Часть 1

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

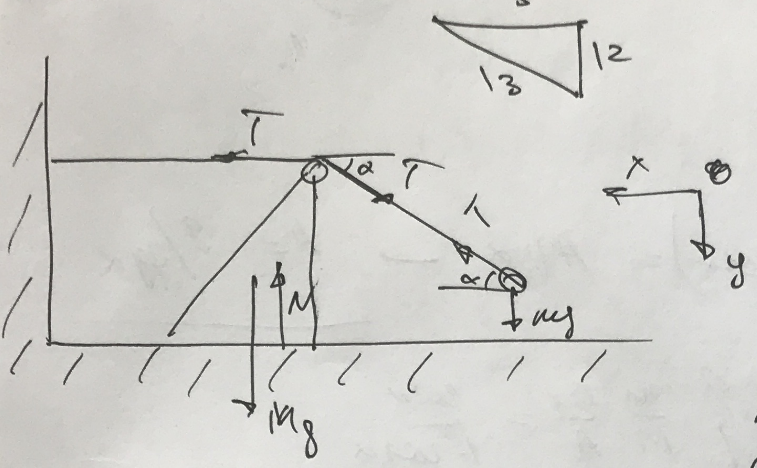
Шифр: **21202459**

ID профиля: **314991**

Вариант 3

#1. Чистовик

стр №1



для шарика на OX:

$T\cos\alpha = ma_x$ (1)

OY:

$mg - T\sin\alpha = ma_y$ (2)

для клина на OX:

$T - T\cos\alpha = MA$. (3)

Пусть прошло Δt, клин сместился влево на Δz.

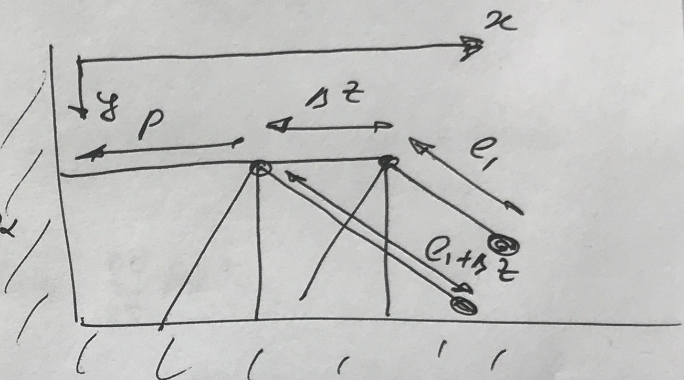
x, шара:

$x_1 = p + \Delta z + l_1\cos\alpha$

$x_2 = p + (l_1 + z)\cos\alpha$

$|\Delta x| = p + \Delta z + l_1\cos\alpha - p - l_1\cos\alpha - z\cos\alpha$

$|\Delta x| = \Delta z(1 - \cos\alpha)$



y, шара:

$y_1 = l_1\sin\alpha$

$y_2 = (l_1 + \Delta z)\sin\alpha$

$\Delta y = (l_1 + \Delta z)\sin\alpha - l_1\sin\alpha = \Delta z\sin\alpha$

$\Delta z = \frac{A(\Delta t)^2}{2} \rightarrow \Delta z \sim A$

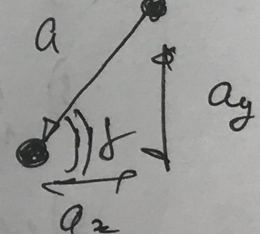
$\Delta x \sim a_x$ (аналогично)

$\Delta y \sim a_y$

$a_x = A(1 - \cos\alpha)$

$a_y = A\sin\alpha$

$\frac{a_y}{a_x} = \operatorname{tg}\gamma = \frac{\sin\alpha}{1-\cos\alpha} = \frac{\frac{12}{13}}{1 - \frac{5}{13}} = \frac{12}{8} = \frac{3}{2}$



из (1) $T = \frac{ma_x}{\cos\alpha} \rightarrow$ во (2):

$mg - ma_x\operatorname{tg}\alpha = ma_y$

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#1 Продолжение чистовик стр №2

$g - a_x \operatorname{tg}\alpha = a_y$

$g - A(1-\cos\alpha)\operatorname{tg}\alpha = A\sin\alpha$

$g = A\left(\sin\alpha + \frac{\sin\alpha}{\cos\alpha} - \frac{\sin\alpha}{\cos\alpha}\cos\alpha\right) = A\operatorname{tg}\alpha \rightarrow A = g/\operatorname{tg}\alpha$

ay (3) $MA = T(1-\cos\alpha)$

ay (1) $ma_x = T\cos\alpha$

$\frac{m}{M}\frac{a_x}{A} = \frac{\cos\alpha}{1-\cos\alpha}$

$\frac{m}{M}\cdot\frac{A(1-\cos\alpha)}{A} = \frac{\cos\alpha}{1-\cos\alpha}$

$\frac{m}{M} = \frac{\cos\alpha}{(1-\cos\alpha)^2} = \frac{\frac{5}{13}}{\left(1-\frac{5}{13}\right)^2} =$

$= \frac{\frac{5}{13}\cdot 13\cdot 13}{64} = \frac{65}{64}$

$a_y = A\sin\alpha = \frac{g}{\frac{\sin\alpha}{\cos\alpha}}\sin\alpha = g\cos\alpha$

$H = \frac{(\Delta t)^2 a_y}{2} \rightarrow \Delta t = \sqrt{\frac{2H}{a_y}} = \sqrt{\frac{2H}{g\cos\alpha}} = \sqrt{\frac{2H}{g\cdot\frac{5}{13}}} = \sqrt{\frac{26}{5}\frac{H}{g}}$

Ответ: 1) под углом γ : $\operatorname{tg}\gamma = 3/2$

2) $A = \frac{g}{\operatorname{tg}\alpha} = g\cdot\frac{5}{12}$

3) $\frac{m}{M} = \frac{65}{64}$

4) $\Delta t = \sqrt{\frac{26}{5}\frac{H}{g}}$

#2.

ν_0

$T_0 \xrightarrow{\text{охл.}}$

$C(T) = 3R\frac{T}{T_0}$

1) $C\nu dT = pdV + \frac{3}{2}\nu RdT$ (1ое нач Терм)

~~$\nu RT = pV$~~ $\delta Q = C\nu dT$

~~$\nu RdT = pdV + VdP$~~ ~~$\neq pdV$~~

$\delta Q = C\nu dT$

$$\int_0^Q \delta Q = \int_{T_0}^{\frac{3}{5}T_0} \frac{3R}{T_0}\nu \cdot dT \cdot T$$

$$Q = \frac{3R\nu}{T_0} \frac{T^2}{2} \Big|_{T_0}^{\frac{3}{5}T_0} = \frac{3\nu R}{T_0} \cdot \frac{1}{2}T_0^2\left(\frac{9}{25} - 1\right) =$$

$$= -\frac{3}{2}\nu RT_0 \cdot \frac{16}{25} = -\frac{24}{25}\nu RT_0 \text{ — подведенное тепло}$$

$$\rightarrow Q_1 = -Q = \frac{24}{25}\nu RT_0.$$

2) $C\nu dT = pdV$ ~~$+ Vdp$~~ $+ \frac{3}{2}\nu RdT$ когда A min $dV = 0$

~~$\nu RT = pV$ $\nu RdT = pdV + Vdp$~~

~~$3R\frac{T}{T_0}\nu dT = pdV + \frac{3}{2}(pdV + Vdp)$~~

~~$3\frac{T}{T_0}\cdot(pdV + Vdp) = pdV + \frac{3}{2}pdV + \frac{3}{2}Vdp$~~

$C\nu dT = dA + \frac{3}{2}\nu RdT$

$dA = C\nu dT - \frac{3}{2}\nu RdT = 3R\frac{T}{T_0}\nu dT - \frac{3}{2}\nu RdT$

при A min $dA = 0$

$\rightarrow 3R\frac{T}{T_0}\nu dT - \frac{3}{2}\nu RdT = 0$

~~$\frac{T}{T_0} - \frac{1}{2} = 0$~~ $\frac{T}{T_0} = \frac{1}{2} \rightarrow \boxed{T = \frac{T_0}{2}}$

2 продолжение.

$$\int_0^A dA = \int_{T_0}^{T_0/2} 3R\frac{T}{T_0}\nu dT - \int_{T_0}^{T_0/2} \frac{3}{2}\nu R dT \qquad -\frac{3}{4}T_0^2$$

$$A = \frac{3R\nu}{T_0}\,\frac{T^2}{2}\Big|_{T_0}^{T_0/2} - \frac{3}{2}\nu R\left(\frac{T_0}{2}-T_0\right) = \frac{3R\nu}{T_0}\cdot\frac{1}{2}\left(\frac{T_0^2}{4}-T_0^2\right) + \frac{3}{2}\nu R\cdot\frac{T_0}{2} =$$

$$= -\frac{3}{4}T_0^2\cdot\frac{3\nu R}{2T_0} + \frac{3}{4}\nu RT_0 = \nu RT_0\left(\frac{3}{4}-\frac{9}{8}\right) = -\frac{3}{8}\nu RT_0$$

Ответ: 1) $Q_1 = \frac{24}{25}\nu RT_0$

2) $T_0/2$

3) $A = -\frac{3}{8}\nu RT_0$.

