Часть 1

Олимпиада: **Физика, 9 класс (1 часть)**

Шифр: **21206531**

ID профиля: **818296**

Вариант 3

Чистовик.

задача 1

Дано:

$M = 0{,}45$ кг

$\rho_0 = 1000$ кг/м^3

$\rho = 900$ кг/м^3

$t_1 = 30°C$

$V_1 = 25$ см^3

$\lambda = 3{,}36 \cdot 10^5$ Дж/кг

$c = 4200$ Дж/(кг·°C)

Найти:

1) V_2 – объем подводной части льда

2) $m_в$ – масса добавленной воды

Решение:

1) $Mg = Fa_1$ – сила Архимеда

$Fa_1 = \rho_0 \cdot g \cdot V_{п_1}$ $\quad Mg = \rho_0 \cdot g \cdot V_{п_1} \Rightarrow V_{п_1} = \frac{M}{\rho_0}$

объем льда $- V = \frac{M}{\rho}$ $\quad \boxed{V_2 = V - V_{п_1} = \frac{M}{\rho} - \frac{M}{\rho_0} = M\frac{\rho_0 - \rho}{\rho_0 \rho}} = 0{,}45 \cdot \frac{1000 - 900}{900 \cdot 1000} =$

$= 50$ см$^3 = 5 \cdot 10^{-5}$ м^3

2) $m_в \cdot c \cdot (t_1 - t_0) = \Delta m \lambda$ – масса растаявшего льда $\quad t_0 = 0°C$.

$m_в = \frac{\Delta m \lambda}{c(t_1 - t_0)}$ $\quad (M - \Delta m)g = Fa_2$ $\quad Fa_2 = \rho_0 \cdot g \cdot V_{п_2} \Rightarrow V_{п_2} = \frac{M - \Delta m}{\rho_0}$

$V_1 = V_{п_1} - V_{п_2} = \frac{M}{\rho_0} - \frac{M - \Delta m}{\rho_0} = \frac{\Delta m}{\rho_0} \Rightarrow \Delta m = \rho_0 \cdot V_1$

$\boxed{m_в = \frac{\Delta m \lambda}{c(t_1 - t_0)} = \frac{\rho_0 \cdot V_1 \cdot \lambda}{c(t_1 - t_0)}} = \frac{1000 \cdot 25 \cdot 10^{-6} \cdot 3{,}36 \cdot 10^5}{4200 \cdot 30} = \frac{1}{15}$ кг $= 66{,}67$ гр.

Ответ: 1) $V_2 = 5 \cdot 10^{-5}$ м$^3 = 50$ см^3

2) $m_в = 6{,}67 \cdot 10^{-2}$ кг $= 66{,}67$ гр.

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Чистовик.

задача 2.

Дано:	Найти:
$U_0 = 10 м/с$	1) L
$a = 2 м/с^2$	2) μ
$S = 12 м$	3) T
$g = 10 м/с^2$	4) U_{max}

Решение:

1) $L = U_0 t - \frac{at^2}{2}$ $\quad 0 = U_0 - at \Rightarrow t = \frac{U_0}{a}$

$$\boxed{L = \frac{U_0^2}{a} - \frac{U_0^2}{2a} = \frac{U_0^2}{2a}} = \frac{10^2}{2 \cdot 2} = 25 м.$$

2) $\mu mg = ma_0 \Rightarrow \mu = \frac{a_0}{g}$, где a_0 - ускорение коробка

$S = U_1 t - \frac{a_0 t^2}{2}$, где U_1 - начальная скорость коробка $\quad 0 = U_1 - a_0 t$

$U_1 = a_0 t$

$$S = a_0 t^2 - \frac{a_0 t^2}{2} = \frac{a_0 t^2}{2} = \frac{a_0 U_0^2}{2a^2} \Rightarrow a_0 = \frac{2Sa^2}{U_0^2} = 0{,}96 \; м/с^2; \text{ тогда}$$

$t = \frac{U_0}{a}$ $\quad \boxed{\mu = \frac{2Sa^2}{U_0^2 \cdot g}}$ $\quad \mu = \frac{a_0}{g} = \frac{0{,}96}{10} = 0{,}096$

3) $\boxed{T = t = \frac{U_0}{a}} = 5 сек.$ $\quad$ 4) $\boxed{U_{max} = U_1 = a_0 \cdot t = \frac{a_0}{a} \cdot U_0} = 4{,}8 м/сек.$

