

NYB

Equipotentials and Lines of Forces

Objective:

To map the *equipotential lines* of a pair of charges on an electric board, and to draw the *electric field lines* (also called *lines of forces*).

Equipment:

Electric potential mapping set (mounting board, conducting paper, special graph paper) battery, connecting wires, voltmeter.

Basic Concepts:

-An *electric field line* is the path along which a *free* (no other forces but this of the field) electric charge would move inside a space region occupied by an electric field.

-An *equipotential line* is a line on which all points have the same value of electric potential. Since these points have no potential difference between them, charges would not move from one point to the other. But, they would move between two points on two different equipotential lines. A positive charge would move from the higher to the lower potential and a negative charge would move in opposite direction.

- A configuration of charges (+ and -) creates in the surrounding space an electric field with a particular geometry. Michael Faraday introduced the concept of electric field lines to visualize this field characteristics.

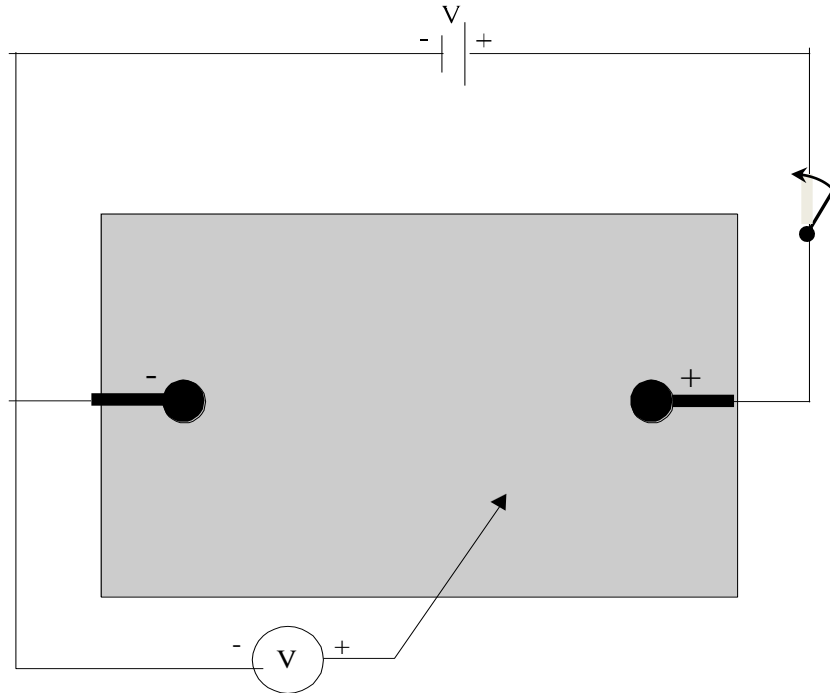
The electric field lines are always perpendicular to equipotential lines (or surfaces).

They get out of “+” charges and get into “-” charges.

Also, they are directed *from the higher versus the lower values* of potential.

Procedure:

1. Draw the profile of electrodes charges) on a paper(given by the instructor).
2. Connect a 6V battery to the two posts on the mapping board, as shown.
3. Connect the negative terminal of a voltmeter to the negative post on the mounting board (negative side of battery).
4. Connect one end of a wire to the positive terminal of the voltmeter and use the other end of the wire to measure the electric potential point on the mapping board.
5. Place the free end of the wire on the board at mid distance between the electrodes, measure the voltage and write its value at the same point on the white paper map . Next, move it on the board to find a few points (5-7) with approximately same electric potential (say 2.5V). Show their locations on the map paper and draw a smooth line passing close by these points. This is the equipotential line at 2.5 V.



6. Move to some other spot that shows another voltage (e.g. 3.0 volt). Repeat the same procedure; take readings to determine and draw another equipotential line.
7. Continue to increase/decrease the potential by 0.5-1.0V intervals to map the whole board. You have to draw at least 5 ***equipotential lines*** (*If you have time you should record 7 lines*). Then, draw a set of electric field lines (lines of force) .
8. Repeat the same procedure with the linear electrodes on the other side of mapping board.

Analysis:

Draw the set of equipotential lines by blue color. From the set of equipotential lines sketch the system of electric field lines; draw them by red color.

Calculate the magnitude (or the strength) of electric field in seven points selected in different regions of each of the two maps by using its relation with potential change. Show these points on the map and the corresponding calculations for electric field .

Comment on the distribution of these lines;

- Are they straight or curved?
- What is their direction?
- Are equally dense or not?
- Where is bigger and where is smaller the magnitude of electric field?
- Compare your experimental findings with theoretical predictions.
- Do they seem to be uniform or non uniform electric fields?
- May any region of those fields be assumed almost uniform?