

Часть 1

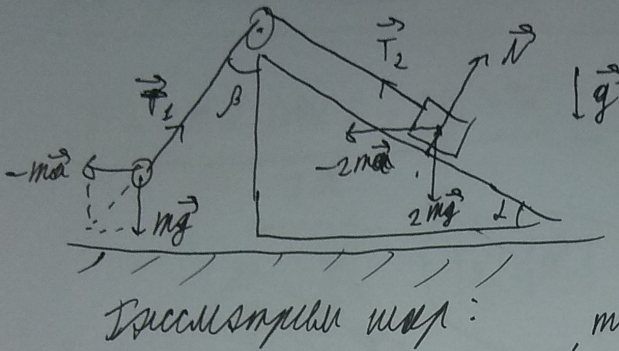
Олимпиада: **Физика, 11 класс (1 часть)**

Шифр: **21201270**

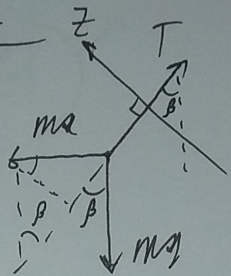
ID профиля: **220378**

Вариант 6

1 задача решим 1): Керамический в КНС клина, тогда возникнет сила трения $-m\vec{a}$ и $-2m\vec{a}$

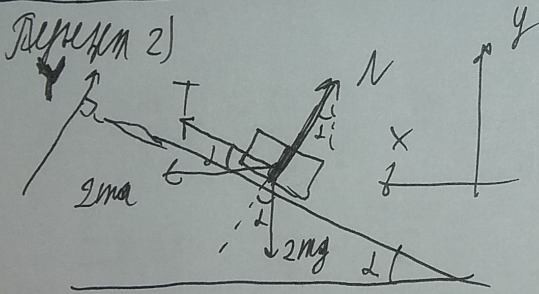


$|\vec{T}_1| = |\vec{T}_2| = T$, н.к.
 число неизвестных.

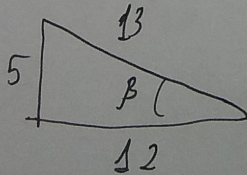
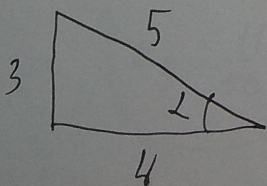


$a_z = 0$
 \downarrow
 $m a \cdot \cos \beta - m g \cdot \sin \beta = 0$
 \downarrow
 $\tan \beta = \frac{a}{g}$

$a = g \cdot \tan \beta = \frac{5g}{12}$



$a_y = 0$
 \downarrow
 $2mg \cdot \cos \alpha + 2ma \cdot \sin \alpha = N$
 \downarrow
 $N = 2mg \cdot \frac{4}{5} + 2m \cdot \frac{5g}{12} \cdot \frac{3}{5} =$
 $= mg \left(\frac{2^3}{5} + \frac{5 \cdot 2 \cdot 3}{2 \cdot 5} \right) = mg \left(\frac{8}{5} + \frac{1}{2} \right) =$
 $= mg \frac{21}{10} = N$



$\sin \alpha = \frac{3}{5}$
 $\sin \beta = \frac{5}{13}$
 $\tan \beta = \frac{5}{12}$
 $\tan \alpha = \frac{3}{4}$

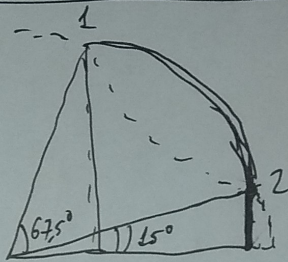
Учимосеб, Базисом 11-06 грозина.

$$-\frac{7}{5} \cdot \frac{p}{V} = -\frac{p_0^2}{V_0^2} \cdot \frac{V}{p} \rightarrow \frac{7}{5} \cdot \frac{p^2}{V^2} = \frac{p_0^2}{V_0^2}$$

$$\hookrightarrow \frac{7}{5} \cdot \frac{(p/p_0)^2}{(V/V_0)^2} = 1$$

$$\hookrightarrow \frac{(p/p_0)^2}{(V/V_0)^2} = \frac{5}{7} = \tan^2 \theta \rightarrow \theta = \arctan \frac{\sqrt{5}}{\sqrt{7}} \approx 35,5^\circ$$

