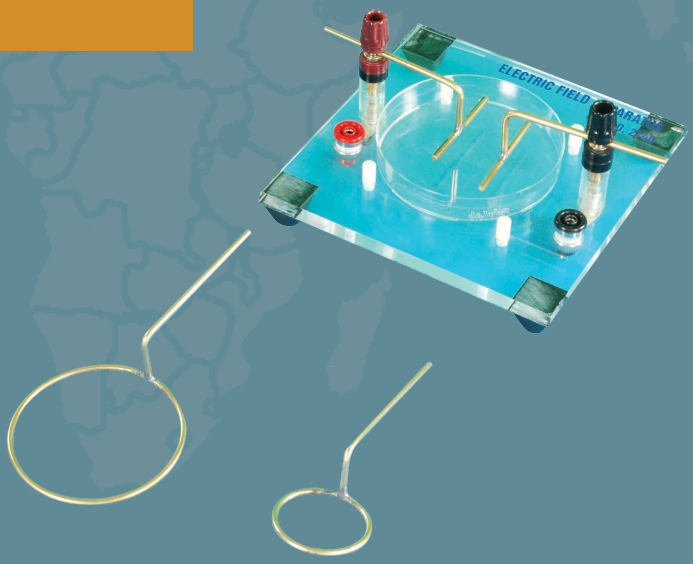
ELECTRIC FIELD APPARATUS

INSTRUCTION MANUAL

Ref. 1090120



ISO 9001:2000 Certified Organisation

PARTS INCLUDED:

1. Base with two 4mm socket terminals – 1
2. Circular Dish (transparent) – 1
3. Point Electrodes – 2
4. Parallel (Line) Electrodes – 2
5. Circular Electrode (35mm) – 1
6. Circular Electrode (70mm) – 1
7. User Instructions

OTHER ITEMS REQUIRED:

1. EHT Power Supply
2. Fine Semolina
3. Tetra chloromethane (Carbon tetra chloride, CCl_4) with Castor Oil; or Liquid Paraffin
4. Overhead Projector Unit (if magnified projection of the demonstration to a group of students or a class on a bigger screen is required)

THEORY:

Around an electrically charged body, it is observed that an area of influence always exists. This area of influence depends significantly on shape and size of the body, medium around the body and the magnitude of charge. This field tends to influence other objects or electrical charges placed in its area of influence and the quantum or magnitude of influence depends on the electrical/magnetic behavior of object. This area of influence of the electrified body is referred to as its electric field and is represented by the lines of electric force that depicts the motion of a unit positive point charge placed in that electric field. These electric lines of forces of an electric field obey some basic rules, on the basis of which, electric field due to one or more electrified objects of different shapes and sizes can be predicted.

1. Lines of force of electric field always start from a positive charge and ends on a negative charge or from where negative charge can be received (i.e., these lines travel in the electric field from higher to lower potential).
2. These lines of force do not pass through a conducting body, but always end on its surface. This is due to the reason that the potential is uniform inside a solid conducting body, or inside a hollow conducting body if there are no electrical charges inside (and therefore the force inside is zero); the electric field, in fact, is annihilated inside.

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3. These lines of force do not cross each other. The intersection of two lines of force will indicate the resultant force due to electric field to be in two different directions at the point of intersection, which is impossible.
4. The lines of force always leave or enter the surface of a charged body in a direction normal to the surface, independent of their path. If this is not the case, there would be a component of the electric force along the surface and the electric charge would move across it.
5. Fundamental force of attraction between unlike charges and that of repulsion between like charges explains that each line of force tends to contract longitudinally, whilst lines of force proceeding in the same direction tends to repel each other (and hence diverge) laterally.

The behavior of electric lines of force is observed to be very much similar to the magnetic lines of force. The number of electric field lines passing through a unit area represents the magnitude of electric field. If a set of lines is drawn in such a way that they are perpendicular to electric field lines at every point of intersection, the result obtained is a set of equipotential lines that represent the points at which electric potential remains unchanged. Potential gradient is the potential difference of the electric field per unit distance. On thorough observation of electric field lines and equipotential lines, there is strong correlation of potential gradient (as represented by the distance between equipotential lines) with the shape, size, geometry and configuration of the electrodes.

PLOTTING ELECTRIC FIELD LINES:

Electric Field Apparatus is specially designed for the study and demonstration of various electric field patterns generated between different types of electrodes. When connected to an EHT power supply, electric field pattern is generated between two electrodes in the manner similar to the magnetic field pattern of a magnet with iron filings.

The base unit consists of a clear acrylic sheet with rubber feet for added stability and has two 4mm socket terminals for connecting it to the EHT power supply. The transparency of the base permits its use on the Overhead Projector Unit for magnified projection of the demonstrations or experiments on a bigger screen to enable clear understanding of the concept for a classroom or group of students. Alongside each terminal, thumbscrew arrangement is provided which facilitates the height adjustment of the electrodes mounted in the terminals as and when desired. Any two of the electrodes can be mounted on the base by inserting its stem in the transverse hole of the terminals after unscrewing its top. The distance between electrodes can be adjusted by sliding the electrodes in and out of the transverse hole. The design of the base and terminals provide complete insulation.

A set of six electrodes are included which are made of brass wire formed into different electrode configurations to enable various electrode geometry configurations for the demonstrations / experiments. The electrodes included are 2 simple 'L' shaped electrodes, whose smaller arm terminates in a point to provide point electrode, 2 electrodes having their ends bent in the form of 'U' to give parallel electrode configuration and 2 electrodes with their arms in circular shape, one each of 35mm and 70mm diameter.

Position the base on a level horizontal surface and place the circular transparent dish on it between the two terminals, so that the electrodes when mounted in the terminal can be conveniently located in the circular dish. Select the two electrodes for which, electric field pattern is desired to be studied and mount both the electrodes as explained above such that they are comfortably positioned inside the circular dish. Fill the dish with liquid paraffin up to the level where the shaped parts of both the electrodes are just submerged in it. Adjust the height of both the electrodes, if needed to bring their shaped part to the same level. Sprinkle the fine semolina uniformly, all over the surface of liquid paraffin. Connect the two terminal of the base to EHT power supply and switch on the power supply. The electric field pattern corresponding to the electrode configuration forms in the semolina on top of the liquid paraffin.

Different combinations of the electrodes can be used to obtain the corresponding electric field patterns and the dependence of electric field patterns on the shapes, sizes, geometry and configuration of the electrodes in relation to rules regarding electric field lines (as explained above) can be studied.

NOTE: Instead of liquid paraffin, equal proportions of carbon tetrachloride (CCl_4) and castor oil can also be used for performing the experiment. In this case, first pour castor oil in the dish and on top of this layer carefully pour a layer of carbon tetrachloride (CCl_4) and proceed with the experiment as explained above.

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