Часть 1

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

Шифр: **21205360**

ID профиля: **313153**

Вариант 2

Чистовик

№3

Дано:
$U_0 = 6$ В
$P_1 = 2{,}4$ Вт
$P_2 = 0{,}5$ Вт

I_1 – ?
I_2 – ?
$P_{1ч}$ – ?
$R_{2ч}$ – ?

$P_1 = \frac{U_0^2}{R}$

$2{,}4 = \frac{6^2}{R_1}$

$2{,}4 R_1 = 36$

$R_1 = 15$ Ом

$I_1^2 R_1 = 2{,}4$

$I_1^2 = \frac{2{,}4}{15}$

$I_1^2 = \frac{0{,}8}{5}$

$I_1^2 = 0{,}16$ А

$I_1 = 0{,}4$ А

$P_2 = \frac{U_0^2}{3R}$

$1{,}5R = 36$

$R = 24$

$I_2 \cdot 15 = 0{,}5$

$P_2 = \frac{U_0^2}{9R_2}$

$4{,}5 R_2 = 3 \cdot 6$

$R_2 = 8$

$I_2^2 R_2 = 0{,}5$

$I_2^2 = 0{,}0625$

$I_2 = 0{,}25$ А

Ответ: $I_1 = 0{,}4$ А; $I_2 = 0{,}25$ А

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Чистовик

№1

Дано: τ, g

t_{x2} - ?

$h_и$ - ?

v - ?

~~$t_{ип1} = \frac{v}{g}$~~

~~$t_{x2} = \tau - t_{ип1} = t_x \quad \tau - \tau\frac{v}{g}$~~

$t_2 = \tau - t_{иа}$

$l_{иа} = $ ~~$\frac{(g \cdot t_2)^2}{2} + v \cdot \tau - t_x$~~ $\frac{g \cdot t_2^2}{2} + v_и \cdot t_2 - \frac{g \cdot t_2^2}{2} \neq$

$l_{иа} = v_и \cdot t_2$

~~$t_и$~~ $= t_{иа} = \frac{v_и}{g}$

$l_{иа} = v_и \cdot t_{иа} - \frac{g \cdot t_{иа}^2}{2} =$ ~~$v_и \cdot t_{иа} - 0{,}5$~~ $\frac{v_и^2}{g} - 0{,}5\frac{v_и^2}{g} = 0{,}5\frac{v_и^2}{g}$

$0{,}5\frac{v_и^2}{g} = v_и\tau - \frac{v_и^2}{g}$

$v_и\tau = 1{,}5\frac{v^2}{g}$

$v_и = \frac{\tau g}{1{,}5}$

$t_2 = \tau - \frac{v}{g}$

$t_2 = \tau - \frac{\tau g}{1{,}5} : g$

$t_2 = \tau - \frac{2}{3}\tau = \frac{1}{3}\tau$

$l_{иа} = \frac{1}{2} \cdot \left(\frac{\tau^2 g^2}{2{,}25} : g\right) = \frac{\tau^2 g}{4{,}5}$

Ответ: $t_{x2} = \frac{1}{3}\tau$; $l_{иа} = \frac{\tau^2 g}{4{,}5}$; $v_и = \frac{\tau g}{1{,}5}$

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№2

Дано:

$S = 9\ см^2$

$H_ж = 20\ см$

$m_л = 250\ г$

$\rho_в = 1000\ кг/м^3$ | $1\ г/см^3$

$P_0 = 100\ кПа$

$g = 10\ м/с^2$

$P_л$ – ?

$m_{по}$ – ?

$h_ц$ – ?

