1. Дано:

$N = 60$

$t = 60$ с

$v_{max} = 0{,}5$ м/с

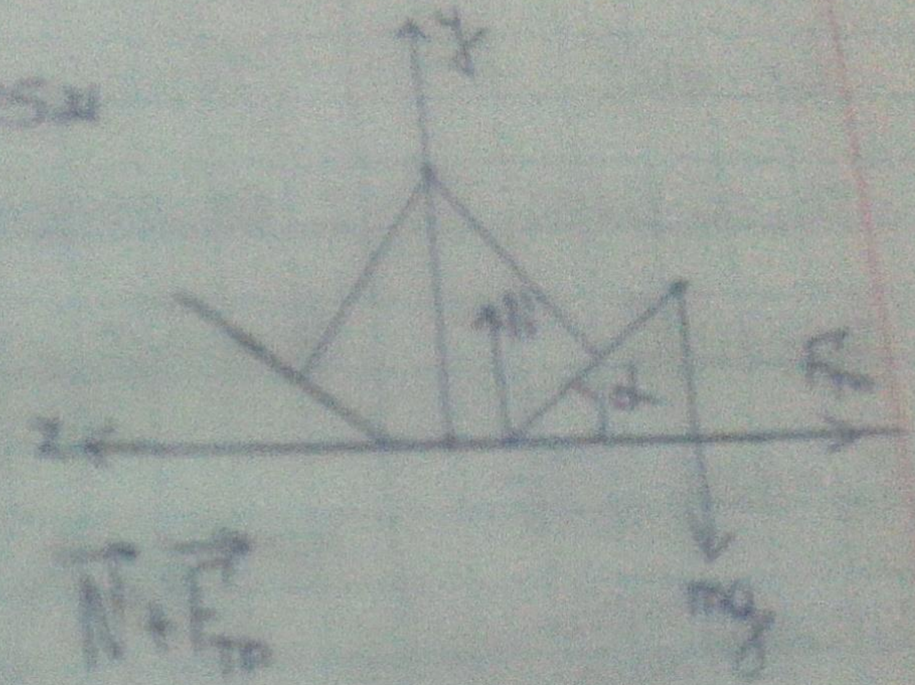
$\mu - ?$

Решение:

$t = 60$ с проедет: $0{,}5 \cdot 60 = 30$ м

$h_{ш} = \frac{30}{120} = 0{,}25$ м

$L_{max} = ?$ м



$\vec{N} + \vec{F}_{тр}$

$F_{тр} = kN$

$\mu = \frac{F_{тр}}{N} = tg\alpha$

$\mu = tg\alpha = \frac{\frac{h}{2}}{\sqrt{L^2 - \left(\frac{h}{2}\right)^2}} = \frac{\frac{0{,}25}{2}}{\sqrt{1 - \left(\frac{0{,}25}{2}\right)^2}} \approx 0{,}126$

Ответ: $\mu = 0{,}126$

$$\mu = \frac{F_{тр}}{N} = tg\varphi$$

$$\mu = tg\varphi = \frac{\frac{h}{2}}{\left(\frac{l}{2}\right)} = \frac{\frac{0{,}25}{2}}{\left(\frac{2}{2}\right)} \approx 0{,}126$$

Ответ: $\mu = 0{,}126$

2. Дано:

L

L_1

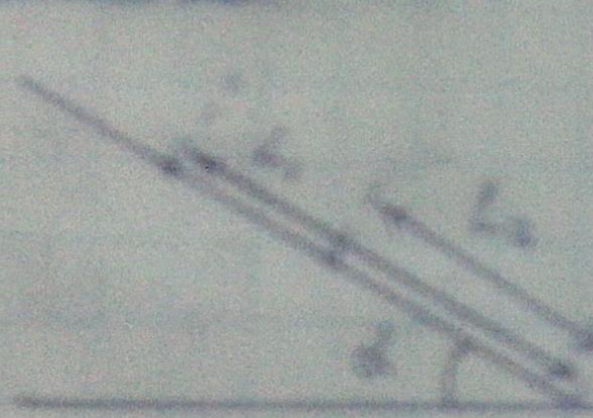
L_2

α

g

$t - ?$

Решение:



