

Electricity Overview

1. Applications of Electricity
2. History
3. Electrical Current
4. Direct Current (DC) vs. Alternating Current (AC)
5. Transformers
6. Electrical Potential
7. Resistance
8. Power and Energy
9. Electricity Cost



SAMPLE FILE

Thank you for your interest in my lesson.

The following slides will give you a good idea of how this lesson is structured although, much of the information has been removed.

For instance, when you see, that represent text that has been removed.

Note: This sample was created from the student version of the PowerPoint. Furthermore, the videos have also been removed.

If you have any questions, please send me an email –
devon@teachwithfergy.com

Applications of Electricity

- Electricity is all around us
- We use it all day, every day and our world would be very different without it
- With the person beside you, come up with a definition of electricity and write it below

Applications of Electricity

With the person beside you discuss where we get our electricity from. Is this form of electricity generation good or bad for the environment? What other methods could/should we be using?

A Brief (and incomplete) History

1600 - English scientist, William Gilbert first coined the term "electricity" from the Greek word for amber.

1729 - Stephen Gray's discovery of the conduction of electricity.

1733 - Charles Francois du Fay discovered that electricity comes in two forms which he called resinous(-) and vitreous(+). Benjamin Franklin and Ebenezer Kinnersley later renamed the two forms as positive and negative.



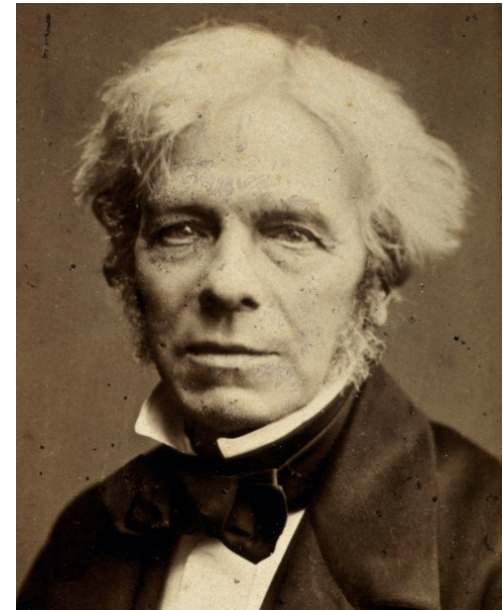
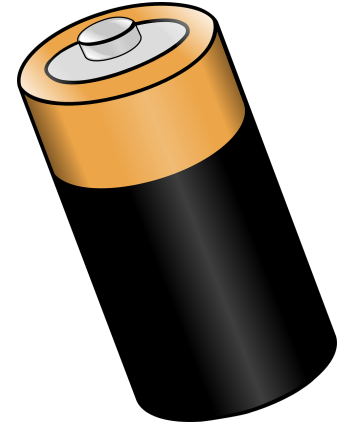
A Brief (and incomplete) History

1800 - First electric battery invented by Alessandro Volta. Volta proved that electricity could travel over wires.

1820 - Relationship of electricity and magnetism confirmed by Hans Christian

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1821 - First electric motor invented by Michael Faraday.