Ответ: 1) $L = 25м$ $\quad$ 3) $T = 5 сек$

2) $\mu = 0{,}096$ $\quad$ 4) $4{,}8 м/сек.$

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Чистовик

задача 3

Дано:

$U_0 = 12$ м/с

$tg\,\alpha = \frac{8}{3}$

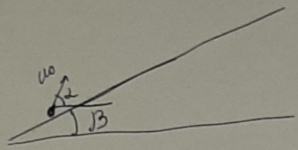
Найти:

1) H

2) $tg\,\beta$

3) T

4) μ



Решение:

1) $\left[H = U_0 \sin\alpha t - \frac{gt^2}{2} = \frac{U_0^2 \sin^2\alpha}{g} - \frac{U_0^2 \sin^2\alpha}{2g} = \frac{U_0^2 \sin^2\alpha}{2g} \right] = 6{,}31$ м.

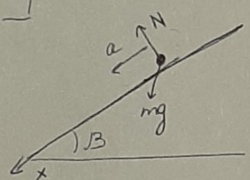
$0 = U_0 \sin\alpha - gt$

$t = \frac{U_0 \sin\alpha}{g}$

$\sin\alpha = \frac{tg\,\alpha}{\sqrt{1+tg^2\alpha}} = \frac{8}{\sqrt{73}}$

2) $\left[tg\,\beta = \frac{H}{L} = \frac{U_0^2 \sin^2\alpha}{2g} \cdot \frac{g}{U_0^2 \cos\alpha \sin\alpha} = \frac{1}{2}\, tg\,\alpha \right] = \frac{8}{6}$

$L = U_0 \cos\alpha\, t = \frac{U_0^2 \cos\alpha \sin\alpha}{g}$



3) $ox: ma = mg \sin\beta \Rightarrow a = g \sin\beta$

$U - a \cos\beta \cdot T = 0 \Rightarrow \left[T = \frac{U}{a \cos\beta} = \frac{U_0 \cos\alpha}{g \sin\beta \cos\beta} = \frac{U_0}{g} \cdot \frac{\cos\alpha \cdot tg\,\beta}{\sin^2\beta} \right] = \frac{12}{10} \cdot \frac{8}{6} \cdot \frac{100}{64} \cdot \frac{3}{\sqrt{73}} =$

$= 0{,}88$ сек.

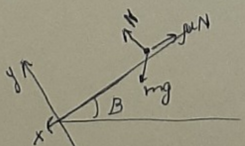
$U = U_0 \cos\alpha$

$\sin\beta = \frac{tg\,\beta}{\sqrt{1+tg^2\beta}} = \frac{8}{10}$

$oy: N = mg \cos\beta$

4) $ox: \mu mg \cos\beta = mg \sin\beta$

$[\mu > tg\,\beta]$ $\quad \mu > \frac{8}{6}$



Ответ: 1) $H = 6{,}31$ м $\quad$ 3) $T = 0{,}88$ сек

2) $tg\,\beta = \frac{8}{6}$ $\quad$ 4) $\mu > \frac{8}{6}$

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Черновик.

$Mg = \rho_0 g V_{n_1}$

$V_{n_1} = \frac{M}{\rho_0}$

$V_0 = V - V_{n_1} = \frac{M}{\rho} - \frac{M}{\rho_0} = \frac{M(\rho_0 - \rho)}{\rho_0 \rho}$

$V = \frac{M}{\rho}$

$m_б \cdot c \cdot \Delta t = \lambda +$

$m_x \cdot c \cdot (t_1 - t_0) = \Delta m \lambda + m_б \cdot c\,(t_0 - t_0).$

$\Delta m g = \rho_0 g V_{n_2}$

$V_{n_2} = \frac{\Delta m}{\rho_0}$

$V_y = V - V_{n_2} = \frac{\Delta m}{\rho} - \frac{\Delta m}{\rho_0} = \frac{\Delta m(\rho_0 - \rho)}{\rho_0 \rho}$

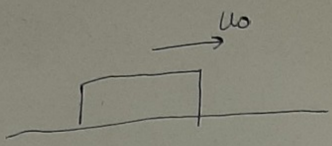
$V = \frac{\Delta m}{\rho}$

$V_0 - V_y = V_1$

$\frac{M(\rho_0 - \rho)}{\rho_0 \rho} - \frac{\Delta m(\rho_0 - \rho)}{\rho_0 \rho} = V_1.$

$\frac{\left(\frac{M(\rho_0 - \rho)}{\rho_0 \rho} - V_1\right)\rho_0 \rho}{\rho_0 - \rho} = \Delta m.$

Черновик



$L = v_0 t - \frac{at^2}{2}$

$v_0 - at = 0$

$v_0 = at$

$t = \frac{v_0}{a}$

$L = 25$ м.

