№2

$Q_1 = c_в m (\Theta - t_1)$

$Q_2 = c_л m (0 - t_2) + \lambda m + c_в m (\Theta - 0)$

1 дел – Q_0 $\quad Q_1 = 16 Q_0$

$$-c_л m t_2 = 4 Q_0 \quad | \Rightarrow \frac{c_л t_2}{\lambda} = -\frac{1}{2} \qquad t_2 = -\frac{\lambda}{2 c_л}$$
$$\lambda m = 8 Q_0$$

$$c_в m \Theta = 4 Q_0 \quad | \Rightarrow \frac{c_в \Theta}{\lambda} = \frac{1}{2} \qquad \Theta = \frac{\lambda}{2 c_в}$$
$$\lambda m = 8 Q_0$$

$$+ c_в m (\Theta - t_1) = -16 Q_0$$
$$\lambda m = 8 Q_0$$

~~$\frac{c_в}{\lambda} / 2 (\Theta - t_1) = -1$~~

$$+ \frac{c_в}{\lambda} (\Theta - t_1) = -2$$

$$\Theta - t_1 = -\frac{2\lambda}{c_в}$$

$$t_1 = \frac{2\lambda}{c_в} + \frac{\lambda}{2 c_в} = \frac{5\lambda}{2 c_в}$$

$t_2 = \frac{330000}{2 \cdot 2100} \approx 78{,}6°$ (по модулю), $t_2 = -78{,}6°C$

$t_1 = \frac{5\lambda}{2 c_в} = 196{,}4°C$; $\Theta = \frac{\lambda}{2 c_л} = 39{,}3°C$

не довален $\quad t_1 > t_{кип}$.

№3

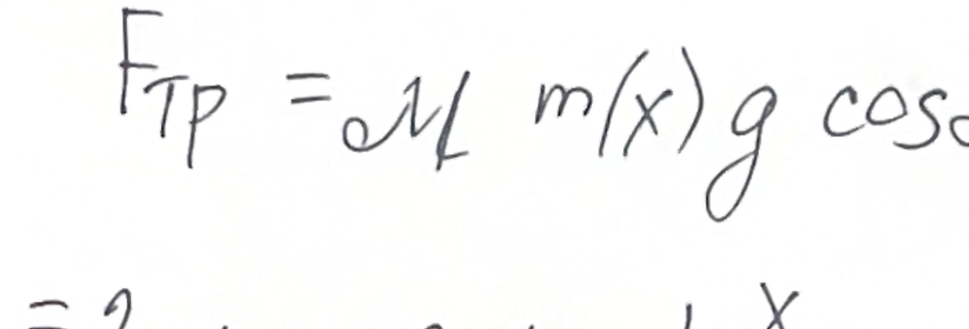
$$F_{тр} = \mu\, m(x)\, g \cos\alpha = \mu mg \cos\alpha \frac{x}{l} = 2\mu$$

$$= 2\,\mu\, m\, g \cos\alpha \frac{x}{S}$$

$$m(x) = \frac{x}{l} m$$

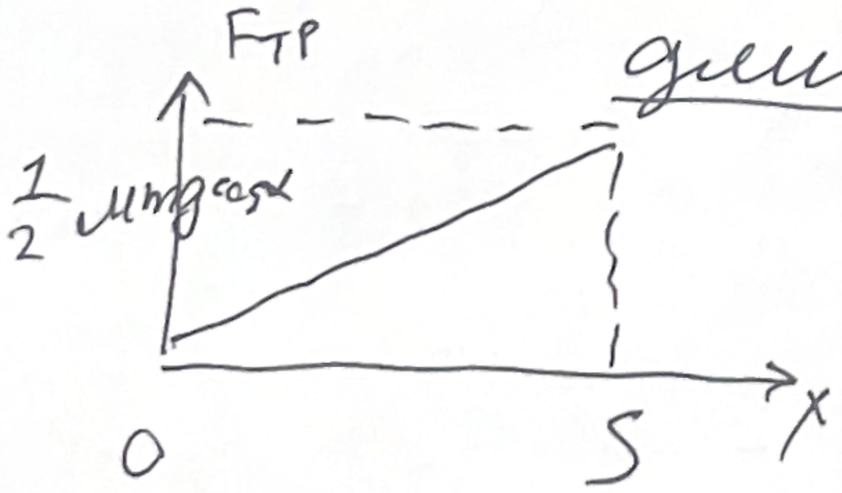
<u>коротная</u>

$F_{тр}$



$$A_{тр_1} = -\frac{0,5\,S + S}{2} \mu mg\cos\alpha = \frac{3}{4} \mu mg\, S \cos\alpha$$