Пример 3: $\eta = \frac{A_2}{A_{12}}$



$$Q_{12} = \Delta u_{12} + A_{12} \rightarrow Q_{12} - |Q_{21}| = A_{12} \approx Q_{12}$$

$$Q_{21} = \Delta u_{21} + A_{21}$$

$$\hookrightarrow \eta = \frac{Q_{12}}{A_{12}} = \frac{\Delta u_{12} + A_{12}}{A_{12}} = 1 + \frac{\frac{5}{2} \gamma R \Delta T_{12}}{A_{12}}$$

$$A_{12} = \left(\pi \gamma^2 \cdot \frac{1}{4} \right) \cdot \frac{67,5^\circ}{90^\circ} - \frac{1}{2} \cdot \frac{(p_1/p_0) \cdot (V_1/V_0)}{2} - \left(\pi \gamma^2 \cdot \frac{15^\circ}{360^\circ} - \frac{(p_2/p_0)(V_2/V_0)}{2} \right) =$$

$$\gamma = \frac{p_0}{p} = \frac{V_0}{V} = 1$$

$$= \frac{\pi \gamma^2}{360^\circ} (67,5^\circ - 15^\circ) - \frac{p_1 V_1 + p_2 V_2}{2 p_0 V_0} =$$

$$= \pi \gamma^2 \cdot \frac{52,5}{360} - \frac{\gamma R (T_1 + T_2)}{2 p_0 V_0} = \pi \cdot \frac{52,5}{360} - \frac{\gamma R (T_1 + T_2)}{2 p_0 V_0}$$

$$\eta = 1 + \frac{52,5}{360}$$

5

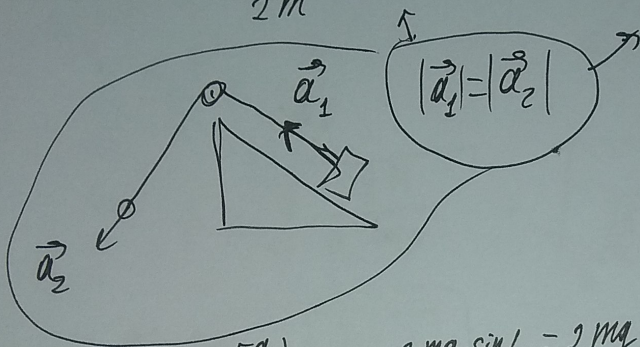
Yucmsblik, Bayram 11-06, qizilna.

$$2m \cdot a_x = 2m \left(\frac{5g}{12} \right) + T \cdot \cos \alpha - N \cdot \sin \alpha$$

$$2m a_y = T \cdot \sin \alpha + N \cdot \cos \alpha - 2mg$$

m.x. qizilna kummi nasmsaxeta mo:

$$\frac{T + 2ma \cdot \cos \alpha - 2mg \cdot \sin \alpha}{2m} = \frac{mg \cdot \cos \beta + ma \cdot \sin \beta - T}{m}$$



$$\textcircled{T} + 2m \cdot \left(\frac{5g}{12} \right) \cdot \cos \alpha - 2mg \cdot \sin \alpha = 2mg \cdot \cos \beta + 2ma \cdot \sin \beta - 2T$$

$$T = \frac{2mg}{3} \left(\cos \beta + \frac{5}{12} \cdot \sin \beta - \frac{5}{12} \cos \alpha + \sin \alpha \right) = \frac{2mg}{3} \left(\frac{12}{13} + \frac{5}{12} \cdot \frac{5}{13} - \frac{5}{12} \cdot \frac{4}{5} + \frac{3}{5} \right) =$$

$$= \frac{2mg}{3} \left(\frac{12 \cdot 12 + 5 \cdot 5 - 4 \cdot 13}{12 \cdot 13} + \frac{3}{5} \right) = \frac{2mg}{3} \left(\frac{13(13-4)}{12 \cdot 13} + \frac{3}{5} \right) = \frac{2mg}{3} \left(\frac{1}{4} + \frac{1}{5} \right) =$$

$$= 2mg \cdot \frac{9}{20} = \frac{9mg}{10} = T$$

$$2ma_x = 2m \left(\frac{5g}{12} \right) + \frac{9mg}{10} \cdot \frac{3}{5} - \frac{21}{10} mg \cdot \frac{3}{5} = \frac{22}{75} mg$$

