Часть 1

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

Шифр: **21201641**

ID профиля: **809493**

Вариант 2

№1 (продолжение)   Черновик.

$\beta = \frac{\alpha}{2} \Rightarrow \cos\beta = \cos\frac{\alpha}{2} = \sqrt{\frac{1+\cos\alpha}{2}}$ $\cos\beta = \sqrt{\frac{1+\frac{4}{5}}{2}} = \sqrt{\frac{\frac{9}{5}}{2}} = \frac{3}{\sqrt{10}} =$

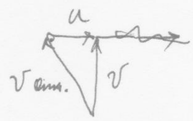
$= 0,949$

2) $T' = T\sqrt{2} \cdot \sqrt{1-\cos\alpha}$ $\sin\beta = \sqrt{1-\cos^2\beta} = \frac{1}{\sqrt{10}}$

$\operatorname{tg}\beta = \frac{1}{9}$

$\operatorname{tg}\beta\, g - \frac{T}{m}\sin\alpha \operatorname{tg}\beta = \frac{T}{m}\cos\alpha$

$T(\sin\alpha \operatorname{tg}\beta + \cos\alpha) = \operatorname{tg}\beta\, mg$



$m a_{отн} \cos\beta = mg - T\sin\alpha$

$m a_{отн} \sin\beta = T\cos\alpha$ $T = m a_{отн}\frac{\sin\beta}{\cos\alpha}$ $\vec{v} = \vec{v}_{отн} + \vec{u}$

$m a_{отн} = \frac{mg}{\cos\beta} - \frac{T\sin\alpha}{\cos\beta} = \frac{mg}{\cos\beta} - \frac{\frac{m a_{отн}\sin\beta}{\cos\alpha}}{\cos\beta}$

$a_{отн} = \frac{g}{\cos\beta} - \frac{a_{отн}\operatorname{tg}\beta}{\cos\alpha}$ $a_{отн}\left(1 + \frac{\operatorname{tg}\beta}{\cos\alpha}\right) = \frac{g}{\cos\beta}$

$a_{отн} = \frac{g\cos\alpha}{\cos\beta(\cos\alpha + \operatorname{tg}\beta)}$ $a_{отн}\frac{\cos\alpha + \operatorname{tg}\beta}{\cos\alpha} = \frac{g}{\cos\beta}$

$a_к =$

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Черновик.

№2

$$C(T)=\frac{5}{2}R\frac{T}{T_0}$$

1) $\frac{Q'(T)}{\nu}=C=\frac{5}{2}R\frac{T}{T_0} \Rightarrow Q'(T)=\frac{5}{2}\nu R\frac{T}{T_0}$; $Q_1=\int\limits_{\frac{1}{2}T_0}^{T_0}\frac{5}{2}\nu R\frac{T}{T_0}\,dT=$

$$=\frac{5}{2}\frac{\nu R}{T_0}\int\limits_{\frac{1}{2}T_0}^{T_0}T\,dT=\frac{5\nu R}{2T_0}\cdot\frac{T^2}{2}\Big|_{\frac{1}{2}T_0}^{T_0}=\frac{5}{4}\frac{\nu R}{T_0}\left(T_0^2-\frac{1}{4}T_0^2\right)=\frac{3}{4}\cdot\frac{5}{4}\frac{\nu R}{T_0}\cdot T_0^2=\frac{15}{16}\nu RT_0$$

2) $\Delta U=\frac{3}{2}\nu R\Delta T=\frac{3}{2}\nu R(T-T_0)$

$$Q'(T)=A'(T)+\Delta U'(T)=A'(T)+\frac{3}{2}\nu R=C\nu=\frac{5}{2}\nu R\frac{T}{T_0}$$

$$A'(T)=\frac{5}{2}\nu R\frac{T}{T_0}-\frac{3}{2}\nu R=\frac{\nu R}{2}\left(\frac{5T}{T_0}-3\right)=$$

$$=\frac{5\nu R}{2T_0}\left(T-\frac{3}{5}T_0\right)$$

$A'(T)$ $-$ $+$; $A(T)$ $\frac{3}{5}T_0$ T $\Rightarrow A(T)_{min}=A\left(\frac{3}{5}T_0\right)$

