

Chapter 7.2: Flow of Electric Current in a Series Circuit and Parallel Circuit

1. Introduction to Electric Circuits 电路

- **Definition:** Electric current requires a complete path to flow, known as an electric circuit.

Example Sentence: An electric circuit provides a continuous path for electric current to flow.

2. Electrical Circuit Components

- **Components and Symbols:**
 - **Switch**
 - **Dry Cell**
 - **Voltmeter**
 - **Galvanometer**
 - **Ammeter**
 - **Bulb**
 - **Resistor**
 - **Fuse**
 - **Variable Resistor**

Example Sentence: Different circuit components like switches and bulbs are represented by specific symbols in circuit diagrams.

3. Series Circuit and Parallel 并联 Circuit

Series Circuit

- **Definition:** Components are connected one after another, and current flows through a single path.

Example Sentence: In a series circuit, all components are connected end-to-end, forming a single path for current flow.

Parallel Circuit

- **Definition:** Components are connected in separate paths, and each path has electrical components.

Example Sentence: In a parallel circuit, components are connected in multiple paths, allowing current to flow through each path independently.

4. Current, Voltage, and Resistance in a Series Circuit

- **Current:** The same through each component.
- **Voltage:** Sum of voltages across each component.
- **Resistance:** Sum of resistances of all components.
 - Formulas:
 - Current: $I = I_1 = I_2$
 - Voltage: $V = V_1 + V_2$
 - Resistance: $R = R_1 + R_2$

Example Sentence: In a series circuit, the total voltage is the sum of the voltages across all components, and the current remains the same throughout.

Advantages and Disadvantages of Series Circuit

- **Advantages:**
 - Same current through every component.
 - Controlled by one switch.
 - Increased voltage supplies more electric current.
- **Disadvantages:**
 - One damaged component stops the entire circuit.

- Adding components increases resistance, decreasing current.
- Components cannot be switched off individually.

Example Sentence: A major disadvantage of a series circuit is that if one component fails, the entire circuit stops functioning.

5. Current, Voltage, and Resistance in a Parallel Circuit

- **Current:** Sum of currents through each path.
- **Voltage:** Same across each component.
- **Resistance:** Reciprocal of the sum of reciprocals of individual resistances.
 - Formulas:
 - Current: $I = I_1 + I_2$
 - Voltage: $V = V_1 = V_2$
 - Resistance: $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$

Example Sentence: In a parallel circuit, each component receives the same voltage, but the total current is the sum of the currents through each path.

Advantages and Disadvantages of Parallel Circuit

- **Advantages:**
 - Each component can be switched on/off separately.
 - Adding components does not affect other components.
- **Disadvantages:**
 - Voltage cannot be adjusted separately for each component.

Example Sentence: An advantage of a parallel circuit is that each appliance can be operated independently without affecting others.

6. Numerical Problems Related to Series and Parallel Circuits

- **Series Circuit Example:**
 - Calculate effective resistance, current, and voltage.

- Example Solution:

- Effective Resistance: $R = R_1 + R_2 = 2\Omega + 2\Omega = 4\Omega$
- Current: $I = \frac{V}{R} = \frac{6V}{4\Omega} = 1.5A$
- Voltage: $V_1 = I \times R_1 = 1.5A \times 2\Omega = 3V$

Example Sentence: Calculating the effective resistance in a series circuit involves summing up the resistances of all components.

- **Parallel Circuit Example:**

- Calculate effective resistance, current, and voltage.

- Example Solution:

- Effective Resistance: $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{2\Omega} + \frac{1}{2\Omega} = 1\Omega$
- Voltage: $V = 6V$
- Current: $I = I_1 + I_2 = 3A + 3A = 6A$

Example Sentence: In a parallel circuit, the effective resistance is calculated using the reciprocal of the sum of the reciprocals of individual resistances.