Часть 1

Олимпиада: **Физика, 11 класс (1 часть)**

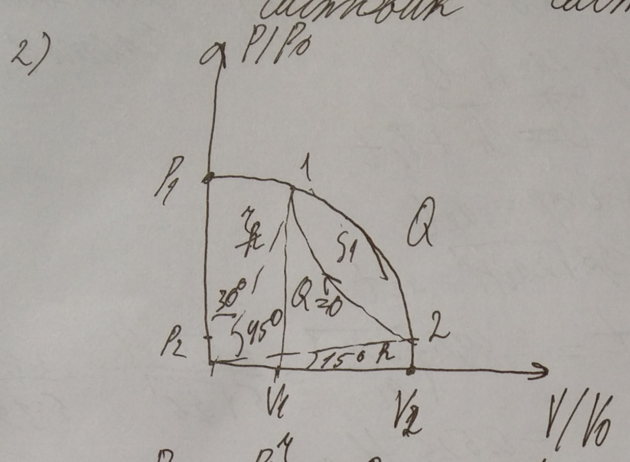
Шифр: **21203620**

ID профиля: **339692**

Вариант 7

Чистовик часть 1 (4)

2)



1) $\frac{T_1-T_2}{T_2}$ – ?

2)

3) η – ?

$P_1 = r\cos 30°$ $\quad P_2 = r\sin 15°$ $\quad P_1V_1 = \nu R T_1$

$V_1 = r\sin 30°$ $\quad V_2 = r\cos 15°$ $\quad P_2V_2 = \nu R T_2$

$\frac{P_1V_1}{P_2V_2} = \frac{T_1}{T_2}$ $\quad \frac{r\cos 30 \sin 30°}{\sin 15°\cdot\cos 15°} = \frac{T_1}{T_2}$

$\frac{T_1}{T_2} = \frac{\cos 30°\,2\cdot\sin 15\cos 15°}{\sin 15°\cdot\cos 15} = 2\cos 30° = \sqrt{3}$

$T_1 = \sqrt{3}\,T_2$

$\frac{T_1-T_2}{T_2} = \frac{\sqrt{3}T_2 - T_2}{T_2} = \frac{T_2(\sqrt{3}-1)}{T_2} \approx 0{,}7$

$\Delta U_{21} = A_{21}$ $\quad \nu R\Delta T_{12} = |A_{21}| = \nu R(\sqrt{3}-1)T_2$

~~$P^2 + V^2 = r^2$~~

~~$P = \sqrt{r^2 - V^2}$~~

~~$A_{12} = \int_{V_1}^{V_2} P^2 + V^2$~~

$Q = \Delta U_{12} + A_{12}$

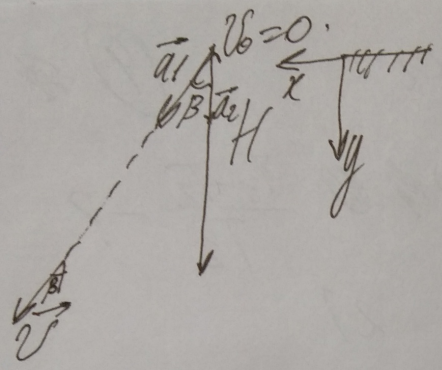
$S = \frac{\pi r^2 45}{360} = \frac{\pi r^2}{8}$

$A_{12} - A_{21} = A_n = S_1$ $\quad A_{12} = \frac{r^2(\pi - 2\sqrt{2})}{4}$

$S_1 = \left(S - \frac{r^2\sin 45°}{2}\right)2 = \left(\frac{\pi r^2}{8} - \frac{r^2\sqrt{2}}{4}\right)2 = \left(\frac{\pi r^2 - 2r^2\sqrt{2}}{8}\right)2$

$\eta = \frac{A_n}{Q} = \frac{A_{12}-A_{21}}{\Delta U_{12}+A_{12}} = \frac{A_{12}-A_{21}}{A_{12}+A_{21}}$

Ответ: $\frac{T_1-T_2}{T_2} = 0{,}7$

3) 

$2\vec{a}_1 \vec{S} = \vec{v}^2$

③ Чистовик. Часть 1.