СИ:

Чистовик

~~т.к. всё везде сверху есть воздух~~

т.к. воздух давит на поршень и на открытую часть воды, то P_0 можно убрать

$P_л = \frac{F_{дл}}{S}$

$F_{дл} = S \cdot H \cdot \rho_в \cdot g = 2 \cdot 9 \cdot 1 \cdot 0{,}01 = 1{,}8\ Н$

$P_л = \frac{F_{дл}}{S} = 0{,}2\ кПа$

$F_{дпо} = F_{дв} \cdot F_{дл} - F_л = g \cdot m_л - 1{,}8 = 250 \cdot 0{,}01 - 1{,}8$

$= 2{,}5 - 1{,}8 = 0{,}7\ Н$

$m_{по} = \frac{F_{дпо}}{g} = \frac{0{,}7}{0{,}01} = 70\ г$

$h_ц = \frac{F_{дпо} - F_{дц}}{S \cdot g \cdot \rho_в}$

$h_ц = \frac{0{,}7 - \frac{F_{дц}}{10}}{0{,}9 \cdot 0{,}01 \cdot 1} = \frac{0{,}7 - 0{,}25}{9 \cdot 0{,}01} = \frac{0{,}45}{0{,}01 \cdot 9} = 5\ см$

Ответ: $P_л = 0{,}2\ кПа$; $m_{по} = 70\ г$; $h_ц = 5\ см$

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Чернов

$2,4 = \frac{36}{R}$

$2,4R = 36$

$R = \frac{36}{2,4} = 15$

$\frac{U_0^2}{9} R = 24$

$U_0^2 R = 216.$

$36R = 216$

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$R = 6$

Черновик

№1

1) $t_м = \frac{v}{g}$ $t_л = \tau - t_м$

2) $l_м = v \cdot t = \frac{v^2}{g} - \frac{g \cdot v^2}{2} = 0{,}5\frac{v^2}{g}$

$\frac{g(\tau - t_м)^2}{2} + v \cdot (\tau - t_м) - \frac{g \cdot (\tau - t_м)^2}{2} =$

$= l_м$

$v \cdot (\tau - \frac{v}{g}) = l_м$

$v\tau - \frac{v^2}{g} = 0{,}5\frac{v^2}{g}$

$1{,}5\frac{v^2}{g} = v\tau$

3) $v = \frac{\tau g}{1{,}5}$

№2

1) $F_g = S \cdot l \cdot \rho_в \cdot g = 20 \cdot 9 \cdot 1 \cdot 0{,}01 = 1{,}8$ Н

$P = \frac{F}{S} = 20 \cdot 10 \cdot 1 \cdot 0{,}01 = 0{,}2$ Па

I^2R

2) $F_2 = 250 \cdot 0{,}01 = 2{,}5$ Н

$F_л = F_2 - F_g = 0{,}7$ Н

3) $F_{выт2} = \frac{F_л}{10} = 0{,}25$ Н

$F_{g2} = |F_{л2} - F_{выт1}| = 0{,}45$ Н

$F_{g2} = S \cdot l_2 \cdot \rho_в \cdot g = 9 \cdot 0{,}01 \cdot 10 \cdot l_2 = 0{,}09 l_2$

$0{,}45 = 0{,}09 l_2$

$l_2 = 5$ см

№3

$\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{R_2R_3 + R_1R_3 + R_1R_2}{R_1R_2R_3} = \frac{3R^2}{R^3} = \frac{3}{R}$

$R_0 = \frac{R}{3}$ $I_0 = \frac{U_0}{R_0} = \frac{3U_0}{R}$ $P = I^2R \Rightarrow \frac{U_0^2}{R}$

$\frac{U_0^2}{R} = \frac{U_0^2}{9}R \Rightarrow R = 3$ $P_1 = \frac{U_0^2}{9}R$

$2{,}4 =$

21205300 (UU3153 M1281709)

