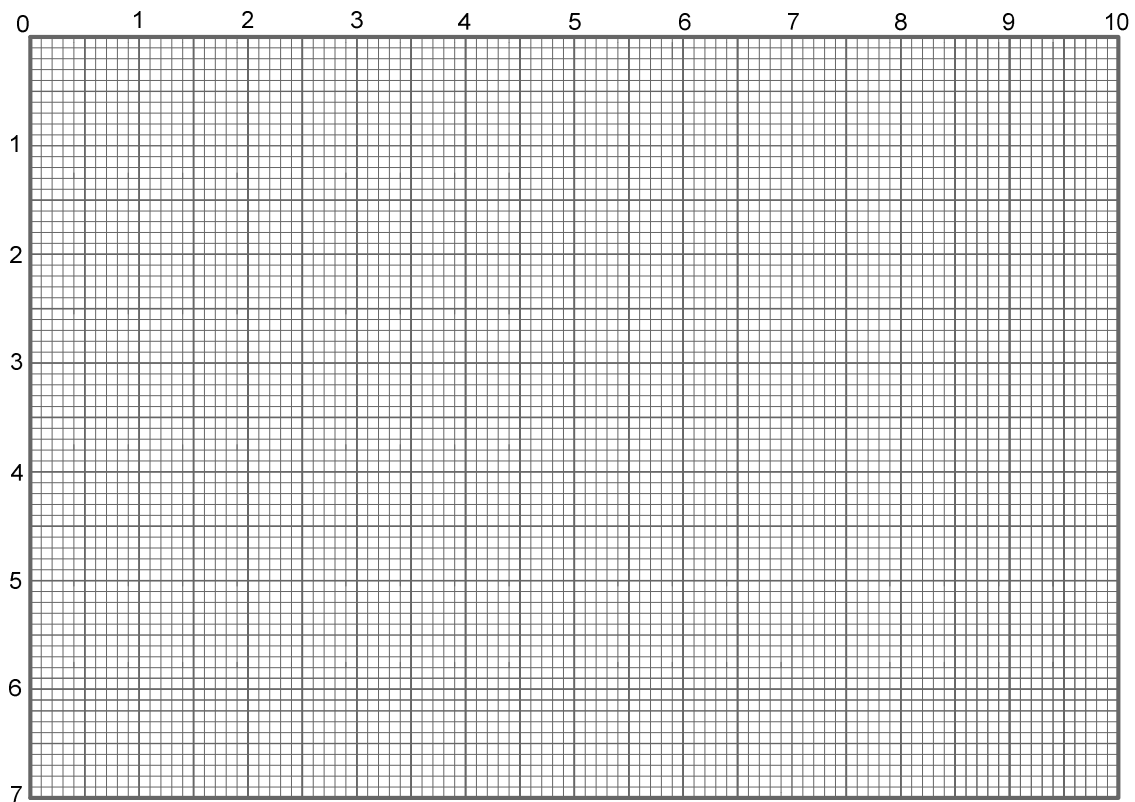