$$2ma_y = \frac{9mg}{10} \cdot \frac{3}{5} + \frac{21}{10} mg \cdot \frac{4}{5} - 2mg = \frac{11}{50} mg$$

$$\begin{aligned} \rightarrow a_x &= \frac{11}{75} g \\ a_y &= \frac{11}{100} g \end{aligned} \rightarrow a_{2m} = g \sqrt{\frac{11^2}{75^2} + \frac{11^2}{100^2}} = 11g \sqrt{\frac{1}{3^2 \cdot 5^4} + \frac{1}{2^4 \cdot 5^4}} =$$

$$= \frac{11}{25} g \cdot \sqrt{\frac{1}{9} + \frac{1}{16}} = \frac{11}{60} g = a_{2m}$$

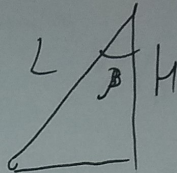
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Учсмавук, Вэршан 11-06. гугава.

перекит 3): кангэй $a_2 = \frac{m_1 \cdot \cos \beta + m_2 \cdot \sin \beta - T}{m} =$

$$= g \cdot \frac{12}{13} + \frac{5g}{12} \cdot \frac{5}{13} - \frac{9g}{10} = \frac{11}{60} g$$

$$\frac{a_2 t^2}{2} = L \rightarrow$$



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

$$t = \sqrt{\frac{2H}{a_2 \cdot \cos \beta}} = \sqrt{\frac{2H}{\frac{11}{60} g \cdot \frac{12}{13}}} = \sqrt{\frac{2 \cdot 5 \cdot 13 H}{11 g}}$$

$$t = \sqrt{\frac{130 \cdot H}{11 \cdot g}}$$

Онбем: 1) $a = \frac{5g}{12}$;

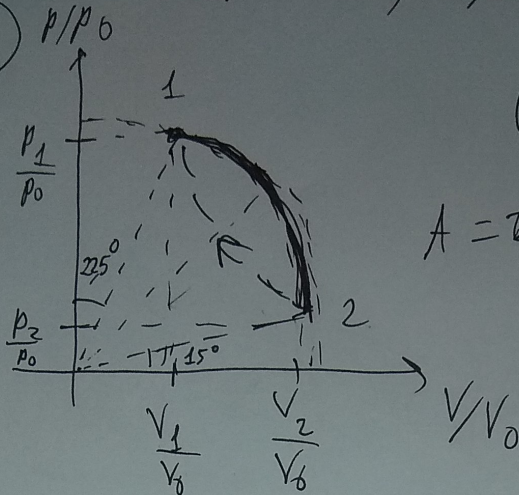
2) $a_{2m} = \frac{11}{60} g$;

3) $t = \sqrt{\frac{130 \cdot H}{11 \cdot g}} \approx 3,44 \sqrt{\frac{H}{g}}$;

Учсмабек, Вазирлар 11-06, 9/12/2017.

Зангирова 2

Решение 1):



$$\left(\frac{p_1}{p_0}\right)^2 + \left(\frac{v_1}{v_0}\right)^2 = \left(\frac{p_2}{p_0}\right)^2 + \left(\frac{v_2}{v_0}\right)^2$$

$$A = \tan(22.5^\circ) = \frac{v_1/v_0}{p_1/p_0} = \frac{p_0}{v_0} \cdot \frac{v_1}{p_1}$$

$$B = \tan(15^\circ) = \frac{p_2/p_0}{v_2/v_0} = \frac{v_0}{p_0} \cdot \frac{p_2}{v_2}$$

$$p_1 v_1 = \gamma RT_1$$

$$p_2 v_2 = \gamma RT_2$$

$$\rightarrow \frac{T_1}{T_2} = \frac{p_1 v_1}{p_2 v_2} = \frac{p_1^2 \left(\frac{A v_0}{p_0}\right)^2}{p_2^2 \left(\frac{B p_0}{v_0}\right)^2} = \frac{p_1^2 v_0^2 A^2}{p_2^2 p_0^2 B^2} = \frac{p_1^2 v_0^2 A^2}{p_2^2 p_0^2 B^2}$$

$$A \cdot B = \frac{p_2 v_1}{p_1 v_2}$$

$$A \cdot B = \frac{v_1}{p_1} \cdot \frac{p_2}{v_2} \rightarrow p_1 = \left(\frac{p_2 v_1}{A B v_2}\right)^2$$

