

Часть 1

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

Шифр: **21204369**

ID профиля: **359263**

Вариант 2

Чистовик

Дано:

τ - время столкновения

v_0 - ?
 τ_1 - ?
 h - ?

$$h = \frac{v_0^2}{2g}$$

$$\tau_0 = \frac{v_0}{g}$$

$$1) h_1 = v_0 \tau_1 - \frac{g \tau_1^2}{2}$$

$$h_2 = \frac{g \tau_1^2}{2}$$

$$h_1 + h_2 = h$$

$$v_0 \tau_1 = \frac{v_0^2}{2}$$

$$\tau_1 = \frac{v_0}{2g}$$

$$3) \tau_1 = \frac{v_0}{2g} = \frac{\frac{2}{3} \tau g}{2g} = \frac{\tau}{3}$$

$$4) h = \frac{v_0^2}{2g} = \frac{24 \tau^2 g}{2g} = \frac{24}{2} \tau^2 g = 12 \tau^2 g$$



$$2) \tau_0 = \frac{v_0}{g} \quad \tau_1 = \frac{v_0}{2g}$$

$$\tau_0 + \tau_1 = \tau$$

$$\frac{3v_0}{2g} = \tau$$

$$v_0 = \frac{2}{3} \tau g$$

Ответ: 1) $\tau_1 = \frac{\tau}{3}$

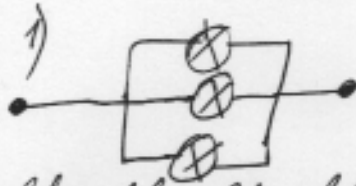
$$2) h = \frac{2}{9} \tau^2 g$$

$$3) v_0 = \frac{2}{3} \tau g$$

Умнобук

$\sqrt{3}$

Дано:
 $U_0 = 6 \text{ В}$
 $P_1 = 2,4 \text{ Вт}$
 $P_2 = 0,5 \text{ Вт}$
 $U_3 = U_0/3$
 $I_1 = ?$
 $I_2 = ?$
 $P_3 = ?$

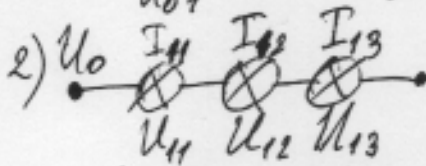


$$U_{01} = U_{02} = U_{03} = U_0 = 6 \text{ В}$$

$$I_{01} = I_{02} = I_{03} = \frac{I}{3}$$

$$U_{01} \cdot I_{01} = P_1$$

$$I_{01} = \frac{P_1}{U_{01}} = \frac{2,4}{6} = 0,4 \text{ А}$$



$$U_{11} + U_{12} + U_{13} = U_0$$

$$U_{11} = U_{12} = U_{13} = \frac{U_0}{3} = 2 \text{ В}$$

$$I_{11} = I_{12} = I_{13} = I_1$$

$$P_2 = I_{11} \cdot U_{11} = I_{11} \cdot U_0$$

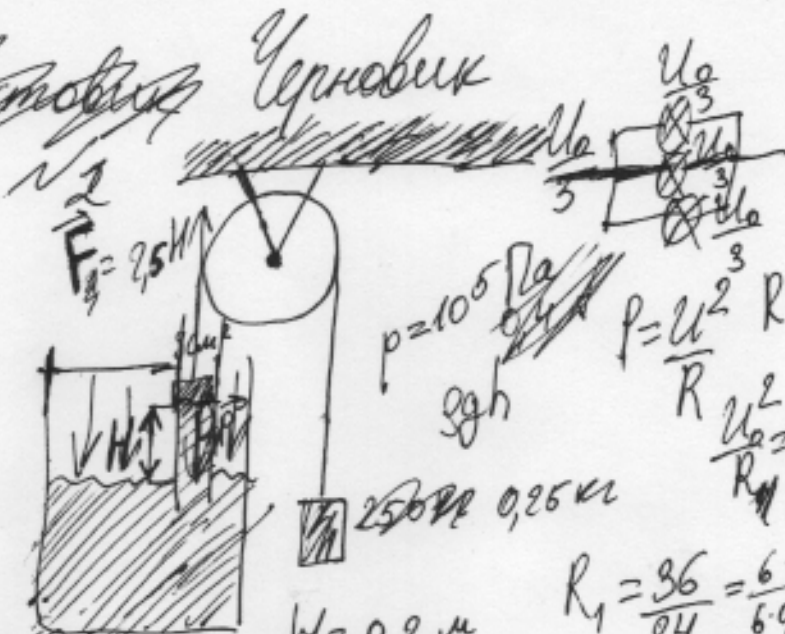
$$I_{11} = \frac{3P_2}{U_0} = \frac{3 \cdot 0,5}{6} = 0,25 \text{ А}$$

