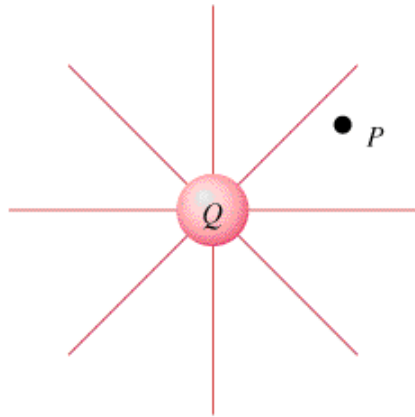


III. Electric Field



By a single point charge:

Extends from the charge and permeates all of space

Not a kind of matter

Test Charge: q

very little charge, almost zero

$$\mathbf{E} = \mathbf{F}/q, \text{ vector}$$

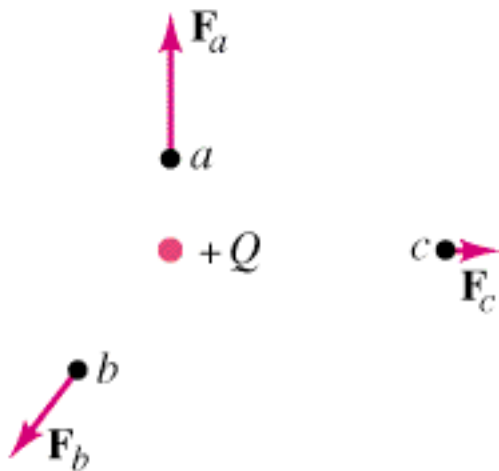
$$\mathbf{F} = q\mathbf{E}$$

$$\begin{aligned} \mathbf{E} &= [kQq/r^2]/q \\ &= kQ/r^2 \end{aligned}$$

Direction independent of q :

+ Q : away from Q

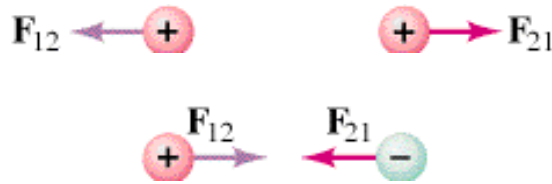
- Q : towards Q



Comparison Between F & E

$$F = k \frac{Q_1 Q_2}{r^2}$$

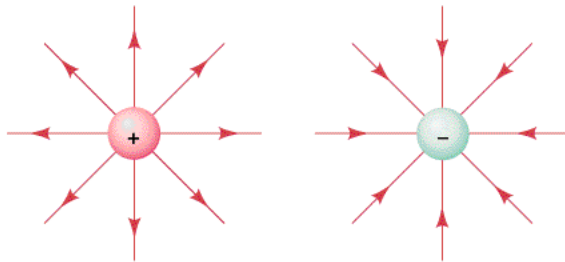
Force: N, depends on both Q_1 & Q_2
Only at discrete locations



