

Часть 1

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

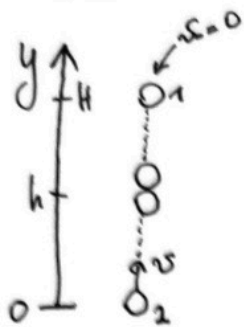
Шифр: **21205712**

ID профиля: **815820**

Вариант 1

① Чистовик.

N1.



$$1) y_1(t) = H - \frac{gt^2}{2}$$

$$y_2(t) = vt - \frac{gt^2}{2}$$

в момент времени t :

$$y_1(t) = y_2(t) \Leftrightarrow$$

$$H - \frac{gt^2}{2} = vt - \frac{gt^2}{2} \Leftrightarrow$$

$$H = vt$$

$$2) H = t \cdot v_{\text{ср}} = \frac{v_k - v_0}{g} \cdot \frac{v_0 + v_k}{2} = \frac{v_k^2 - v_0^2}{2g} = \frac{0 - v^2}{2g} = \frac{v^2}{2g}$$

$$\left[v_k = v_0 + gt \Leftrightarrow t = \frac{v_k - v_0}{g} \right]$$

$$3) H = \frac{v^2}{2g} = vt \Leftrightarrow$$

$$\frac{v}{2g} = t \Leftrightarrow \boxed{v = 2gt} \Rightarrow H = vt = 2gt^2$$

$$4) h = y_1(t) = H - \frac{gt^2}{2} = 2gt^2 - \frac{gt^2}{2} = \frac{3}{2}gt^2$$

~~$$5) \frac{s_1}{s_2} = \frac{H - \frac{gt^2}{2}}{vt - \frac{gt^2}{2}} \Rightarrow \frac{s_1}{s_2} = \frac{2gt^2 - \frac{gt^2}{2}}{2gt^2 - \frac{gt^2}{2}}$$~~

$$\frac{s_1}{s_2} = \frac{H-h}{h} = \frac{2gt^2 - 1,5gt^2}{1,5gt^2} = \frac{\frac{1}{2}gt^2}{\frac{3}{2}gt^2} = \frac{1}{3}$$

- Ответ:
- 1) $H = 2gt^2$
 - 2) $h = 1,5gt^2$
 - 3) $\frac{s_1}{s_2} = \frac{1}{3}$

Листовик. (2)

N2



$$1) \quad p_1 = p_0 - \rho g H = 100 \text{ кПа} - 1000 \text{ кг/м}^3 \cdot 10 \text{ м} \cdot 0,1 \text{ м} = 100 \text{ кПа} - 1 \text{ кПа} = \boxed{99 \text{ кПа}}$$

2) Т.к. система в равновесии:

$$T = Mg$$

$p_1 < p_0 \Rightarrow F_{\text{давления}} \text{ направлена вниз}$

$$F_{\text{давления}} = (p_0 - p_1) \cdot S = \rho g H S$$

$$T = mg + F_{\text{давл}} = Mg \Leftrightarrow$$

$$\boxed{M = m + \rho H S} = \text{отсюда}$$

$$= 50 \text{ г} + 1 \text{ г/см}^3 \cdot 10 \text{ см} \cdot 8 \text{ см}^2 = \boxed{130 \text{ г}}$$

3) Новая масса поршня: $(m + \Delta m) = 170 \text{ г}$

$$T = (m + \Delta m)g + F_{\text{давл}} = Mg \Leftrightarrow$$

$$(m + \Delta m)g + S \cdot \rho g H = Mg \Leftrightarrow$$

$$\boxed{H = \frac{M - \Delta m - m}{S \cdot \rho}} = -\frac{40 \text{ г}}{8 \text{ см}^2 \cdot 1 \text{ г/см}^3} = -5 \text{ см} \Rightarrow$$