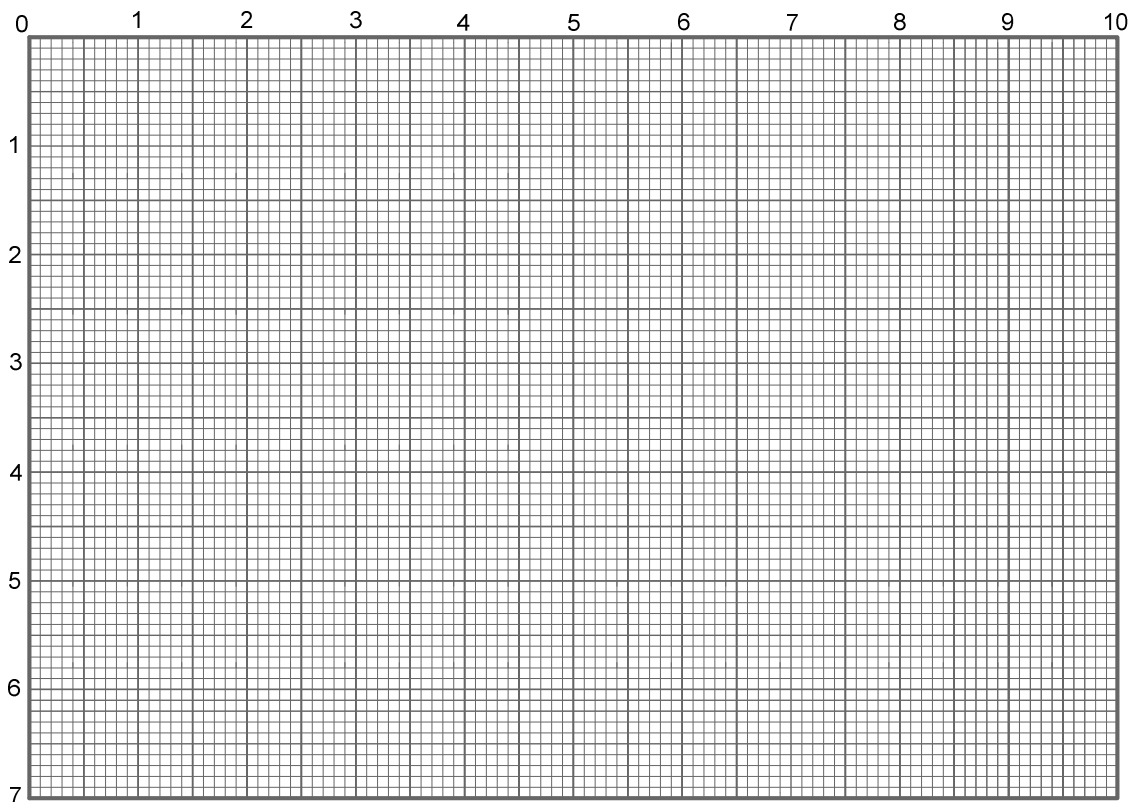