$$E = k \frac{Q}{r^2}$$

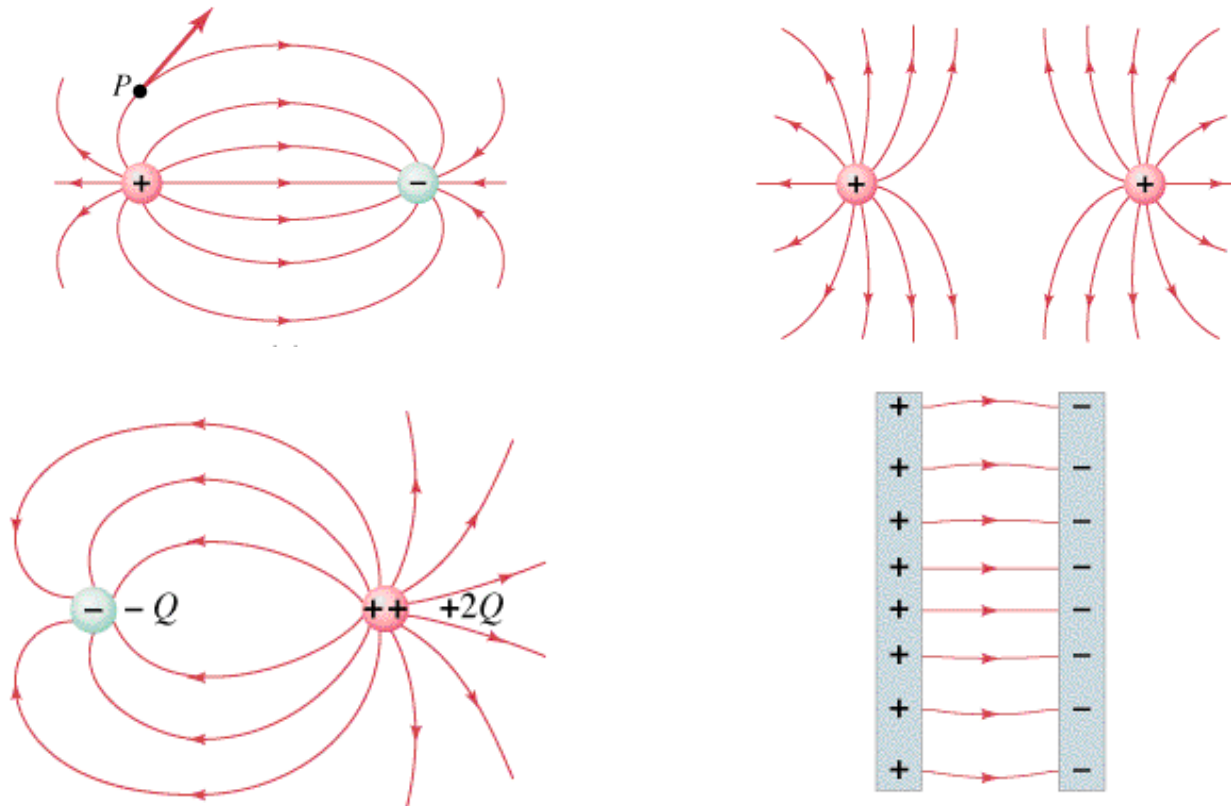
Electric Field: N/C

depends only on Q
independent of test charge
everywhere



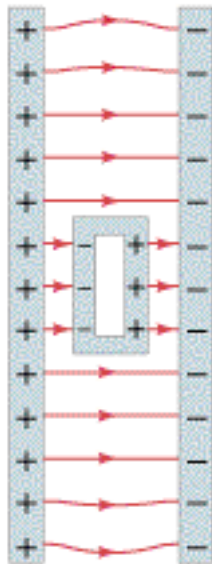
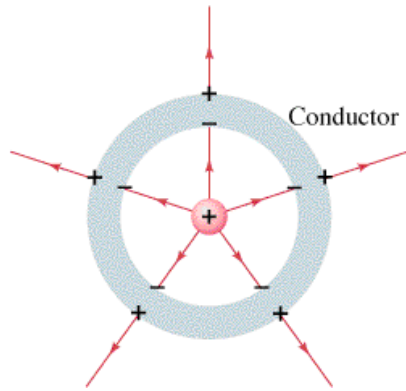
Visualization: Field Lines

- Starting on a positive charge, ending on a negative charge
- Field lines indicate the direction of the \mathbf{E} field (tangent to the line at any point)
- Number of lines \sim magnitude of charge
closer the lines, stronger the field

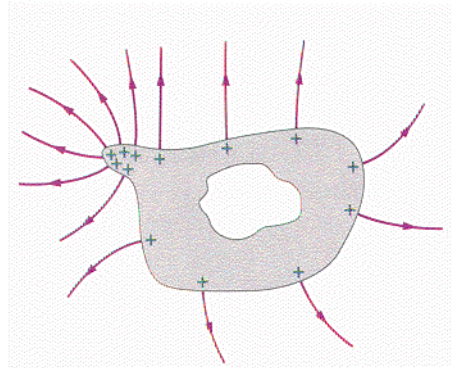


IV. Shielding

Static: No electric field inside a good conductor



Lightening Rod



Electric field lines contact conductor surfaces at right angles.