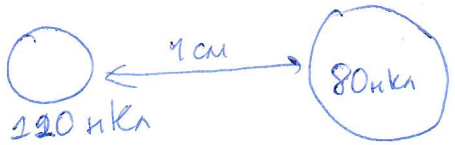
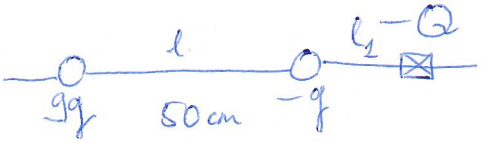
(1) 

$\Rightarrow Q = q_1 + q_2 = 200$ нКл

$\frac{Q}{2}$ – новый заряд $\Rightarrow F_{кл} = k\frac{(\frac{Q}{2})^2}{4\varepsilon_0 r^2} =$

$= \frac{40000\ \text{нКл}}{4\,(0{,}04)^2 \cdot 8\,\text{м}} = 6\cdot 10^6 \frac{\text{нКл}}{\text{м}} = 6\ \text{мКл/м}$

(2) 

$F_{9q9} = k\frac{9qQ}{(l+l_1)^2}$ $F_{Qq} = k\frac{qQ}{l_1^2}$

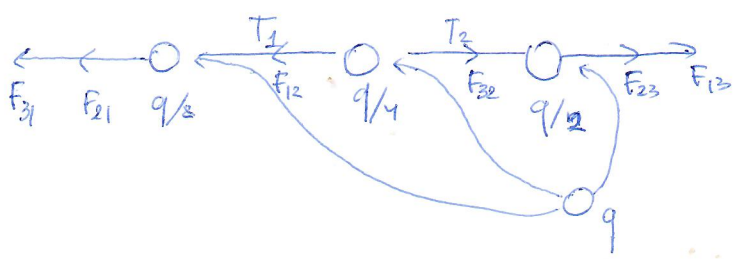
$F_{9q9} = F_{Qq} \Rightarrow \frac{9}{(l+l_1)^2} = \frac{1}{l_1^2}$

$\Rightarrow 2l_1 = l \Rightarrow l_1 = \frac{l}{2} = 25$ см

(3) 

$F_{ср} = F_{32} - F_{12} = k\frac{2q^2}{r^2} - k\frac{q^2}{r^2} = \frac{kq^2}{r^2}$

$F_{ц} = F_{13} + F_{23} = k\frac{2q^2}{4r^2} + k\frac{2q^2}{r^2} = 5/2\ kq^2/r^2 \Rightarrow F_{ц} = \frac{5}{2}F_{ср} = \frac{5}{2}\cdot 8\,\text{Н} = 20\,\text{Н}$

(4) 

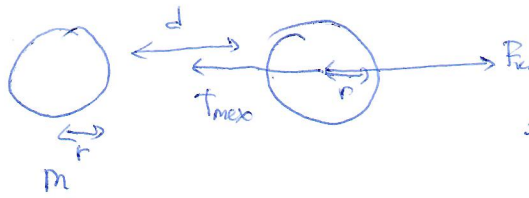
$T_1 = F_{31} + F_{21} = k\frac{q^2}{16\cdot 4r^2} + \frac{kq^2}{32\,r^2} = \frac{3kq^2}{64r^2}$

$T_2 = F_{13} + F_{23} = k\frac{q^2}{16\cdot 4r^2} + \frac{kq^2}{8\,r^2} = \frac{9kq^2}{64r^2}$

$\Rightarrow \frac{T_2}{T_1} = 3$

(5) 

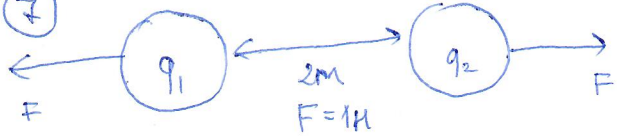
$q = 1{,}4q_1 \Rightarrow 2q = q_1 + q_2 = 2\cdot 1{,}4q_1$

(6) 

$\frac{kq^2}{d} = G\frac{m^2}{d^2}$ $m = \rho V = \frac{4}{3}\pi R^3 \rho$

$\Rightarrow \frac{1}{d^2}kq^2 = G\frac{16}{9}\pi^2 R^6 \frac{1}{d^2}\rho^2 \Rightarrow$