Часть 2

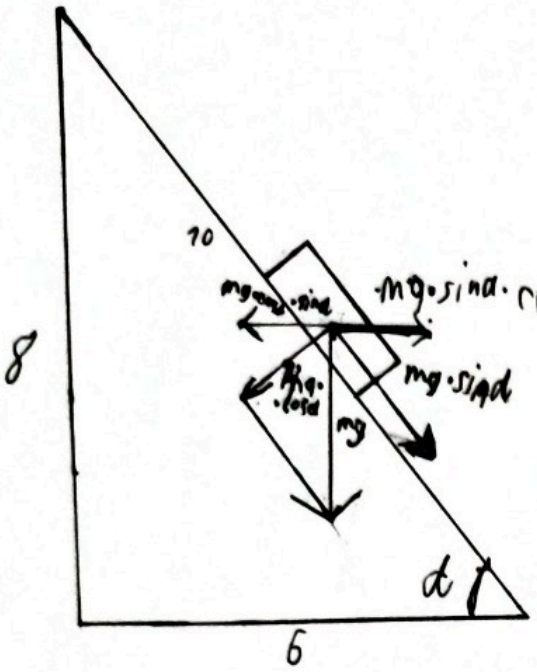
Олимпиада: **Физика, 9 класс (2 часть)**

Шифр: **21205360**

ID профиля: **313153**

Вариант 2

Черновик



$a_k = g \cdot \cos\alpha \cdot \sin\alpha \cdot \frac{m_2}{m_k} = 10 \cdot \frac{3}{5} \cdot \frac{4}{5} \cdot \frac{1}{2} = \frac{120}{2 \cdot 5 \cdot 2} =$

$= \frac{24}{10} = 2{,}4$

$l = H \cdot \operatorname{ctg}\alpha \cdot \operatorname{tg}\alpha = \frac{3}{4} H = 0{,}75H$

$l_n = H : \sin\alpha = \frac{5}{4} H$

$t = \frac{l_n}{a_k}$

$a_u = g \cdot \sin\alpha \cdot \cos\alpha = 2{,}4 \cdot 3{,}1 = 7{,}2\ м/с^2$

$l = \frac{a_u \cdot t^2}{2}$

$\sqrt{\frac{2l}{a_u}} = t_0$

$t_0 = \sqrt{\frac{1{,}5H}{7{,}2}}$

$t_0 = \sqrt{\frac{0{,}5H}{2{,}4}}$

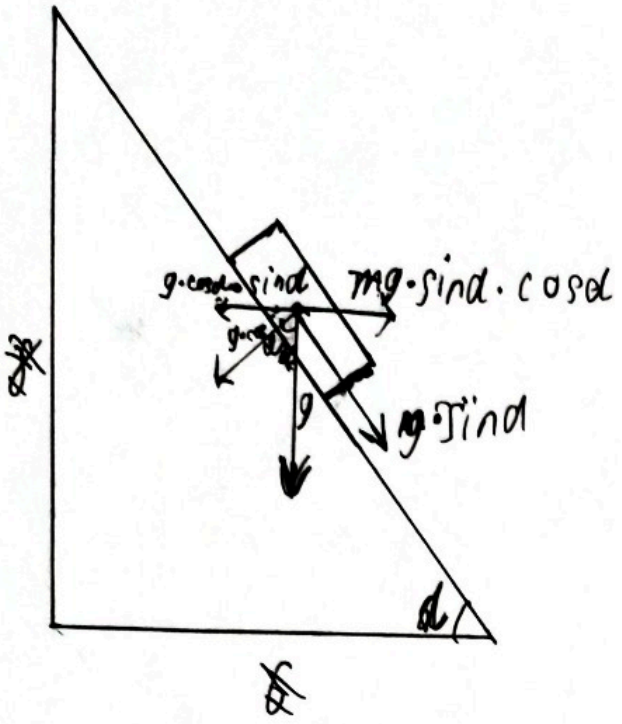
$t_0 = \sqrt{\frac{H}{4{,}8}}$

$t_0 = 0{,}4581\sqrt{H}$

$t_g = \frac{1{,}25H}{g \cdot \sin\alpha} = 1{,}25H : (10 \cdot \frac{4}{5}) = \frac{5}{4}H \frac{5H}{32}$

21205360 (U313153 M1281710)

