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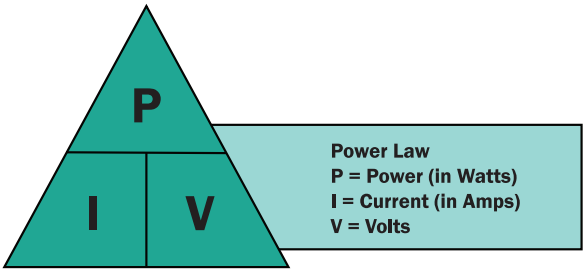
ELECTRIC FIELD, ELECTRIC CHARGE & POTENTIAL

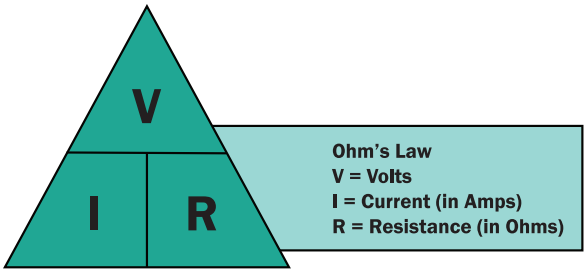
MOVEMENT OF ELECTRIC CHARGES

CONCEPT The movement of electric charges, a fundamental concept in physics, involves the flow of charged particles such as electrons and protons, driven by forces created from imbalances between positive and negative charges. Two primary forms of charge movement are static electricity, which results from charge buildup on surfaces, and current electricity, which refers to the continuous flow of charges through conductive materials. Electric fields, generated by charged particles or objects, play a critical role in affecting the movement of charges. A thorough understanding of electric charge movement is essential for grasping various aspects of physics, electronics and electrical engineering, including circuits, electromagnetism and electrostatic phenomena.

BACKGROUND

The history of the movement of electric charges dates back to ancient Greece when Thales of Miletus observed static electricity in 600 BCE by rubbing amber against fur, attracting nearby objects. In the 18th century, pioneers such as Benjamin Franklin and Charles François de Cisternay du Fay made significant discoveries related to positive and negative charges and their interactions. The development of the first true battery by Alessandro Volta in 1800 facilitated further understanding of charge movement and electrical currents. Over time, the work of scientists like Michael Faraday, James Clerk Maxwell and J.J. Thomson further advanced our knowledge of electric charges, their movement, and the role of electric fields, laying the foundation for modern-day electrical systems, electronics and electromagnetic theory.





REAL WORLD CONNECTIONS

A real-world example of the movement of electric charges is the functioning of a smartphone. Inside a smartphone, there are various electrical components, such as the battery, processor, memory and display, that rely on the movement of electric charges to operate.

The battery stores electrical energy, which is converted into a flow of electric charges (current) when the smartphone is in use. This flow of charges passes through the circuitry of the device, allowing the processor to execute instructions, the memory to store and retrieve data and the display to show images and information.

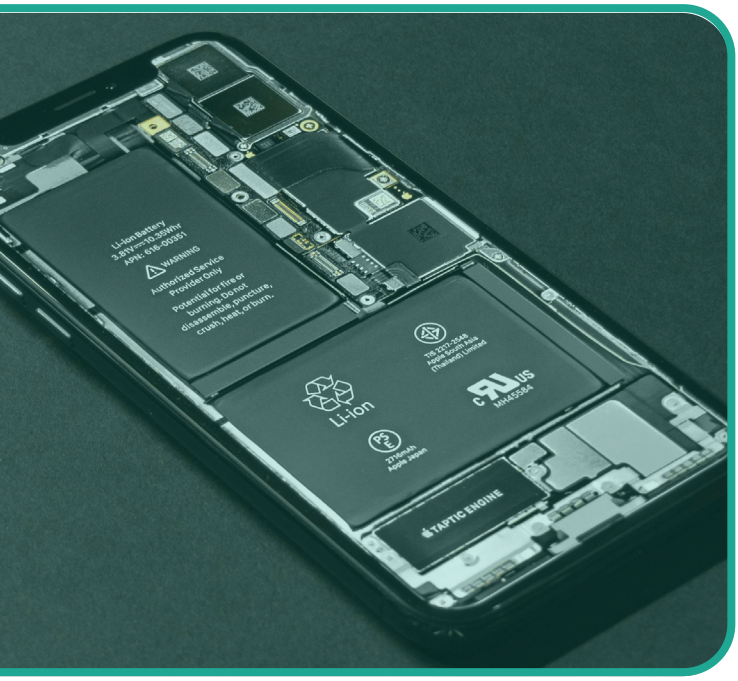
Additionally, the touchscreen relies on capacitive sensing, which detects changes in the distribution of electric charges when a finger or conductive stylus comes into contact with the screen. These changes are then processed to determine the precise location of the touch input, enabling user interaction with the device.

Make sure it measures up

EXAMPLES

LIGHTNING: During a thunderstorm, static electricity builds up in the atmosphere due to the movement and collision of air particles. The imbalance of charges between the ground and the storm clouds causes a massive discharge of electric charges in the form of lightning, equalizing the charges momentarily. This electrical discharge can flow from cloud to cloud, ground to cloud or cloud to ground.

ELECTRIC CIRCUIT: In a simple electric circuit with a battery and a resistor, the movement of electric charges (typically electrons) through the resistor generates an electric current. This flow of charges is driven by the voltage difference created by the battery and is influenced by the resistance of the circuit.



APPLICATION

The flow of electricity in a solar cell:
The movement of electrons, each carrying a negative charge, toward the front surface of the solar photovoltaic cell creates an imbalance of electrical charge between the cell's front and back surfaces. This imbalance, in turn, creates a voltage potential like the negative and positive terminals of a battery. Electrical conductors on the cell absorb the electrons. When the conductors are connected in an electrical circuit to an external load, such as a battery, electricity flows through the circuit.

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