(36) (a) Electric field at A due to Fe points to the right, as does the electric field at A due to Cl.

$$E_A = \frac{1}{4\pi\epsilon_0}\frac{|q_{Fe}|}{|r_{Fe}|^2} + \frac{1}{4\pi\epsilon_0}\frac{|q_{Cl}|}{|r_{Cl}|^2}$$

$$= (9\times10^9)\frac{3\times1.60\times10^{-19}C}{(300\,nm)^2} + (9\times10^9)\frac{1.6\times10^{-19}C}{(100\,nm)^2}$$

$$= 1.92\times10^5\,N/C \text{ to the right}$$

(b) At B, E_{Fe} points to the right and E_{Cl} to the left

$$E_B = \frac{1}{4\pi\epsilon_0}\frac{|q_{Fe}|}{|r_{Fe}|^2} - \frac{1}{4\pi\epsilon_0}\frac{|q_{Cl}|}{|r_{Cl}|^2}$$

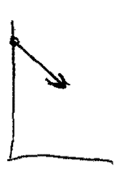
$$= -1.27\times10^{5}\,N/C \text{ (to the left)}$$

(c) $F = qE = (1.6\times10^{-19}C)(1.92\times10^5\,N/C) = 3.07\times10^{-14}\,N$ to the left

(38) (a) $E_2 = \frac{1}{4\pi\epsilon_0}\frac{8\times10^{-6}C}{(0.04m)^2} = 4.50\times10^7\,\frac{N}{C}$ in $+y$ direction

$E_3 = \frac{1}{4\pi\epsilon_0}\frac{5\times10^{-6}C}{(0.05m)^2} = 1.80\times10^7\,N/C$ acting toward Q_3

$= \langle +1.08\times10^7\,N/C, -1.44\times10^7\,N/C, 0\rangle$



$\vec{E}_2 + \vec{E}_3 = \langle 0, +4.50\times10^7\,N/C, 0\rangle + \langle +1.08\times10^7\,\frac{N}{C}, -1.44\times10^7\,\frac{N}{C}, 0\rangle$

$= \langle +1.08\times10^7\,N/C, +3.06\times10^7\,N/C, 0\rangle$

(b) $\vec{F} = q_1\vec{E} = (+3\times10^{-6}C)\langle +1.08\times10^7\,N/C, +3.06\times10^7\,\frac{N}{C}, 0\rangle$

$= \langle +32.4, +91.8, 0\rangle\,N$

(c) $E_1 = \frac{1}{4\pi\epsilon_0} \frac{3\times10^{-6}C}{(.03m)^2} = 3.0\times10^7$ N/C in $+x$ direction

$E_2 = \frac{1}{4\pi\epsilon_0} \frac{8\times10^{-6}C}{(.05m)^2} = 2.88\times10^7$ N/C with components

$\langle +1.73\times10^7, 2.30\times10^7, 0 \rangle$ N/C

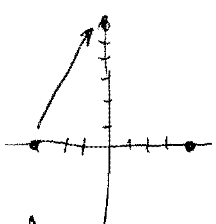
$E_3 = \frac{1}{4\pi\epsilon_0} \frac{5\times10^{-6}}{(.04)^2} = 2.81\times10^7$ N/C in $-y$ direction

$$\vec{E} = \vec{E}_1 + \vec{E}_2 + \vec{E}_3$$

$$= \langle 3.0\times10^7, 0, 0 \rangle + \langle 1.73\times10^7, 2.30\times10^7, 0 \rangle + \langle 0, -2.81\times10^7, 0 \rangle$$

$$= \langle 4.73\times10^7, -0.51\times10^7, 0 \rangle \text{ N/C}$$

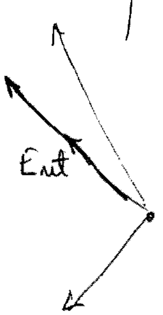
(39) The ball can be replaced with a point charge located at its center. $\langle -3, 0, 0 \rangle$



The vector from the ball's center to the observation point is $\vec{r}_b = \langle 3, 6, 0 \rangle$ cm which has magnitude $\sqrt{3^2+6^2} = \sqrt{45} = 6.71$ cm

$$\vec{E}_b = \frac{1}{4\pi\epsilon_0} \frac{q_b}{|r_b|^2} \hat{r}_b = 9\times10^9 \frac{(-3\times10^{-9}C)}{(0.0671)^2} \frac{\langle 0.03, 0.06, 0 \rangle m}{0.0671 \ m}$$

$$= \langle -2681, -5364, 0 \rangle \text{ N/C}$$



The vector from the point charge to the observation point is $\vec{r}_p = \langle -4, 6, 0 \rangle$ cm with the magnitude $\sqrt{4^2+6^2} = 7.21$ cm

$$\vec{E}_p = \frac{1}{4\pi\epsilon_0} \frac{q_p}{|r_p|^2} \frac{\vec{r}_p}{|r_p|} = (9\times10^9) \frac{5\times10^{-9}C}{(0.0721m)^2} \frac{\langle -0.04, 0.06, 0 \rangle m}{0.0721m}$$

$$= \langle 4803, +7204, 0 \rangle \text{ N/C}$$

$$\vec{E}_{net} = \vec{E}_b + \vec{E}_p = \langle -7484, 1842, 0 \rangle \text{ N/C}$$

(41) On the perpendicular to the axis

$$E = \frac{1}{4\pi\epsilon_0}\frac{qs}{r^3} = (9\times10^9)\frac{(18\times10^{-9}C)(4\times10^{-4}m)}{(0.24m)^3}$$

$$= 4.69\ N/C \text{ downward}$$

along the axis

$$E = \frac{1}{4\pi\epsilon_0}\frac{2qs}{r^3} = (9\times10^9)\frac{2(7\times10^{-9}C)(3\times10^{-4}m)}{(0.16m)^3}$$

$$= 9.23\ N/C \text{ upward}$$

Net electric field $= 9.23 - 4.69 = 4.54\ N/C$ upward