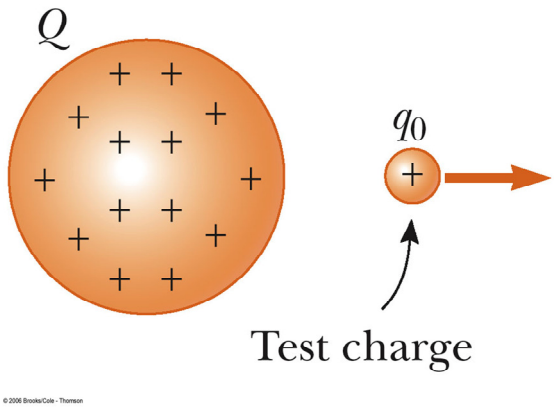
23.4 The Electric Field

Concept of electric field

- A charged particle, with charge Q, produces an electric field in the region of space around it.
- A small *test charge*, q_o, placed in the field, will experience a force.



Definition of electric field:

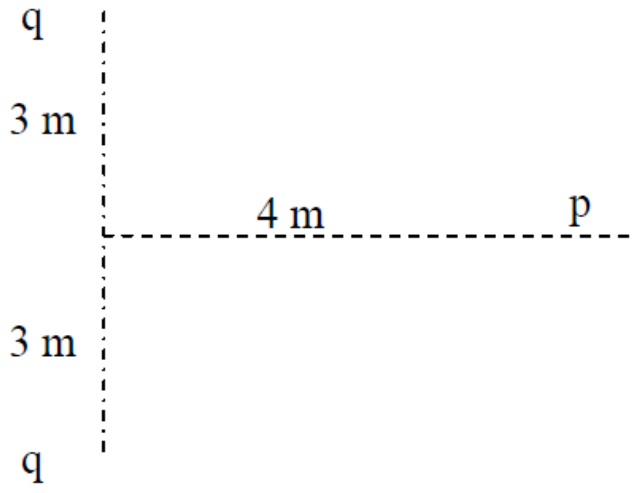
the electric field E at a point in space is defined as the electric force $\mathbf{F}_e$ acting on a positive test charge q_0 placed at that point divided by the magnitude of the test charge:

$$\mathbf{E} \equiv \frac{\mathbf{F}_e}{q_0} \qquad (23.3)$$

at any point *P*, the total electric field due to a group of charges equals the vector sum of the electric fields of the individual charges.

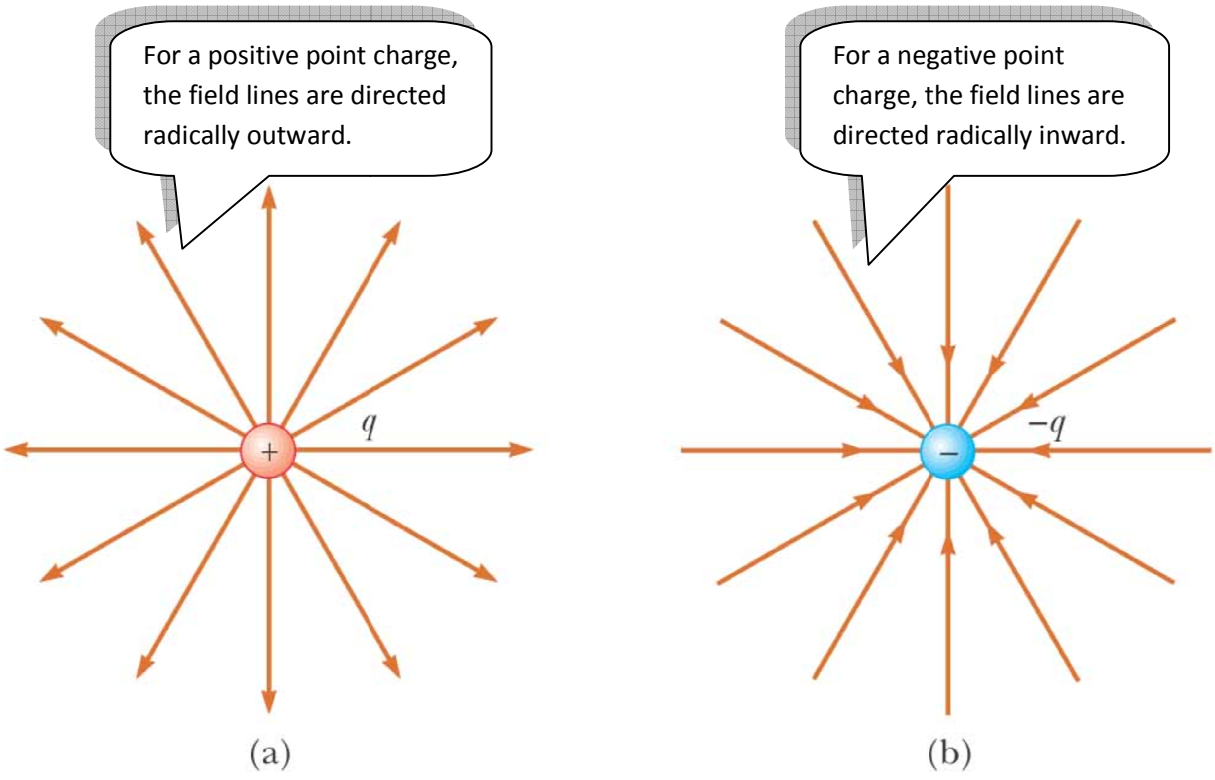
$$\mathbf{E} = k_e \sum_i \frac{q_i}{r_i^2} \hat{\mathbf{r}}_i$$

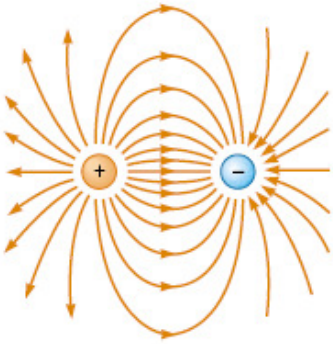
Example: Find the resultant electric field due to the two charges (q = 10^{-6} C) at the point p.



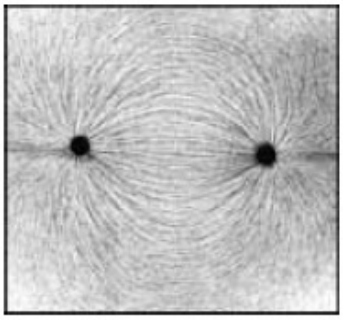
23.6 Electric Field Lines

- The electric field vector **E** is tangent to the electric field line at each point.
- The number of lines per unit area through a surface perpendicular to the lines is proportional to the magnitude of the electric field in that region. Thus, E is great when the field lines are close together and small when they are far apart.

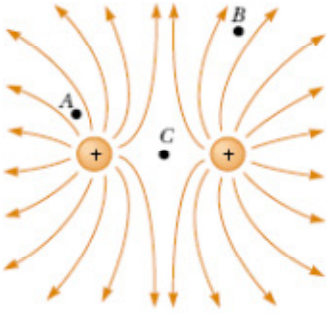




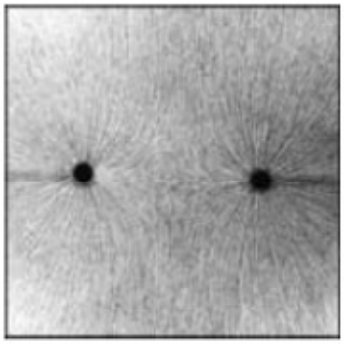
(a)



(b)



(a)



(b)