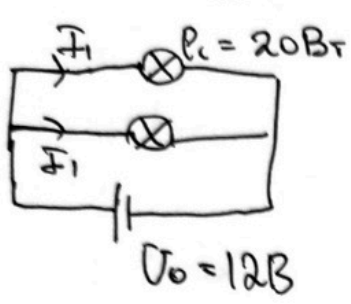
нижний край поршня опустится на 5 см

Ответ: 1) 99 кПа

2) 130 г

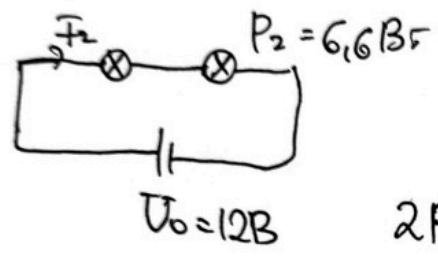
3) опустится на 5 см

ис. λ числовик. (3)
 N3.



$$1) P_1 = U_0 \cdot I_1 \Leftrightarrow I_1 = \frac{P_1}{U_0} = \frac{20Bт}{12B} = \boxed{\frac{5}{3}A} \approx 1,66A$$

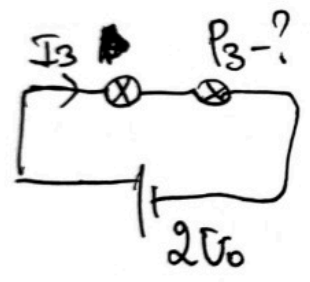
$$P_1 = \frac{U_0^2}{R} \Leftrightarrow R = \frac{U_0^2}{P_1}$$



2) Общая потребляемая мощность:
 $\cdot 2P_2$

$$2P_2 = U_0 \cdot I_2 \Leftrightarrow I_2 = \frac{2P_2}{U_0} = \frac{2 \cdot 6,6Bт}{12B} = \frac{13,2Bт}{12B} = \frac{66}{5}Bт = \frac{66}{60}A = \frac{11}{10}A = \boxed{1,1A}$$

3)

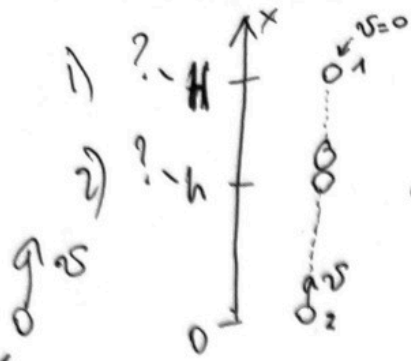


$$2P_3 = \frac{(2U_0)^2}{2R} = \frac{4U_0^2}{2 \cdot \frac{U_0^2}{P_1}} = 2P_1 \Leftrightarrow$$

$$\boxed{P_3 = P_1} = 20Bт$$

- Ответ:
- 1) 1,66A
 - 2) 1,1A
 - 3) 20Bт

N1.



перновик.

3) $\frac{s_1}{s_2} = ?$

$$H = \frac{v^2 - 0^2}{2g} = \frac{v^2}{2g} \quad (2)$$

$$H = vt - \frac{gt^2}{2}$$

$$H = \frac{gt^2}{2}$$

1: $x(t) = H - \frac{gt^2}{2}$

$$h = H - \frac{gt^2}{2} = 2gt^2 - \frac{gt^2}{2} = \frac{3gt^2}{2} = h$$

$$h = vt - \frac{gt^2}{2}$$

$$H = \frac{v_0^2 - v_k^2}{2a}$$

$$H = \frac{(v_0 - v_k)(v_0 + v_k)}{2g} = \frac{v_0 - v_k}{g} \cdot v_{cp}$$

(1) $x(t) = H - \frac{gt^2}{2}$

$$x_2(t) = vt - \frac{gt^2}{2}$$

$$x_1(t) = x_2(t) \Rightarrow H - \frac{gt^2}{2} = vt - \frac{gt^2}{2} \Rightarrow t =$$

$$H = vt = \frac{2gt^2}{2} \Rightarrow v_k = v_0 + gt \Rightarrow$$

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

$$\frac{M}{c} = e$$

$$h = H - \frac{gt^2}{2}$$

(3) $H = vt = \frac{v^2}{2g} \Rightarrow$

$$\frac{v}{2g} = t \Rightarrow$$

$$\frac{M}{c^2} \cdot c = M/c \quad (+)$$

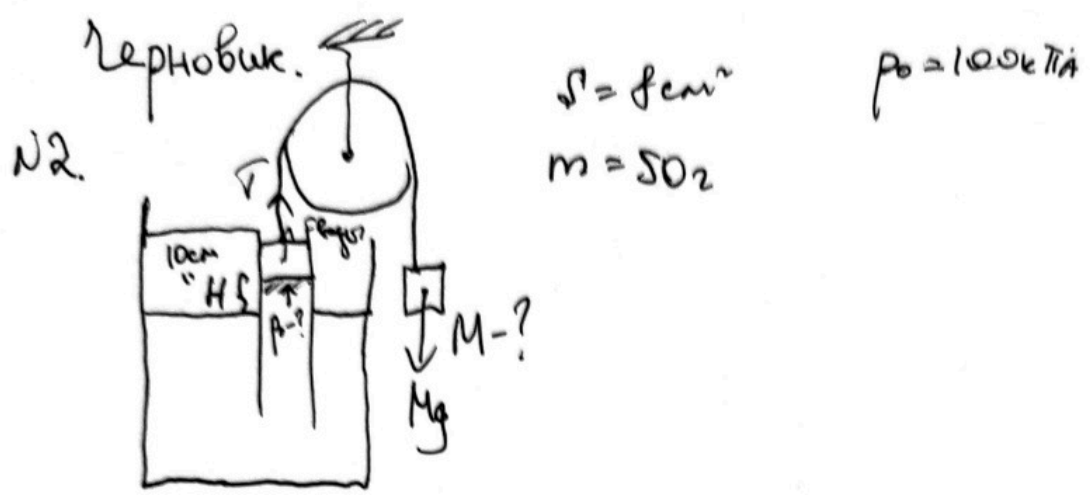
$$s_1 = \frac{gt^2}{2}$$

$$s_2 = vt - \frac{gt^2}{2} \Rightarrow$$

$$v = 2gt \quad (4)$$

$$\Rightarrow \frac{s_2}{s_1} = \frac{vt - \frac{gt^2}{2}}{\frac{gt^2}{2}} = \frac{2gt - 1}{1} = \frac{2gt^2}{\frac{gt^2}{2}} - 1 = 3$$

N1 $\Delta ? \dots \uparrow^x \leftarrow v=0$ Лерновик.



~~$p_0 = ?$~~ $p_1 = p_0 - \rho g H$? ~~$p_0 = ?$~~

~~$F_{\text{богга}} = \rho \cdot S \cdot H \cdot g$~~

$T = Mg$

$\sum F = mg - F_{\text{богга}} = [mg - \rho \cdot S \cdot g H] \Rightarrow$

$Mg = mg - \rho \cdot S \cdot g H \Leftrightarrow$

$M = m - \rho \cdot S \cdot H$

$T = (\Delta m + m)g - F_{\text{богга}} = Mg \Leftrightarrow$

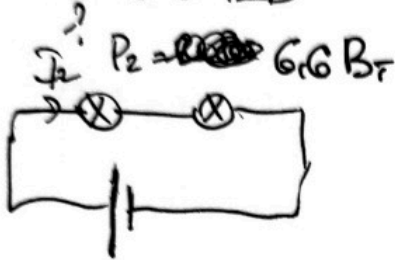
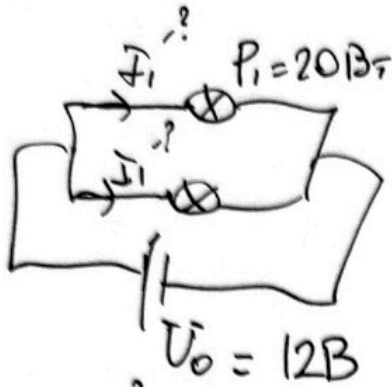
$(\Delta m + m)g - \rho \cdot S \cdot g H = Mg \Leftrightarrow$

$M = \Delta m + m - \rho \cdot S \cdot H \Leftrightarrow$

$H = \frac{\Delta m + m - M}{\rho \cdot S}$

Черновик.

N3.