<u>длинная</u>



$$A_{тр_2} = \frac{1}{2} \mu mg\, S \cos\alpha$$

№3 продолжение

$$A\,mg_1 = Amg_2 = A = -mg\,S\sin\alpha$$

$$\frac{mV_1^2}{2} - \frac{mV_0^2}{2} = A_{Tp_1} + Amg$$

$$\frac{mV_2^2}{2} - \frac{mV_0^2}{2} = A_{Tp_2} + Amg$$

$$V_1^2 = V_0^2 - 2gS\sin\alpha - \frac{3}{2}\mu mg\,S\cos\alpha$$

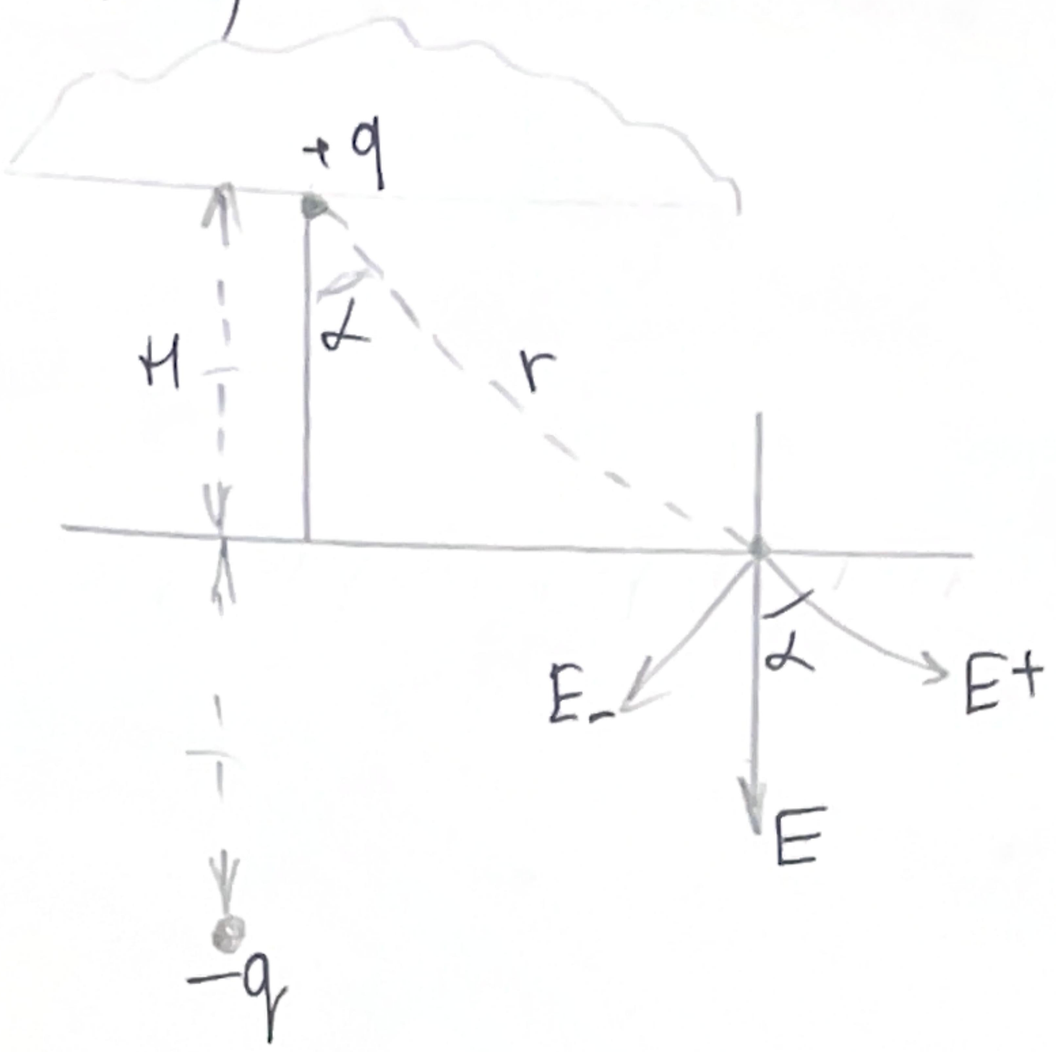
$$V_2^2 = V_0^2 - 2gS\sin\alpha - \frac{1}{2}\mu mg\cos\alpha$$

$$V_2 > V_1$$

$$\Delta V = V_2 - V_1 = -\sqrt{V_0^2 - 2gS\sin\alpha - \frac{1}{2}\mu mg\cos\alpha} - \left(-\sqrt{V_0^2 - 2gS\sin\alpha - \frac{3}{2}\mu mg\,S\cos\alpha}\right)$$

