Часть 1

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

Шифр: **21200582**

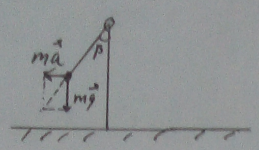
ID профиля: **801457**

Вариант 8

Числовик Вариант 21-08

Задача №1

Перейдем в НИСО сопутствующую клину, тогда a – ускорение инерциальное.



1) β - const $\Rightarrow$ колебаний или вращения нет

Запишу уравнение моментов:

$$mg\sin\beta\, l - ma\cos\beta\, l = 0$$

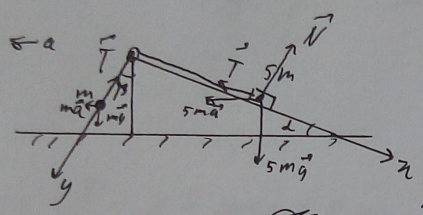
$$g\sin\beta = a\cos\beta$$

$$a = g\,\mathrm{tg}\,\beta$$

$\cos\beta = \frac{5}{13}$ $\sin\beta = \frac{12}{13}$ $\mathrm{tg}\,\beta = \frac{12}{5}$

$$\Rightarrow a = g\cdot\frac{12}{5} = 10\cdot\frac{12}{5}\ \frac{м}{с^2} = 24\ \frac{м}{с^2}$$

2)



Запишем II з. Ньютона в проекциях на:

$$\begin{cases} 5m:(x):\ 5ma_1 = T + 5ma\cos\beta - 5mg\sin\beta \\ m:(y):\ ma_2 = -T + ma\sin\beta + mg\cos\beta \end{cases}$$

т.к. нить нерастяжима, то $a_1 = a_2$

тогда сложу уравнения:

$$6ma_1 = T - T + 5ma\cos\beta - 5mg\sin\beta + ma\sin\beta + mg\cos\beta$$

$$6ma_1 = 5ma\frac{3}{5} - 5mg\frac{4}{5} + ma\frac{12}{13} + mg\frac{5}{13}$$

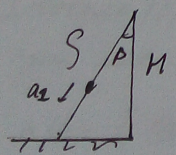
$$6a_1 = 3a - 4g + \frac{12a}{13} + \frac{5g}{13}$$

$$78a_1 = 39a - 52g + 12a + 5g$$

$$78a_1 = 51a - 47g$$

$$a_1 = \frac{51\cdot 24 - 47\cdot 10}{78}\ \frac{м}{с^2} = 9{,}67\ \frac{м}{с^2}$$

3) $a_2 = a_1 = 9{,}67\ \frac{м}{с^2}$ $\quad S = \frac{H}{\cos\beta} = a_2\frac{t^2}{2}$



$$t^2 = \frac{2H}{a_2\cos\beta}$$

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

$$t = \sqrt{\frac{26H}{9{,}67\cdot\frac{5}{13}}} \approx 0{,}73\sqrt{H}$$

Ответ: 1) $a = g\,\mathrm{tg}\,\beta = 24\ \frac{м}{с^2}$

2) $a_1 = \frac{1}{6}(a(5\cos\beta + \sin\beta) - g(5\sin\beta - \cos\beta)) = 9{,}67\ \frac{м}{с^2}$

3) $t = \sqrt{\frac{2H}{a_2\cos\beta}} = 0{,}73\sqrt{H}$ с.

прод. задача №2

$5(\cancel{p_1V_1} + p_1\Delta V + V_1\Delta p + \Delta p\Delta V - \cancel{p_1V_1}) = (2p_1 + \Delta p)\Delta V$

($\Delta p\Delta V \to$) 0, т.к. 2 степень малости, (до этого линеаризовал дугу)

$5p_1\Delta V + 5V_1\Delta p = 2p_1\Delta V + \Delta p\Delta V$ ($\to 0$)

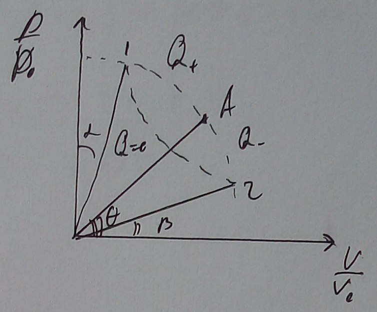
$3p_1\Delta V = -5V_1\Delta p$

$-\frac{3}{5} = \frac{V_1}{p_1}\frac{\Delta p}{\Delta V}$ $\qquad V_1 = \frac{V_0}{p_0} p_1 \operatorname{ctg}\theta$

$-\frac{3}{5} = \frac{V_0}{p_0}\operatorname{ctg}\theta(-\operatorname{ctg}\theta)$

$\frac{3p_0}{5V_0} = \operatorname{ctg}\theta^2$

$\operatorname{tg}\theta = \sqrt{\frac{5V_0}{3p_0}}$



3) Пусть A — точка где $c = 0$

2-1 — адиабата, т.к. $Q = 0$

В процессе 1-2 теплоемкость меняется (уменьшается) и как бы меняет знак в точке A