3) $A=\left|\int\limits_{T_0}^{\frac{3}{5}T_0}A'(T)\,dT\right|=\left|\int\limits_{T_0}^{\frac{3}{5}T_0}\left(\frac{5}{2}\nu R\frac{T}{T_0}-\frac{3}{2}\nu R\right)dT\right|=\left|\left(\frac{5}{4}\nu R\frac{T^2}{T_0}-\frac{3}{2}\nu RT\right)\Big|_{T_0}^{\frac{3}{5}T_0}\right|=$

$$=\left(\frac{5}{4}\nu R\cdot\frac{T_0^{\cancel{2}}}{\cancel{T_0}}-\frac{3}{2}\nu RT_0-\frac{5}{4}\nu R\cdot\frac{\frac{9}{25}T_0^{\cancel{2}}}{\cancel{T_0}}+\frac{3}{2}\nu R\cdot\frac{3}{5}T_0\right)=\frac{\nu RT_0}{2}\left(\frac{5}{2}-3-\frac{9}{10}+\frac{9}{5}\right)=$$

$$=\frac{\nu RT_0}{2}\left(\frac{25-30-9+18}{10}\right)=\frac{\nu RT_0}{\cancel{2}}\cdot\frac{\cancel{4}2}{\cancel{10}5}=\frac{\nu RT_0}{5}$$

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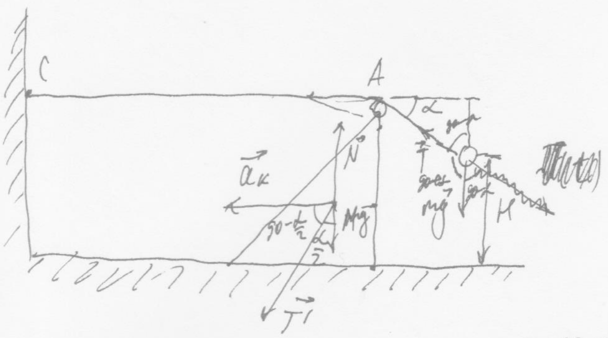
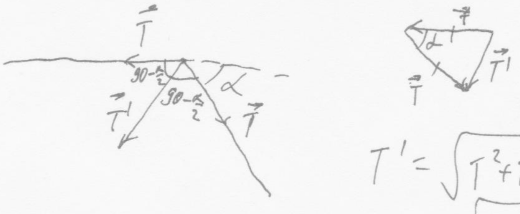
Черновик.

1





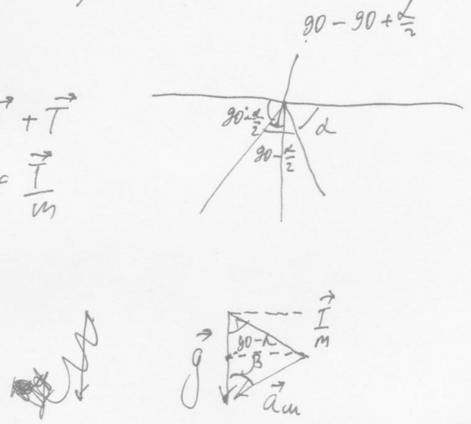
$$T' = \sqrt{T^2 + T^2 - 2T\cdot T\cos\alpha} = \sqrt{2T^2 - 2T^2\cos\alpha} = T\sqrt{2}\cdot\sqrt{1-\cos\alpha}$$

$$\cos\frac{\alpha}{2} = \sqrt{\frac{1+\cos\alpha}{2}}$$

1) ~~скорость~~ ~~шар~~ вектор скорости шара лежит на той же прямой, что и нить => ~~угол~~ угол наклона нити не меняется => => ускорение сонаправлено скорости => угол между вертикалью и ускорением равен $90° - \alpha$

$$m\vec{a} = m\vec{g} + \vec{T}$$

$$\vec{a} = \vec{g} + \frac{\vec{T}}{m}$$



$$\frac{T}{m}\sin(90-\alpha) = \frac{T}{m}\cos\alpha$$

$$a_m = \sqrt{\frac{T^2}{m^2} + g^2 - 2\cdot\frac{T}{m}g\cdot\sin\alpha}$$

$$\cos\beta = \frac{a_m^2 + g^2 - \frac{T^2}{m^2}}{2\cdot a_m\cdot g} = \frac{\frac{T^2}{m^2} + g^2 - 2\frac{T}{m}g\sin\alpha - \frac{T^2}{m^2}}{2a_m g} = \frac{g - 2\frac{T}{m}\sin\alpha}{2a_m}$$

