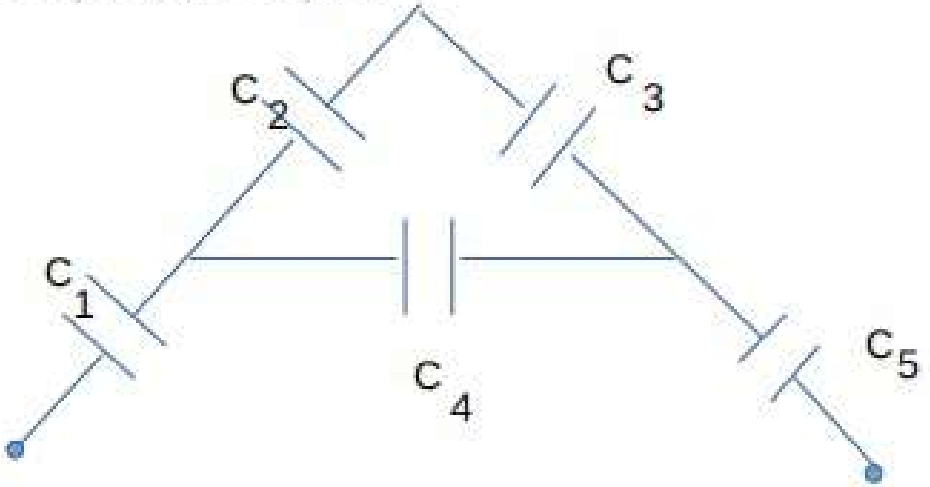
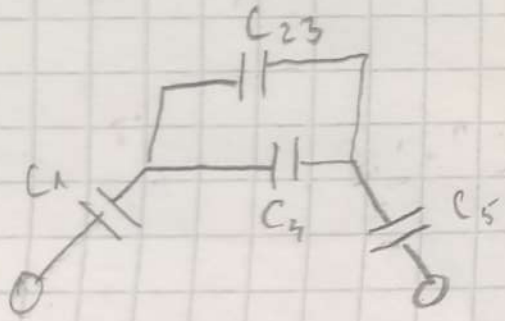
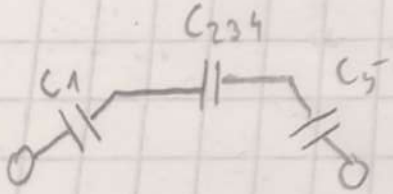
1. Izračunajte ekvivalentni kapacitet kondenzatora na slici. $C_1 = 2\,\mu F$, $C_2 = 4\,\mu F$, $C_3 = 5\,\mu F$, $C_4 = 1\,\mu F$, $C_5 = 7\,\mu F$.



1. $\frac{1}{C_{23}} = \frac{1}{C_2} + \frac{1}{C_3} = \frac{C_2 + C_3}{C_2 \cdot C_3}$ $\quad C_{23} = \frac{C_2 \cdot C_3}{C_2 + C_3} = 2{,}22\ \mu F$




$C_{234} = C_{23} + C_4 = 3{,}22\ \mu F$

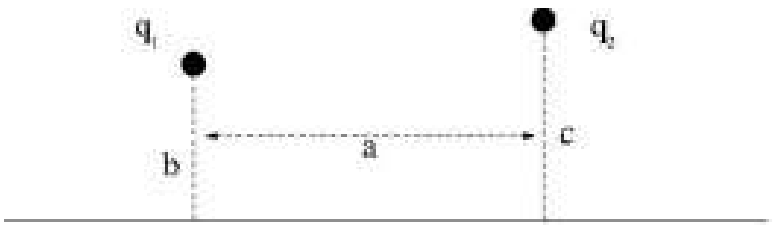



$\frac{1}{C_{ekv}} = \frac{1}{C_1} + \frac{1}{C_{234}} + \frac{1}{C_5} = \frac{C_1 C_{234} + C_1 C_5 + C_{234} \cdot C_5}{C_1 C_{234} \cdot C_5}$

