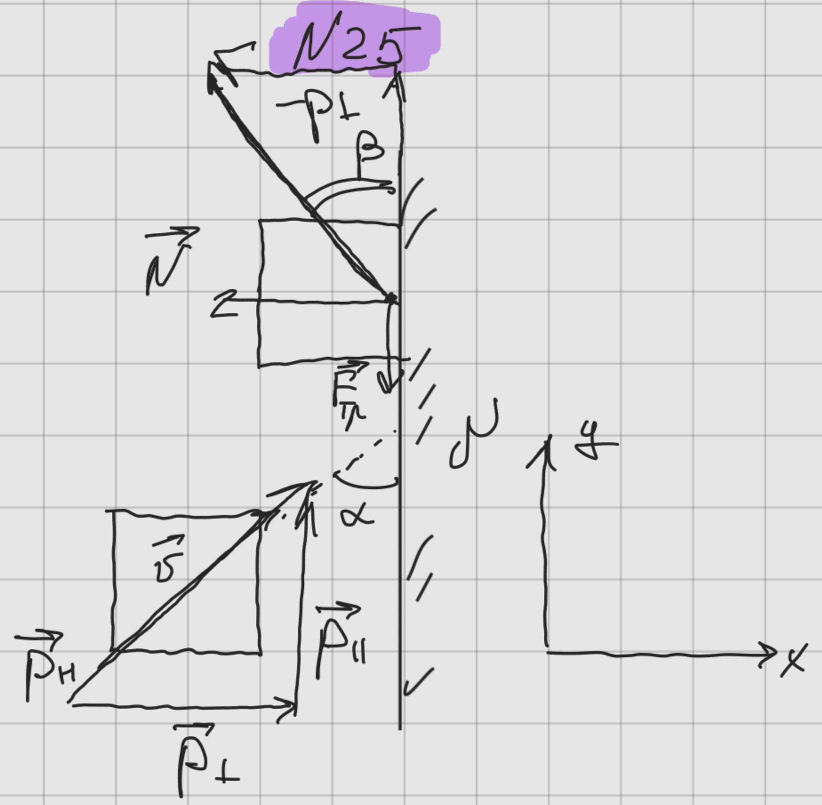
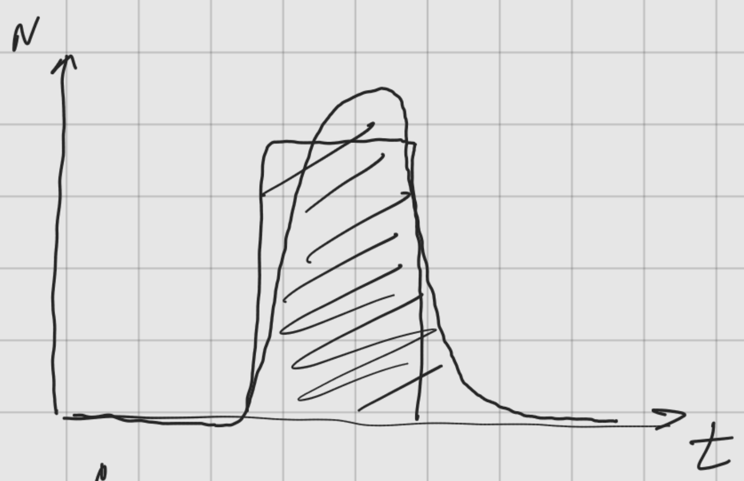
$d\vec{p} = \vec{F}\,dt$

F - скорость передачи импульса





$$\int N\,dt = N_{ср}\cdot\tau$$

$$\Delta p_x = (-p_\perp) - p_\perp = -2p_\perp = -\int N\,dt = -N_{ср}\tau$$

всё время скользило

$$\Delta p_y = p_{yк} - p_\parallel = -\int F_{тр}\,dt = -\int \mu N\,dt = -\mu\int N\,dt$$

$$= -\mu 2p_\perp$$

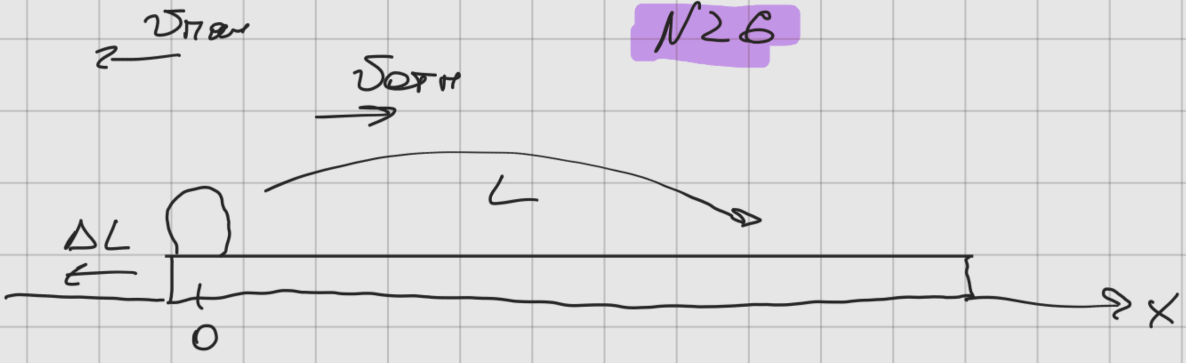
!!!

$$P_{ук} = p_{\parallel} - 2\mu p_{\perp}$$

$$\text{tg}\,\beta = \frac{p_{\perp}}{P_{ук}} = \frac{p_{\perp}}{p_{\parallel} - 2\mu p_{\perp}} = \frac{\text{tg}\,\alpha}{1 - 2\mu\,\text{tg}\,\alpha} \quad \left(\text{tg}\,\alpha < \frac{1}{2\mu}\right.$$

$$\text{tg} \geq \frac{1}{2\mu} \rightarrow \beta = \frac{\pi}{2}$$

№26



$$X_{цм} = \text{const} \Leftarrow \begin{cases} \sum F_{вн,x} = 0 \\ \sum p_{x,н} = 0 \end{cases}$$

$$X_{цм} = \frac{m_* x_* + M x_п}{M+m} \underset{t=0}{=} \frac{M x_п}{M+m} = \frac{ML}{2(M+m)}$$

$$t = t_к \rightarrow X_{цм} = \frac{m(L - \Delta L) + M\left(\frac{L}{2} - \Delta L\right)}{M+m}$$

