Blank Lesson Template

Yellow highlight = required component

Subject Area(s) **Physics**

Associated Unit **Electric Circuits**

Lesson Title **Resistor Circuits**

Header

Image 1
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Caption: ___?

Grade Level 12 (10-12)

Lesson # 1 of 1

Lesson Dependency

Time Required 45 minutes

Summary

Students will learn about resistors and Ohm's Law. They will learn about different connection configurations (series and parallel connection). Finally, they will learn to calculate the equivalent circuit resistance in both the series and parallel settings.

Engineering Connection

Resistor circuits are used in every modern electronic device or electrical system. Electrical engineers use different circuit configurations for designing efficient electrical networks. For, electrical fuses (low resistance resistors) are usually connected in series to electrical networks to provide protection to the circuit i.e. if there is excess current in the circuit, the fuse breaks, thus prevents the current from flowing to the rest of the circuit.

Engineering Category =

1. Engineering analysis or partial design

Keywords

Resistors, Ohm's Law, Parallel Connection, Series Connection, Resistor Circuits.

Educational Standards

National and State

Choose standards from http://asn.jesandco.org/resources/ASNJurisdiction or browse educational standards on TeachEngineering.

State/national science/math/technology (provide source, year, number[s] and text):

ITEEA Educational Standard(s)

ITEEA (provide standard number, grade band, benchmark letter and text):

Pre-Requisite Knowledge

Learning Objectives

After this lesson, students should be able to:

- Apply Ohm's Law.
- Compute equivalent resistance for parallel connection
- Compute equivalent resistance for series connection

Introduction / Motivation

Question:

If you were to design a home network, how would connect your appliances, would connect them in series or in parallel? If so why?

Answer:

Home networks are designed to be connected in parallel; the reasoning behind using this configuration is because unlike a series connection, not all appliances need to be turned on at the same time for one of them to work.

Lesson Background & Concepts for Teachers

Resistors:

A resistor is an electrical component with two-terminals. It is classified as a passive circuit element in a sense that it only consumes energy and it is not capable of storing it. The relationship between the current and the voltage across a resistor is governed by the so-called *Ohm's Law* as follows:

$$V = R\,I$$

Where *V* represents the voltage across the resistor in *volts*, *I* represents the current through the resistor in *amperes* and *R* represents the resistance in *ohms.*

Resistors in Series

In a series setting, the current through the resistors is the same. The voltage across each resistor in the series connection is proportional to its resistance as stated by *Ohm's Law*. The total resistance or the equivalent resistance of a series connection can be obtained as follows:

$$R_{eq} = R_1 + R_2 + \cdots + R_n$$

It is obvious that the total resistance is going to be larger than any individual resistance.

Resistors in Parallel

Connecting resistors in parallel is similar to connecting to independent circuits. For instance, when reaching two resistors in parallel, the current will split into two different currents one for each resistance. However, the voltage between resistors connected in parallel is the same. The equivalent resistance of a resistance parallel connection can be calculated using the following formula:

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_n}$$

The effective resistance in this case is smaller than any individual resistance.

Resistor Circuits

Resistor circuits are networks which combine both series and parallel connections. Removing a resistor in parallel increases the current flow through the other resistor in parallel but Â decreases the overall current flow. Dimming a resistor in series within a parallel circuit kills an entire branch in parallel, reducing the overall current but increasing the current that goes through the other parallel branch.

Image Insert Image # or Figure # here [use Figure # if referenced in text]

Figure 1
Image file: ___?
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Caption: Figure 1. ___?

Vocabulary / Definitions

Word	Definition

Associated Activities

Series and Parallel Resistors.doc

Lesson Closure

Assessment

circuits worksheet.pdf

Lesson Extension Activities

Additional Multimedia Support

References

Attachments

Other

Redirect URL

Contributors

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