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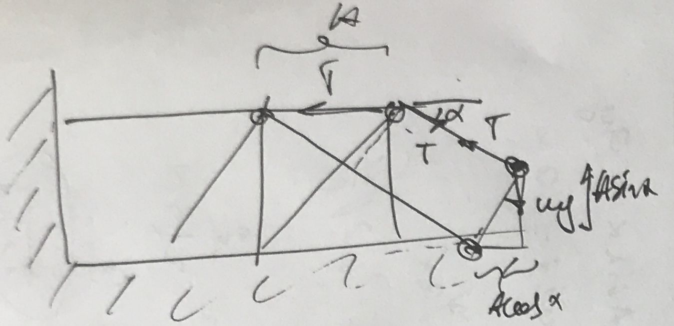


$MA = T(1 - \cos\alpha)$

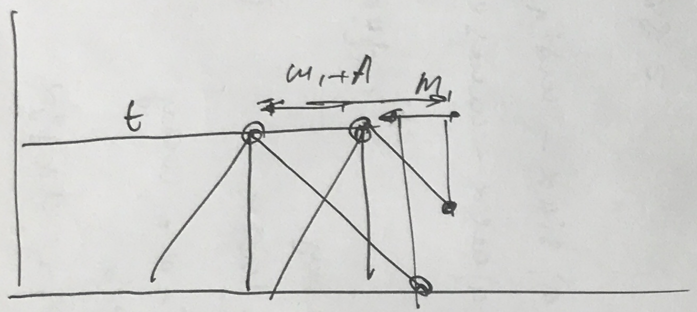
$ma_x = T\cos\alpha$

$mg - T\sin\alpha = ma_y$

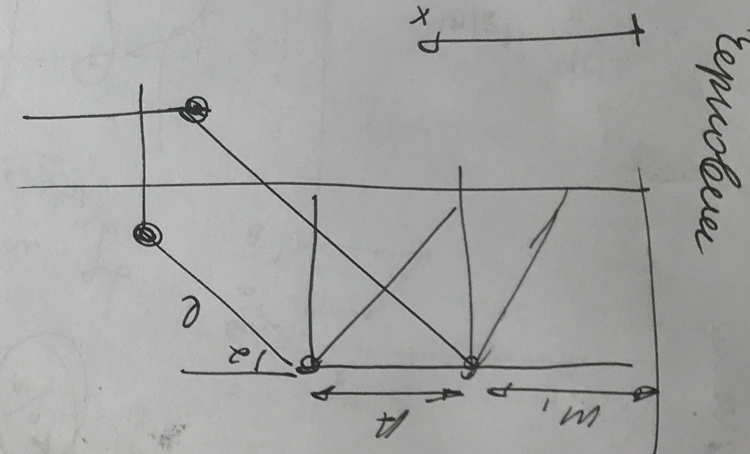
$\Delta x = A + \ldots - l\cos\alpha - A\cos\alpha$

$\Delta x = A + l\cos\alpha - (l + A)\cos\alpha$

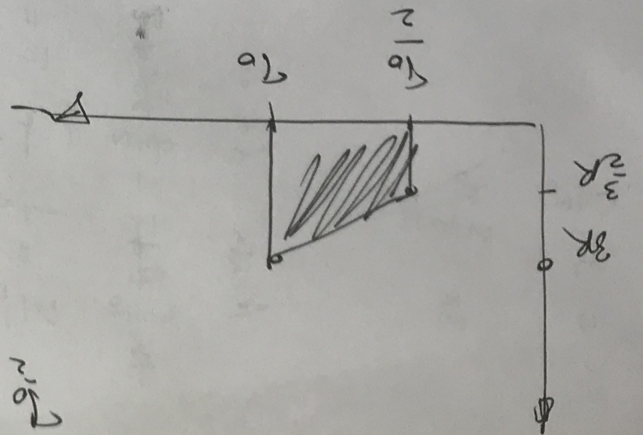
$a_x =$



$A + t + m_1 -$



Зеркальное



$\frac{T_0}{2} \cdot \nu_0 R \cdot \frac{1}{2}(3 + 1.5) = \frac{9}{8}\nu R T_0 \Rightarrow -\frac{9}{8}\nu R T_0$

$+ \frac{3}{2}\nu R \cdot \frac{T_0}{2} = \frac{3}{4}\nu R T_0 - \frac{9}{8}\nu R T_0$

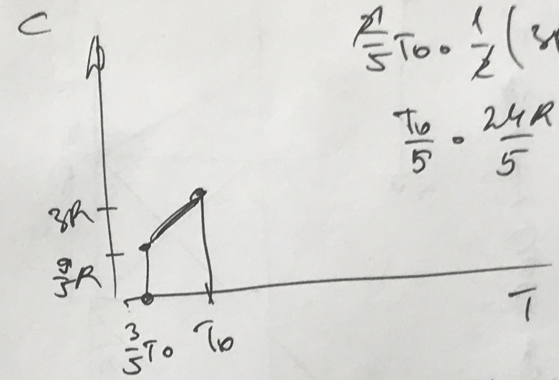
$\frac{6-3}{8} = -\frac{3}{8}\nu R T_0$

Черновик

D. T_0

$C = 3R\frac{T}{T_0}$

$3R \quad \frac{3}{5}T_0$

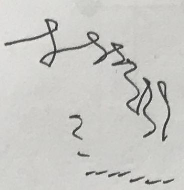


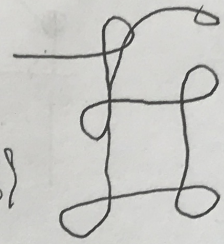
$\frac{2}{5}T_0 \cdot \frac{1}{2}\left(3R + \frac{9}{5}R\right)$

$\frac{T_0}{5} \cdot \frac{24R}{5} = \frac{24}{25}\nu R T_0$

$A_{min} \quad dA = 0$

~~$3R\frac{T}{T_0}\nu dT - \frac{3}{2}\nu R dT = 0$~~



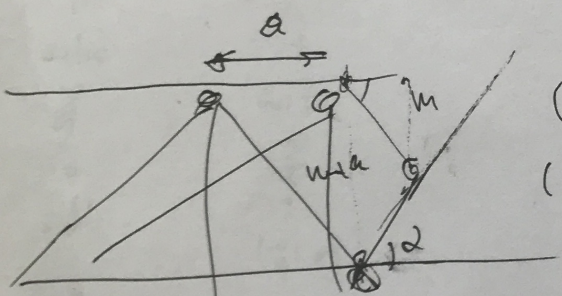


$\frac{T}{T_0} = \frac{1}{2} \rightarrow T = \boxed{T_0/2}$

$dA = 3R\frac{T}{T_0}\nu dT - \frac{3}{2}\nu R dT = 3\nu R\left(\frac{1}{T_0}TdT - \frac{dT}{2}\right) =$

$= 3\nu R\left(\frac{1}{T_0}\left(-\frac{3}{8}T_0^2\right) + \frac{T_0}{4}\right) = 3\nu RT_0\left(\frac{1}{4} - \frac{3}{8}\right)$

$= 3\nu RT_0 \cdot -\frac{1}{8} = -\frac{3}{8}\nu RT_0$



$(m+a)\sin\alpha - m\sin\alpha = A\sin\alpha = a_y$

$(m+a)\cos\alpha - m\cos\alpha = A\cos\alpha = a_x$

$tg\alpha = a_y/a_x$

$mg - T\sin\alpha = ma_y$

$T\cos\alpha = ma_x$

$\sqrt{\frac{2h}{g/2}} = 2\sqrt{\frac{h}{g}}$

$\frac{1-\cos\alpha}{\cos\alpha} = \frac{M}{m}$

$mg - \frac{ma_x}{\cos\alpha}\sin\alpha = ma_y$

$a_x = \frac{g}{2tg\alpha}$

$m - M = \frac{1}{1-\cos\alpha} = \frac{1}{1-\frac{5}{13}} \quad 13/8$

$g - a_x tg\alpha = a_x tg\alpha$

$a_y = g/2$

$A = \boxed{\frac{g}{2\sin\alpha}}$

$T - T\cos\alpha = M\frac{g}{2\sin\alpha}$

$T\cos\alpha = \frac{mg}{2tg\alpha}$

#2. черновик

$\delta Q = C\nu dT$

$\nu, \nu.$

$\delta Q = 3R\frac{T}{T_0}\nu dT$

$T_0 \to \frac{3}{5}T_0$

$$\int_0^Q \delta Q = \int_{T_0}^{\frac{3}{5}T_0} 3R\frac{T}{T_0}\nu dT$$

$$\frac{25}{-9}{16}$$

$$Q = \frac{3R\nu}{T_0}\frac{T^2}{2}\Big|_{T_0}^{\frac{3}{5}T_0} = \frac{3\nu R}{T_0}\frac{1}{2}\left(\frac{9}{25}-1\right)T_0^2 =$$

$$= \frac{3}{2}\nu R\cdot T_0\cdot\left(-\frac{16}{25}\right) = -\frac{24}{25}\nu R T_0.$$

$C\nu dT = pdV + \frac{3}{2}\nu R dT$

A min при $pdV = dA = 0$

$C = \frac{3}{2}R$

$3R\frac{T}{T_0} = \frac{3}{2}R$

$T = T_0/2.$

$$\int_0^A dA = \int_{T_0}^{T_0/2} C\nu dT - \int_{T_0}^{T_0/2}\frac{3}{2}\nu R dT$$

$$A = \frac{3R\nu}{T_0}\frac{T^2}{2}\Big|_{T_0}^{T_0/2} + \frac{3}{2}\nu R\cdot\frac{T_0}{2} = \frac{3\nu R}{2T_0}\cdot T_0^2\left(\frac{1}{4}-1\right)+\frac{3}{4}\nu R T_0$$

$$= \frac{3}{2}\nu R T_0\cdot\left(-\frac{3}{4}\right)+\frac{3}{4}\nu R T_0 = \frac{3}{4}\nu R T_0\left(1-\frac{3}{2}\right) = -\frac{3}{8}\nu R T_0$$

$\to$ A отрицательна

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черновик

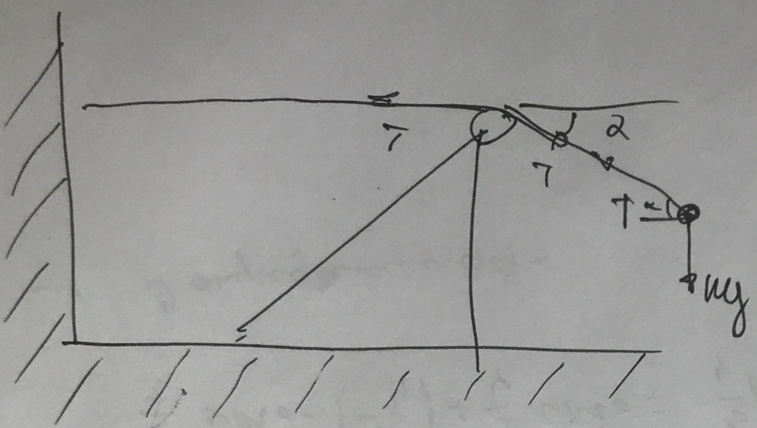
$MA = T - T\cos\alpha$

$May = mg - T\sin\alpha$

$max = T\cos\alpha$

$May = mg - \sin\alpha \frac{max}{\cos\alpha}$

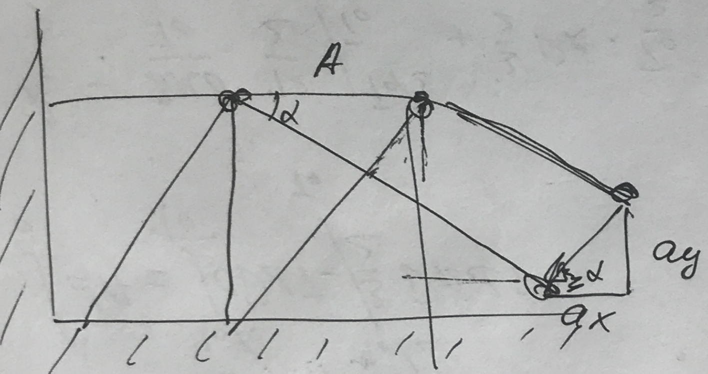
$a_y = g - tg\alpha\, a_x$



$A\sin\alpha = a_y$

$A\cos\alpha = a_x$

$\frac{a_y}{a_x} = tg\alpha$



$2a_x tg\alpha = g$

$a_x = \frac{g}{2tg\alpha}$

$a_y = \frac{g}{2}$

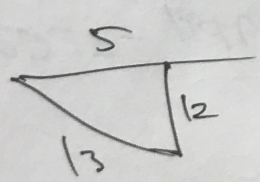
$A = \frac{a_y}{\sin\alpha} = \frac{g}{2\sin\alpha} = \frac{g}{2\frac{12}{13}} = \frac{13}{24}g$

