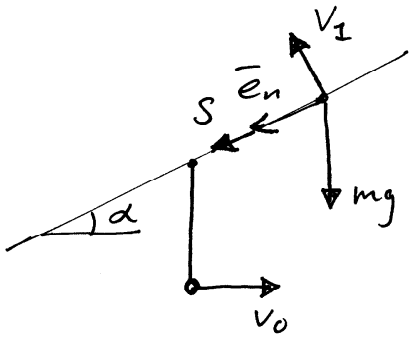
1. Lösningar 5C1102 25/5 05



Energiekvationen:

$$\frac{1}{2}mv_0^2 = \frac{1}{2}mv_1^2 + mgl(1+\sin\alpha)$$

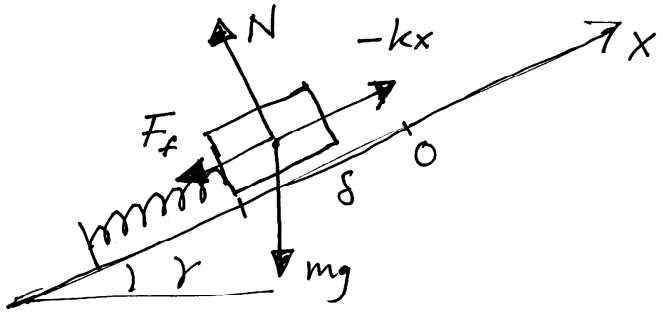
NII $\bar{e}_n$:

$$m\frac{v_1^2}{l} = mg\sin\alpha + S$$

För att kulan ska nå upp måste $S \geq 0$. v_{0min} fås för $S = 0 \Rightarrow$

$$v_{0min} = \sqrt{gl(2+3\sin\alpha)}$$

2.



NII ↑ $\quad 0 = N - mg\cos\gamma$

$$N = mg\cos\gamma$$

$$F_f = \mu N = \mu mg\cos\gamma$$

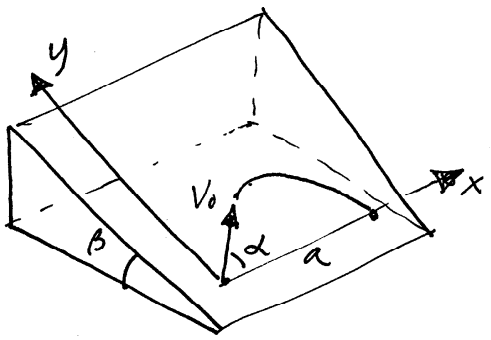
Lagen om den kinetiska energin

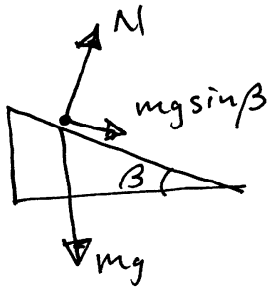
$$\int_{-\delta}^{0} -kx - F_f - mg\sin\gamma\, dx = \frac{1}{2}mv^2$$

$$\frac{1}{2}k\delta^2 - mg\delta(\mu\cos\gamma + \sin\gamma) = \frac{1}{2}mv^2$$

$$v = \sqrt{\frac{k}{m}\delta^2 - 2g\delta(\mu\cos\gamma + \sin\gamma)}$$

3





$m\ddot{y} = -mg\sin\beta$
$m\ddot{x} = 0$

Begynnelsevillkor: $t=0$, $x=y=0$, $\dot{x}=V_0\cos\alpha$, $\dot{y}=V_0\sin\alpha$

Integrera två gånger:

$y = -\frac{1}{2}g\sin\beta t^2 + V_0\sin\alpha t$

$x = V_0\cos\alpha t$

$x=a$ $y=0$ ger

$0 = t(V_0\sin\alpha - \frac{1}{2}g\sin\beta t) \Rightarrow$

$a = V_0\cos\alpha t$

$2\sin\alpha\cos\alpha = \frac{ga\sin\beta}{V_0^2} \Rightarrow \sin(2\alpha) = \frac{ga\sin\beta}{V_0^2}$

$\alpha = \frac{1}{2}\arcsin\left(\frac{ga\sin\beta}{V_0^2}\right)$

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4. Keplers tredje lag:

Kometen $T_k = \frac{2\pi}{\sqrt{GM}}a^{3/2}$ $\Rightarrow$ $\frac{a}{R} = \left(\frac{T_k}{T_j}\right)^{2/3} = 64^{2/3} = 16$

Jorden $T_j = \frac{2\pi}{\sqrt{GM}}R^{3/2}$

När mest solen: $R = \frac{a(1-e^2)}{1+e} = a(1-e)$; $e = 1 - \frac{R}{a} =$

$= 1 - \frac{1}{16} = \frac{15}{16}$

Längst från solen: $r_{max} = \frac{a(1-e^2)}{1-e} = a(1+e) =$

$= 16R\left(1+\frac{15}{16}\right) = 31R$