38

$$\vec{a} = \begin{bmatrix} a_r \\ a_\theta \end{bmatrix} = \begin{bmatrix} 6 \\ 2 \end{bmatrix}$$

$$a = \sqrt{36+4} = \sqrt{40} = 6{,}32 \ m/s^2$$

$$\boxed{a = 6{,}32 \ m/s^2}$$

$$\vec{v} = \begin{bmatrix} v_r \\ v_\theta \end{bmatrix} = \begin{bmatrix} 0 \\ r\omega \end{bmatrix} = \begin{bmatrix} 0 \\ \sqrt{24} \end{bmatrix}$$

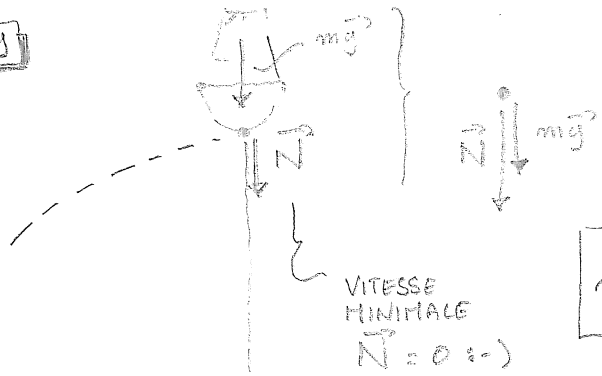
ON SAIT QUE :

$$\boxed{a_r = r\omega^2 \quad v_\theta = r\omega} \Rightarrow \boxed{ra = (r\omega)^2 \quad \sqrt{ra} = v}$$

4 — 6

$$\boxed{v = 4{,}9 \ m/s}$$

39



VITESSE MINIMALE $\vec{N} = 0$:-)

