UNIVERSITY OF WOLLONGONG IN DUBAI

ELECTRIC FIELD MAPPING

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Subject: PHYS143 (DB123) Physics for Engineers.

Group Members:

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EXPERIMENTS

Purpose: The goal of these experiments is to understand potentials, equipotential curves and electric fields produced by 2-dimensional electrostatic charge distribution. However, the conditions in this experiment are not truly electrostatic. Electrostatic charge configurations are difficult to setup and control. So, we will be using a small current flowing through conducting paper and carefully shaped electrodes to simulate electrostatic charge distributions. The resulting potentials, equipotential curves and electric fields will be identical to the electrostatic case.

Hypothesis statement: The equipotential curves should always be perpendicular to the electric field. In experiment B, we expect the equipotential curves to be parallel to the electrodes. In experiment A, we expect the equipotential curves produced to go around the electrode creating a circle. All the points on the circle produced will have the same potential. As we get closer to any electrode, the equipotential curves tend to curve towards it. This is because the force on the point from the electrode increases therefore resulting in a sharper curve and as we move away from an electrode the force on that point from the electrode decreases hence why the curve is less sharp.

Materials used: D.C. Power supply, Voltage meter, Power supply wires, Electrodes, Meter probes, Conducting paper, Silver ink pen, Silver pins, Wood board.

Procedures:

Experiment A (Electric Dipole): First off, we used a silver ink pen to draw 2 electrodes 10 cm apart. We then put a silver pin on both dots. Next, we connected the power supply wires from the D.C. power supply to the silver pins. The negative charge was on the left electrode and the positive charge was on the right electrode. We connected the meter probes from the voltage meter to the top of the silver pins. Setting the voltage to 10, we found the equipotential curves for every voltage decreasing by 1 unit by moving the meter probe connected to the positive charge. We drew the equipotential curves for 9V-2V included.