$\frac{gt^2}{2} = H$

$t = \sqrt{\frac{2H}{g}}$

$max = T\cos\alpha$

$MA = T(1-\cos\alpha)$



$\frac{m}{M} \cdot \frac{g}{2tg\alpha}\frac{2\sin\alpha}{g} = \frac{\cos\alpha}{1-\cos\alpha}\sqrt{\frac{2H}{g/2}}$

$= 2\sqrt{\frac{H}{g}}$

$\frac{m}{M} \cdot \cos\alpha = \frac{\cos\alpha}{1-\cos\alpha}$

$\frac{M}{m} = \frac{1}{1-\cos\alpha} = \frac{1\cdot 13}{8} = \frac{13}{8}$

$a_x tg\alpha = g - a_x tg\alpha$

$g - a_x tg\alpha = g - \frac{g}{2} = \frac{g}{2}$

Черновик

$$\int_{T_0}^{\frac{3}{5}T_0} 3R\frac{T}{T_0}\,dT = \frac{3R\nu}{T_0}\quad \frac{9}{25}T_0^2 - T_0^2 = -\frac{16}{25}T_0 \cdot \frac{3\nu R}{2}$$

$$= -\frac{24}{25}\nu R T_0$$

$$\int 3R\frac{T}{T_0}\nu\,dT = 0 + \frac{3}{2}\nu R\,dT$$

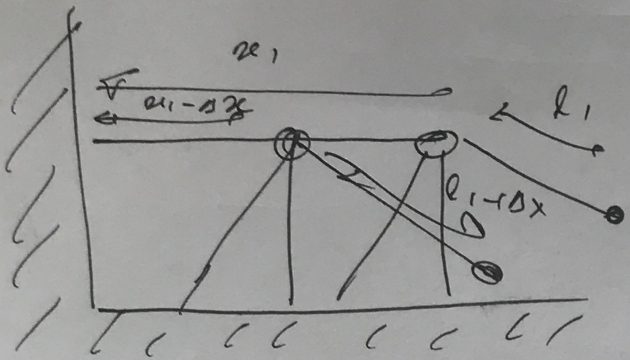
$$\frac{T}{T_0} = \frac{1}{2} \to T = T_0/2$$

$$\int_{T_0}^{T_0/2} 3R\frac{T}{T_0}\nu\,dT + \int_{T_0}^{T_0/2} \frac{3}{2}\nu R\,dT = \frac{3R\nu}{T_0}\cdot\frac{1}{2}\left(\frac{T_0^2}{4} - T_0^2\right) + \frac{3}{4}\nu R T_0$$

$$-\frac{9}{8}\nu R T_0 + \frac{3}{4}\nu R T_0$$

$$-\frac{3}{8}\nu R T_0$$

$$-\frac{3}{8}\nu R T_0 - \frac{3}{4}\nu R T_0 = -\frac{9}{8}\nu R T_0$$



~~$\dots + \Delta x - \dots$~~ $-\Delta x\cos\alpha$

$= \Delta x(1-\cos\alpha)$

$a_x = A(1-\cos\alpha)$

$(l_1+\Delta x)\sin\alpha - l_1\sin\alpha$

$\Delta x\sin\alpha$

5, 12, 13

$a_y = A\sin\alpha = \frac{g}{\frac{\sin}{\cos}}\sin = g\cos\alpha$

$\frac{g}{12}5 =$

$mg - T\sin\alpha = ma_y$

$T\cos\alpha = ma_x$

$mg - ma_x\,tg\alpha = ma_y$

$mg - mA(1-\cos\alpha)\,tg\alpha = mA\sin\alpha$

$g - A\,tg\alpha$ ~~$+ A\sin\alpha$~~ $=$ ~~$A\sin\alpha$~~

$A = g/tg\alpha$

$\frac{(1-\cos\alpha)}{\cos\alpha} = \frac{M\beta}{M\beta(1-\cos\alpha)}$

$\frac{M\beta}{\mu} = \frac{\cos\alpha}{(1-\cos\alpha)^2} =$

$\frac{g\frac{5}{13}t^2}{2} = \mu$

$= \frac{\frac{5}{13}}{\frac{64}{169}} = \frac{65}{64}$

$t = \sqrt{\frac{26\mu}{5g}}$

Черновик

#1 Продолжение ~~штатовии~~ №2

Объединив (4) и (5)

$$2a_x \operatorname{tg}\alpha = g \quad a_x = \frac{g}{2\operatorname{tg}\alpha} \; ; \; a_y = a_x \operatorname{tg}\alpha = g/2$$

$$\rightarrow T = \frac{ma_x}{\cos\alpha} = \frac{mg}{2\frac{\sin\alpha}{\cos\alpha}\cos\alpha} = \frac{mg}{2\sin\alpha}$$

из (6) и (8) с учетом малости Δ

~~$\frac{x}{\Delta y} = \frac{A}{a_y} =$~~

$$\frac{x}{\Delta x} = \frac{A}{a_x} = \frac{1}{\cos\alpha} \rightarrow A = \frac{a_x}{\cos\alpha} = \frac{g}{2\frac{\sin\alpha}{\cos\alpha}\cos\alpha} = \frac{g}{2\sin\alpha}$$

$$\left.\begin{aligned} M &= \frac{T(1-\cos\alpha)}{A} \\ m &= \frac{T\cos\alpha}{a_x} \end{aligned}\right\} \rightarrow \frac{M}{m} = \frac{T(1-\cos\alpha)}{A} \cdot \frac{a_x}{T\cos\alpha} = \frac{\cos\alpha(1-\cos\alpha)}{\cos\alpha} =$$

$$= 1 - \frac{5}{13} = \frac{8}{13}.$$

$$\Delta y' = H = \frac{a_y t^2}{2} \Rightarrow t = \sqrt{\frac{2H}{a_y}} = \sqrt{\frac{2H}{g}\cdot 2} = 2\sqrt{\frac{H}{g}}$$

Ответ: 1) под углом α ($\cos\alpha = 5/13$).

2) $A = \frac{g}{2\sin\alpha} = \frac{g}{2\cdot\frac{12}{13}} = \frac{13}{24}g$

3) $\frac{m}{M} = \frac{13}{8}$

4) $t = 2\sqrt{H/g}$.

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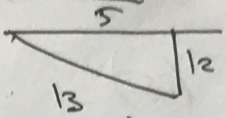
Чистовик.

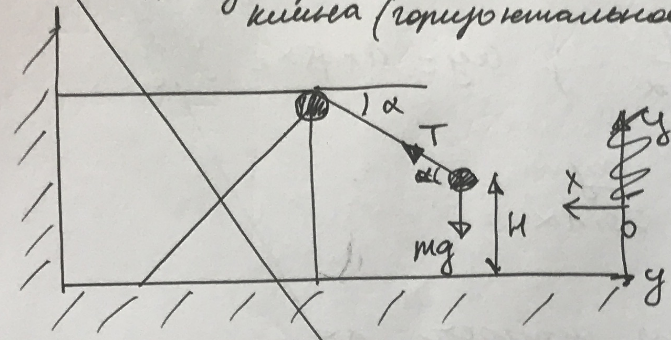
№1.

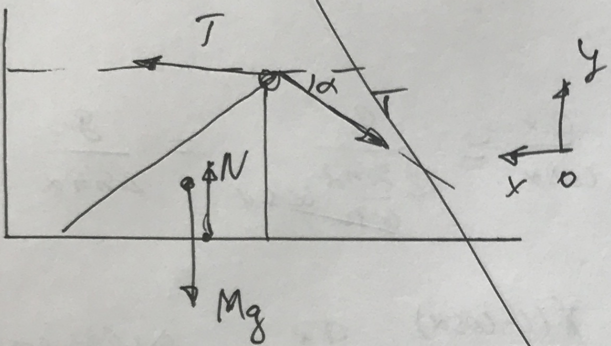


$\cos\alpha = \frac{5}{13}$

$\rightarrow \sin\alpha = \frac{12}{13}$

A – ускорение клина (горизонтальное)





Для шара на Ox:

$T\cos\alpha = m a_x$ (1)

$mg - T\sin\alpha = m a_y$ (2)

Для клина на Ox:

$M A_x = T - T\cos\alpha$ (3)

из (1) $T = \frac{m a_x}{\cos\alpha}$

во (2):

$mg - \frac{m a_x}{\cos\alpha}\sin\alpha = m a_y$

$g = a_x \operatorname{tg}\alpha + a_y$

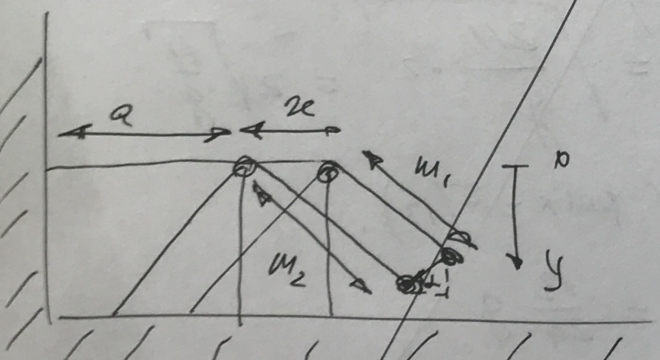
$a_y = g - a_x \operatorname{tg}\alpha$ (4)

Пусть прошло Δt: клин сдвинется влево на x.

