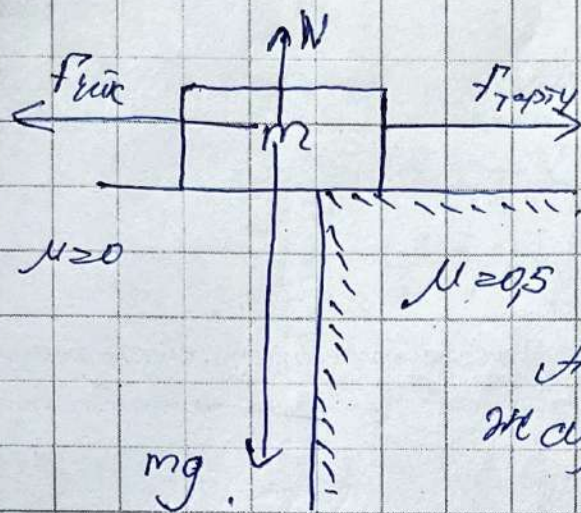
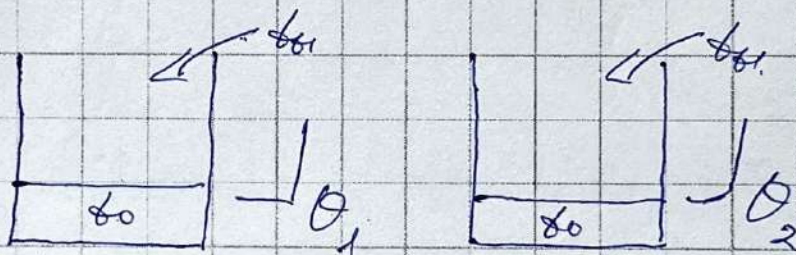


№1.  
m = 1 кг  
L = 2 м  
μ = 0,5  
Ж/к А.



$Ox: F_{тарту} = F_{\text{тр}}.$   
 $Oy: N = mg.$   
 $F_{\text{тр}} = \mu N = \mu mg.$   
 $A = F_{тарту} \cdot L \Rightarrow$   
 $A = F_{\text{тр}} \cdot L = \mu mg \cdot L.$   
 $A = 0,5 \cdot 1 \text{ кг} \cdot 10 \text{ Н/кг} \cdot 2 \text{ м} = 10 \text{ Дж}.$   
 жауабы: А 10 Дж.

№2.  
Бері:  
 $\theta_1 = 60^\circ \text{C}$   
 $\theta_2 = 75,5^\circ \text{C}$



$\theta_{\text{ср}} = 100^\circ \text{C}$   
 ыссы сууды  
 қалыңдығы  
 меншеп атурасы.

Ж/к 60

$V_1 = \frac{1}{3} V_{\text{ж}}$   
 $V_2 = \frac{2}{3} V_{\text{ж}}$

$V_1' = \frac{1}{4} V_{\text{ж}}$   
 $V_2' = \frac{3}{4} V_{\text{ж}}$   
 $Q_1' = Q_2'$

$Q_1 = Q_2$   
 $c m_1 (\theta_1 - \theta_0) = c m_2 (\theta_0 - \theta_1)$

$c m_1' (\theta_2 - \theta_0) = c m_2' (\theta_0 - \theta_2)$

$c \rho V_1 (\theta_1 - \theta_0) = c \rho V_2 (\theta_0 - \theta_1)$

$c \rho V_1' (\theta_2 - \theta_0) = c \rho V_2' (\theta_0 - \theta_2)$

$c \rho \frac{1}{3} V_{\text{ж}} (\theta_1 - \theta_0) = c \rho \frac{2}{3} V_{\text{ж}} (\theta_0 - \theta_1)$

$c \rho \frac{1}{4} V_{\text{ж}} (\theta_2 - \theta_0) = c \rho \frac{3}{4} V_{\text{ж}} (\theta_0 - \theta_2)$

$\frac{1}{3} \theta_1 - \frac{1}{3} \theta_0 = \frac{2}{3} \theta_0 - \frac{2}{3} \theta_1$

$\frac{1}{4} \theta_2 - \frac{1}{4} \theta_0 = \frac{3}{4} \theta_0 - \frac{3}{4} \theta_2$

$\frac{1}{3} \theta_1 + \frac{2}{3} \theta_1 = \frac{2}{3} \theta_0 + \frac{1}{3} \theta_0$

$\frac{1}{4} \theta_2 + \frac{3}{4} \theta_2 = \frac{3}{4} \theta_0 + \frac{1}{4} \theta_0$

$\theta_1 = \frac{2}{3} \theta_0 + \frac{1}{3} \theta_0$

$\theta_2 = \frac{3}{4} \theta_0 + \frac{1}{4} \theta_0$

$\frac{1}{3} \theta_0 = \theta_1 - \frac{2}{3} \theta_0 \Rightarrow \theta_0 = 3(\theta_1 - \frac{2}{3} \theta_0)$

$\frac{1}{4} \theta_0 = \theta_2 - \frac{3}{4} \theta_0 \Rightarrow \theta_0 = 4(\theta_2 - \frac{3}{4} \theta_0)$

$\theta_0 (60 - \frac{2}{3} \cdot 100) \cdot 3 = -19,8$

$\theta_0 (75,5 - \frac{3}{4} \cdot 100) \cdot 4 = 2^\circ \text{C}$

жауабы: Ықпым температурасы  $2^\circ \text{C} - 5^\circ \text{C}$  мен



№2 (жауапсыз).

Егер  $\theta_1 = 100^\circ$  ретінде ұарастырмай, оны белгісізден есептеп көрейік:

$$\theta_2 = (\theta_1 - \frac{1}{3}\theta_0) \cdot \frac{3}{2} \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} \quad (\theta_1 - \frac{1}{3}\theta_0) \cdot \frac{3}{2} = (\theta_2 - \frac{1}{4}\theta_0) \cdot \frac{4}{3}$$

$$\theta_2 = (\theta_2 - \frac{1}{4}\theta_0) \cdot \frac{4}{3} \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} \quad \frac{3}{2}\theta_1 - \frac{3}{2} \cdot \frac{1}{3}\theta_0 = \frac{4}{3}\theta_2 - \frac{4}{3} \cdot \frac{1}{4}\theta_0$$

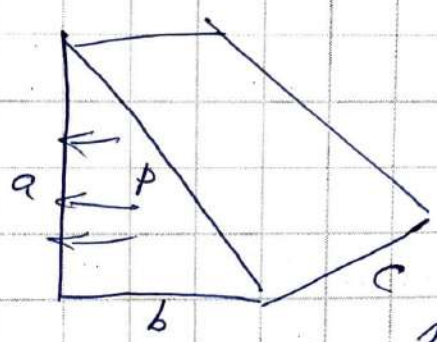
$$\frac{3}{2}\theta_1 - \frac{1}{2}\theta_0 = \frac{4}{3}\theta_2 - \frac{1}{3}\theta_0 \Rightarrow \frac{3}{2}\theta_1 - \frac{1}{3}\theta_2 = \frac{1}{2}\theta_0 - \frac{1}{3}\theta_0 \Rightarrow$$

$$\frac{3}{2}\theta_1 - \frac{1}{3}\theta_2 = \frac{1}{6}\theta_0 \Rightarrow \theta_0 = (\frac{3}{2}\theta_1 - \frac{1}{3}\theta_2) \cdot 6 \Rightarrow \theta_0 = (\frac{3}{2} \cdot 100 - \frac{1}{3} \cdot 75) \cdot 6 \Rightarrow$$

$$\theta_0 = (90 - 100, 6) \cdot 6 = \underline{\underline{63,6}}$$



№3,  
Беріл:  
 $b = 10 \text{ см } 20, 1 \text{ м}$   
 $a = 20 \text{ см } 20, 2 \text{ м}$   
 $c = 20 \text{ см } 20, 2 \text{ м}$

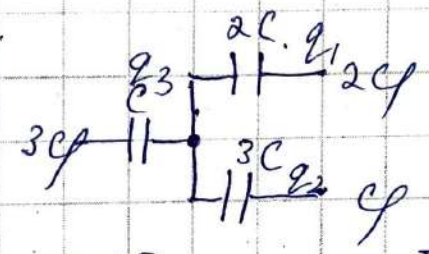


$P = P \cos \alpha$   $h = a$   
 $P = 10^3 \cdot 10 \cdot 0,2 = 2000 \text{ Н}$   
 $\cos \alpha = \frac{b}{a} = \frac{0,1}{0,2} = 0,5$   
 $\alpha = 60^\circ$

Ж/к P,  $\alpha$

Жауабы:  $\alpha = 60^\circ$   $P = 2000 \text{ Н}$

№4  
Беріл:  
 $C = 10 \text{ мкФ } 10^{-5} \text{ Ф}$   
 $\varphi = 300 \text{ В}$



$C = \frac{q}{u} \Rightarrow q = C u$   
 $u = \varphi_1 - \varphi_2$

Ж/к  $q_{\text{жн}}$ ,  $q_1$ ,  $q_2$ ,  $q_3$

Тізбек:  
 $q_{\text{жн}} = q_1 = q_2$   
 $\frac{1}{C_{\text{жн}}} = \frac{1}{C_1} + \frac{1}{C_2}$   
 $u_{\text{жн}} = u_1 + u_2$

Параллель  
 $q_{\text{жн}} = q_1 + q_2$   
 $C_{\text{жн}} = C_1 + C_2$   
 $u_{\text{жн}} = u_1 = u_2$

$q_1 = C_1 u_1 = 2C \cdot (2\varphi - \varphi) = 2C\varphi = 2 \cdot 10^{-5} \cdot 300 = 6 \cdot 10^{-3} \text{ Кл}$

$q_2 = C_2 u_2 = 3C \cdot (2\varphi - \varphi) = 3C\varphi = 3 \cdot 10^{-5} \cdot 300 = 9 \cdot 10^{-3} \text{ Кл}$

Тізбек кезде  $q_1$  мен  $q_2$ -нің қосындысы  $q_3$ -тің мәніне тең деп қарастыруға болады

$q_3 = q_1 + q_2 = q_{\text{жн}} = 6 \cdot 10^{-3} \text{ Кл} + 9 \cdot 10^{-3} \text{ Кл} = 15 \cdot 10^{-3} \text{ Кл}$

$q_3 = C_3 \cdot (3\varphi - \varphi) = C \cdot 2\varphi = 10^{-5} \cdot 2 \cdot 300 \text{ В} = 6 \cdot 10^{-3} \text{ Кл}$

Жауабы:  $q_1 = 6 \cdot 10^{-3} \text{ Кл}$   $q_2 = 9 \cdot 10^{-3} \text{ Кл}$   $q_3 = 15 \cdot 10^{-3} \text{ Кл}$



№ 1.

Бер:

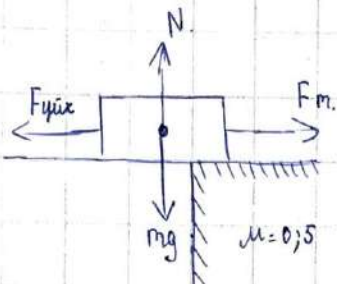
$m = 1 \text{ кг.}$

$L = 2 \text{ м}$

$\mu = 0,5$

н/к:  $A$

Таңдау.



Шешуі:

$F_m = 0,5 \cdot 1 \text{ кг} \cdot 10 \text{ Н/кг} = 5 \text{ Н.}$

$A = 5 \text{ Н} \cdot 2 \text{ м} = 10 \text{ Дж.}$

$v = \text{const} \Rightarrow$  Ньютон I заңы.

$O_x: F_m - F_{yix} = 0.$

$O_y: N = mg.$

$F_m - \mu mg = 0.$

$F_m = \mu mg.$

$L = S \Rightarrow$  себеі білікшенің ұзандығы білікшенің ең аз жұмысалатан жұмысындағы арақашықтыққа тең шамада болады.

$A = F \cdot S \Rightarrow A = \mu mg \cdot L.$

Жауабы:  $A = 10 \text{ Дж.}$

№ 4

Бер:

сбжж.

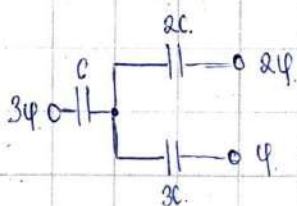
$= 10 \cdot 10^{-3} \text{ ф}$

$C = 10 \text{ мкф.}$

$\varphi = 300 \text{ В.}$

н/к:  $q_1, q_2, q_3$

Таңдау.



Шешуі:

$C_{\text{мапа}1} = 2C + 3C = 5C = 5 \cdot 10^{-2} = 0,05 \text{ ф}$

$C_{\text{мапа}} = \frac{1}{10^{-2}} + \frac{1}{5 \cdot 10^{-2}} \approx 8,3 \cdot 10^{-3} \text{ ф.}$

1) Параллель:  $U_{2C} = 2U + U = 3U = 3 \cdot 300 \text{ В} = 900 \text{ В}$

2) Тізбек:  $U_{2C} = U_1 = 900 \text{ В.}$

$C_1 = C, C_2 = 2C.$

$C_3 = 3C; \varphi_1 = 3\varphi$

$\varphi_2 = 2\varphi, \varphi_3 = \varphi$

$$C_{жалпа} / I = C_2 + C_3 \Rightarrow C_2 \parallel C_3.$$

$$C_{жалпа} = \frac{1}{C_1} + \frac{1}{C_{жалпа2}}$$

$$q = U \cdot I; \quad q = C \cdot U.$$

$$q_{ж} = 8,3 \cdot 10^{-3} \varphi \cdot 900 \text{ В} \approx 7,5 \text{ кВ.}$$

$$q_1 = C \cdot 3U = 10^{-2} \cdot 900 = 9 \text{ кВ.}$$

$$q_2 = 2C \cdot 2U = 0,02 \cdot 600 \text{ В} = 12 \text{ кВ.}$$

$$q_3 = 3C \cdot U = 0,03 \cdot 300 = 9 \text{ кВ.}$$

1) Параллель:  $U_{ж} = U_2 + U_3$

2) Тізбек:  $U_1 \pm U_2 = U_{ж}$

$$q_{жалпа} = C_{жалпа} \cdot U_{жалпа}$$

$$q_1 = C_1 U_1, \quad q_2 = C_2 U_2$$

$$q_3 = C_3 U_3$$

Жауабы:  $q_{жалпа} \approx 7,5 \text{ кВ}; \quad q_1 = 9 \text{ кВ.}$

$$q_2 = 12 \text{ кВ} \quad q_3 = 9 \text{ кВ.}$$

№ 3

Бер:

2 б.ж.

Тарауы

Шешуі

$$a = 20 \text{ см.}$$

$$= 0,2 \text{ м.}$$

$$b = 10 \text{ см.}$$

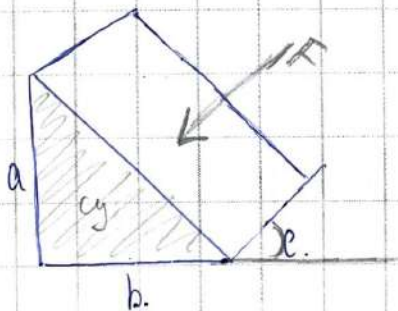
$$= 0,1 \text{ м.}$$

$$c = 20 \text{ см.}$$

$$= 0,2 \text{ м.}$$

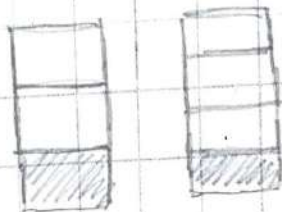
$$\rho_{сү} = 1000 \text{ кг/м}^3.$$

т/к: F; d.





Талау.



1-а. Төз:

1-таман:

$$V_{ay} = \frac{1}{3}$$

$$\theta = 60^\circ \text{C}$$

2-таман:

$$V_{ay} = \frac{1}{4}$$

$$\theta = 75,5^\circ \text{C}$$

м.к:  $t$ ;

$$V_{ay} = \frac{1}{2} \rightarrow t_2 = 100^\circ \text{C} \Rightarrow t_1 = ?$$

$$(Q_1 + Q_2 = Q_3 + Q_4)$$

$$(cm(t_2 - t_1) + cm(\theta - t_1) = cm(t))$$

$$1) Q_1 = Q_2$$

$Q_1$  - басманға н.м.

$$cm_{ay}(t_2 - t_1) = cm_{ay}(\theta - t_1)$$

$Q_2$  - соңға н.м.

$$m_{ay}t_2 - m_{ay}t_1 = m_{ay}\theta - m_{ay}t_1$$

$$(m_{ay}t_2 - m_{ay}\theta = -m_{ay}t_1 + m_{ay}t_1)$$

$$(p_{ay}V_{ay}t_2 - p_{ay}V_{ay}\theta = -p_{ay}V_{ay}t_1 + p_{ay}V_{ay}t_1)$$

$$\text{Шығ.} \left( 1000 \cdot \frac{1}{3} \cdot 100 - 1000 \cdot \frac{3}{3} \cdot 60 = -1000 \cdot \frac{1}{3} t_1 + \left( \frac{1000}{3} \right) \cdot 1000 t_1 \right)$$

$$\frac{1000}{3} \cdot 100 - \frac{1000}{3} t_1 = 1000 \cdot 60 - 1000 t_1$$

$$33333 - 333 t_1 = 60000 - 1000 t_1$$

$$-26667 = -667 t_1$$

$$t_1 \approx 40^\circ \text{C}$$

№1.  
Бер:  
m  
l  
μ  
α  
mlk: A

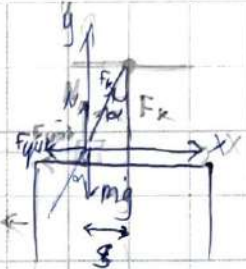
Ш:  $\begin{cases} O_y: N + F_k \cos \alpha = mg; N = mg - k \cdot l \cos \alpha \\ O_x: F_{цик} - F_k \sin \alpha = ma = 0; a = 0; \text{сбдб; толқыштыққа түр.} \end{cases}$

$A = F_{цик} S = F_k \cdot l = \frac{k \cdot l^2}{2}; \frac{g}{l} = \sin \alpha; S = l \sin \alpha$

$A = (mg - k \cdot l \cos \alpha) \mu l \sin \alpha$

$(A = mg) \quad F_{цик} = F_k \sin \alpha = k \cdot l \sin \alpha; \frac{k \cdot l^2}{2} = F_{цик} l \sin \alpha = \frac{k \cdot l \cdot l^2}{2} = \frac{F_{цик} \cdot l^2}{2 \sin \alpha} \Rightarrow$

$\Rightarrow 2 F_{цик} l \sin^2 \alpha = F_{цик} (l - l \cos \alpha) \Rightarrow 2 \sin^2 \alpha = 1 - \cos \alpha \Rightarrow l_0 = l(1 - 2 \sin^2 \alpha) \Rightarrow l = \frac{l_0}{1 - 2 \sin^2 \alpha}$



$A = F_{цик} S; F_k = k \cdot l = mg; k = \frac{mg}{\Delta l}$

$F_{цик} = N \mu = (mg - k \cdot l \cos \alpha) \mu$

$A = (mg - mg \cos \alpha) \mu \cdot \frac{l_0 \sin \alpha}{(1 - 2 \sin^2 \alpha)} = \frac{mg(1 - \cos \alpha) l_0 \sin \alpha \mu}{\cos 2 \alpha}$

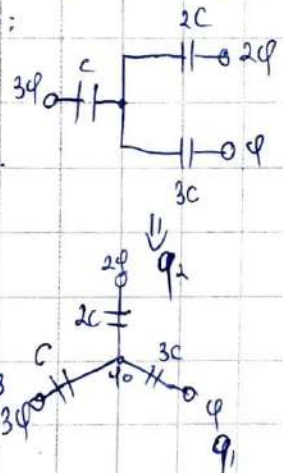
№2.  
C = 10 шкФ  
φ = 300 В  
q<sub>1</sub>; q<sub>2</sub>; q<sub>3</sub>

Ш: Зарядтардың сақталу заңы біша 1 күттеле қосылған зарядтардың қосындысы 0-ге тең болады, яғни:

$q_1 + q_2 + q_3 = 0$

$q_1 = 3C(\varphi - \varphi_0); q_2 = 2C(2\varphi - \varphi_0); q_3 = C(3\varphi - \varphi_0)$

$\Rightarrow 3C(\varphi - \varphi_0) + 2C(2\varphi - \varphi_0) + C(3\varphi - \varphi_0) = 0$



$3C\varphi - 3C\varphi_0 + 4C\varphi - 2C\varphi_0 + 3C\varphi - C\varphi_0 = 0$

$10C\varphi - 6C\varphi_0 = 0 \Rightarrow 10C\varphi = 6C\varphi_0; \varphi_0 = \frac{10\varphi}{6}$

$\Rightarrow \varphi_0 = \frac{10 \cdot 10^{-6} \cdot 300}{6} = 500 \cdot 10^{-6} = 5 \cdot 10^{-3} \text{ В} \quad \varphi_0 = 500 \cdot \text{В}$

$q_1 = 3C(\varphi - \varphi_0) = 3C(\varphi - \frac{10\varphi}{6}) = 3C(\frac{2\varphi - 10\varphi}{6}) = -6 \cdot 10^{-3} \text{ Кл}$

$q_2 = 2C(2\varphi - \varphi_0) = 2C(2\varphi - \frac{10\varphi}{6}) = 2C(\frac{4\varphi - 10\varphi}{6}) = 2 \cdot 10^{-3} \text{ Кл}$

$q_3 = C(3\varphi - \varphi_0) = C(3\varphi - \frac{10\varphi}{6}) = 4 \cdot 10^{-3} \text{ Кл}$

Ш:  $q_1 = -6 \cdot 10^{-3} \text{ Кл}$   
 $q_2 = 2 \cdot 10^{-3} \text{ Кл}$

$q_3 = 4 \cdot 10^{-3} \text{ Кл}$



№3. 1-ші процесс жұбара:  $P = \text{const} \Rightarrow \frac{V_0}{T_0} = \frac{V_1}{T_1} = \frac{\alpha S}{T_0} = \frac{(H+x)}{T_1}$