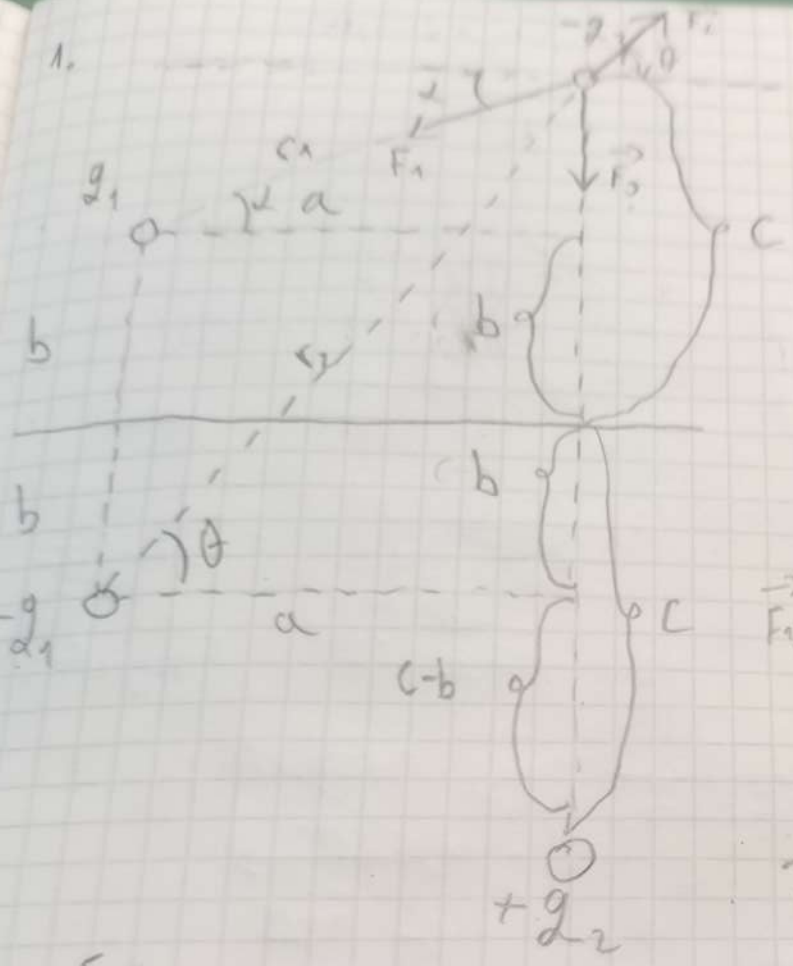
$C_{ekv} = \frac{C_1 \cdot C_{234} \cdot C_5}{C_1 C_{234} + C_{234} C_5 + C_1 C_5} = 1{,}048\ \mu F$

1. Dva naeleketrisanja $q_1$ i $-q_2$ nalaze se na medjusobnom rastojanjima $b$ i $c$ od električno neutralne metalne ploče, a svako rastojanje izmedju normala na metalnu ploču je $a$. Izračunajte ukupnu silu koja deluje na naelektrisanja $q_1$ i $q_2$.

Két töltés, $q_1$ és $-q_2$ $b$ és $c$ távolságra van egy elektromosan semleges fémlemeztől. A töltésekből a lemezre szerkesztett két merőleges irány egymástól $a$ távolságra van. Számolja ki a $q_1$ és $q_2$ töltésekre ható erőket.



1.



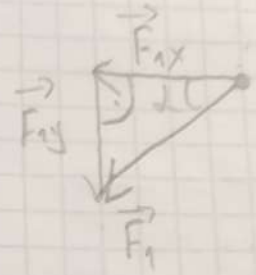

$r_1^2 = a^2 + (c-b)^2$

$r_2^2 = a^2 + (c+b)^2$

$F_1 = k \frac{|q_1||q_2|}{r_1^2}$ [N]

$F_2 = k \frac{|q_1||q_2|}{r_2^2}$ [N]

$F_3 = k \frac{|q_1||q_2|}{4c^2}$ [N]

