Т1.1

$V = V_0 - kS$

$V = \dot{S}$

$S = \frac{V_0 - V_1}{k}$

$V_0 = 30\ м/с$

$k = \frac{1}{10}\ с^{-1}$

$V_1 = 1\ м/с$

$\frac{dS}{dt} = V_0 - kS$

$$\int_0^{\frac{V_0 - V_1}{k}} \frac{dS}{V_0 - kS} = \int_0^t dt$$

$$t = -\frac{1}{k} \ln \left| \frac{V_0 - V_0 + V_1}{V_0} \right| = -10 \cdot \ln \frac{1}{30} \approx 34\ с$$

Т2.1

$A = F \cdot x$

$F(x) = kx$

$k = 400\ Н/м$

$\Delta x_0 = 0{,}02\ м$

$\Delta x_1 = 0{,}06\ м$

$$A = \int_{\Delta x_0}^{\Delta x_1} kx\,dx = \frac{k\Delta x_1^2}{2} - \frac{k\Delta x_2^2}{2} = 2 \cdot 10^{-2}(6^2 - 2^2) = 0{,}64\ Дж$$

№1.4

$\alpha = 45^\circ$

$x(t) = V_0 t \cos\varphi$

$y(t) = V_0 t \sin\varphi - \frac{gt^2}{2}$

$y(t) = x \quad (\alpha = 45^\circ)$

$V_0 \cos\varphi = V_0 \sin\varphi - \frac{gt}{2} \Rightarrow t = \frac{2V_0}{g}(\sin\varphi - \cos\varphi)$

$x(t) = \frac{2}{g}(\sin\varphi - \cos\varphi)\cos\varphi$

$$\dot{x} = \frac{2}{g}(\cos\varphi + \sin\varphi)\cos\varphi - \frac{2}{g}\sin 2\varphi(\sin\varphi - \cos\varphi) =$$

$$= \frac{2}{g}\left(\cos^2\varphi + 2\cos\varphi\sin\varphi - \sin^2\varphi\right)$$

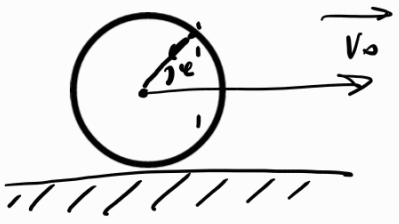
$$\left((\cos\varphi + \sin\varphi)^2 - 2\sin^2\varphi\right)$$

$$(\cos\varphi + (1+\sqrt{2})\sin\varphi)(\cos\varphi + (1-\sqrt{2})\sin\varphi)$$

$$tg\varphi = \frac{1}{\sqrt{2}-1} = \sqrt{2}+1$$

$$\varphi = arctg(\sqrt{2}+1)$$ ч.т.д. $\frac{3\pi}{8}$

№1.19



$$a_{g.c.} = \frac{V_0^2}{R}$$

$$a_x = \frac{V_0^2}{R}\cos\varphi$$

$$a_y = \frac{V_0^2}{R}\sin\varphi$$

№4.47

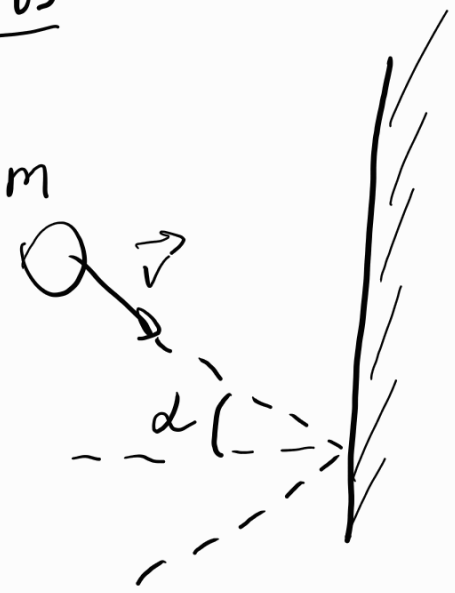
ЗСИ: $2mV_0 = 3mV_2 \Rightarrow V_2 = \frac{2}{3}V_0$