$$P_3 = \frac{U_3^2}{R} = \frac{U_0^2}{9 \cdot \frac{U_0}{I_{01}}} = \frac{U_0 \cdot I_{01}}{9} = \frac{6 \cdot 0,4}{9} \approx 0,27 \text{ Вт}$$

Омбем: 1) 0,4 А; 2) 0,25 А; 3) 0,27 Вт

Установки Черновик

Дано:
 v_0 - скорость течения
 τ - время столбования
 $g = 10$



$$I = \frac{U}{R} \quad \frac{\tau}{3} = \frac{26}{29}$$

$$\frac{2}{15} \quad v_0 = \frac{2 \cdot g}{3} \quad UI = 95 \text{ Вт}$$

$$\frac{U_0}{3} \cdot \frac{I}{3} = 95 \text{ Вт} \quad R_1 = 36 \text{ Ом}$$

$$P = \frac{U^2}{R} \quad I_1 = \frac{U_1}{R_1}$$

$$0,5 = \frac{36}{R} \quad \text{Паралл.}$$

$$R = 72 \text{ Ом} \quad U = I + U$$

$$I = UR \quad U = I = \frac{U}{R}$$

$$R = \frac{U}{I}$$

$$UI = P$$

$$\frac{U^2}{R_1} = P$$

$$R_1 = \frac{3U}{I}$$

$$\frac{U^2}{\frac{3U}{I}} = P$$

$$R = UI \quad UI = I^2 R t \quad U = I R t$$

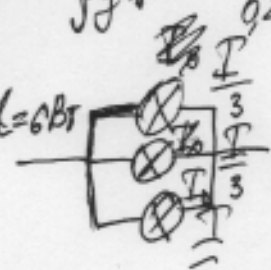
$$UI = P \quad I = 1,2 \text{ А}$$

$$P_1 = 2,5 - 0,002$$

$$R = \frac{U}{I} = \frac{6}{0,25} = 24 \text{ Ом}$$

$$S = 9 \cdot 10^{-6} \text{ м}^2$$

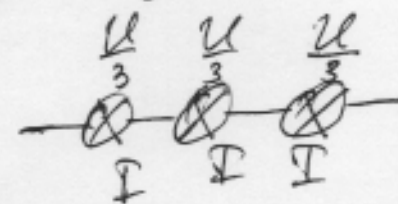
$$R_1 = \frac{36}{34} = \frac{6 \cdot 6}{6 \cdot 94 \cdot 94} = \frac{6 \cdot 10}{4} = 15$$



$$\frac{1}{R_1} + \frac{1}{R_1} + \frac{1}{R_1} = \frac{I}{U}$$

$$\frac{3}{R_1} = \frac{I}{U}$$

$$\frac{U \cdot I}{3} = 24 \text{ Вт} \quad I = \frac{7,2}{6} = 1,2 \text{ А}$$

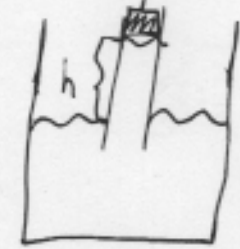


$$\frac{U}{3} \cdot I = P_2$$

$$\frac{U \cdot I}{3} = P_1$$

$$UI = P_2$$

$$P_2 = \frac{F}{S} = \frac{2,5 \cdot 10^6}{9}$$



$$\frac{F - P_1}{S} = 1000 \cdot 10 \cdot 0,2 + 10 \cdot 10^5 = 2000 + 10^5$$

$$\frac{F - P_1}{S} = pgh + P_0$$

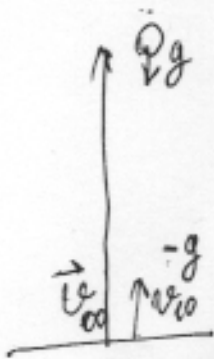
$$12000 \cdot 102000 = 100000 + \frac{F - P_1}{S}$$