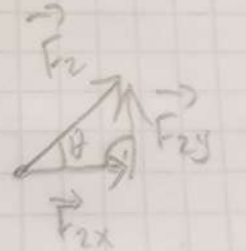



$\sin\alpha = \frac{F_{1y}}{F_1} = \frac{(c-b)}{r_1}$

$F_{1y} = F_1 \frac{(c-b)}{r_1}$

$\cos\alpha = \frac{F_{1x}}{F_1} = \frac{a}{r_1}$

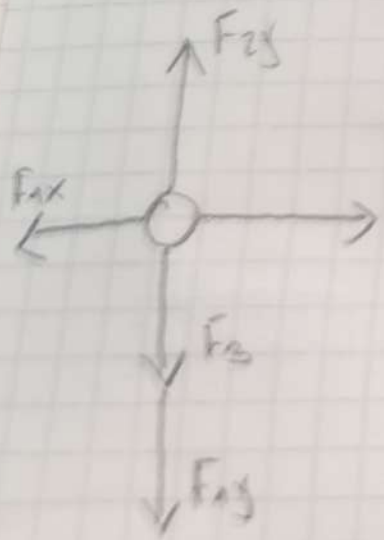
$F_{1x} = F_1 \frac{a}{r_1}$




$\cos\theta = \frac{F_{2x}}{F_2} = \frac{a}{r_2}$

$F_{2x} = F_2 \frac{a}{r_2}$

$\sin\theta = \frac{F_{2y}}{F_2} = \frac{(c+b)}{r_2}$ $F_{2y} = F_2 \frac{(c+b)}{r_2}$



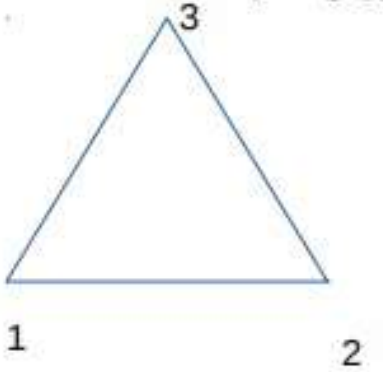

$\rightarrow \sum F_{ox} = F_{2x} - F_{1x}$

$\uparrow + \sum F_{oy} = F_{2y} - F_3 - F_{1y}$

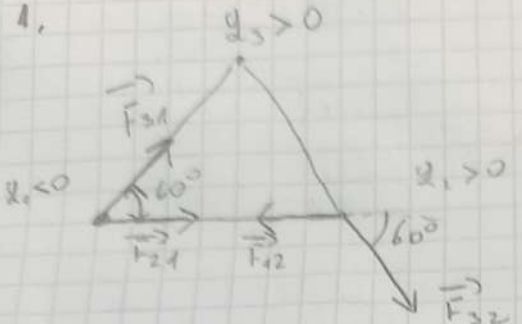
$F_{oc2} = \sqrt{F_{ox}^2 + F_{oy}^2}$

1. Na slici je jednkostranični trougao, dužina stranice je $a$. Predzaci naboja su $q_1 < 0$, $q_2 > 0$, $q_3 > 0$. Izračunajte sile koje deluju na naboje $q_1$ i $q_2$.

Az ábrán egenylőoldalú háromszög van. Az oldal hossza $a$. Az első csúcsban $q_1 < 0$, a másodikban $q_2 > 0$, a harmadikban pedig $q_3 > 0$ töltés van. Számolja ki a $q_1$ és $q_2$ töltéskre ható erőket.

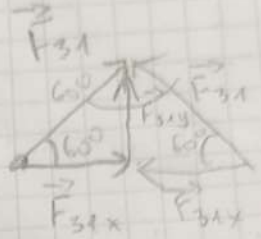


1.



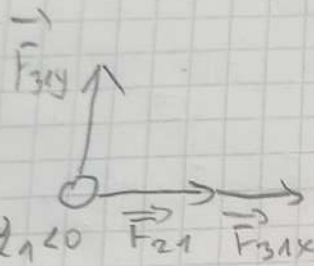

$$F_{12} = F_{21} = \frac{k|q_1|q_2}{a^2}\ [N] \qquad F_{31} = \frac{k|q_1|q_3}{a^2}\ [N]$$

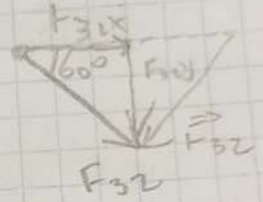
$$F_{32} = \frac{k q_3 q_2}{a^2}\ [N]$$




$$F_{31x} = \frac{F_{31}}{2}$$

$$F_{31y} = F_{31}\frac{\sqrt{3}}{2}$$



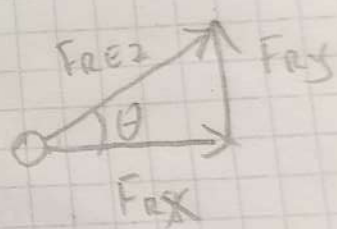

$$F_{32x} = \frac{F_{32}}{2}$$

$$F_{32y} = F_{32}\frac{\sqrt{3}}{2}$$

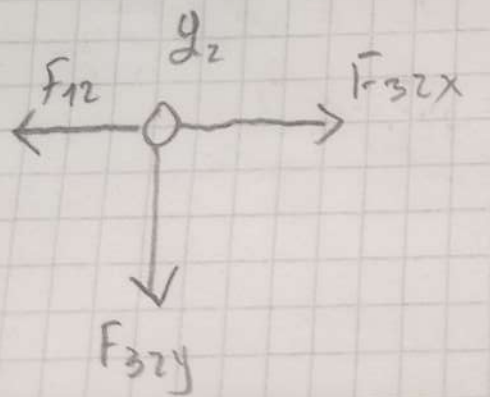
$$\rightarrow +\sum F_{Rx} = F_{21} + F_{31x}$$

$$\uparrow +\sum F_{Ry} = F_{31y}$$

$$F_{RE2} = \sqrt{F_{Rx}^2 + F_{Ry}^2}$$




$$\theta = \arctan\left(\frac{F_{Ry}}{F_{Rx}}\right)$$

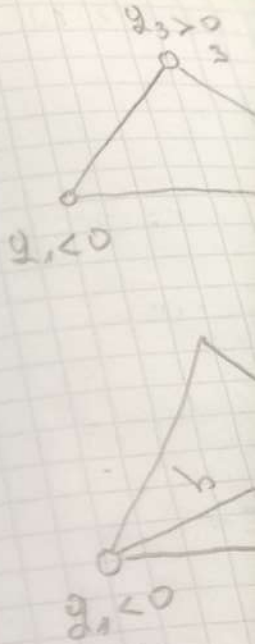



$$\rightarrow +\sum F_{Rx} = F_{32x} - F_{12}$$

$$\downarrow +\sum F_{Ry} = F_{32y}$$

$$F_{RE2} = \sqrt{F_{Rx}^2 + F_{Ry}^2}$$

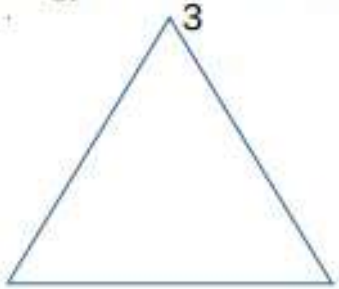
1.




2.

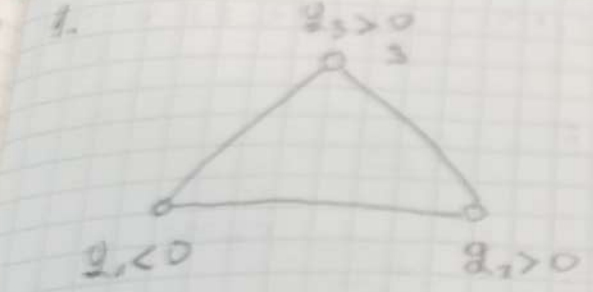
1. Na slici je jednkostranični trougao, dužina stranice je $a$. Predzaci naboja su $q_1 < 0$, $q_2 > 0$, $q_3 > 0$. Izračunajte potencijalnu energiju naboja $q_3$. Koliki se rad izvrši ukoliko se naboj $q_3$ pomeri iz temena trougla u tačku koja polovi stranicu 23?

Az ábrán egenylőoldalú háromszög van. Az oldal hossza $a$. Az első csúcsban $q_1 < 0$, a másodikban $q_2 > 0$, a harmadikban pedigalnj$q_3 > 0$ töltés van. Számolja ki a $q_1$ töltés helyzeti energiáját. Mekkora munkát kell elvégezni, hogy az 1-es töltést a háromszög csúcsából az 23 oldal felezőpontjába elmozdítsuk?




2. Imamo dve paralelne metalne ploče koje se nalaze na rastojanju od pola santimetra. Napon izmedju ploča je 90 $V$. Kolika je jačina električnog polja izmedju ploča i kolika je površinska gustina naelektrisanja na pločama?$\varepsilon_0 = 8.8541878128(13) \cdot 10^{-12} F/m$ Ako je površina svake ploče 2 $cm^2$ izračunajte količinu naelektrisanja na pozitivnoj ploči.

1.