$y: 2a_2 H = v^2$

$\vec{v} = \vec{v}_0 + \vec{a}_1 t$

$y: v\cos\beta = a_2 t$

$\cos\beta \sqrt{2a_1 H} = a_2 t$

$t = \cos\beta \sqrt{\frac{2H}{a_2}} = \frac{3\sqrt{2}\cdot H}{5\sqrt{3,6}} = \frac{3\cdot 1,4\ H}{5\cdot 1,9} =$

$= 0.525\ Нс$

Ответ 1) ~~$t = 12,36$ 2) Путь $= 16,5$ м~~ 3) $t = 0.525$ Н

Чернавин.

mg $mg_{пр} = \frac{mg}{\cos\beta}$ $mg = mg_{пр} \cdot \cos\beta$

$-mg\sin\alpha$

$-mg_{пр}\cos\beta\sin\alpha$

$\sin\alpha = \sqrt{1 - \frac{25}{169}} = \sqrt{\frac{169-25}{169}} =$

$= \sqrt{\frac{169-25}{169}} = \sqrt{\frac{144}{169}} =$

$= \frac{12}{13}$

$\sin\beta = \sqrt{\frac{25-9}{25}} = \frac{4}{5}$

$ma_1 = \frac{mg}{\cos\beta} - T$

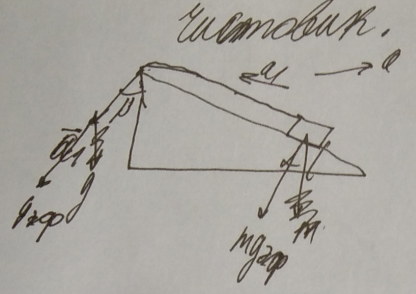
$3ma_1 = \frac{2mg}{\cos\beta} - mg\sin\alpha$

$\frac{ma_1}{2} = T - \frac{mg\sin\alpha}{2}$

$3a_1 = \frac{2g}{\cos\beta} - g\sin\alpha$

$3a_1 = \frac{20 \cdot 5}{3} - 10 \cdot \frac{12}{13} \approx 33,3 - 9,2$

$a_1 = 8,$ м/с^2

1) 

$g_{эф} = g\cos\beta$ (5)

$$\begin{cases} \frac{ma_1}{a} = mg_{эф} - T \\ \frac{ma_1}{2a} = T - mg_{эф}\cos\beta\sin\frac{\alpha}{2} \end{cases}$$

$$3a_1 = \frac{2g}{\cos\beta} - g\sin\alpha$$

$$a_1 \approx 8\ м/с^2$$

$$ma_1 = \frac{mg}{\cos\beta} - T$$

$$T = \frac{mg}{\cos\beta} - ma_1 = \frac{10m\cdot 5}{3} - \frac{24m}{3} = \frac{26m}{3}$$

$$g_{эф} = \frac{ma_1 + T}{m} = \frac{8m + \frac{26m}{3}}{m} = 8 + 8{,}7 = 16{,}7$$

$$a = g_{эф}\sin\beta = 16{,}7\cdot\frac{4}{5} = 13{,}36$$

Ответ: $a = 13{,}36\ м/с^2$.

x_1 $a_{отн x_1} = -a - a_1\cdot\cos\alpha = -13{,}36 - 8\cdot\frac{5}{13} \approx -16{,}36$

y_1 $a_{отн y_1} = a_1\sin\alpha = 8\cdot\frac{12}{13} \approx 7{,}4$

$$a_{отн} = \sqrt{a_{отн x_1}^2 + a_{отн y_1}^2} = \sqrt{267{,}6 + 54{,}8} \approx 18\ м/с^2$$