Чистовик



$l = H \cdot tg(\arccos(\cos\alpha)) =$

$\pm l = H \cdot tg\alpha \mp$

$l = \frac{3}{4} H$

Дано:
$\cos\alpha = \frac{3}{5}$
H
$m_2 = m$
$m_к = 2m$

$t_з - ?$
$a_к - ?$
$t_0 - ?$

$\alpha = \arccos(\cos\alpha) \approx 53,13^\circ$

$l_2 = H : \sin\alpha = H \cdot \frac{5}{4} =$

$= \frac{5}{4} H$

Из рисунка видно: $a_2 \parallel$ гипотенузе $g \cdot \sin\alpha = 8 м/с^2$

$\frac{8 \cdot t_з^2}{2} = 10$

$t_з^2 = 2,5$

$t_з = 1,58$

$a_к = g \cdot \cos\alpha \cdot \sin\alpha \cdot \frac{m_2}{m_к} = 10 \cdot \frac{3}{5} \cdot \frac{4}{5} \cdot \frac{1}{2} = \frac{120}{50} = 2,4 м/с^2$

$a_0 = g \cdot \sin\alpha \cdot \cos\alpha + a_к = 1,5 g \cdot \sin\alpha \cdot \cos\alpha = 1,5 \cdot 2,4 = 7,2 м/с^2$

~~$l = H \cdot tg\alpha$~~ $\frac{a_0 t_0^2}{2} = l$

$\frac{3}{4} H = \frac{7,2 \cdot t_0^2}{2}$

$t_0^2 = \frac{3 \cdot 2}{4 \cdot 7,2} H$

$t_0^2 = \frac{1}{2 \cdot 2,4} H$

$t_0 = \sqrt{\frac{H}{4,8}}$

$t_0 = 0,4564\sqrt{H}$

Ответ: $t_з = 1,58 с$; $a_к = 2,4 м/с^2$; $t_0 = 0,4564\sqrt{H}$

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Черновик

$v = \sqrt{2,1gH}$

$t = \frac{0,5H}{v \cdot \cos\alpha}$

$v \cdot \sin\alpha \cdot t - \frac{g \cdot t^2}{2} = \frac{v \cdot \sin\alpha \cdot 0,5 \cdot H}{v \cdot \cos\alpha} - \frac{0,25H^2 \cdot g}{v^2 \cdot \cos^2\alpha} =$

$= \frac{v^2 \cdot \sin\alpha \cdot \cos\alpha \cdot 0,5H - 0,125H^2 g}{v^2 \cdot \cos^2\alpha} = H$

$1,25gH^2 \cdot \sin\alpha \cdot \cos\alpha - 1,25H^2 = 2,5H^2 g \cdot \cos^2\alpha$

$H^2(1,25g \cdot \sin\alpha \cdot \cos\alpha - 1,25 - 2,5g \cdot \cos^2\alpha) = 0$

$1,25g \cdot \sin\alpha \cdot \cos\alpha - 1,25 - 2,5g \cdot \cos^2\alpha = 0$

$1,25g \cos\alpha (\sin\alpha - 2\cos\alpha) = 1,25$

$g \cos\alpha (\sin\alpha - 2\cos\alpha) = 1$

$\sin\alpha - 2\cos\alpha = \frac{1}{g\cos\alpha}$

$g \cdot (1 - 2\operatorname{ctg}\alpha) = \frac{\sin\alpha}{\cos\alpha} : \cos\alpha$

$g \cdot (1 - 2\operatorname{ctg}\alpha) = \operatorname{tg}\alpha$

~~$g\operatorname{tg}\alpha - 2g\operatorname{ctg}\alpha$~~

$10 - 20\operatorname{ctg}\alpha = \operatorname{tg}\alpha$

$10 - 19\operatorname{ctg}\alpha = \frac{\cos\alpha}{\sin\alpha} + \frac{\sin\alpha}{\cos\alpha}$

$10 - 19\operatorname{ctg}\alpha = \frac{\cos^2\alpha + \sin^2\alpha}{\cos\alpha \sin\alpha}$

$\frac{10\sin\alpha - 19\cos\alpha}{\sin\alpha} = \frac{1}{\cos\alpha \cdot \sin\alpha}$

