Chemistry & Physics Alnojoum Academy

At what separation is the electrostatic force between a +11.2 μC point charge and a +29.1 μC point charge equal in magnitude to 1.57 N?

$r = ??$

$q_1 = 11.2\ \mu C$

$q_2 = 29.1\ \mu C$

$F = 1.57\ N$

$$\vec{F} = k\frac{q_1 q_2}{r^2}$$

$$F r^2 = k q_1 q_2$$

$$r^2 = k\frac{q_1 q_2}{F}$$

$$r = \sqrt{k\frac{q_1 q_2}{F}}$$

$$r = \sqrt{\frac{8.99\times10^{9} \times 11.2\times10^{-6} \times 29.1\times10^{-6}}{1.57}}$$

$$r = 1.37\ m$$

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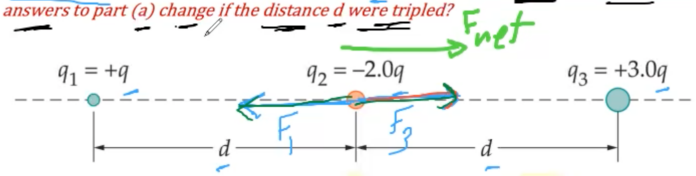
Given that $q = +12\ \mu C$ and $d = 19$ cm, (a) find the direction and magnitude of the net electrostatic force exerted on the point charge q_2 in Figure 19–29. (b) How would your answers to part (a) change if the distance d were tripled?



$q_1 = +12\ \mu C$

$q_2 = -24\ \mu C$

$q_3 = +36\ \mu C$

$$F_1 = k\frac{q_1 q_2}{r^2} = 8.99\times10^{9} \times \frac{12\times10^{-6} \times 24\times10^{-6}}{(0.19)^2} = 71.7\ N$$

$$F_3 = k\frac{q_2 q_3}{r^2} = 8.99\times10^{9} \times \frac{24\times10^{-6} \times 36\times10^{-6}}{(0.19)^2} = 215.2\ N$$

$$F_{net} = F_3 + (-F_1) = 215.2 + (-71.7) = 143.5\ N$$

to right

(a)

$d = 0.19$

(b)

$d = 0.19 \times 3$

$F \propto \frac{1}{r^2}$

$$F' = \frac{F}{9} = 15.9\ N$$

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Find the direction and magnitude of the net electrostatic force exerted on the point charge q_2 in Figure 19–32. Let $q = +2.4\mu C$ and $d = 33$ cm.

$q_1 = 2.4\mu C$

$q_2 = -4.8\mu C$

$q_3 = -7.2\ \mu C$

$q_4 = -9.6\ \mu C$

$r_1 = 0.33$ m

$r_3 = 0.33$ m

$r_4 = \sqrt{0.33^2 + 0.33^2} = 0.47$ m

$F_1 = K\frac{q_1 q_2}{r_1^2} = 8.99\times10^9 \times \frac{2.4\times10^{-6} \times 4.8\times10^{-6}}{0.33^2}$

$\vec{F_1} = -0.95\ j\ N$

$F_3 = K\frac{q_2 q_3}{r_3} = 8.99\times10^9 \times \frac{4.8\times10^{-6} \times 7.2\times10^{-6}}{0.33^2}$

$\vec{F_3} = -2.85\ i\ N$

$F_4 = K\frac{q_2 q_4}{r^2} = 8.99\times10^9 \times \frac{4.8\times10^{-6} \times 9.6\times10^{-6}}{(0.47)^2}$

$F_4 = 1.9\ N$

$F_{4x} = F_4 \cos 45 = -1.9 \cos 45 = -1.34\ N$

$F_{4y} = F_4 \sin 45 = 1.9 \sin 45 = +1.34\ N$

$F_x = F_3 + F_{4x} = -2.85 + -1.34 = -4.19\ N$

$F_y = F_1 + F_{4y} = -0.95 + 1.34 = 0.39\ N$

$\vec{F} = -4.19\ i + 0.39\ j\ N$

$|F| = \sqrt{(4.19)^2 + (0.39)^2}$

$|F| = 4.92\ N$

$\theta = \tan^{-1}\frac{0.39}{-4.19} = -5.3^\circ$

$\theta = 174.7^\circ$

H.W

1. *The attractive electrostatic force between the point charges* $+844 \times 10^{-6} C$ *and* Q *has a magnitude of 0.975 N when the separation between the charges is 1.31 m. Find the sign and magnitude of the charge Q.*

2. *When two identical ions are separated by a distance of* 62×10^{-10} *m, the electrostatic force each exerts on the other is* $54 \times 10^{-9} N$*. How many electrons are missing from each ion?*

(في هذه المسالة نقوم بحساب الشحنة Q عن طريق قانون كولوم ثم نستخدم القانون $N = \frac{Q}{e}$ حيث . N عدد الالكترونات ، e شحنة الالكترون $16 \times 10^{-19} C$ و Q الشحنة)