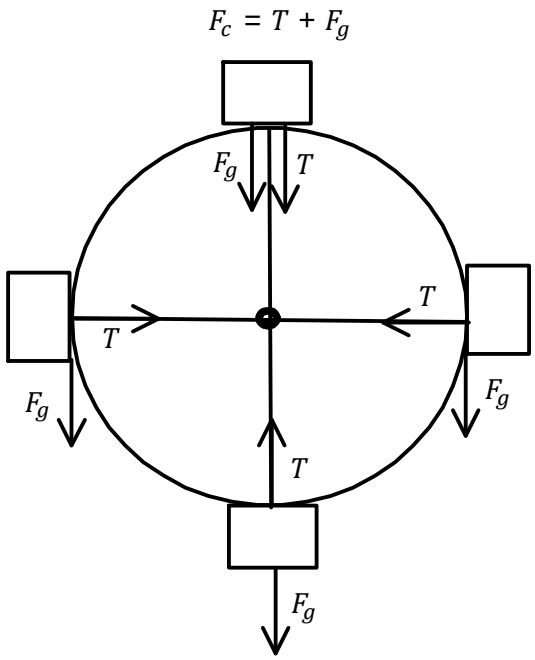
$F_c = m\frac{4\pi^2 r}{T^2}$

$F_c = \frac{(2000)(4)\pi^2(15)}{20^2}$

$F_c = 2960.88\ N$

P12 - 7.2 - Circular Ball String Motion Notes

A ball is attaced to a string and spun around in a circle.



F_g: *Always straight down*

T: *Always towards centre*

Usually only asked questions at the top and bottom

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 tension in the string when the object is at the top and bottom of the circular path.

$F_g = mg$
$F_g = 2(9.8)$
$F_g = 19.6\ N$

$F_c = \frac{m4\pi^2 r}{T^2}$
$F_c = \frac{(2)(4)(\pi^2)(0.7)}{1.2^2}$
$F_c = 38.38\ N$

Top

$F_c = T + F_g$
$T = F_c - F_g$
$T = 38.38 - 19.6$
$T = 18.78\ N$

Bottom

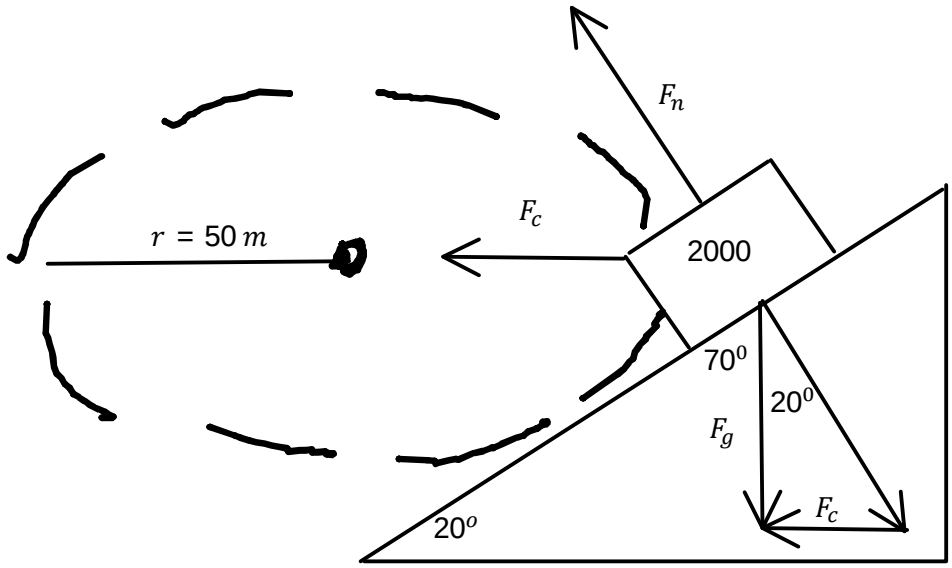
$F_c = T - F_g$
$T = F_c + F_g$
$T = 38.38 + 19.6$
$T = 57.98\ N$

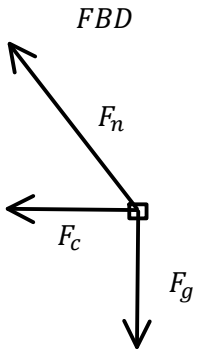
What is the minimum speed of the object at the top of the circular path to remain in circular motion?

$T = 0$

$F_c = T + F_g$
$F_c = F_g$
$\frac{mv^2}{r} = mg$
$\frac{v^2}{r} = g$
$v = \sqrt{gr}$
$v = \sqrt{9.8(0.7)}$
$v = 2.62\frac{m}{s}$

P12 - 7.3 - Circular Banked Curve Motion Notes





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

$$F_c = \frac{2000(4)(\pi^2)(50)}{30^2}$$

$$F_c =$$

$$F_c = F_g sin\theta$$
$$F_c = mgsin20$$
$$F_c = 2000(9.8)sin20$$
$$F_c = 6703.59$$

Find the Centripital Force of a 2000 *kg Car travelling around a* 20^0 *frictionles circular banked curve with a radius of* 50 *m in* 30 *s*?