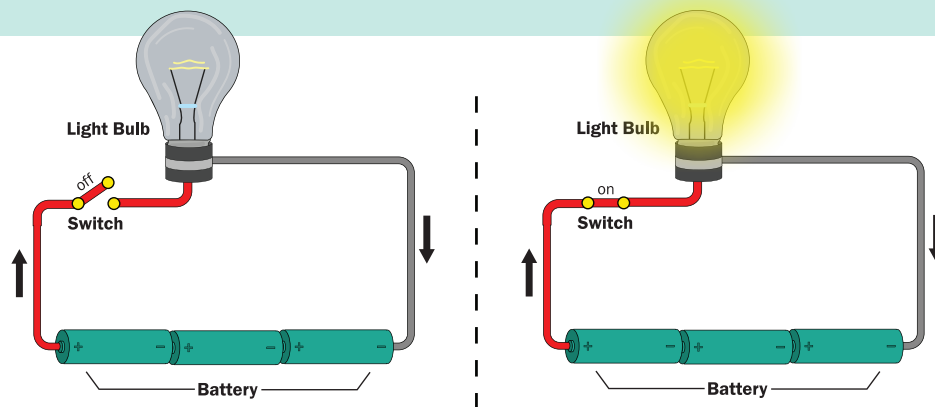


CONCEPT Primary circuit components are the basic building blocks of electrical circuits, which serve various functions in controlling and managing the flow of electric current. These components can be broadly categorized into passive and active components.

BACKGROUND

The history of circuit components dates back to the 19th and early 20th centuries, a time when the foundation of modern electrical engineering was established. Early innovations include the invention of the resistor by Georg Simon Ohm, who also formulated Ohm's Law in 1827, defining the relationship between voltage, current, and resistance. As the electronics field advanced through the 20th century, improvements in materials and manufacturing methods led to the miniaturization and diversification of primary circuit components, facilitating a wide range of electronic devices and applications today.



REAL WORLD CONNECTIONS

Nebraska, known for its extensive farmland, relies heavily on irrigation systems to supply water to crops, ensuring healthy growth and high yields. Many of these irrigation systems incorporate electrical control panels, which use primary circuit components to manage and control the flow of electricity, powering the pumps and valves that distribute water across the fields.

In these electrical control panels, you'll find various primary circuit components, such as resistors, capacitors, inductors, diodes, and more. All these components work together to maintain the proper functioning of the irrigation system, allowing farmers in Nebraska to effectively manage water distribution and optimize crop production.

EXAMPLES

Make sure it measures up

RESISTORS:

Fixed resistors: Have a constant resistance value, e.g., carbon film, metal film, and wirewound resistors.

Variable resistors: Allow for adjustable resistance, e.g., potentiometers and rheostats.

Thermistors: Resistance varies with temperature, e.g., NTC (negative temperature coefficient) and PTC (positive temperature coefficient) thermistors.

CAPACITORS:

Ceramic capacitors: Offer high stability and low losses, used in high-frequency applications.

Electrolytic capacitors: Provide high capacitance values, used in power supplies and audio applications.

Tantalum capacitors: Feature stability and reliability, used in sensitive circuits and timing applications.

INDUCTORS:

Air-core inductors: Consist of wire coils with no magnetic core, used in high-frequency applications.

Iron-core inductors: Contain a magnetic core, offering higher inductance values at the cost of increased losses.

Toroidal inductors: Feature a toroidal (doughnut-shaped) core, providing higher efficiency and reduced electromagnetic interference (EMI).

DIODES:

Rectifier diodes: Allow current to flow in one direction, used for rectification in power supplies.

Zener diodes: Provide voltage regulation by maintaining a constant reverse-biased voltage.

Light-emitting diodes (LEDs): Emit light when current passes through them, used for illumination and signaling.

FORMULAS

Ohm's Law: Describes the relationship between voltage (V), current (I), and resistance (R).

$$V = I * R$$

Power Dissipation: The power (P) dissipated across a resistor in the form of heat.

$$P = I^2 * R \text{ or } P = V^2 / R$$



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