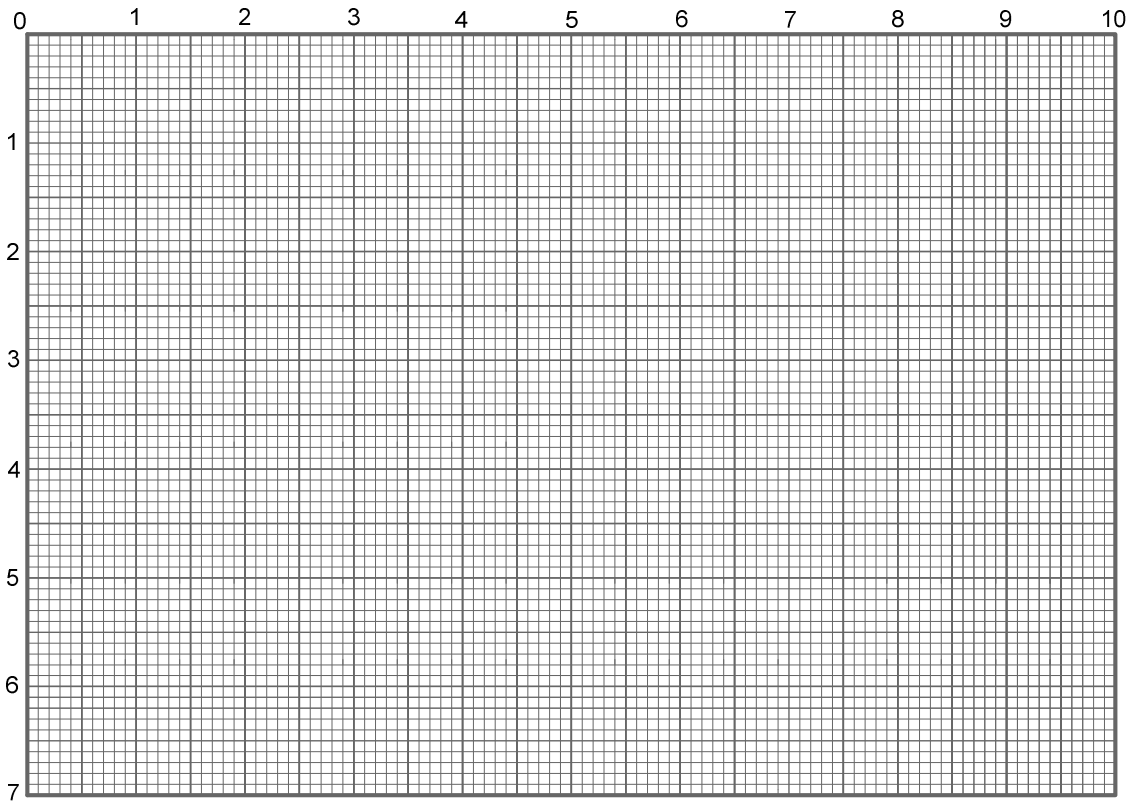
Electric Fields and Potentials

Name _____ ID _____ TA _____

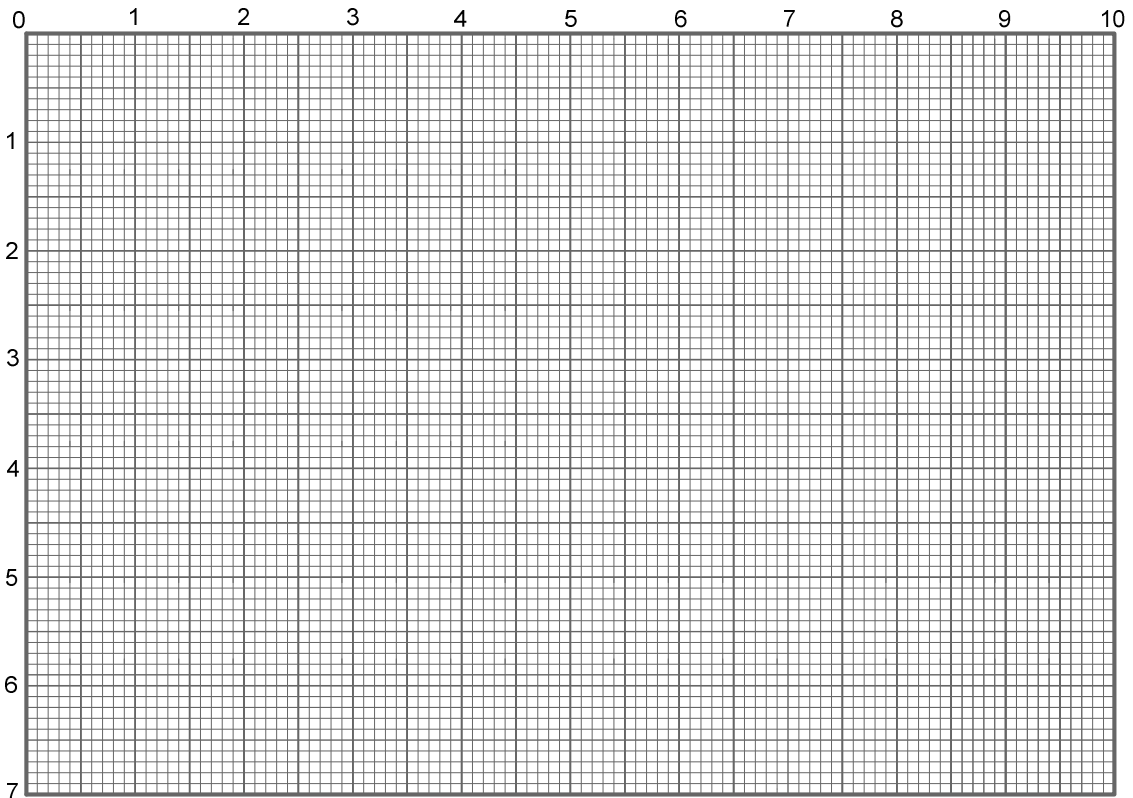
Partners _____

Date _____ Section _____





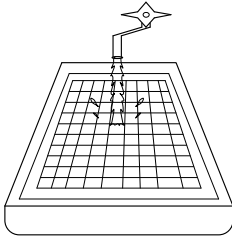
Question: Make sure that the voltage difference between + and - point charges is the same as the displayed in the voltage source. Then measure the difference between one of charge and the center potential line. Is it just half of the above difference? Can you imagine the geometrical potential shape for that? Please show the TA what you get.



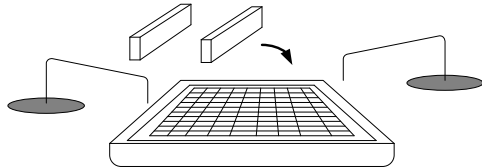
Lab Procedure for Electric Fields and Potentials

Please do not write on the plastic grid sheet (experimental equipment).

