Physics Lab Electrostatic Field Plots

Electric Fields:
The purpose of this lab is to gain some experience in understanding the shape of an electric field created by a combination of + and - charge distributions. Instead of actually measuring the field lines themselves, which would be difficult to do, you will measure lines of constant potential difference (equipotential surfaces) which by definition are perpendicular to the electric field lines and then add the field lines later.

Set up:
You will be using several electrode configurations. Charge on the electrodes will be provided by a power supply and voltage (potential difference) measurements will be made with a digital multimeter. Your instructor will explain the setup, how to use the meters, and how to take and transcribe the data. The water in which the electrodes will be placed sustain the electric field created between the electrodes.

Make sure the electrodes are on the transparency In the tank so that they will appear on our plot. If needed, use masking tape to hold wires In place and to keep the transparency from lifting. Do not use any metal weights to hold the transparency in place since conducting objects will change the electric fields of the electrodes you are interested in.

Rules and suggestions for drawing the equipotential lines (curves):

1) Let the voltmeter, not the grid; determine where the points are read.
2) Accurate points are tiny. Since they will be hard to find again, draw a small circle around them but do not make a huge dark blob. Make sure you label at least some of the points with the voltage so that you do not lose track of which equipotential you are on when you draw the line.
3) The equipotential lines should be drawn as solid, smooth lines that pass through the corresponding points at the same potential. They should not have any unexplained wiggles, just a minimum of curvature that passes smoothly through the data points.
4) Since each point in the water can only have one potential relative to zero, two equipotentials cannot cross each other.
5) Each equipotential line, including the two electrodes, must be labeled with the potential relative to the zero. Include the unit (volt).
6) How many points and how many lines? The lines should be enough to show the pattern over the entire sheet of graph paper, with no large, open areas (e.g. fist-sized) on the page. About 5 or 6 equipotentials should be enough. Try O V, 2 V, 4 V, 6 V, 8 V, and 10 V, or you could try steps of 2.5 V. For the 'point' electrode, you will find it easier to use larger voltage steps near the point and smaller ones further from the point.
7) Do not use a ruler for any of the equipotential lines, even if you think they should be straight. For finite sized objects, equipotentials are never straight.

Rules and suggestions for **drawing** the electric field lines:

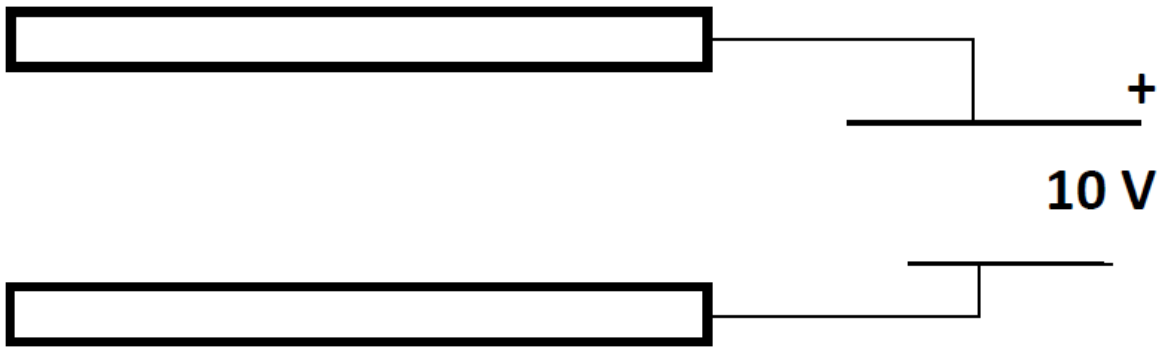
1) The E lines cut the equipotential lines exactly at 90°.
2) The E lines need to have as few bends as possible - eliminate unexplained wiggles.
3) The E-field vector at any position on one of the E lines Is tangent to the E line. The E lines must be labeled with several arrows the show the direction of the field.
4) Since the electric field can only point in one direction at any location in space, E lines cannot cross each other.
5) The E lines are determined by the equipotential lines, not the data points. The voltmeter data points will not trace out the E lines for you.
6) Do not be Influenced by the grid in making the E lines. The only purpose of the grid is to transfer the data points from the water tray.

