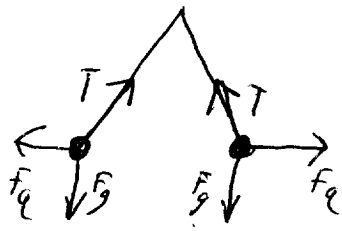
Home Work #3

22-27



$$F_x = T\sin\theta = kqQ/l^2$$

$$F_y = T\cos\theta = mg$$

$$\tan\theta = \frac{kq^2}{mgr^2} = \frac{kq^2}{mg(2L\sin\theta)^2}$$

$$= (9\times10^9\ N\cdot m^2/C^2)\,q^2/[2(.20m)\sin 10^\circ]^2(.2\times10^{-3}\ kg)(9.8\ m/s^2)$$

$$\boxed{q = 1.4\times10^{-8}\ C}$$

22-46

$F = 0$

If q and Q are + Then the position is a stable equilibrium in the x-y plane and unstable on the z-axis

If q and Q are of opposite sign Then the position is a unstable equilibrium in the x-y plane and stable on the z-axis

$F = 0$ for the sphere as well and is stable in all directions

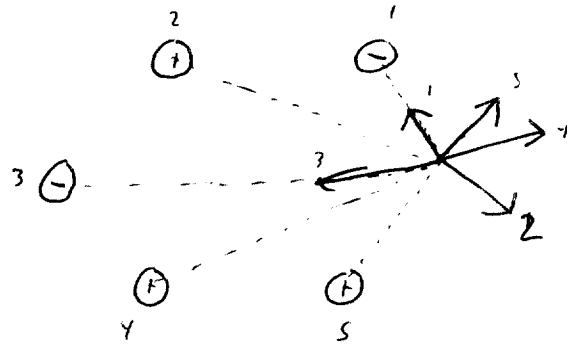
HW 1

23-5)

$r_1 = r_5 = L = 10\,cm$

$r_2 = r_4 = 2L\cos 30^\circ = 17.3\,cm$

$r_3 = 2L = 20\,cm$



$F = Eq$

$E_1 + E_5 = 2\left[k\frac{q_1}{r_1^2}\right]\sin 60^\circ \hat{y} = 3.12\times10^6\ N/C\ \hat{y}$

$E_2 + E_4 = 2\left[k\frac{q_2}{r_2^2}\right]\cos 30^\circ \hat{x} = 1.56\times10^6\ N/C\ \hat{x}$

$E_3 = -k\frac{q_3}{r_3^2}\hat{x} = -.90\times10^6\ N/C\ \hat{x}$

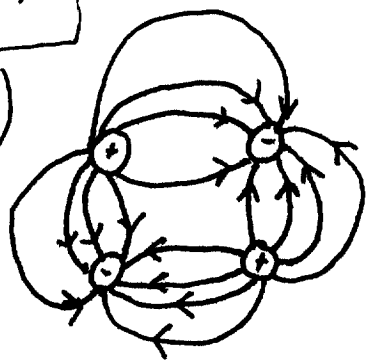
$\Sigma E = [.66\times10^6\hat{x} + 3.12\times10^6\hat{y}]\ N/C$

$= 3.19\times10^6\ N/C,\ 78^\circ$ above $+X$-axis

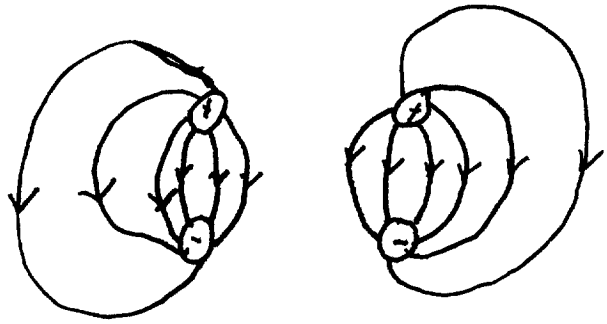
HW2

23-17

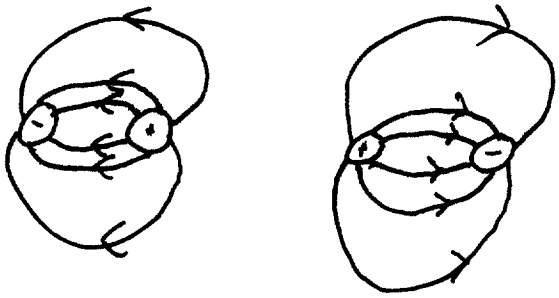
a)



