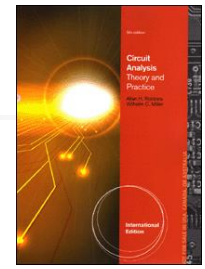


Chapter 02

Voltage and Current

C-C Tsai Source: Circuit Analysis: Theory and Practice ©Delmar Cengage Learning

Electrical Charge

- **When electrons are stripped from parent atoms, free electrons**
- The charge on one electron (or proton)
  =1 / 6.24×10^{18} C or **1.6 × 10^{-19} C**
- Unit of charge is the **coulomb** (**C**)
  1 C = 6.24 × 10^{18} electrons (or protons)

Voltage

- When two objects have a difference in charges
  - They have a **potential difference** or **voltage** between them. Unit of voltage is the **volt**
- **One volt** if it requires **one joule of energy** **to move one coulomb of charge** from one point to another

  V **= Work/Charge =** ***W / Q***

Current

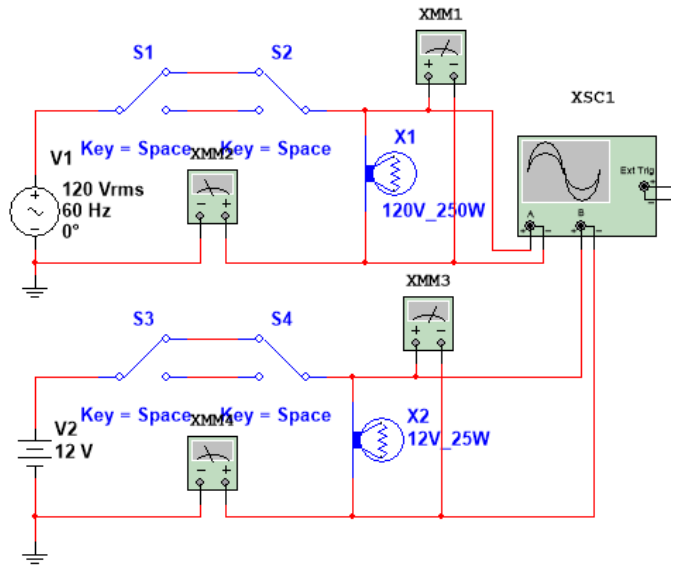
- **Movement of charge** is **electric current**
- Unit of current is **ampere (A)**
- **One ampere** (**1 A**)
  - Current in a circuit when **one coulomb of charge** passes a given point in **one second**
- **Current = Charge / time**

  I = Q / t

Exercise 1

1. What unit is for the charge?
2. What the charge is on one electron?
3. Please show the priority of excellent conductors, gold, copper, aluminum, and silver.
4. What two semiconductors are used for electronic devices?
5. Please show the definition of voltage.
6. Please show the definition of current

Multisim



Exercise 2 using Multisim

1. Please show the schematic with Multisim to use DMM to measure AC 110V, DC 12V, AC current, and DC current.
2. Please show the schematic with Multisim to use Oscilloscope to measure AC 110V, DC 12V, AC current, and DC current.
3. Please show the two-way switch control of a light, i.e., two-level down-up-stair floors
4. Please extend the two-way switch control of a light to three-level down-up-stair floors.

Kernel abilities

1. What is the charge of an electron? Please give an example.
2. What are the differences between conductor, semi-conductor, and insulator. Please give their representative materials?
3. What are differences between DC and AC voltages and currents? Please give their examples.
4. How to measure DC and AC voltages and currents? Please give their examples.
5. What the maximum limited current is safe for human?