Electric Field Problems

$m_e = 9.11 \times 10^{-31}$ kg $m_p = 1.67 \times 10^{-27}$ kg, $q_p = q_e = 1.6 \times 10^{-19}$ C)

1. An electron passing through a TV tube experiences a force of 10^{-15} N at a particular point. What is the electric field at that point? **(6250 N/C)**

$$E = \frac{F}{q} = \frac{F}{q_e} = \frac{10^{-15}}{1.6 \times 10^{-19}} = 6{,}250 \text{ N/C}$$

2. A proton has a mass of 1.67×10^{-27} kg. It is observed to experience an acceleration of 3×10^{14} m/s^2 in a region where an electric field acts upon it. What is the strength of the field? **(3.13 x 10^6 N/C)** *Hint: Find force first (Remember F = ma)*

$$F = ma$$
$$F = 1.67 \times 10^{-27}(3 \times 10^{14})$$
$$F = 5.018 \times 10^{-13} N$$

$$E = \frac{F}{q} = \frac{5.018 \times 10^{-13}}{1.6 \times 10^{-19}}$$
$$E = 3.13 \times 10^6 \text{ N/C}$$

3. A +5 μC charge is located at some point. Find the **electric field strength at point "P"** which is located 2.0 m to the left of the charge. What is the direction of the field at "P" **(11250 N/C)**

$$E = \frac{Kq}{d^2} = \frac{9 \times 10^9 (5 \times 10^{-6})}{2^2} = 11250 \text{ N/C} \quad \underset{\longleftarrow}{\text{Left}}$$

b) Find the force that a -2 μC charge would experience if placed at point "P" **(0.0225 N→)**

$$F = Eq = 11{,}250(2 \times 10^{-6}) = 0.0225 N \rightarrow$$

FORCE is against THE FIELD Because
The charge is Negative.

4. At a given instant an electron is 2×10^{-6} m from a proton. The electron is moving directly away from the proton with a speed of 3×10^6 m/s.
    a) Find the electric field at the position of the electron. **(360 N/C)**

    $$E = \frac{KQ}{d^2} = \frac{9 \times 10^9 \, (1.6 \times 10^{-19})}{(2 \times 10^{-6})^2} = 360 \, N/C$$

    b) Find the force experienced by the electron. Is it positive or negative?

    $$F = Eq = 360(-1.6 \times 10^{-19}) = -5.76 \times 10^{-17} N$$

5. A +5 µC charge is located at some point 0.25m from a sphere of unknown charge and experiences a force of 0.035 N.
    a) Find the electric field strength at the location of the +5 µC charge. **(7000 N/C)**

    $$E = \frac{F}{q} = \frac{0.035}{5 \times 10^{-6}} = 7000 \, N/C$$

    b) What must the charge on the sphere be in order to produce this field at the location of the +5 µC charge? **(4.86×10^{-8} C)**

    $$E = \frac{KQ}{d^2} \implies \frac{Ed^2}{K} = Q$$

    $$Q = \frac{700(.25)^2}{9 \times 10^9} = 4.86 \times 10^{-8} C$$