$S = 12$ м

$L = \frac{v_0^2}{a} - \frac{v_0^2}{2a} = \frac{v_0^2}{2a}$

$a_x = 0{,}96$

$S = \frac{a_x t^2}{2}$

$\frac{2S}{t^2} = a_x = \frac{2Sa^2}{v_0^2} = a_x$

$a_x = \mu g$ $\quad \mu = \frac{a_x}{g}$

$\frac{м \cdot м^2 \cdot с^2}{м^2 с^4} = \frac{м}{с^2}.$

$\mu = 0{,}096$

$v_{max} \neq a_x \cdot t$

$0 = v_0 - at$

$v_{max} = a_x \cdot \frac{v_0}{a} = 4{,}8$ м/с

$0 = v_0 - at$

$t = \frac{v_0}{a}$

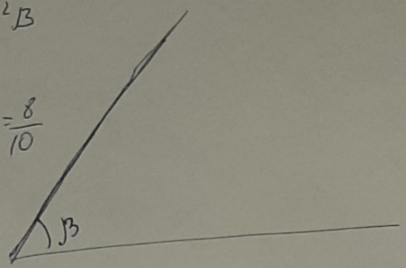
$L = v_0 t - \frac{at^2}{2}$

Черновик

$\sin\beta = \frac{tg\beta}{\sqrt{1+tg^2\beta}}$

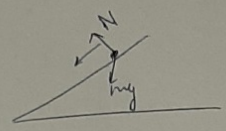
$\mu mg\cos\beta = mg\sin\beta$

$\sin\beta = \frac{8}{6\sqrt{1+\frac{64}{36}}} = \frac{8}{10}$

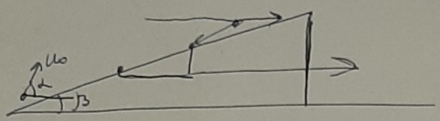


$0 = v_0$

μ



$64 + 36 = 100$



$ma = mg\sin\beta$

$a = g\sin\beta$

$\cancel{H = v_0t - \frac{gt^2}{2}}$

$v - a\cos\beta t = 0$

$t = \frac{v}{a\cos\beta} = \frac{v}{2g\cos\beta\sin\beta}$

$v_0 = v_0\cos\alpha$

$H = v_0\sin\alpha t - \frac{gt^2}{2} = \frac{v_0^2\sin^2\alpha}{g} - \frac{v_0^2\sin^2\alpha}{2g} = \frac{v_0^2\sin^2\alpha}{2g} = \frac{12^2\cdot 64}{73\cdot 2\cdot 10} =$

$v_0\sin\alpha - gt = 0$

$\boxed{6,31\text{ м}}$

$0 =$

$t = \frac{v_0\sin\alpha}{g}$

$\frac{H}{L} =$

$tg\beta = \frac{8}{6}$

$\cos\beta = \frac{\sin}{tg}$

$tg\alpha = \frac{\sin\alpha}{\cos\alpha}$

$tg\alpha = \frac{\sin\alpha}{\sqrt{1-\sin^2\alpha}}$

$tg^2\alpha = \frac{\sin^2\alpha}{1-\sin\alpha^2}$

$L = v_0\cos\alpha\, t = \frac{v_0^2\sin 2\alpha}{2g} =$

$tg^2\alpha - tg^2\alpha\sin^2\alpha = \sin^2\alpha$

$tg^2\alpha = \sin^2\alpha(1+tg^2\alpha)$

$\frac{v_0^2\cos\alpha\sin\alpha}{g} = \frac{144}{10}\cdot\frac{24}{73} = 4,73\text{ м}$

$\sin\alpha = \frac{tg\alpha}{\sqrt{1+tg^2\alpha}} = \frac{8}{3\sqrt{1+\frac{64}{9}}} =$

$\frac{\cancel{v_0^2}\sin^2\alpha}{2\cancel{g}}\cdot\frac{\cancel{g}}{\cancel{v_0^2}\cos\alpha\cancel{\sin\alpha}} = \frac{\sin\alpha}{2\cos\alpha}$

$\frac{8}{\sqrt{73}}$

$\cos\alpha = \sqrt{1-\frac{64}{73}} = \frac{3}{\sqrt{73}}$

Часть 2

Олимпиада: **Физика, 9 класс (2 часть)**

Шифр: **21206531**

ID профиля: **818296**

Вариант 3

Задача 5 Чистовик

Дано:

$U = 6$ В

$P = 1$ Вт

Найти:

1) R

2) R_1

3) P_{max}

Решение:

1) $P = \frac{U^2}{2R} \Rightarrow R = \frac{U^2}{2P} = \frac{36}{2} = 18\ \Omega$

3)
$$P_1 = U_1 \cdot I_1 = (U - I_0 R)\cdot(I_0 - I_2) = (U - I_0R)\left(I_0 - \frac{U - I_0R}{R}\right) =$$

$$(U - I_0R)\left(\frac{2I_0R - U}{R}\right) = \frac{(U - I_0R)(2I_0R - U)}{R} = \frac{2I_0RU - U^2 - 2I_0^2R^2 + UI_0R}{R} =$$

$$\frac{3I_0RU - U^2 - 2I_0^2R^2}{R} = 3I_0U - \frac{U^2}{R} - 2I_0^2R$$

P_1 - max, при $I_0 = \frac{3U}{4R}$ $\quad P_{max} = \frac{9U^2}{4R}^{\cdot 4} - \frac{U^2}{R}^{\cdot 16} - \frac{18U^2}{16R} = \frac{36U^2 - 16U^2 - 18U^2}{16R} = \frac{1}{8}\frac{U^2}{R} =$

$$= \frac{1}{8}\cdot\frac{36}{18} = \frac{1}{4}\ \text{Вт.}$$

2)
$$P_1 = \frac{U_1^2}{R_1} = \frac{(U - I_0R)^2}{R_1} = \frac{\left(U - \frac{U}{R_0}R\right)^2}{R_1} = \frac{U^2}{R_1}\left(1 - \frac{R(R_1 + R)}{2RR_1 + R^2}\right)^2 =$$

$$= \frac{U^2}{R_1}\left(\frac{RR_1}{2RR_1 + R^2}\right)^2 = \frac{U^2R^2R_1}{4R^2R_1^2 + 4R^3R_1 + R^4}$$

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$$4R^2R_1^2P_1 + 4R^3R_1P_1 + R^4P_1 = U^2R^2R_1$$

Ответ: 1) $R = 18\ \Omega$

3) $P_{max} = \frac{1}{4}$ Вт

Чистовик

задача 4

Дано:	Найти:
$R = 6400$ км	1) T
$g = 10$ м/с^2	2) T_1
$R_1 = 2R$	3) υ

Решение:

$$g = \frac{GM}{R^2} \qquad g_0 = \frac{GM}{4R^2} = \frac{g}{4}$$

ускорение свободного падения на расстоянии $2R$.

1) $$T = \frac{2\pi R_1}{\upsilon} = \frac{4\pi R}{\upsilon}$$

$$T_0 = \frac{2\pi R}{\upsilon} \qquad T_0 \upsilon = \frac{T\upsilon}{2} \Rightarrow T = 2T_0 = 2 \cdot 24ч = 48ч. = 172800 \text{ сек.}$$

2) $$T_1 = \frac{T}{4} = 43200 \text{сек} = 12 \text{ часов.}$$

3)

Ответ: 1) $T = 48$ часов

2) $T_1 = 12$ часов.

