



1	2	3	4	5
8	10	10	0	10

Задача 5

Дано:

$$\Delta t_1 = 6^\circ\text{C}$$

$$\Delta t_2 = 4^\circ\text{C}$$

$$n_1 = 1$$

$$n_2 = 3$$

$$\Delta t_3 = ?$$

Решение

Известно, что

$$\begin{cases} \Delta t_1 (c_b m_b + c_a m_a) = q m \\ \Delta t_2 (c_b m_b + n_2 c_a m_a) = q m \Rightarrow \\ c_b m_b \Delta t = q m \end{cases}$$

$$\begin{cases} \Delta t_1 (c_b m_b + c_a m_a) = c_b m_b \Delta t \\ \Delta t_2 (c_b m_b + n_2 c_a m_a) = c_b m_b \Delta t \\ c_a m_a \Delta t_1 = c_b m_b \Delta t - c_b m_b \Delta t_1 \end{cases}$$

$$n_2 c_a m_a \Delta t_2 = c_b m_b \Delta t - c_b m_b \Delta t_1$$

$$\frac{\Delta t_1}{n_2 \Delta t_2} = \frac{\Delta t - \Delta t_1}{\Delta t - \Delta t_2}$$

$$\Delta t_1 (\Delta t - \Delta t_2) = n_2 \Delta t_2 (\Delta t - \Delta t_1)$$

$$\Delta t_1 \Delta t - \Delta t_1 \Delta t_2 = n_2 \Delta t_2 \Delta t - n_2 \Delta t_2 \Delta t_1$$

$$n_2 \Delta t_2 \Delta t_1 - \Delta t_1 \Delta t_2 = n_2 \Delta t_2 \Delta t - \Delta t_1 \Delta t$$

$$\Delta t_1 \Delta t_2 (n_2 - 1) = \Delta t (n_2 \Delta t_2 - \Delta t_1)$$

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$$\Delta t = \frac{\Delta t_1 \Delta t_2 - n_2 \Delta t_1}{\Delta t_1 - n_2 \Delta t_2}$$

$$\Delta t = \frac{\Delta t_1 \Delta t_2 (n-1)}{n_2 \Delta t_2 - \Delta t_1}$$

$$\Delta t = \frac{6 \cdot 4 \cdot 2}{3 \cdot 4 - 6} = \frac{48}{6} = 8^\circ \text{C}$$

Ответ:  $\Delta t = 8^\circ \text{C}$

Задача № 2.

Дано:

$$m = 1110 \text{ кг}$$

$$m_1 = 40 \text{ кг}$$

$$\rho_0 = 1,23 \frac{\text{кг}}{\text{м}^3}$$

$$\rho_2 = 0,18 \frac{\text{кг}}{\text{м}^3}$$

$V = ?$

$n_2 = ?$

Решение

$$F_A - F_T \geq 0.$$

$$F_A = \rho_0 g V$$

$$F_T = (m + m_1)g = (m + \rho_2 V)g$$

$$\rho_0 g V \geq (m + \rho_2 V)g$$

$$\rho_0 g V = mg + \rho_2 g V,$$

$$\rho_0 g V - \rho_2 g V = mg$$

$$V(\rho_0 - \rho_2)g = mg$$

$$V = \frac{mg}{g(\rho_0 - \rho_2)} = \frac{m}{\rho_0 - \rho_2}$$

$$V = \frac{1110}{1,23 - 0,18} = \frac{1110}{1,11} =$$

$$= 1000 \text{ м}^3$$

если  $V$  вычислить без  $n_2$ ,

$$\text{то } V_1 = 2 \cdot 1000 = 2000$$

$$n_2 = \frac{\rho_0 V_1 - \rho_2 V_1 - m}{m_1}$$



$$n = \frac{2580 - 260 - 410}{70} \approx 15 (\text{к})$$

Ответ:  $n = 15 \text{ к.}$

$$V = 1000 \text{ м}^3$$

Задача 13. (У)

Дано:

$$P = 200 \text{ Вт}$$

$$m = 1 \text{ кг}$$

$$c = 4200 \frac{\text{Дж}}{\text{кг} \cdot \text{°C}}$$

$$t_{01} = 60 \text{ °C}$$

$$t_{02} = 61 \text{ °C}$$

$$t_{04} = 1 \text{ мин} = 60 \text{ с}$$

$$t_{02} = 61 \text{ °C}$$

$$t_{02} = 60 \text{ °C}$$

$$t_{\text{ост}} = ?$$

Решение:

$$Q_1 = Pt$$

$$Q_1 = 200 \cdot 60 = 12000 \text{ Дж}$$

$$Q_2 = cm \Delta t = cm(t_{01} - t_{02})$$

$$Q_2 = 4200 \cdot 1 \cdot 1 =$$

$$= 4200 \text{ Дж}$$

$$Q_3 = Q_1 - Q_2 =$$

$$Q_3 = 12000 - 4200 =$$

$$= 7800 \text{ Дж}$$

Всего нагреваем

$$Q = \frac{Q_3}{t_{\text{н}}}$$

$$Q = \frac{7800}{60} = 130 \frac{\text{Дж}}{\text{с}}$$

$$t_{\text{ост}} = \frac{Q_2}{Q}$$

$$t_{\text{ост}} = \frac{4200}{130} = 32,3 (\text{с})$$

Ответ:  $t_{\text{ост}} = 32,3 \text{ с.}$

10.

Задача 1.

Дано:

$$h_1 = 2h_2$$

$$h_3 = ?$$

Решение

$$h_1 = v_0 t + \frac{gt^2}{2} = \frac{gt^2}{2} \quad \text{+}$$

t - общее  
 $\Delta t$  - время  
рыткан

$$h_2 = \frac{g(t-\Delta t)^2}{2} \quad \text{+}$$

$$h_1 = 2h_2$$

$$\frac{gt^2}{2} = \frac{2g(t-\Delta t)^2}{2} \quad | \cdot 2$$

$$gt^2 = 2g(t-\Delta t)^2$$

$$gt = 2(t-\Delta t)^2 = \frac{gt^2}{2g}$$

$$t - \Delta t = \sqrt{\frac{t^2}{2}}$$

$$t - \Delta t = \frac{t}{\sqrt{2}}$$

$$-\Delta t = \frac{t}{\sqrt{2}} - t$$

$$\Delta t = t - \frac{t}{\sqrt{2}}$$

$$h_3 = \frac{g(t-2\Delta t)^2}{2} = \frac{g(t-2(t-\frac{t}{\sqrt{2}}))^2}{2}$$

$$= \frac{g(t-2t+\frac{2t}{\sqrt{2}})(t-\frac{t}{\sqrt{2}})}{2} =$$

$$= \frac{g(t-(2t^2-\frac{2t^2}{\sqrt{2}}-\frac{2t^2}{\sqrt{2}}+\frac{t^2}{2}))}{2} =$$

$$= \frac{g(t-2t^2+\frac{4t^2}{\sqrt{2}}-t)}{2} =$$

$$= \frac{\frac{4gt^2}{\sqrt{2}} - 2gt^2}{2}$$

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