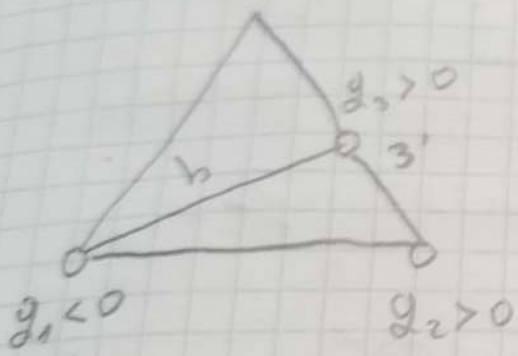

$W_{P_3} = q_3 V_3$ [J]

$V_3 = V_{(q_1)} + V_{(q_2)}$ Σ-I

$V_{(q_1)} = -\frac{k|q_1|}{a}$ $V_{(q_2)} = \frac{k q_2}{a}$

$A_{3-3'} = q_3 U_{3-3'}$

$U_{3-3'} = V_3 - V_{3'}$

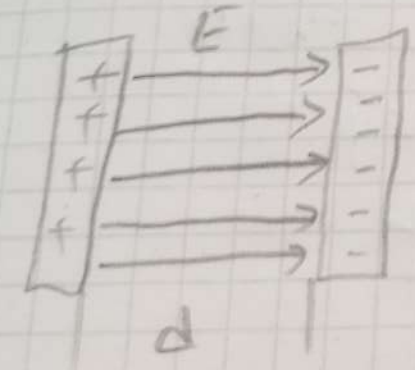



$h = \frac{a\sqrt{3}}{2}$

$V_3 = V_{(q_1)} + V_{(q_2)}$

$V_{(q_1)} = -\frac{k|q_1|}{h}$ $V_{(q_2)} = \frac{k q_2}{(\frac{a}{2})}$

2.




$U = E \cdot d$ $E = \frac{U}{d} = \frac{90}{0,5 \cdot 10^{-2}} = 18 k\frac{V}{m}$

$C = \frac{Q}{U}$ $C = \varepsilon_0 \frac{S}{d}$

$C = \frac{8,85 \cdot 10^{-12} \cdot 2 \cdot 10^{-4}}{0,5 \cdot 10^{-2}} = 0,354 pF$

$Q = C \cdot U = 31,86 pF$ $\sigma = \frac{Q}{S} = \frac{31,86 \cdot 10^{-12}}{2 \cdot 10^{-4}} = 159,3 \frac{nC}{m^2}$

**25.23** The two balls shown in Fig. 25-8 have identical masses of 0.20 g each. When suspended from 50-cm-long strings, they make an angle of 37° to the vertical. If the charges on each are the same, how large is each charge?

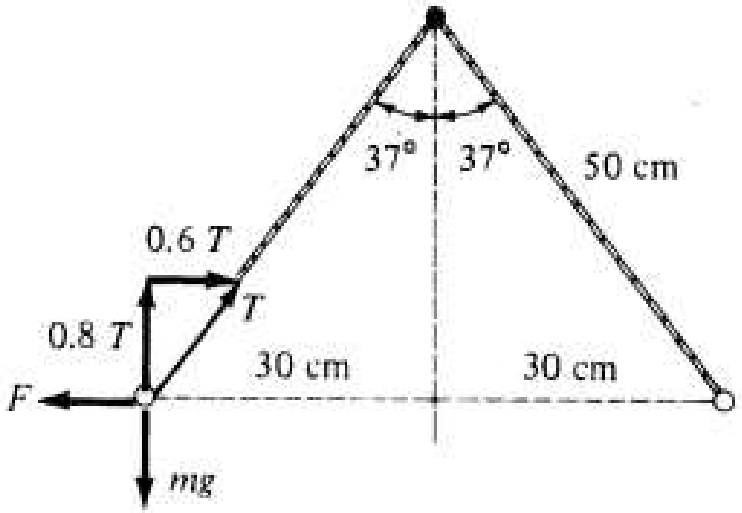
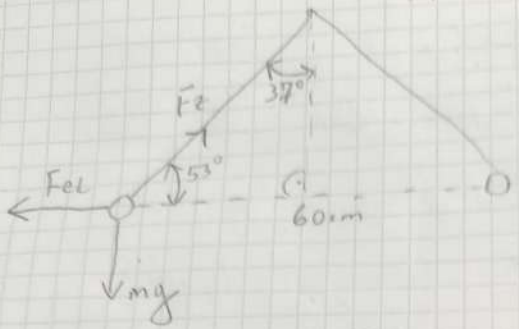
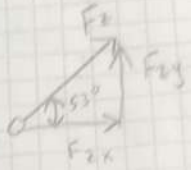



