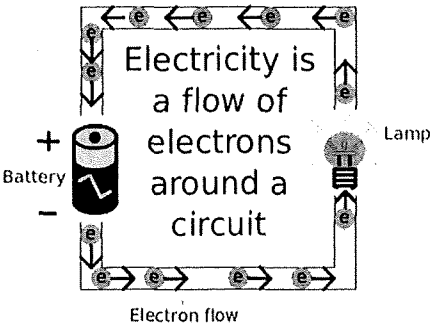
13.3 Current

Learning Goals/Success Criteria: *At the end of this lesson, I will be able to:*

- ☐ Use an ammeter to measure current experimentally
- ☐ Calculate current using the formula Q=IxT

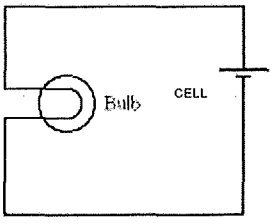
Define **ELECTRIC CURRENT** - measure of electron flow past a given point in a circuit
- measured in amperes (A)

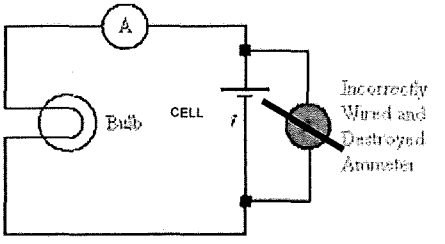


- What type of current flows out of cells? Direct current (DC)
- How about wall sockets? Alternating current (AC)
- Which way does current flow?
  - Electron flow anode to cathode
  - Conventional current positive to negative

Measuring Current Experimentally:

- The current in a circuit is measured using an ammeter.
- **The SI UNIT used for electric current is the** ampere (A).
  An amp is a measure of the amount of electrical energy that passes in 1s
  ≈ 6.2×10^{18} e-
- The ammeter needs to be connected in ***series***.



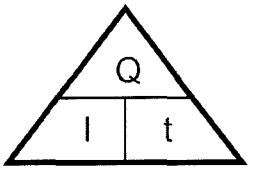


Safety Rules:

1. Connect the **positive** side of the ammeter leads back to the **positive** side of the battery. Connect the **negative** side of the ammeter back to the **negative** side of the battery.
2. Always set the ammeter to the **highest** current setting. Too low a setting can damage the meter.
3. To prevent an electric shock, never touch the tips of the ammeter leads when they are connected to a circuit.

Calculating Current Mathematically:

An electric current consists of **electric charges** moving from one place to another in a conductor such as a copper wire. Electric current measures a **rate**: the **amount** of charges that passes a point in a certain **time**. It is measured in a unit called **amperes** using the symbol **A**.



I = Current (Ampere, A)
Q = Total charge (Coulombs, C)
t = Total time (seconds, s)

Note: 1 C = 6.2 x 10^{18} electrons

Use the GRASS method to solve the following equations.

1. What is the current in a metal wire if a charge of 0.00048C passes a point in 0.10s?

$I = \frac{Q}{t}$
$= \frac{0.00048C}{0.10s}$
$= 0.004\ A$

2. The amount of current flowing through an electric toaster is 10A and it takes 900C of charge to toast two slices of bread. How long does it take to make the toast?

$t = \frac{Q}{I}$
$= \frac{900\ C}{10\ A}$
$= 90\ s$

13.5 Potential Difference or Voltage (V)

Learning Goals/Success Criteria: *At the end of this lesson, I will be able to:*

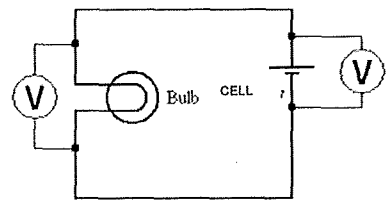
- ☐ Use an voltmeter to measure voltage experimentally
- ☐ Calculate voltage using the formula E=VxQ

Define **POTENTIAL DIFFERENCE** (also called **VOLTAGE**) - difference in electrical potential difference per unit of charge measured at two points

- This difference causes electrons to flow in a closed circuit.
- The _____ the potential difference in a circuit, the _____ the potential energy of each _____.

Measuring Potential Difference Experimentally:

- Potential difference between 2 locations in a circuit is measured with a voltmeter.
- **The SI UNIT used for measuring potential difference is the** volt (V).
- The voltmeter needs to be connected in ***parallel***. (see diagram)

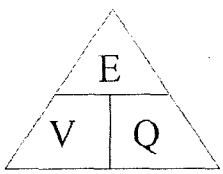


Safety Rules:

1. Connect the **positive** side of the voltmeter leads back to the **positive** side of the battery. Connect the **negative** side of the ammeter back to the **negative** side of the battery.
2. Always set the voltmeter to the **highest** voltage setting. Too low a setting can damage the meter.
3. To prevent an electric shock, never touch the tips of the voltmeter leads when they are connected to a circuit.

Calculating Voltage Mathematically:

Electric potential difference is a measure of the **amount of energy per charge**. It is either an electric potential **rise** across a **cell** or an electric potential **drop** across a **load**. It is measured in a unit called **volts** using the symbol **V**.



V = electric potential difference (Volts, V)
Q = total charge (Coulombs, C)
E = energy gained or lost (Joules, J)

Use the GRASS method to solve the following equations.

3. What is the potential difference across a refrigerator if 95C of charge transfers 9.0x 10^3J of energy to the compressor motor?

$$V = \frac{9.0 \times 10^3}{95\ C}$$

4. A spark transfers 1.5J of electric energy through a potential difference of 5.0V between your hand and the doorknob. Calculate the quantity of charge transferred in the spark.

$$Q = \frac{E}{V}$$

$$= \frac{1.5\ J}{5.0\ V}$$