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DPP – 04

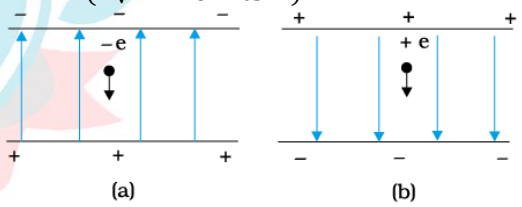
Class - 12th

Electric Charges and Fields

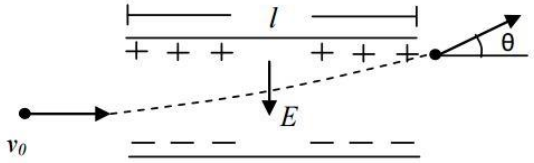
Topics:

- **Electric field Strength and Force**

1. Calculate the electric field strength required to just support a water drop of mass $10^{-3}\ kg$ and having a charge 1.6×10^{-19}C. $(\mathbf{6.125 \times 10^{16}\ NC^{-1}})$
2. A positively charged oil drop is prevented from falling under gravity by applying a vertical electric field of $100\ Vm^{-1}$. If the mass of the drop is $1.6 \times 10^{-3} g$, find the number of electrons carried by the drop. $(\mathbf{10^{12}})$
3. In Millikan's experiment, an oil drop of radius $10^{-4} cm$ remains suspended between the plates which are $1\ cm$ apart. If the drop has charge of $5e$ over it, calculate the potential difference between the plates. The density of oil may be taken as $1.5\ gcm^{-3}$. $(\mathbf{770\ V})$
4. A particle of mass $10^{-3} kg$ and charge $5\ \mu C$ is thrown at a speed of $20\ ms^{-1}$ against a uniform electric field of strength $2 \times 10^{5}\ NC^{-1}$. How much distance will it travel before coming to rest momentarily? $(\mathbf{0.2\ m})$
5. A α – particle of mass $6.4 \times 10^{-27} kg$ and charge of $3.2 \times 10^{-19}\ C$ is situated in an electric field of $1.6 \times 10^{5}\ Vm^{-1}$. If the particle starts from rest, find its velocity at the end of $2 \times 10^{-2}\ m$ path. $(\mathbf{4\sqrt{2} \times 10^{5}\ ms^{-1}})$
6. An electron falls through a distance of $1.5\ cm$ in a uniform electric field of magnitude $2.0 \times 10^{4}\ Nc^{-1}$. The direction of the field is reversed keeping its magnitude unchanged and a proton falls through the same distance. Compute the time of fall in each case. Contrast the situation (a) with that of 'free fall under gravity'. **(a)** $\mathbf{2.9 \times 10^{-9} s}$ **(b)** $\mathbf{1.25 \times 10^{-7} s}$



7. A simple pendulum consists of a small sphere of mass m suspended by a thread of length l. The sphere carries a positive charge q. The pendulum is placed in a uniform electric field of strength E directed vertically downwards. Find the period of oscillation of the pendulum due to the electrostatic force acting on the sphere, neglecting the effect of the gravitational force. $\left(\mathbf{2\pi\sqrt{\frac{ml}{qE}}}\right)$
8. A stream of electrons moving with a velocity of $3 \times 10^{7}\ ms^{-1}$ is deflected by $2\ mm$ in traversing a distance of $0.1\ m$ in a uniform electric field of strength $18\ V\ cm^{-1}$. Determine e/m of electrons. $(\mathbf{2 \times 10^{11}\ C\ kg^{-1}})$
9. An electric field E is set up between the two parallel plates of a capacitor, as shown in fig. An electron enters the field symmetrically between the plates with a speed v_0. The length of each plate is l. Find the angle of deviation of the path of the electron as it comes out of the field. $\left(\mathbf{\tan^{-1}\frac{eEl}{mv_0^2}}\right)$



10. A charged particle, of charge $2\ \mu C$ and mass $10\ milligram$, moving with a velocity of $1000\ m/s$ enters a uniform electric field of strength $10^{3}\ NC^{-1}$ directed perpendicular to its direction of motion. Find the velocity and displacement, of the particle after $10\ s$. $(\mathbf{10000\sqrt{2}\ m})$