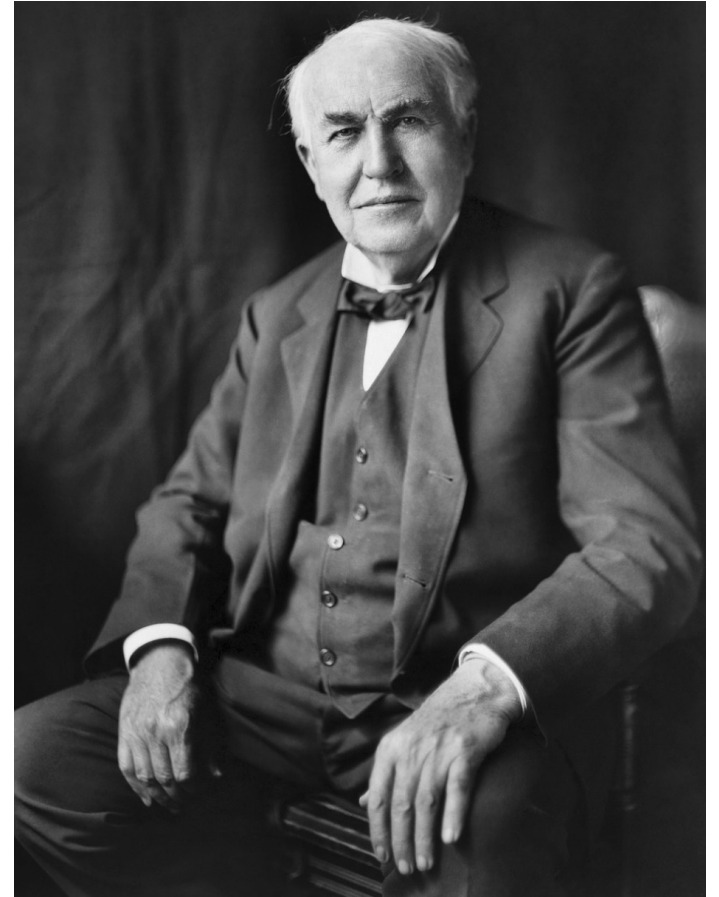
Michael Faraday

A Brief (and incomplete) History

1831 - Principles of electromagnetism induction, generation, and transmission discovered by Michael Faraday.

1878 - Edison Electric Light Co. (US) and American Electric and Illuminating (Canada) founded.

1879 - First commercial power station opens in San Francisco



Thomas Edison

A Brief (and incomplete) History

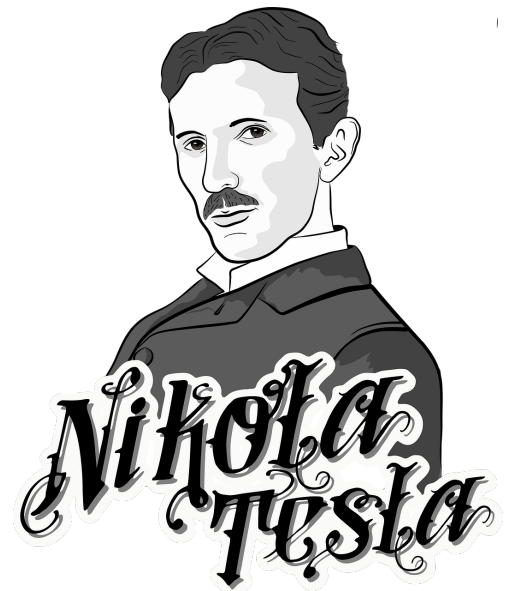
1886 - William Stanley develops transformer and Alternating Current electric system.

1888 - Rotating field AC alternator invented by Nikola Tesla.

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1913 - The electric refrigerator is invented. Robert Millikan measured the electric charge on a single electron.

1947 - The transistor is invented.



Electrical Current

- _____
- The movement of electrons is required for an electrical device to operate
- Electric current is responsible for the transfer of electrical energy along a conducting wire
- There are two kinds
 - 1) Direct Current (DC)
 - 2) Alternating Current (AC)



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Direct Current Applications

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- Examples of DC electronics include:
 - Cell phones
 - Flat-screen TVs (AC goes into the TV, which is converted to DC)
 - Flashlights
 - Hybrid and electric vehicles



Direct Current

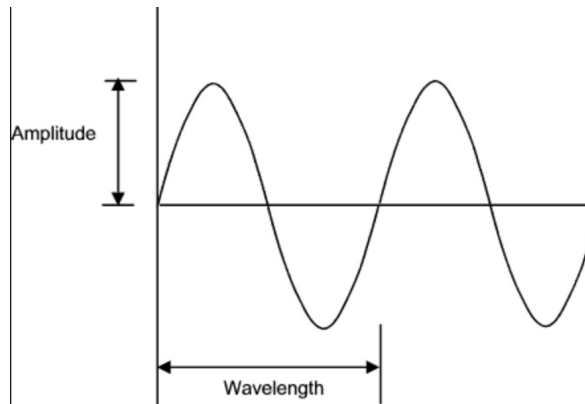
- In 1820, French physicist André-Marie Ampère performed experiments on direct currents in wires. This is why today we use the symbol I and the unit ampere (A) to represent electric current.
- The equation that describes the amount of electric current is

Alternating Current (AC)

- _____
- The electrons move one way to a maximum distance, go back to where they started, then go the other way until they reach the same maximum in the

Alternating Current (AC)

- The time it takes to make one complete cycle (a wavelength) is called the period
- _____
- The maximum value in either direction is the amplitude of the alternating current.
-
- Much higher frequencies are used in television, radar communication and cellular telephone operations which can reach frequencies of 1,000 megahertz (1 gigahertz).