II. III:  $\frac{V_0}{T_0} = \frac{V_1}{T_1}$ ;  $P = \frac{T_0 \nu R}{V_0} = \frac{T_0 \nu R}{\alpha S}$   $P_0 \approx 0 \Rightarrow$  ;  $P_0 = P = \frac{\nu R T_0}{\alpha S} = \frac{\nu R}{(H+x)}$

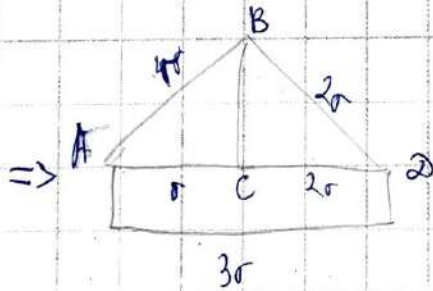
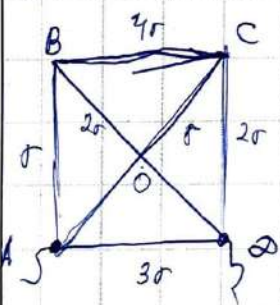
$(mg + PS)H = PSH = \nu p_0 T_0 = mgH = \nu R (T_1 - T_0)$  ;  $P_0(x+H) = T_0 x$

2-мәңгей: жұбара;  $V = \text{const}$  ;  $\frac{P}{T_1} = \frac{P_1}{T_0} \Rightarrow P_1 = \frac{T_0 \nu R}{S(x+H)}$

3-мәңгей: изотермия;  $T_0 = \text{const} = T_0$  ;  $P_1 V_1 = P_2 V_2$  ;  $(P_2 = \frac{2}{3} \frac{RT_0}{V_2})$

$P_2 = \frac{P_1 V_1}{V_2} = \frac{T_0 \nu R}{(H+x-h)S}$

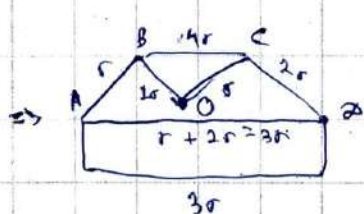
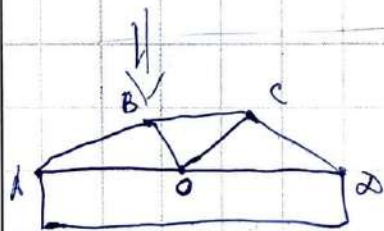
№4.



$\Rightarrow$  BC-геім тоқ өтпейді.  
 $\Rightarrow R_{ABC} = r + 2r = 3r$   
 $R_{AC} = r + 2r = 3r$

$\frac{R}{R} = \frac{1}{3r} + \frac{1}{3r} + \frac{1}{3r} = \frac{3}{3r} = \frac{1}{r}$

$k = r$



$\frac{R_{BOC}}{R_{BOC}} = \frac{1}{4r} + \frac{1}{3r} = \frac{7}{12r}$  ;  $R_{BOC} = 1,7r$

$R_{ABC}$  үшін  $(2+1+1)r = 4,7r$

$R_{ABC} = 3r$  ;  $R_{AD} = 3r$

$R_{(AOC)}(AOC) = \frac{3}{2}r = 1,5r$

$R = \frac{4,7 \cdot 1,5}{4,7 + 1,5} = 1,1r$



1. бер.

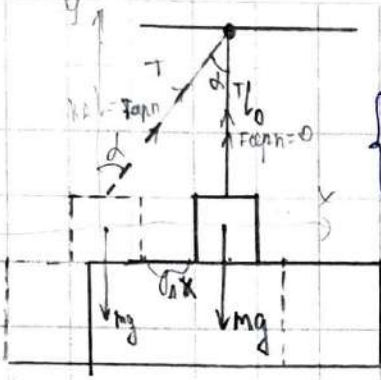
m

l<sub>0</sub>

μ

d

Ж/к: A



$$\sin \alpha = \frac{\Delta x}{\Delta l + l_0}$$

$$\begin{cases} y: mg - T \cos \alpha - F_{ср} \cos \alpha - N = 0 \\ x: F_{yин} + F_{ср} \cos(90 - \alpha) + T \cos(90 - \alpha) = 0 \Rightarrow \end{cases}$$

$$mg - T - N = 0$$

$$\begin{cases} k \Delta x \cos \alpha = mg - mg \cos \alpha + N \cos \alpha - N \\ k \Delta x \sin \alpha = N \sin \alpha - \mu N - mg \sin \alpha \Rightarrow \end{cases}$$

$$\begin{cases} k \Delta x \cos \alpha = \frac{mg}{\cos \alpha} - mg + N - \frac{N}{\cos \alpha} \\ k \Delta x = N - \frac{\mu N}{\sin \alpha} - mg \Rightarrow \end{cases} \Rightarrow \frac{mg}{\cos \alpha} - mg + N - \frac{N}{\cos \alpha} = N - \frac{\mu N}{\sin \alpha} - mg \Rightarrow$$

$$\frac{mg}{\cos \alpha} - \frac{N}{\cos \alpha} + \frac{\mu N}{\sin \alpha} = 0 / \cdot \sin \alpha \Rightarrow mg \tan \alpha - N \tan \alpha + \mu N = 0 \Rightarrow N(\tan \alpha - \mu) = mg \tan \alpha \Rightarrow N = \frac{mg \tan \alpha}{\tan \alpha - \mu}$$

$$\begin{aligned} F_{yин} &= \mu mg = \mu N \\ A = FS &= \mu k \Delta x \end{aligned}$$

$$\tan \alpha = \frac{\Delta x}{l_0} \Rightarrow (\Delta l =) \Delta x = \tan \alpha \cdot l_0 \Rightarrow A = \mu \cdot \frac{mg \tan \alpha}{\tan \alpha - \mu} \cdot \tan \alpha \cdot l_0 \Rightarrow$$

$$A = \frac{mg \tan^2 \alpha \cdot l_0 \cdot \mu}{\tan \alpha - \mu}$$

2. бер.

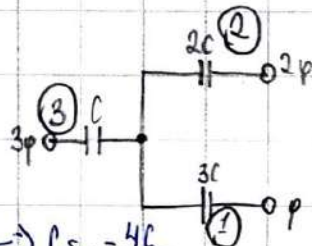
C = 10 мкФ

U = 300 В

Ж/к: q

$$\mu: C = \frac{q}{U} \quad q_1 = 3C U \quad q_2 = 2C \cdot 2U \quad q_3 = 3C U$$

$$C_{1,3} = C_1 + C_3 = 3C + C = 4C \quad \frac{1}{C_{1,3 \mu 2}} = \frac{1}{4C} + \frac{1}{2C} = \frac{3}{4C} \Rightarrow C_{соды} = \frac{4C}{3}$$



$$\frac{4C}{3} = 10 \cdot 10^{-6} \quad C = 7,5 \cdot 10^{-6} \text{ Ф} \Rightarrow q_1 = 3 \cdot 7,5 \cdot 10^{-6} \cdot 300 = 6,75 \cdot 10^{-3} \text{ Кл}$$

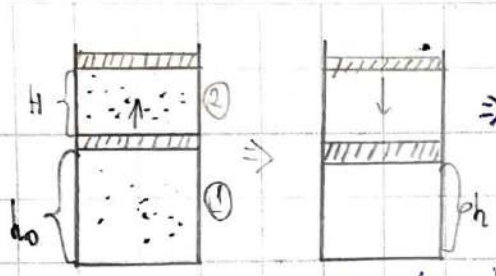
$$q_2 = 2 \cdot 7,5 \cdot 10^{-6} \cdot 2 \cdot 300 = 9 \cdot 10^{-3} \text{ Кл}$$

$$q_3 = 3 \cdot 300 \cdot 7,5 \cdot 10^{-6} = 6,75 \cdot 10^{-3} \text{ Кл}$$



3. бер.  
H

$T_0 = T_1$   
M/K: h



$$\Delta U = \nu R \Delta T \frac{1}{2} \Rightarrow U_0 = \nu R T_0 \frac{1}{2}$$

$$U_2 = \nu R T_2 \frac{1}{2}$$

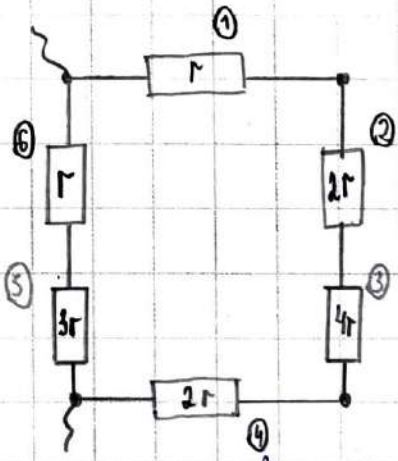
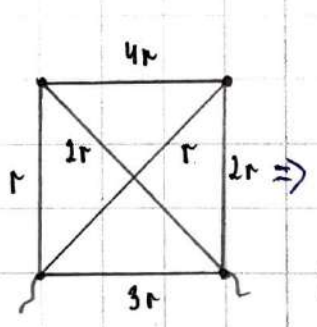
Усынан:  $\nu \frac{T_1}{V_1} = \frac{T_2}{V_2} \Rightarrow T_2 = \frac{V_2 T_1}{V_1} = \frac{(h_0 + H) \nu k \cdot T_0}{h_0 \nu k} = \frac{(h_0 + H) T_0}{h_0} \Rightarrow U_2 = \nu R \frac{(h_0 + H) T_0}{h_0} \frac{1}{2}$

$$\Delta U = \nu R T_0 \frac{1}{2} \left( 1 - \frac{h_0 + H}{h_0} \right) = \frac{H}{h_0} \cdot \frac{\nu R T_0}{2} = \frac{\nu R T_0 H}{2 h_0} \Rightarrow h_0 = h \Rightarrow h = \frac{\nu R T_0 H \frac{1}{2}}{\nu R T_0 \frac{1}{2}} = \frac{T_0 H}{\Delta T}$$

$$h = \frac{T_0 H}{T_2 - T_0}$$

4. бер.  
(A) r, r

4r  
2r, 2r  
3r  
M/K: R<sub>x</sub>



$$R_{2,3} = 2r + 4r = 6r$$

$$\Rightarrow R_{6,5} = r + 3r = 4r$$

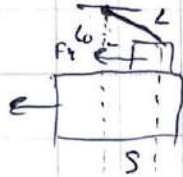
↓  
дифференциал

$$\frac{1}{R_{6,5 \parallel 2,3 \parallel 4}} = \frac{1}{2r} + \frac{1}{4r} + \frac{1}{6r} = \frac{11r}{12r} \Rightarrow \frac{1}{R_H} = \frac{11}{12r} + \frac{1}{r} = \frac{23}{12r} \Rightarrow R_H = \frac{12r}{23}$$

Параллель



1)  $l_0$   
 $\mu$   
 $\alpha$   
-----  
m/r A



$S$  - бұзылған жүзет қанықпақ

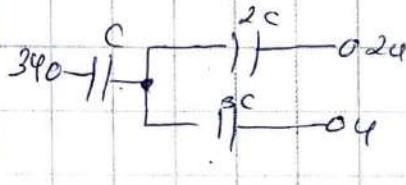
$l$  - ұзындығы

$$F_{тр} = \mu N = \mu mg$$

$$\mu = \tan \alpha = \frac{S}{l_0} \Rightarrow S = l_0 \mu = l_0 \tan \alpha$$

$$A = FS = \mu N \cdot l_0 \mu = \mu mg l_0 \mu = \mu^2 mg l_0 = \mu mg l_0 \tan \alpha = \mu g^2 l_0 mg l_0$$

