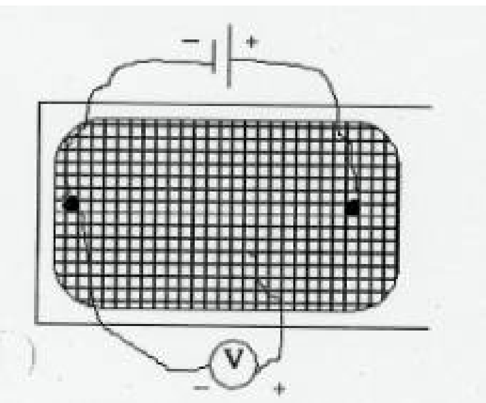
# Mapping An Equal Potential Field
# **Bring some Graph Paper--Graphing required**

In this experiment you will map an equal potential field that is produced when two oppositely charged conductors are placed in a conducting solution. In other words, you will measure the voltage (electrical potential energy difference per coulomb) between two points. After taking measurements at various places in the field you will be able to draw lines of equal electrical potential. This is very similar to drawing an elevation map where lines represent points of equal elevation.

Materials **Graph Paper-don't come to lab without it.**

Pyrex baking pan, voltmeter, connecting wires with alligator clips, two lead fishing weights, three metal strips, battery pack, graph paper, salt. **Don't forget the graph paper.**

Setting Up




Place the Graph Paper on a table and center the baking dish on the grid. Put 2 or 3 inches of water in the dish and stir in about a half teaspoon of salt. Hook one alligator lead to the positive terminal of the battery pack and the other alligator lead to the negative terminal. Attach each of the wire ends to one of the lead weights and place the weights on opposite sides of the dish.

Turn the selector knob on the voltmeter to a voltage scale

that will allow you to read up to 9.99 volts.

Take the positive test probe, the one that you are to move

around in the dish, and touch it to the negative conductor.

You should get a reading of Zero. Touch the positive

conductor (lead weight) and you should get a reading that is the dry-cell output. Touch a point in the middle of the dish and

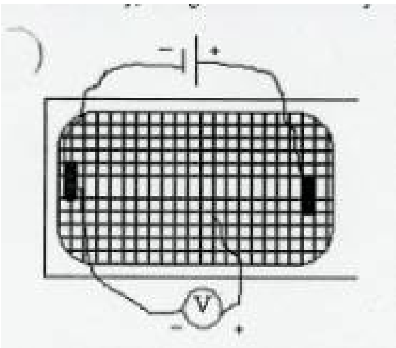
you should get a reading about half the dry cell output. If the

reading is lower than this add a few grains of salt to the water.

Take another sheet of graph paper and draw the locations of the conductors. Label them with the voltage readings of your voltmeter.

Procedure

To map the field that you have created, locate six or seven points in the field that have the same voltage to within 0.05 volts. Mark these points on your graph paper and connect them with a smooth curve. Label the curve with the voltmeter reading. You have now plotted a section of one equipotential line. Now plot five more lines to complete the map. Space these lines out evenly, taking into account the dry cell output.




Repeat this procedure with the copper strips. Arrange them in the pan as shown below. After you finish making this map, place one of the fishing weights in the middle of the pan (Do Not remove the metal strips) and repeat the procedure.

**That makes THREE (3) different maps that you are required to make.**

Making Sense of it all

The voltmeter reading tells you how many joules of energy a coulomb of charge will gain or lose as it moves between the positive probe and the negative bar. A positive charge will lose potential energy as it moves from the probe to the bar. This makes sense because the positive charge "wants" to rush over to the negative bar just like a parachutist's body wants to rush toward the earth (and thus lose gravitational potential energy.) In this case the electric field is doing work on the charge just as the earth's gravitational field is doing work on the parachutist.

Post Lab Questions

Answer these on another sheet of paper and turn them in with your lab report

1. What happens to a negative charge as it moves from the positive test probe to the negative bar?

1. What could cause a negative charge to move from the positive test probe to the negative bar?

(Hint: the answer is one word)

1. Where would a positive test charge have the least potential energy?

1. How much energy must you add to the system to move 1 electron 1 meter in a direction along one of the equal potential lines?

1. If lightening strikes a tree 20 m away, would it be better to stand facing the tree, your back to the tree, or your side to the tree? Assume your feet are a comfortable shoulder width apart. Explain your answer.