в силу нерастяжимости нити

$a + x + m_1 = a + m_2$

$x = m_2 - m_1$ (6)

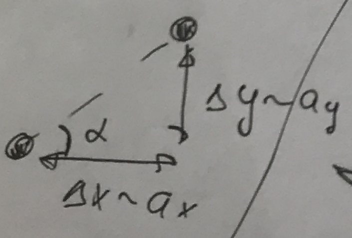


Для шарика нач. полож. по OY: $m_1 \sin\alpha$

конечное: $m_2 \sin\alpha$

$\Delta y = (m_2 - m_1)\sin\alpha$ (7)

$\Delta x = (m_2 - m_1)\cos\alpha$ (8)



в нач. мом. (через $\Delta t \to 0$): $\frac{\Delta y}{\Delta x} = \frac{a_y}{a_x} = \operatorname{tg}\alpha$

$a_y = a_x \operatorname{tg}\alpha$

$\frac{a_y}{a_x} = \operatorname{tg}\alpha = \frac{12}{5}$ (5)

→ ускорение напр. под углом α.

Часть 2

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

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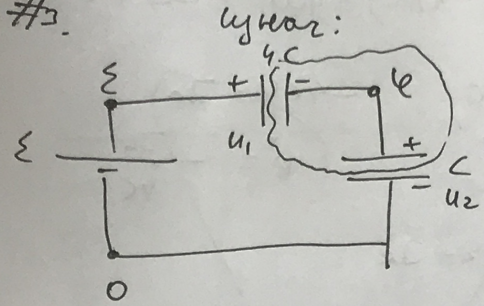
ID профиля: **314991**

Вариант 3

#3. Сначала:



режим уст → $I = 0$

выберем изол. обл.

~~для нее~~ верно: (по 3-ну сох q)
для нее

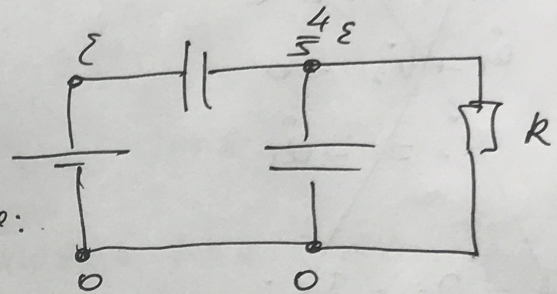
$$0 = -4C(\varepsilon - \varphi) + \varphi C$$

$$-4\varepsilon + 4\varphi + \varphi = 0$$

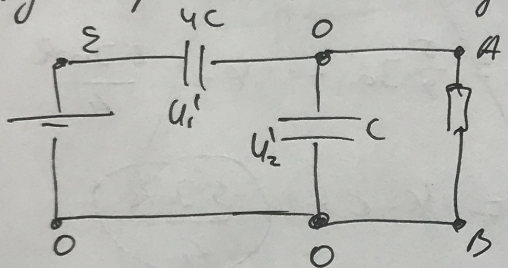
При замыкании ключа U конденсаторов не изменится скачком:

$$5\varphi = 4\varepsilon \rightarrow \varphi = \frac{4}{5}\varepsilon$$

$$I_R = \frac{\frac{4}{5}\varepsilon - 0}{R} = \frac{4\varepsilon}{5R}.$$



Пусть режим снова установился:



$I_R = 0 \rightarrow \varphi_A = \varphi_B = 0$

$\rightarrow U_1' = \varepsilon$

$U_2' = 0$ рассм. левую обкладку C_1.

$$q(0) = U_1 \cdot 4C = (\varepsilon - \varphi)4C = \frac{\varepsilon}{5} \cdot 4C$$

$$q' = U_1' \cdot 4C = \varepsilon \cdot 4C$$

$$\rightarrow \Delta q = C\varepsilon\left(4 - \frac{4}{5}\right) = C\varepsilon \cdot \frac{16}{5}$$

По ЗСЭ:

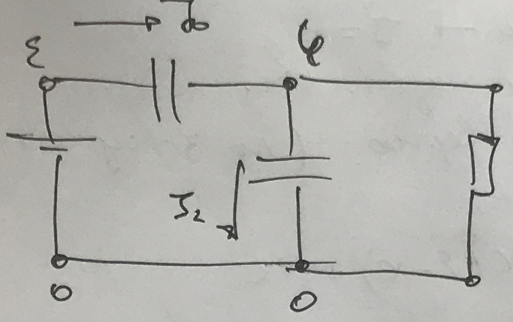
~~$W(0) = Q$~~ $A_\varepsilon = \Delta W + Q$

$$Q = A_\varepsilon - \Delta W = C\varepsilon \cdot \frac{16}{5} \cdot \varepsilon - \left(\frac{4CU_1'^2}{2} + \frac{CU_2'^2}{2} - \frac{4CU_1^2}{2} - \frac{CU_2^2}{2}\right)$$

$$= \frac{16}{5}C\varepsilon^2 - \left(\frac{4C}{2} \cdot \varepsilon^2 + 0 - \frac{4C}{2} \cdot \frac{\varepsilon^2}{25} - \frac{16}{25}\frac{C}{2}\varepsilon^2\right) =$$

$$= C\varepsilon^2\left(\frac{16}{5} - 2 + \frac{2}{25} + \frac{8}{25}\right) =$$ ~~$C\varepsilon^2\left(14 + \frac{2}{5}\right) = \frac{72}{5}C\varepsilon^2$~~ $\frac{8}{5}C\varepsilon^2$

3 Продолжение. Частовик №2



$\dot{I}_2 = C\dot{U}_2$

$U_1 + U_2 = \mathcal{E}$

$\dot{U}_1 + \dot{U}_2 = 0$

$\dot{U}_2 = -\dot{U}_1$

$I_0 = I_2 + I_R$:

$4C\dot{U}_1$

$I_0 = ((\mathcal{E} - \dot{\varphi})4C) = 4C\dot{U}_1 = -4\dot{\varphi}C$

$I_2 = \dot{\varphi}C$ $\quad -4C\dot{\varphi} = I_0$

$I_R = \frac{\varphi}{R}$ $\quad \dot{\varphi} = -\frac{I_0}{4C}$

$I_0 = I_2 + I_R$

$-4C\dot{\varphi} = \dot{\varphi}C + I_R$

$I_R = -5\dot{\varphi}C = \frac{\varphi}{R}$

$\frac{\varphi}{R} + 5\dot{\varphi}C = 0$

$\frac{\varphi}{R} - 5C \cdot \frac{I_0}{4C} = 0$

$\frac{\varphi}{R} = \frac{5}{4} I_0 \rightarrow \varphi = \frac{5I_0R}{4}$

$U_R = \varphi - 0 = \frac{5I_0R}{4}$

$I_2 = -\dot{\varphi}C$

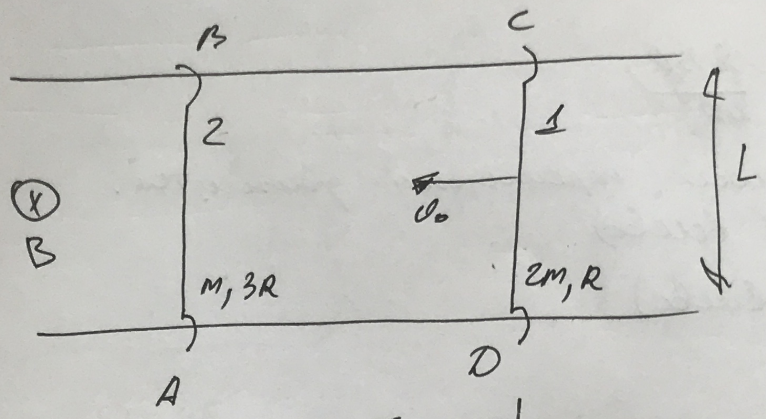
$I_0 = I_2 + I_R$

$-4\dot{\varphi}C = -\dot{\varphi}C + I_R \rightarrow I_R = \frac{\varphi}{R} = -3\dot{\varphi}C = +3 \cdot \frac{I_0}{4}$

$\varphi = \frac{3RI_0}{4}$

$U_R = \varphi - 0 = \frac{3RI_0}{4}$

№4.

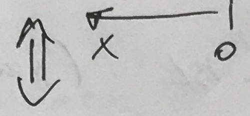


$\Phi_{ABCD} = AD \cdot L \cdot B$

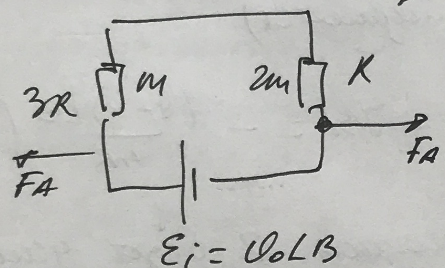
$\dot{\Phi}_{ABCD} = \dot{AD} \cdot L \cdot B$

$\dot{\Phi}(0) = -\upsilon_0 L B$

$\rightarrow \mathcal{E}_i = -\dot{\Phi} = \upsilon_0 L B.$



$\rightarrow J(0) = \dfrac{\upsilon_0 L B}{4R}$



~~F_{A}~~ $F_{амп} = 2m a$

$J(0) BL = 2ma \rightarrow a = \dfrac{J(0) BL}{2m} = \dfrac{\frac{\upsilon_0 L B}{4R} \cdot B \cdot L}{2m} = \boxed{\dfrac{\upsilon_0 (BL)^2}{8mR}}$

~~В произв. момент~~
~~$|\mathcal{E}_i| = \dot{x} L B$~~

~~В системе~~ На систему не действ. никакие силы (в гориз. плоскости), кроме F_A. В произв. момент времени они напр. в разные стороны, равны по модулю.

$\rightarrow$ сохраняется импульс на Ox:

$2m\upsilon_0 = 2m\upsilon' + m u'$

$2(\upsilon_0 - \upsilon') = u'$

Через большой промежуток времени $\dot{\Phi} = 0 \Rightarrow \upsilon' = u'$ (Φ снова станет const)

~~Аналогично $A_1 = F_A |r|$~~
~~$A_2 =$~~

$2\upsilon_0 = u' + 2u' \rightarrow \boxed{u' = \frac{2}{3}\upsilon_0 = \upsilon'}$

#4. Продолжение. чистовик (4) (y – коорд. левой перемычк)

~~II для перемычки x~~

~~$2m\ddot{x} = -JBL = -BL\frac{\varepsilon_i}{4R} = -BL\frac{\dot{x}BL}{4R}$~~

Пусть в произв. мом перемычки движутся.

тогд. $v_{левой} = \dot{y}$ (влево)

$v_{правой} = \dot{x}$ (влево)

$$\dot{\Phi} = (\dot{y} - \dot{x})LB$$

$$m\ddot{y} = JBL = \frac{\varepsilon_i}{4R}BL = \frac{(\dot{y}-\dot{x})LB}{4R}BL \quad (\text{ускоряется})$$

~~$2m\ddot{x} = -JBL = \frac{(\dot{y}-\dot{x})LB}{4R}BL(-)$ (замедляется)~~

$$2m\ddot{x} = -JBL = -\frac{(\dot{y}-\dot{x})LB}{4R} \quad (\text{замедл})$$

$$\rightarrow m\ddot{y} + 2m\ddot{x} = 0$$

$$a_{лев} + 2a_{пр} = 0$$

$$|a_{лев}| = 2|a_{пр}| = 2a$$

Перемычка 2 будет ускоряться, 1 – тормозиться. В опр. момент их скорости станут равны, тогда $\dot{\Phi} = 0 \rightarrow \varepsilon_i = 0 \rightarrow J = 0 \rightarrow F_A = 0 \rightarrow a = 0 \rightarrow$ скорости перемычек сравняются и перестанут меняться.

~~$a_{пр} = ka$~~

~~$t = \frac{\Delta v}{a} = \frac{v_0 - \frac{2}{3}v_0}{a} = \frac{1}{3}\frac{v_0}{a}$~~ ~~← через это время перестанет меняться~~

$$2ma = \frac{(\dot{y}-\dot{x})(LB)^2}{4R}$$

$$S = S_0 - \frac{8mv_0R}{3(LB)^2}$$

$$\int_{v_0}^{\frac{2}{3}v_0} 2ma\,dt = \left(\frac{dy}{dt}dt - \frac{dx}{dt}dt\right)\frac{(LB)^2}{4R}$$

$\Delta y = y - S_0$

$\Delta x = x$

$\Delta y - \Delta x = y - x - S_0$ (S иском.)

$$2m\left(\frac{2}{3}v_0 - v_0\right) = (\Delta y - \Delta x)\frac{(LB)^2}{4R}$$

$$-\frac{2mv_0}{3} = (S - S_0)\frac{(LB)^2}{4R} \rightarrow S - S_0 = -\frac{8mv_0R}{3(LB)^2}$$

~~$S - S_0 = -\frac{3(LB)^2}{8mv_0R}$~~ ~~$S = S_0 - \frac{3(LB)^2}{8mv_0R}$~~

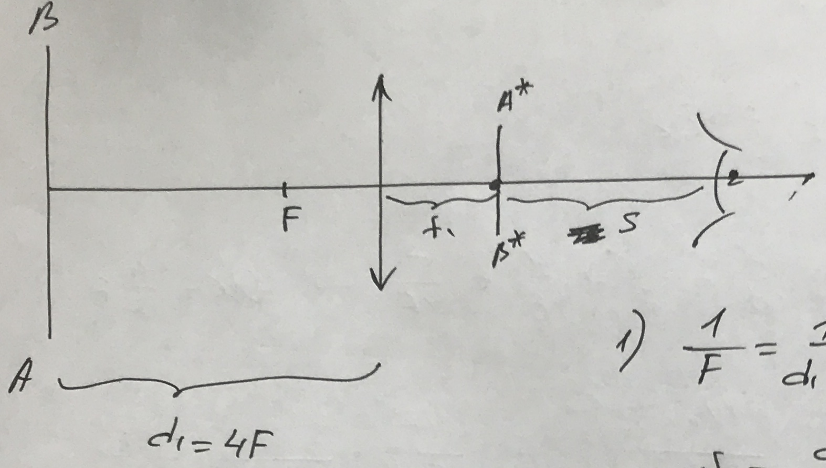
#5. Чистовик (№5)

$AB = H = 9$ см

$d_1 = 72$ см

$F = 18$ см

~~$x = 24$ см~~



1) $\frac{1}{F} = \frac{1}{d_1} + \frac{1}{f_1}$

$f_1 = \frac{d_1 F}{d_1 - F} = \frac{72 \cdot 18}{54} = 24$ см

$Г = \frac{24 см}{72 см} = \frac{1}{3}$ – изобр AB в линзе уменьшенное

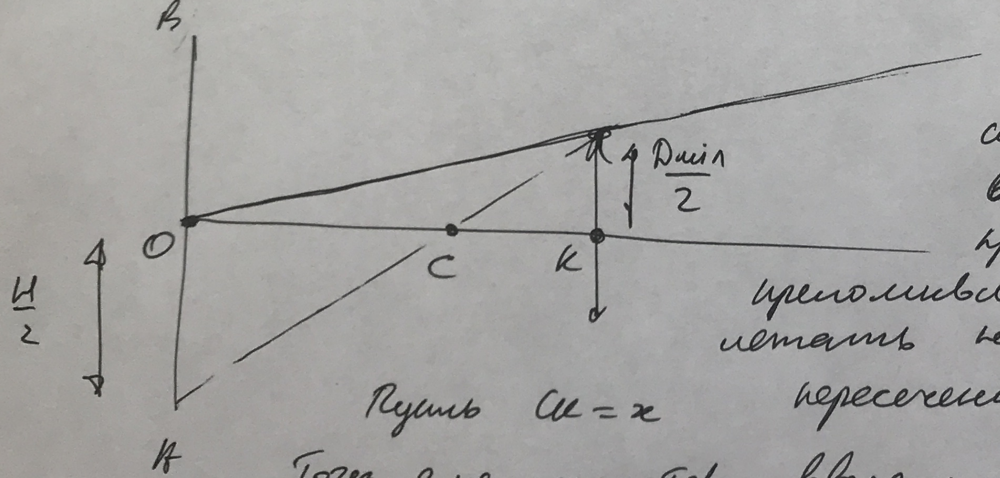
Человек настраивает глаз так, чтобы видеть четкое изображение, которое будет находиться на расстоянии f_1 от линзы.

~~поэт~~ $\Rightarrow S = 24$ см, $f_1 = 24$ см $\} \rightarrow x = S + f_1 = 48$ см

2) ~~Чтобы увидеть все изоб- изображение~~

Если будет видно крайние точки картины, то тем более будет видно другие.

Расм. D_{min}: построим луч из т. A. он преломится в линзе.



Тогда в крайнем случае, чтобы было видно картину, продолжение этого преломившегося луча должно лежать не левее т. O (его пересечение с ГОО).

Пусть $CK = x$

Тогда для расчетов введем предмет в т. C. Для него верно, что: $\frac{1}{F} = \frac{1}{CK} - \frac{1}{OK}$

#5 Продолжение. Чистовик (№6)

Из подобия Δ-ков:

$$\frac{OC}{H/2} = \frac{Ck}{\frac{D_{min}}{2}} \Rightarrow \frac{H}{D} = \frac{OC}{Ck}$$

$$\frac{1}{F} = \frac{1}{Ck} - \frac{1}{4F} \Rightarrow \frac{1}{Ck} = \frac{1}{F} + \frac{1}{4F} = \frac{5}{4F} \rightarrow Ck = \frac{4}{5}F$$

$$D = \frac{H\,Ck}{OC} = \frac{H \cdot \frac{4}{5}F}{4F - \frac{4}{5}F} = \frac{H}{4}$$

$$D = \frac{9}{4}\text{ см} = 2{,}25\text{ см}$$

3) В точке C.

$$Ck = \frac{4}{5}F = \frac{4}{5} \cdot 18 = 14{,}4\text{ см}$$

$2\cancel{x}mv_0 = u \cdot 3\cancel{m}$

$u = \frac{2v_0}{3}$

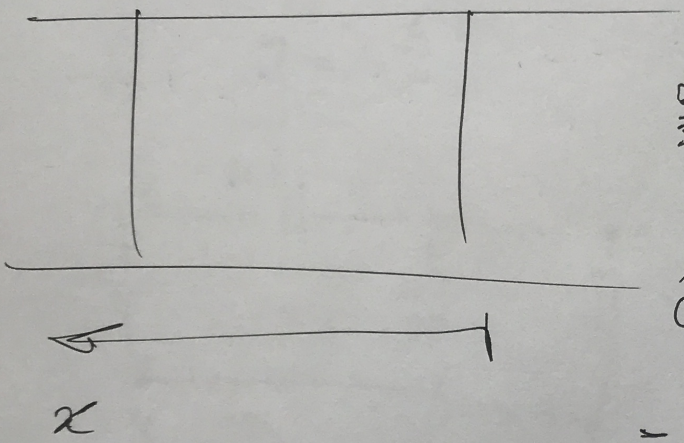
~~$S - S_0$~~ $= \frac{8mv_0R}{3(LB)^2}$

$S_0 - S =$

$2ma = IBL = \frac{vBL\,BL}{4R} = \frac{v(BL)^2}{4R}$

$a = \frac{v(BL)^2}{8mR}$

$F = \frac{(\dot{y} - \dot{x})BL}{4R}BL = 2ma$



$$\int_{v_0}^{\frac{2}{3}v_0} a\,dt\,2m = \int (\dot{y}\,dt - \dot{x}\,dt)\frac{(BL)^2}{4R}$$

$$-\frac{v_0}{3} \cdot 2m = (\Delta y - \Delta x)\frac{(BL)^2}{4R}$$

$\frac{8m\frac{x}{c} \cdot om}{\cancel{x} \cdot Ta}$

$\Delta y = y - S_0$

$\Delta x = x$

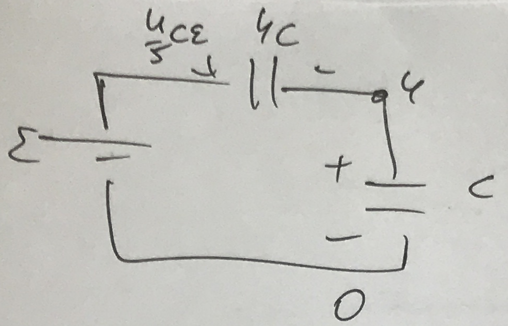
$vBL = B$

$\Delta y - \Delta x = y - S_0 - x = S' - S_0$

~~$\Delta x = B$~~

$$-\frac{v_0}{3}2m = (S' - S_0)\frac{(BL)^2}{4R}$$

~~S'~~ $S_0 - S' = \frac{24Rmv_0}{3(BL)^2}$



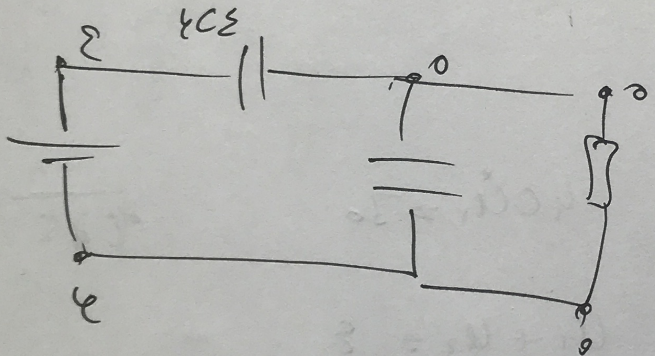
$$\varphi \cancel{C} - 4\cancel{C}(\varepsilon - \varphi) = 0$$

$$\varphi - 4\varepsilon + 4\varphi = 0$$

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

$$W_1 = \frac{4C \cdot \frac{\varepsilon^2}{25}}{2} + \frac{C \cdot \frac{16}{25}\varepsilon^2}{2} = \frac{2}{5}C\varepsilon^2$$

$$\rightarrow \quad I = \frac{4}{5}\frac{\varepsilon}{R}$$



$$\left(4C\varepsilon - \frac{4}{5}C\varepsilon\right)\varepsilon - \Delta W = 0$$

$$\frac{16}{5}C\varepsilon^2 - \left(\frac{4C\varepsilon^2}{2} - \frac{2}{5}C\varepsilon^2\right) = Q$$