2)  $C = 10 \text{ мкФ} = 10 \cdot 10^{-6} \text{ Ф}$   
 $\varphi = 300 \text{ В}$   
-----  
m/r  $q_1, q_2, q_3$



$$C = qU \Rightarrow q = \frac{C}{U} \quad U = \varphi_1 - \varphi_2$$

$\varphi_1 = 3\varphi$  - бағаты потенциалы

$$C_1 = C$$

$$C_2 = 2C$$

$$C_3 = 3C$$

$$q_1 = \frac{C_1}{U_1} = \frac{C}{\varphi_1} = \frac{C}{3\varphi} = \quad U_1 = \varphi_1$$

$$= \frac{10 \cdot 10^{-6}}{300} = 0,033 \cdot 10^{-6} \text{ Кл}$$

$$q_2 = \frac{C_2}{U_2} = \frac{20 \cdot 10^{-6}}{\varphi} = \quad U_2 = \varphi_1 - \varphi_2 =$$

$$= \frac{20 \cdot 10^{-6}}{300} = 0,066 \cdot 10^{-6} \text{ Кл} = 3\varphi - 2\varphi = \varphi$$

$$q_3 = \frac{C_3}{U_3} = \frac{30 \cdot 10^{-6}}{2\varphi} = \quad U_3 = \varphi_1 - \varphi_3 =$$

$$= 0,05 \cdot 10^{-6} \text{ Кл} = 3\varphi - \varphi = 2\varphi$$

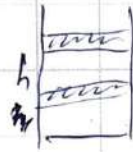
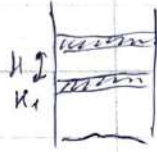
$$\text{як: } q_C = 0,033 \cdot 10^{-6} \text{ Кл} = 0,033 \text{ мкКл}$$

$$q_{2C} = 0,066 \cdot 10^{-6} \text{ Кл} = 0,066 \text{ мкКл}$$

$$q_{3C} = 0,05 \cdot 10^{-6} \text{ Кл} = 0,05 \text{ мкКл}$$



3) H



$k_1$  - бастапқы биіктік

c/n h

$$P_1 V_1 = \nu R T_1$$

$$P_2 V_2 = \nu R T_2$$

$$\frac{Mg}{S} \delta k_1 = \nu R T_1$$

$$Mg (k_1 + k - h) = \nu R T_2$$

$$Mg k_2 = \nu R T_1$$

$$Mgh = \nu C_v (T_2 - T_1) \quad C_v = \frac{5}{2} R$$

$$\nu R T_2 - \nu R T_1 = Mg (k_1 + k - h) - Mg k_1 =$$

$$= Mg k_1 + Mg k - Mg h - Mg k_1 = Mg (k - h)$$

$$Mgh = \nu \frac{5}{2} R (T_2 - T_1) \Rightarrow \frac{2Mgh}{5} = \nu R T_2 - \nu R T_1$$

$$\nu R T_2 - \nu R T_1 = \frac{2Mgh}{5} = \frac{2Mgh}{5}$$

$$k - h = \frac{2}{5} h$$

$$k = \frac{2}{5} h + h$$

$$k = \frac{7h}{5} \Rightarrow h = \frac{5}{7} k$$

$$\text{жн: } \lambda = \frac{5}{7} k$$







1. Бер:  
 $m, l_0$   
 $M, d$   
 $A_y = ?$



Таңғау:

$$A_y = F_y \cdot S.$$

$$F_c + F_{ax} = F_{y1}$$

$$O_y: T = mg.$$

$$mg = T \cdot \cos \alpha.$$

$$F_c = F.$$

$$F_{ax} = \text{tg} \alpha \cdot mg.$$

$$(m+M) \frac{v^2 \cos \alpha}{l_0} = F - F_{y2}$$

$$O_y: N - mg = 0.$$

$$O_x: (M+m)a = F - F_{y2}$$

$$(M+m) \frac{v^2 \cos \alpha}{l_0} = F - F_{y2}$$

$$F = (M+m) \frac{v^2 \cos \alpha}{l_0} + F_{y2} = (M+m) \frac{v^2 \cos \alpha}{l_0} + M \cdot M_2 g.$$

$$1) O_x: F_c + F_{ax} = F_{y1}$$

$$F_c = F; F_{ax} = \text{tg} \alpha \cdot mg; mg = T \cdot \cos \alpha.$$

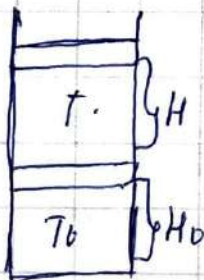
$$M \cdot M_2 g + (M+m) \frac{v^2 \cos \alpha}{l_0} + \text{tg} \alpha \cdot mg = F_{y1}$$

$$M \cdot M_2 g + (M+m) \frac{v^2 \cos \alpha}{l_0} + \frac{\sin \alpha}{\cos \alpha} \cdot T \cdot \cos \alpha = F_{y1}$$

$$F_{y1} = (M+m) \frac{v^2 \cos \alpha}{l_0} + M \cdot M_2 g + T \sin \alpha.$$

$$A_y = F_y \cdot S = \left( (M+m) \frac{v^2 \cos \alpha}{l_0} + M \cdot M_2 g + T \sin \alpha \right) S.$$

2 бер:  
 $H_0, T_0$   
 $M, T$   
 $\Delta H = ?$



$$A_0 = p \Delta V = p_0 \cdot H_0 \cdot S = \Delta R T_0.$$

$$p_0 \cdot H_0 \cdot S = \Delta R T_0.$$

$$A_1 = p \Delta V = (p_0 + p) (H + H_0) \cdot S.$$

$$(p_0 + p) (H + H_0) \cdot S = \Delta R T.$$

$$A_2 = p \Delta V = p_0 \Delta H \cdot S.$$

$$p_0 \Delta H \cdot S = \Delta R T.$$

$$\frac{(p_0 + p) (H + H_0) \cdot S = \Delta R T}{p_0 \cdot H_0 \cdot S} = \frac{\Delta R T}{\Delta R T_0}$$

шүткіл ауа үлестіріліп өте ау шама бауып өсілетіндігін.

$$\begin{cases} (p_0 + p) (H + H_0) \cdot S = \Delta R T \\ p_0 \cdot H_0 \cdot S = \Delta R T_0 \end{cases}$$

$$\frac{M + H_0}{H_0} = \frac{T}{T_0} \Rightarrow T = \frac{(M + H_0) \cdot T_0}{H_0}$$

$$A_2 = p_0 \Delta H \cdot S \Rightarrow \Delta H = \frac{A_2}{p_0 S}$$

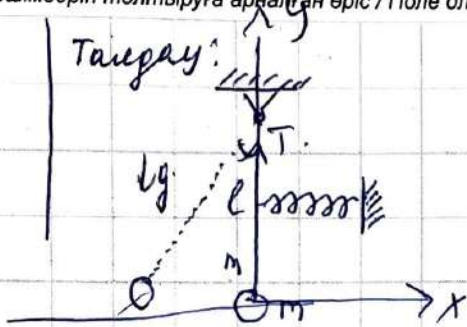
$$p_0 \cdot \Delta H \cdot S = \Delta R T.$$

$\Delta H =$

$$\Delta H = \frac{\Delta R T}{p_0 S} = \frac{\Delta R (M + H_0) \cdot T_0}{H_0 \cdot p_0 \cdot S} = \frac{\Delta R T_0 (M + H_0)}{H_0 p_0 S}$$



3. Бер:  
 $m, l, k, g$   
 $T = ?$



$$T = \alpha \sqrt{\frac{m}{k}}; T = \alpha \sqrt{\frac{l}{g}}; F = k \Delta x$$

$$O_y: ma = mg - T.$$

$$\operatorname{tg} \alpha = \frac{l_x}{l_y} \Rightarrow l_x = l \cdot \operatorname{tg} \alpha.$$

$$\sin \alpha = \frac{F_x}{F \sin \alpha} \Rightarrow F_x = F \cdot \sin^2 \alpha.$$

$$E_n = F \cdot n, \quad h = l$$

$$mgh = \frac{kx^2}{2}$$

$$mgl \operatorname{tg} \alpha = \frac{F \cdot \sin^2 \alpha \cdot x}{2}$$

$$2mgl \operatorname{tg} \alpha = F \cdot \sin^2 \alpha \cdot x$$

$$2mgl \operatorname{tg} \alpha = kx^2 \cdot \sin^2 \alpha.$$

$$m = \frac{kx^2 \sin^2 \alpha}{2gl \operatorname{tg} \alpha}.$$

$$T = \alpha \left( \sqrt{\frac{m}{k}} + \sqrt{\frac{l}{g}} \right) =$$

$$= \alpha \left( \sqrt{\frac{kx^2 \sin^2 \alpha}{2gl \operatorname{tg} \alpha k}} + \sqrt{\frac{gl \operatorname{tg} \alpha}{g}} \right) =$$

$$= \alpha \left( x \sin \alpha \sqrt{\frac{1}{2gl \operatorname{tg} \alpha}} + \sqrt{\frac{gl \operatorname{tg} \alpha}{g}} \right).$$

4 бер:

$m; q$

$R; d; B.$

$\omega = ? T = ?$

Таңдау:

$$F_n = q \cdot B \cdot l \cdot \sin \alpha$$

$$ma = q \cdot B \cdot l \cdot \sin \alpha$$

$$\frac{m l \omega^2}{R} = q \cdot B \cdot l \cdot \sin \alpha.$$

$$R = \frac{m l \omega^2}{q \cdot B \cdot l \cdot \sin \alpha} = \frac{m l \omega^2}{q B \sin \alpha}$$



$$\omega = \frac{2\pi}{T}; \quad \ell = \omega R \Rightarrow \omega = \frac{\ell}{R}.$$

$$\frac{\ell}{R} = \frac{2\pi}{T} \Rightarrow T = \frac{2\pi R}{\ell}.$$

$$R = \frac{m l \omega^2}{q B \sin \alpha} \Rightarrow \ell = \frac{R q B \sin \alpha}{m}.$$

$$T = \frac{2\pi R m}{R q B \sin \alpha} = \frac{2\pi m}{q B \sin \alpha}.$$

Тәңішк электр

өрісін айнама

открыт магнит

өрісіне енеді.





4 - тапсырма

Бер:

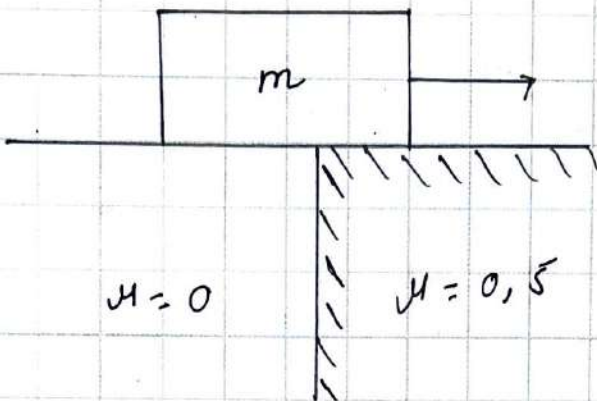
$$m = 1 \text{ кг.}$$

$$L = 2 \text{ м}$$

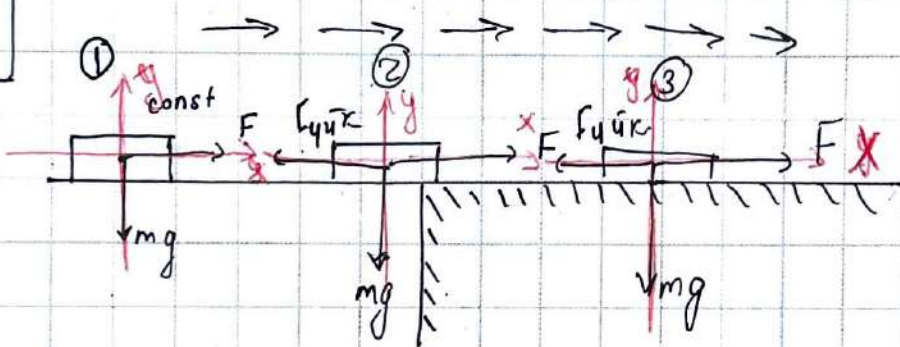
$$\mu_1 = 0$$

$$\mu_2 = 0,5$$

м/к А - ?

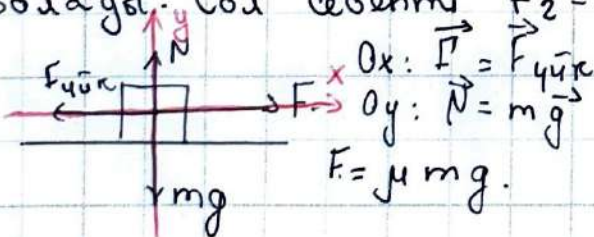


$$A = F \cdot L$$



① мұз бойымен (тегіс жол) қозғалту үшін ~~және~~ жұмыс істейтін күш кем дегенде білекпен тірел тұрған ауырлық күшіне тең болуы керек:  $F_1 = mg$ . (1)

② және ③. Дегенің тек  $\frac{1}{4}$  бөлігі кедергіге тап болса да, жартысы тап болса да, толықтай дегенімен ~~кедергі~~ кедір-бұдыр бетке түсседі кедергі күшіне тап болады. Сол себепті  $F_2 = F = \mu mg$ . (2)



$$A = (F_1 + F_2)L = (\mu mg + mg) \cdot L$$

$$= mg(\mu + 1) \cdot L = 1 \cdot 10 \cdot 1,5 \cdot 2$$

$$= 30 \text{ Дж}$$

Жауабы: кем дегенде  $A = 30 \text{ Дж}$  қажет.



2- тапсырма

Бер:

$$1) V_1 = \frac{1}{3} V$$

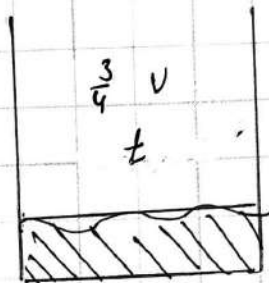
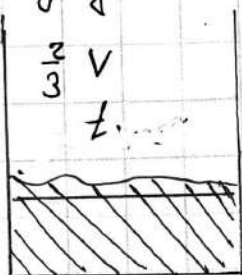
$$V_2 = \frac{1}{4} V$$

$$\theta_1 = 60^\circ \text{C}$$

$$\theta_2 = 25,5^\circ \text{C}$$

$$2) V_3 = \frac{1}{2} V$$

Тапсырма



м.к. 1)  $t_0$  - ?

2)  $\theta_3$  - ?

бастапқы температура ортақ:  $t_0$ .  
өстөс сугау температура көрсет-  
мелендіктен, оны  $t$  деп қойғам.

Қалу = Қберу (бірінші жағдай)

$$c_{\text{сy}} m_{\text{сy}_1} (\theta_1 - t_0) = c_{\text{сy}} m_{\text{сy}_1'} (t - \theta_1)$$

$$m_{\text{сy}_1} = \rho_{\text{сy}} V_1 = \rho_{\text{сy}} \cdot \frac{1}{3} V$$

$$m_{\text{сy}_1'} = \rho_{\text{сy}} \cdot \frac{2}{3} V \text{ (өстөс су массасы)}$$

$$\rho_{\text{сy}} \cdot \frac{1}{3} V (60 - t_0) = \rho_{\text{сy}} \cdot \frac{2}{3} V (t - 60)$$

$$\frac{1}{3} (60 - t_0) = \frac{2}{3} (t - 60) \quad | : \frac{1}{3}$$

$$60 - t_0 = 2t - 120$$

$$2t + t_0 = 180 \quad (1)$$



$$Q_{\text{су}} = Q_{\text{беру}} \text{ (екінші ыдыс)}$$

$$\rho_{\text{су}} m_{\text{су}1} (\theta_1 - t_0) = \rho_{\text{су}} m_{\text{су}2}'' (t - \theta_2)$$

$$m_{\text{су}1} = \rho_{\text{су}} \cdot \frac{1}{4} V$$

$$m_{\text{су}2}'' = \rho_{\text{су}} \cdot \frac{3}{4} V. \text{ (көптеген су массасы)}$$

$$\rho_{\text{су}} \cdot \frac{1}{4} (75,5 - t_0) = \rho_{\text{су}} \cdot \frac{3}{4} (t - 75,5)$$

$$\frac{1}{4} (75,5 - t_0) = \frac{3}{4} (t - 75,5) \quad | : \frac{1}{4}$$

$$75,5 - t_0 = 3t - 226,5$$

$$3t + t_0 = 302. \quad (2)$$

$$\begin{cases} 2t + t_0 = 180 \\ 3t + t_0 = 302 \end{cases} \Rightarrow \begin{cases} (2t + t_0) + t = 302 \\ t = 302 - 180 = 122^\circ \end{cases} \quad (3)$$

$$3t + t_0 = 302.$$

$$t_0 = 302 - 3 \cdot 122 = -64^\circ \text{C}. \quad (4)$$

$\frac{1}{2} V$
$t = 122^\circ$
$t_0 = -64^\circ$
$\frac{1}{2} V$

$$2) \quad Q_{\text{су}} = Q_{\text{беру}}.$$

$$\rho_{\text{су}} m_{\text{су}3} (t_3 - t_0) = \rho_{\text{су}} m_{\text{су}3}' (t - \theta_3)$$

$$m_{\text{су}3} = \rho_{\text{су}} \cdot \frac{1}{2} V \quad m_{\text{су}3}' = \rho_{\text{су}} \cdot \frac{1}{2} V. \text{ (көптеген су массасы)}$$

$$\rho_{\text{су}} \cdot \frac{1}{2} (t_3 - (-64)) = \rho_{\text{су}} \cdot \frac{1}{2} (122 - \theta_3) \quad | : \frac{1}{2}$$

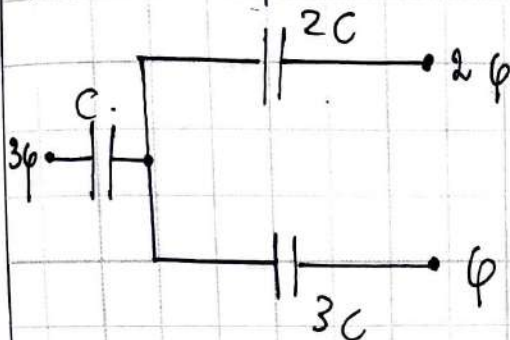
$$\theta_3 + 64 = 122 - \theta_3$$

$$2\theta_3 = 58 \quad \theta_3 = 29^\circ \text{C}.$$



Жауабы: Бірінші температурасы  $= -64^{\circ}\text{C}$   
Екінші орныққан температура  $28^{\circ}\text{C}$ .

4 - тапсырма.

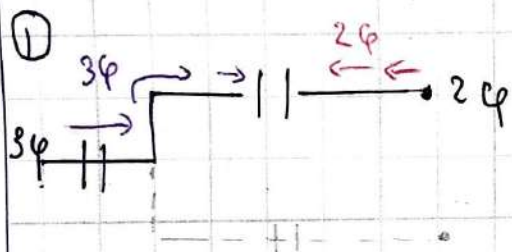


Бер:

$$C = 10 \cdot 10^{-6} \text{ Ф}$$

$$\varphi = 300 \text{ В}$$

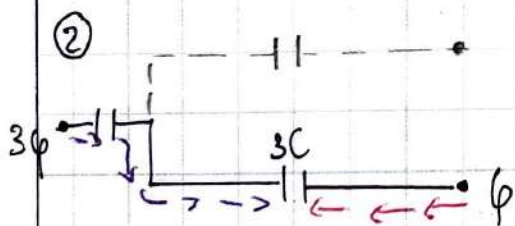
м.к.  $Q_1 - ?$   
 $Q_2 - ?$   
 $Q_3 - ?$



потенциалдардың айырмасы керекке тең.  
 $\varphi_1 - \varphi_2 = U_{12}$

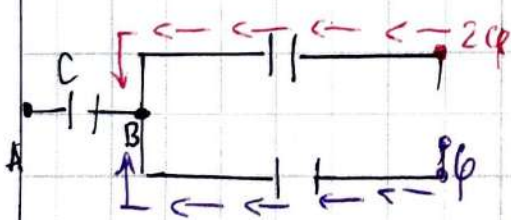
$U_1 = 3\varphi - 2\varphi = \varphi = 300 \text{ В}$  (үстіңгі конденсаторға жеткен кернеу)

$Q_1 = C \cdot U = \frac{Q}{U} \quad Q_1 = C_1 \cdot U_1 = 10 \cdot 10^{-6} \cdot 300 = 6 \cdot 10^{-3} \text{ Кл}$



$U_2 = 3\varphi - \varphi = 2\varphi = 600 \text{ В}$

$Q_2 = 3 \cdot 10 \cdot 10^{-6} \cdot 600 = 18 \cdot 10^{-3} \text{ Кл}$



B нүктесіндегі кернеу:  $2\varphi - \varphi = \varphi$   
A нүктесінде:  $3\varphi$

$U_A - U_B = 3\varphi - \varphi = 2\varphi = 600 \text{ В}$

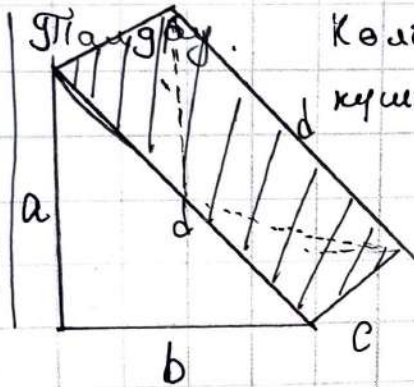
$Q_3 = C \cdot 600 = 10 \cdot 10^{-6} \cdot 600 = 6 \cdot 10^{-3} \text{ Кл}$



жауабы:  $Q_1 = 6 \cdot 10^{-3} \text{ Кж}$ ;  $Q_2 = 18 \cdot 10^{-3} \text{ Кж}$ ;  $Q_3 = 6 \cdot 10^{-3} \text{ Кж}$

3- тап сұрама.

