Electric Field Lines
Lesson Notes

Focus Questions:

- How can the electric field lines be constructed for single source charges and simple configurations of two or more source charges?

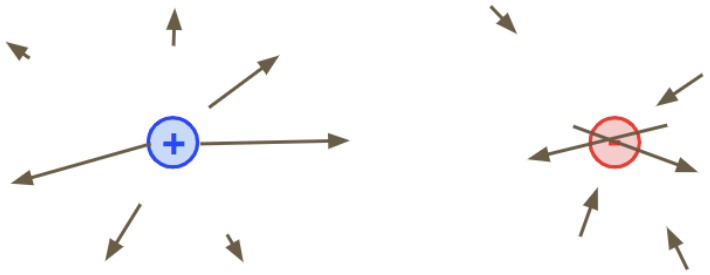
Electric Field Review

- Electric Field is a vector quantity that is fully described by a numerical value (magnitude) and a direction.
- The **magnitude** of the electric field (E) at any given location is given by the equation shown at the right
- By definition, the **direction** of the electric field at any given location is the direction that a + test charge would be pushed or pulled when placed at that location.

$$E = \frac{k \cdot Q_{source}}{d^2}$$

Electric Lines of Force Diagrams

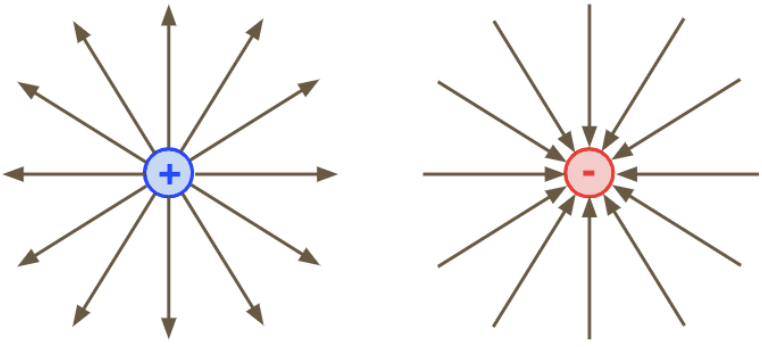
Lines of force can be drawn around a charge at various locations to indicate the magnitude and direction of the electric field vector.



The length of the vector arrow indicates the magnitude of E. The direction of the arrow represents the direction of E.

Electric Field Lines Diagrams

Electric field lines are used to represent the magnitude and direction of the electric fields by a series of continuous lines that stretch between the source charge and *infinity*.



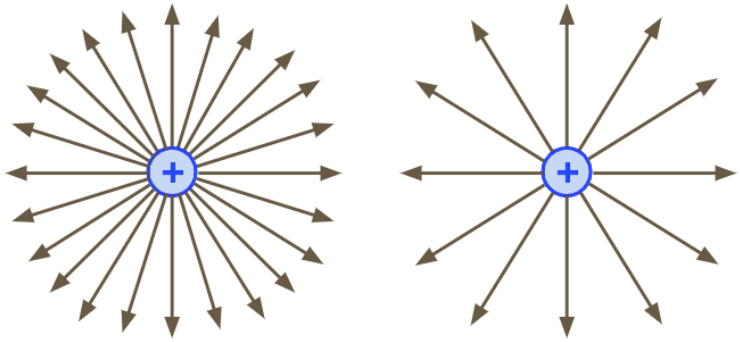
For a Positive Source For a Negative Source

Rules for Electric Field Line Diagrams

1. Electric field lines display the direction of E by **arrowheads**. Lines are directed from + source charges to infinity, from infinity towards - source charges, or from + towards - source charges.
2. At locations where the lines join up with the surfaces of objects, they are **perpendicular to the surface**.
3. Electric field lines should **NEVER cross one another**.

Line Density

Source charges with a greater quantity of charge have more lines extending from or to their surfaces.



Large Amount of Charge Small Amount of Charge

Field Lines for Configurations of Two or More Charges

Draw the electric field lines for the following configurations: