

# Potential Lines

## Equipment

- Digital Multimeter (DMM)
- DC voltage source (battery eliminator) [two required for -3 volts and +3 volts configuration]
- Water, tray and various conductors and non-conductors

## Objective

### Physics Concepts

- Electric Potential (voltage)
- Electric field

### Experimental analysis

- Learn how to configure DMM to measure voltage
- Learn how to determine the E-field from equipotential lines

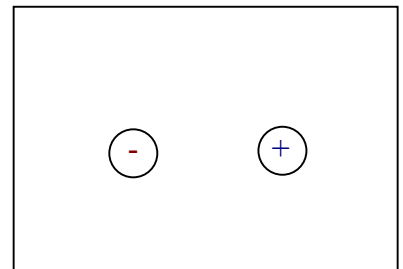
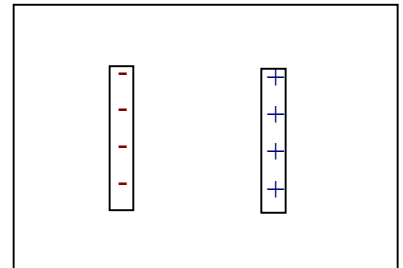
## Conceptual (C-Level)

Express the relationship between the electric field and voltage symbolically (mathematically) and semantically (written description).

Draw the equipotential lines (lines of constant voltage) and electric field lines for the

- Parallel plates at two different voltages (top diagram, shown to the right)
- Point charges at two different voltages (bottom diagram, shown to the right).

Use different colors for the voltage and E-field.



Using the simulation verify (or modify as necessary) your drawings.

## Basic Lab (B-Level)

You will experimentally determine the E-field for the above two configurations by mapping out the equipotential lines. Note: Use different colored lines to clearly indicated voltage and E-field.

- Secure (can you say “duct tape”) the conducting plates before putting water in the tray.
- You need just enough water to cover the bottom of the tray.
- Ground one conductor and connect the other conductor to +6 volts.

EXPLORATIONS: Do these for one configuration – generalize for the other configuration.

- How does the E-field change if you ground one conductor and connect +12 volts to the other conductor?
- How does the E-field change if you use -3 volts and +3 volts?
- How does the E-field change if you use the same voltage on each conductor?

## Advanced/Extended Lab Ideas (A-Level)

- Determine the E-field inside and outside a conducting and an insulating cylinder placed between two parallel plates at different voltages. Note: use steel wool to remove rust and dirt from the conducting cylinder.