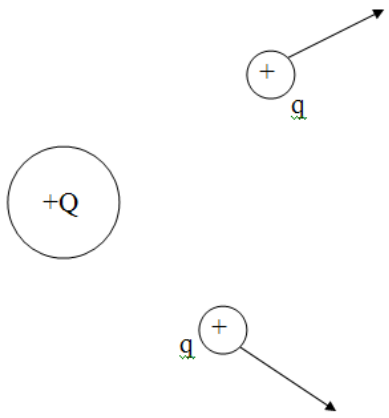
Lesson 3
Electric Fields

Electric Field:
A region of influence in the space surrounding a charged object, that will exert a force on another charged object that is brought into the region.

Mapping Electric Fields:
To draw a picture of an electric field, we imagine placing a small positive test charge near the charged object that is producing the field.



Wherever the test charge is placed it will be repelled from the positively charged object.

Electric Field around single charges:

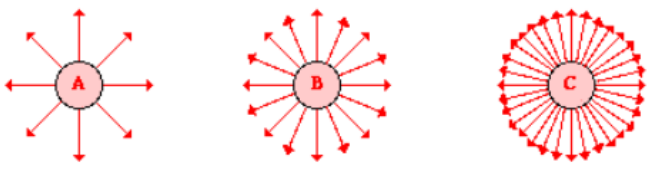
Electric Field Lines for Two Source Charges

Negative Source Positive Source

Rules for Electric Field Lines:

1. Direction of the field lines is the direction in which a positive test charge would move when placed in the field. Field lines start on positive charge and end at negative charge.
2. Field lines meet the charged object at right angles.
3. Field lines never touch or cross.
4. Density of field lines indicates strength of the field.

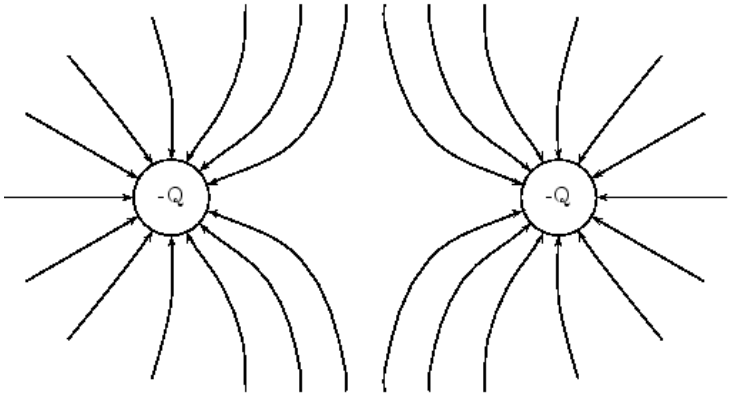
Density of Lines in Patterns



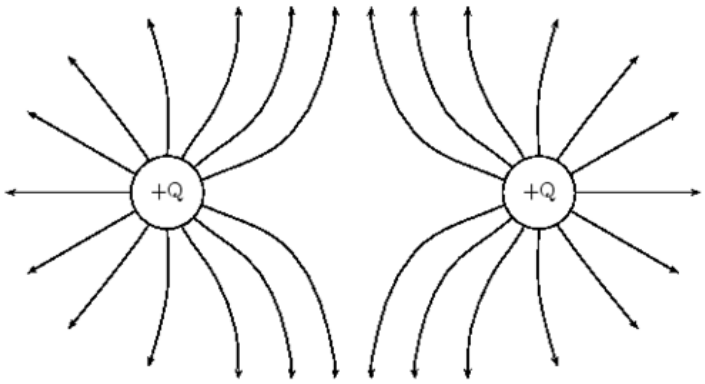
The density of electric field lines around these three objects reveals that the quantity of charge on C is greater than that on B which is greater than that on B.

5. Field is three dimensional.

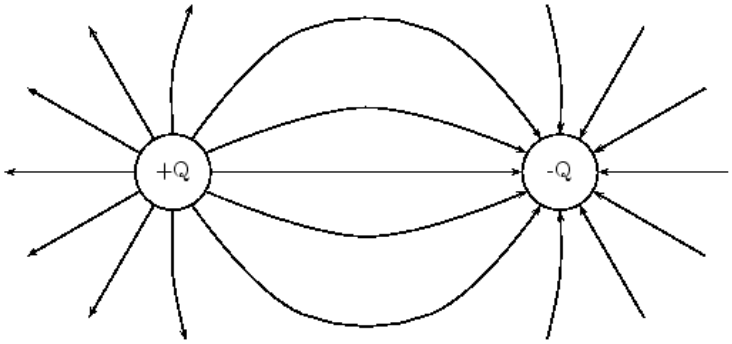
Other Electric Fields (see p. 549)
Two negative charges:



Two positive charges:

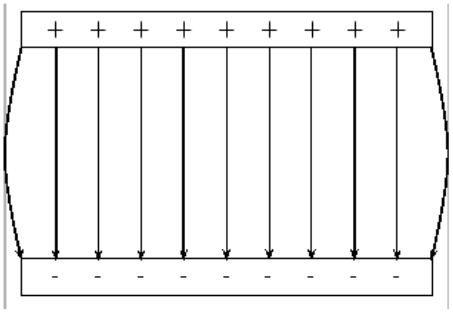


Positive and Negative Charge:

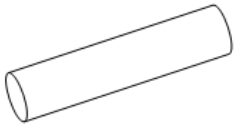


Parallel plates:

Field Map for Oppositely Charged Parallel Plates



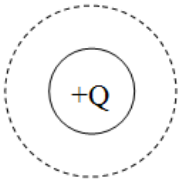
Single conductor (wire):



No electric field lines exist inside the conductor – the electric field is 0.

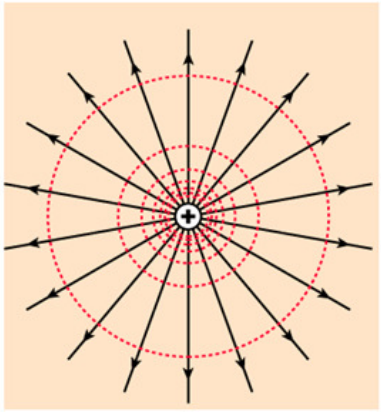
Equipotential Lines:
These are similar to contour lines in geography.

Consider a positive charge Q:

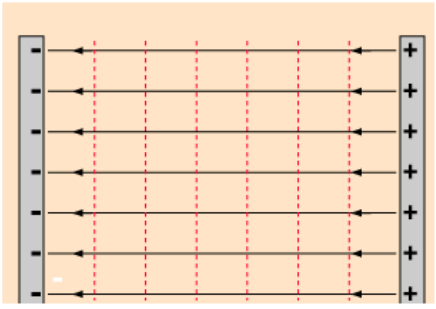


The dashed line is an equipotential line. A test charge q, could be placed anywhere on this line and it would experience the same amount of repulsive force.

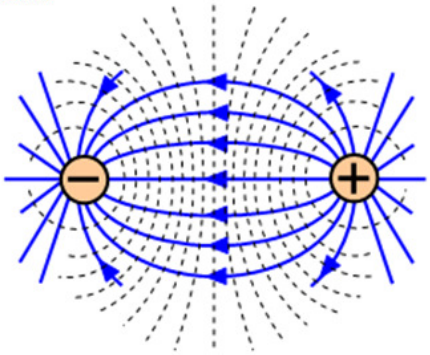
Note the equipotential lines are perpendicular to electric field lines.



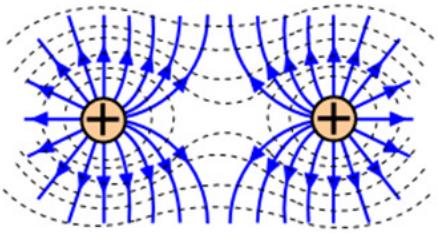
Parallel Plates:



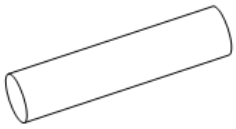
Dipole:



Like Charges:



Conductor:



Note that these 2D diagrams represent 3D situations. Onion analogy.
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