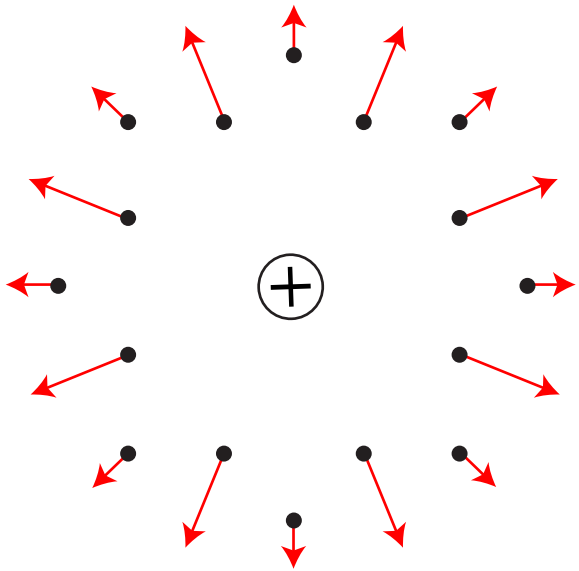
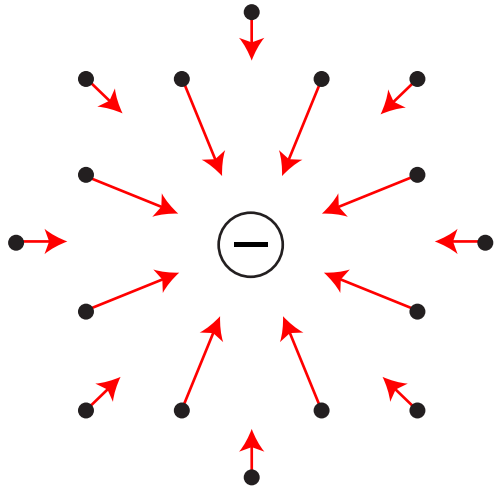
# PHY-112
# Principles of Physics-II
Akiful Islam (AZW)
Spring-24 | Class-3

# Electric Field Lines

They are imaginary lines used to visualize and represent the direction and strength of an electric field.



Radially Outward

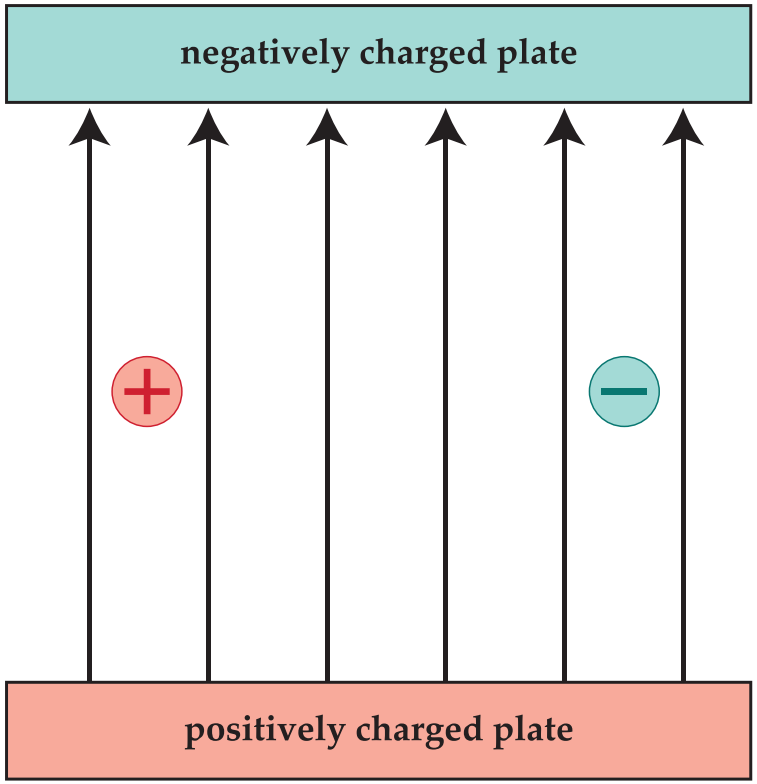


Radially Inward

Note: **Electric field lines are not trajectories. No two electric field lines will intersect.**

# Motion in Uniform $\vec{E}$ Field: Straight

Q: Find the direction of motion of the two charges. The charges are placed from rest.



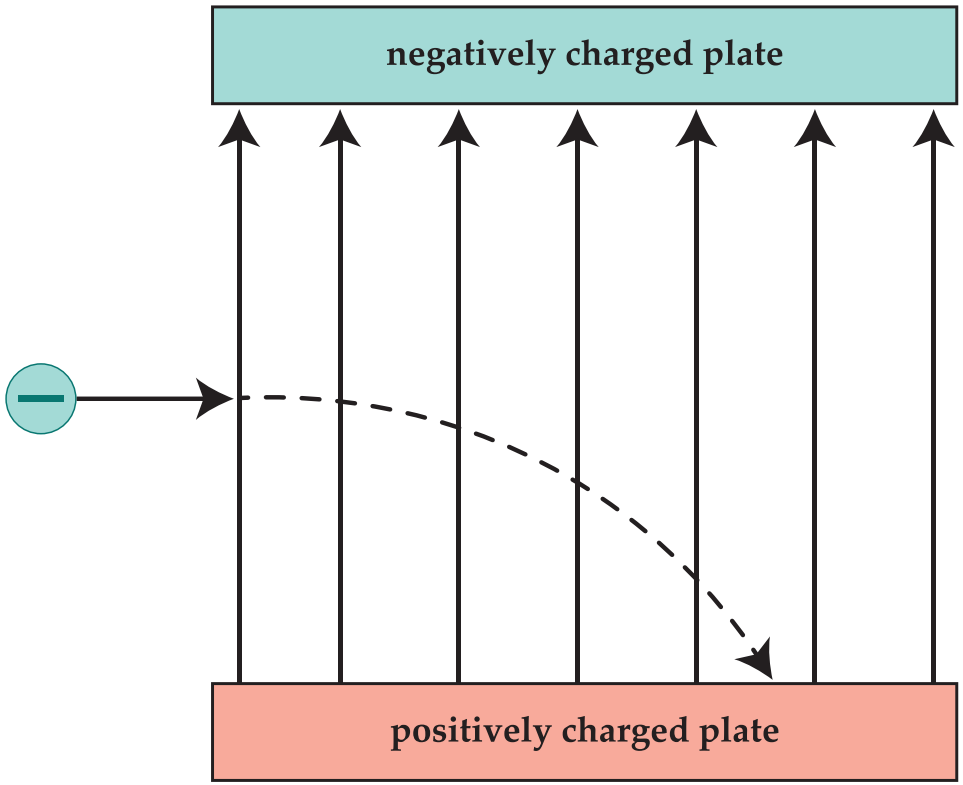
# Testing Concepts (1)