Бер:  $b = 0,1 \text{ м}$   
 $c = 0,2 \text{ м}$   
 $a = 0,2 \text{ м}$   
 $\rho = 1000 \frac{\text{Кж}}{\text{м}^3}$

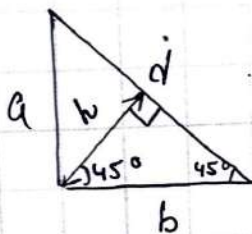


Көлбеу қиымы:  $F_g = N + \rho g h$   
(Насилье формула)

(1)  $N = mg \cos \alpha$

1)  $F_g = ?$   
2)  $\alpha = ?$

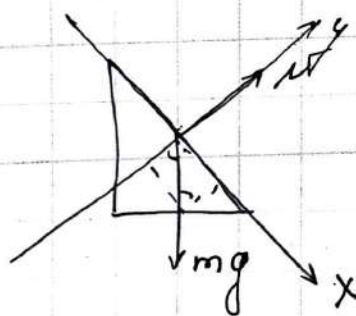
3)  $d = \sqrt{a^2 + b^2} = \sqrt{0,2^2 + 0,1^2} = 0,2236 \text{ м}$



$h = \frac{d}{2} = 0,1118 \text{ м}$

$\rho g h = 1000 \cdot 10 \cdot 0,1118 =$

$= 1118 \text{ Н. (1)}$



$N = mg \cos \alpha$

$\alpha = 45^\circ$  (екінші суретте де  $\alpha = 45^\circ$  екені дәлелденген)

$N =$

$(m = \rho_{\text{сұ}} V)$

$V = \frac{a \cdot b}{2} \cdot c = \frac{0,2 \cdot 0,1}{2} \cdot 0,2 = 2 \cdot 10^{-3} \text{ м}^3 \text{ (2)}$

$m = \rho_{\text{сұ}} \cdot V = 1000 \cdot 2 \cdot 10^{-3} = 2 \text{ Кж. (3)}$

$N = 2 \cdot 10 \cdot \cos 45 = 14,14 \text{ Н. (4)}$

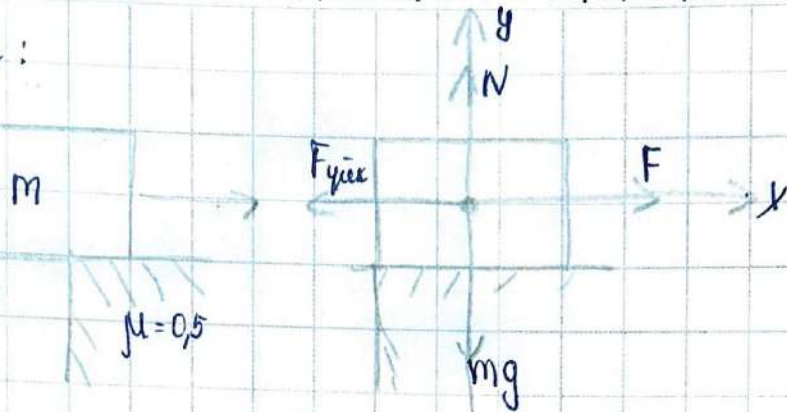
$F_g = \rho g h + N = 1118 + 14,14 = 1132,14 \text{ Н. (5)}$

Жауабы: горизонталь бағыттағы бұрыш  $\alpha = 45^\circ$ . Ал күші  $F_g = 1132,14 \text{ Н}$ .



1. Бер:  
 $m = 1 \text{ кг}$   
 $L = 2 \text{ м}$   
 $\mu = 0,5$   
 $a = 0$   
 Ш/к:  $A = ?$

Шешуі:



$$\text{Ox: } F = F_{\text{үйк}}$$

$$\text{Oy: } N = mg$$

$$F_{\text{үйк}} = \mu N = \mu mg$$

$$F = \mu mg$$

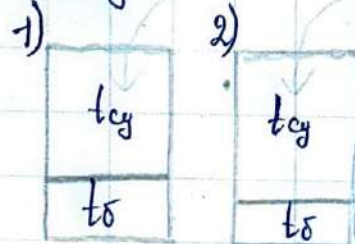
$$s = L$$

$$A = FS = \mu mg \cdot L = 0,5 \cdot 1 \cdot 10 \cdot 2 = 10 \text{ Дж}$$

Жауабы:  $A = 10 \text{ Дж}$

2. Бер:  
 $\theta_1 = 60^\circ \text{C}$   
 $\theta_2 = -75,5^\circ \text{C}$   
 Ш/к:  $t_0 = ?$   
 $\theta_3 = ?$

Шешуі:



$m$ - шеткі ернеуге дейін  
толтырылған су

$$m_1 = \frac{1}{3} m$$

$$m_1 = \frac{2}{3} m$$

$$m_2 = \frac{1}{4} m$$

$$m_2 = \frac{3}{4} m$$

$$\textcircled{1} t_0 < \theta_1 < t_{ey}$$

$$\frac{1}{3} cm(\theta_1 - t_0) = \frac{2}{3m} cm(t_{ey} - \theta_1) \quad | \cdot 3$$

$$cm(\theta_1 - t_0) = 2cm(t_{ey} - \theta_1)$$

$$cm\theta_1 - cm t_0 = 2cm t_{ey} - 2cm\theta_1$$

$$2cm t_{ey} = cm\theta_1 - cm t_0 + 2cm\theta_1$$

$$t_{ey} =$$

$$t_{ey} = \frac{cm(\theta_1 - t_0 + 2\theta_1)}{2cm} = \frac{\theta_1 - t_0 + 2\theta_1}{2}$$



$$\textcircled{2} \quad t_5 < \theta_2 < t_{cy} \\ \frac{1}{4} cm(\theta_2 - t_5) = \frac{3}{4} cm(t_{cy} - \theta_2) \quad | \cdot 4$$

$$cm(\theta_2 - t_5) = 3cm(t_{cy} - \theta_2) \quad t_{cy} = \frac{3\theta_2 - t_5}{2}$$

$$\theta_2 - t_5 = 3t_{cy} - 3\theta_2$$

$$\theta_2 - t_5 = 3 \cdot \frac{3\theta_2 - t_5}{2} - 3\theta_2$$

$$\theta_2 - t_5 = \frac{9\theta_2 - 3t_5}{2} - 3\theta_2$$

$$\theta_2 - t_5 = \frac{9\theta_2 - 3t_5 - 6\theta_2}{2}$$

$$2\theta_2 - 2t_5 = 9\theta_2 - 3t_5 - 6\theta_2$$

$$-2t_5 + 3t_5 = 9\theta_2 - 6\theta_2 - 2\theta_2$$

$$t_5 = 9\theta_2 - 8\theta_2$$

$$t_5 = 9 \cdot 60 - 8 \cdot (-75,5) = 540 + 604 = 1144^\circ\text{C}$$

$t_{cy}$
$t_5$

$$t_{cy} = \frac{3\theta_2 - t_5}{2} = \frac{3 \cdot 60 - 1144}{2} = \frac{180 - 1144}{2} = -482^\circ\text{C}$$

$$\frac{1}{2} cm(\theta_3 - t_5) = \frac{1}{2} cm(t_{cy} - \theta_3)$$

$$\theta_3 - t_5 = t_{cy} - \theta_3$$

$$2\theta_3 = t_{cy} + t_5$$

$$\theta_3 = \frac{t_{cy} + t_5}{2} = \frac{-482 + 1144}{2} = \frac{662}{2} = 331^\circ\text{C}$$

Жауабы:  $t_5 = 1144^\circ\text{C}$ ,  $\theta_3 = 331^\circ\text{C}$



3. Бер:

$$b = 10 \text{ см} = 0,1 \text{ м}$$

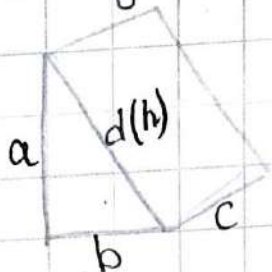
$$c = 20 \text{ см} = 0,2 \text{ м}$$

$$a = 20 \text{ см} = 0,2 \text{ м}$$

$$\rho_{\text{сұ}} = 1000 \text{ кг/м}^3$$

Ш/к:  $F = ?$

Шешуі:



$$F = pS$$

$$P = \rho_{\text{сұ}} g h = \rho_{\text{сұ}} g d$$

$$S = h \cdot c = d \cdot c$$

$$d = \sqrt{a^2 + b^2} \text{ (Пифагор)}$$

$$h = d$$

$$F = \rho_{\text{сұ}} g d \cdot dc = \rho_{\text{сұ}} g \sqrt{a^2 + b^2} \cdot \sqrt{a^2 + b^2} \cdot c =$$

$$= \rho_{\text{сұ}} g c (a^2 + b^2) = 1000 \cdot 10 \cdot 0,2 \cdot (0,2^2 + 0,1^2) =$$

$$= 2000 (0,04 + 0,01) = 2000 \cdot 0,05 = 100 \text{ Н}$$

Жауабы:  $F = 100 \text{ Н}$

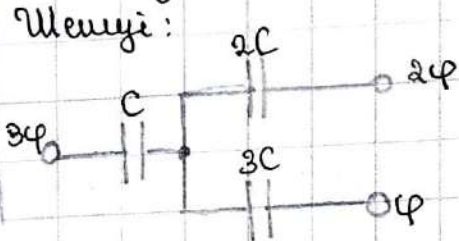
4. Бер:

$$C = 10 \text{ мкФ}$$

$$\varphi = 300 \text{ В}$$

Ш/к:  $q_1, q_2, q_3 = ?$

Шешуі:



$$C_1 = 2 \cdot 10 \cdot 10^{-6} = 20 \cdot 10^{-6} \text{ Ф}$$

$$C_2 = 3 \cdot 10 \cdot 10^{-6} = 30 \cdot 10^{-6} \text{ Ф}$$

$$C_3 = 10 \cdot 10^{-6} \text{ Ф}$$

$$q_1 = C_1 \varphi_1 = 10 \cdot 10^{-6} \cdot 300 \cdot 3 = 9000 \cdot 10^{-6} \text{ Кл} = 9 \cdot 10^{-9} \text{ Кл}$$

$$q_2 = 2C \cdot 2\varphi = 4 \cdot 10 \cdot 10^{-6} \cdot 300 = 12000 \cdot 10^{-6} \text{ Кл} = 12 \cdot 10^{-9} \text{ Кл}$$

$$q_3 = 3C \cdot \varphi = 3 \cdot 10 \cdot 10^{-6} \cdot 300 = 9000 \cdot 10^{-6} \text{ Кл} = 9 \cdot 10^{-9} \text{ Кл}$$

Жауабы:  $q_1 = 9 \cdot 10^{-9} \text{ Кл}$

$$q_2 = 12 \cdot 10^{-9} \text{ Кл}$$

$$q_3 = 9 \cdot 10^{-9} \text{ Кл}$$



1)

$m$

$l_0$

$\mu$

$\alpha$

$A_{\text{үтік}}$

1)



2)



$$A = F_{\text{үтік}} l_0 = \mu m g l_0 \cos \alpha$$

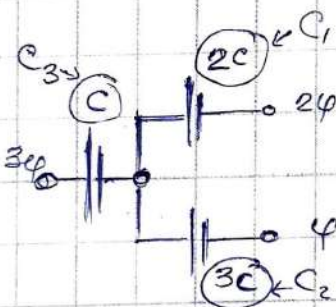
$$l_0 = \frac{l_0}{\Delta x} \cos \alpha$$

2)

$$C = 10 \text{ мккФ}$$

$$\varphi = 300 \text{ В}$$

$q$



$$C_{\text{пар}} = C_1 + C_2 = 5C = 50 \text{ мккФ}$$

$$C_{\text{сер}} = \frac{1}{\frac{1}{5C} + \frac{1}{C_3}} = \frac{C + 5C}{5C^2} = \frac{6C}{5C^2} = \frac{6}{5C} = 0,12 \text{ мккФ}$$

$$C = \frac{6}{q}$$

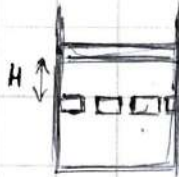
$$A = q\varphi$$



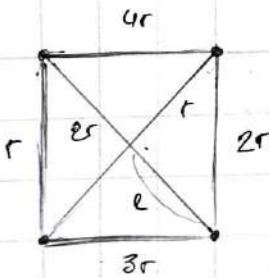
3)

$$T_0 = 25^\circ\text{C}$$

$$k_2 = H$$



4)



$$(3r)^2 + r^2 = 10r^2$$

$$l = r(\sqrt{10} - 2)$$

Егер бұл квадрат, то  
бәрі 4 жағы тең болуы  
қажет.

