

We consider body at some point t .

• The 2nd N. Law α : $N = mg \cos d$

$$Y: F = F_{fric} + mg \sin d =$$

$$= \mu N - mg \sin d = mg(\mu \cos d + \sin d)$$

$$F_x = F_{cord}$$

$$F_{cord} = F_{cord} = F_{fr} \cos d + N \sin d$$

$$mg = N \cos d$$

$$N = \frac{mg}{\cos d}$$

(mech. energy)

$$F_{cord} = \mu \frac{mg}{\cos d} + \frac{mg \cos d}{\sin d}$$



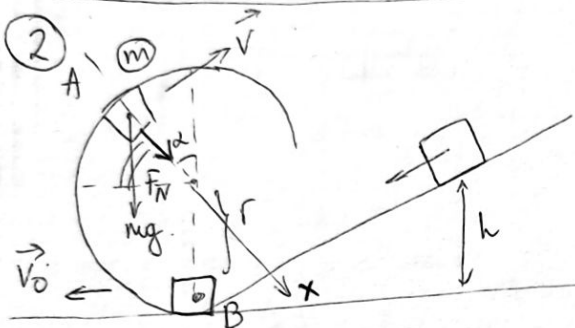
• The law of changing full energy

$$A_F + A_{Fr} = mgh \quad \int_S (F - F_{Fr}) ds$$

1) The 2nd N. law at point A:

$$x: mg \cos d + F_N = m a_{normal} = m \frac{v^2}{r}$$

$$F_N = m \frac{v^2}{r} - mg \cos d \quad (4)$$



2) The law of saving full (mechanical) energy:

$$E_B = E_A: \frac{1}{2} m v_0^2 = \frac{1}{2} m v^2 + mg(r + r \cos d) = mgh \quad (**)$$

3) We know that body goes through the highest point in Loop

• The law of saving energy.

$$mgh = \frac{1}{2} m v_1^2 + mg \cdot 2r \quad (*)$$

• The 2nd N. law at point C

$$mg + N = m \frac{v_1^2}{r} \quad (\text{at this point } N=0)$$

$$v_1^2 = gr \quad \rightarrow \quad mgh = \frac{1}{2} mgr + 2mgr = \frac{5}{2} mgr$$

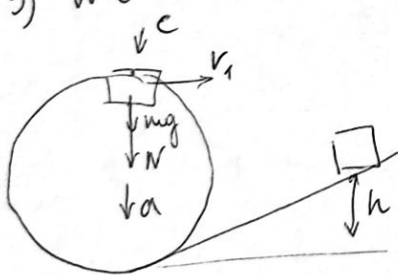
$$h = \frac{5}{2} r$$

$$h = \frac{5}{2} r \text{ into } (**): \frac{1}{2} m v^2 = mg \left(\frac{5}{2} r - r - r \cos d \right) = mgr \left(\frac{3}{2} - \cos d \right)$$

$$\frac{m v^2}{r} = mg (3 - 2 \cos d) \quad (***)$$

$$(***) \text{ into } (4): F_N = mg (3 - 2 \cos d) - mg \cos d = 3mg (1 - \cos d)$$

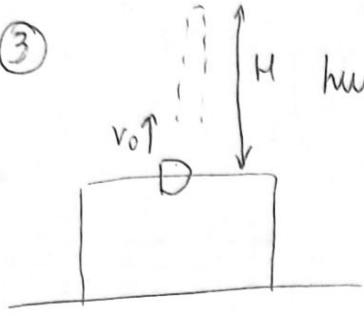
$$\text{Answer: } F_N = 3mg (1 - \cos d)$$



$$\textcircled{1} \quad W_F = \frac{dA_F}{dt} = \frac{F ds}{dt} = FV \Rightarrow F = \frac{W_F}{V} = \frac{90 \cdot 10^6}{\frac{60}{3,6}} = 5,4 \cdot 10^6 \text{ N}$$

Answer: $5,4 \cdot 10^6 \text{ N}$

$\textcircled{3}$ humans legs ~ springs.

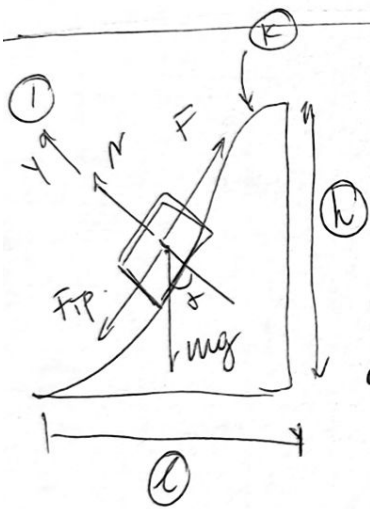


• Law of saving energy: $\frac{1}{2} m v_0^2 = m g H = \frac{1}{2} k x^2$

$$v_0 = \sqrt{2gH} = \sqrt{2 \cdot 9,81 \cdot 70} = 37,059 \frac{\text{m}}{\text{s}} = 133,412 \frac{\text{km}}{\text{h}}$$

$k = \frac{2H}{x^2} = \frac{2 \cdot 70}{0,5^2}$

$$k = \frac{2mgH}{x^2} = \frac{2 \cdot 9,81 \cdot 80 \cdot 70}{0,5^2} = 493488 \frac{\text{N}}{\text{m}}$$



the second N. law at time t . // $\mu = k$
in my test sol.

• y : $N = mg \cos \alpha$

• x : $F = F_{FP} + mg \sin \alpha = \mu mg \cos \alpha + mg \sin \alpha$

• $A_F = \int_S F ds = \int_S (\mu mg \underbrace{ds \cos \alpha}_{dL} + mg \underbrace{ds \sin \alpha}_{dh}) =$

$$= \int_S \mu mg dL + \int_S mg dh = \mu mg L + mgh$$

$$A_F = mg(\mu L + h)$$