Вернее: при 1-A тепло поступает
при A-2 тепло отдается

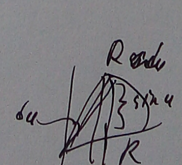
З.С.Э: $Q_+ = A + Q_-$

условия: 1) $p_1; V_1$: $\frac{p_1}{p_0} = \frac{V_1}{V_0}\operatorname{ctg}\alpha$

2) $p_2; V_2$: $\frac{p_2}{p_0} = \frac{V_2}{V_0}\operatorname{tg}\beta$

A) $p_A; V_A$: $\frac{p_A}{p_0} = \frac{V_A}{V_0}\operatorname{tg}\theta$

~~$\Delta U = A + Q$~~



$\Delta U_{1A} = A + Q_+$ $\qquad$ | $A = p_0V_0\int R^2\sin\varphi\, d\varphi$

$\Delta U_{A2} = A + Q_-$ $\qquad$ | $A = p_0V_0 R^2\cos\Big|_{\varphi_2}^{\varphi_1}$

$\frac{5}{2}(p_AV_A - p_1V_1) = R^2(\cos\theta - \sin\alpha) + Q_+$

$\frac{5}{2}(p_2V_2 - p_AV_A) = R^2(\cos\beta - \cos\theta) + Q_-$

$c_p = \frac{7}{2}R$

$pV = \nu RT$

черновик

2 (прод) ч. 2

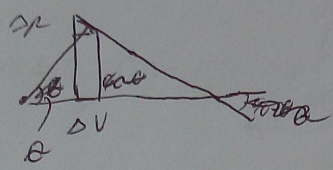
$Q = \nu c \Delta T$

$\Delta U = A + Q$

$\frac{5}{2}\nu R\Delta T = A + \nu c\Delta T$

$c = 0$

$\Rightarrow \frac{5}{2}\nu R\Delta T = A$



$\frac{5}{2}(p_1V_1 - p_2V_2) = A$

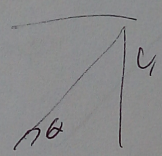
$A = \frac{p_2+p_1}{2}(V_2 - V_1)$ $\quad \Delta p = \Delta V\, ctg\,\theta$

$A = \frac{p_2+p_1}{2}$

$A = \frac{2p_1+\Delta p}{2}\Delta V$

~~$A = p_1\Delta V + \frac{\Delta p\Delta V}{2}$~~

$5\, p_1V_1 - p_1V_2 = 2p_1\Delta V$



$p_1 = V_1 tg\,\theta$

$\Delta p = \Delta V\, ctg\,\theta$

$5p_1V_1 - 5(p_1+\Delta p)(V_1+\Delta V) =$

$5(p_1V_1 - (p_1+\Delta p)(V_1+\Delta V)) = 2p_1\Delta V + \Delta p\Delta V$

$5(p_1V_1 - p_1V_1 + \Delta pV_1 + \Delta Vp_1 + \Delta p\Delta V) = 2p_1\Delta V + \Delta p\Delta V$

$5V_1\Delta p + 5p_1\Delta V + 5\Delta p\Delta V = 2p_1\Delta V + \Delta p\Delta V$

$5V_1\Delta p + 3p_1\Delta V + 4\Delta p\Delta V = 0$

$5p_1 ctg\,\theta + 3p_1 tg\,\theta + 4\Delta p\, tg\,\theta = 0$

$(5ctg\,\theta + 3tg\,\theta) = -4\frac{\Delta p}{p_1}tg\,\theta$

$5ctg^2\theta = -4\frac{\Delta p}{p_1} - 3$

$5ctg\,\theta = 3tg\,\theta$

$\frac{5}{3} = tg^2\theta$

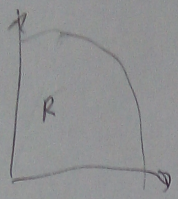
$tg\,\theta = \sqrt{\frac{5}{3}}$

21200582 (U801457 M1266326)

Чернован №2 1

$C_V = \frac{5}{2}R$ $i=5$

$C_p = \frac{7}{2}R$



$\frac{\Delta p}{p} = \frac{\Delta V}{V} + \frac{\Delta T}{T}$

$pV = \nu RT$

$p = \frac{\nu RT}{V}$

$\Delta p = \nu R\left(\frac{T_1}{V_1} - \frac{T_2}{V_2}\right)$

$\frac{\Delta p}{p} = \frac{\nu R}{\nu R}\frac{V_1}{T_1}\left(\frac{T_1}{V_1} - \frac{T_2}{V_2}\right)$

$\frac{\Delta p}{p} = 1 - \frac{V_1 T_2}{T_1 V_2}$

$\frac{\Delta V}{V} = 1 - \frac{\mu_2 T_1}{T_1 \mu_2}$

$\frac{\Delta T}{T} = 1 - \frac{\mu_1 V_1}{\mu_1 V_1}$

$(p+\Delta p)(V+\Delta V) = \nu R(T+\Delta T)$

$pV + p\Delta V + V\Delta p + \Delta p \Delta V = \nu R T + \nu R \Delta T$

$\frac{\Delta p}{p} + \frac{\Delta V}{V} = \frac{\nu R \Delta T}{\nu R T}$ $\frac{\Delta p}{p} + \frac{\Delta V}{V} = \frac{\Delta T}{T}$

$p' = \frac{\nu RT}{V}$

$\dot{p} = \frac{\dot{V}\nu RT - \nu R\dot{T}V}{V^2}$

$R\cos$

$\alpha = 23,6$

$\beta = 16$

$(p+\Delta p)V = \nu RT'$ $\frac{\Delta p}{p} + \frac{\Delta V}{V} = \frac{\Delta T}{T}$

$(p+\Delta p$

$R\cos\alpha = \frac{\mu_1}{\mu_0}$ $U = \frac{5}{2}\nu RT = \frac{5}{2}pV$

$R\sin\alpha = \frac{V_1}{V_0}$ $U_1 = \frac{5}{2}\mu_1 V_1 = \nu RT_1$ $T_1 = \frac{U_1}{\nu R}$

$R\cos\beta = \frac{\mu_2}{\mu_0}$ $U_2 = \frac{5}{2}\mu_2 V_2 = \nu R T_2$ $T_2 = \frac{U_2}{\nu R}$

$R\sin\beta = \frac{V_2}{V_0}$

$\frac{T_2 - T_1}{T_2} = \frac{U_2 - U_1}{U_2} = 1 - \frac{U_1}{U_2} = 1 - \frac{\mu_1 V_1}{\mu_1 V_2} = \sqrt{2} - 1$

$\approx \sqrt{2}$

$\frac{\Delta T}{T_2} = 1 - \frac{\mu_0 R\cos\alpha V_0 R\sin\alpha}{\mu_0 R\cos\beta V_0 R\sin\beta} = 1 - \frac{\cos\alpha\sin\alpha}{\cos\beta\sin\beta} = 1 - \frac{\sin 2\alpha}{\sin 2\beta} = 1 - \frac{\sin 45}{\sin 30} = 1 - \frac{\frac{\sqrt{2}}{2}}{\frac{1}{2}} =$

Задача №2

г) $\frac{\Delta T}{T_2} = \frac{T_1 - T_2}{T_2} = \frac{T_1}{T_2} - 1$

~~$U = \frac{5}{2} R \nu i = 5 \nu \Rightarrow U = \frac{5}{2} \nu R T = \frac{5}{2} pV$~~

~~$U_1 = \frac{5}{2} \nu R T$~~ $pV = \nu R T$ – закон Клапейрона-Менделеева

$T = \frac{pV}{\nu R}$

$\Rightarrow \frac{\Delta T}{T_2} = \frac{p_1 V_1}{p_2 V_2} - 1$

Из графика $\frac{p}{p_0}, \frac{V}{V_0}$: $p_1 = p_0 R \cos\angle$ $\angle = 22{,}5$

$V_1 = V_0 R \sin\angle$

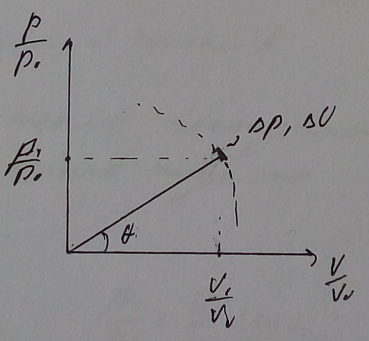
$p_2 = p_0 R \sin\beta$ $\beta = 15$

$V_2 = V_0 R \cos\beta$

$\Rightarrow \frac{\Delta T}{T_2} = \frac{p_0 R \cos\angle \, V_0 R \sin\angle}{p_0 R \sin\beta \, V_0 R \cos\beta} - 1 = \frac{\cos 2 \sin\angle}{\cos\beta \sin\beta} - 1 = \frac{\sin 2\angle}{\sin 2\beta} - 1$

$\frac{\Delta T}{T_2} = \frac{\sin 45}{\sin 30} - 1 = \frac{\frac{\sqrt{2}}{2}}{\frac{1}{2}} - 1 = \sqrt{2} - 1 \approx 0{,}41$

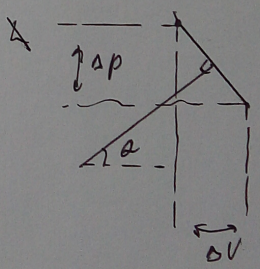
г) Пусть θ – искомый



тогда:

$\frac{p_1}{p_0} = \frac{V_1}{V_0} \operatorname{tg}\theta$

$\Delta p = -\Delta V \operatorname{ctg}\theta$



I начало термодинамики: $\Delta U = A + Q$

при изохоре $c = c_v$ $Q = 0$ $\Rightarrow \Delta U = A$ (пересечение с адиабатой)

$\Delta U = \frac{5}{2} \nu R \Delta T = \frac{5}{2} (p_2 V_2 - p_1 V_1)$ min. $C_V = \frac{5}{2} R \Rightarrow i = 5$

$\Delta U = \frac{5}{2} \left((p_1 + \Delta p)(V_1 + \Delta V) - p_1 V_1 \right)$

$A = \frac{p_1 + p_1 + \Delta p}{2} \Delta V =$

$5 \left((p_1 + \Delta p)(V_1 + \Delta V) - p_1 V_1 \right) = (2p_1 + \Delta p) \Delta V$

проч задания

$$Q_+ + Q_- = \frac{5}{2}(p_2V_2 - p_1V_1 + p_1V_1 - p_2V_2) + R^{\Delta V}(\cos\beta - \sin\alpha + \cos\beta - \cos\theta)$$

$$Q_+ + Q_- = \frac{5}{2}(p_2V_1 - p_1V_1) + R^{\Delta V}(\cos\beta - \sin\alpha)$$

$$Q_+ + Q_- = \frac{5}{2}(Rp_0\cos\beta\, RV_0\sin\beta - R^2p_0V_0\sin\alpha\cos\alpha) + R^{\Delta V}(\cos\beta - \sin\alpha)$$

$$Q_+ + Q_- = \frac{5}{4}R^2p_0V_0(\sin 2\beta - \sin 2\alpha) + R^{\Delta V}(\cos\beta - \sin\alpha)$$

$$Q_+ = \frac{5}{4}R^2p_0V_0(\sin 2\theta - \sin 2\alpha) + R^{\Delta V}(\cos\theta - \sin\alpha)$$

$$\eta = \frac{Q_+ + Q_-}{Q_+} = \frac{\frac{5}{4}(\sin 2\beta - \sin 2\alpha) + \cos\beta - \sin\alpha}{\frac{5}{4}(\sin 2\theta - \sin 2\alpha) + \cos\theta - \sin\alpha}$$

$$\eta = \frac{\frac{5}{4}\sin 45 - \frac{5}{4}\sin 30 + \cos 22{,}5 - \sin 15}{\frac{5}{4}\sin 2\theta - \frac{5}{4}\sin 30 + \cos\theta - \sin 15}$$

$$\eta = \frac{\frac{5\sqrt{2}}{8} - \frac{5}{8} + \cos 22{,}5 - \sin 15}{\frac{5}{4}\sin 2\theta - \frac{5}{8} + \cos\theta - \sin 15}$$

Ответ: 1) $\frac{\Delta T}{T_2} = \frac{\sin 2\alpha}{\sin 2\beta} - 1 = \sqrt{2} - 1 \approx 0{,}41$

2) $\operatorname{tg}\theta = \sqrt{\frac{5}{3}\frac{V_0}{p_0}}$

3) $\eta = \frac{\frac{5}{8}(\sqrt{2}-1) + \cos\frac{45}{2} - \sin\frac{30}{2}}{\frac{5}{4}\sin 2\theta - \frac{5}{8} + \cos\theta - \sin\frac{30}{2}}$

$\eta = \frac{A}{Q_1} =$

1-2 – изо

2-1 – адиабата

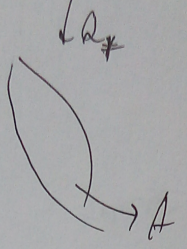
$\sin^2\varphi \, d\varphi$

A

$\Delta U = A_{21}$

$\Delta U = A_{12} + R_t$

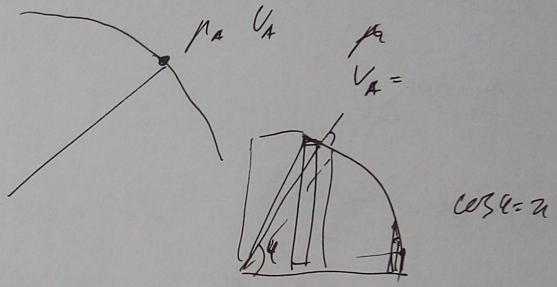
$A_{21} = A_{12} + R_t$



$Q_1 = A$ ~~$2\sin\varphi\cos\varphi$~~ $\sin 2\varphi$

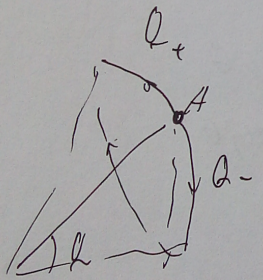
$\Rightarrow \eta = 100\%$

$\sin^2\varphi = \frac{\cos 2\varphi - 1}{2}$ $d\varphi$ $R\,d\varphi$



$dx = dl\sin\varphi$

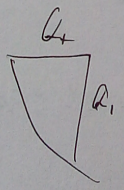
$dx = d\varphi R\sin\varphi$



$Q_1 = A + Q_-$

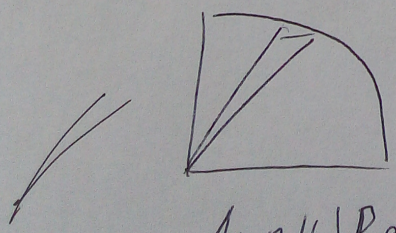
$A = \int dx \cdot R \sqrt{1-x^2}$

$A = R \int \sqrt{1-x^2}\, dx$



$\frac{d\sqrt{1-x^2}}{dx} = \frac{1 \cdot 2x}{2\sqrt{1-x^2}}$

$A = R \int \frac{\sqrt{1-x^2}}{2\sqrt{1-x^2}} 2x \, d\sqrt{1-x^2}$



$A = p_c V_c \int R\sin\varphi \, dx$

$A = \int d\varphi R\sin\varphi$

$dx = dl\sin\varphi$

$dl = R\,d\varphi$

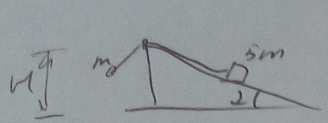
$A = R\cos\varphi$

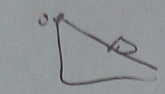
$A = p_c V_c R^2 \int \sin^2\varphi \, d\varphi \, d\sin\varphi$