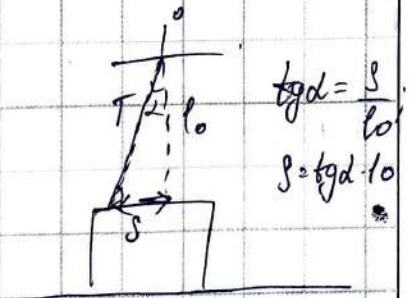
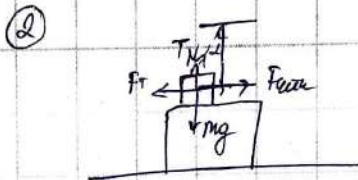
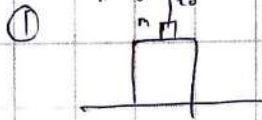
Тигіз.  $R_2 = R_1 + R_2 \dots$

Нәтижесінде  $R_2 = \frac{R_1 + R_2}{R_1 R_2}$



1) Бер:  $m$  (байлесе)  
 $l_0$  (үзіндісі үшін)  
 $\mu$  (үйк. коэффициент)  
 $m$  к:  $F_T$ .

- Шешуі:



$$\operatorname{tg} \alpha = \frac{s}{l_0}$$

$$s = \operatorname{tg} \alpha \cdot l_0$$

$$\sin \alpha = \frac{s}{T}; \quad \cos \alpha = \frac{l_0}{T}$$

$$T = 2\pi \sqrt{\frac{l_0}{g}} \Rightarrow T = 2\pi \sqrt{\frac{l_0}{10}} = 2\pi \sqrt{\frac{2}{5} l_0}$$

$$N_2 = \mu g + mg; \quad F_{\text{reak}2} = F_T \Rightarrow T_T = \mu l_0 g;$$

$$T + N = g(\mu + m) \Rightarrow N_1 = \mu g + mg - T; \quad N_1 = N_2 \Rightarrow \mu g = \mu g + mg - T \Rightarrow \boxed{T = mg}$$

$$T \sin \alpha - mg + N = 0. \Rightarrow T \cos \alpha - F_T = 0. \Rightarrow F_T = T \cos \alpha;$$

$$N = mg - T \sin \alpha = mg - mg \sin \alpha = mg(1 - \sin \alpha); \quad \boxed{F_{\text{reak}} = \mu mg(1 - \sin \alpha)}$$

②. 
$$\begin{cases} F_{\text{reak}} + T \cos \alpha - F_T = 0 \\ N + T \sin \alpha - mg = 0. \end{cases} \Rightarrow \begin{cases} \mu N + T \cos \alpha - F_T = 0 \\ N = mg - T \sin \alpha \end{cases}$$

$$\mu mg - \mu T \sin \alpha + T \cos \alpha - F_T = 0$$

$$F_T = F_{\text{reak}} \Rightarrow N = (m + \mu)g;$$

$$F_T = \mu g(m + \mu); \quad F_T = \mu mg - \mu T \sin \alpha + T \cos \alpha;$$

$$\mu mg - \mu T \sin \alpha + T \cos \alpha = \mu mg + \mu mg \Rightarrow \mu T \sin \alpha - T \cos \alpha = 0.$$

$$\mu(Mg + T \sin \alpha) = T \cos \alpha \Rightarrow \mu = \frac{T \cos \alpha}{Mg + T \sin \alpha};$$

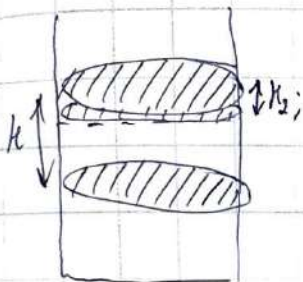
$$F_{\text{reak}} = \frac{T \cos \alpha}{\mu g + T \sin \alpha} \cdot g(m + \mu);$$

③ 
$$A = F_{\text{reak}} \cdot s \Rightarrow A = \mu mg(1 - \sin \alpha) \cdot \frac{s}{\cos \alpha} \Rightarrow A = \mu mg l_0 \operatorname{tg} \alpha - \mu mg l_0 \frac{\sin^2 \alpha}{\cos \alpha}$$

$$= \mu mg l_0 \left( \operatorname{tg} \alpha - \frac{\sin^2 \alpha}{\cos \alpha} \right);$$

3

9-сін;  
Шешімі:



$$p = \frac{1}{2} \rho g h$$

$$A = p \Delta V; A = p S; \Rightarrow p S = \rho \Delta V \Rightarrow S \Delta h = \rho S h \Rightarrow h = 1;$$

$$A_1 = p \Delta V \Rightarrow A_1 = \rho S h_1$$

$$p_1 = \frac{1}{2} \rho g h_1 = \frac{\rho g R T_1}{2}$$

$$p_2 = \frac{\rho g R T_2}{2}; \quad A_1 = p_1 \Delta V_1 = p_1 S h_1 \Rightarrow A_1 = \frac{\rho g R T_1}{2} S h_1$$

$$A_2 = \frac{\rho g R T_2}{2} S h_2$$

$$\Rightarrow \Delta t = t_2 - t_1 = \frac{\rho g R \Delta T \cdot S h_1}{2} - \frac{\rho g R T_1 \cdot S h_2}{2} = \frac{\rho g R S (h_1 \Delta T - h_2 T_1)}{2}$$

$$p = \frac{F}{S} = \frac{mg}{S}; \quad A_1 = \frac{mg}{S} S h_1 = mg h_1; \quad h_2 = \frac{mg}{S} \Rightarrow S h_2 = mg h_2 \quad \Rightarrow \Delta t = t_2 - t_1$$

$$= mg (h_2 - h_1)$$

$$\Delta t = \frac{\rho g R S h_1 \Delta T}{2} - \frac{\rho g R S h_2 T_1}{2} = \frac{\rho g R S (h_1 \Delta T - h_2 T_1)}{2} = \frac{\rho g R S (h_1 T_1 - h_2 T_2 - h_2 T_1)}{2}$$

$$mg (h_2 - h_1) = \frac{\rho g R S}{2} (h_1 T_1 - h_1 T_2 - h_2 T_1)$$

$$mg h_2 - mg h_1 = \frac{\rho g R S}{2} h_1 T_1 - \frac{\rho g R S}{2} h_1 T_2 - \frac{\rho g R S}{2} h_2 T_1$$

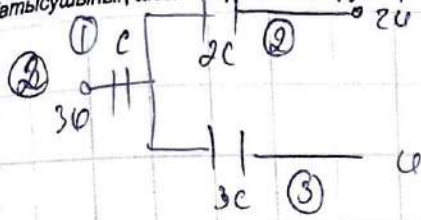
$$mg h_2 + \frac{\rho g R S}{2} h_2 T_1 = \frac{\rho g R S}{2} (h_1 T_1 - h_1 T_2) + mg h_1$$

$$h_2 (mg + \frac{\rho g R S T_1}{2}) = \frac{\rho g R S}{2} (h_1 T_1 - h_1 T_2) + mg h_1 = \frac{\rho g R S h_1 \Delta T}{2} + mg h_1$$

$$h_2 = \frac{\frac{\rho g R S h_1 \Delta T}{2} + mg h_1}{mg + \frac{\rho g R S T_1}{2}} = \frac{\frac{\rho g R S h_1 \Delta T}{2} + F h_1}{F + \frac{\rho g R S \Delta V T_1}{2}}$$

$$h_2 = \frac{m R \Delta T + F h_1}{F + T_1 \cdot m}$$





$$2C = 2 \cdot 10^{-6} \quad \left\{ \begin{array}{l} 2C = 20 \mu\text{кФ}; \\ 3C = 30 \mu\text{кФ}; \\ C = 10 \mu\text{кФ}; \end{array} \right. \quad \left\{ \begin{array}{l} 2U = 2 \cdot 300 = 600\text{В}; \\ U = 300\text{В}; \\ 3U = 900\text{В}; \end{array} \right.$$

$$\left[ C_{23} = \frac{C_2 \cdot C_3}{C_2 + C_3} \right]$$

$$C_{23} = C_2 + C_3 = 2C + 3C = 5C = 50 \mu\text{кФ};$$

$$C_{\text{сезу}} = \frac{C_{23} \cdot C_1}{C_{23} + C_1} = \frac{5C \cdot C}{6C} = \frac{5C}{6} = \frac{50 \mu\text{кФ}}{6} = 8,3 \mu\text{кФ}; = 8,3 \cdot 10^{-6} \text{Ф}$$

$$q_n = \frac{C_{\text{сезу}} \cdot U_n}{d}$$

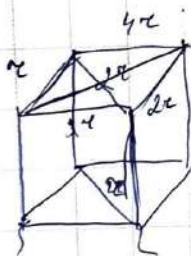
$$q_1 = \frac{C U_1}{d} \Rightarrow q_1 = \frac{8,3 \mu\text{кФ} \cdot 600}{2} = 300 \cdot \frac{50}{6} = 2500 \mu\text{кКл}; = 25 \cdot 10^{-6} \text{Кл}$$

$$q_2 = \frac{C U_2}{d} \Rightarrow q_2 = \frac{8,3 \cdot 10^{-6}}{2} \cdot 300 = 150 \cdot 8,3 \cdot 10^{-6} = 12,45 \cdot 10^{-6} \text{Кл}$$

$$q_3 = \frac{83 \cdot 10^{-9}}{2} \cdot 900 = 45 \cdot 10 \cdot 83 \cdot 10^{-9} = 37,35 \cdot 10^{-6} \text{Кл};$$

Мәжамп:  $25 \cdot 10^{-6} \text{Кл};$   
 $12,45 \cdot 10^{-6} \text{Кл};$   
 $37,35 \cdot 10^{-6} \text{Кл};$

4



1-мат:

$$\text{Шешуі: } ① \quad x + 2x = 3x;$$

$$② \quad \frac{3x \cdot 3x}{6x} = \frac{3}{2} x;$$

$$③ \quad \frac{3}{2} x + x = \frac{5}{3} x; \quad ④ \quad \frac{\frac{5}{3} x \cdot 4x}{\frac{5}{3} x + 4x} = \frac{\frac{5}{3} x^2}{\frac{17}{3}} = \frac{20}{17} x \approx 1,17x$$

$$⑤ \quad r_m = \frac{\frac{20}{17} x^2}{\frac{54x}{17}} = \frac{40x}{54} = \frac{20x}{27} \approx 0,74x$$

①  
2-мат:  $2x + 2x = 4x;$

$$② \quad \frac{4x \cdot 3x}{7x} = \frac{12x}{7}; \quad ③ \quad \frac{12x}{7} + x = \frac{19x}{7};$$

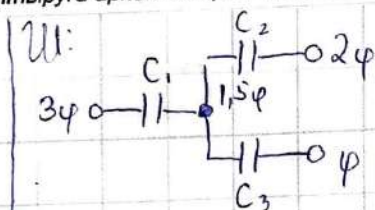
$$④ \quad \frac{\frac{19x}{7} \cdot 4x}{\frac{19x}{7} + 4x} = \frac{\frac{76x^2}{7}}{\frac{47x}{7}} = \frac{76x}{47} \approx 1,62x; \quad ⑤ \quad r_m = \frac{\frac{76x}{47} \cdot x}{\frac{46x}{47} + x} = \frac{\frac{76x^2}{47}}{\frac{123x}{47}} = \frac{76x}{123} \approx 0,61x$$

2. БЕР:

$$C = 10 \text{ нкФ} = 10 \cdot 10^{-9} \text{ Ф}$$

$$\varphi = 300 \text{ В}$$

$$\text{Табу: } q_1, q_2, q_3$$



$$C_1 = C$$

$$C_2 = 2C$$

$$C_3 = 3C$$

$$\frac{2\varphi + \varphi}{2} = 1,5\varphi$$

$$U = \varphi_1 - \varphi_2$$

$$q = CU = C(\varphi_1 - \varphi_2) =$$

$$q_2 = C_2 (1,5\varphi - 2\varphi) = 2C \cdot (-0,5\varphi) = 2 \cdot 10^{-5} \cdot (-0,5 \cdot 300) = \underline{3 \cdot 10^{-3} \text{ Кл}}$$

$$q_3 = C_3 (1,5\varphi - \varphi) = 3C \cdot 0,5\varphi = 3 \cdot 10^{-5} \cdot 0,5 \cdot 300 = \underline{4,5 \cdot 10^{-3} \text{ Кл}}$$

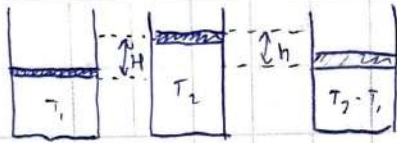
$$q_1 = C_1 (3\varphi - 1,5\varphi) = C \cdot 1,5\varphi = 1,5 \cdot 300 \cdot 10^{-5} = \underline{4,5 \cdot 10^{-3} \text{ Кл}}$$

$$q_1 = 4,5 \cdot 10^{-3} \text{ Кл} \quad q_3 = 4,5 \cdot 10^{-3} \text{ Кл} \quad q_2 = 3 \cdot 10^{-3} \text{ Кл}$$



B. H  
h-?

Ш:



$$h_2 = (H + h_1 + h_1) = (h + b_1 + H) = H + h_1 - h_1$$

$$P_1 V_1 = \nu R T_1$$

$$\frac{F_1}{S} \cdot S h_1 = \nu R T_1$$

$$m g h_1 = \nu R T_1$$

$$P_2 V_2 = \nu R T_2$$

$$\frac{F_2}{S} \cdot S h_2 = \nu R T_2$$

~~$$m g (h + h_1)$$~~

$$m g (H + h_1 - h) = \nu R T_2$$

$$m g h = \nu C_v (T_2 - T_1) \quad C_v - \text{мольерлік тепеөсімдікшілік. } C_v = \frac{5}{2} R$$

$$m g h = \frac{5}{2} (R \nu T_2 - R \nu T_1)$$

$$m g h = \frac{5}{2} (m g (H + h_1 - h) - m g h_1)$$

$$\frac{2}{5} h = H + h_1 - h - h_1$$

$$\frac{2}{5} h + h = H$$

$$\frac{7}{5} h = H \Rightarrow h = \frac{5}{7} H$$

~~Ш:~~

$$\text{Ж: } h = \frac{5}{7} H$$

4. БЕР:

$n$   
Ш/и:  $R_{21c}$



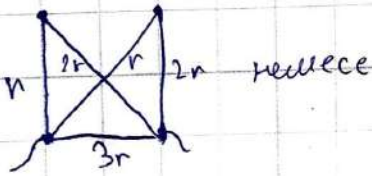
$R_{ABD}$ , яғни  $r, 2r -$

теу

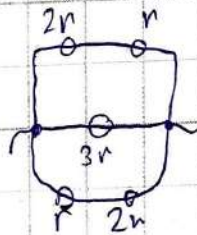
$R_{ACD}$ , яғни  $r, 2r - 2r$

Содан енеуі теу болса BC тізбегінде теу жүрмейді. Сонда  $4r$  болмайды.

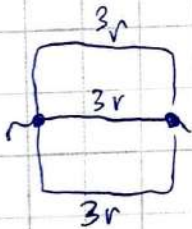
Сонда схема өзгереді.



кешесе



← эквивалентной схема

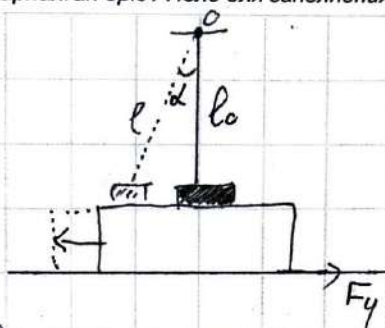


$$R_{21c} = \frac{3r \cdot 3r \cdot 3r}{3r \cdot 3r + 3r \cdot 3r + 3r \cdot 3r} = \frac{27r^3}{27r^2} = r$$

Ш/и:  $R_{21c} = r$



1 БЕР:  
 $l_0; \mu; \alpha$   
 $mg; A$



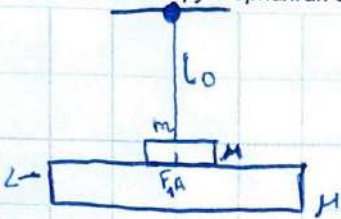
$$F_y = \mu N \quad F = kx = k_0 l$$

$$A = FS$$

$$\sin \alpha = \frac{l_0}{e}$$

$$F = mg$$

1)  $m_1$   
 $L_0$   
 $M$   
 $\alpha$

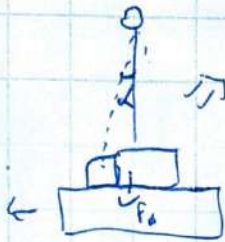


$$F_T = -F_{y1A} + F_{y1R}$$

$$0 = M\alpha - F_A + F_R - F_{1A}$$

$$F_{y1R} = F_T + F_{y1A}$$

$$F_A = F_R - F_{1A}$$



$F_A \sin \alpha$   
 $F_{y1R} \cos \alpha$

$$F_{y1R} \cos \alpha = F_T + M(F_R - F_{1A} \sin \alpha)$$

$$M m_1 g \cos \alpha = F_T + M F_R - M F_0 \sin \alpha$$

$$M = \frac{F_T + M F_R (L - L_0) - M m_1 g \sin \alpha}{m_1 g \sin \alpha}$$

4)  $m$   
 $q$   
 $L$   
 $\alpha$   
 $B$

$$F = q L B \cos \alpha$$

$$\frac{R q^2}{R^2} = q L B \cos \alpha$$

$$R q = R^2 L B \cos \alpha$$

$$R q = \frac{R^2 2\pi R \cdot \cos \alpha}{T}$$

$$R q = \frac{2\pi B R^3 \cos \alpha}{T}$$

$$m = \frac{2\pi B R^3 \cos \alpha}{R L}$$

$$T = \frac{2\pi B L^6 \cos \alpha}{R q g B}$$

$$L = \frac{2\pi R}{T}$$

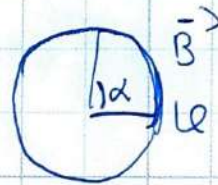
$$F = m a$$

$$F = \frac{m L^2}{R}$$

$$m g = \frac{m L^2}{R}$$

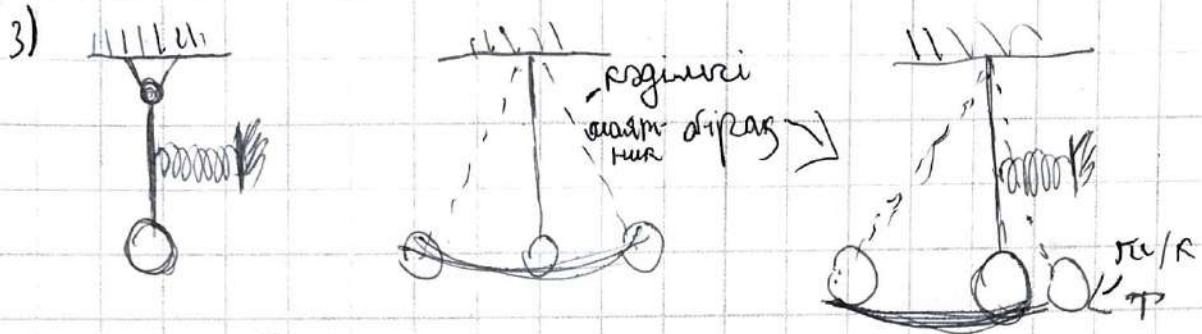
$$R = \frac{m L^2}{g}$$

$$R^3 = \frac{L^6}{g^3}$$



Бәлшек мензбер тәрізінде траекториясымен  
қозғалып кетеді. Өйткені  $\alpha$  бұрышы жақын біз сандық-  
тау кышқандықпен көрініс мәніне өрісіне елкенік  
білеміз.





$$T = 2\pi \sqrt{\frac{m}{k}}$$

$$T = 2\pi \sqrt{\frac{m}{k}}$$

$$T = T_1 - T_2$$

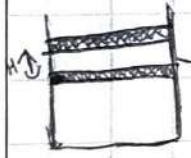
$$T = 2\pi \sqrt{\frac{L}{g}} - 2\pi \sqrt{\frac{m}{k}}$$

$$T = 2\pi \left( \sqrt{\frac{L}{g}} - \sqrt{\frac{m}{k}} \right)$$



2) H

сигнализациялық басын  $P = \frac{F}{S} = \frac{F}{S}$



$$Q = P \cdot t$$

$$\Rightarrow A = N \cdot t$$

$$Q = N \cdot t$$

$$Q = P \cdot t(\text{уақыт}) \Rightarrow$$

өлшемі  
талық  
түрде

$$P = \frac{F}{S} = \frac{F}{a \cdot h}$$

$$a = \frac{F}{P \cdot h}$$

$$P = 10^5$$

$$\Delta L = L - h =$$

H - көтерілсе, басын азаяды