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

$$P_3 = \frac{U_0^2}{R} = \frac{U_0^2}{\frac{U_0^2}{P_1}} = P_1$$

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

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

$$R = \frac{U_0^2}{P_1} \Rightarrow I_1 = \frac{P_1}{U_0}$$

$$U' = \frac{U_0}{2}$$

$$I_2 = \frac{P_2}{\frac{U_0}{2}} = \frac{2P_2}{U_0}$$

~~U_0~~ ~~U_0~~

$$\frac{U_0}{2} = I_2 \cdot \frac{U_0^2}{P_1} \Leftrightarrow$$

$$I_2 = \frac{\frac{U_0}{2}}{\frac{U_0^2}{P_1}} =$$

Часть 2

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

Шифр: **21205712**

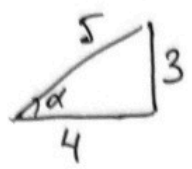
ID профиля: **815820**

Вариант 1

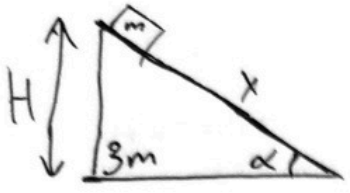
Черновик.

NH.

$$\cos \alpha = \frac{4}{5}$$



$$\operatorname{tg} \alpha = \frac{3}{4}$$

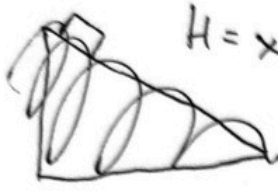


$$\cos \alpha = \frac{4}{5} \Rightarrow \operatorname{tg} \alpha = \frac{3}{4}$$



$$mg \sin \alpha = ma \Leftrightarrow$$

$$a = g \sin \alpha$$

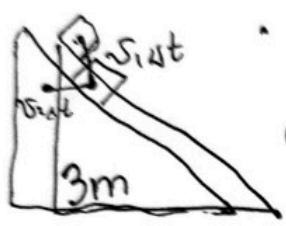


$$H = x \cdot \sin \alpha \Leftrightarrow$$

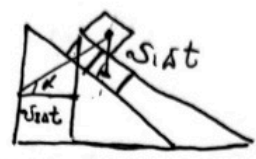
$$x = \frac{H}{\sin \alpha}$$

$$v_1 = v_2 \operatorname{tg} \alpha$$

- уравнение кин. энергии



$$a_{\text{отн}} = g \sin \alpha$$

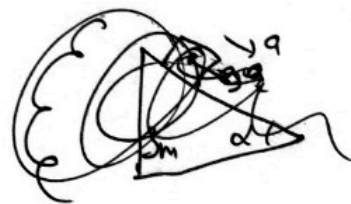
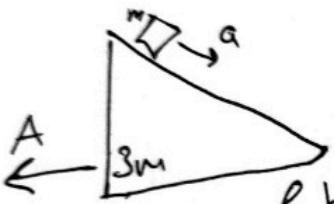


в HУCO:

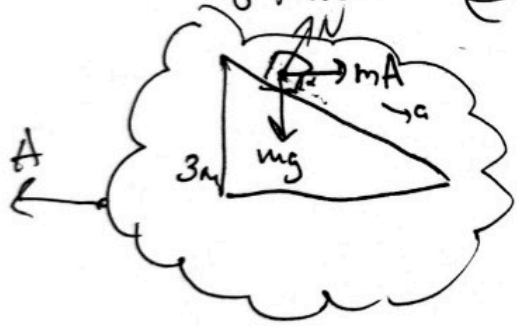
$$\operatorname{tg} \alpha = \frac{v_1}{v_2} \Leftrightarrow$$

$$v_1 = v_2 \operatorname{tg} \alpha \left| \frac{d}{dt} \right. \Leftrightarrow$$

$$a_1 = a_2 \operatorname{tg} \alpha \Leftrightarrow$$



в HУCO:



a?

$$s = \frac{H}{\sin \alpha}$$

$$a = A \operatorname{tg} \alpha$$

$$A = g \dots c_1$$

$$a = \frac{at^2}{2}$$

$$ma = mA \cos \alpha + mg \sin \alpha \Leftrightarrow$$

$$a = A \cos \alpha + g \sin \alpha$$

$$A \operatorname{tg} \alpha = A \cos \alpha + g \sin \alpha \Leftrightarrow$$

$$A = \frac{g \sin \alpha}{\operatorname{tg} \alpha - \cos \alpha} = \frac{3}{5} g$$