$$pgh = P_0 + \frac{F - P_1}{S}$$

$$2000 \cdot 2 \cdot 10^{-3} = F - P_1$$

$$P_1 = 2 \cdot 10^3 - 2,5$$

Черновик



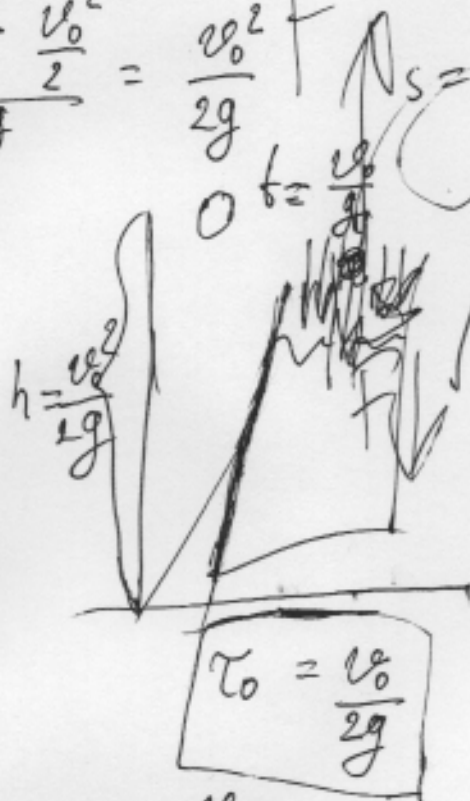
$$s = v_0 t + \frac{v_0^2}{2g}$$

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

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

$$s = \frac{v_0 \cdot v_0}{g} = \frac{v_0^2}{g}$$

$$F = \frac{v_0^2}{g} - \frac{v_0^2}{2g} = \frac{v_0^2}{2g}$$



$$h_1 = v_0^2 t_0 - \frac{g t_0^2}{2}$$

$$h_2 = \frac{g t_0^2}{2}$$

$$h_1 + h_2 = h$$

$$v_0^2 t_0 = \frac{v_0^2}{2g}$$

$$t_1 = \frac{v_0}{g} \quad t_0 = \frac{v_0}{2g}$$

$$\frac{2v_0 + v_0}{g} = t \quad 3v_0 = t \cdot g$$

$$v_0 = \tau g$$

Часть 2

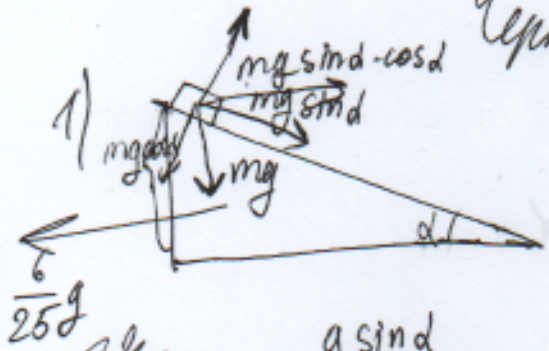
Олимпиада: **Физика, 9 класс (2 часть)**

