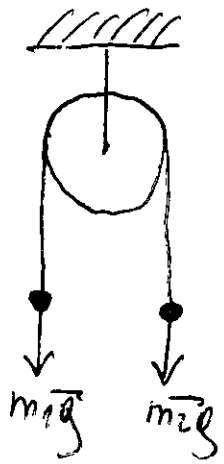
ФР-11-32С-7

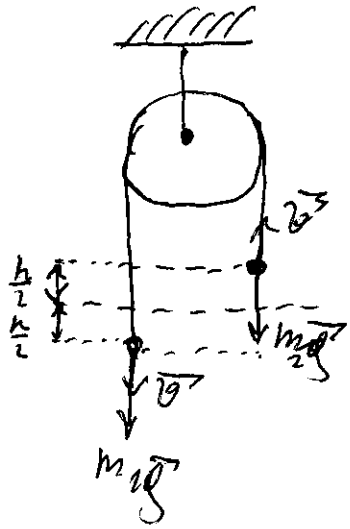
1	2	3	4	5	сум	%
10	10	10	10	10	50	100

№1

Дано:
$m_1; m_2; h; g$
$m_1 > m_2$
$v - ?$

Решение:





10б

$$E_{п1} + E_{к1} = E_{п2} + E_{к2}$$

$$0 = -m_1 g\frac{h}{2} + m_2 g\frac{h}{2} + \frac{m_1 v^2}{2} + \frac{m_2 v^2}{2}$$

$$(m_1 - m_2) g h = v^2 (m_1 + m_2)$$

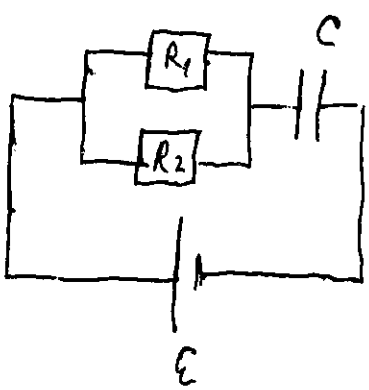
$$v = \sqrt{\frac{(m_1 - m_2) g h}{m_1 + m_2}}$$

Ответ: $v = \sqrt{\frac{(m_1 - m_2) g h}{m_1 + m_2}}$

№4

Дано:
$R_1; R_2; C; \mathcal{E}$
$q_1 - ?$
$q_2 - ?$

Решение:



$$I_1 R_1 = I_2 R_2$$

$$\frac{dq_1}{dt} R_1 = \frac{dq_2}{dt} R_2$$

$$q_1 R_1 = q_2 R_2$$

10б

$$q = C\mathcal{E} = q_1 + q_2 = q_1 + q_1 \frac{R_1}{R_2}$$

$$q_1 = \frac{C\mathcal{E}R_2}{R_1 + R_2} \qquad q_2 = \frac{C\mathcal{E}R_1}{R_1 + R_2}$$

Ответ: $q_1 = \frac{C\mathcal{E}R_2}{R_1 + R_2}$; $q_2 = \frac{C\mathcal{E}R_1}{R_1 + R_2}$

№5

Дано:

$\mathcal{E}_1 = 2\ В$

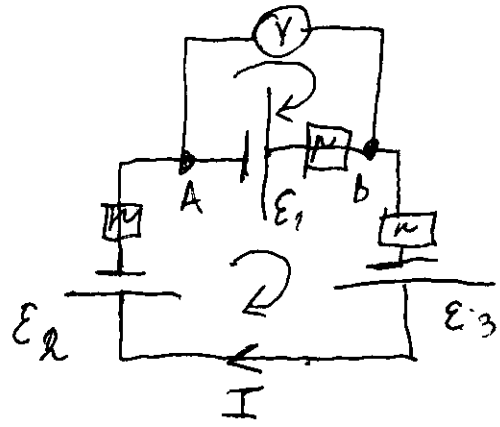
$\mathcal{E}_2 = 3\ В$

$\mathcal{E}_3 = 4\ В$

$r_1 = r_2 = r_3 = r = 1\ Ом$

$U_{AB} - ?$

Решение:



$3Ir = \mathcal{E}_1 + \mathcal{E}_3 - \mathcal{E}_2$

$I = \frac{\mathcal{E}_1 + \mathcal{E}_3 - \mathcal{E}_3}{3r} = 1\ А$

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$U_{AB} - Ir = -\mathcal{E}_1$

