Solutions to practice problems

This equation can be used to find the electric field of a point charge q some distance r away from that charge.

$$E = \frac{kq}{r^2}$$

This equation can be used to find the electric (Coulombic) force between two charges q_1 and q_2 which are separated by a distance r.

$$F = \frac{kq_1q_2}{r^2}$$

Write an equation which relates the electric field created by a point charge q to the force between that charge and another charge q_o

$$F = Eq_0 \rightarrow \frac{kq}{r^2} \cdot q_0$$

$k = 8.99 \times 10^9$

A 40 μC charge produces an Electric field of 30 N/C at what distance from the charge?

q E

$$E = \frac{kq}{r^2}$$

$$30 = \frac{k(40 \times 10^{-6})}{r^2} \qquad \boxed{r = 109\ m}$$

What is the intensity (magnitude) of the electric field produced by a -3.0 C charge at a distance of 2.3 m? What is the direction of that field? Explain your answer.

$$E = \frac{kq}{r^2}$$

$$= \frac{k(-3)}{2.3^2} = \boxed{5.10 \times 10^9 \frac{N}{C}}$$

b/c it's negative

Towards the charge

A negative charge of 4.0×10^{-5} C and a positive charge of 7.0×10^{-5} C are separated by a distance of 0.15 m. What is the magnitude and direction of the electric force between the two charges?

$$F = \frac{kq_1q_2}{r^2}$$

$$F = \frac{k(4 \times 10^{-5})(7 \times 10^{-5})}{.15^2} = \boxed{1119\ N \quad \text{attract}}$$

Two protons are separated by 36 μm. What is the magnitude and direction of the electric force between the two charges?

$q_1 = q_2 = 1.6 \times 10^{-19} C$

$$F = \frac{kq_1q_2}{r^2} = \frac{k(1.6 \times 10^{-19})^2}{36 \times 10^{-6}}$$

$\boxed{F = \text{[illegible]} \text{ repulsive}}$

$\boxed{1.78 \times 10^{-19} N}$

A positive charge of 72 μC is separated from a positive charge of 15 μC by a distance of 3.2 cm. What is the magnitude and direction of the electric force between the two charges?

$$F = \frac{kq_1q_2}{r^2} = \frac{k(72\times10^{-6})(15\times10^{-6})}{.032^2} = 9482\ N$$

Two negative charges of magnitude 50 nC push each other apart with a force of 32 N. How far apart are the charges and what are their signs?

$$F = \frac{kq_1q_2}{r^2}$$

Same signs

$$32 = \frac{k(50\times10^{-9})^2}{r^2}$$

$$r = \sqrt{7.02\times10^{-7}}$$

$$r = 8.38\times10^{-4}\ m$$

A negative charge of 500 μC exerts an attractive force of 9.0 N on a second charge 10 m away. What is the sign and magnitude of the second charge?

$$9 = \frac{k(500\times10^{-6})q_2}{10^2}$$

$$q_2 = 2.00\times10^{-4}\ C$$ positive

If an electric field produces a force of 12.3 N on a charge of 6 μC, what is the intensity of the field which produced the force?

$$F = Eq$$

$$12.3 = E(6\times10^{-6})$$

$$E = 2.05\times10^{6}\ \frac{N}{C}$$

When an electric field of 3milli-Newton/Coulomb interacts with an electron, what magnitude of force is "felt" by the electron?

↳ $3\ \frac{mN}{C}$

↳ $q = 1.6\times10^{-19}\ C$

$$\frac{3\ mN}{C}\left|\frac{1\ N}{1000\ mN}\right. = .003\ \frac{N}{C}$$

$$F = Eq$$

$$F = (.003)(1.6\times10^{-19})$$

$$F = 4.8\times10^{-22}\ N$$