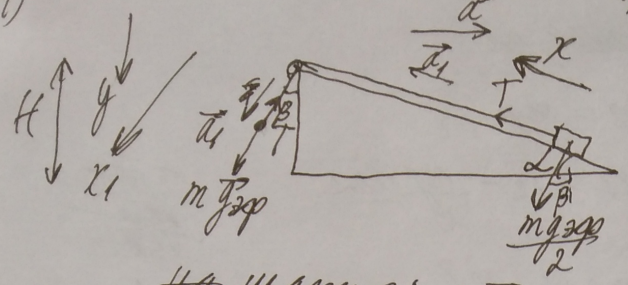
$322{,}36$

Ответ: 1) $a = 13{,}36\ м/с^2$ 2) $a_{отн} = 18\ м/с^2$ 3) $t = 0{,}525$

Чистовик

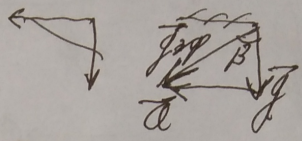
Часть 1. ~~Вариант 11-07.~~ ①

1)



$\cos\beta = \frac{3}{5}$ $\cos\alpha = \frac{5}{13}$

$\vec{g}_{2p} = \vec{g} - \vec{a}$



~~по шарику~~: $m\vec{a}_1 = m\vec{g}_{2p} + \vec{T}$ x_1: $ma_1 = mg_{2p} - T$ (1)

брусок: $m\vec{a}_1 = \frac{m\vec{g}_{2p}}{2} + \vec{T}$ x: $\frac{ma_1}{2} = T - \frac{mg_{2p}\cos\beta \cdot \sin\alpha}{2}$ (2)

~~Без проскальзывания нити~~

~~$ma_1 = mg - T$~~

ЗСЭ: $\Delta W_{кин} = -\Delta W_п$ $\frac{mv_1^2}{2} = mgH$ $v_1^2 = 2gH$

$2\vec{a}_1\vec{S} = v_1^2 - v_0^2$ ($v_0 = 0$)

y: $2a_1\cos\beta H = v_1^2$ $2a_1\cos\beta H = 2gH$

$2a_1\cos\beta = 2g$ $a_1 = \frac{g}{\cos\beta}$

(1)+(2) $\frac{3ma_1}{2} = mg_{2p} - \frac{mg_{2p}\cos\beta \cdot \sin\alpha}{2}$

$3ma_1 = 2mg_{2p} - mg_{2p}\cos\beta \cdot \sin\alpha$

$3a_1 = 2g_{2p} - g_{2p}\cos\beta \cdot \sin\alpha$

$3g = 2g_{2p}\cos\beta - g_{2p}\cos^2\beta \sin\alpha$

$30 = \frac{6}{5}g_{2p} - g_{2p}\frac{9}{25} \cdot \frac{12}{13}$

$30 = g_{2p}\left(\frac{30}{25} - \frac{9 \cdot 12}{25 \cdot 13}\right) = g_{2p}\left(\frac{30}{25} - \frac{108}{325}\right)$

$30 = g_{2p} \cdot \frac{390 - 108}{325}$ $30 = g_{2p} \cdot \frac{282}{325}$

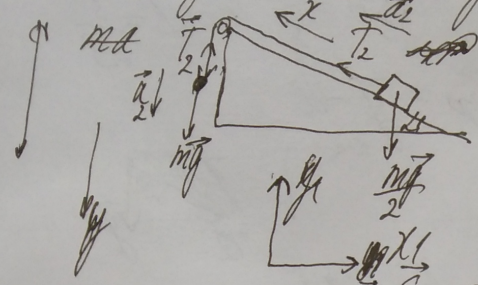
$g_{2p} = \frac{30 \cdot 325}{282} \approx 34{,}6$

$a = g_{2p} \cdot \sin\beta = \frac{30 \cdot 325}{282} \cdot \frac{4}{5} = \frac{30 \cdot 65}{70{,}5} \approx 27{,}7$

a - ускорение клина

Чистовик часть 1. (2)