$$t_1 = \sqrt{\frac{2L_1}{g\sin\alpha}} \qquad t_2 = \sqrt{\frac{2L_2}{g\sin\alpha}}$$

$$t = t_2 + \frac{(t_1 - t_2)v_2}{v_1 - v_2} = \frac{t_1 v_1 - t_2 v_2}{v_1 - v_2}$$

$$t = \sqrt{\frac{2L_1}{g\sin\alpha}} + \frac{2L_2}{g\sin\alpha} = t_1 + t_2$$

Ответ: $t = t_1 + t_2$

$$v_1 = \sqrt{2g\sin\alpha \cdot L_1} \qquad v_2 = \sqrt{2g\sin\alpha \cdot L_2}$$

$$t = \frac{L_1 + S}{v_1} + t_2 + \frac{S}{v_2} \qquad S = \frac{(t_2 - t_1)\, v_1 v_2}{v_1 - v_2}$$

5. Дано:

$m_1 = 1 кг$

$t_1 = -10 °C$

$m_2 = 0,01 кг$

$t_2 = 10 °C$

$c_в = 4200 \frac{Дж}{кг \cdot К}$

$c_л = 2100 \frac{Дж}{кг \cdot К}$

$\lambda = 334 \cdot 10^3 \frac{Дж}{кг}$

$t - ?$

Решение.

1. Вода остывает до 0 °C ⇒ выделяется тепло

$Q_1 = c_в m_2 (t_2 - 0 °C) = 4200 \cdot 0,01 \cdot 10 = 420 Дж$

2. Отвердевание

$Q = \lambda m_2 = 334 \cdot 10^3 \cdot 0,01 = 3340 Дж$ ⇒

$⇒ c_л m_1 (t - t_1) = c_л m_2 (0 °C - t)$

$1 (t + 10) = -10 \cdot 10^{-3} t$

$t = \frac{-10}{1 + 0,01} = -9,9 °C$

Ответ: $t = -9,9 °C$

4. Дано.

Решение.

4 Дано:

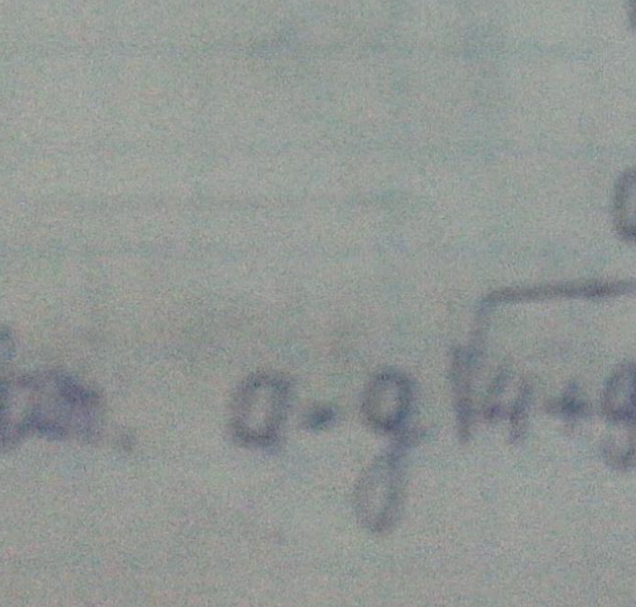
b_m

R

$b_t R$

μ

Решение:



$V = \sqrt{2gR}$

$a = \sqrt{a_\tau^2 + a_n^2}$

$a_n = \frac{V^2}{R} = 2g$

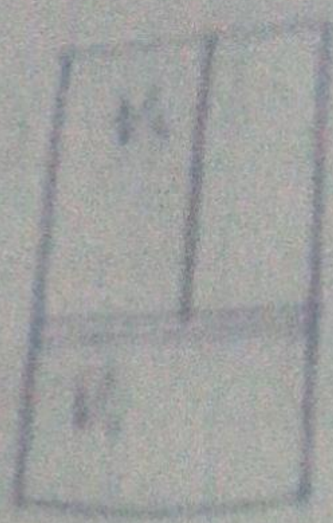
$N - mg = m\frac{V^2}{R}$

$N = 3mg$

$a_\tau = 3\mu g \Rightarrow a = \sqrt{a_\tau^2 + a_n^2} = g\sqrt{4 + 9\mu^2}$

$-g(2 + 3\mu)$

Ответ: $a = g\sqrt{4 + 9\mu^2}$



P_1 давление в верхней части

P_2 давление в нижней части

m - масса поршня

S

$$P_2 - P_1 = \frac{mg}{S} \qquad p = \frac{RT}{V}$$

$$\frac{RT}{V_2} - \frac{RT}{V_1} = \frac{RT'}{V_2'} - \frac{RT'}{V_1'}$$

$$V_1 + V_2 = V' + V'$$

$$\frac{V_2'}{V_1'} = \frac{3}{5}$$

$$T' = T \cdot \frac{\left(\frac{1}{V_2'} - \frac{1}{V_1}\right)\left(\frac{2}{V_2'} - \frac{1}{2V_2'}\right)}{\left(\frac{1}{V_2} - \frac{1}{V_1}\right)\left(\frac{3}{V_2} - \frac{1}{4V_2}\right)} = 2{,}5T$$

Ответ: $2{,}5T$

6. Дано: | Решение:

C_0

ε

E

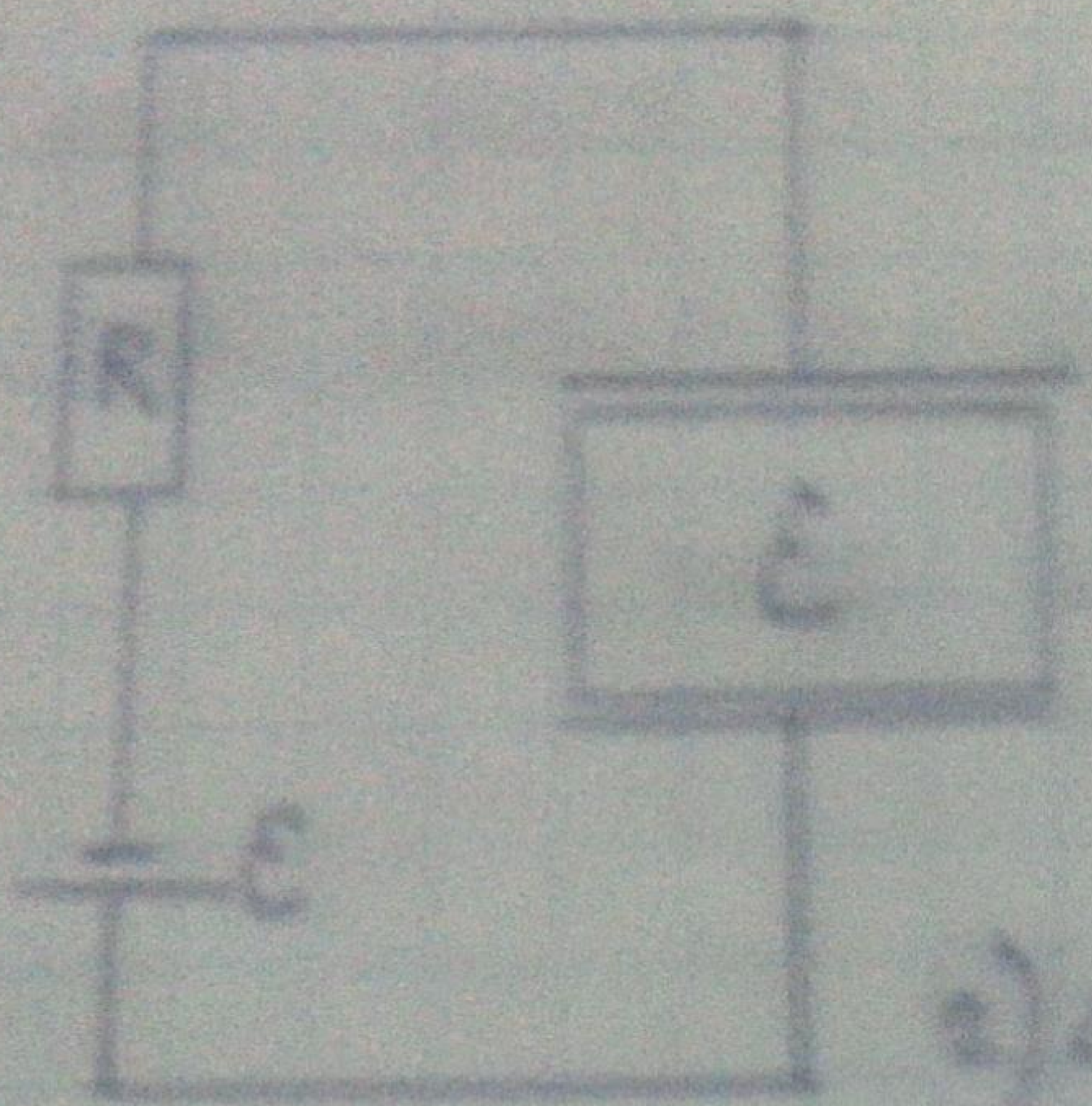
R

1) $A_м - ?$

2) $\Delta W - ?$

3) $A_б - ?$

4) $Q - ?$



1) $A_м = \Delta W_1$

$\Delta W_1 = W_2 - W_1 = \frac{(\varepsilon E C_0)^2}{2C_0} - \frac{(C_0 \varepsilon E)^2}{2\varepsilon C_0} =$

$= \frac{C_0 \varepsilon E^2}{2}(\varepsilon - 1)$ $\quad A_б = 0$

$\Delta q = 0$

2) $\Delta W_2 = W_2 - W_1 = \frac{(C_0 E)^2}{2C_0} - \frac{(\varepsilon C_0 E)^2}{2C_0} =$

$= -\frac{C_0 E^2}{2}(\varepsilon^2 - 1)$

$\Delta q = -C_0 E(\varepsilon - 1)$

3) $A_б = E \Delta q = -C_0 E^2(\varepsilon - 1)$

4) $Q = A_б - \Delta W_2 = \frac{C_0 E^2}{2}(\varepsilon - 1)^2$

Ответ: 1) $A_м = \Delta W_1 = \frac{C_0 \varepsilon E^2}{2}(\varepsilon - 1)$ 2) $\Delta W_2 = -\frac{C_0 E^2}{2}(\varepsilon^2 - 1)$, 3) $A_б = -C_0 E^2(\varepsilon - 1)$

4) $Q = \frac{C_0 E^2}{2}(\varepsilon - 1)^2$

3. Дано:

m

q

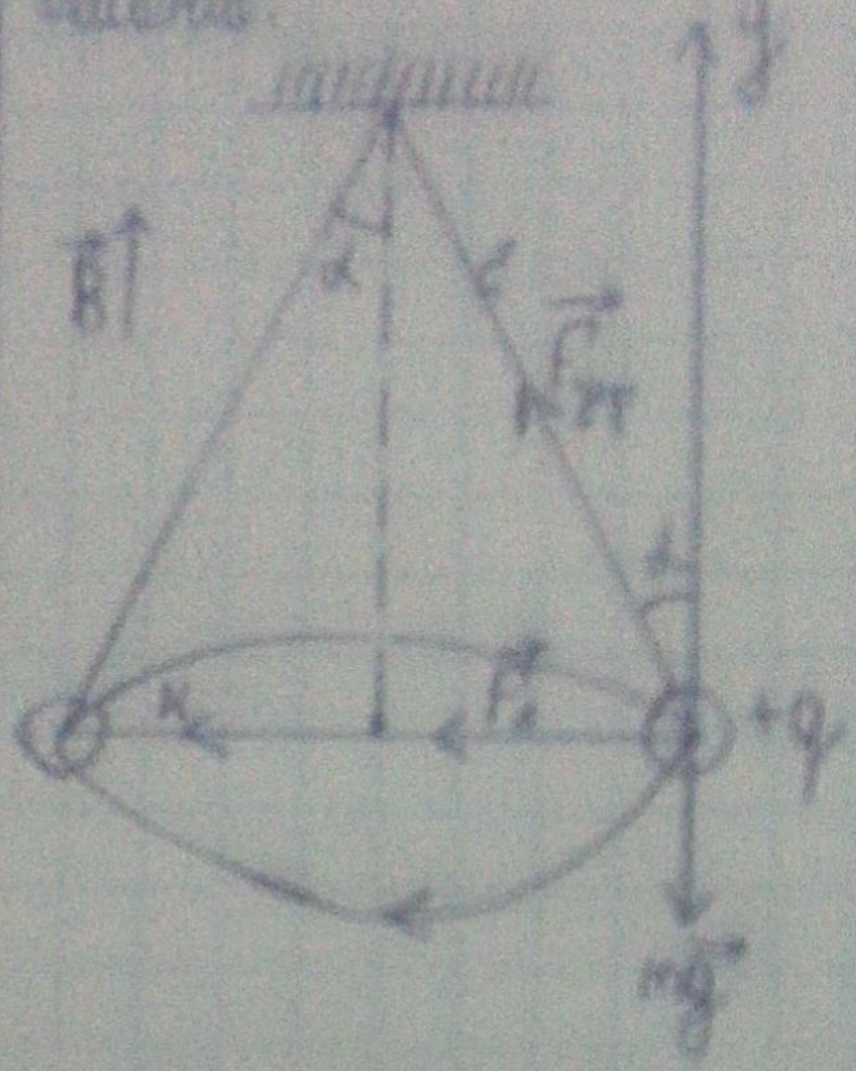
l

B

$\angle\alpha$

E_k - ?

Решение:



$$m\vec{a} = m\vec{g} + \vec{T}_л + \vec{F}_{эл}$$

$$ma_y = F_{эл}\sin\alpha + F_л$$

$$0 = -mg + F_{эл}\cos\alpha$$

$$a_ц = \frac{v^2}{r} \qquad r = l\sin\alpha \qquad F_л = qvB\sin\beta \quad \angle\beta = 90° \Rightarrow$$

$$\Rightarrow F_л = qvB$$

$$\frac{mv^2}{l\sin\alpha} = F_{эл}\sin\alpha \pm qvB$$

$$F_{эл}\cos\alpha = mg$$

$$\frac{ml}{l\sin\alpha}\cdot mg\operatorname{tg}\alpha \pm qvB \Rightarrow v = \left(\pm\sqrt{\frac{B^2q^2}{4m^2} + \frac{g}{l\cos\alpha}} \pm \frac{Bq}{2m}\right)l\sin\alpha$$

$$E_k = \frac{ml^2\sin^2\alpha}{2}\cdot\left(\sqrt{\frac{B^2q^2}{4m^2}l^2 + \frac{g}{l\cos\alpha}} + \frac{Bq}{2m}\right)^2 > 0$$

Ответ: $E_k = \frac{ml^2\sin^2\alpha}{2}\cdot\left(\sqrt{\frac{B^2q^2}{4m^2} + \frac{g}{l\cos\alpha}} + \frac{Bq}{2m}\right)^2$