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~~Чистовик~~ Черновик

Задача 5

Дано:

$U = 6$ В

$P = 1$ Вт

Найти:

1) R

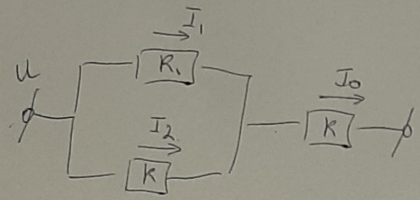
2) R_1

3) P_{max}

Решение:

1) $P = \frac{U^2}{2R} \Rightarrow R = \cancel{\frac{2P}{U^2}} = \frac{U^2}{2P} = \frac{36}{2} = 18\Omega$

2)



$$P_1 = I_1^2 \cdot R_1 = \left(\frac{U_1}{R_1}\right)^2 \cdot R_1 = \frac{(U - I_0 R)^2}{R_1}$$

$$U_1 = (U - I_0 R)$$

$$I_0 = \frac{U}{R_0}$$

$$P_1 = \frac{U_1^2}{R_1}$$

$$\frac{\left(U\left(1 - \frac{R}{R_0}\right)\right)^2}{R_1} =$$

$$\frac{R^2 R_1 U^2}{(2RR_1 + R^2)^2}$$

$$U\left(1 - \frac{R(R_1 + R)}{2RR_1 + R^2}\right.$$

$$\left(\frac{RR_1 U}{\quad}\right)^2$$

Черновик

$$P_1 = I_1^2 \cdot R_1 = (I_0 - I_2)^2 \cdot R_1 = \left(\frac{U}{R_0} - \frac{U_1}{R}\right)^2 \cdot R_1 \quad \left(\frac{UR - UR_0 + I_0 R R_0}{R_0 R}\right)^2 R_1$$

$(UI_0 - I_0^2 R)(R + R_1)$

$UI_0R + UI_0R_1 - I_0^2R^2 + I_0^2 RR_1$ $UR - U \cdot \frac{2RR_1 + R^2}{R_1 + R} + I_0 \cdot R \cdot \frac{2RR_1 + R^2}{R_1 + R}$ $\frac{U^2}{(2R_1 + R)^2} = P_1$

$P = U_1 \cdot I_1$ $UI_0R + UI_0R_1 - I_0^2R^2 - I_0^2RR_1 - U^2 + UI_0R.$

$(U - I_0R)\left(I_0 - \frac{(U - I_0R)}{R_1}\right)$ $2UI_0R - I_0^2R(R + R_1)R \cdot \frac{2RR_1 + R^2}{R + R}$ $\frac{U^2 \cdot R^4}{(R+R_1)^2 \cdot R^2 \cdot \frac{(2RR_1 + R^2)^2}{(R+R_1)^2}}$

$\frac{I_0R_1 - U + I_0R}{R_1} \cdot (U - I_0R)$

$\frac{2R_1R + R^2}{R_1 + R}$ $2UR - U\frac{2RR_1 + R^2}{R_1 + R}$

$\frac{I_0(R + R_1) - U}{R_1}$

$\frac{1}{R_1} + \frac{1}{R}$ $\frac{R_1R}{R + R_1} + R.$ $R \cdot \left(\frac{2RR_1 + R^2}{R_1 + R}\right)$

$D = (4R - 1)^2 - 16R^2$

$\frac{I_0(U - I_0R)(R + R_1) - U(U - I_0R)}{R_1}$ $U \Big| \; 2RR_1 + 2R^2 - 2RR_1$

$16R^2 - 8R + 1 - 16R^2$

$1 - 8R$

$2R - R_0 = 2R - \frac{2RR_1 + R^2}{R + R_1}$ $2R^2$ $\frac{3R^2}{R_1 + R} \cdot U$ $U_1 = U - I_0R$

$\frac{2R^2 + \cancel{2RR_1} - \cancel{2RR_1} - R^2}{R + R_1} = \frac{R^2}{R + R_1}$ $\frac{3\cancel{R^2} \cdot U}{\cancel{R^2}(2R_1 + R)} = \frac{3U}{2R_1 + R} \cdot R_1$ $R_1 = 4R_1^2 + 4R_1R + R^2$

$4R_1^2 + R_1(4R - 1) + R^2 = 0$

$$P_1 = I_1^2 \cdot R_1 = (I_0 - I_2)^2 R_1 = \left(\frac{U}{R_0} - \frac{U_1}{R}\right)^2 \cdot R_1 = \left(\frac{UR - U_1R_0}{R_0R}\right)^2 R_1 = \left(\frac{UR - R_0(U - I_0R)}{R_0R}\right)^2$$

$U^2 \cdot R^2$ $\left(\frac{UR - UR_0 + I_0RR_0}{R_0R}\right)^2 R_1 = \left(\frac{2UR - UR_0}{R_0R}\right)^2 R_1$ $\frac{U^2}{(2R_1 + R)^2} = P_1$