Если клин имеет ускорение, то



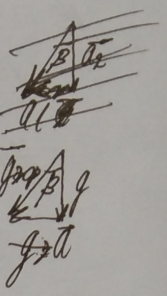
$y: ma_2 = mg - T_2$

$x: \frac{ma_2}{2} = T_2 - \frac{mg\sin\alpha}{2}$

$\frac{v_2^2}{2} = gH \quad v_2^2 = 2gH$

$2a_2 S = v_2^2 - v_0^2$

$y: 2a_2 H = v_2^2 \quad a_2 = \frac{2gH}{2H} = g$



$\frac{3ma_2}{2} = mg - \frac{mg\sin\alpha}{2} \quad 3ma_2 = 2mg - mg\sin\alpha$

$3a_2 = 2g - g\sin\alpha$

$a_2 = \frac{20 - \frac{120}{13}}{3} \approx 3{,}6\ м/с^2$

$ma_1 = mg\sin\varphi - T$

$\frac{ma_1}{2} = T - \frac{mg\sin\varphi\cos\beta\sin\alpha}{2}$ 9,2

$\vec{a}_{отн} = \vec{a} - \vec{a}_2$ бруска.

$a_{отн} = \vec{a}_1$ бруска $- \vec{a}$

$\frac{ma}{\sin\beta} = mg$

$a_1 = \frac{a_2}{\cos\beta} = \frac{3{,}6 \cdot 5}{3} = 6\ м/с^2$

$\frac{ma_2}{\cos\beta} = \frac{mg}{\cos\beta} - T$

x_1: $a_{отн x_1} = -a - a_1 \cdot \sin\alpha \cdot \frac{\cos\alpha}{\cos\alpha} =$

$= -13{,}36 - 5{,}5 = -18{,}8 = -13{,}36 - 2{,}3 = -15{,}6$

$T = \frac{mg - ma_2}{\cos\beta} =$

y_1: $a_{отн y_1} = a_1\cos\alpha = a_1\sin\alpha = 5{,}5$

$= \frac{m(g - a_2)}{\cos\beta} = 10{,}7m$

$a_{отн} = \sqrt{a_{отн x_1}^2 + a_{отн y_1}^2} = \sqrt{243{,}36 + 30{,}25} \approx 16{,}5\ м/с^2$

$\frac{ma_2}{\cos\beta} = \frac{ma}{\sin\beta} - T$

$\frac{ma}{\sin\beta} = \frac{ma_2}{\cos\beta} + 10{,}7m$

ускорение клина

$a = 16{,}7 \cdot \frac{4}{5} = 13{,}36$

$\frac{a}{\sin\beta} = 6 + 10{,}7 = 16{,}7$

Часть 2

Олимпиада: **Физика, 11 класс (2 часть)**

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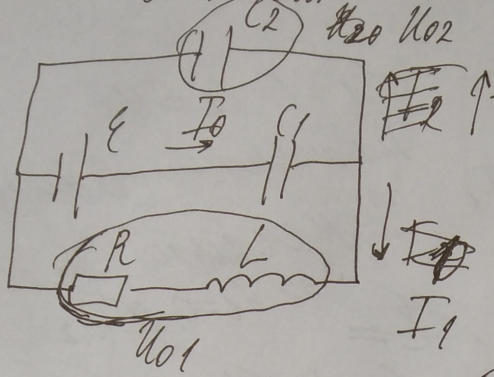
Вариант 7

Чистовик. Часть 2 (2)

Ч.р. + 1.

3)



$U_{c2} = U_{c1}$

~~$\varepsilon q = \frac{q^2}{2C} + \frac{q^2}{2C}$~~

2) $\varepsilon q = \frac{q^2}{2C} + \frac{q^2}{8C} + Q$ После выделения всего тепла тока не будет.