$$\frac{3}{4} = \frac{4}{5}$$

$$s = \frac{at^2}{2} \Leftrightarrow$$

$$t_1 = \sqrt{\frac{2s}{a}} =$$

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

$$= \sqrt{\frac{2H}{g \sin \alpha}}$$

$$3 \sin \alpha = mg \sin \alpha \cos \alpha - m A \sin^2 \alpha$$

$$(3 - \sin^2 \alpha) A = g \sin \alpha \cos \alpha$$

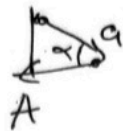
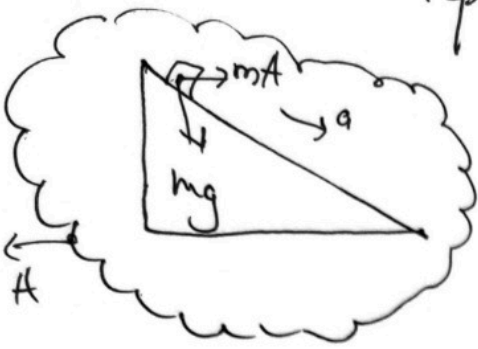
$$N \sin \alpha = 3m A$$

$$mg \cos \alpha - m A \sin \alpha$$



B Heco:

Черковик.



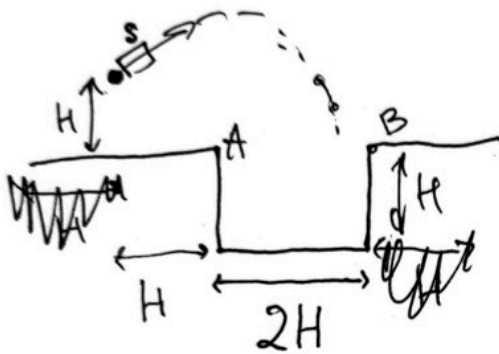
$$A = a \cos \alpha = g \sin \alpha \cos \alpha$$

$$y(t) = H + v_y t - \frac{g t^2}{2}$$

$$x(t) = v_x t \quad \Leftrightarrow \quad t = \frac{H}{v_x} = \frac{H}{v \cos \alpha}$$

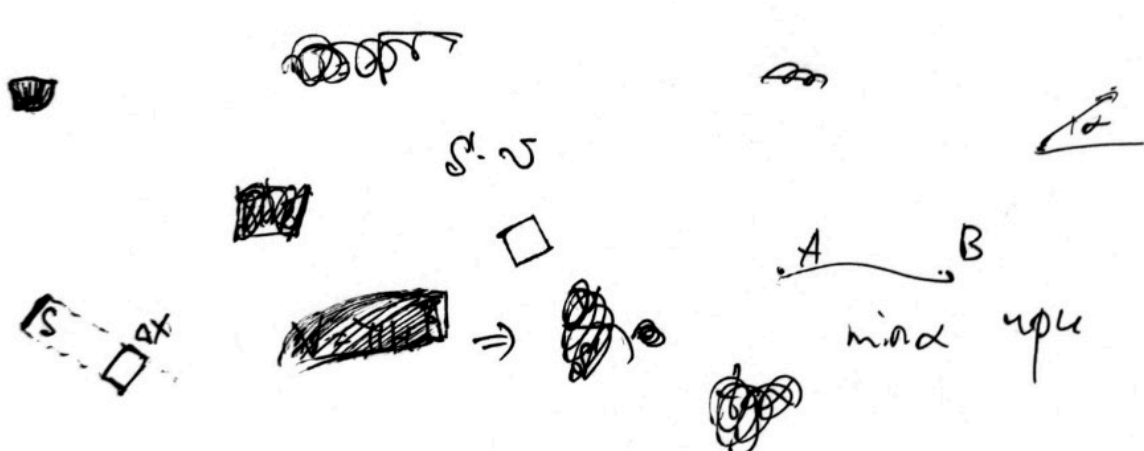
$$v = \sqrt{0,5 g H}$$

N5.



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

$$V = \pi R^2 \cdot H = \pi H^2 \cdot H = \pi H^3 = H + \frac{1}{2} g H - \frac{g H^2}{2 v^2 \cos^2 \alpha}$$



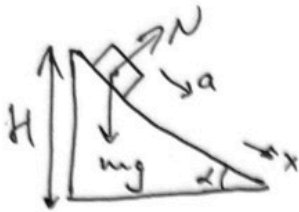
A B
min x y H; H



$$v T \cdot S = V \quad \Leftrightarrow \quad T = \frac{V}{v \cdot S} = \frac{\pi H^3}{S \cdot \sqrt{0,5 g H}}$$

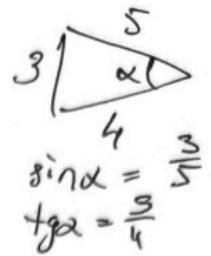
Числовик. (1)

НН.