$\frac{U^2R}{2R_1 + R}$ $\frac{U^2(2R - R_0)^2}{R_0^2R^2} R_1$ $\frac{U^2 \cdot R^2}{\cancel{(R+R_1)^2} \cdot \cancel{R^2} \cdot (2RR_1 + R^2)^4}$

$$P_1 = U_1 \cdot I_1 = (U - I_0 R)(I_0 - I_2) = (U - I_0 R)\left(I_0 - \frac{U - I_0 R}{R}\right) =$$

$$(U - I_0 R)\left(\frac{2I_0 R - U}{R}\right)$$

$$\frac{(U - I_0 R)(2 I_0 R - U)}{R}$$

$$2 I_0 R U - U^2 - 2 I_0^2 R^2 + U I_0 R$$

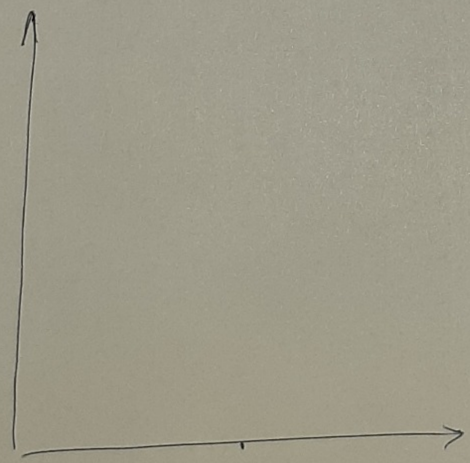
$$\frac{3 U I_0 R - 2 I_0^2 R^2 - U^2}{R}$$

$$3 U I_0 - 2 I_0^2 R - \frac{U^2}{R} = P$$

$$m = -\frac{b}{2a}$$

$$\frac{3U}{4R} \qquad \frac{3}{4}\frac{U}{R} = P_{max}$$

$$\boxed{\frac{3}{4}\frac{U}{R} = I_0}$$



U_1

$I_1^2 R_1$

$$3U \cdot \frac{3U}{4R} - 2\frac{9U^2}{16R^2} - \frac{U^2}{R}$$

$$\frac{9U^2}{4R} - \frac{18U^2}{16R^2} - \frac{U^2}{R}$$

$$\frac{5U^2 \cdot 4R}{4R} - \frac{18U^2}{16R^2}$$

$$\frac{20U^2 R - 18U^2}{16R^2} = P_{max}$$

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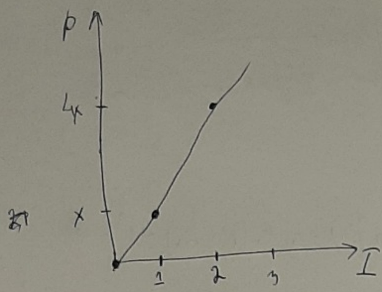
$$P = I^2 \cdot \frac{(2R_1 + R)R}{R_1 + R} \quad -x$$

$$a u^2 \cdot A^2$$

$$A^2 \cdot a u$$

$$P = UI = I^2 \cdot R$$



$$P = \frac{U^2}{R_1} = \frac{(U - I_0 R)^2}{R_1}$$

$$P = I_1^2 \cdot R_1 =$$

$$U_1 = U - I_0 R.$$

$$P = I^2 \cdot R_1$$

$$P_{max} = I^2 \cdot R_1 = \frac{(U - I_0 R)^2}{R_1} = \frac{U^2 - 2I_0 \cancel{R}U + I_0^2 R^2}{R_1}$$

$$\left(\frac{U}{R_1}\right)^2 \quad U = U - I_0 R$$

$$I = \frac{U_1}{R_1} = \frac{U - I_0 R}{R_1}$$

$$a^2 \quad ax^2 + bx + c = 0$$

$$(x - m)^2 + n$$

$$\frac{(U - I_0 R)^2}{R_1^2} \cdot R_1 = P$$

$$P_1 = U_1 \cdot I_1 = (U - I_0 R)\frac{U_1}{R_1} = \frac{(U - I_0 R)^2}{R_1} \quad m = -\frac{b}{2a}$$