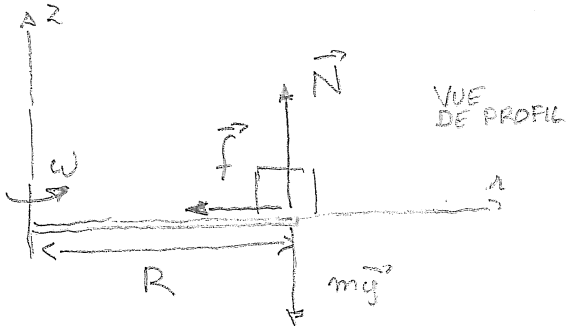
$$\boxed{\sum \vec{F} = m\vec{a}}$$

$$\boxed{mg = mr\omega^2} \quad r\omega^2 = \frac{v^2}{r}$$

$$\boxed{v = \sqrt{gr} = 2{,}8 \ m/s}$$

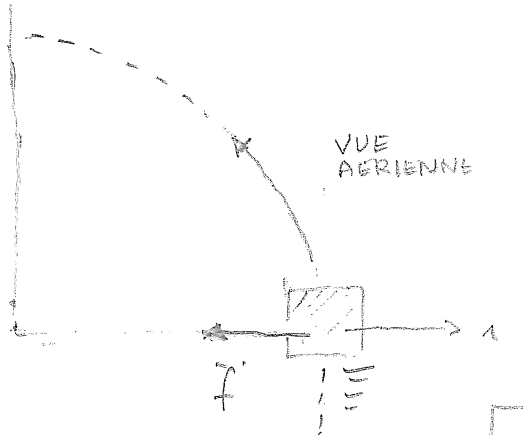
9,81 — 0,8

40



VUE DE PROFIL

$$\boxed{N = mg \quad f = \mu_s N \quad f = \mu_s mg}$$



VUE AERIENNE

ACCELERATION CENTRIPETE

$$\boxed{\mu_s mg = mr\omega^2}$$

FORCE DE FROTTEMENT $\quad \sum \vec{F} = m\vec{a}$

0,15 — 4,7²

$$\boxed{\mu_s = \frac{r\omega^2}{g}}$$

9,81

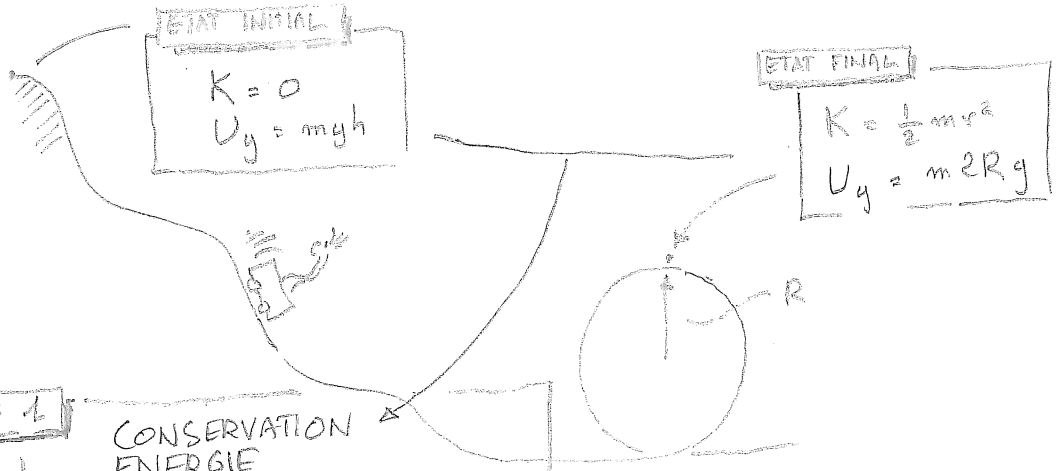
$$\omega = 45 \ \frac{2\pi}{60} = 4{,}7 \left[\frac{rad}{s}\right]$$

$$\left[\frac{tour}{minute}\right]\left[\frac{rad}{tour}\right]\left[\frac{minute}{sec}\right]$$

VALEUR NUMERIQUE

$$\mu_s = 0{,}34$$

41



ETAPE 1

CONSERVATION ENERGIE MECANIQUE

$$\frac{1}{2}mv^2 + mg\,2R = mgh$$

$$v^2 = 2g(h-2R)$$

ETAPE 2

$$\underbrace{mg}_{\text{GRAVITE}} = \underbrace{mRw^2}_{\text{ACCELERATION CENTRIPETE}} \qquad \sum \vec{F} = m\vec{a} \;:-)$$

CAS LIMITE
$N = 0$ CAR ON EST A LA LIMITE DE QUITTER LE CERCLE

$$g = \frac{2g(h-2R)}{R}$$

$Rw^2 = v^2/R$

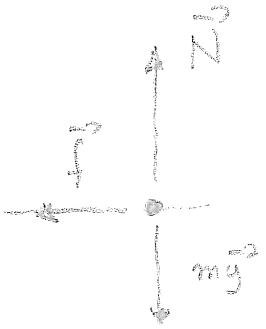
$$R = 2h - 4R$$

$$5R = 2h$$

$$\frac{5R}{2} = h$$

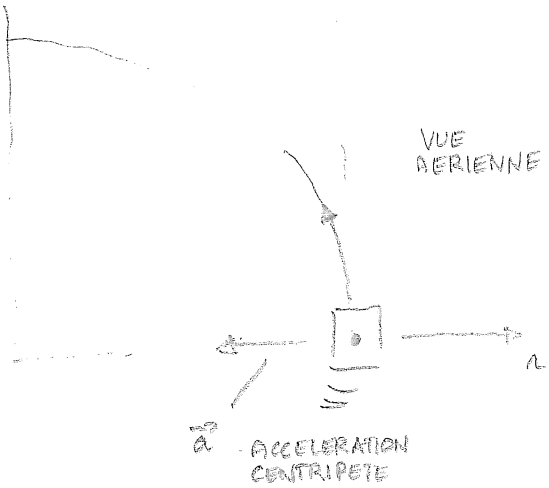
IL FAUT QUE $h > 5R/2$

42



$N = mg$

$f = \mu_s mg$



$$\underbrace{m\frac{v^2}{R}}_{\text{ACCELERATION CENTRIPETE}} = \underbrace{\mu_s mg}_{\text{FORCE DE FROTTEMENT}}$$