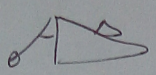
$\cos\varphi \, d\sin\varphi$

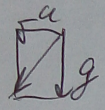
Термиза

$\cos\alpha = 0.6 \quad \sin\alpha = 0.8$





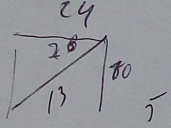


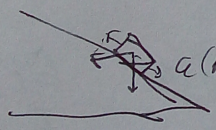


$\cos\beta = \frac{10}{\sqrt{g^2+a^2}} = \frac{10}{\sqrt{100+a^2}} = \frac{25}{169}$

$100 + a^2 = 144 \cdot 169 - 100$

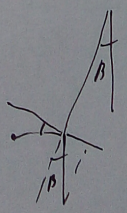
$a^2 = 576$





$5ma = -5mg\sin\alpha + 5ma\cos\alpha + T$

$ma = m\sqrt{g^2+a^2} - T$



$g\sin\beta = a\cos\beta$

$a = g\operatorname{tg}\beta$

$13 \cdot 6 = 60 + 18 = 78$

$4 \cdot 13 = 40 + 12$

Часть 2

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

Шифр: **21200582**

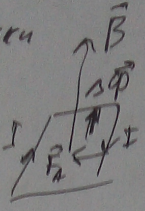
ID профиля: **801457**

Вариант 8

Задание 4

1) $\mathcal{E} = -\dot{\Phi} = -B\dot{S} = -Bd\dot{x} = -Bdv$

$I = \frac{-Bdv}{R}$ – по часовой стрелке



$F_A = IBd = \frac{B^2d^2v}{R}$

$ma = F_A$

$a_0 = \frac{B^2d^2v_0}{mR}$

2) $ma = \frac{B^2d^2}{mR}v$

$\Delta v = \frac{B^2d^2}{mR}\Delta x$

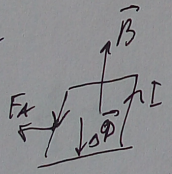
$\Delta x = b = \frac{2}{3}d$

} т.к. при полном входе в поле $\dot{S}=0 \Rightarrow \mathcal{E}=0 \Rightarrow I=0 \Rightarrow F_A=0 \Rightarrow a=0$, $\Delta v=0$

$\Delta v = \frac{2}{3}\frac{B^2d^3}{mR}$

$v_1 = v_0 - \frac{2}{3}\frac{B^2d^3}{mR}$

3) $\mathcal{E} = -\dot{\Phi} = -B\dot{S} = Bdv$



$F_A = IBd = \frac{B^2d^2v}{R}$

$\Delta v = \frac{B^2d^2}{mR}\Delta x$

$\Delta v = \frac{2}{3}\frac{B^2d^3}{mR}$

$v_2 = v_1 - \frac{2}{3}\frac{B^2d^3}{mR}$

$v_2 = v_0 - \frac{4}{3}\frac{B^2d^3}{mR}$

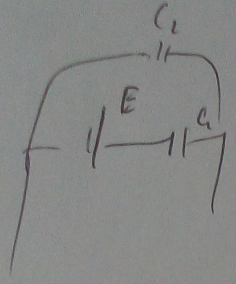
Ответ: 1) $a_0 = \frac{B^2d^2}{mR}v$

2) $v_1 = v_0 - \frac{2}{3}\frac{B^2d^3}{mR}$

3) $v_2 = v_0 - \frac{4}{3}\frac{B^2d^3}{mR}$

Черновик

№3



$q_1 = q_2$

$E = \frac{q_1}{C} + \frac{q_1}{5C} = q_1 \frac{q_1}{C}\left(1 + \frac{1}{5}\right) = \frac{\frac{6}{5}q}{C}$