$R = \sqrt[6]{\frac{9kq^2}{G\cdot 16\pi^2\rho^2}}$

(7) 

$Q = q_1 + q_2 = 5\cdot 10^{-5}$ Кл $\frac{kq_1q_2}{r^2} = F$

$\Rightarrow q_1 = Q - q_2$ $\frac{kq_2(Q-q_2)}{r^2} = F$

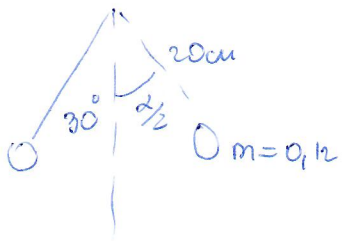
$kq_2^2 - kQq_2 + Fr^2 = 0$

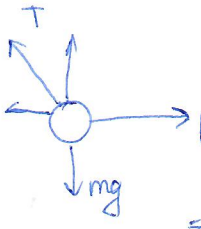
$q_1 = Q - q_2 = 1{,}2\cdot 10^{-5}$ Кл $\Rightarrow q_2 = \frac{-Q \pm \sqrt{Q^2 - 4Fr^2/k}}{2} \Rightarrow$

$q_2 = \frac{-Q + \sqrt{Q^2 - 4Fr^2/k}}{2} =$

$= \frac{-5\cdot 10^{-5}\,\text{Кл} + \sqrt{25\cdot 10^{-10}\,\text{Кл}^2 - 4\,\text{Н}^2\cdot 4\,\text{м}^2\cdot 6{,}6\cdot 10^{-11}\,\frac{\text{м}^3}{\text{кг}\cdot\text{с}^2}}}{2} = 3{,}8\cdot 10^{-5}\,\text{Кл}$

(8)



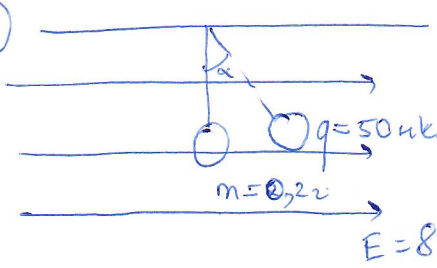


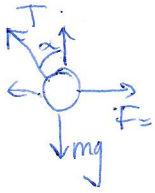
$mg = \cos\frac{\alpha}{2} T$

$F_к = k\frac{q^2}{r^2} = \sin\frac{\alpha}{2} T \Rightarrow r = 2\sin\alpha/2\, l$

$\Rightarrow \operatorname{tg}\frac{\alpha}{2} mg = k\frac{q^2}{2l\sin\alpha} \Rightarrow q = \sqrt{\frac{2\operatorname{tg}\alpha/2\, mg\, l \sin\alpha/2}{k}}$

(9)





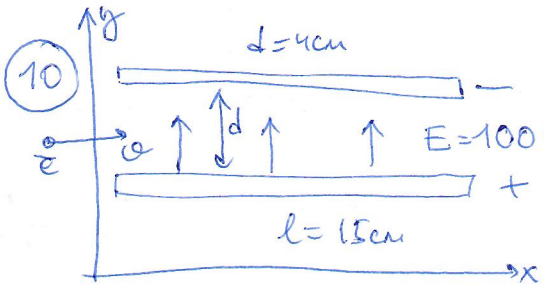
$T\cos\alpha = mg$

$T\sin\alpha = Eq \Rightarrow T = \frac{Eq}{\sin\alpha} \Rightarrow$

$\Rightarrow Eq\operatorname{tg}\alpha = mg \Rightarrow \alpha = \operatorname{arctg}\left(\frac{mg}{Eq}\right) =$

$= \operatorname{arctg}(5)$

(10)



$F_{эл} = ma \quad eE = ma \quad \frac{d}{2} = \frac{at^2}{2} \Rightarrow a = \frac{d}{t^2}$

$\Rightarrow eE = m\frac{d}{t^2} \Rightarrow t = \sqrt{\frac{md}{Ee}} \Rightarrow$

$v = \frac{l}{t} = \frac{l}{\sqrt{\frac{md}{Ee}}}$ – скорость, чтобы электрон успел вылететь.