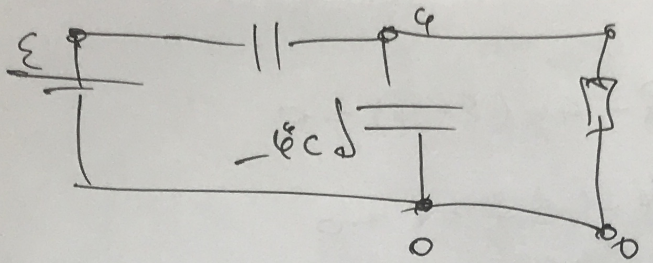
$$C\varepsilon^2\left(\frac{16}{5} - 2 + \frac{2}{5}\right) = Q$$

$$C\varepsilon^2\left(\frac{18}{5} - 2\right) = Q$$

$$\frac{8}{5}C\varepsilon^2$$

$$\frac{16}{5} - \left(2 - \frac{2}{5}\right)$$

$$\frac{16}{5} - 2 + \frac{2}{5} \qquad \frac{18}{5} - 2 = \frac{8}{5}$$



$$J_0 = 4(\dot{\varepsilon - \varphi})C = -4\dot{\varphi}C \qquad \dot{\varphi} = -\frac{J_0}{4C}$$

~~$-5\dot{\varphi}C = ?$~~

~~$-4\dot{\varphi}C = -\dot{\varphi}C + J_R C$~~

J_0

$\frac{J_0}{4}$ $\quad \frac{3J_0}{4}$

$$(\dot{\varepsilon - \varphi})4C = J_0$$

$$-\dot{\varphi}4C = J_0$$

$$J_2 = \dot{\varphi}C$$

$$4C\dot{u}_1 = J_0$$

$$u_1 + u_2 = \varepsilon$$

$$\dot{u}_1 + \dot{u}_2 = 0$$

$$\dot{u}_2 = -\dot{u}_1$$

$$J_2 = -\dot{u}_1 C$$

$$4C\dot{u}_1 = J_R - \dot{u}_1 C$$

$$\frac{\varphi}{R} = 5\dot{u}_1 C = \frac{5}{4}J_0$$

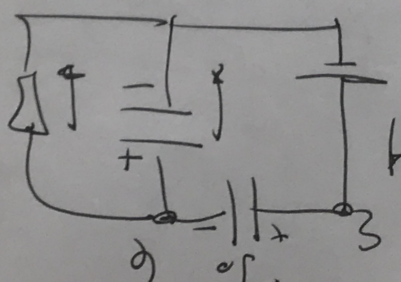
$$\frac{\varphi}{R} = -5\dot{\varphi}C = \frac{5}{4}J_0$$

δQ

$$dQ_0 = dQ_2 + J_R dt$$

$$J_0 = J_2 + J_R$$

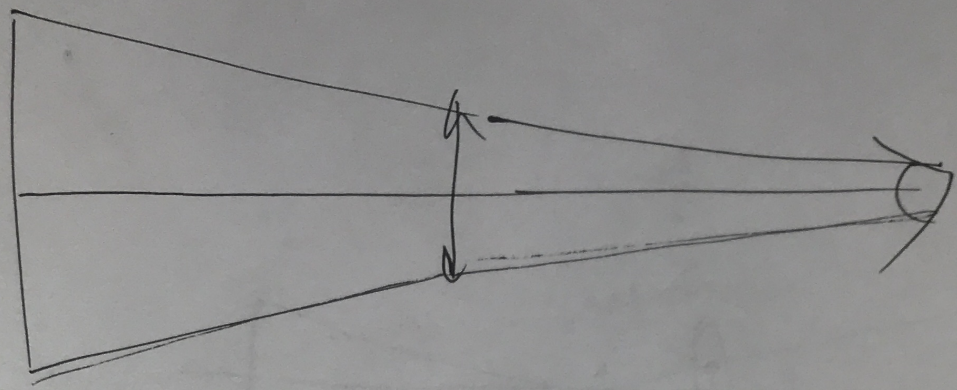
$$-4\dot{\varphi}C = -\dot{\varphi}C$$

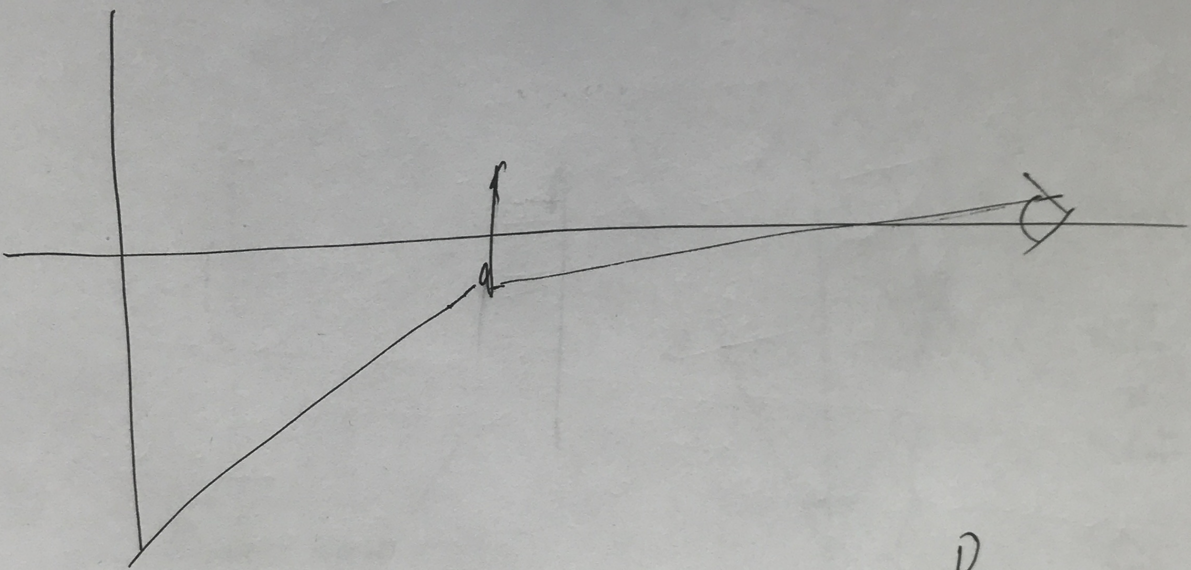


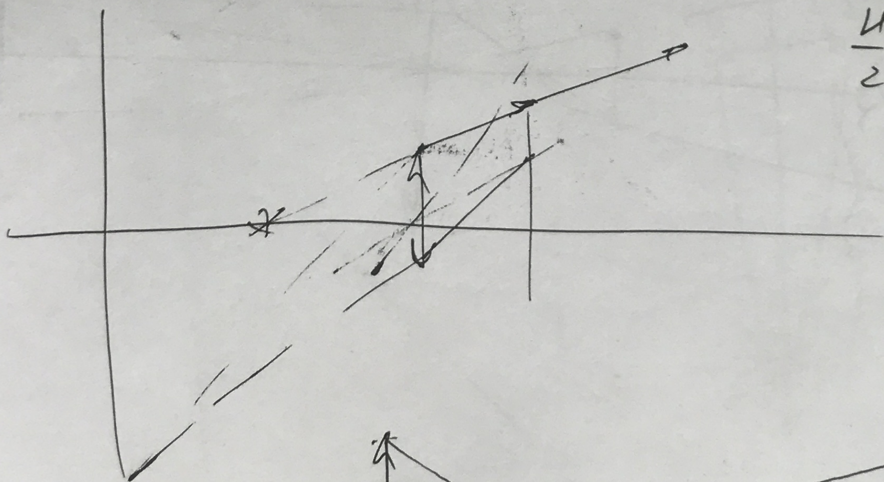
$$\varepsilon - \varphi_2 - \varepsilon + \varphi_1$$