**Fig. 25-8**

$q_1 = q_2 = q$ $\quad m = 0{,}2\,g = 0{,}2 \cdot 10^{-3}\,kg$ $\quad r = 0{,}6\,m$

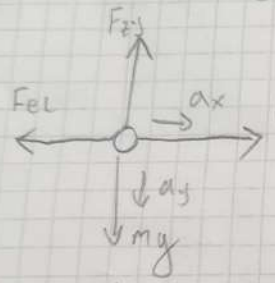
$F_{el} = \frac{k q^2}{r^2}$




$\sin 53^\circ = \frac{F_{zy}}{F_z} \qquad F_{zy} = F_z \sin 53^\circ$

$\cos 53^\circ = \frac{F_{zx}}{F_z} \qquad F_{zx} = F_z \cos 53^\circ$




$\downarrow + \sum \vec{F}_y = m\vec{a}_y \qquad a_y = 0$

$mg - F_{zy} = m \cdot 0$

$F_{zy} = mg$

$F_z = \frac{mg}{\sin 53^\circ}$

$\rightarrow + \sum \vec{F}_x = m\vec{a}_x \qquad a_x = 0$

$F_{zx} - F_{el} = m \cdot 0$ $\qquad F_{zx} = F_{el}$

$F_z \cos 53^\circ = \frac{k q^2}{r^2}$

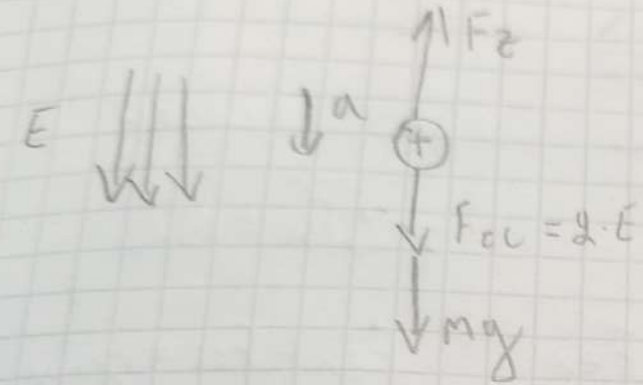
$\frac{mg \cos 53^\circ}{\sin 53^\circ} = \frac{k q^2}{r^2} \qquad q^2 = \frac{mg r^2 \cos 53^\circ}{k \sin 53^\circ}$

$$q = \sqrt{\frac{mg r^2 \cos 53^\circ}{k \sin 53^\circ}} = \sqrt{\frac{0{,}2 \cdot 10^{-3} \cdot 9{,}81 \cdot 0{,}6^2 \cos 53^\circ}{9 \cdot 10^9 \sin 53^\circ}}$$

$$q = 0{,}24\,\mu C$$

**25.46** A tiny 0.60-g ball carries a charge of magnitude 8 $\mu$C. It is suspended by a thread in a downward electric field of intensity 300 N/C. What is the tension in the thread if the charge on the ball is **(*a*)** positive, **(*b*)** negative?

a) $q = +8\,\mu C$ $m = 0{,}6\,g = 0{,}6 \cdot 10^{-3}\,kg$ $a = 0$ $E = 300\ \frac{V}{m}$




$\downarrow + \Sigma \vec{F}_y = m\vec{a}_y$

$mg + F_{el} - F_z = m \cdot 0 \cdot a$

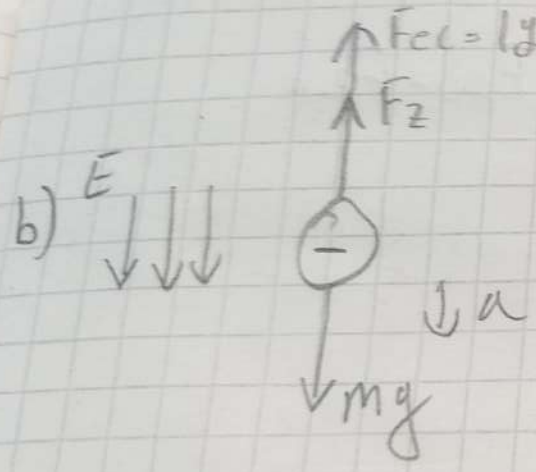
$F_z = mg + F_{el} = 0{,}6 \cdot 10^{-3} \cdot 9{,}81 + 300 \cdot 8 \cdot 10^{-6}$

