# PHYSICS | Electricity

# **Kirchhoff's Laws**

### **General Aim**

To verify Kirchhoff's laws for electric circuits.

#### Method

Two-loops circuit

### Learning Objectives (ILOs)

- State Kirchhoff's laws for electric circuits.
- Apply Kirchhoff's current law at node (or junction) points in an electric circuit.
- Apply Kirchhoff's voltage law around closed loops within electric circuits.
- Deduce the value of the current in different branches of an electric circuit.

## Theoretical Background/Context

#### Kirchhoff's First Law (or current law) KCL

It is based on the principle of conservation of charge. It states that

The sum of current that entering the junction equals the sum of current that leave the junction.

$$\sum I_{in} = \sum I_{out}$$

#### Kirchhoff's Second Law (or voltage law) KVL

It is based on the principle of conservation of charge. It states that

Around any closed path, the sum of all voltage drops on all branches within the loop is equal to the sum of the emf's of the batteries within the loop.

$$\sum V = \sum \varepsilon$$

### **Principle of Work**

Applying Kirchhoff's laws to the circuit



then measuring the currents in different branches.

 On the other hand, we theoretically apply Kirchhoff's to the circuit and calculate the currents in the different branches. Then compare the results to check the validity of Kirchhoff's laws.