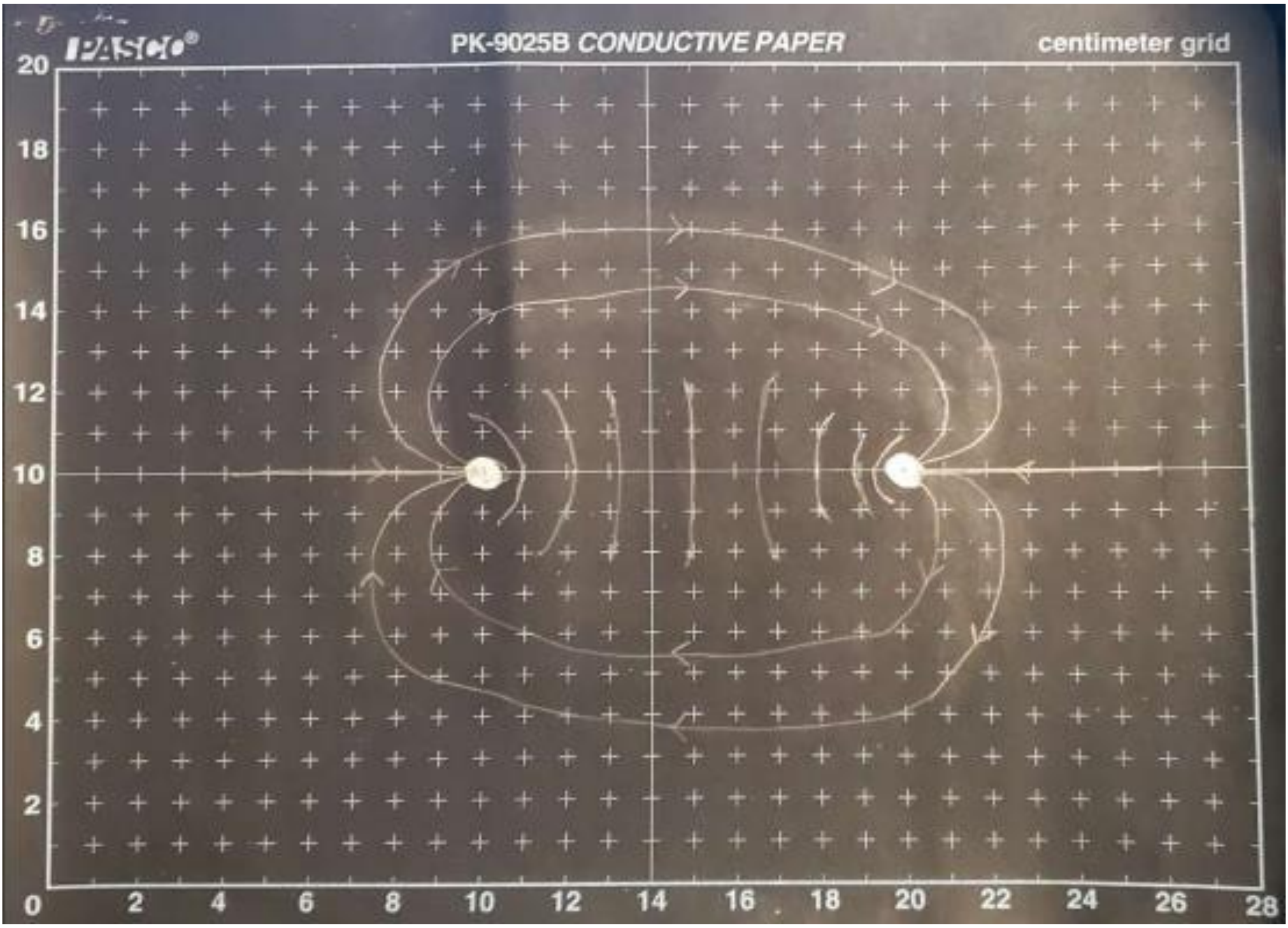
Experiment B (Parallel Plates): Firstly, we used a silver ink pen to draw 2 parallel electrodes, of height 8 cm, 10 cm apart. We then put a silver pin in the middle of the lines. Next, we connected the power supply wires from the D.C power supply to the silver pins. The negative electrode was on the left and the positive electrode was on the right. We connected the meter probes from the voltage meter to the top of the silver pins. Setting the voltage to 10, we found the equipotential curves for every voltage decreasing by 1 unit by moving the meter probe connected to the positive plate. The maximum potential between any 2 points on the same electrode should not exceed 1% of the potential applied between the 2 electrodes. We drew the equipotential curves for 5V-2V included.

Observations: When we place the tip of the meter probe on different parts of the conducting paper, it gives us different values of voltage. However, there are some places where the voltage is the same. This can help us draw the equipotential curves. Some of the curves are either more curved or longer than the other curves. The equipotential curves are perpendicular to the electric field lines. Distance between the equipotential curves are random.

Conclusion:

- We wanted to understand potential, equipotential curves and electric fields produced by 2-dimensional electrostatic charge distribution. An experiment can help us understand what we learn in classes. It gives a different perspective.
- We drew 2 electrodes 10 cm apart with a silver ink pen and inserted a silver pin in the middle of the electrodes. After connecting the power supply wires from D.C. power supply to the silver pins, we set the voltage to 10V. We connected the meter probes from the voltage meter to the top of the silver pins. Then we can find the equipotential curves by moving the meter probe connected to the positive electrode.
- The results are pretty accurate. Some sources of errors could be that the voltage meter is not calibrated or is not fully functional. The conductive paper might have some dust on it which can interfere with the results. The wires connected to the voltage meter or the D.C. power supply may not be connected properly. The parallel lines/dots might not have been drawn perfectly. One of the lines/dots might be thicker than the other giving inaccurate results.
- We learnt that the equipotential lines curve around the electrode creating a circle and that these equipotential curves are perpendicular to the electric field. If we redo the experiment, we would clean the conductive paper properly, check if the voltage meter is working precisely and check whether the wires are usable or not.

Experiment A (Electric Dipole):



Experiment B (Parallel Plates):