$q = \frac{5EC}{6}$

$E + \frac{q}{C_1} = E + \frac{1}{6}E = \frac{11}{6}E$

$I = 0$

$I_C = 0$

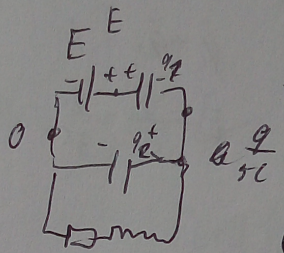
$U = -L\dot{I} = \frac{11}{6}E$

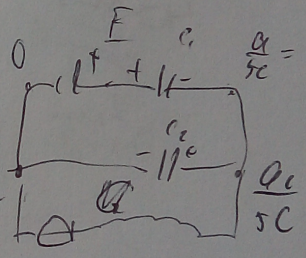
$\dot{I} = \frac{11E}{6L}$

$1 - \frac{1}{5} = 0{,}8$

$iR = Li$

$\frac{q}{5C} = E + C = iR + L\dot{i}$



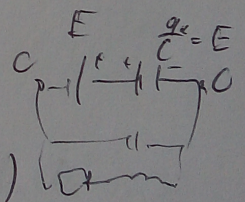


$\frac{q}{5C} = iR + L\dot{i}$

$\frac{q}{5C} = U - L\ddot{q}$

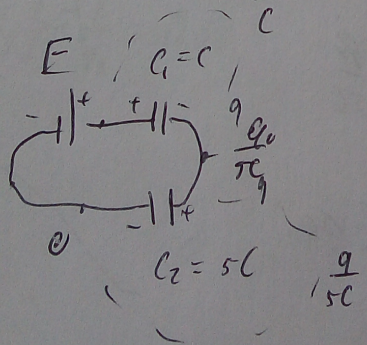
$\dot{q}_1 + \dot{q}_2 = i$

$\dot{q} = 5C(\dot{U} - L\ddot{q})$



$\frac{q}{C}$

$EC = \frac{q}{C}\left(1 + \frac{1}{5}\right)$



$\Delta q_1 = EC - 0{,}8EC = 0{,}2EC$

$E\Delta q$

$A = \frac{q_0^2}{2C} + \frac{q_0^2}{10C} + E\Delta q = Q + \frac{CE^2}{2}$

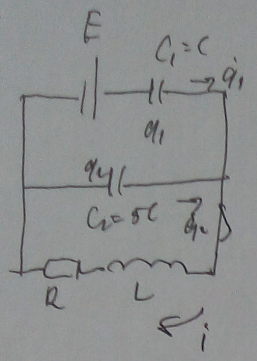
$Q = 0{,}1CE^2$

$\frac{5}{24}E^2C^2 + E \cdot 0{,}2EC = \frac{CE^2}{2} + Q$

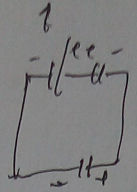
Задача №3

1) сразу после замыкания ключа $i = 0$

$$\Rightarrow L\dot{i} = \frac{q_2}{C_2} \quad \dot{i} = \frac{q_2}{LC_2} = \frac{q_0}{5LC}$$



До замыкания:



$q_1 = q_2 = q_0$

$$E - \frac{q_1}{C} = \frac{q_2}{5C}$$

$$E = \frac{6}{5}\frac{q_0}{C}; \quad q_0 = \frac{5EC}{6}$$

$$\Rightarrow \dot{i} = \frac{5EC}{6 \cdot 5LC} = \frac{E}{6L}$$

2) Рассмотрим энергии:

до замыкания ключа: $W_1 = \frac{q_1^2}{2C} + \frac{q_2^2}{10C} = \frac{6}{10}\frac{q_0^2}{C} = \frac{6}{10}\cdot\frac{5}{24}\cdot\frac{E^2C^2}{6C} = \frac{5}{12}E^2C$

много после: Предположим, токи погасли, тогда $q_1 = 0$; $q_2 = 0$:

$$E = \frac{q_к}{C} \quad q_к = EC$$

$$W_2 = \frac{q_к^2}{2C} = \frac{E^2C}{2} + Q$$

За это время Е совершило работу $A = E\Delta q = E(q_к - q_0)$

З.С.Э: $W_1 + A = W_2$

$$\frac{5}{12}E^2C + E\left(\frac{1}{6}EC - \frac{5}{6}EC\right) = \frac{E^2C}{2} + Q$$

$$\frac{5}{12}E^2C + \frac{2}{12}E^2C = \frac{6}{12}E^2C + Q$$

$$Q = \frac{E^2C}{12}$$

3) $E - \frac{q_1}{C} = \frac{q_2}{5C}$

$-q_1 = \frac{\dot{q}_2}{5}$

$\dot{q}_2 = -5q_1$

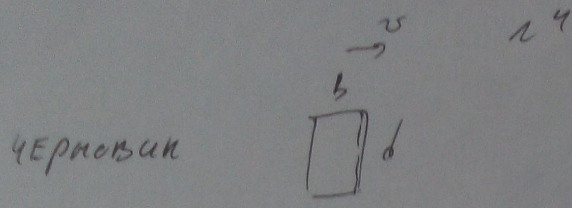
При $I_0 = \dot{q}_2$: $i = \dot{q}_2 - \dot{q}_1 = \dot{q}_2 + \frac{\dot{q}_2}{5} = \frac{6}{5}\dot{q}_2 = \frac{6}{5}I_0$

$U_R = iR = \frac{6}{5}I_0R$

Ответ: 1) $i = \frac{E}{6L}$

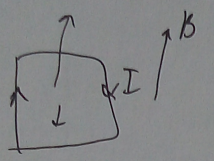
2) $Q = \frac{E^2C}{12}$

3) $U_R = \frac{6}{5}I_0R$

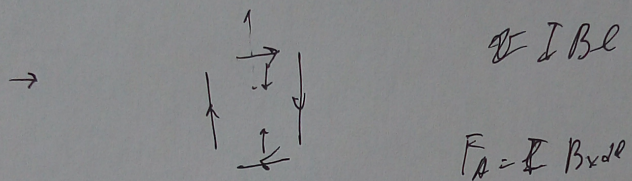


$$\mathcal{E} = -\dot{\Phi} = -B\dot{S} = -Bdv$$

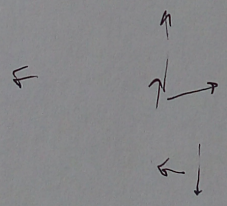
$$I = \frac{\mathcal{E}}{R} \qquad I = \frac{-Bdv}{R}$$

