Unit 6: Electricity

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Contents

Textos Marea Verde

Prior knowledge

Activity: Summarize your general knowledge on this topic.

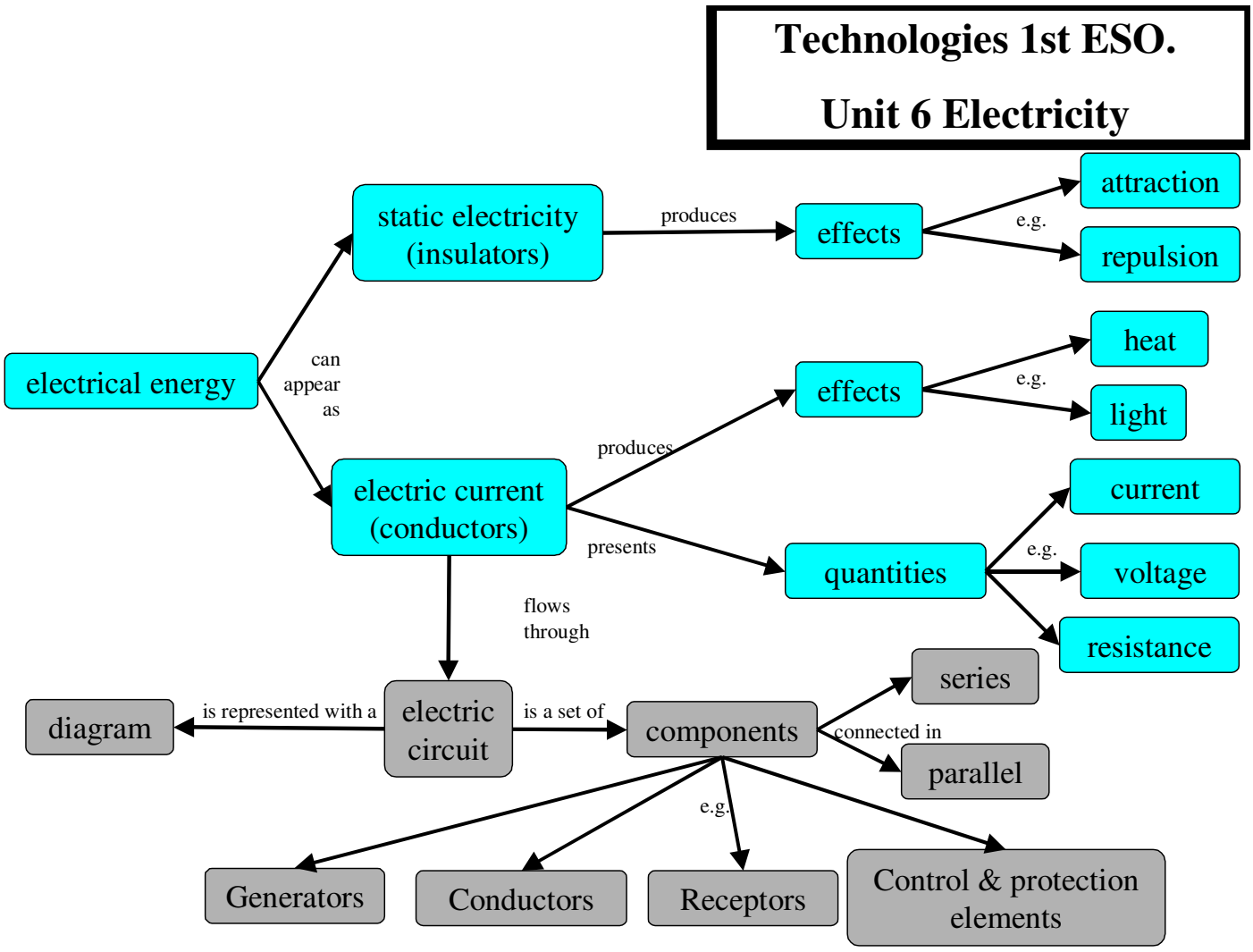
Keywords

Activity: Copy following keywords, explaining their meaning and translate them into Spanish.

Charge	Current	Fuse
static	Circuit	Loop
repel	Battery	Shaft
attract	Switch	Resistance
Imbalance	Light bulb	Voltage
Conductor	Bell	
Insulator	Motor	

Mindmap of the unit

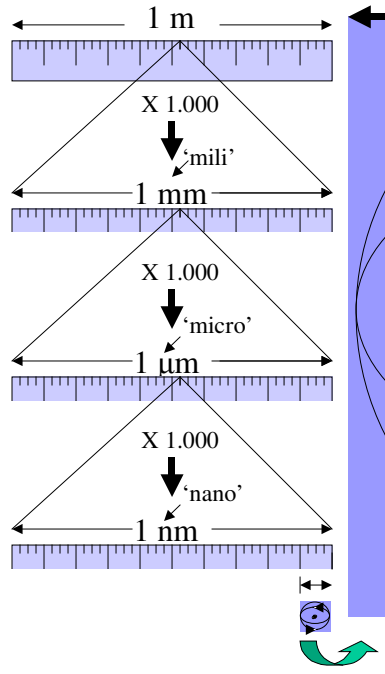
Activity: Analize and try to understand following mindmap