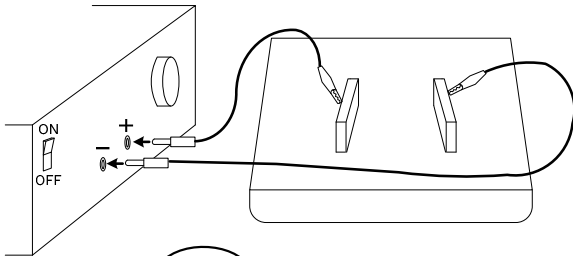
The basic method to find equipotential lines



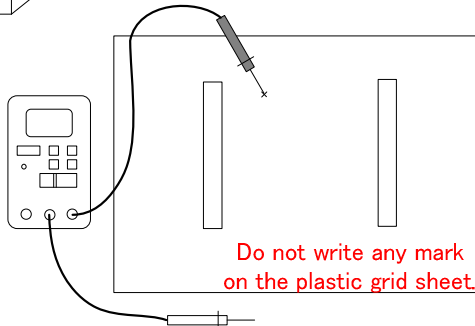
- **Pour water into the white container with the plastic grid sheet.** Fill the container until the water is one half inch from the bottom. Water will be the conductor of electricity.



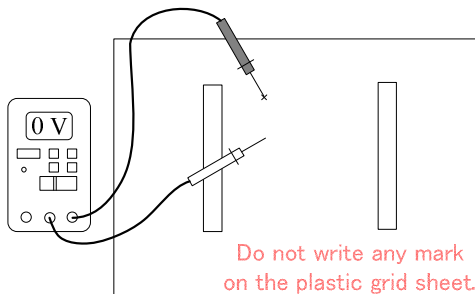
- **Put appropriate electrodes into the container.** For each case, you will choose the proper equipment to find the equipotential lines.



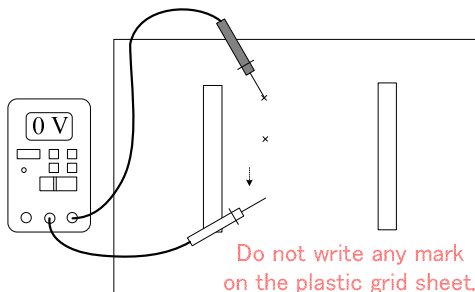
- **Connect each electrode with positive and negative voltage respectively.** The figure is for rectangular electrodes. Use the banana plugs to make the basic set-up.