21205360 (1).153 M1281710

$10\sin\alpha - 19\cos\alpha = \frac{1}{\cos\alpha}$

Черновик

$10\sin\alpha\cdot\cos\alpha = 11 + 19\cos^2\alpha$

$10\operatorname{tg}\alpha - \frac{19}{\cos^2\alpha} = 19$

$\frac{10\sin\alpha}{\cos\alpha} - \frac{1}{\cos^2\alpha} = 19$

~~$10\sin\alpha\cdot\cos\alpha - 1 - 19\cos^2\alpha = 0$~~

~~$\frac{10\sin\alpha}{\cos\alpha}$~~ $10\operatorname{tg}\alpha - 1 - \operatorname{tg}^2\alpha = 19$

$\operatorname{tg}^2\alpha - 10\operatorname{tg}\alpha + 20 = 0$

$D = 100 - 80 = (2\sqrt{5})^2$

$\operatorname{tg}\alpha =$

Чистовик

№5

Дано:

$v = \sqrt{1{,}5gH}$

$g = 10$

$R = 0{,}25H$

$h = H$

$S = S$

$t_z - ?$

$\alpha - ?$

$\varphi - ?$

$$t_z = \frac{\pi R^2 \cdot h}{v \cdot S} = \frac{3{,}14 \cdot 0{,}0625H^2 \cdot H}{5\sqrt{H}} = \frac{0{,}03925 H^{\frac{5}{2}}}{S}$$

$$t_n = \frac{0{,}5H}{v \cdot \cos\alpha}$$

$$v \cdot \sin\alpha \cdot t - \frac{g \cdot t^2}{2} = \frac{v \cdot \sin\alpha \cdot 0{,}5H}{v \cdot \cos\alpha} - \frac{0{,}125H^2 \cdot g}{v^2 \cdot \cos^2\alpha}$$

$$= \frac{v^2 \cdot \sin\alpha \cdot \cos\alpha \cdot 0{,}5H - 0{,}125H^2 \cdot g}{v^2 \cdot \cos^2\alpha} = H$$

$$1{,}25gH^2 \cdot \sin\alpha \cdot \cos\alpha - 1{,}25H^2 = 2{,}5H^2 g \cdot \cos^2\alpha$$

$$H^2(1{,}25g \cdot \sin\alpha \cdot \cos\alpha - 1{,}25 - 2{,}5g \cdot \cos^2\alpha) = 0$$

$$1{,}25g \cdot \sin\alpha \cdot \cos\alpha - 1{,}25 - 2{,}5g \cdot \cos^2\alpha = 0$$

$$g \cdot \cos\alpha(\sin\alpha - 2\cos\alpha) = 1{,}25$$

~~$g \cos\alpha($~~

$$\sin\alpha - 2\cos\alpha = \frac{1}{g\cos\alpha}$$

$$g(1 - 2ctg\alpha) = tg\alpha$$

$$10 - 20\,ctg\alpha = tg\alpha$$

~~$\frac{10 - 20ctg\alpha}{\sin\alpha} = \frac{\cos^2\alpha + \sin^2\alpha}{\cos\alpha \cdot \sin\alpha}$~~

~~$10\sin\alpha \cdot \cos\alpha = 1 + 19$~~

$$\frac{10\sin\alpha - 19\cos\alpha}{\sin\alpha} = \frac{1}{\cos\alpha \cdot \sin\alpha}$$

$$10\sin\alpha - 19\cos\alpha = \frac{1}{\cos\alpha}$$

$$10\,tg\alpha - \frac{1}{\cos^2\alpha} = 19$$

$$tg^2\alpha - 10\,tg\alpha + 20 = 0$$

$$D = 100 - 80 = (2\sqrt{5})^2$$

$$tg\alpha = \frac{10 \pm 2\sqrt{5}}{2} = 5 \pm \sqrt{5}$$

21205360 (4513153 M1281710)

$\alpha_1 = 82{,}13$

$\alpha_2 = 70{,}11$

Ответ: $t_z = \frac{0{,}03925 H^{\frac{5}{2}}}{S}$; $\alpha_1 = 82{,}13$; $\alpha_2 = 70{,}11$; $\varphi(70{,}11; 82{,}13)$ (2)