ELECTRIC FIELD

OBJECT

To plot the equipotential lines and the lines of force in an electric field.

APPARATUS

Mounting board, (battery) (1-3 volts d.c.), 2 sheets of assorted conducting paper, galvanometer, mounted probe, hand probe and graph paper.

THEORY

An electric field exists in the space around any charged body. Any charge placed in this field will experience a force tending to move it. The direction of the electric field at any point is the direction a positive charge would tend to move if placed at that point.

Points having the same potential are called equipotential points, and a line connecting these points is called an equipotential line. The path a free test charge would follow in traversing an electric field is called a line of force and is everywhere perpendicular to the equipotential line.

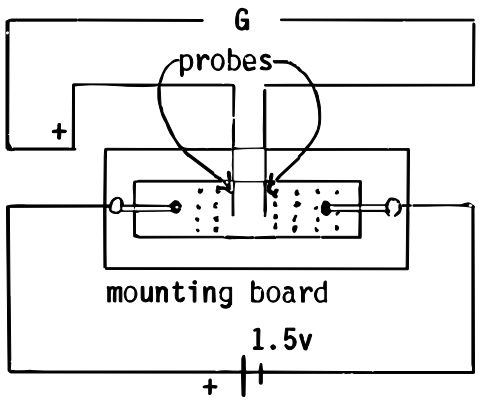

FIGURE 1

PROCEDURE:

1. Connect the battery to the binding posts on the mounting board and the galvanometer to the two probes, as indicated in Figure 1.

2. Select a sheet of the conducting paper and place it on the mounting board with the spring mounted contacts touching the silver electrode configuration.

3. Locate the mounted probe so that its point touches the conducting paper between the electrodes (at point (8,3) of the coordinate system). Mark this point as a point on the graph paper. Now move the point of the hand probe over the paper to find a point giving a zero reading of the galvanometer. Mark this point on the graph paper.

4. Without moving the mounted probe, locate (with the hand probe) a series of points across the paper recording every one on the graph paper.

5. Connect these equipotential points with a smooth curve (in ink) to give the equipotential line.

6. Repeat procedures 3 to 5 by locating the mounting probe at points (8,4); (8,5); (8,6); (8,7); (8,8); and (8,9) respectively.

7. Draw in an arbitrary number of interrupted lines in pencil to represent the lines of force.

8. Repeat procedures 2 to 7 for the second sheet of conducting paper.

In your discussion of the results, explain why lines of force are everywhere perpendicular to equipotential lines. (Hint: the direction a positive charge moves is from positive to negative potential.) Comment on the shape of the lines for each electrode configuration. Are there any surprises? If so, explain.

The procedure above can be accomplished equally well if the plotting of the equipotential lines is done in excel and the conductive ink pattern and the electric field lines are drawn by hand.