$U_{AB} = Ir - \mathcal{E}_1 = -1\ В$

Ответ: $-1\ В$

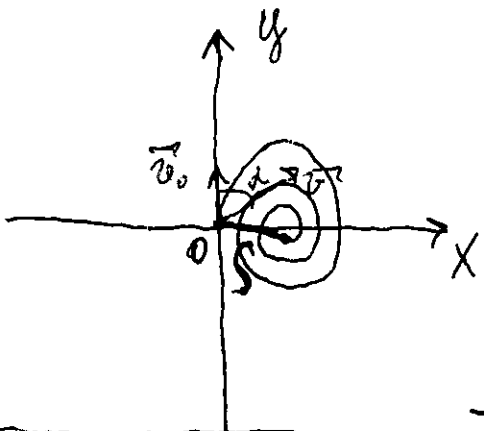
№2

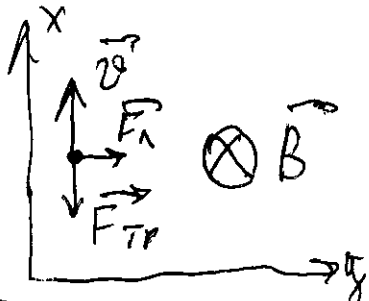
Дано:

$k; L_1; B; q$

$S - ?$

Решение:





$S = \sqrt{x^2 + y^2}$

$F_{тр} = -kv$

$-kv = ma_x = m\frac{dv}{dt}$

$1 = \frac{-m}{kv}\frac{dv}{dt}$

$\int 1\,dt = \int -\frac{m}{kv}\frac{dv}{dt}\,dt$

$t + C = -\frac{m}{k}\ln v \Rightarrow v = e^{-\frac{k}{m}t + \frac{k}{m}C}$

$$x = \frac{v_0}{-\left(w^2 + \frac{k^2}{m^2}\right)} e^{-\frac{k}{m}t}\left(w\cos wt + \frac{k}{m}\sin wt\right) + C_1$$

$$x(0) = 0 = \frac{v_0}{-\left(w^2 + \frac{k^2}{m^2}\right)} \cdot w + C_1$$

$$C_1 = \frac{v_0 w}{w^2 + \frac{k^2}{m^2}} \; ; \; x(\infty) = C_1$$

Аналогично к найдём y.

$$y = \frac{v_0}{-\left(w^2 + \frac{k^2}{m^2}\right)} e^{-\frac{k}{m}t}\left(\frac{k}{m}\cos wt - w\sin wt\right) + C_2$$

$$y(0) = 0 = \frac{v_0}{-\left(w^2 + \frac{k^2}{m^2}\right)} \cdot \frac{k}{m} + C_2$$

$$C_2 = \frac{v_0\left(\frac{k}{m}\right)}{w^2 + \frac{k^2}{m^2}} \; ; \; y(\infty) = C_2$$

$$S = \sqrt{x^2(\infty) + y^2(\infty)} = \sqrt{C_1^2 + C_2^2} = \frac{v_0}{w^2 + \frac{k^2}{m^2}}\sqrt{w^2 + \frac{k^2}{m^2}} = \frac{v_0}{\sqrt{w^2 + \frac{k^2}{m^2}}} =$$

$$= \frac{L_1 k}{m\sqrt{\frac{B^2q^2}{m^2} + \frac{k^2}{m^2}}} = \frac{L_1 k}{\sqrt{B^2q^2 + k^2}}$$

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Ответ: $S = \frac{L_1 k}{\sqrt{B^2q^2 + k^2}}$

$v = v_0 e^{-\frac{k}{m}t}$ 9-11-326-7

$F_л = qvB = ma_n = m\frac{v^2}{R} \Rightarrow v = \frac{qBR}{m}$

$\omega = \frac{v}{R} = \frac{qB}{m} \Rightarrow \alpha = \omega t = \frac{qB}{m}t$

если нет магнитного поля, то частица проходит путь L_1, рассмотрим этот случай:

$v = v_0 e^{-\frac{k}{m}t}$

$L = \int v\,dt = v_0 \int e^{-\frac{k}{m}t}\,dt = -v_0\frac{m}{k}e^{-\frac{k}{m}t} + C$

$L(\infty) = C = L_1$

$L(0) = -v_0\frac{m}{k} + L_1 \Rightarrow v_0 = \frac{L_1 k}{m}$

рассмотрим случай с магнитным полем

$v_x = v_0 e^{-\frac{k}{m}t}\sin\omega t = -i v_0 e^{-\frac{k}{m}t} Im(e^{i\omega t})$

$v_y = v_0 e^{-\frac{k}{m}t}\cos\omega t = v_0 e^{-\frac{k}{m}t} Re(e^{i\omega t})$

$X = \int v_x\,dt = -i v_0 Im\left(\int e^{-\frac{k}{m}t}\cdot e^{i\omega t}\,dt\right) = -i v_0 Im\left(\int e^{t(i\omega - \frac{k}{m})}\,dt\right) =$

$= -i v_0 Im\left(\frac{e^{t(i\omega-\frac{k}{m})}}{i\omega - \frac{k}{m}}\right) = -i v_0 e^{-\frac{k}{m}t} Im\left(\frac{e^{i\omega t}(i\omega + \frac{k}{m})}{(i\omega - \frac{k}{m})(i\omega + \frac{k}{m})}\right) =$