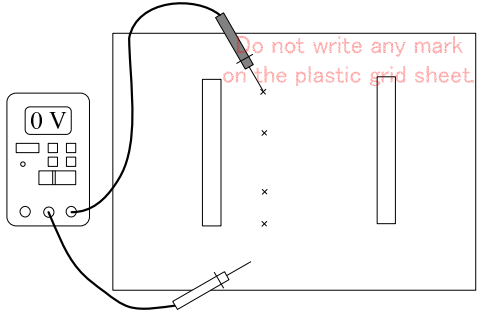
- **To find an equipotential line, use a multimeter.** One probe should be fixed as shown. Please look at the reference in the last page of this manual. You anticipate obtaining the equipotential lines similar to the reference. (Note: The figure is for the rectangular electrodes. Banana plugs, a voltage source, and a plastic grid sheet are omitted in the figures hereinafter.)



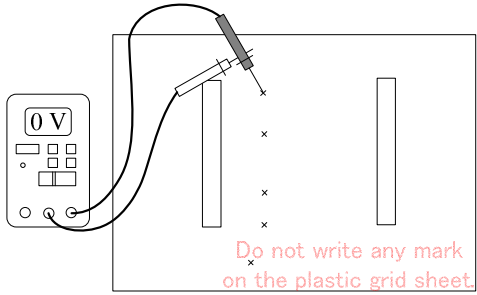
- **Put the other probe on the sheet and try to look for the place so that the multimeter indicates zero voltage on the multimeter.** Please do not mark on the experimental equipment. Mark on the data sheet provided. The scale is exactly the same.



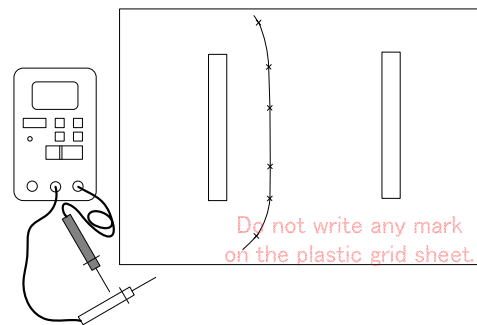
- **Find another equipotential point as shown.** You have to keep fixing one probe. After finding another equipotential point, mark the coordinate on the data sheet. (Again, please do not scratch or mark on the plastic grid sheet.)



- **Keep finding enough equipotential points so that you can draw the equipotential line.**
When you can anticipate the curved line, you should take more points.

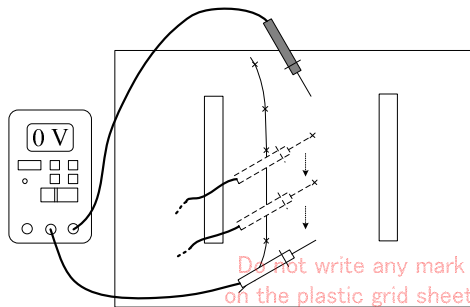
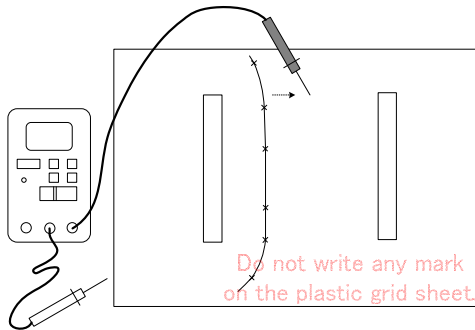


- **Try to get the points symmetrically.**
Please do not forget to fix one probe. By looking at the references, try to take the points symmetrically.

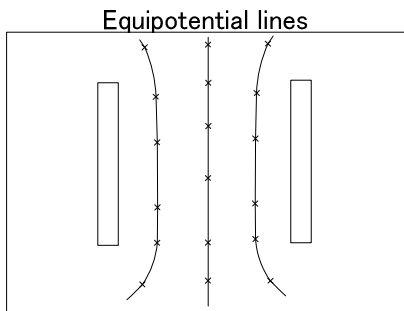


- **After obtaining appropriate amount of the points, draw a smooth line expected by the electric potential theory.**
Again, this drawing is supposed to be on the data sheet, NOT on the equipment.