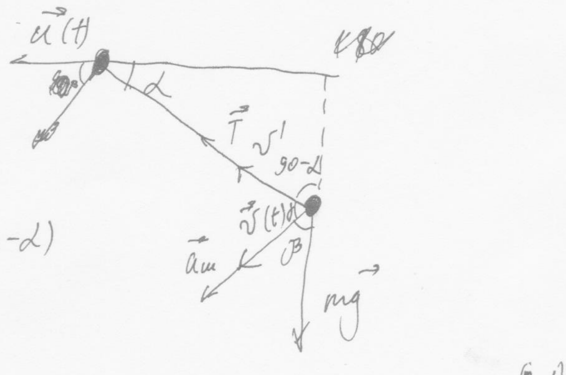
$$T'\cos\left(90-\frac{\alpha}{2}\right) = $$

$$g - \frac{T}{m}\sin\alpha$$

$$\frac{T}{m}\cos\alpha = a_m\sin\beta$$

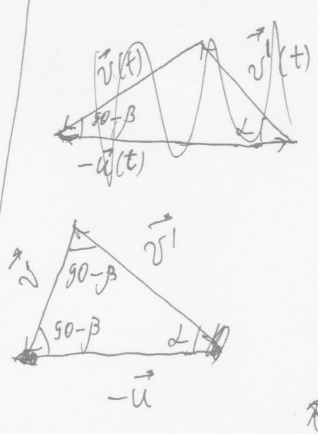
$$\operatorname{tg}\beta = \frac{\frac{T}{m}\cos\alpha}{g - \frac{T}{m}\sin\alpha} = \frac{T\cos\alpha}{mg - T\sin\alpha} = \frac{T\cdot\cos\alpha}{\left(\frac{mg}{\sin\alpha} - T\right)\sin\alpha} = \frac{\frac{T}{\operatorname{tg}\alpha}}{\frac{mg}{\sin\alpha} - T} =$$

$$= \frac{T - mg\cos(90-\alpha)}{m} = \frac{T\sqrt{2}\sqrt{1-\cos\alpha}\,\sin\frac{\alpha}{2}}{M}$$



$$u(t) = v(t)\cos\gamma = v(t)\sin(\beta-\alpha)$$

$$180 - 90 + \alpha - \beta = \gamma = 90 - (\beta - \alpha)$$



$$\frac{180-\alpha}{2} = 90 - \beta$$

$$180 - \alpha = 180 - 2\beta \Rightarrow \beta = \frac{\alpha}{2}$$

1

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Чистовик. Вариант 11-02. Лист №1

№2

$C(T) = \frac{5}{2} R \frac{T}{T_0}$

1) $\frac{Q'(T)}{\nu} = C = \frac{5}{2} R \frac{T}{T_0} \Rightarrow Q'(T) = \frac{5}{2}\nu R \cdot \frac{T}{T_0}$; $Q_1 = \left| \int_{T_0}^{\frac{1}{2}T_0} \frac{5}{2}\nu R \frac{T}{T_0}\, dT \right| = \frac{5}{4}\nu R \frac{T^2}{T_0}\Big|_{\frac{1}{2}T_0}^{T_0} =$

$= \frac{5}{4}\nu R \cdot \frac{1}{T_0}\left(T_0^2 - \left(\frac{1}{2}T_0\right)^2\right) = \frac{15}{16}\nu R T_0 = 0{,}9375\, \nu R T_0$

2) $\Delta U = \frac{3}{2}\nu R (T - T_0)$; $Q'(T) = A'(T) + \Delta U'(T) = A'(T) + \frac{3}{2}\nu R = \frac{5}{2}\nu R \cdot \frac{T}{T_0} = C\nu \Rightarrow$

$\Rightarrow A'(T) = \frac{5}{2}\nu R \frac{T}{T_0} - \frac{3}{2}\nu R = \frac{\nu R}{2}\left(\frac{5T}{T_0} - 3\right) = \frac{5\nu R}{2T_0}\left(T - \frac{3}{5}T_0\right)$ $A'(T)$ $-$ $+$ $\frac{3}{5}T_0$ T $A(T)$ $\Rightarrow$

$\Rightarrow A_{min} = A\left(\frac{3}{5}T_0\right) \Rightarrow T = 0{,}6\, T_0$

3) $A = \int_{T_0} A'(T)\, dT = \int_{T_0}^{\frac{3}{5}T_0} \frac{\nu R}{2}\left(\frac{5T}{T_0} - 3\right) dT = \frac{\nu R}{2}\left(\frac{5T^2}{2T_0} - 3T\right)\Big|_{T_0}^{\frac{3}{5}T_0} =$