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Вариант 2

Упробан



$$g \cdot \sin d \cdot \cos d = \frac{12}{25} g$$

$$\frac{H}{x} = \sin d$$

$$x = \frac{H}{\sin d}$$

0,5 p

$$p^2 - 0,5p + 1 + 1 = 0$$

$$p^2 - 0,5p + 2 = 0$$

$$1 - \frac{g}{25} = \frac{16}{25}$$

$$p = 0,25 - \sin d$$

$$\frac{H}{\sin d} = \frac{g \sin d \cdot t^2}{2}$$

$$2H = g \sin^2 d \cdot t^2$$

$$H^2 = 0,25 H^2 \left(\frac{-g}{2v^2 \cos^2 d} \right) + 0,5 H \cdot t g d$$

$$= \sqrt{\frac{2H}{g \sin^2 d}}$$

$$= \sqrt{\frac{2H}{g(1 - \cos^2 d)}}$$



$$1 = 0,5 p - p^2 - 1 \sqrt{\frac{2H}{g \cdot \frac{16}{25}}}$$

$$p^2 - 0,5p + 2 = 0 \sqrt{\frac{25H}{8g}}$$

$$y^2 = x^2 \left(\frac{-g}{2v^2 \cos^2 d} \right) + x \cdot t g d$$

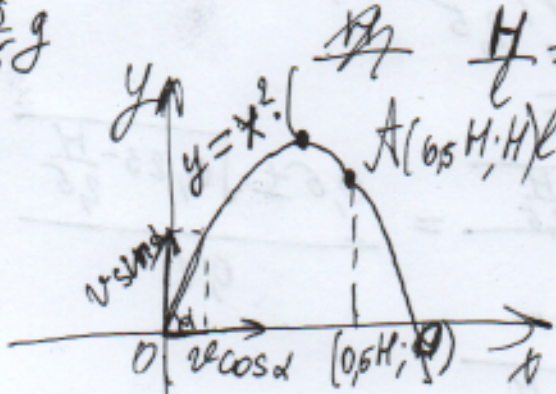
2) $m g \sin d \cdot \cos d =$

$$= 2m g \cdot \frac{3}{5} \cdot \sqrt{\frac{16}{25}} = 2m g \cdot \frac{3}{5} \cdot \frac{4}{5} = \frac{12}{25} m g$$

$$F = ma$$

$$a = \frac{F}{2m} = \frac{12 m g}{50 m} = \frac{6g}{25}$$

$$\frac{18}{25} g$$



$$H = b g d$$

$$A(0,5 H, H) \Rightarrow \frac{H}{g d} = \frac{H \cdot \cos d}{\sin d}$$

В. максимум скорости t

$$y = v \sin d \cdot t - \frac{g t^2}{2}$$

$$x = v \cos d \cdot t$$

$$y = \frac{v \cdot \sin d \cdot x}{v \cdot \cos d} - \frac{g \cdot x^2}{2v^2 \cos^2 d} =$$

$$t = \frac{x}{v \cdot \cos d}$$

$$= \frac{g}{2v^2 \cos^2 d}$$

Черновик

$$M = 0,25M \left(\frac{-g}{2v^2 \cos^2 \alpha} \right) + 0,5 \operatorname{tg} \alpha$$

$$M = \frac{0,25Mg}{2v^2} \cdot (1 + \operatorname{tg}^2 \alpha) + 0,5 \operatorname{tg} \alpha$$

$$\int q = \operatorname{tg} \alpha$$

$$\text{РЗ} \quad -\frac{0,25Mg}{2v^2} - M \cdot \frac{-0,25Mgq^2}{2v^2} + 0,5q = 0$$

$$q^2 \left(\frac{0,25Mg}{2v^2} \right) - 0,5 \cdot q + \left(\frac{M + 0,25Mg}{2v^2} \right) = 0$$

$$D = 0,25 - \frac{Mg}{v^2} \cdot \left(\frac{M + 0,25Mg}{2v^2} \right) =$$

$$= 0,25 - \frac{M^2g}{v^2} \left(\frac{1 + 0,25\frac{g}{M}}{2v^2} \right) = 0,25 - \frac{M^2g}{2,5gM} \left(1 + \frac{0,25g}{5gM} \right) =$$

$$q = 0,5 \pm \sqrt{0,23}$$

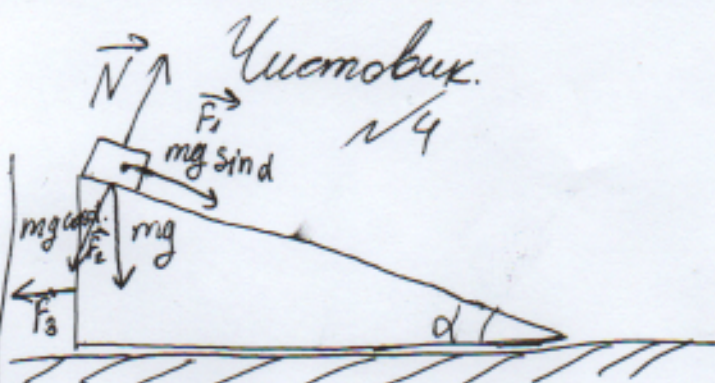
$$= 0,25 - \frac{M}{2,5} \left(1 + \frac{0,25}{M} \right) =$$