~~$\varepsilon q = \frac{q^2}{2C} + \frac{q^2}{8C} + Q$~~ $\varepsilon q = \frac{q^2}{2C} + \frac{q^2}{8C} + Q$

$U = \frac{q}{C} = \frac{4\varepsilon}{5}$ $q = UC = \frac{4\varepsilon C}{5}$

$Q = \left(\varepsilon q - \frac{q^2}{2C} + \frac{q^2}{8C}\right) = q\left(\varepsilon - \frac{U}{2} - \frac{U}{8}\right) =$

$= \frac{4\varepsilon C}{5}\left(\varepsilon - \frac{4\varepsilon}{10} - \frac{4\varepsilon}{40}\right) = \frac{4\varepsilon C}{5}\left(\frac{40\varepsilon - 16\varepsilon - 4\varepsilon}{40}\right) =$

$= \frac{4\varepsilon C}{5} \cdot \frac{20\varepsilon}{40} = \frac{20\varepsilon^2 C}{50} = \frac{2\varepsilon^2 C}{5}$

$Q = \frac{2\varepsilon^2 C}{5}$

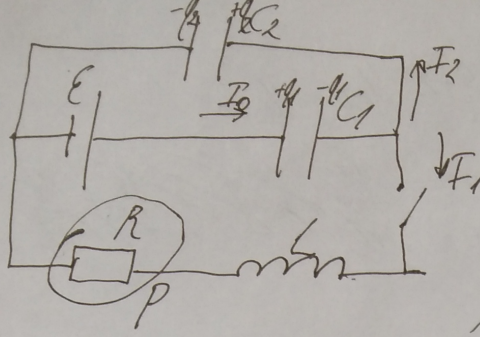
3) $\varepsilon = \frac{I_0 \Delta t}{C} + L\frac{\Delta I}{\Delta t} + I_1 R$ $\varepsilon = \frac{I_0 \Delta t}{C} + \frac{I_2 \Delta t}{C}$

$\frac{I_2 \Delta t}{C} = L\frac{I_1}{\Delta t} + I_1 R$

Ответ: 1) $I = \frac{\varepsilon}{5L}$ 2) $Q = \frac{2\varepsilon^2 C}{5}$

Часть 2. Чистовик ①

3



$C_1 = C$ $C_2 = 4C$

~~В начальный момент~~ Изначально $q_1 = 0$ $q_2 = 0 \Rightarrow$

$\Rightarrow U_1 = 0$ и $U_2 = 0$

$\varepsilon = LI'$

$I' = \frac{\varepsilon}{L}$

~~В момент замыкания~~ ток через резистор не успеет возрасти и будет равен нулю

Пока ключ разомкнут конденсаторы заряжаются до $\varepsilon = C_1$ максимума.

$\varepsilon = U_1 + U_2 = \frac{q_1}{C} + \frac{q_2}{4C}$

$q_2 - q_1 = 0 \Rightarrow q_2 = q_1 = q$

$\varepsilon = \frac{q}{C} + \frac{q}{4C}$

$U_1 = \frac{q}{C} = U$

$\varepsilon = U + \frac{U}{4} = \frac{5U}{4}$

$U = \frac{4\varepsilon}{5}$

$U_2 = \frac{q}{4C} = \frac{U}{4}$

Ключ замкнули ток сначала в резисторе равен нулю.

$\varepsilon = LI' + U_1$

$\varepsilon - U = LI'$

$\varepsilon - \frac{4\varepsilon}{5} = LI' = \frac{\varepsilon}{5}$

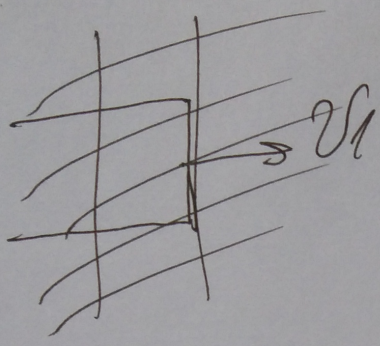
$I' = \frac{\varepsilon}{5L}$

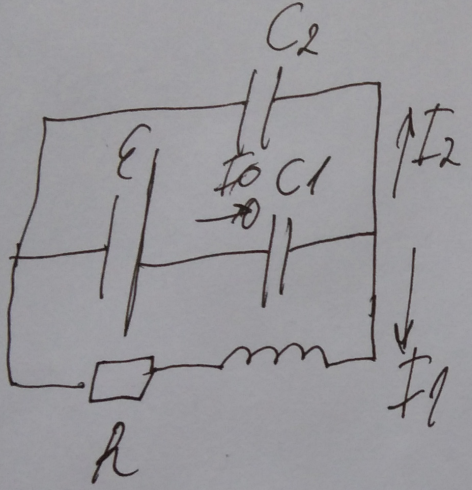
3)