$= \frac{\nu R}{2}\left(\frac{5}{2}\cdot\frac{9}{25}\frac{T_0^{\cancel{2}}}{\cancel{T_0}} - 3\cdot\frac{3}{5}T_0 - \frac{5}{2}\cdot\frac{T_0^{\cancel{2}}}{\cancel{T_0}} + 3T_0\right) = \frac{\nu R T_0}{2}\left(\frac{9}{10} - \frac{9}{5} - \frac{5}{2} + 3\right) =$

$= \frac{\nu R T_0}{2} \cdot \frac{9 - 18 - 25 + 30}{10} = -\frac{4}{20}\nu R T_0 = -\frac{1}{5}\nu R T_0 = -0{,}2\, \nu R T_0$

Ответ: 1) $Q_1 = 0{,}9375\, \nu R T_0$

2) $T = 0{,}6\, T_0$

3) $A = -0{,}2\, \nu R T_0$

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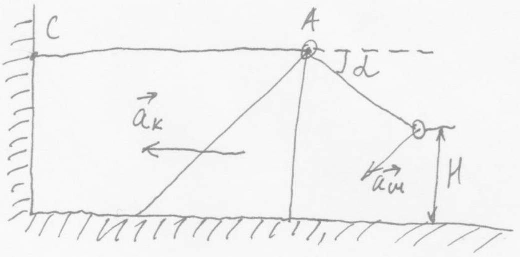
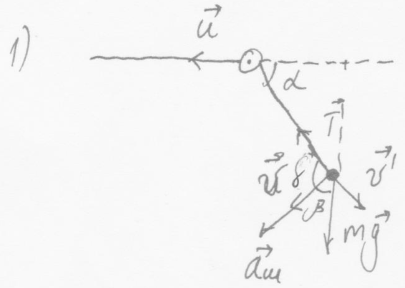
№1

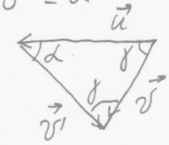


1)



$\vec{v} = \vec{v}' + \vec{u}$

$v' = u$



$\gamma = 90° - \beta = 90° - \frac{\alpha}{2} \Rightarrow$

$\Rightarrow \beta = \frac{\alpha}{2} \Rightarrow \cos\beta = \cos\frac{\alpha}{2} = \sqrt{\frac{1+\cos\alpha}{2}}$

$\cos\beta = \sqrt{\frac{1+\frac{4}{5}}{2}} = \sqrt{\frac{9}{10}} = \frac{3}{\sqrt{10}} \approx 0,95$

2) $\delta = 180° - \beta - 90° + \alpha = 90° - (\beta - \alpha) = 90° + \frac{\alpha}{2} \Rightarrow 180° - \delta = 90° - \frac{\alpha}{2}$

$a_к = a_м \cos\left(90° - \frac{\alpha}{2}\right) = a_м \sin\frac{\alpha}{2} = a_м\sqrt{\frac{1-\cos\alpha}{2}}$

$\cancel{m a_м = mg - T\sin\alpha}$ $\quad m a_м \cos\beta = mg - T\sin\alpha \Rightarrow T = \frac{m a_м \sin\beta}{\cos\alpha}$

$\cancel{m a_м = T\cos\alpha \Rightarrow T = m a_м}$ $\quad m a_м \sin\beta = T\cos\alpha$

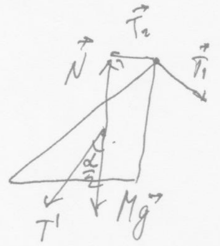
$a_м \cos\beta = g - \frac{a_м \sin\beta \sin\alpha}{\cos\alpha} \Rightarrow$

$\Rightarrow a_м = \frac{g\cos\alpha}{\cos\beta(\cos\alpha + tg\,\beta)} \Rightarrow a_к = \frac{g\cos\alpha\sqrt{\frac{1-\cos\alpha}{2}}}{\cos\frac{\alpha}{2}\left(\cos\alpha + tg\frac{\alpha}{2}\right)}$

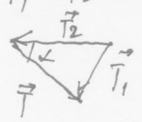
$tg\frac{\alpha}{2} = \frac{\sin\frac{\alpha}{2}}{\cos\frac{\alpha}{2}} = \frac{\sqrt{1-\cos^2\frac{\alpha}{2}}}{\cos\frac{\alpha}{2}} \Rightarrow tg\frac{\alpha}{2} = \frac{\sqrt{1-\frac{9}{10}}}{\frac{3}{\sqrt{10}}} = \frac{1}{3}$