физик на коротких

№4



$$|E_+| = |E_-| = \frac{kq}{r^2}$$

$$r^2 = H^2 + D^2$$

$$\cos\alpha = \frac{H}{r}$$

$$E = 2|E_+|\cos\alpha = \frac{2kqH}{r^3} = \frac{2kqH}{(D^2+H^2)^{\frac{3}{2}}}$$

$$\frac{\partial E}{\partial H} = 2kq \; \frac{(D^2+H^2)^{\frac{3}{2}} - H\cdot\frac{3}{2}(D^2+H^2)^{\frac{1}{2}}\cdot 2H}{(D^2+H^2)^3} = 0$$

$$(D^2+H^2)^{\frac{3}{2}} - 3H^2(D^2+H^2)^{\frac{1}{2}} = 0 \quad / \sqrt{D^2+H^2}$$

$$D^2 + H^2 - 3H^2 = 0$$

$$D^2 = 2H^2$$

$$D = \sqrt{2}H$$

$$E_{max} = \frac{2kH}{(3H^2)^{\frac{3}{2}}} = \frac{2k}{3^{\frac{3}{2}}}\,\frac{H}{H^3} = \frac{2k}{\sqrt{3^3}H^2}$$

$$H^2 = \frac{2k}{\sqrt{27}E_{max}} = \frac{2\cdot 9\cdot 10^{9}6}{\sqrt{27}\cdot 2000} = \frac{3^2}{3^{\frac{3}{2}(1,5)}}\cdot 10^6 = \sqrt{3}\cdot 10^6 \Rightarrow$$

$$\Rightarrow H = \sqrt[4]{3}\cdot 10^3 = 1316{,}1\text{м}$$

Сегмент.

$N = PS = 2\pi r h \cdot \rho g$

$F_{тр} = \mu N = 2\mu\pi r h \rho g$

$M_{тр} = F_{тр} \cdot r = 2\mu\pi r^2 h \rho$ - момент трения

$P_{тр} = \omega \cdot M_{тр} = 2\pi\nu F_{тр}$

$\eta = \frac{P_{тр}}{P} \Rightarrow P = \frac{P_{пр}}{\eta} = \frac{4\pi^2 r^2 \mu \nu_1 h \rho g}{\eta}$

$P = \frac{4 \cdot 3{,}14^2 \cdot (20 \cdot 10^{-3})^2 \cdot 0{,}8 \cdot \frac{534}{60} \cdot 15 \cdot 10^{-3} \cdot 2500}{0{,}6}$