Check Your Understanding

Calculate the amount of current through a wire that has 0.85 C of electrons passing a point in 2.5 min.

$$I = \frac{Q}{\Delta t}$$

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Step-up Transformers

- _____
- It is used to increase the voltage for certain appliances and for voltage transmission across large distances
 - Example: There is a step-up transformer in every microwave oven. Input is mains voltage (120/240V), output is around 5000V.
 - Step-up transformers are used in power plants to transform the several

Step-down Transformers

- Step-up transformers decreases the output voltage
- A step-down transformer reduces the output voltages or in other words, _____
- For example, our power circuit carries 110 V – 220 V, but

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Electrical Potential Difference

- If electric potential is the potential energy per charge at a specific location, electric potential difference is the difference in electric potential between the final and the initial location

- _____

Electrical Potential Difference

- If electric potential difference can be calculated using the formula
 - V = electric potential difference (joules per coulomb or volts)
 - ΔE = change in electric potential energy (joules)
 - Q = the amount of charge (electrons) (coulombs)

Check Your Understanding

Calculate the electric potential difference between two points in a circuit if 1000.0 J of electric potential energy is used to move 150 C of charge between them.

Electrical Resistance

- Electrical resistance (R) is a measure of how difficult it is for electric current to travel through a material

- _____



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Ohm's Law

- _____

- So $V \propto I$.

- How are Current, Voltage, and Resistance equated?

$$V = IR$$

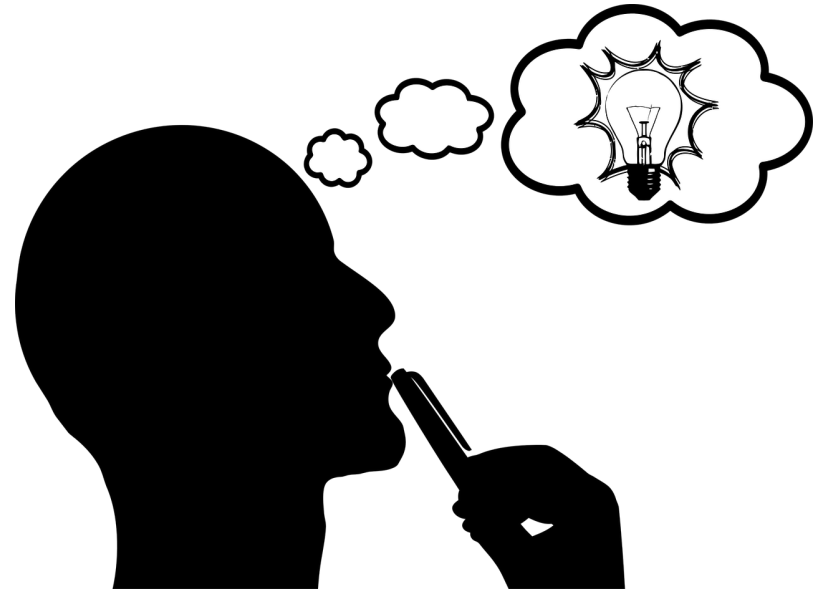
- R = resistance measured in ohms

- V = electric potential difference or voltage measured in volts (V)

- I = electric current measured in amperes (A)

Check Your Understanding

What is the voltage if the current is 0.41 A and the resistance is 61 Ω ?



Power and Energy

- _____
- The equation that describes power is $P = \Delta E / \Delta t$
- Power is expressed in watts (W)
- Electrical devices have power ratings that tell the consumer how much energy they use and how much it will cost to use them

Check Your Understanding

What power is needed required to charge a cellphone if 740 J of energy is

$$P = \Delta E / \Delta t$$

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Measuring Electrical Energy

- _____
- One kilowatt hour is equal to 3.6 million joules.
- A typical home in

Electrical Energy Pricing

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- Certain places have different rates depending on time of use

- Example

Off-Peak	6.5 ¢/kWh
Mid-Peak	9.4 ¢/kWh
On-Peak	13.2 ¢/kWh

- You can save money by using more electricity during off-peak hours

Check Your Understanding

A long-range Tesla 3, has a battery size of 75 kWh. With a full charge, it can travel approximately 500 km (310 mi). How much will it cost to charge if you only charge your car during off-peak hours at a cost of 6.5 cents/kWh?

Check Your Understanding

Using your answer from the previous question, how much will you save if instead of charging your Tesla, you fill up your car (tank size = 50 liters) at a cost of \$1.10 per liter? If you fill up every other week, how much will you save over 1 year?