Решение 2):

$$C = \frac{dQ}{dT} = \frac{d(\delta u + A_2)}{dT} = \frac{\left(\frac{5}{2} p dV + \frac{5}{2} V dp + p dV\right)}{dT}$$

$$= \frac{7}{2} p \frac{dV}{dT} + \frac{5}{2} V \frac{dp}{dT} = 0$$

$$\rightarrow 7 p dV = -5 V dp$$

$$-\frac{5}{7} \cdot \frac{V}{p} = \frac{dV}{dp} \rightarrow -\frac{7}{5} \frac{p}{V} = \frac{dp}{dV}$$

$$\left(\frac{p}{p_0}\right)^2 + \left(\frac{v}{v_0}\right)^2 = \gamma^2 \rightarrow 0 = \frac{2p dp}{p_0^2} + \frac{2v dv}{v_0^2}$$

$$\rightarrow \frac{2p dp}{p_0^2} = -\frac{2v dv}{v_0^2} \rightarrow \frac{dp}{dV} = -\frac{p_0^2 v}{v_0^2 p}$$

4

Часть 2

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

Шифр: **21201270**

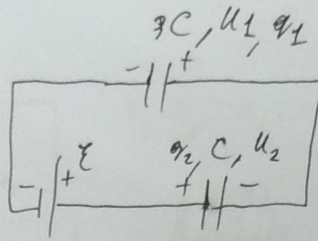
ID профиля: **220378**

Вариант 6

Условие. Варшент 11-06. Физика

Задача 3

Перемычка 1



$$U_1 + U_2 = \epsilon$$

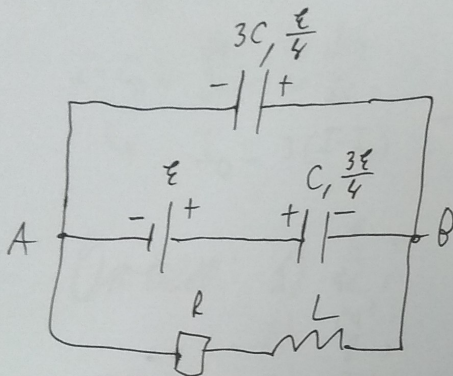
$$3CU_1 = CU_2$$

$$\downarrow (q_1 = q_2)$$

$$U_1 = \frac{\epsilon}{4}$$

$$U_2 = \frac{3\epsilon}{4}$$

Ищем:
справа после замыкания $I=0$.



$$U_B - U_A = \frac{\epsilon}{4} = L \frac{dI}{dt}$$

$$\hookrightarrow \left(\frac{dI}{dt} = -\frac{\epsilon}{4L} \right)$$

В конце: [Перемычка 2]

$$U_2 = 0 = U_B - U_A = -U_1 + \epsilon$$

$$U_1 = \epsilon$$

$$A_{\text{ист}} = \Delta W + Q$$

$$Q = \epsilon (CU_1 - \frac{3\epsilon}{4}) - \left(\frac{CU_1^2}{2} + 0 - \frac{C(\frac{3\epsilon}{4})^2}{2} - \frac{3C \cdot (\frac{\epsilon}{4})^2}{2} \right) =$$

$$= C\epsilon \cdot \frac{\epsilon}{4} - \left(\frac{C\epsilon^2}{2} - \frac{C \cdot 9\epsilon^2}{32} - \frac{3C \cdot \epsilon^2}{32} \right) =$$

$$= \frac{C\epsilon^2}{4} - \frac{16 - 9 - 3}{32} \cdot C\epsilon^2 =$$

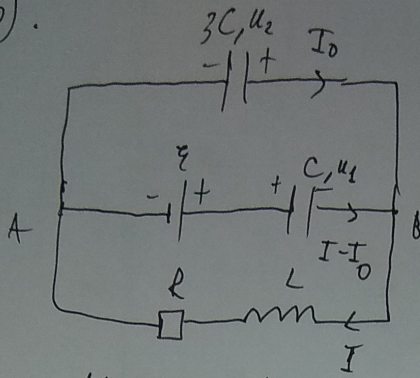
$$= C\epsilon^2 \left(\frac{1}{4} - \frac{4}{32} \right) = \frac{C\epsilon^2}{8}$$

$$Q = \frac{C\epsilon^2}{8}$$

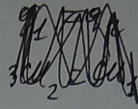
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Учурсбек, багвартам 11-06. гэгээний.