$\varepsilon q = \frac{q_0^2}{2C} + \frac{q_0^2}{8C} + \frac{LI_0^2}{2} + I_0^2 R \Delta t$

U_2

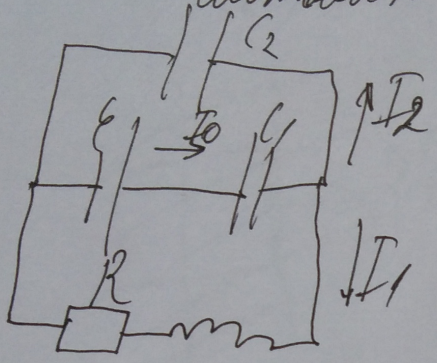
нагреватель.





$\frac{I_2 \Delta t}{C} = I_1 R$ $I_0 \Delta t = \varepsilon$ $\Delta t = \frac{\varepsilon}{I_0}$

Вариант № 2. (5)



$$\mathcal{E} = \frac{I_0 t}{C} + I_1 R$$

$$\mathcal{E} = \frac{I_0 t}{C} + \frac{I_2 \Delta t}{2C}$$

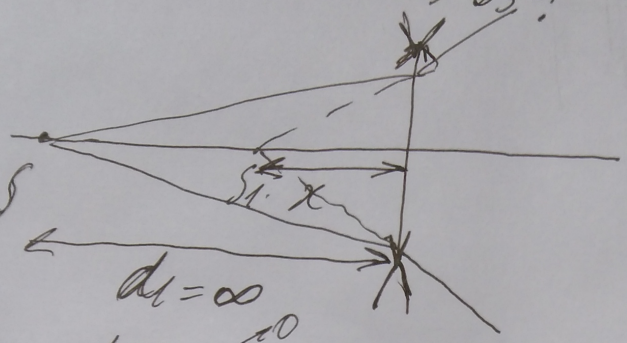
$$\mathcal{E}_{sq} = \frac{I_0^2 t^2}{2C} + \frac{I_2^2 t^2}{8C}$$

$$\mathcal{E} I_0 t =$$

Шестьдесят часть 2 ⑨

6. 1) $\frac{D_1}{D_2} = 3$ 1) x-? D_1-? $\frac{F_2}{F_1} = 3$

2) D_3-?

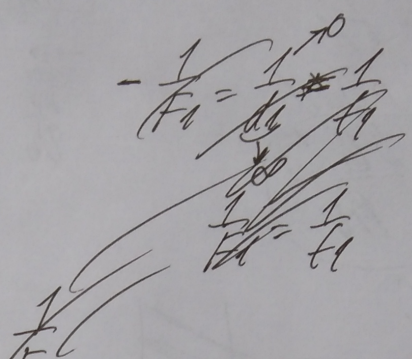


$-\frac{1}{F_1} = \frac{1}{d_1} - \frac{1}{f_1}$ $f_1 = x$

$\frac{1}{F_1} = \frac{1}{f_1}$ $x = F_1$

$D_1 = 3D_2$ $\frac{1}{F_1} = \frac{3}{F_2}$

$D_1 = \frac{1}{F_1} = \frac{1}{0,167_м} \approx 6$ дптр



Очки для чтения.