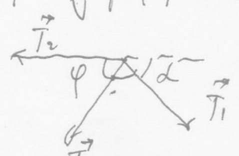
$a_к = \frac{10\cdot\frac{4}{5}\sqrt{\frac{1-\frac{4}{5}}{2}}}{\frac{3}{\sqrt{10}}\left(\frac{4}{5}+\frac{1}{3}\right)} = \frac{8\cdot\frac{1}{\sqrt{10}}}{\frac{3}{\sqrt{10}}\left(\frac{12+5}{15}\right)} = \frac{8\cdot 15}{3\cdot 17} = \frac{40}{17} = 2,35\ \frac{м}{с^2}$

3)



$\vec{T}' = \vec{T}_1 + \vec{T}_2 \Rightarrow T = \sqrt{T^2 + T^2 - 2T\cdot T\cdot\cos\alpha} = T\sqrt{2}\sqrt{1-\cos\alpha}$





$\varphi = \frac{180° - \alpha}{2} = 90° - \frac{\alpha}{2}$

$90° - \varphi = \frac{\alpha}{2}$

$T'\sin\frac{\alpha}{2} = M a_к; \quad T\sqrt{2}\sqrt{1-\cos\alpha}\cdot\sin\frac{\alpha}{2} = M a_к = T(1-\cos\alpha) \quad \left(\sin\frac{\alpha}{2} = \sqrt{\frac{1-\cos\alpha}{2}}\right)$

$T = \frac{m a_м \sin\beta}{\cos\alpha} \Rightarrow \frac{M}{m} = \frac{a_м\sin\beta}{\cos\alpha}(1-\cos\alpha)\cdot\frac{1}{a_к} = \frac{a_м\sin\beta(1-\cos\alpha)}{\cos\alpha}\cdot\frac{1}{a_м\sin\frac{\alpha}{2}} =$

$= \frac{\sin\beta(1-\cos\alpha)}{\cos\alpha\cdot\sin\frac{\alpha}{2}} = \frac{1-\cos\alpha}{\cos\alpha} \Rightarrow \frac{M}{m} = \frac{1-\frac{4}{5}}{\frac{4}{5}} = \frac{1}{4} = 0,25$

4) $\cancel{\frac{a_м t^2 \cos\frac{\alpha}{2}}{2} = H \Rightarrow t = \sqrt{\frac{2H}{a_м\cos\frac{\alpha}{2}}}}$

Ответ: 1) $\cos\beta = 0,95$

2) $a_к = 2,35\ \frac{м}{с}$

3) $\frac{M}{m} = 0,25$

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Часть 2

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

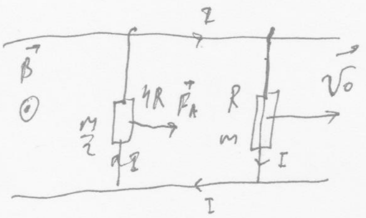
Шифр: **21201641**

ID профиля: **809493**

Вариант 2

№4 Черновик.

$d\vec{B} = \frac{I_0 \ldots \mu_0}{r^3}$



1) $\mathcal{E} = v_0 BL$

$I = \frac{v_0 BL}{R+4R} = \frac{BLv_0}{5R}$

$F_A = ILB = \frac{B^2L^2v_0}{5R} \Rightarrow a_1 = \frac{F_A}{\frac{m}{2}} = \frac{2B^2L^2v_0}{5Rm}$