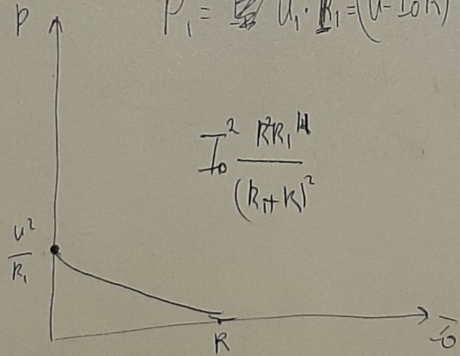
$$\frac{(U - I_0 R)^2}{R_1} = P$$

$$\frac{\cancel{2}R}{\cancel{2}R^2} = \boxed{R}$$

$$I_0^2 \frac{R R_1^{1/4}}{(R_1 + R)^2}$$

$$\frac{2UR}{2R^2} = \boxed{\frac{U}{R}}$$

$$\frac{U^2 - 2I_0 R U + I_0^2 R^2}{R_1} = P$$



$$2R_1 R + R^2 - R R_1 - R^2$$

$$\frac{I_0^2 R_1^2 R^2}{R_1 + R}$$

$$P_1 = \frac{U_1^2}{R_1} = \frac{(U - I_0 R)^2}{R_1}$$

$$U = I_0 R_0 = I_0 \cdot \frac{(2R_1 + R)R}{R_1 + R}$$

$$2R R_1 + R^2 - R R_1 - R^2$$

$$P_1 = \frac{\left(I_0 \frac{R R_1}{R_1 + R}\right)^2}{R_1}$$

$$\frac{R_1^2 R^2}{R_1 + R} = R_1$$

$$U = I_0 \cdot \frac{2RR_1 + R^2}{R_1 + R} - I_0 R$$

$$R_1^2 R^2 = R_1^2 + R_1 R.$$

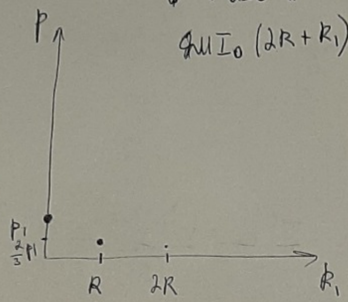
$R_0 = \frac{2RR_1+R^2}{R_1+R}$

$P = I^2 \cdot \frac{2RR_1+R^2}{R_1+R}$

$P = U^2 \cdot \frac{R_1+R}{2RR_1+R^2} = \boxed{\frac{U^2}{R}} \frac{R_1+R}{2R_1+R} = P_1 \cdot \frac{R_1+R}{2R_1+R} = P_1 \frac{R_1+R}{2R_1+R}$

$2UI_0R$

$2UI_0(2R+R_1) - I_0^2R(R+R_1) - U^2 = P$



$P = I^2 \cdot \frac{2RR_1+R^2}{R_1+R} = \frac{R(2R_1+R)}{R_1+R} \cdot I^2$

$(R_1+R)x = 2R_1+R$

$R_1x + Rx = 2R_1+R$

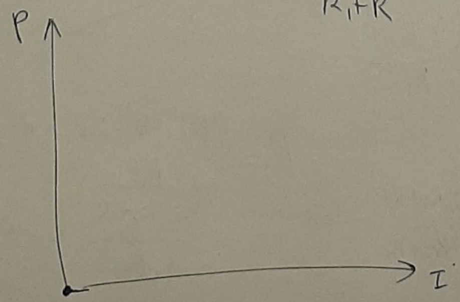
$P = 4I^2 \cdot R^2 \frac{R_1+R}{R(2R_1+R)} = 4I^2 \frac{R(R_1+R)}{2R_1+R}$

$P = I^2 \cdot \frac{R(2R_1+R)}{R_1+R}$

$P = \frac{U^2}{2R}$

$2RP = U^2$

$R = \frac{U^2}{2P}$



$P = I^2 \cdot R = UI = \frac{U^2}{R}$ $\quad P = I_a^2 \cdot R$

$mg = \frac{GmM}{R^2}$

$g = \frac{GM}{R^2}$

$R_1 \cdot (I_0 - I_2)^2$

$I_2 = \frac{U_1}{R} = \frac{U - I_0 R}{R}$ $\quad g_0 = \frac{GM}{4R^2}$

$R_1 \left(I_0 - \frac{U - I_0 R}{R}\right)^2$

$P = I^2 \cdot \frac{R_1 R + R^2}{R_1 + R}$

$U = I R_0 = I \cdot \frac{R_1 R + R^2}{R_1 + R}$ $\quad -\frac{U}{R}$ $\quad \frac{U^2}{R^2} R_1 = P_1$