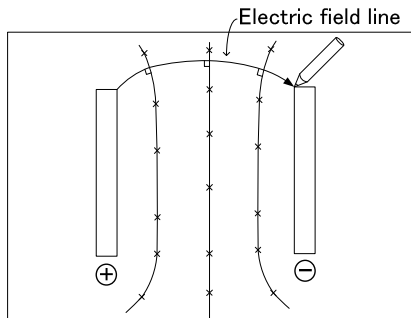
- **After completing one equipotential line, move into the second one.**
As shown in the figure, place one probe on a different location, then repeat the procedure.



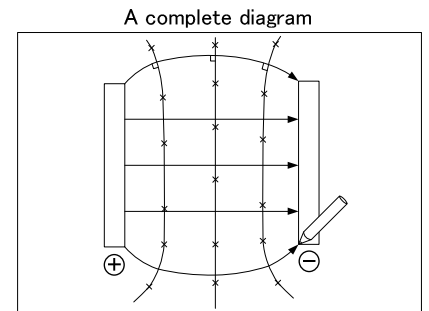
- **After you got the proper number of equipotential lines, draw the electric field lines.**
The electric field lines are perpendicular to the equipotential lines. Unlike equipotential lines, electric field lines have directions. Those are always directed from positive to negative.



On the data sheet



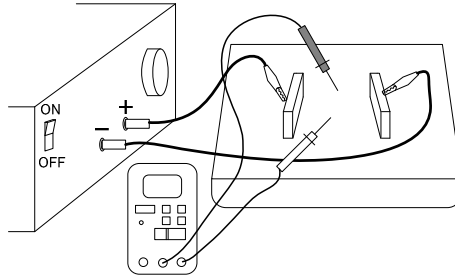
On the data sheet



On the data sheet

1. Two parallel plates with equal charges of opposite signs

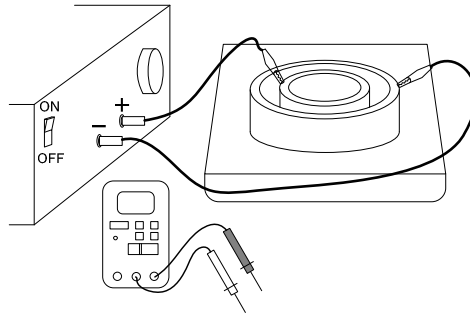
- Set up the equipment as follows:



- **Look for the equipotential lines (at least 3 lines).**
Between two points on an equipotential line, the voltage difference should be zero.
- **Draw the equipotential lines and the electric field lines on the data sheet.**
This procedure is explained in “The basic method to find equipotential lines.”

2. Two concentric circular electrodes with equal charges of opposite signs

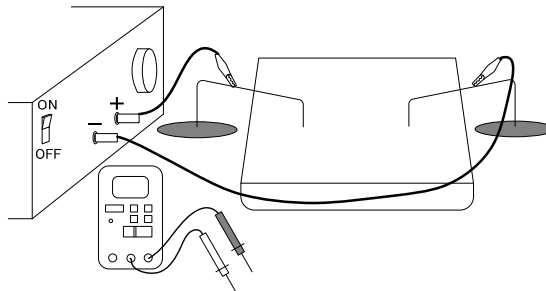
- Using two circular electrodes, make the following set up:



- **Look for the equipotential lines (at least 3 lines).**
Follow the patterns of the lines for these cases: inside the small circle, between small and large circles, and outside the large circle.
- As you did in part 1, draw the equipotential lines on the data sheet, then draw also the electric field lines.