$a_1 = \frac{I'BL}{m}$ $\quad a_2 = \frac{2I'BL}{m}$

2) $\frac{mv_0^2}{2} = \frac{mv_1^2}{2} + \frac{mv_2^2}{4} + Q$

$Q = \frac{(\mathcal{E}_1 - \mathcal{E}_2)^2}{5R}$

$\mathcal{E}_1 = (v_0 - a_1 t)BL \qquad \mathcal{E}_2 = a_2 t BL$

$\mathcal{E}_1 - \mathcal{E}_2 = \frac{I'}{5R} = BL(v_0 - a_1 t - a_2 t)$

$v = v_0 - a_1 t - a_2 t =$

$= v_0 - t(a_1 + a_2) =$

$= v_0 - \frac{3I'BLt}{m}$

$\frac{I'}{5R} = BL\left(v_0 - \frac{I'BL}{m}t - \frac{2I'BL}{m}t\right)$

$\frac{I'}{5R} = BLv_0 - \frac{3I'B^2L^2t}{m}$

$I'\left(\frac{1}{5R} + \frac{3B^2L^2t}{m}\right) = BLv_0$

$I'\left(\frac{m + 15B^2L^2Rt}{5mR}\right) = BLv_0$

$I' = \frac{5mRBLv_0}{m + 15B^2L^2Rt}$

$v = v_0 - \frac{15RB^2L^2v_0t}{m + 15B^2L^2Rt} =$

$= v_0\left(1 - \frac{15RB^2L^2t + m - m}{m + 15B^2L^2Rt}\right) =$

$= v_0 - v_0 + \frac{mv_0}{m + 15B^2L^2Rt} = \frac{mv_0}{m + 15B^2L^2Rt}$

$\mathcal{E}_1 - \mathcal{E}_2 = BLv = \frac{mv_0BL}{m + 15B^2L^2Rt}$

$Q = \frac{5m^2B^2L^2v_0^2Rt}{(m + 15B^2L^2Rt)^2} = \quad t \to \infty \Rightarrow$

$= \frac{5m^2B^2L^2v_0^2Rt}{30mB^2L^2Rt + m^2 + 225B^2L^2R^2t^2} \qquad t \to \infty \Rightarrow Q = \frac{5m^2B^2L^2v_0^2R}{30mB^2L^2R} =$

$= \frac{mv_0^2}{6}$

$\frac{mv_0^2}{3} = \frac{mv_1^2}{2} + \frac{mv_2^2}{4} \qquad 4v_0^2 = 6v_1^2 + 3v_2^2$

$mv_0 = \frac{m}{2}v_1 + mv_2 \qquad 2v_0 = v_1 + 2v_2$

$v_0 = \frac{v_1}{2} + v_2$

$S = vt = \frac{mv_0t}{m + 15B^2L^2Rt} \qquad t \to \infty \Rightarrow S = \frac{mv_0}{B^2L^2R}$

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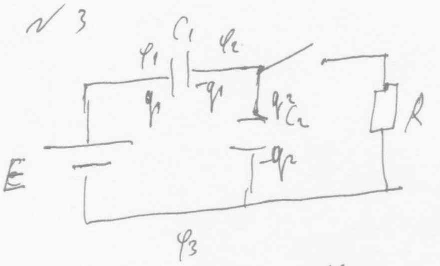
Черновик.

$\frac{1}{3C}+\frac{1}{C}=\frac{1}{3C}+\frac{3}{3C}=\frac{4}{3C}$

№ 3



$C_2=C$

$C_1=3C$

$\varphi_1-\varphi_3=E$

$\varphi_1-\varphi_2=U_1$

$\varphi_2-\varphi_3=U_2$

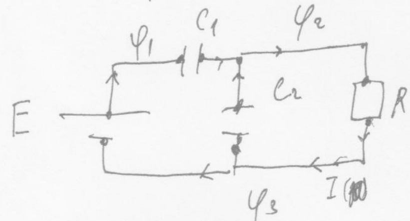
$U_1+U_2=E$

$q_1+q_2=\frac{3CE}{2}$

$C_0=\frac{1}{\frac{1}{C}+\frac{1}{3C}}=\frac{C}{1+\frac{1}{3}}=\frac{3C}{2}$

$q=EC_0=\frac{3CE}{2}$

$U_2=E-U_1$



$q_1=3U_1C$ $\quad q_2=U_2C$ $\quad 3U_1+U_2=\frac{3}{2}E$

$6U_1+2U_2=3E$

$6U_1+2E-2U_1=3E$

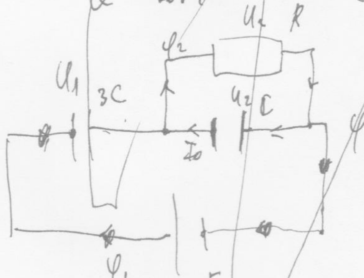
$E=4U_1 \Rightarrow U_1=\frac{E}{4} \Rightarrow$

$\Rightarrow U_2=\frac{3E}{4}$

1) $I=\frac{\varphi_2-\varphi_3}{R}=\frac{U_2}{R}=\frac{\frac{3}{4}E}{R}=\frac{3E}{4R}$

$12U_1+4E-4U_1=3E$

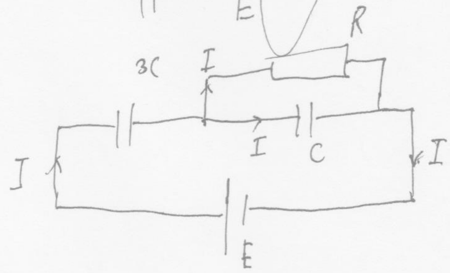
2) $Q=W_1+W_2=W_1=\frac{3CU_1^2}{2}=\frac{3CU_1^2}{2}$



