Electric Fields
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1. **Calculate the magnitude and direction of the electric force if a charge of $-\ 3.5\ \times\ 10^{-7}C$ is placed in a field of 12 N/C [right]. (5 marks)**

- $q_1 =-\ 3.5\ \times\ 10^{-7}C$
- $\overline{E}\ =\ 12N/C\ [right]$
- $Force\ =\ q_1\overline{E}\ =\ (-\ 3.5\ \times\ 10^{7})\ \times\ 12\ =-\ 4.2\ \times\ 10^{-6}N$

  Thus, the answer would be $4.2\ \times\ 10^{-6}N$that moves to the left.

2. **An electron at rest of mass $9.11\ \times\ 10^{-31}kg$ is accelerated through a potential difference of 350 V. It then enters some deflecting plates of 50 V with dimensions as shown. Calculate the distance, x, or of the deflection of the electron. The charge on an electron is $1.6\ \times\ 10^{-19}C$).**

- Electron is accelerated from rest ($u\ =\ 0m/s$) to a particular velocity v in a potential difference of 350V.
  $\Delta v\ \bullet\ q\ =\frac{1}{2}mv^2(Final\ kinetic\ energy)\ -\frac{1}{2}mu^2(Initial\ kinetic\ energy)$
  $1.6\ \times\ 10^{-19}\ \times\ 350\ =\frac{1}{2}\ \times\ 9.11\ \times\ 10^{-31}\ \times\ v^2\ -\frac{1}{2}m(0)^2$
  $v^2\ =\frac{2\times1.6\times10^{-19}\times350}{9.11\times10^{-31}}\rightarrow\ v\ =\sqrt{\frac{2\times1.6\times10^{-19}\times350}{9.11\times10^{-31}}}\ =\ 1.11\ \times\ 10^{7}m/s$

- Now when electrons with velocity v enter in the 50V region. Initially, when it enters the electron, it only has horizontal velocity v_h. But, due to some electric force in the vertical fashion, it gains some velocity in the direction

- Force in vertical direction
  $E\ =\frac{V}{r}\ =\frac{50}{5\times10^{-2}}$
  $F\ =\ q_1E\ =\frac{1.6\times10^{-19}\times50}{5\times10^{-2}}$
  $F\ =\ ma\rightarrow\ a\ =\frac{F}{m}\ =\frac{1.6\times10^{-19}\times50}{9.11\times10^{-31}\times5\times10^{-2}}\frac{m}{s^2}$

- Thus, the time required to cover a distance 25cm in horizontal direction is the following.
  $distance\ =\ velocity\ \times\ time$
  $time\ =\frac{distance}{velocity}\ =\frac{25\times10^{-2}}{11.1\times10^{6}}\ =\ 2.25\ \times\ 10^{-8}s$

- Now, use the equation in horizontal direction.

$$s = ut + \frac{1}{2}at^2$$

$$x = 0 \times t + \frac{1}{2}\frac{1.6\times10^{-19}\times50\times2.25\times2.25\times10^{-16}}{9.11\times10^{-31}\times5\times10^{-2}}$$

$$x = 4.445 \times 10^{-2}m$$

Thus, the answer would be $4.4cm$.