$60\ Km/h = \underbrace{\frac{60000}{3600}}_{16,7}\ m/s$

$$\mu_s = \frac{v^2}{Rg}$$

v: $16,7^2\ [m^2/s^2]$

R: $60\ [m]$

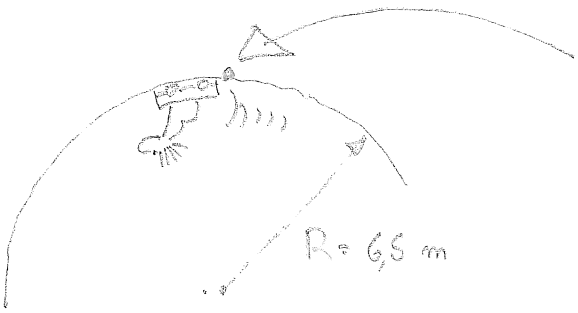
g: $9,81\ [m/s^2]$

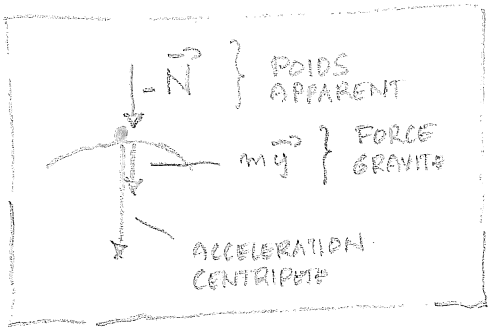
VALEUR NUMERIQUE

$\mu_s > 0,47$

C'EST UNE VALEUR LOGIQUE !

43





$$\underbrace{N + mg}_{\text{FORCES}} = \underbrace{m\frac{v^2}{R}}_{\text{ACCELERATION CENTRIPETE}}$$

1

$$\text{POIDS APPARENT} = m\left(\frac{v^2}{R} - g\right)$$

LE POIDS APPARENT AUGMENTE LORSQUE $v \nearrow$

2

VITESSE MINIMALE $\Leftrightarrow N = 0$!

$$mg = m\frac{v^2}{R}$$

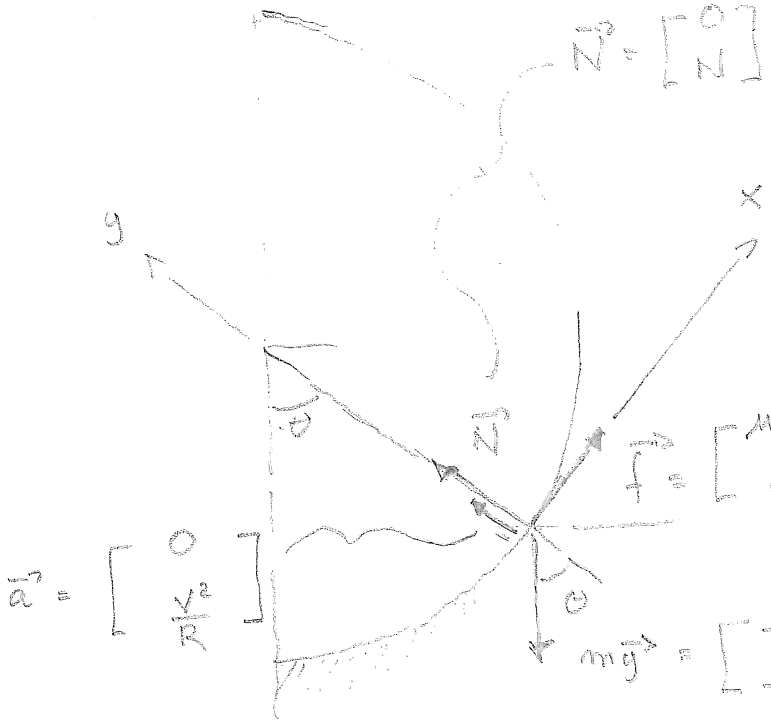
$$\text{VITESSE MINIMALE REQUISE} = \sqrt{gR} \approx 8 \text{ m/s}$$

(g : 9,81 ; R : 6,5)

44

$$\sum \vec{F} = m\vec{a}$$

$$m\begin{bmatrix} 0 \\ \frac{v^2}{R} \end{bmatrix} = \begin{bmatrix} \mu_s N - mg\sin\theta \\ N - mg\cos\theta \end{bmatrix}$$



$$m\frac{v^2}{R} = \frac{mg\sin\theta}{\mu_s} - mg\cos\theta$$

$$g\sin\theta = \mu_s\left(g\cos\theta + \frac{v^2}{R}\right)$$

TROUVER θ

$$\sin\theta = \mu_S\left(\cos\theta + \frac{v^2}{Rg}\right)$$

$$\sin^2\theta = \mu_S^2\left(\cos\theta + \frac{v^2}{Rg}\right)^2$$

$$1-\cos^2\theta = \mu_S^2\cos^2\theta + \mu_S^2\frac{v^4}{R^2g^2} + 2\mu_S^2\cos\theta\frac{v^2}{Rg}$$

EQUATION DU SECOND DEGRE EN $\cos\theta$

VALEURS NUMERIQUES

$$\cos\theta = 0{,}631$$

$$\theta = 51°$$