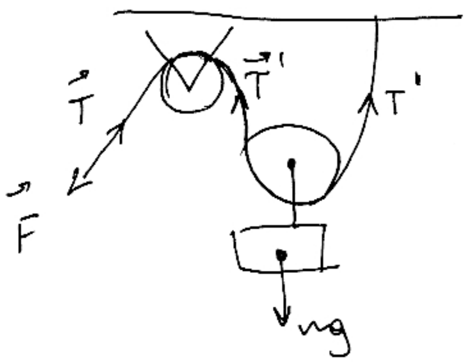
1.



$T = T'$

1	2	3	4	5	Σ
9	8	4	5	1	27

$$\begin{cases} mg - 2T = ma, \\ F - T = 0 \cdot \frac{a}{2}; \end{cases}$$

$$a = \frac{mg - 2T}{g} = \frac{mg - 2F}{g}$$

$$S = \frac{|a|t^2}{2} \Rightarrow t = \sqrt{\frac{2S}{|a|}} = \sqrt{\frac{2Sg}{|mg - 2F|}} = \sqrt{\frac{2 \cdot 1{,}1\,м \cdot 15\,кг}{|15\,кг \cdot 10\,м/с^2 - 2 \cdot 90\,Н|}} =$$

$$= \sqrt{1{,}1}\,с \approx 1{,}05\,с$$

Ответ: 1,05 с.

№2.

$T = const.$

$$A = p\Delta V \Rightarrow \boxed{p = \frac{A}{\Delta V} = \frac{177\,Дж}{1{,}25 \cdot 10^{-3}\,м^3} = 141600\,Па}$$

$$p \cdot 0{,}999V = \nu_н RT$$

$$p \cdot (0{,}999V + \Delta V) = \left(\nu_н + \frac{0{,}001 V \rho_в}{M_в}\right) RT \quad \text{„ — "}$$

$$p\Delta V = \frac{0{,}001 V \rho_в}{M_в} RT \Rightarrow V = \frac{p\Delta V M_в}{0{,}001 \rho_в RT} =$$

$$= \frac{141600\,Па \cdot 1{,}25 \cdot 10^{-3}\,м^3 \cdot 0{,}018\,\frac{кг}{моль}}{0{,}001 \cdot 1000\,\frac{кг}{м^3} \cdot 8{,}31\,\frac{Дж}{моль \cdot К} (110 + 273)\,К} = 1 \cdot 10^{-3}\,м^3$$

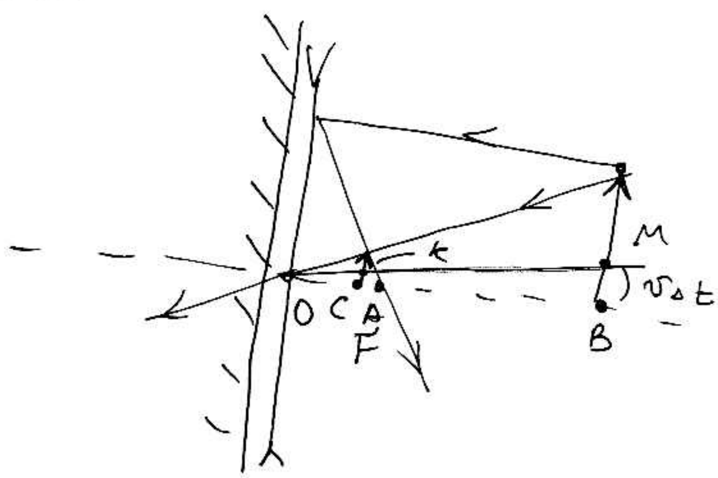
$$\left. \begin{aligned} & p \cdot 0{,}999\, V = \nu_н RT \\ & \nu_н = \frac{m_н}{M_в} \end{aligned} \right| \Rightarrow$$

$$m_п = \frac{p \cdot 0{,}999 V M_в}{RT} = \frac{141600\, Па \cdot 0{,}999 \cdot 1 \cdot 10^{-5}\, м^3 \cdot 0{,}018\, \frac{кг}{моль}}{8{,}31\, \frac{Дж}{моль\, К} \cdot (110 + 273)\, К} = 8 \cdot 10^{-8}\, кг$$

$$m_в = V_в \rho_в = 0{,}001\, V \cdot \rho_в = 0{,}001 \cdot 10^{-5}\, м^3 \cdot 1000\, \frac{кг}{м^3} = 10^{-5}\, кг$$

Ответ: 1) 141600 Па ; 2) $m_{пара} = 8 \cdot 10^{-8}$ кг ; $m_{воды} = 10^{-5}$ кг.

№5.



$$\frac{1}{-OA} = \frac{1}{-OC} + \frac{1}{OB}$$

$OC = d$
$OB = L$
$OA = f$

$$d = \frac{Lf}{L+f} = \frac{4{,}5 f^2}{5{,}5 f} = \frac{9}{11} f$$

$KC = v'_0 t \qquad MB = v_0 t$

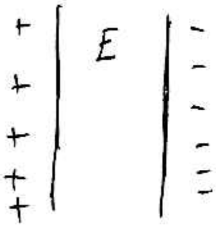
$\triangle OKC \sim \triangle OMB \Rightarrow \dfrac{v'_0 t}{d} = \dfrac{v_0 t}{L} \Rightarrow v' = v \dfrac{d}{L} \Rightarrow$

$\Rightarrow v' = \dfrac{2}{11} v$

$$\frac{m v^2}{2} = \frac{k A^2}{2} \Rightarrow v = A\sqrt{\frac{k}{m}}$$

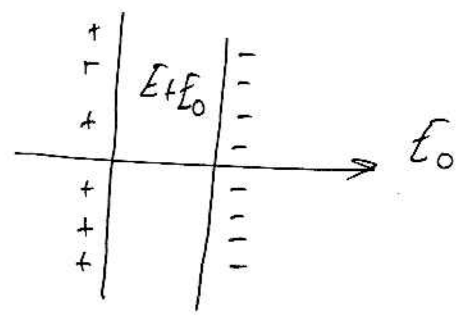
$$\Rightarrow v' = \frac{2}{11} A \sqrt{\frac{k}{m}}$$

№3.



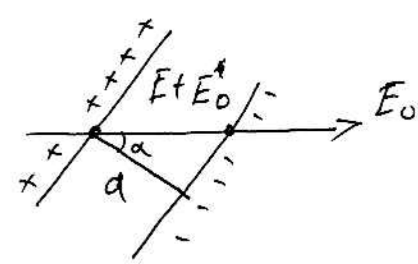
$$\cancel{U = Ed \quad U = \frac{q}{C} \Rightarrow E = \frac{\varepsilon_0 S}{q}}$$

$$E_{конд} = \frac{CU^2}{2} = \frac{C(Ed)^2}{2}$$



$$E_{конд}' = \frac{CU'^2}{2} = \frac{C\left((E+E_0)d\right)^2}{2}$$

$$E_{конд}'' = \frac{CU''^2}{2} = \frac{C\left(Ed + E_0\frac{d}{\cos\alpha}\right)^2}{2}$$



$$A_1 = E_{конд}' - E_{конд} = \frac{Cd^2}{2}\left((E+E_0)^2 - E^2\right)$$

$$A_2 = E_{конд}'' - E_{конд}' = \frac{Cd^2}{2}\left(\left(E+\frac{E_0}{\cos\alpha}\right)^2 - (E+E_0)^2\right)$$

$$\frac{A_2}{A_1} = \frac{\left(E+\frac{E_0}{\cos\alpha}\right)^2 - (E+E_0)^2}{(E+E_0)^2 - E^2} = \frac{\left(\frac{E_0}{\cos\alpha} - E_0\right)\left(2E + E_0\left(1+\frac{1}{\cos\alpha}\right)\right)}{(2E+E_0)(E_0)} =$$

$$= \frac{\frac{1-\cos\alpha}{\cos\alpha}\left(2E + E_0 + \frac{E_0}{\cos\alpha}\right)}{2E + E_0} = \frac{1-\cos\alpha}{\cos\alpha}\left(1 + \frac{E_0}{(2E+E_0)\cos\alpha}\right)$$

при $E << E_0$ получаем

$$\frac{A_2}{A_1} = \left(\frac{1-\cos\alpha}{\cos\alpha}\right)\left(\frac{1+\cos\alpha}{\cos\alpha}\right) =$$

$$= \frac{\sin^2\alpha}{\cos^2\alpha} = \underline{tg^2\alpha}$$

№4.

$$U_{12} = E_{12} d_1 \Rightarrow E_{12} = \frac{U_{12}}{d_1}$$

$$U_{12} = I \frac{\rho_1 d_1}{S} \Rightarrow E_{12} = \frac{I\rho_1 d_1}{S d_1} = \frac{I\rho_1}{S}$$

аналогично $E_{23} = \frac{I\rho_2}{S}$

$$E = \frac{\varepsilon\varepsilon_0 S}{q} \Rightarrow q_{12} = \frac{\varepsilon\varepsilon_0 S}{E_{12}}, \quad q_{23} = \frac{\varepsilon\varepsilon_0 S}{E_{23}}$$

$$F = q_{12}E_{12} + q_{23}E_{23} = \frac{\varepsilon\varepsilon_0 S}{E_{12}}\cdot E_{12} + \frac{\varepsilon\varepsilon_0 S}{E_{23}}\cdot E_{23} =$$

$$= \underline{2\varepsilon\varepsilon_0 S}$$

Ответ: $2\varepsilon\varepsilon_0 S$, в сторону направления течение тока.