ЗСЭ: $\frac{mV_0^2}{2} = A_{тр} + \frac{mV_2^2}{2}$

$$V_0^2 = kgl + \frac{4}{9}V_0^2$$

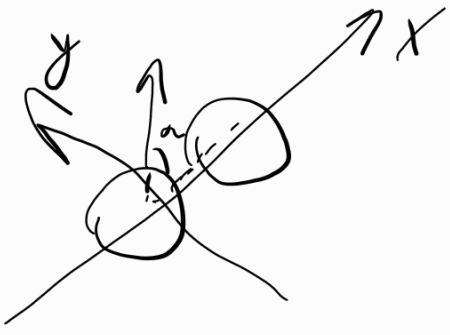
$$l = \frac{5}{9}\frac{V_0^2}{gk}$$

N 4.69



$2mv\cos\alpha$

N 4.82



$Oy: V\sin\alpha$

$Ox: V_{1x}m = (V_{2x}+u_2)m$

$\frac{V_{1x}^2 m}{2} = \frac{(V_{2x}^2+u_2^2)m}{2}$

$2V_{2x}u_2 = 0$

T 3.1

$Ma = \mu u - Mg$

$\mu = \frac{M(a+g)}{u}$

$2 \cdot 3g \approx 59\ км/с$

$M = 6\cdot 10^3$

$u = 3\cdot 10^3\ м/с$

$\mu - ?$

$a = 2g$

T 3.2

$R_з = 6{,}4\cdot 10^6\ м$ $\quad T_з = 24\cdot 60^2\ с = T_с$

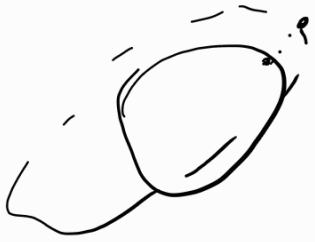
$g = G\frac{M_з}{R_с^2} = \frac{V^2}{R_с}$ $\quad T = \frac{R_с}{V}$ $\quad 5{,}9\cdot 10^{24}$

$V = \sqrt{\frac{GM_з}{R_с}} \Rightarrow T = \frac{R_с^{3/2}}{\sqrt{GM_з}} \Rightarrow R_с = \left(\frac{T\sqrt{GM_з}}{2\pi}\right)^{\frac{2}{3}} =$

$= \left(24 \cdot 60^2 \cdot \sqrt{6{,}67 \cdot 10^{-11} \cdot 5{,}9 \cdot 10^{24}}\right)^{\frac{2}{3}} =$

$T = 1 \text{ сут.} = 24 \cdot 60^2 = \frac{2\pi R_c}{V}$

$g = G\frac{M_з}{R_c^2} = \frac{V^2}{R_c}$



$V = \sqrt{\frac{GM_з}{R_c}}$

$T = \frac{2\pi R_c^{\frac{3}{2}}}{\sqrt{GM_з}} \Rightarrow R_c = \left(\frac{T\sqrt{GM_з}}{2\pi}\right)^{\frac{2}{3}} \approx$

$\approx 4{,}2 \cdot 10^7 \text{ м}$

№ 3.31

$u = 10^3 \text{ м/с}$

$a = 3g = \text{const}$

$H - ?$

$\eta = 0{,}67$

$V_0 - 3gt = 0$

$H(t) = V_0 t - 3g\frac{t^2}{2}$

$3mg = \frac{dm}{dt}u - mg$

$\int_0^t \frac{4g}{u}dt = \ln\frac{m_1}{m_0} = \ln\eta$

$4gt = u\ln\eta$

$t = \frac{u\ln\eta}{4g}$

$\frac{3}{2}gt^2 = \frac{3}{2}\frac{u^2\ln^2\eta}{g \cdot 16}$

$H \approx 1{,}5 \cdot 10^3 \text{ м}$

№2.74

$r = 0{,}17$ см

$\eta = 0{,}99$

$m = \frac{4}{3}\pi r^3 \rho_б$

$F_{comp.} = \frac{1}{2}\rho_а \pi r^2 v^2$

$\rho_а = 1{,}2 \cdot 10^{-3}$ г/см^3

$\rho_б = 1$ г/см^3

$mg - F_{comp} = m\frac{dv}{dt}$

$\frac{4}{3}\pi r^3 \rho_б g = \frac{1}{2}\rho_а \pi r^2 V_\infty^2$

$V_\infty = \sqrt{\frac{4}{3} r \frac{\rho_б}{\rho_а} g} = \sqrt{\frac{4}{3} \cdot \frac{0{,}17}{1{,}2} \cdot 10^3 \cdot 9{,}8 \cdot 10^2} =$

$= 430 \frac{см}{с}$

$mg - \frac{1}{2}\rho_а \pi r^2 v^2 = m\frac{dv}{dt}$

$T = \int \frac{dv}{g - \frac{3\rho_а \pi r^2 v^2}{8\pi r^3 \rho_б g}} =$

$= \underbrace{\frac{8 r \rho_б g}{3\rho_а}}_{A} \int_0^{\eta V_\infty} \frac{dv}{\underbrace{\frac{8 r \rho_б g}{3\rho_а}}_{Ag} - v^2} =$

$\sqrt{A} = \sqrt{\frac{8 \cdot 0{,}17 \cdot 980}{3 \cdot 1{,}2}} \cdot 10^3 = 608$

$= A \cdot \frac{1}{2\sqrt{Ag}} \ln \left| \frac{\sqrt{Ag} + \eta V_\infty}{\sqrt{Ag} - \eta V_\infty} \right| \approx 44$ с