$$J_2 = \dot{\varphi}C$$

$$J_0 = 4(\varepsilon - \varphi)C = -\dot{\varphi}C$$





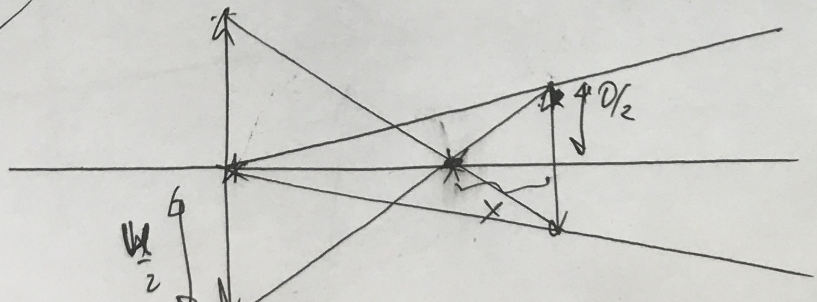


$$\frac{D/2}{W/2} = \frac{D}{W} = \frac{x}{4F-x}$$

$$\frac{D}{W} = \frac{\frac{4}{5}F}{4F-\frac{4}{5}F}$$

$$\frac{D}{W} = \frac{4F}{16F} = \frac{1}{4}$$

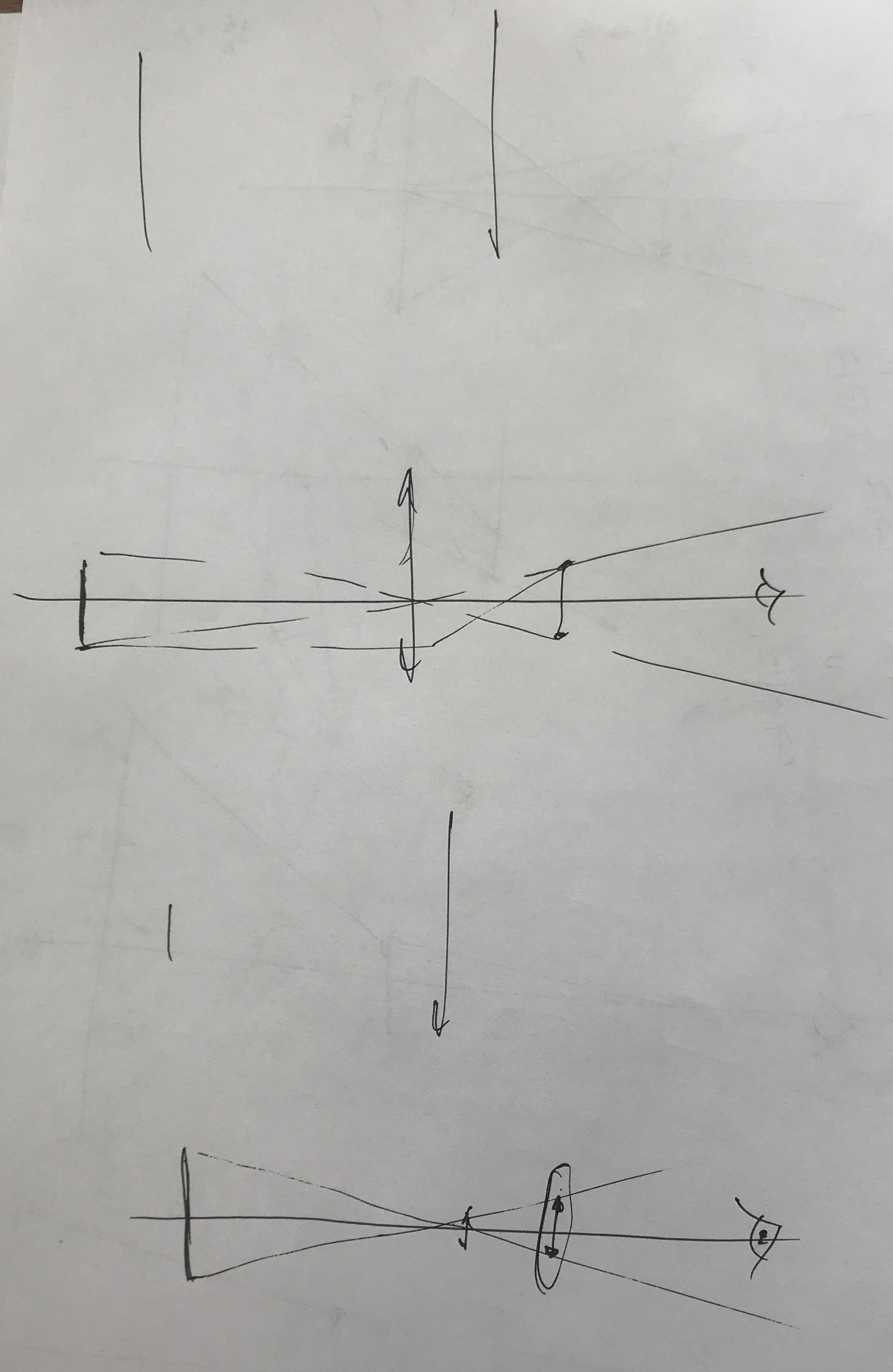
$$D = \frac{W}{4}$$

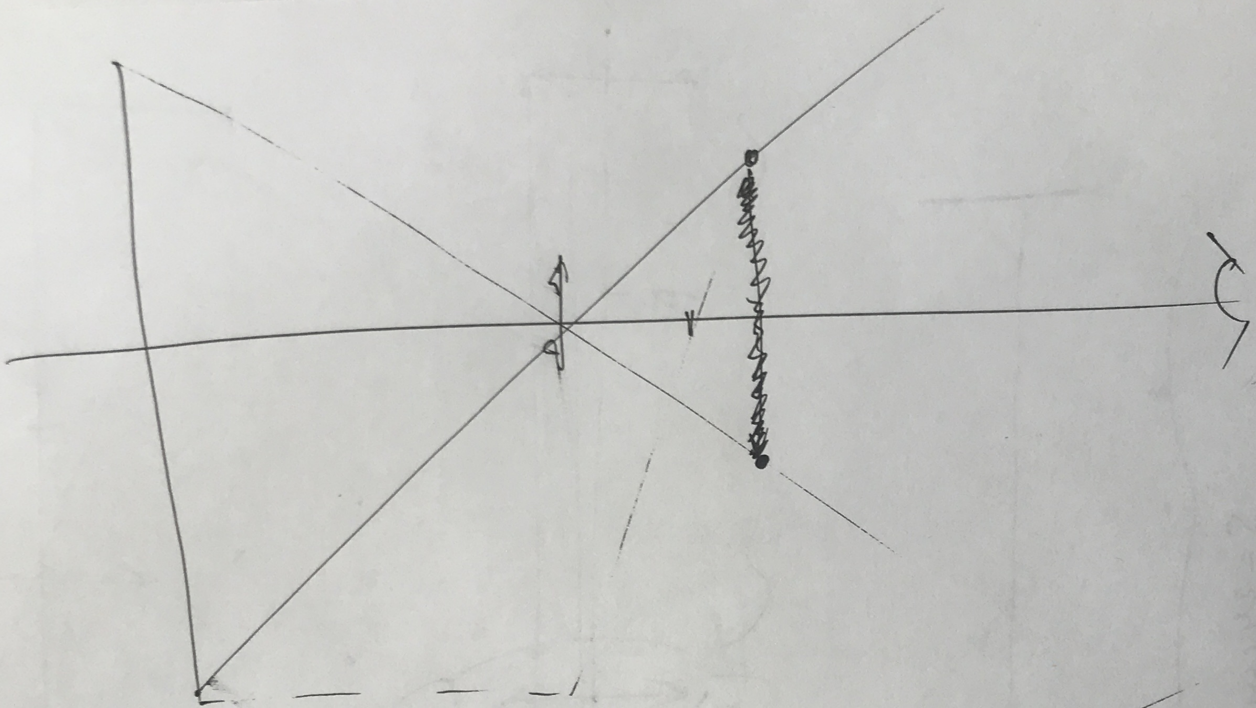


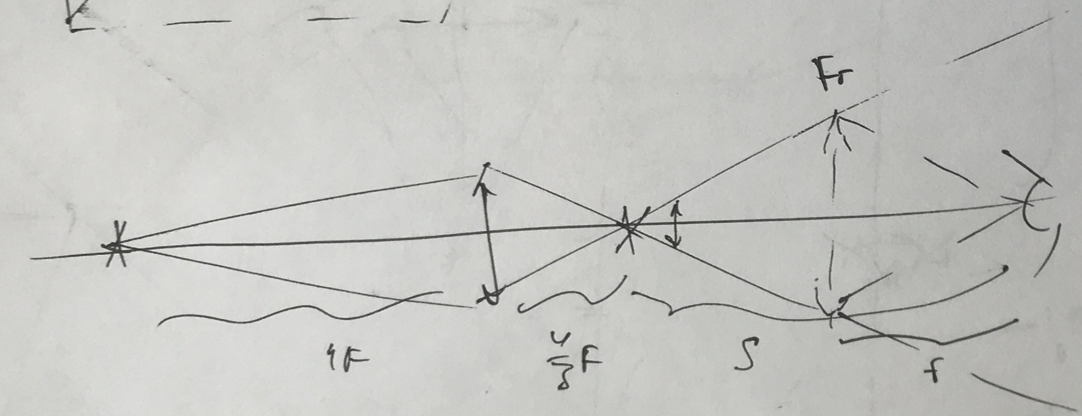
$$\frac{1}{x} + \frac{1}{4F} = \frac{1}{F}$$