$Q=W_2=\frac{CU_2^2}{2}=\frac{C\cdot\frac{9}{16}E^2}{2}=\frac{9CE^2}{32}$

3)

$U=I_0R$

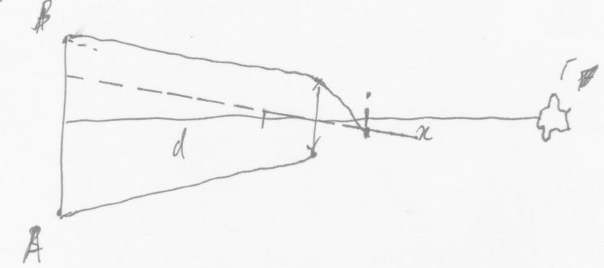


$q_1=q_2$

$3CU_1$

Черновик.

№5



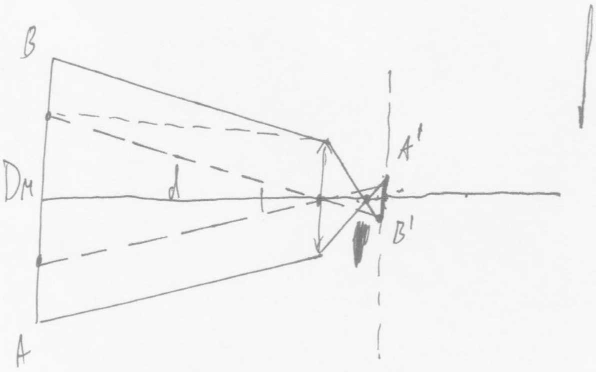
$H = 9$ см $d = 48$ см $F_0 = 24$ см

1) $\frac{1}{d} + \frac{1}{F_0 - x} = \frac{1}{F}$ $\Rightarrow F = \frac{(F_0 - x)d}{F_0 - x + d}$

$\frac{1}{F_0 - x} = \frac{1}{F} - \frac{1}{d} = \frac{d - F}{Fd}$ $\Rightarrow F_0 + x = \frac{dF}{d - F}$

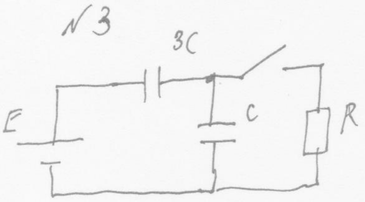
$x = \frac{dF}{d - F} + F_0$

2)



Чистовик. Вариант 11-02. Лист №1

№3

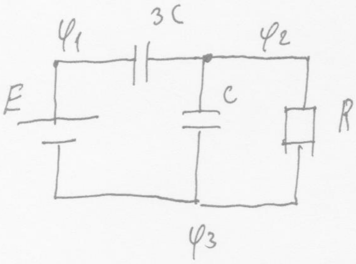


1) $C_0 = \dfrac{1}{\frac{1}{3C}+\frac{1}{C}} = \dfrac{C}{1+\frac{1}{3}} = \dfrac{3C}{4} \Rightarrow q = C_0 E = \dfrac{3CE}{4}$; $q_1 = q_2 \Rightarrow$

$\cancel{3CU_1 = CU_2 = \frac{3CE}{4} \Rightarrow 12U_1 + 4U_2 = 3E}$

$\cancel{U_1 + U_2 = E \Rightarrow U_2 = E - U_1 \Rightarrow 12U_1 + 4E}$

$\Rightarrow 3CU_1 = CU_2 \Rightarrow U_2 = 3U_1$; $U_1 + U_2 = E \Rightarrow 4U_1 = E \Rightarrow U_1 = \dfrac{E}{4}$; $U_2 = \dfrac{3E}{4}$



$U = \varphi_2 - \varphi_3 = U_2 = \dfrac{3E}{4}$; $I = \dfrac{U}{R} = \dfrac{3E}{4R}$

2) $Q = W_2 = \dfrac{CU_2^2}{2} = \dfrac{C\cdot\frac{9}{16}E^2}{2} = \dfrac{9CE^2}{32}$

3) $U_R = I_0 R$

Ответ: 1) $I = \dfrac{3E}{4R}$

2) $Q = \dfrac{9CE^2}{32}$

3) $U_R = I_0 R$

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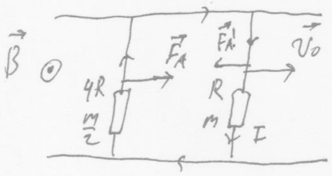
Чистовик. Вариант 11-02. Лист №2