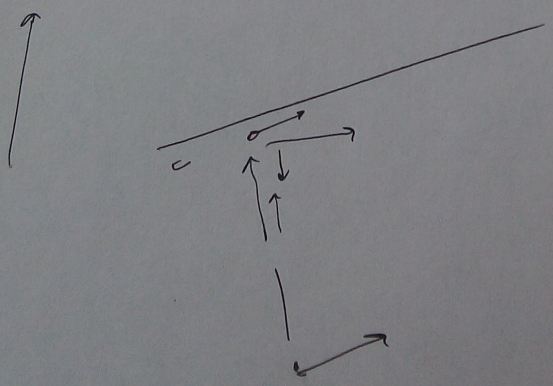


$$F_A = IBl$$



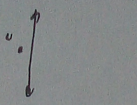
$$F_A = I\,B \times dl$$



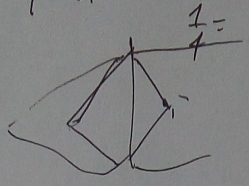


Чертежи №5

$D_0 = \frac{1}{d}$

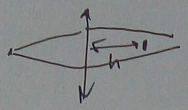


$\frac{1}{f} + \frac{1}{h} = D_0 + D_1$



$\frac{1}{f} =$

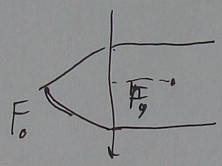
$D_1 = \frac{1}{d}$



$D_0 + D_1 = \frac{1}{h}$ $\quad D_1 = \frac{1}{h} - \frac{1}{d}$

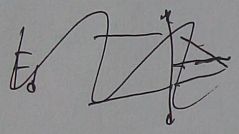
$D_0 + D_2 = \frac{1}{d} + \frac{1}{h}$ $\quad D_2 = \frac{1}{h}$

$F = 25$ см



$D_F = \frac{1}{F_0}$ $\quad F_0 = 25$ см

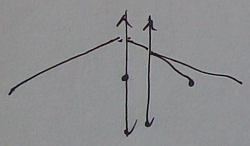
$\frac{D_2}{D_1} = 5$



$D_f + D_{об}$

$D_0 + D_1 = \frac{1}{h}$

$D_0 = \frac{1}{F_0}$ $\quad F_0 = 25$



$\frac{1}{f} + \frac{1}{f} = D_1$

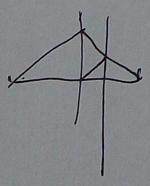
$D_0 + D_2 =$

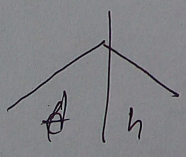
$-\frac{1}{f} + \frac{1}{f_h} = D_2$

$-\frac{1}{2d} + \frac{1}{h} = D_0 + D_3 = D_3 + \frac{1}{d}$

$D_3 = \frac{1}{h} - \frac{1}{2d}$

$\frac{1}{d} + \frac{1}{f_h} = D_2 + D_2$

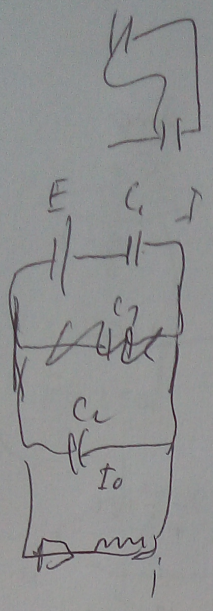




$\frac{1}{d} + \frac{1}{h} = D_0 + D_2$

$\frac{1}{h} \quad 1 + \frac{1}{0,2} = \frac{1}{0,25}$

$h = 20$ $\quad D_1 = \frac{1}{20} - \frac{1}{25} = \frac{25 - 20}{25 \cdot 20} = \frac{1}{100}$ $\quad 1 + 5$



$I_1 = \dot{q}_1$

$I_2 = \dot{q}_2 = I - i$

$\dot{q}_1 + \dot{q}_2 = i$

$E + \frac{q_1}{C} = \frac{q_2}{5C} = iR + L\dot{i}$

$E + \frac{q_1}{5C} = \frac{q_2}{C}$

$E + \frac{q_1}{5C} = \cancel{iR} + L\dot{i}$

$\cancel{E} \frac{q_2}{C} = \cancel{iR} + L\dot{i}$

$\frac{\dot{q}_2}{C} = \frac{\dot{q}_1}{5C}$

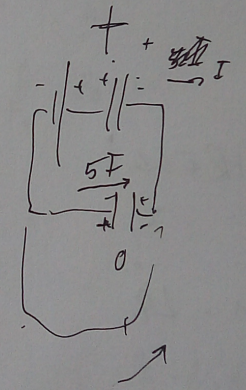
$\Delta q_2 = \frac{1}{5}\Delta q_1$

$E + \frac{q_1}{C} = \frac{q_2}{5C}$

$\frac{\Delta q_1}{C} = \frac{\Delta q_2}{5}$

$5\Delta q_1$

$5\dot{q}_1 = \dot{q}_2$



$E - \frac{q_1}{C} = \frac{q_2}{5C}$

$E - \frac{q_1}{C} = \cancel{+}\frac{q_2}{5C}$

$-5\dot{q} = \dot{q}_2$

$\frac{1}{2d} + \frac{1}{h} = \frac{1}{d} + D_3$

2) $D_3 = 3$ дптр.