$F_z = 8{,}286\ mN$

dečuje prema gore

kugla je isod

$q = -8\,\mu C$




$\downarrow + \Sigma \vec{F}_y = m\vec{a}_y$

$mg - F_z - F_{el} = m \cdot a$ 0

$F_z = mg - F_{el}$

$= 0{,}6 \cdot 10^{-3} \cdot 9{,}81 - 8 \cdot 10^{-6} \cdot 300$

$= 3{,}486\ mN$

dečuje prema gore

kugla je isod

**25.47** The tiny ball at the end of the thread shown in Fig. 25-20 has a mass of 0.60 g and is in a horizontal electric



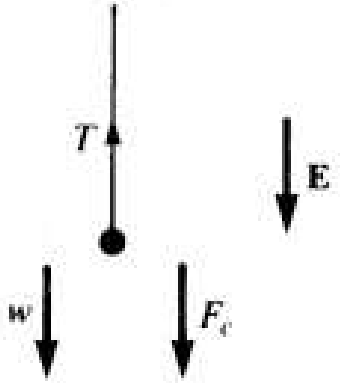



Fig. 25-19

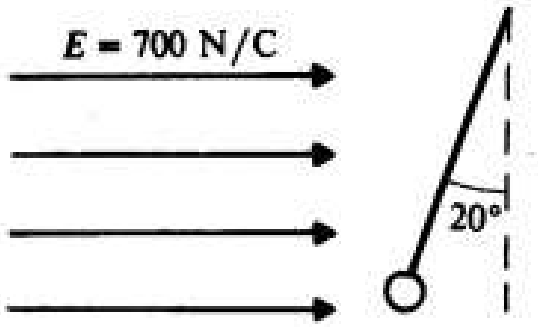
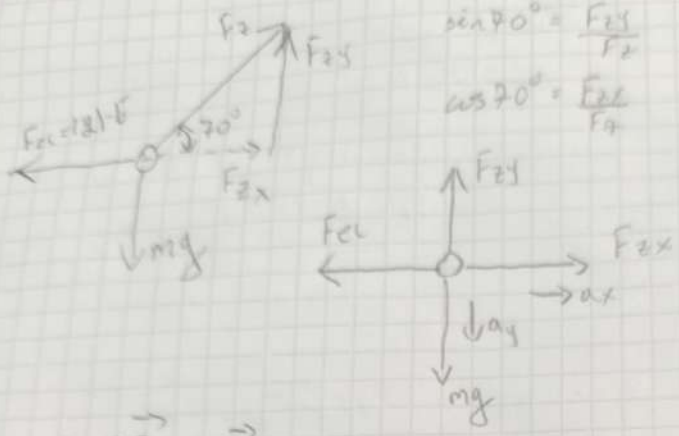



Fig. 25-20

field of intensity 700 N/C. It is in equilibrium in the position shown. What are the magnitude and sign of the charge on the ball?

Preostavka naelektrisanje negativno




$\sin 70° = \frac{F_{zy}}{F_z}$ $\quad F_{zy} = F_z \sin 70°$

$\cos 70° = \frac{F_{zx}}{F_z}$ $\quad F_{zx} = F_z \cos 70°$

$\rightarrow \Sigma \vec{F}_x = m\vec{a}_x$

$F_{zx} - F_{el} = ma_x^0$

$F_{el} = F_{zx}$

$\downarrow + \Sigma \vec{F}_y = m\vec{a}_y$

$mg - F_{zy} = ma_y^0$

$F_{zy} = mg$

$F_z = \frac{mg}{\sin 70°}$

$|q|E = F_{zx}$

$|q|E = F_z \cos 70°$

$|q| = \frac{mg}{E} \frac{\cos 70°}{\sin 70°} = \frac{0{,}6 \cdot 10^{-3} \cdot 9{,}81 \cdot \cos 70°}{700 \quad \sin 70°}$

$|q| = 3{,}06\,\mu C$

$\boxed{q = -3{,}06\,\mu C}$