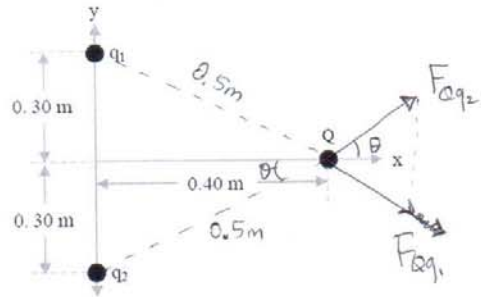


Physics 102Rec
Quiz#6
Chapter 21

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1. Three charges, $q_1 = q_2 = 2.0 \mu\text{C}$ and $Q = 4.0 \mu\text{C}$, are fixed in their places as shown in the figure. Calculate the **magnitude** and **direction** of the net electrostatic force on Q due to q_1 and q_2 .



$$F_{y, \text{net}} = F_{aq_2} \sin \theta - F_{aq_1} \sin \theta = 0$$

$$F_{aq_1} = \frac{k Q q_1}{r^2} \quad r = 0.5 \text{ m}$$

$$= \frac{9 \times 10^9 \times 4 \times 10^{-6} \times 2 \times 10^{-6}}{(0.5)^2} = 0.288 \text{ N}$$

$$F_{aq_2} = 0.288 \text{ N}$$

$$F_{x, \text{net}} = F_{aq_1} \cos \theta + F_{aq_2} \cos \theta$$

$$= 0.288 \cos 36.9^\circ + 0.288 \cos 36.9^\circ$$

$$= 0.46 \text{ N}$$

$$\tan \theta = \frac{0.3}{0.4} = 0.75$$

$$\theta = 36.9^\circ$$

$$\vec{F}_{\text{net}} = 0.46 \hat{i} + 0 \hat{j} \text{ N}$$

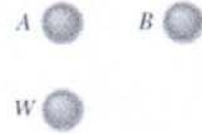
magnitude $F_{\text{net}} = 0.46 \text{ N}$

direction positive x-axis

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The figure shows three identical conducting spheres that are well separated from one another. Sphere W (with an initial charge of zero) is touched to sphere A and then they are separated. Next, sphere W is touched to sphere B (with an initial charge of $-14e$) and then they are separated. The final charge on sphere W is $+14e$. What was the initial charge on sphere A?



- ① $Q_W = 0$ $Q_A = Q$ $Q_B = -14e$
- ② $Q_W = \frac{Q}{2}$ $Q_A = \frac{Q}{2}$ $Q_B = -14e$
- ③ $Q_W = \frac{Q}{4} - 7e$ $Q_B = \frac{Q}{4} - 7e$

$$\frac{Q}{4} - 7e = +14e \Rightarrow \frac{Q}{4} = +21e$$

$$\boxed{Q = +84e}$$

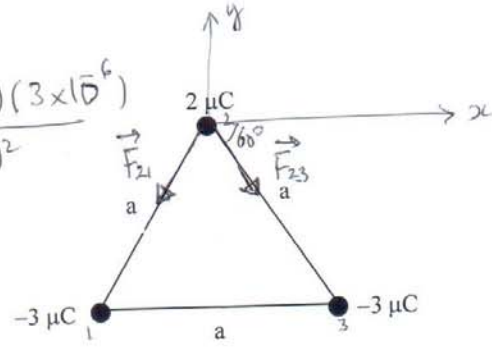
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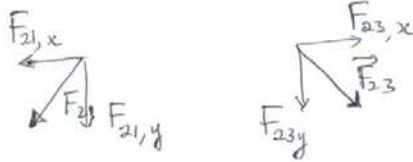
Three point charges, $+2 \mu\text{C}$, $-3 \mu\text{C}$, and $-3 \mu\text{C}$ are located at the vertices of an equilateral triangle of side $a = 5 \text{ cm}$. Determine the **magnitude** and **direction** of the electric force on the charge $2e$ due to the other two charges?

$$F_{21} = \frac{k|q_1||q_2|}{r^2} = \frac{9 \times 10^9 \times (2 \times 10^{-6})(3 \times 10^{-6})}{(0.05)^2}$$

$$= 21.6 \text{ N}$$



$$F_{23} = F_{21} = 21.6 \text{ N}$$



$$F_{\text{net},x} = -F_{21,x} + F_{23,x} = 0$$

$$F_{\text{net},y} = -(F_{21,y} + F_{23,y}) = -2 \times 21.6 \sin 60^\circ = -37.4 \text{ N}$$

$$\vec{F}_{\text{net}} = 0\hat{i} - 37.4\hat{j} \text{ N}$$

magnitude $|\vec{F}_{\text{net}}| = 37.4 \text{ N}$

direction negative y-axis.