$= -i v_0 e^{-\frac{k}{m}t} Im\left(\frac{(\cos\omega t + i\sin\omega t)(i\omega + \frac{k}{m})}{-\omega^2 - \frac{k^2}{m^2}}\right) = -i\frac{v_0 e^{-\frac{k}{m}t}}{-\omega^2 - \frac{k^2}{m^2}}$ •

• $Im\left(i\omega\cos\omega t - \omega\sin\omega t + \frac{k}{m}\cos\omega t + i\frac{k}{m}\sin\omega t\right) = \frac{v_0 e^{-\frac{k}{m}t}}{-(\omega^2 + \frac{k^2}{m^2})}\left(-i\left(i\omega\cos\omega t + i\frac{k}{m}\sin\omega t\right)\right)$

$= \frac{v_0}{-(\omega^2 + \frac{k^2}{m^2})} e^{-\frac{k}{m}t}\left(\omega\cos\omega t + \frac{k}{m}\sin\omega t\right) + C_1$

№3 Ф-11-326-7

Дано:
$P_1; V_1$
$P = kV + P_0$
$T(P)$-?

Решение:

$$\begin{cases} P_1 = kV_1 + P_0 \\ 3P_1 = 2kV_1 + P_0 \end{cases}$$

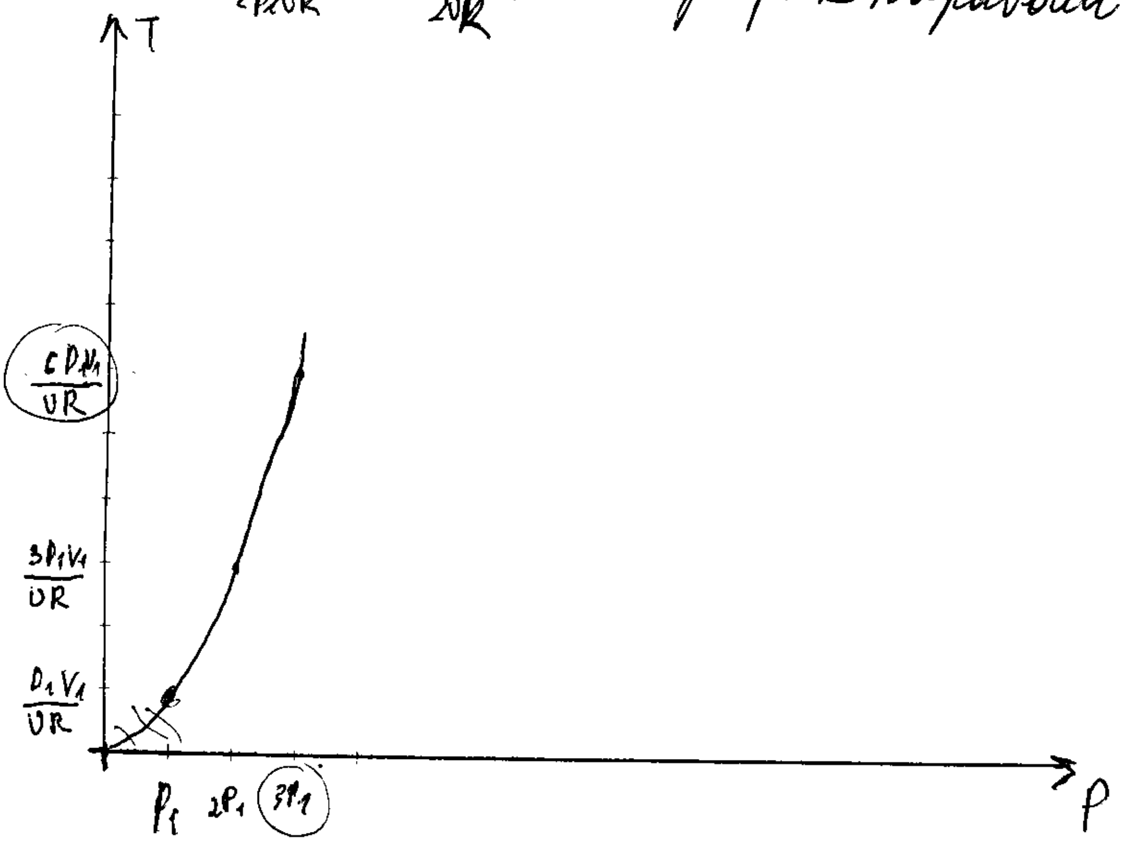
$2P_1 = kV_1$

$k = \frac{2P_1}{V_1}$ $P_0 = -P_1$ $\Rightarrow$ $P = \frac{2P_1}{V_1}V - P_1$

$V = \frac{V_1}{2P_1}P + \frac{V_1}{2}$

$PV = \nu RT = \frac{V_1}{2P_1}P^2 + \frac{V_1}{2}P$

$T = \frac{V_1}{2P_1\nu R}P^2 + \frac{V_1}{2\nu R}P$ – график парабола



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