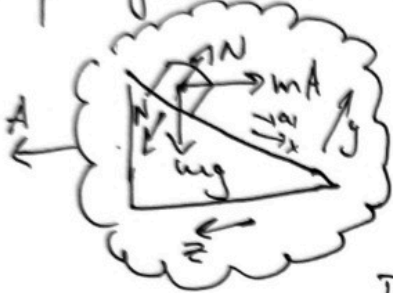
$$\text{ИЗН: } x: mg \sin \alpha = ma \Leftrightarrow$$

$$a = g \sin \alpha = \frac{3}{5}g$$



$$\Rightarrow s = \frac{at^2}{2} \Leftrightarrow t_1 = \sqrt{\frac{2s}{a}} = \sqrt{\frac{2 \cdot \frac{H}{\sin \alpha}}{g \sin \alpha}} = \sqrt{\frac{2H}{g \sin^2 \alpha}} = \sqrt{\frac{2H}{g \left(\frac{3}{5}\right)^2}} = \frac{5}{3} \sqrt{\frac{2H}{g}}$$

Перейдем в НУСО клина:



$$\text{ИЗН: } y: N + m A \sin \alpha = mg \cos \alpha \Leftrightarrow$$

$$N = mg \cos \alpha - m A \sin \alpha$$

На клин действует сила N:

$$\text{ИЗН: } z: N \sin \alpha = 3m A \Leftrightarrow$$

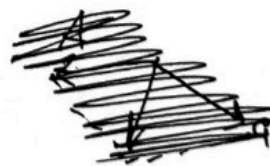
$$mg \cos \alpha \sin \alpha - m A \sin^2 \alpha = 3m A \Leftrightarrow$$

$$A(3 + \sin^2 \alpha) = g \cos \alpha \sin \alpha \Leftrightarrow$$

$$A = \frac{\cos \alpha \sin \alpha}{3 + \sin^2 \alpha} \cdot g = \frac{\frac{3}{5} \cdot \frac{4}{5}}{3 + \frac{9}{25}} g =$$

$$= \frac{\frac{12}{25}}{\frac{84}{25}} g = \frac{1}{7} g$$

~~Сила N действует на блок:~~



$$x: m a_1 = m A \cos \alpha + mg \sin \alpha \Leftrightarrow$$

$$a_1 = A \cos \alpha + g \sin \alpha = \frac{4}{35}g + \frac{3}{5}g = \frac{25}{35}g = \frac{5}{7}g$$

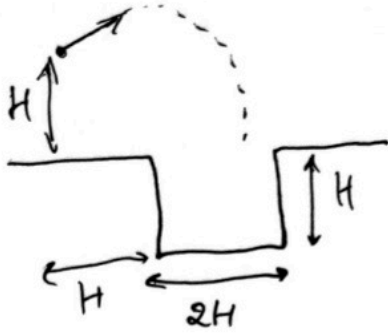
$$\Rightarrow t_2 = \sqrt{\frac{2H}{\sin \alpha \cdot \frac{5}{7}g}} = \sqrt{\frac{2H}{\frac{3}{5} \cdot \frac{5}{7}g}} = \sqrt{\frac{14}{3} \cdot \frac{H}{g}}$$

Ответ:

- 1) $\frac{5}{3} \sqrt{\frac{2H}{g}}$
- 2) $\frac{1}{7}g$
- 3) $\sqrt{\frac{14}{3} \cdot \frac{H}{g}}$

Чистовик. (2)

N5.



Объём цилиндрического бака:

$$V = \pi R^2 \cdot H = \pi H^2 \cdot H = \boxed{\pi H^3}$$

$$\sigma \cdot \tau \cdot S = V \quad \leftarrow$$
$$\boxed{\tau} = \frac{V}{S \cdot \sigma} = \frac{\pi H^3}{S \cdot \sigma \cdot \sqrt{0,5gH}}$$