Түгээм 3):



$$u_0 - u_A = u_2 = -u_1 + \epsilon = L \frac{dI}{dt} + IR$$



$$I_0 = \frac{-dq_2}{dt} = \frac{-d(3Cu_2)}{dt} = -3C \frac{du_2}{dt} = 3C \cdot \frac{-d(-u_1 + \epsilon)}{dt} = +3C \frac{du_1}{dt}$$

$$I - I_0 = \frac{dq_1}{dt} = C \frac{du_1}{dt}$$

$$\hookrightarrow I_0 = 3(I - I_0)$$

$$\rightarrow 4I_0 = 3I$$

$$I = \frac{4I_0}{3} \rightarrow \left(U_R = I_A = \frac{4I_0 R}{3} \right)$$

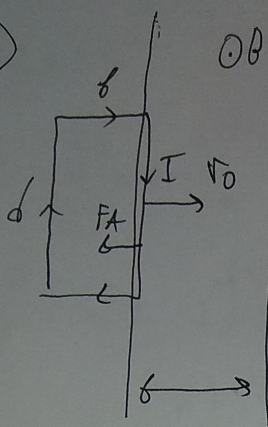
Омбөр: 1) $\frac{\epsilon}{4L}$;

2) $\frac{C\epsilon^2}{8}$;

3) $\frac{4I_0 R}{3}$;

Загвар 1

Төгсгөл 1:



$$|\mathcal{E}| = \left| \frac{d\Phi}{dt} \right| = \frac{B \cdot d^2}{dt} = B \cdot d \cdot v_0 = B v_0 d$$

$$I = \frac{|\mathcal{E}|}{R} = \frac{B v_0 d}{R}$$

$$F_A = B \cdot \left(\frac{B v_0 d}{R} \right) d = \frac{B^2 v_0 d^2}{R}$$

$$a = \frac{F_A}{m} = \frac{B^2 v_0 d^2}{mR} \quad (\text{булс})$$

~~Загвар 2~~ Төгсгөл 2:

Хэрэв гэрэлтэй хөдөлгөөн бол, үс $v = \text{const}$, м.к $F=0 \rightarrow a=0$.

$$\begin{cases} v_0 t - \left(\frac{B^2 v_0 d^2}{mR} \right) \frac{t^2}{2} = b \\ v_1 = v_0 - \left(\frac{B^2 v_0 d^2}{mR} \right) t \end{cases}$$

$$v_0 \cdot \frac{v_0 - v_1}{a} - \frac{1}{2} \cdot \frac{(v_0 - v_1)^2}{a^2} =$$

$$= \frac{2v_0(v_0 - v_1) - (v_0 - v_1)^2}{2a}$$

$$= \frac{(v_0 - v_1)(2v_0 - v_0 + v_1)}{2a} =$$

$$= \frac{v_0^2 - v_1^2}{2a} = b$$

$$\rightarrow v_1^2 = v_0^2 - 2ab$$

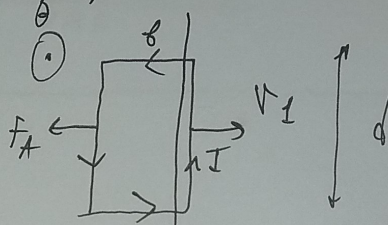
$$v_1 = \sqrt{v_0^2 - \frac{2B^2 v_0 d^2 \cdot b}{mR}}$$

$$= \sqrt{v_0^2 - \frac{2B^2 v_0 d^2 \cdot d}{mR \cdot 2}}$$

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

Энэ бичлэг нь

Төгсгөл 3:



$$|\mathcal{E}| = \left| \frac{d\Phi}{dt} \right| = B \cdot v_1 d$$

$$I = \frac{B v_1 d}{R}; F_A = \frac{B^2 v_1 d^2}{R}$$

$$a_2 = \frac{B^2 v_1 d^2}{mR} \quad (\text{булс})$$

$$\begin{cases} v_1 t - \frac{B^2 v_1 d^2}{mR} \cdot \frac{t^2}{2} = b \\ v_2 = v_1 - \frac{B^2 v_1 d^2}{mR} \cdot t \end{cases}$$

$$v_1 \cdot \frac{v_2 - v_1}{-a_2} + \frac{1}{2} \cdot \frac{(v_2 - v_1)^2}{a_2^2} =$$

$$= \frac{(v_2 - v_1)(2v_1 + v_2 - v_1)}{2a_2} = \frac{v_2^2 - v_1^2}{2a_2} = b$$