$$x = \frac{4}{5}F$$

$$\frac{1}{x} = \frac{5}{4F}$$



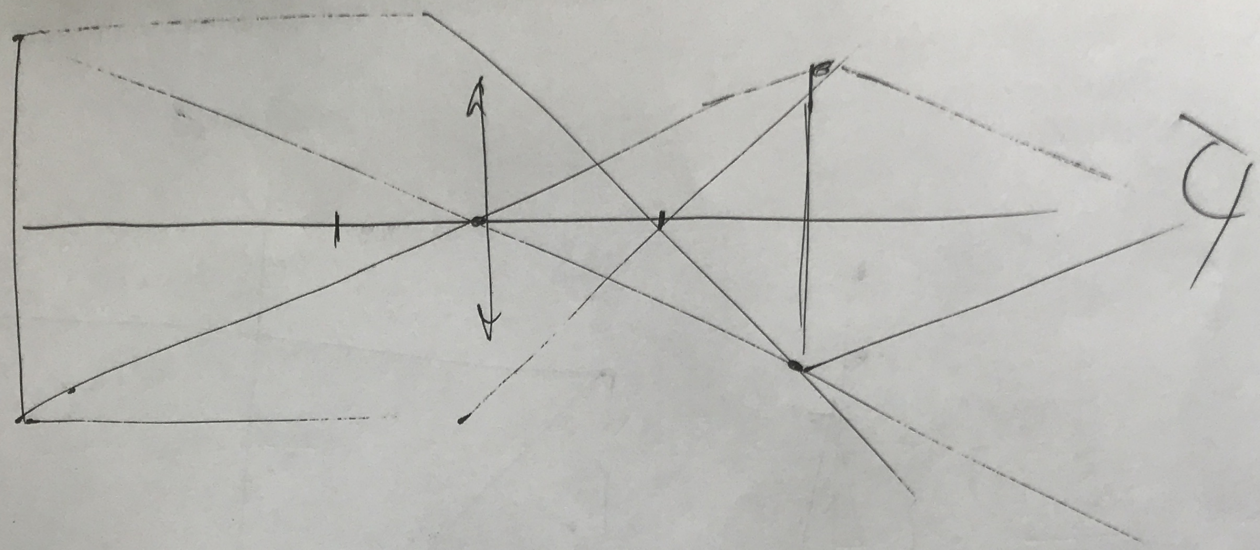


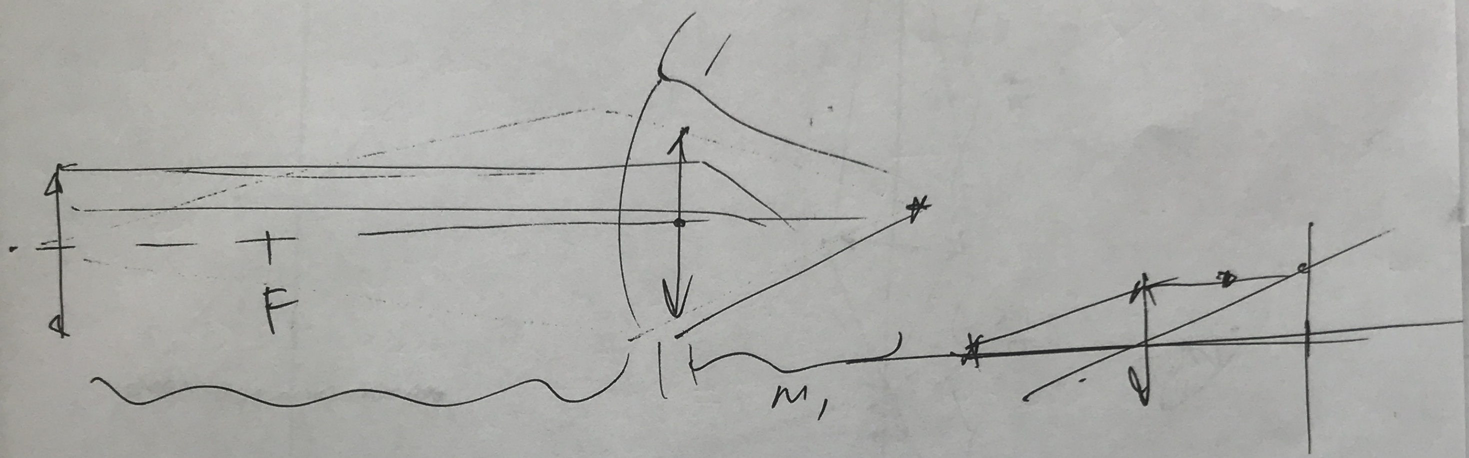


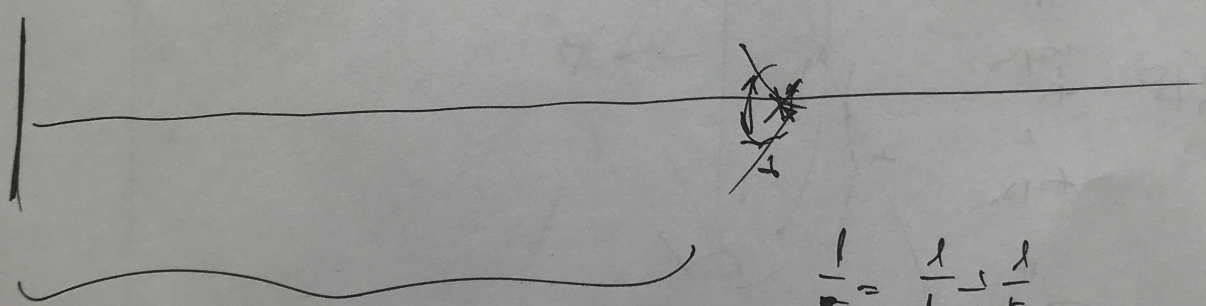
$$\frac{1}{F_r} = \frac{S}{f\ \frac{4}{3}f\ v_r/D_n}$$

~~$\frac{1}{S} =$~~ $$\frac{1}{F_r} = \frac{1}{S-f} + \frac{1}{f} = \frac{S}{(S-F)f}$$

$$\frac{v_r}{S-f} = \frac{D_n}{\frac{4}{3}F}$$







$\frac{1}{F} = \frac{1}{d} - \frac{1}{f}$

$S = 24$ см

$\Gamma \to 0$ $\frac{f}{d} \to 0$

$\frac{1}{S} = \frac{1}{F} + 0$

Черновик

$v' = u'$

$2(v_0 - u) = u$

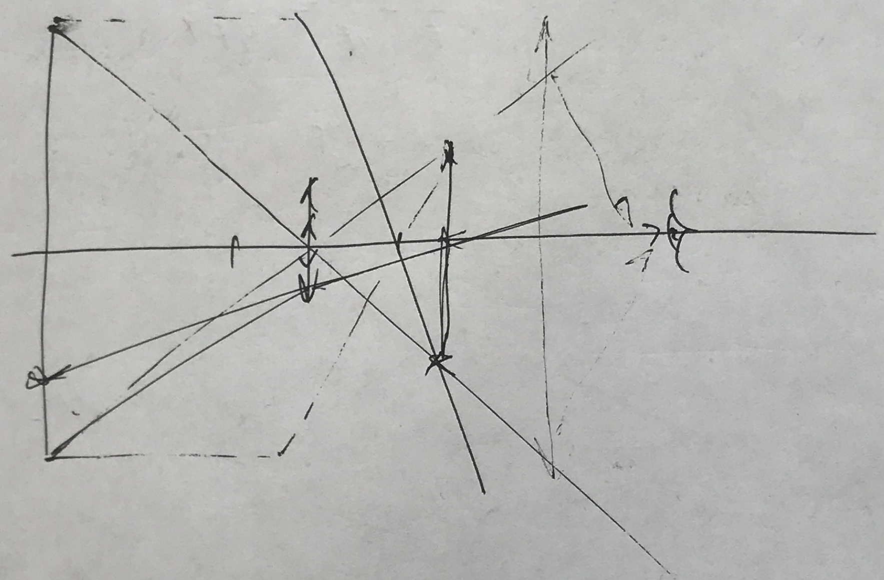
$2v_0 = 3u$

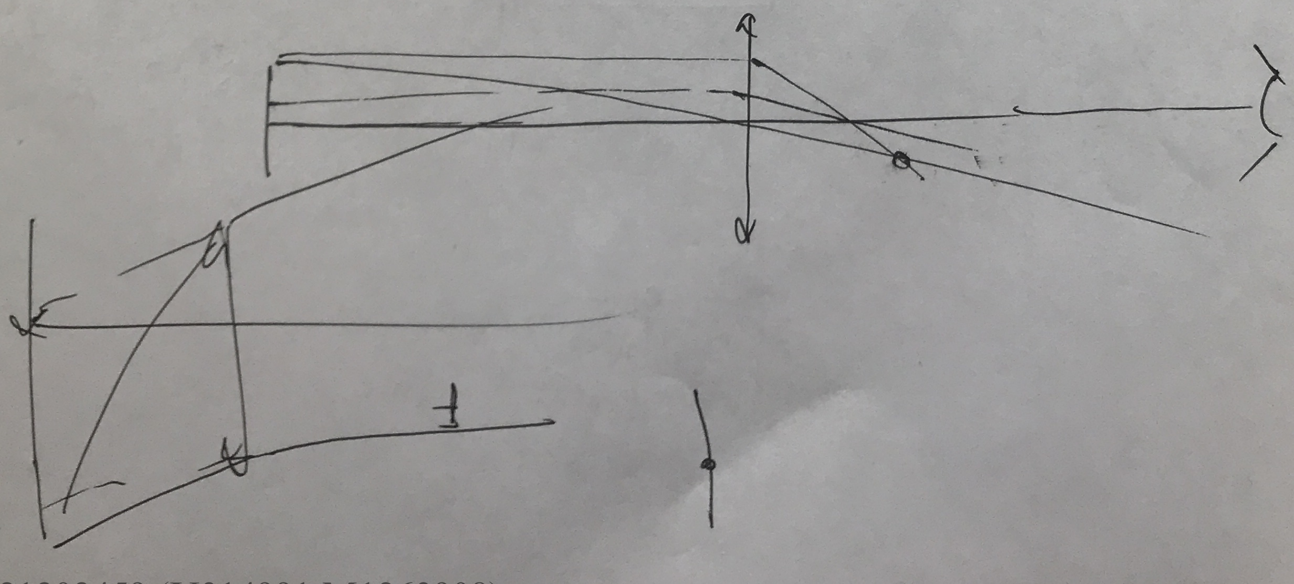
$u = \frac{2}{3} v_0$

$$\frac{2m v_0^2}{2} + E_1 = E_2 + \frac{3m \frac{4}{9} v_0^2}{2}$$

$$E_1 - E_2 = \frac{m v_0^2}{2}\left(\frac{4}{3} - 1\right)$$

$$E_1 - E_2 = \frac{m v_0^2}{2} \cdot \frac{1}{3}$$





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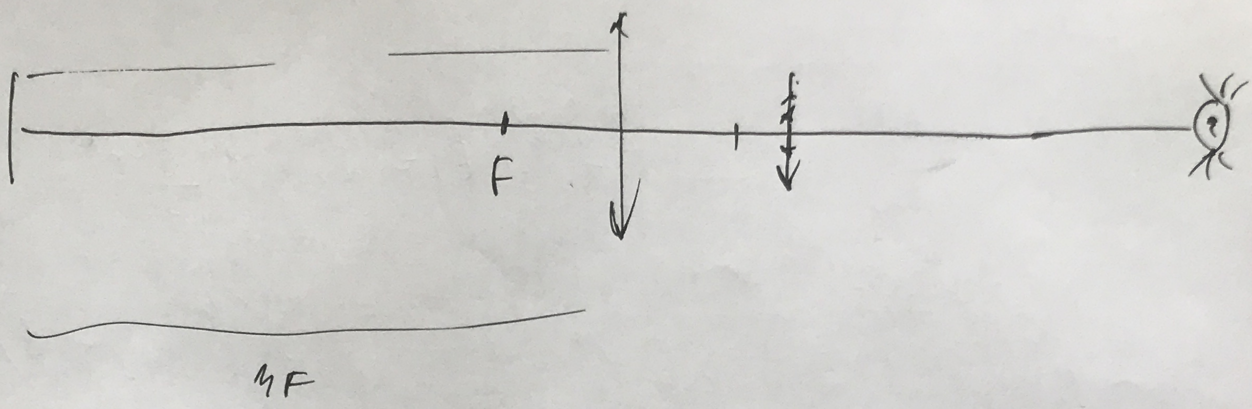
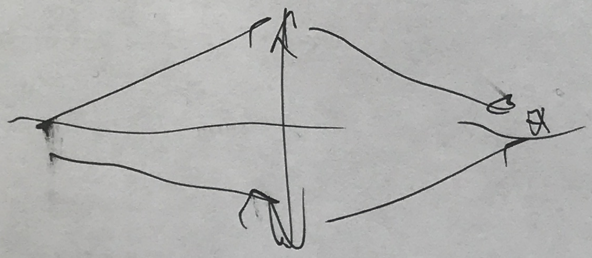


$$\frac{1}{4F} + \frac{1}{f} = \frac{1}{F}$$

$$\frac{1}{f} = \frac{1}{F} - \frac{1}{4F} = \frac{3}{4F}$$

$$f = \frac{4}{3}F = \frac{4}{3}\cdot 18$$



$$\frac{1}{f} + \frac{1}{f-s} = \frac{1}{F_n}$$

$$\frac{f+s-f}{f(s-f)} = \frac{1}{F_n}$$