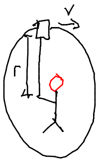
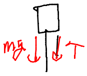
Object moving in a circle at constant speed

then net force must point towards center of circle

$F_{net} = m\boxed{\frac{v^2}{r}}$ — centripetal acceleration

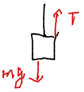




$\downarrow +$

$mg + T = m\frac{v^2}{r}$

$T = m\frac{v^2}{r} - mg$



upward

$mg - T = -m\frac{v^2}{r}$

$T = mg + m\frac{v^2}{r}$

Tension is greater at bottom

At bottom, $T > mg$

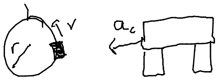
At top, T could "go negative" which means T disappears

If $T \leq 0$, $m\frac{v^2}{r} - mg \leq 0$

$\frac{v^2}{r} \leq g \rightarrow v \leq \sqrt{rg}$

Tension disappears at top if $v \leq \sqrt{rg}$

Car going around a circle



$F_{net} = m\frac{v^2}{r} = ma_c$

$S = m\frac{v^2}{r}$, but only exists if

$S \leq \mu_s N$

$\cancel{m}\frac{v^2}{r} \leq \mu_s \cancel{m}g$

$v^2 \leq \mu_s rg \rightarrow v \leq \sqrt{\mu_s rg}$

Which of these forces causes the centripetal acceleration?

A) W

B) N

$\boxed{\text{C) S}}$

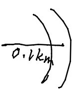
D) K

E) None of these

e.g. rubber on dry concrete

$\mu_k = 0.84$

$r = 0.1\,km$

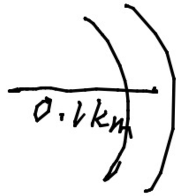


$v \leq \sqrt{(0.84)(0.1\times10^3 m)(9.8 m/s^2)}$

e.g. rubber on dry concrete

$\mu_k = 0.84$

$r = 0.1\,km$

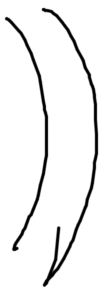


$$v \le \sqrt{(0.84)(0.1\times10^3 m)(9.8\,m/s^2)}$$

$v \le 30\,m/s \sim 60\,mph$

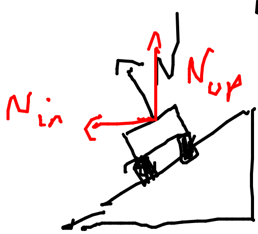
if it rains, μ_s gets smaller

v_{max} goes down



bigger r, more gentle curve

another way to prevent skidding



N_{in} now can contribute to centripetal force