# Current Sources & Resistance

Capacitors as a source

- Suppose a conductor was placed in a charged capacitor, connecting the two charged plates. What would happen?
  - The electrons will move from the negative side to the positive side
- This movement of electrons is called electric current.

Electric Current

- Flow of electrical charge
  - flows between two point of different potential
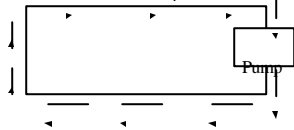
  Pump

  - maintained by a type of charge pump, which continuously changes the potential

Sources of Current

- Electromagnetic Induction
    - Moving a magnetic field
- Photoelectric Effect
    - Emission of electrons when illuminated
- Thermoelectric
    - Two different metals attached at two junctions, each junction at a different temperature

Sources of Current

- Piezoelectric
    - Crystals subjected to mechanical stress
- Chemical
    - Primary
        - Reactants are used up
    - Storage Cell
        - Reaction is reversible

Moving Charge

- Charges are not created or destroyed, only transferred from one side of the pump to the other
- Ampere
    - amount of charge moved in a circuit every second
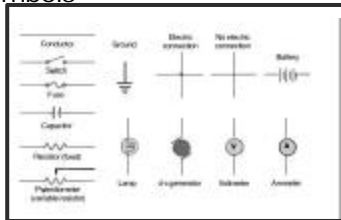
        1 C/s = 1 Amp
    - measured with an ammeter

$$I = \frac{q}{t}$$

Resistance

- The opposition to the flow of electric charge
- In a wire: $R = r\dfrac{L}{A}$

  ? = resistivity
  L = Length
  A = Area(cross-sectional)

- Resistor
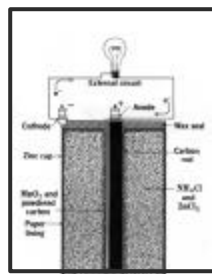 - Carbon granules are mixed with varying amounts of clay can be molded into cylinders having a finite resistance.

Electric Circuit Diagrams

- Symbols

Dry Cell

- Primary Parts
  - Electrolyte
  - Anode (+)
  - Cathode (-)
- Emf (ξ)
  - Electromotive force
  - Amount of energy supplied by the cell for each unit of charge on the electrodes

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Internal Resistance

- The resistance of the battery itself
- Causes the terminal voltage to drop when the battery is connected in a circuit.
- Depends on the electrolyte, the electrode material and the age of the battery
- Very small impact on the circuit and will be ignored in building circuits

Combining Cells in Series

- The emf (V) of the cells is the sum of the emfs of the individual cells
- The current in each cell and in the external circuit is the same throughout
- The internal resistance of the battery is the sum of the internal resistances of the individual cells
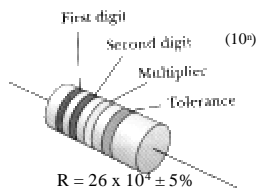

Combining Identical Cells in Parallel

- The emf is equal to the emf of each separate cell
- The total current in the circuit is divided equally among the cells
- The reciprocal of the internal resistance of the battery is equal to the sum of the reciprocals of the internal resistance of the cells

Resistors

First digit
Second digit
Multiplier
Tolerance

$R = 26 \times 10^4 \pm 5\%$

Color	Number	Tolerance
Black	0	
Brown	1	
Red	2	
Orange	3	
Yellow	4	
Green	5	
Blue	6	
Violet	7	
Gray	8	
White	9	
Gold		5%
Silver		10%

Ohm's Law of Resistance

- The ratio of the emf of the source to the current in the circuit is constant.
- This constant is the resistance in the circuit.

$$\frac{V}{I} = R$$

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