Q: An electron traveling parallel to a uniform electric field increases its speed from $2.0 \times 10^7\,\mathrm{m\,s^{-1}}$ to $4.0 \times 10^7\,\mathrm{m\,s^{-1}}$ over a distance of $1.5\,\mathrm{cm}$. What is the electric field strength?

- $$E = \frac{F_E}{q_e} = \frac{m_e a}{q_e}$$
- $$v^2 = v_0^2 + 2ad$$
- $$a = \frac{v^2 - v_0^2}{2d}$$

# Motion in Uniform $\vec{E}$ Field: Parabolic

Q: Find the deflection of the charge off of its main trajectory.



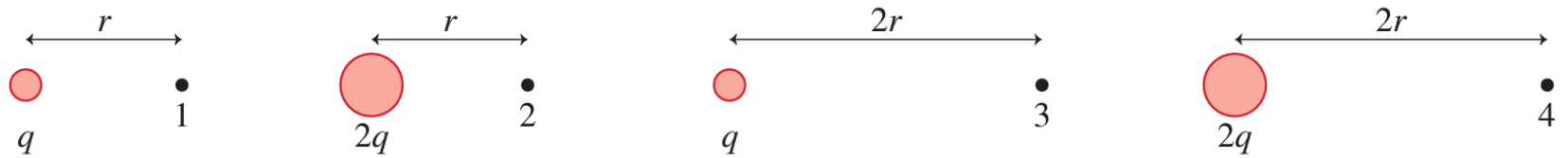
# Testing Concepts (2)

Q: Two charged plates ($2\,\text{cm}$ wide) are kept $1\,\text{cm}$ apart that generates a uniform electric field of intensity $[1\,\text{kN}\,\text{C}^{-1}]\hat{j}$ in between. An electron (proton/neutron) is shot (halfway distant from either plate) perpendicular to $\vec{E}$ with a constant speed $[10^6\,\text{m}\,\text{s}^{-1}]\hat{i}$. Find:

- the direction the electron (proton/neutron) deflects to
- the time the electron (proton/neutron) takes to hit one of the plates, if any
- the horizontal distance covered by the electron (proton/neutron)
- the speed at which it hits

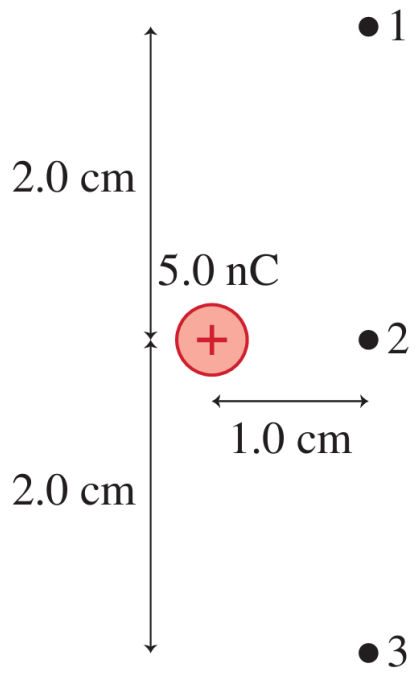
# Testing Concepts (3)

Q: Rank in order, from largest to smallest (descending order), the electric field strengths $E_1$ to $E_4$ at points 1 to 4. Try the same in an ascending order.



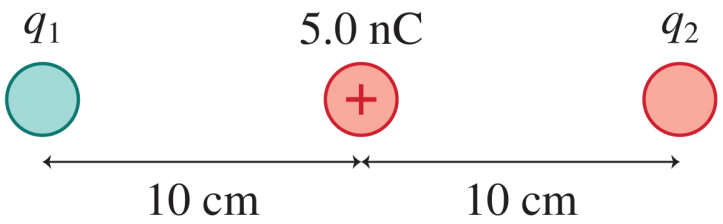
# Testing Concepts (4)

Q: What are the electric field strengths at points 1, 2, and 3?



# Testing Concepts (5)

Q: $q_2$ is in equilibrium. What is $q_1$? What type?



# Our Journey So Far...

**Electric Fields**

- Q: What makes them? $\longrightarrow$ A: Electric Charge
- Q: What does it do to observers? $\longrightarrow$ A: Applies Coulomb Force
- Q: How to measure it? $\longrightarrow$ A: $\dfrac{\text{Coulomb Force}}{\text{Observer Charge}}$
- All were shown using Discrete Source cases

# One Problem Solving Strategy to Rule them All

- The electric field/force of a point charge setup and
- The principle of superposition