$-\frac{1}{F_2} = \frac{1}{d_2} - \frac{1}{f_2}$ $f_2 = x$

$-\frac{1}{F_2} = \frac{1}{25} - \frac{1}{x}$

$-\frac{1}{F_2} = \frac{1}{25} - \frac{1}{F_1}$

$-\frac{1}{3F_1} = \frac{1}{25} - \frac{1}{F_1}$

$\frac{1}{F_1} - \frac{1}{3F_1} = \frac{1}{25}$ $\frac{2}{3F_1} = \frac{1}{25}$

$F_1 = \frac{2 \cdot 25}{3} = \frac{3F_1}{2} = 25$

$= \frac{50}{3} = 16,7$ $x = F_1 = 16,7$ см

2) $-\frac{1}{F_3} = \frac{1}{d_3} - \frac{1}{f_3}$ $d_3 = 50$см $f_3 = x$

$-\frac{1}{F_3} = \frac{1}{50} - \frac{3}{50}$ $-\frac{1}{F_3} = -\frac{2}{50}$

$\frac{1}{F_3} = \frac{2}{50}$ $F_3 = \frac{50}{2} = 25$ см $D_3 = \frac{1}{F_3} = \frac{1}{0,25} = 4$ дптр

Ответ: 1) $x \approx 16,7$ см; $D_1 \approx 6$ дптр 2) $D_3 \approx 4$ дптр.

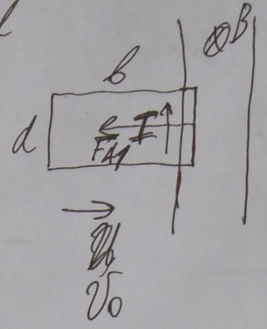
Чистовик. Часть 2. ① ③

q, m, d, V_0, R, B.

$b = 3d$

$H = \frac{d}{5}$

+ 1) a - ?



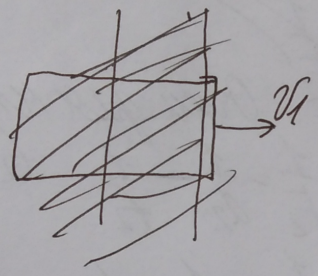
$F_A = BV_0 d$

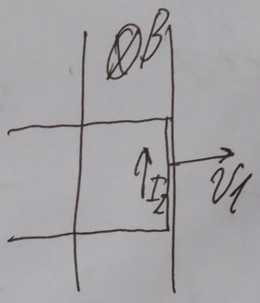
$ma = F_A$

$ma = BV_0 d$

$a = \frac{BV_0 d}{m}$

2) V_1





$\mathcal{E}_2 = BV_1 I_2$

$\mathcal{E} = \frac{\Delta\Phi}{\Delta t} = \frac{H \cdot d}{\Delta t} = \frac{d^2}{5\Delta t}$

$V_1 = V_0 - a\Delta t$

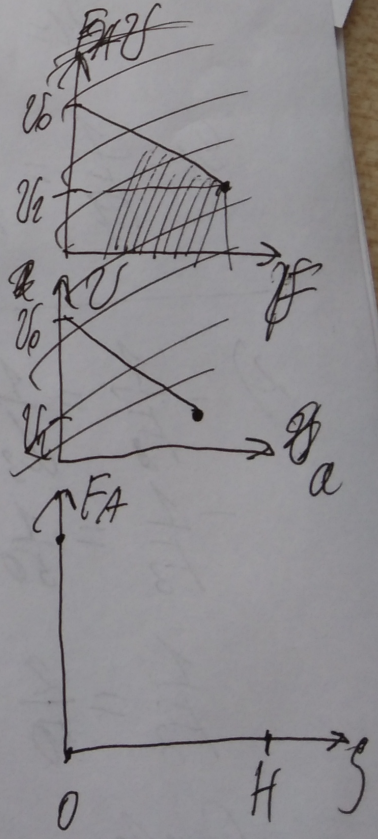
$a\Delta t = V_0 - V_1$

$a_2 = \frac{BV_0 d}{m}$

$F_{A2} = BV_1 d$

$A_{F_A} = \Delta W_{кин}$

$\frac{mV_0^2}{2} - \frac{mV_1^2}{2} = A_{F_A}$



Ответ: 1) $a = \frac{BV_0 d}{m}$