$$= 0,25 - \frac{M}{2,5} - \frac{M}{2,5} =$$

$$= 0,23 - \frac{M}{2,5}$$

$$q = \frac{0,5 \pm \sqrt{0,23 - \frac{M}{2,5}}}{\frac{0,25 \cdot Mg}{2,5gM}} = \frac{0,5 \pm \sqrt{0,23 - \frac{M}{2,5}}}{0,1} =$$

$$= 5 \pm 10 \sqrt{0,23 - \frac{M}{2,5}}$$



Dano:
 $\cos \alpha = \frac{3}{5}$
 M, m, em

$t_1 - ?$
 $a - ?$
 $b - ?$

1) $F_1 = mg \sin \alpha$
 $l_1 = \frac{H}{\sin \alpha} = \frac{H}{\sqrt{1 - \cos^2 \alpha}} = \frac{H}{\frac{4}{5}} = \frac{5H}{4}$
 $a_1 = \frac{F_1}{m} = g \sin \alpha = g \cdot \sqrt{1 - \cos^2 \alpha} = \frac{4}{5}g$

$\frac{a_1 t_1^2}{2} = l_1$

$t_1 = \sqrt{\frac{2l_1}{a_1}} = \sqrt{\frac{2 \cdot \frac{5H}{4}}{\frac{4}{5}g}} = \sqrt{\frac{25H}{8g}} = 2,5 \sqrt{\frac{H}{2g}}$

2) $F_2 = mg \cos \alpha$
 $F_3 = F_2 \cdot \sin \alpha = mg \cos \alpha \cdot \sin \alpha = \frac{12}{25}mg$

$F_3 = 2m \cdot a$
 $a = \frac{F_3}{2m} = \frac{12mg}{50m} = \frac{6g}{25}$

3) Чина F_4 , глумаранае маарды но рожузономану
 правна: $F_4 = F_1 \cdot \cos \alpha = mg \cos \alpha \cdot \sin \alpha = \frac{12}{25}mg$
 $a_{1x} = \frac{F_4}{m} = \frac{12}{25}g$
 $a = \frac{6}{25}g$

$a_{\text{общ}} = a_{1x} + a = \frac{18}{25}g$

$\frac{H}{\tan \alpha} = \frac{H \cos \alpha}{\sin \alpha} = \frac{3}{4}H = \frac{H}{l} = \tan \alpha$

$\frac{a_{\text{общ}} t^2}{2} = l$ $l = \frac{H}{\tan \alpha} = \frac{H}{\frac{3}{4}} = \frac{4}{3}H$

$t = \sqrt{\frac{2l}{a_{\text{общ}}}} = \sqrt{\frac{2 \cdot \frac{4}{3}H}{\frac{18}{25}g}} = \sqrt{\frac{25 \cdot 1,5H}{18g}} = \sqrt{\frac{25 \cdot 1,5H}{18g}} = \frac{5}{2} \sqrt{\frac{H}{3g}}$

$= 2,5 \sqrt{\frac{H}{3g}}$

Ответ: 1) $2,5 \sqrt{\frac{H}{3g}}$ 2) $\frac{6}{25}g$ 3) $2,5 \sqrt{\frac{H}{3g}}$

Условие №5

Дано:

$h = H$

$R = 0,25H$

$L = 0,5H$

$S = S$

$v = \sqrt{2,5gH}$

$t_1 = ?$

$\text{tg} \alpha = ?$

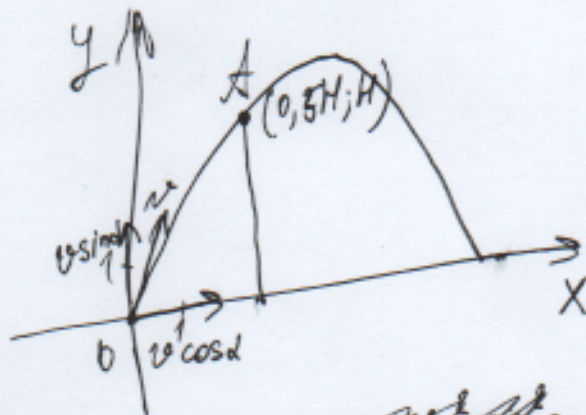
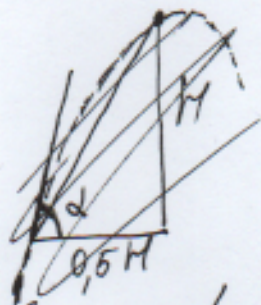
1) $v_1 = S \sqrt{2,5gH}$ (объем / время)

$V = h \cdot \pi R^2 = H \cdot \pi \cdot 0,5^2 \cdot H^2 = 0,0625 \pi H^3$

$t_1 = \frac{V}{v_1} = \frac{S \sqrt{2,5gH}}{0,0625 \pi H^3} = \frac{S \cdot 0,5 \sqrt{10gH}}{0,5^4 \pi H^3} = \frac{S \sqrt{10gH}}{0,125 \pi H^3} =$

$= \frac{S \sqrt{10gH}}{0,39 H^3}$

2)



В момент времени t

$$\begin{cases} y = v \cdot \sin \alpha \cdot t - \frac{g t^2}{2} \\ x = v \cdot \cos \alpha \cdot t \end{cases}$$

$$\begin{cases} y = \frac{v \cdot \sin \alpha \cdot x}{v \cdot \cos \alpha} - \frac{g \cdot x^2}{2 v^2 \cos^2 \alpha} \\ t = \frac{x}{v \cdot \cos \alpha} \end{cases}$$

$y = x \cdot \text{tg} \alpha - \frac{g x^2}{2 v^2} \cdot (1 + \text{tg}^2 \alpha)$ - уравнение движения точки

Пусть $p = \text{tg} \alpha$

$y = x \cdot p - p^2 \left(\frac{g x^2}{2 v^2} \right) - \frac{g x^2}{2 v^2}$

~~$H = p \cdot 0,5H - p^2 \left(\frac{g \cdot 0,25H^2}{2 \cdot 2,5gH} \right) - \frac{g \cdot 0,25H^2}{5gH}$~~

~~$H = 0,5p - p^2 \cdot \frac{g \cdot 0,25H}{5gH} - \frac{g \cdot 0,25H}{5gH}$~~

~~$H = 0,5p - p^2 \cdot 0,05H - 0,05H$~~

~~$0,05H \cdot p^2 - 0,5p + (H + 0,05H) = 0$~~

~~$0,05H \cdot p^2 - 0,5p + 1,05H = 0 \quad (1 + 0,05H) = 0$~~

~~$D = 0,25 - 4 \cdot 0,05 \cdot 1,05H^2 = 0,25 - 0,21H^2$~~

~~$p = 0,5 \pm \sqrt{0,25 - 0,21H^2} = 0,5 \pm 10 \sqrt{0,25 - 0,21H^2}$~~

~~$\text{tg} \alpha = p = 0,5 \pm 10 \sqrt{0,25 - 0,21H^2}$~~



Условие

~~$0,05H \cdot p^2 - 0,5p + (110,05H) = 0$~~

~~$D = 0,25 - 4 \cdot 0,05H(1+0,05H) =$~~

~~$= 0,25 - 0,2H - 0,01H^2 = 1 - (1+0,2H+(0,1H)^2) + 1,25 =$~~

~~$= 1,25 - (0,1H+1)^2$~~

~~$tg \alpha = p = 0,5 \pm \sqrt{1,25 - (0,1H+1)^2} = 5 \pm 10 \sqrt{1,25 - (0,1H+1)^2}$~~

~~5) $y = px - p^2 \left(\frac{gx^2}{2v^2} \right) - \frac{gx^2}{2v^2}$~~

~~$H = p \cdot 0,05H - p^2 \left(\frac{g \cdot 0,25H^2}{2 \cdot 25gH} \right) - \frac{0,25gH^2}{5gH}$~~

~~$1 = 0,5p - p^2 \cdot 0,05 - 0,05$~~

~~$0,05p^2 - 0,5p + 1,05 = 0$~~

~~$p^2 - 10p + 21 = 0 \quad D = 0,25 - 0,21 = 0,04$~~

~~$D = 100 - 84 = 16 \quad p = \frac{10 \pm 4}{2}$~~

~~$p = \frac{-10 \pm 4}{2}$~~

$p = \frac{0,5 + 0,2}{0,1} = 7$
 $p = \frac{0,3}{0,1} = 3$

Ответ: 1) $\frac{5 \sqrt{10gH}}{0,39H^3}$; 2) $p = 7$ $tg \alpha = 9$
 $p = 3$ $tg \alpha = 4$

(2)