3. Two equal point charges of opposite signs

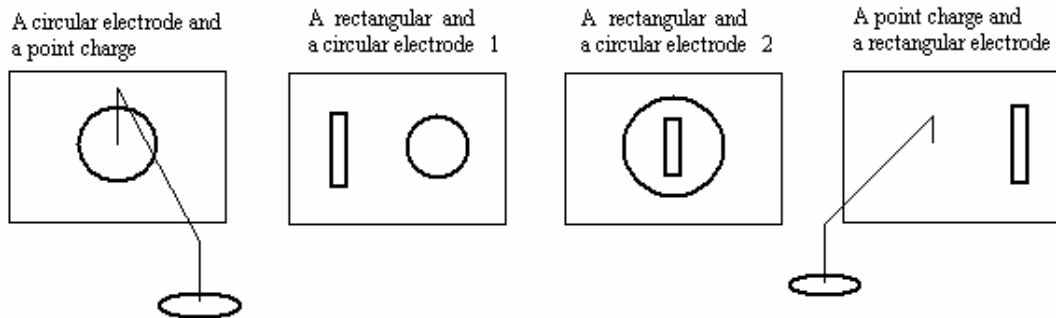
- Set up the equipment as follows:



- **Look for the equipotential lines properly (at least 5 lines).**
Before doing the experiment, you should think about how the pattern would look.
- As you did in parts 1 and 2, draw the equipotential lines on the graph paper, then draw also the electric field lines

4. Arbitrary combination of electrodes or point charges

- You can make any combination by using above electrodes. For example,



Try to guess the equipotential lines for each; then make confirm your guesses with the multimeter. After that, draw the electric potential and field lines.

5. Lab report

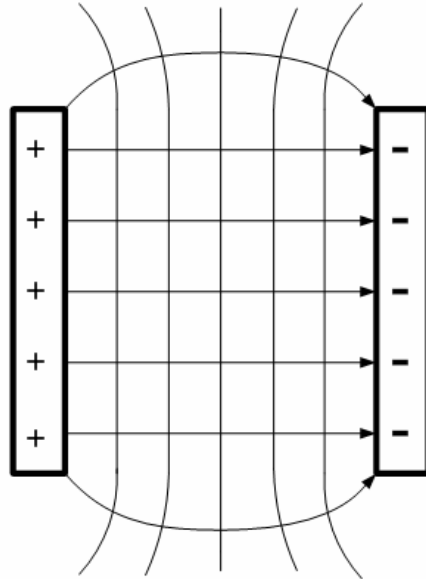
- Make sure if all the drawings for four cases are correct. Label which are the potential or field lines, and positive or negative electrode. Discuss the question on the data sheet and the geometrical perspective of the electric potential and field. Please do not forget the arrows for the electric field lines.

♣Hint:

Remember that the electric field lines are always perpendicular to the equipotential lines. The direction is always from positive to negative charges. Indicate the directions with arrows.

References for the Electric Potential and Field Lines

1. Rectangular Electrodes

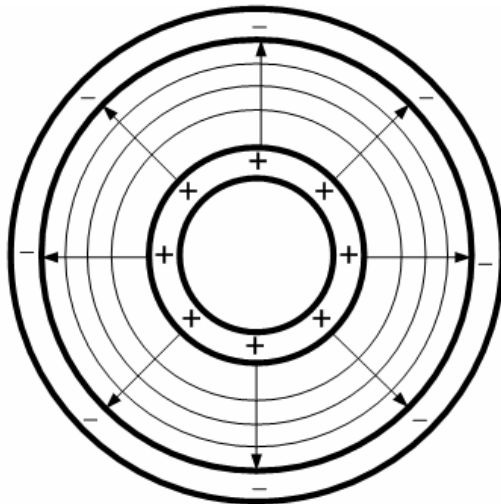


Electric Potential Lines ———

Electric Field Lines —————>

Note: This is just a reference so that you can find the equipotential lines. In the experiment, you have to plot the equipotential points first, and then draw the lines.

2. Circular Electrodes



3. Point Charges