$D_0 = \frac{1}{d}$

$D_1 = \frac{1}{h} - \frac{1}{d}$

$D_2 = \frac{1}{h}$

$\frac{1}{h} = 5 \cdot \frac{5}{h} - \frac{5}{d}$

$\frac{1}{h} - \frac{5}{h} = -\frac{5}{d}$

$\frac{4}{h} = \frac{1}{d}$

$h = \frac{d}{4}$

5см

25см

$D_1 = \frac{1}{20} - \frac{1}{25} = \frac{5}{100} - \frac{4}{100} = \frac{1}{100}$

$D_2 = \frac{1}{5}$

$\frac{\frac{1}{h}}{\frac{1}{h} - \frac{1}{d}} = 5$

$\frac{1}{h} = \frac{5}{h} - \frac{5}{d}$

$+\frac{4}{h} = +\frac{5}{d}$ $h = \frac{4d}{5} = 20$

$\frac{\frac{1}{5}}{\frac{5}{25} - \frac{4}{25}} = \frac{1}{20}$ $\frac{\frac{1}{5}}{\frac{4}{25}} = \frac{4}{1}$

$\frac{1}{20}$

$\frac{1}{20 - 10} = 10$

стр 3 чистовик

Задача № 5

$d = 25$ см

h – "ровная" глаза (норма фокус)

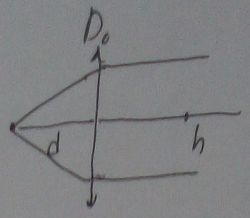
D_0 – сила глаза

D_1 – сила дальнего очков

D_2 – сила ближнего очков

$\frac{D_2}{D_1} = 5$

1)



лучи параллельны – зрение нет, он реально не различает в d, т.е. в фокусе

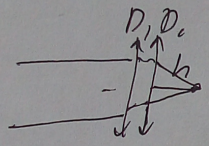
$\Rightarrow F_0 = d \Rightarrow D_0 = \frac{1}{d} = \frac{1}{0{,}25\text{ м}} = 4$ дптр.

f – расстояние чтения

тогда:

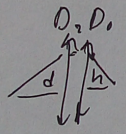
$\frac{1}{f} + \frac{1}{h} = D_0 \quad \frac{1}{f} = D_1 - \frac{1}{h} = \frac{hD_0 - 1}{h} \quad f = \frac{h}{hD_0 - 1}$

• дальнее очки:



$\frac{1}{h} = D_0 + D_1 \; ; \; D_1 = \frac{1}{h} - D_0 = \frac{1}{h} - \frac{1}{d}$

• БЛИЖНИЕ:



$\frac{1}{d} + \frac{1}{h} = D_0 + D_2 \; ; \; D_2 = \frac{1}{d} + \frac{1}{h} - D_0 = \frac{1}{d} + \frac{1}{h} - \frac{1}{d} = \frac{1}{h}$

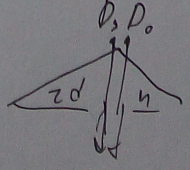
$\frac{D_2}{D_1} = 5 \Rightarrow D_2 = 5D_1 \Rightarrow \frac{1}{h} = 5\left(\frac{1}{h} - \frac{1}{d}\right)$

$\frac{1}{5h} = \frac{d-h}{hd}$, $d - h = \frac{d}{5}$, $h = d - \frac{d}{5} = \frac{4}{5}d = 20$ см

$\Rightarrow f = \frac{0{,}2}{0{,}2 \cdot 4 - 1} = \frac{0{,}2}{0{,}8 - 1} = -1$ м $\Rightarrow$ ЭТОТ ЧЕЛОВЕК НЕ МОЖЕТ ЧИТАТЬ САМ

$D_1 = \frac{1}{h} - \frac{1}{d} = \frac{1}{0{,}2} - \frac{1}{0{,}25} = 5 - 4 = 1$ дптр

2) $\frac{1}{2d} + \frac{1}{h} = D_0 + D_3$



$2d = 50$ $\quad \frac{1}{2d} + \frac{1}{h} = \frac{1}{d} + D_3$

$D_3 = \frac{1}{h} - \frac{1}{2}\frac{1}{d} = \frac{1}{0{,}2} - \frac{1}{2}\frac{1}{0{,}25} = 5 - 2 = 3$ дптр

Ответ:

1) ~~нет~~

$D_1 = 1$ дптр

2) $D_3 = 3$ дптр.