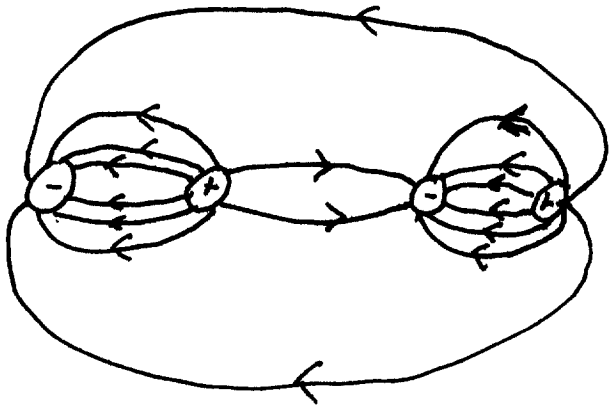
b)



c)

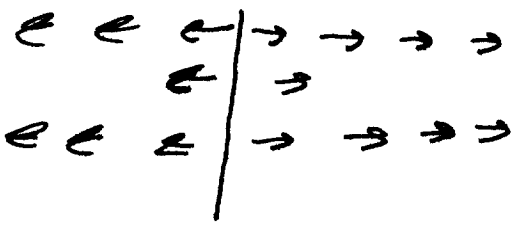


d)

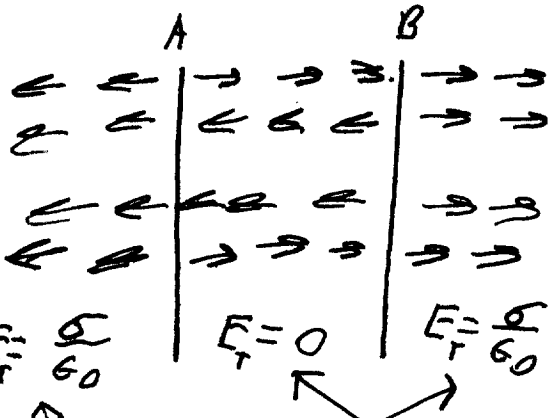


23 - 27

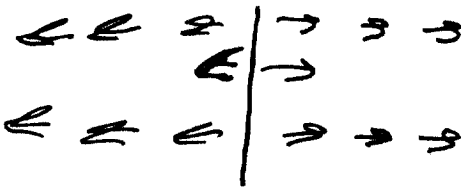
Feild from A



$E = \frac{\sigma}{2\epsilon_0}$



Feild from B

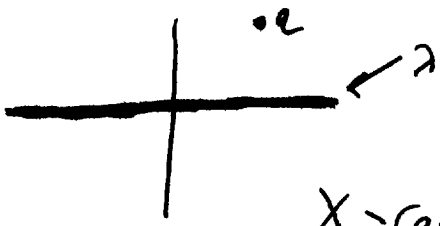


$E = \frac{\sigma}{2\epsilon_0}$

$E_T = \frac{\sigma}{2\epsilon_0} + \frac{\sigma}{2\epsilon_0} = \frac{\sigma}{\epsilon_0}$ outside

$E_T = \frac{\sigma}{2\epsilon_0} - \frac{\sigma}{2\epsilon_0} = 0$ Inside

23-40



X-component $0 = m\frac{d^2x}{dt^2}$

Y-component $\frac{-q\lambda}{2\pi\epsilon_0 y} = m\frac{d^2y}{dt^2}$

$m\ddot{x} = 0$

$m\ddot{y} = \frac{-q\lambda}{2\pi\epsilon_0 y}$

23 - 52

$U_{max} = pE \quad U_{min} = -pE$

$\Delta U = U_{max} - U_{min} = 2pE$

$4.4 \times 10^{-25} J = 2p\,(10^4 N/C)$

$p = 2.2 \times 10^{-29} C \cdot m$