What to turn in:
You should do all four configurations shown below if you have time. Both you and your partner's names should be on each plot. **Each Partner Should Turn in Their Own Plots!**

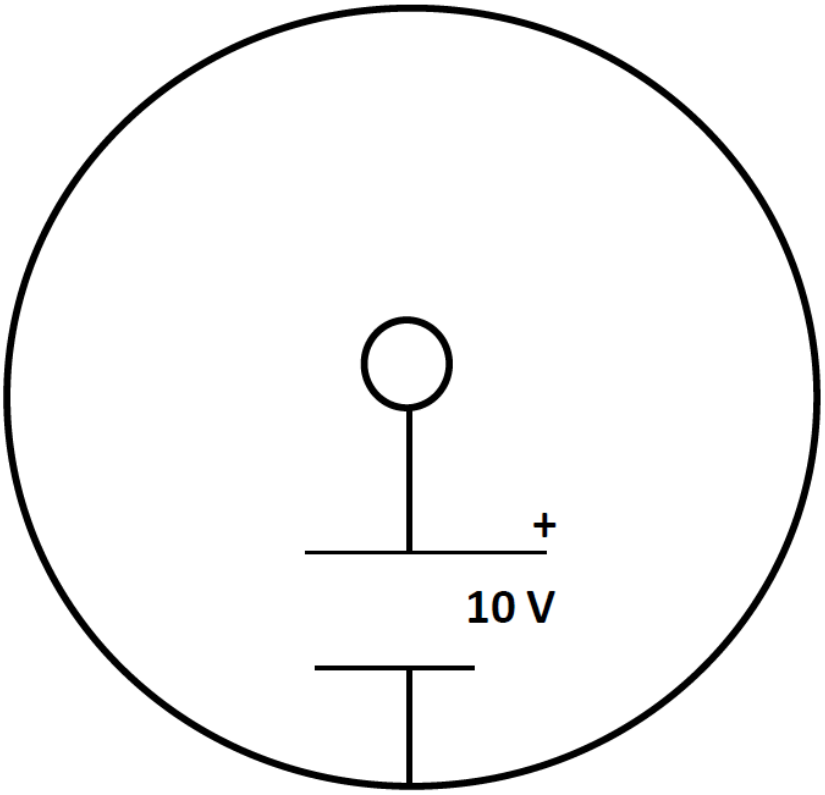
Clean up:
Please turn off the power supply and dry off the electrodes. BE SURE YOUR TABLE IS CLEAN AND DRY BEFORE YOU LEAVE.

Charge Configurations:

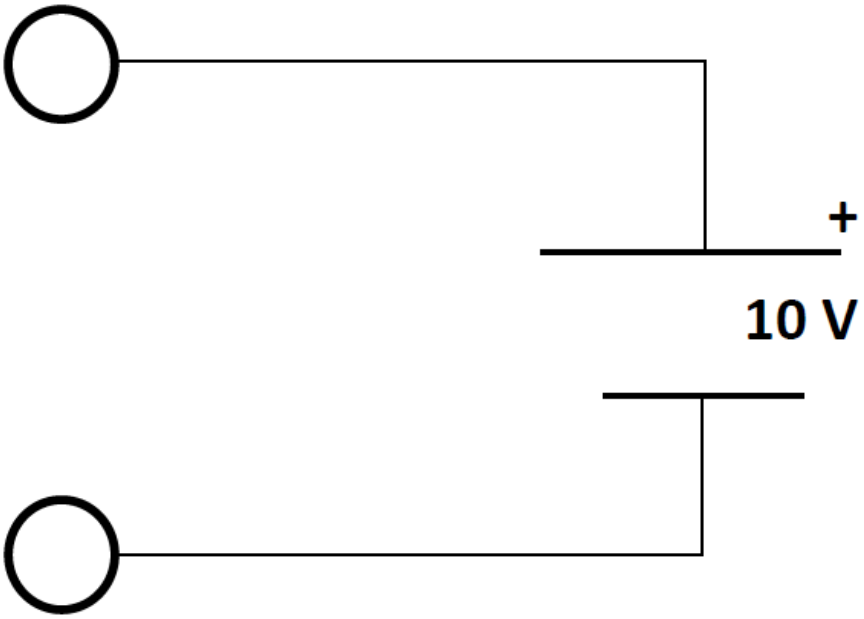
1. Parallel Plate Capacitor



2. Point Charge



3. Electric Dipole



4. Point Charge and Bar