Ученский, Вадим 11-06, физика

$$v_2^2 = -2a_2 b + v_1^2 = v_0^2 - \frac{\theta^2 v_0 d^3}{2mR} - \frac{\theta^2 d^3}{2} \cdot \frac{\theta^2 v_1^2}{mR} \cdot v_1 =$$
$$= v_0^2 - \frac{\theta^2 v_0 d^3}{2mR} - \frac{\theta^2 d^3 v_1}{2mR} = v_0^2 + \frac{\theta^2 d^3 (v_1 + v_0)}{2mR}$$

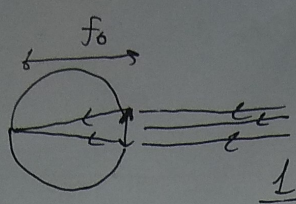
↓
Ответ: 1) $a = \frac{\theta^2 v_0 d^2}{mR}$

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

3) $v_2 = \sqrt{v_1^2 + \frac{\theta^2 v_1 d^3}{2mR}} =$

$$= \sqrt{v_0^2 + \frac{\theta^2 d^3 (\sqrt{v_0^2 - \frac{\theta^2 v_0 d^3}{2mR}} + v_0)}{2mR}}$$

Задача 5
Решит 1):



свет от удаленных тел

$$D_0 = D_1$$

$$D_{\text{глаза}} + D_{\text{увеличитель}} = \frac{1}{f_0}$$

$$\frac{1}{\infty} + \frac{1}{f_0} = \frac{1}{f_0}$$

$$D_{\text{глаза}} + D_2 \text{ перемы} = \frac{1}{d_0} + \frac{1}{f_0}$$

$$D_0 + D_1 = \frac{1}{f_0}$$

$$\frac{D_{\text{увеличитель}}}{D_2 \text{ перемы}} = \frac{7}{3} = \frac{D_1}{D_2}$$

$$D_0 + \frac{3D_1}{7} = \left(\frac{1}{f_0} + \frac{1}{d_0}\right) = D_0 + D_1 + \frac{1}{d_0}$$

$$\frac{3}{7} D_1 = D_1 + \frac{1}{d_0}$$

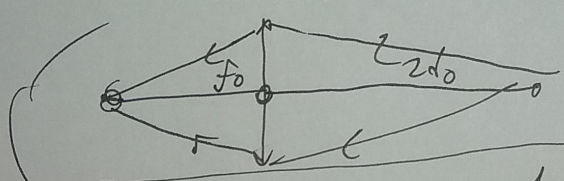
$$\frac{-4}{7} D_1 = \frac{1}{d_0}$$

$$D_1 = -\frac{7}{4d_0} = -\frac{7}{4 \cdot 0.25 \text{ м}} = -7 \text{ диоптр.}$$

$$1 \text{ диоптр.} = \text{м}^{-1}$$

Решит 2):

$$D_0 + D_3 = \frac{1}{f_0} + \frac{1}{2d_0} = D_0 + D_1 + \frac{1}{2d_0}$$

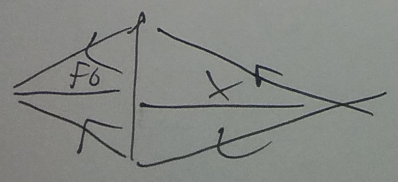


$$D_3 = D_1 + \frac{1}{2d_0} = \left(-7 + \frac{1}{2 \cdot 0.25 \text{ м}}\right) \text{ диоптр.} = -5 \text{ диоптр.}$$

~~Ответ: 1) D_1 = -7 диоптр.~~

Решит 1): выражение:

$$D_0 = \frac{1}{f_0} + \frac{1}{x} = D_0 + D_1 + \frac{1}{x} \rightarrow D_1 + \frac{1}{x} = 0$$



Умножить, барусем 11-06, глызана.

$$D_1 \neq \frac{1}{x} = 0 \rightarrow \frac{1}{x} = -D_1 \rightarrow x = -\frac{1}{D_1} = \frac{1}{7} \mu$$

$$1 \text{ гмм} = \mu^{-1}$$

↓

Орбем: 1) $x = \frac{1}{7} \mu \hat{=} 14,3 \text{ см}; D_1 = -7 \text{ гмм.}$

2) $D_3 = -5 \text{ гмм.}$