VE230 HW1

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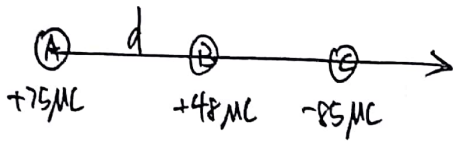
1.



$|F_{AC}| = \frac{kq_Aq_C}{(2d)^2} = 117.1N$ attraction

$|F_{AB}| = \frac{kq_Aq_B}{d^2} = 264.5N$ rejection

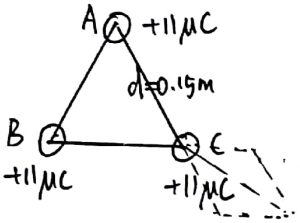
$|F_{BC}| = \frac{kq_Bq_C}{d^2} = 299.8N$ attraction

$F_A = -264.5N + 117.1N = -147.4N$ 147.4N left direction

$F_B = 264.5N + 299.8N = 564.3N$ 564.3N right direction

$F_C = -117.1N - 299.8N = -416.9N$ 416.9N left direction.

2.



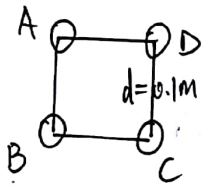
$|F_{AC}| = \frac{kq_Aq_C}{d^2} = 48.4N$

$|F_{BC}| = |F_{AC}| = 48.4N$

$|F_C| = 48.4N \cdot \sqrt{3} = 83.8N$

Direction: Along the perpendicular bisector of oppocite side outwardly.

3.



$|F_{AD}| = \frac{kq_Aq_D}{d^2} = 3.24\times10^7N$

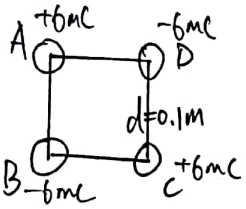
$|F_{CD}| = 3.24\times10^7N$

$|F_{BD}| = \frac{kq_Bq_D}{(\sqrt{2}d)^2} = 1.62\times10^7N$

$|F_D| = |F_A + F_B + F_C| = (\sqrt{2}+\frac{1}{2})|F_A| = 6.20\times10^7N$

Direction: Along the diagonal outwardly.

4.



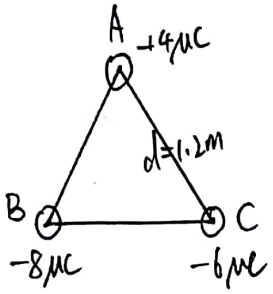
$|F_{AD}| = |F_{CD}| = 3.24\times10^7N$

$|F_{BD}| = 1.62\times10^7N$

$|F_D| = |F_A + F_B + F_C| = (\sqrt{2}-\frac{1}{2})|F_A| = 2.96\times10^7N$

Direction: Along the diagonal inwardly.

5.

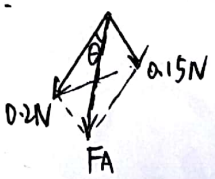


$|F_{AB}| = \frac{kq_Aq_B}{d^2} = 0.2N$

$|F_{AC}| = \frac{kq_Aq_C}{d^2} = 0.15N$

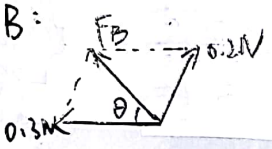
$|F_{BC}| = \frac{kq_Bq_C}{d^2} = 0.3N$

A: $|F_A| = 0.304N$



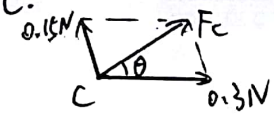
$\theta = 25.3°$

B: $|F_B| = 0.265N$



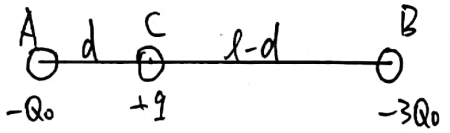
$\theta = 41°$

C: $|F_C| = 0.260N$



$\theta = 30.1°$

6.



It is obvious that charge C is between A and B with positive charge $+q$.

$|F_{AB}| = \frac{k\cdot 3Q_0^2}{l^2}$

$|F_{AC}| = \frac{kqQ_0}{d^2}$

$|F_{BC}| = \frac{kq\cdot 3Q_0}{(l-d)^2}$

$|F_{AB}| = |F_{AC}| = |F_{BC}|$

$\Rightarrow d = \frac{\sqrt{3}-1}{2}l$

$q = \frac{3}{2\sqrt{3}+4}Q_0 = (3-\frac{3}{2}\sqrt{3})Q_0$

7. Distance a.

$F = \frac{kQq}{a^2+\frac{d^2}{4}}$

$F_{net} = \frac{kQq}{a^2+\frac{d^2}{4}} \cdot \frac{a}{\sqrt{a^2+\frac{d^2}{4}}} \cdot 2 = 2kQq \cdot \frac{a}{(a^2+\frac{d^2}{4})^{\frac{3}{2}}}$

$F_{net}' = 0 \Rightarrow a = \frac{\sqrt{2}}{4}d$