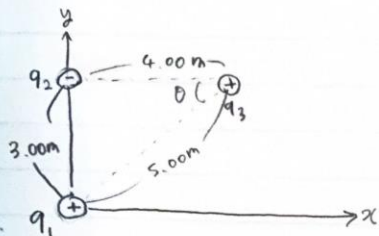


예제 15.2)



$$q_1 = 6.00 \times 10^{-9} \text{ C}, q_2 = -2.00 \times 10^{-9} \text{ C}$$

$$q_3 = 5.00 \times 10^{-9} \text{ C}$$

$$(a) F_{23} = k_e \frac{|q_2||q_3|}{r^2}$$

$$= 8.99 \times 10^9 \text{ N m}^2/\text{C}^2 \times \frac{(2.00 \times 10^{-9} \text{ C})(5.00 \times 10^{-9} \text{ C})}{(4.00)^2}$$

$$= 5.62 \times 10^{-9} \text{ N}$$

$$\therefore F_{23x} = -5.62 \times 10^{-9} \text{ N}$$

$$F_{23y} = 0$$

$$(b) F_{13} = k_e \frac{|q_1||q_3|}{r^2}$$

$$= (8.99 \times 10^9 \text{ N m}^2/\text{C}^2) \times \frac{(6.00 \times 10^{-9} \text{ C})(5.00 \times 10^{-9} \text{ C})}{(5.00 \text{ m})^2}$$

$$= 10.8 \times 10^{-9} \text{ N}$$

q_1, q_3, q_2 가 이 같은 각을 θ 라 하면

$$F_{13x} = F_{13} \times \cos \theta = F_{13} \times \frac{4}{5} = 8.64 \times 10^{-9} \text{ N}$$

$$F_{13y} = F_{13} \times \sin \theta = F_{13} \times \frac{3}{5} = 6.50 \times 10^{-9} \text{ N}$$

(c)

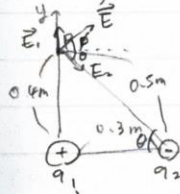
$$\vec{F}_x = F_{13x} + F_{23x} = 3.01 \times 10^{-9} \text{ N}$$

$$\vec{F}_y = F_{13y} + F_{23y} = 6.50 \times 10^{-9} \text{ N}$$

$$|\vec{F}| = \sqrt{F_x^2 + F_y^2} = 7.16 \times 10^{-9} \text{ N}$$

$$\theta = \tan^{-1} \left(\frac{F_y}{F_x} \right) = 65.2^\circ$$

예제 15.3)



$$q_1 = 8.00 \mu\text{C}, q_2 = -5.00 \mu\text{C}$$

$$(a) \vec{E}_1 = k_e \times \frac{18 \times 10^{-6}}{(0.4)^2} = 4.5 \times 10^5 \text{ N/C}$$

$$E_{1x} = E_1 \cos 90^\circ = 0$$

$$E_{1y} = E_1 \sin 90^\circ = 4.5 \times 10^5 \text{ N/C}$$

$$\vec{E}_2 = k_e \frac{1.5 \times 10^{-6}}{(0.5)^2} = 1.80 \times 10^5 \text{ N/C}$$

$$E_{2x} = E_2 \cos(-\theta) = 1.80 \times 10^5 \times \frac{3}{5} = 1.08 \times 10^5 \text{ N/C}$$

$$E_{2y} = E_2 \sin(-\theta) = -1.80 \times 10^5 \times \frac{4}{5} = -1.44 \times 10^5 \text{ N/C}$$

$$\vec{E}_x = E_{1x} + E_{2x} = 1.08 \times 10^5 \text{ N/C}$$

$$\vec{E}_y = E_{1y} + E_{2y} = 3.06 \times 10^5 \text{ N/C}$$

$$E = \sqrt{E_x^2 + E_y^2} = 3.24 \times 10^5 \text{ N/C}, \phi = \tan^{-1} \left(\frac{E_y}{E_x} \right) = 70.6^\circ$$

$$(b) F = qE = 6.48 \times 10^{-3} \text{ N}$$

예제 15.5)

$$(a) EA = E(4\pi r^2) = \frac{Q_{in}}{\epsilon_0} = 0 \rightarrow E = 0$$

$$(b) EA = E(4\pi r^2) = \frac{Q_{in}}{\epsilon_0} = \frac{Q}{\epsilon_0} \therefore E = \frac{Q}{4\pi\epsilon_0 r^2}$$

$$(c) EA = E(4\pi r^2) = \frac{Q_{in}}{\epsilon_0} = \frac{+Q-2Q}{\epsilon_0} \therefore E = -\frac{Q}{4\pi\epsilon_0 r^2}$$

$$(d) EA = \frac{Q_{in}}{\epsilon_0} = \frac{Q_{outer} + Q_{inner}}{\epsilon_0} = 0$$

그러 내부 전기장은 0 이므로 $(Q_{outer} + Q_{inner}) = 0$.

$Q_{inner} = +2Q$, $Q_{outer} + Q_{inner} = Q$,

$Q_{outer} = -Q$

(e) $a < r < b$ 에서의 전기장

$$EA = E(4\pi r^2) = \frac{Q_{in}}{\epsilon_0} = \frac{-2Q + 2Q}{\epsilon_0} = 0 \rightarrow E = 0$$

예제 15.6)

$$EA = \frac{Q_{enc}}{\epsilon_0}, \quad Q_{enc} = \sigma A_0$$

$$E = \frac{\sigma A_0}{2A_0 \epsilon_0} = \frac{\sigma}{2\epsilon_0}$$

$$\therefore E_z = \frac{\sigma}{2\epsilon_0} \quad (z > 0)$$

$$E_z = -\frac{\sigma}{2\epsilon_0} \quad (z < 0)$$