$$\cancel{ML} = 2mL - \cancel{2}m\Delta L + \cancel{ML} - \cancel{2}M\Delta L$$

$$\frac{d(\Delta L)}{dt} = \frac{m \frac{d(L)}{dt}}{M+m}$$

$$L = v_{отн} t$$

$$\Delta L = v_0 \cdot t$$

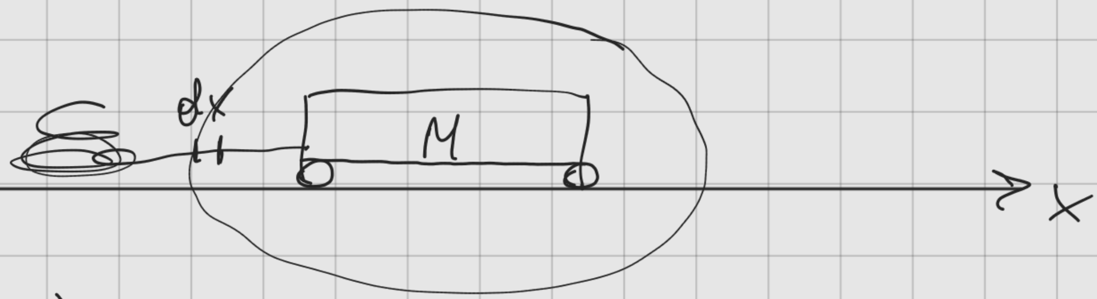
$$v_{пол} = \frac{m v_{отн}}{}$$

$M + m$

L – относительное перемещение жука

$$0 = M v_{пол} - m(v_{отн} - v_{пол})$$

№27



$$\frac{m}{L} = \lambda \qquad\qquad \sigma \cdot v\,dt$$

$$m_\Sigma(t): M \to M + m$$

1) $$m_\Sigma \frac{dv}{dt} = \underset{-v}{\underset{\parallel}{u}} \underset{\lambda \frac{dx}{dt}}{\underset{\parallel}{\frac{dm_\Sigma}{dt}}} = -\lambda v^2$$

$$m_\Sigma \frac{dv}{dt} = -\lambda v^2$$

$$m_\Sigma\, dv = -\underbrace{\lambda v\, dx}_{dm} \to \frac{dv}{v} = -\frac{dm}{m}$$

$$\cancel{\int m_1(t) \frac{dv}{v} = -\lambda \int dx}$$

$$\ln \frac{v_к}{v_0} = -\ln \frac{m_к}{m_н}$$

$$v_k = v_0 \frac{M}{m_k} = v_0 \cdot \frac{M}{M+m}$$

$$v_k m_k = v_0 m_H$$

$$v_k = \frac{v_0 M}{M+m}$$

2) $m \frac{dv}{dt} = -\lambda v^2 \Rightarrow \frac{dv}{v^2} = \frac{-\lambda}{m(t)} \cdot dt$

$$-\frac{1}{v_k} + \frac{1}{v_0}$$

$$m v = m_0 v_0 \Rightarrow dm\, v + m\, dv = 0$$

$$m = \frac{m_0 v_0}{v}$$

$$\frac{dv}{v^2} = -\lambda \frac{dt\, v}{m_0 v_0}$$

$$\int_{v_0}^{v_k} \frac{dv}{v^3} = -\frac{\lambda\, dt}{m_0 v_0}$$

$$-\frac{1}{2}\left(\frac{1}{v_k^2} - \frac{1}{v_0^2}\right) = \frac{-\lambda}{m_0 v_0} \cdot \tau$$

$$\frac{1}{v_0^{\cancel{2}}}\left(\frac{(M+m)^2}{M^2} - 1\right) = \frac{2\lambda}{M \cancel{v_0}} \tau$$

$$\tau = \frac{M}{2\lambda v_0}\left(\left(1 + \frac{m}{M}\right)^2 - 1\right)$$

№28

Решение:

1) Запишем уравнение Мещерского:

$$m\frac{d\vec{v}}{dt} = \vec{u}\frac{dm}{dt} + \vec{F}$$ $\vec{u}$ - относительная ск-ть песка, $u = 0 \Rightarrow$

$$\Rightarrow m\frac{dv}{dt} = F \Rightarrow a = \frac{F}{M - \Delta m t}$$

2) $$\frac{dv}{dt} = \frac{F}{M - \Delta m t}$$

$$\int dv = -\frac{1}{\Delta m} \cdot \frac{F \int d(M - \Delta m t)}{M - \Delta m t}$$

$$v + C = -\frac{F}{\Delta m} \ln|M - \Delta m t|$$

при $t = 0 \rightarrow v_0 + C = -\frac{\ln M \cdot F}{\Delta m} \Rightarrow$

$$\Rightarrow v = v_0 + \frac{\ln MF}{\Delta m} - \frac{F}{\Delta m}\ln(M - \Delta m t) =$$

$$= \overset{\parallel 0}{v_0} + \frac{F}{\Delta m} \cdot \ln\left(\frac{M}{M - \Delta m t}\right) = \frac{F}{\Delta m}\ln\left(\frac{M}{M - \Delta m t}\right)$$