№ 4



1) $\mathcal{E} = v_0 BL$

$I = \frac{\mathcal{E}}{R+4R} = \frac{v_0 BL}{5R}$

$F_A = \frac{ma}{2} \Rightarrow a = \frac{2F_A}{m}$; $F_A = IBL = \frac{v_0 B^2 L^2}{5R} \Rightarrow$

$\Rightarrow a = \frac{2v_0 B^2 L^2}{5Rm}$

2) $\mathcal{E}_1 = (v_0 - a_1 t)BL$; $\mathcal{E}_2 = a_2 t BL \Rightarrow \mathcal{E}_1 - \mathcal{E}_2 = BL(v_0 - a_1 t - a_2 t)$

$a_1 = \frac{I' BL}{m}$ $\quad a_2 = \frac{2I' BL}{m} \Rightarrow \mathcal{E}_1 - \mathcal{E}_2 = BL\left(v_0 - 3\frac{I' BLt}{m}\right) = \frac{I'}{5R}$

$\frac{I'}{5R} + \frac{3I' B^2 L^2 t}{m} = v_0 BL \Rightarrow I' = \frac{5mRBLv_0}{m + 15B^2L^2Rt}$

$\mathcal{E}_1 - \mathcal{E}_2 = \frac{I'}{5R} = \frac{mBLv_0}{m+15B^2L^2Rt} \Rightarrow Q = t\cdot(\mathcal{E}_1 - \mathcal{E}_2)I' = \frac{5m^2B^2L^2v_0^2Rt}{(m+15B^2L^2Rt)^2} =$

$= \frac{5m^2B^2L^2v_0^2Rt}{30mB^2L^2Rt + m^2 + 225B^2L^2R^2t^2}$; $t \to \infty \Rightarrow Q = \frac{5m^2B^2L^2v_0R}{30mB^2L^2R} = \frac{mv_0^2}{6}$

$\frac{mv_0^2}{2} = \frac{mv_1^2}{2} + \frac{mv_2^2}{4} + Q \Rightarrow \frac{mv_0^2}{3} = \frac{mv_1^2}{2} + \frac{mv_2^2}{4} \Rightarrow 4v_0^2 = 6v_1^2 + 3v_2^2$

$mv_0 = mv_1 + \frac{mv_2}{2} \Rightarrow 2v_0 = 2v_1 + v_2 \Rightarrow 4v_1^2 + 4v_1v_2 + v_2^2 = 6v_1^2 + 3v_2^2$

$2v_1^2 + 2v_2^2 = 4v_1v_2 \Rightarrow v_1^2 + v_2^2 - 2v_1v_2 = 0 \Rightarrow v_1 = v_2 \Rightarrow 2v_0 = 2v_1 + v_1 \Rightarrow$

$\Rightarrow v_1 = \frac{2v_0}{3}$; $v_2 = \frac{2v_0}{3}$

3)

$v = v_0 - a_1 t - a_2 t = \frac{\mathcal{E}_1 - \mathcal{E}_2}{BL} = \frac{mv_0}{m+15B^2L^2Rt}$

$S = \frac{mv_0 t}{m+15B^2L^2Rt}$; $t \to \infty \Rightarrow S = \frac{mv_0}{15B^2L^2R}$

Ответ: 1) $a = \frac{2v_0B^2L^2}{5Rm}$

2) $v_1 = v_2 = \frac{2v_0}{3}$

3) $S = \frac{mv_0}{15B^2L^2R}$

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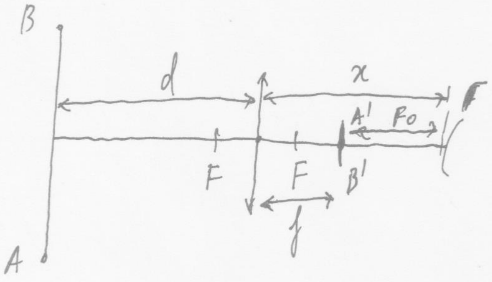
№5



$d = 48$ см
$F_0 = 24$ см
$F = 12$ см

1) $\frac{1}{d} + \frac{1}{f} = \frac{1}{F} \Rightarrow f = \frac{dF}{d-F}$; $f = x - F_0 \Rightarrow$

$\Rightarrow x - F_0 = \frac{dF}{d-F} \Rightarrow x = \frac{dF}{d-F} + F_0$

$x = \frac{48 \cdot 12}{48-12} + 24 = 40$ см

Ответ: 1) $x = 40$ см