$\frac{2 I_0 R - U}{R}$

$P = U^2 \cdot \frac{R_1 + R}{R_1 R + R^2}$

$I_2 R = U_1 = U - I_0 R$ $\quad I = U^2$

$-\frac{GMm}{R} = \frac{mU^2}{2} - \frac{GMm}{2R}$

$I_2 = \frac{U - I_0 R}{R}$ $\quad \frac{U}{R} - I_0$

$\frac{R_1}{R^2} \cdot 4 I_0^2 R^2 - 4 I_0 R U + U^2$

$P = U^2 \frac{R_1 + R}{R_1 R + R^2} = \frac{\frac{R_1}{R} + 1}{R_1 + R} = \frac{\frac{1}{R}(R_1 + R)}{R\left(\frac{R_1}{R} + 1\right)}$

$-\frac{GM}{2R} = \frac{U^2}{2}$

$\frac{GM}{R} = U^2$

$P = P_1 \quad \frac{R_1 + R}{R_1 + R}$

$\frac{1}{R_1} + \frac{1}{R} \quad \frac{R_1 + R}{R_1 R}$

$U = \sqrt{-\frac{GM}{R}}$

$P_0 = U^2 \frac{R_1 + R}{R(2RR_1 + R^2)}$

$\frac{R_1 R}{R_1 + R} + R$

$P_0 = P \frac{R_1 + R}{2R_1 + R}$

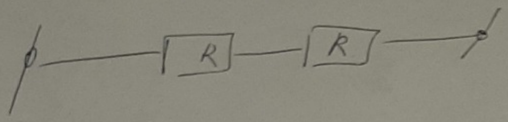
P_{max} $\quad R_1 + R > 2R_1 + R$

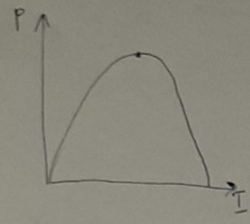
$\boxed{R_1 > 2R_1}$

$\frac{R_1 R + RR_1 + R^2}{R_1 + R}$ $\quad \frac{2RR_1 + R^2}{R_1 + R}$

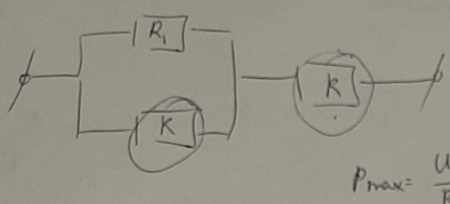
$P_0 = 1 \cdot \frac{1 + 18}{2 + 18} = \frac{19}{20}$ $\quad \frac{20}{22}$ $\quad \frac{10}{11}$

21206531 (U818296 M1278711)





$P = \frac{U^2}{2R}$ $R = \frac{U^2}{2P} = \frac{36}{2} = 18\,\Omega$



$P = UI$

$P = I^2 \cdot R_1$

$P_{max} = I^2 \cdot R_1$

$P_{max} = \frac{U^2}{R_1}$

$P_{max} = \frac{U^2}{R_1}$

$P_2 = \frac{U^2}{R} = \frac{\cancel{R_1}}{2}$

$P_{max} = I^2 \cdot R_1$

$P_{max} = \frac{U^2}{R_1}$

$R_1 < R$

P_{max} при $R_1 \to 0$

$I = \frac{\lambda\Pi}{u} = \frac{\lambda\Pi R}{U}$ ~~$u = ut$~~ $U = u \cdot R$

$V = \frac{\lambda\Pi R}{u}$

$I_1 R_1 = I_2 \cdot R$

$I_1 = I_0 - I_2$

$U = I_0 \cdot \left(\frac{R_1 R}{R_1 + R} + R\right)$

$\frac{1}{R_1} + \frac{1}{R} = \frac{R_1 + R}{R_1 R}$

$I_1 R_1 + I R = I R + I_2 R_x$

$I_1 R_1 = (I - I_1) R$

$R_1 = \frac{I - I_1}{I_1} R$

$\frac{R_1 R}{R_1 + R} + R_x = \boxed{\frac{2RR_1 + R^2}{R_1 + R}}$