Chapter 5

2022年10月24日 21:05

Component in circular motion

① Angular displacement

$\theta = \frac{s}{r}$ → length of arc, → radius

rad

+θ anticlockwise

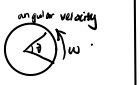
−θ clockwise

② Angular velocity

↳ rate of change of θ

$\omega = \frac{\theta}{t}$

$rads^{-1}$



③ Period

↳ time taken for 1 complete revolution

$T = \frac{2\pi}{\omega}$

s

1. $1rev = 2\pi$, $t = T$
2. $\omega = \frac{\Delta\theta}{\Delta t} = \frac{2\pi}{T}$
3. $T = \frac{2\pi}{\omega}$

④ Frequency

$f = \frac{1}{T}$

Hz, period

$\omega = \frac{2\pi}{T}$

$\omega = 2\pi f$

⑤ linear velocity

$v = r\omega$

ms^{-1}, m, $rads^{-1}$

- perpendicular to radius
- same magnitude
- but different direction

Centripetal

① centripetal acceleration

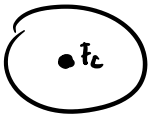
$a_c = \frac{v^2}{r}$ (ms^{-2}, ms^{-1}, m)

$a_c = \frac{(r\omega)^2}{r}$ ← $v = r\omega$

$a_c = r\omega^2$

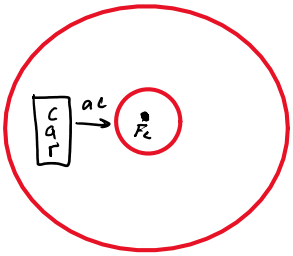
② Centripetal force

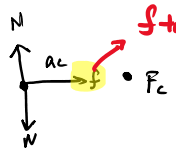
$F_c = \frac{mv^2}{r}$ (kg, N, m)



$F_c = mr\omega^2$

$F_c = mv\omega$ (ms^{-1})





$\Sigma f_y = 0$

$N - W = 0$

$N = W$

$\Sigma F_x = F_c$

$f = ma_c$

$\mu N = m\left(\frac{v^2}{r}\right)$

$\mu mg = m\left(\frac{v^2}{r}\right)$