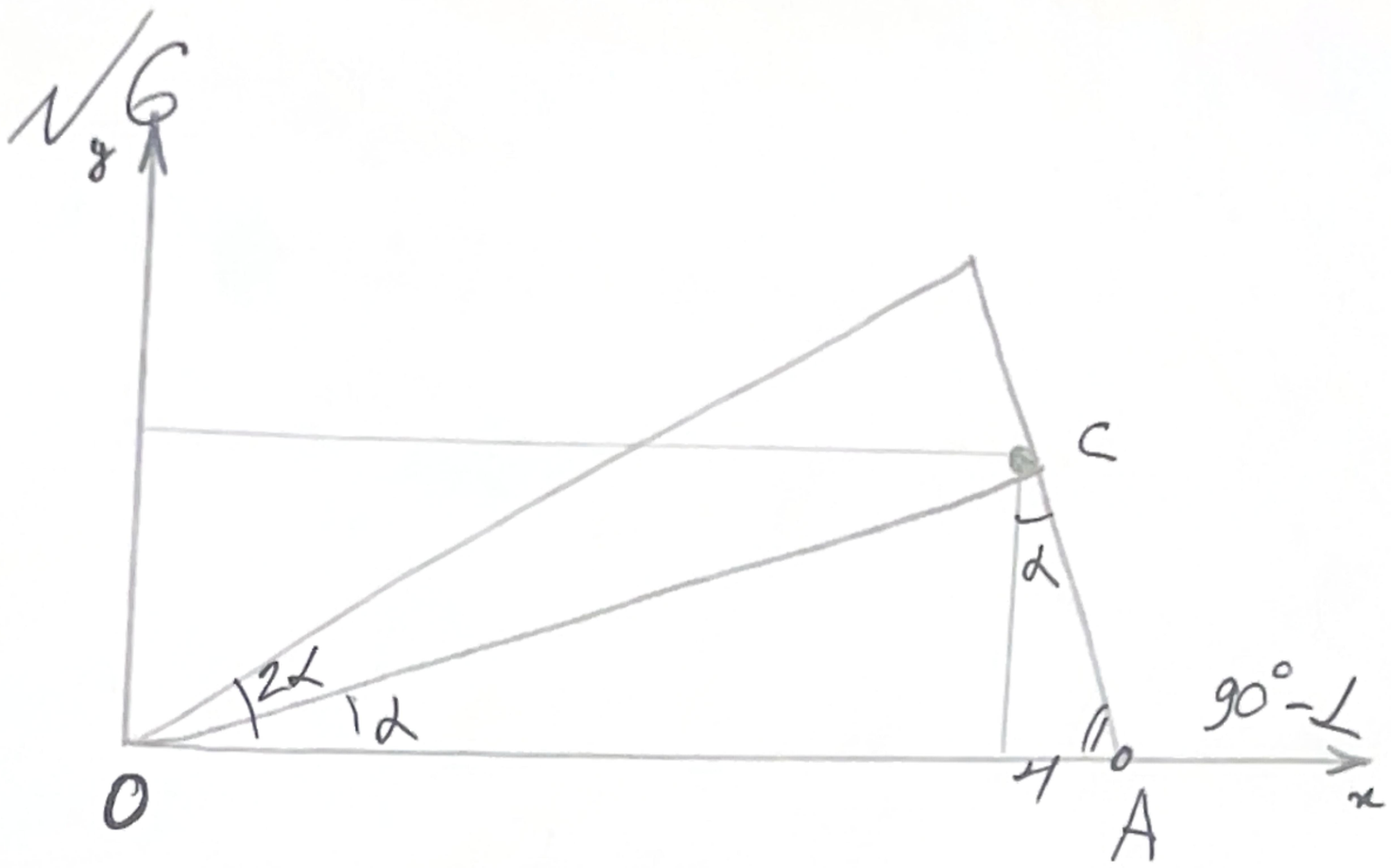
$P = 702$ Вт

Ток

$P_{мех} = n P_{тр} \Rightarrow P = \frac{n P_{тр}}{U I}$

$I = \frac{n P_{тр}}{U \cdot P} = \frac{nP}{U} = \frac{1{,}5 \cdot 702}{U} = \frac{1{,}5 \cdot 702}{220} = \frac{351}{110}$

$P_{тр} = \eta P$ $\quad I \approx 4{,}79$ А



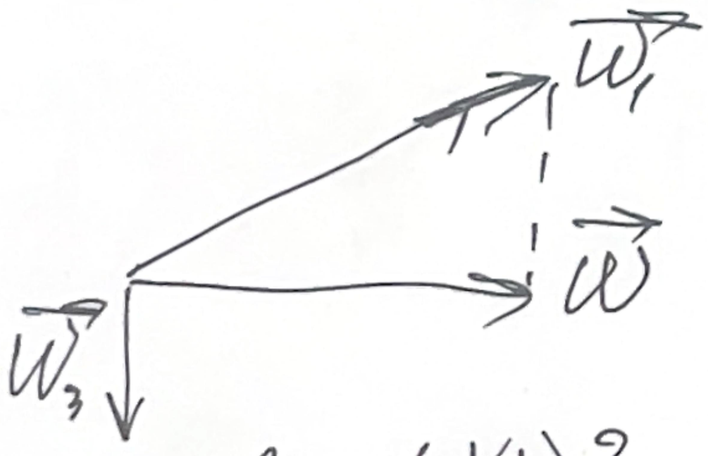
$$CH = CA\cos\alpha = R\cos\alpha$$

$$\omega_1 = \frac{V_c}{CH} = \frac{V_c}{R\cos\alpha}$$ – вокруг OC

$$r_2 = OC\cos\alpha = R\frac{\cos^2\alpha}{\sin\alpha}$$

$$tg\alpha = \frac{R}{OC} \qquad OC = R\,ctg\,\alpha$$

$$\omega_2 = \frac{V_c}{OC} = \frac{V_c\sin\alpha}{R\cdot\cos^2\alpha}$$



$$\omega^2 - \omega_1^2 - \omega_2^2$$

$$\omega^2 = \left(\frac{V_c}{R}\right)^2\left(\frac{1}{\cos\alpha} - \frac{\sin^2\alpha}{\cos^4\alpha}\right)$$

$$\omega = \frac{V_c}{R\cos\alpha}\cdot\sqrt{1-tg^2\alpha}$$

Условное ускорение

$\frac{d\omega}{dt} = 0$ т.к. нет внешних сил задет. крутящие

№5 Дано:

$\varphi = 0{,}5$

$t_1 = 20\,^\circ C$

считаем

$V = const$

$\nu = const$

Решение:

$\Rightarrow p_{n_1} = \varphi p_{нп}(t_1)$

$p_{n_1} V = \nu R T_1 \Rightarrow$

$p_{n_2} V = \nu R T_2$

$\Rightarrow Q = 0$

$\nu = \frac{p_{n_1} V}{R T_1} = \frac{\varphi p_{нп}(t_1)}{R T_1}$

$\nu = \frac{0{,}5 \cdot 2338{,}8 \cdot 3 \cdot 8 \cdot 2{,}5}{8{,}31 \cdot 293} \approx 28{,}8$ моль

$Q = p_c = 3 \nu R (T_2 - T_1)$

$\nu R T_1 = p_{атм} V$

$\nu R = \frac{p_{атм} V}{T_1}$

$p_c = 3 p_{атм} V \left(\frac{T_2 - T_1}{T_1}\right)$

$\Delta T = \frac{p_c}{p_{атм} V} \cdot T_1 = \frac{3400 \cdot 30 \cdot 60}{3 \cdot 10^5 \cdot 3 \cdot 8 \cdot 2{,}5} \cdot 293$

$\Delta T = 9{,}97\,K \approx 10\,K$

$T_2 = 303\,K \Rightarrow t_2 = 30\,^\circ C$

$p_{n_2} V = \nu R T_2$

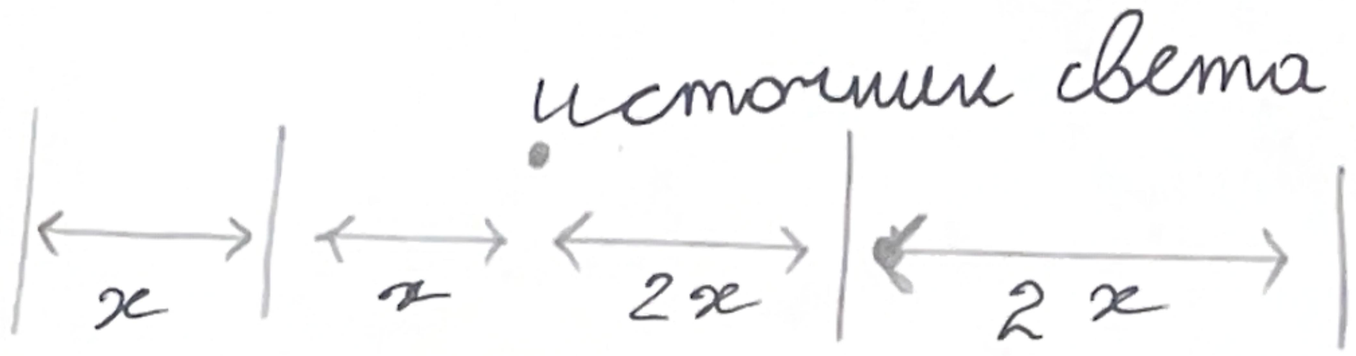
$p_{n_1} V = \nu R T_1$

$p_{n_2} = p_{n_1} \cdot \frac{T_2}{T_1}$

$\varphi = \varphi_0 \cdot \frac{p_{нп}(t_1)}{p_{нп}(t_2)} \cdot \frac{T_2}{T_1} = \frac{2338{,}8}{4245{,}5} \cdot \frac{303}{293} \cdot \varphi_0 \approx$

$\approx 28{,}5\%$

№1



c - скорость звука

$x = \frac{c - v}{T_0}$ $\quad 2x = \frac{c+v}{T_0}$

$\frac{c+v}{c-v} = 2$

$c + v = 2c - 2v$

$3v = c$

$v = \frac{c}{3} = 110 \frac{м}{с}$

$c \approx 330 \frac{м}{с}$ в возд.