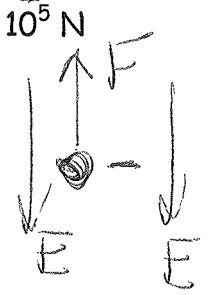
Name: Key

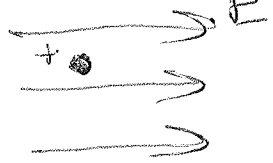
Practice - 18.4 Electric Field

1. What is the magnitude and direction of an electric field that exerts a 2.00×10^{-5} N upward force on a -1.75 μC charge?

$$F = qE \Rightarrow E = \frac{F}{q} = \frac{2.00\times10^{-5}\ N}{1.75\times10^{-6}\ C} = \boxed{11.4\ N/C \text{ downward}}$$



2. What is the magnitude and direction of the force exerted on a 3.50 μC charge by a 250 N/C electric field that points due east?



$$F = qE = (3.50\times10^{-6}\ C)\left(250\ \frac{N}{C}\right) = \boxed{8.75\times10^{-4}\ \text{east}}$$

3. Calculate the magnitude of the electric field 2.00 m from a point charge of 5.00 mC (such as found on the terminal of a Van de Graaff).

$$E = \frac{kQ}{r^2} = \frac{\left(8.99\times10^{9}\ \frac{Nm^2}{C^2}\right)(5.00\times10^{-3}\ C)}{(2.00\ m)^2} = \boxed{1.12\times10^{7}\ \frac{N}{C}}$$

4. What magnitude point charge creates a 10,000 N/C electric field at a distance of 0.250 m?

$$E = \frac{kQ}{r^2} \Rightarrow Q = \frac{Er^2}{k} = \frac{\left(10{,}000\ \frac{N}{C}\right)(0.250\ m)^2}{8.99\times10^{9}\ \frac{Nm^2}{C^2}} = \boxed{6.95\times10^{-8}\ C}$$

5. Calculate the initial (from rest) acceleration of a proton in a 5.00×10^{6} N/C electric field. $m_p = 1.67\times10^{-27}$ kg

$$F = qE = ma \Rightarrow a = \frac{qE}{m} = \frac{(1.60\times10^{-19}\ C)\left(5.00\times10^{6}\ \frac{N}{C}\right)}{1.67\times10^{-27}\ kg} = \boxed{4.79\times10^{14}\ \frac{m}{s^2}}$$

Solutions:

1. 11.4 N/C downward
2. 8.75×10^{-4} N east
3. 1.13×10^{7} N/C
4. 6.95×10^{-8} C
5. 4.79×10^{14} m/s^2