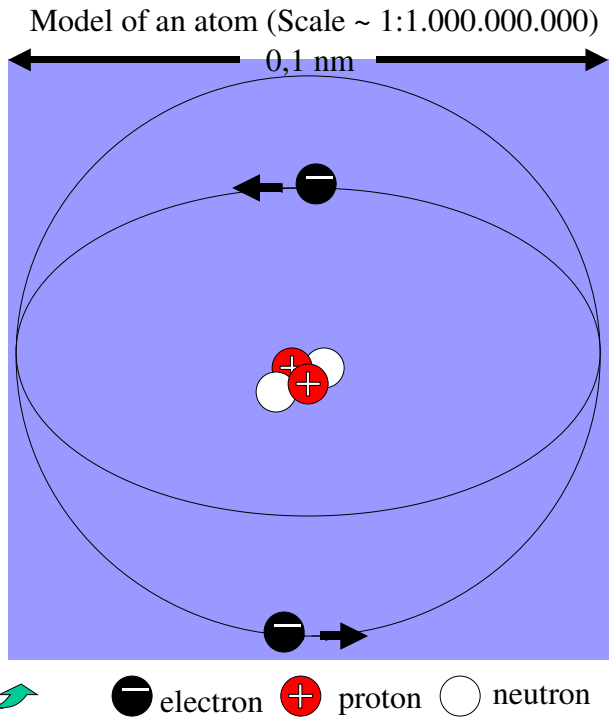


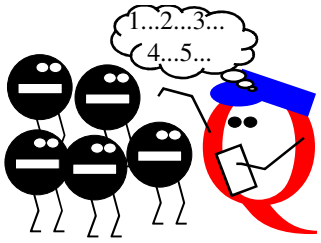
6.1. Electricity

Electricity is any phenomenon that has to do with **electric charges,** either **at rest** (**static electricity**) or **moving** (**electric current**).

Matter is made up of atoms. Atoms are very small particles (0,1 nm) with a nucleus in the center (**positive electric charges; +**) and an electron cloud in the periphery (**negative electric charges; -**) .





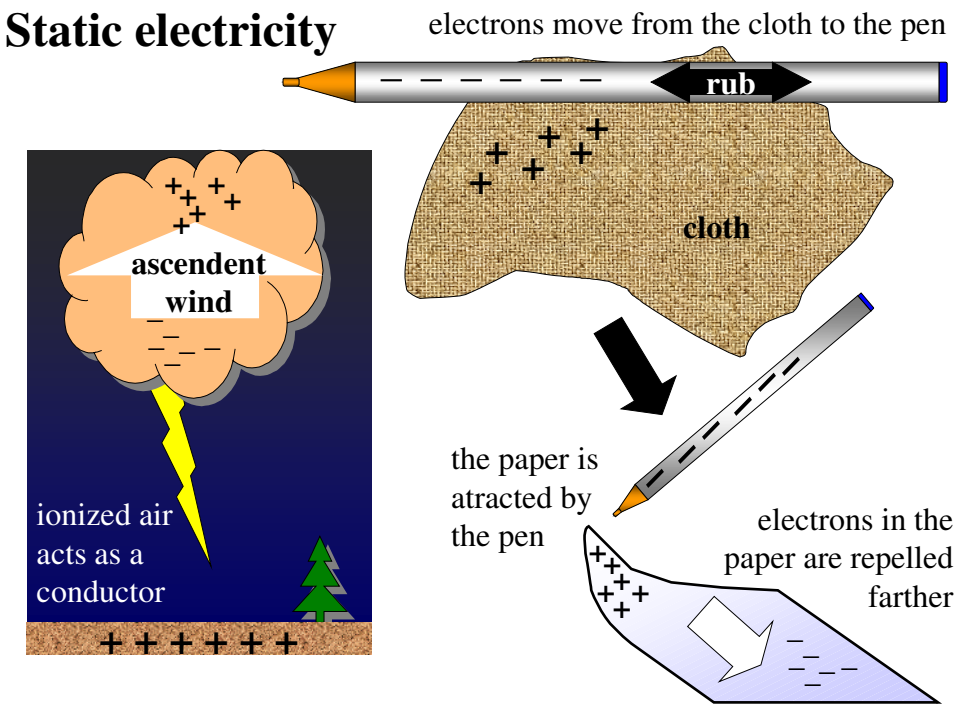


The amount of charges is represented by the letter **Q** and is measured in **coulombs** (C).

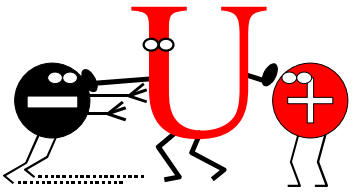
6.1.1. Static electricity

Negative charges repel each other, as do positive charges, but a positive charge and a negative charge attract one another.

Usually in matter the number of negative charges equals that of positive. But for example rubbing a material against another can move electrons from one material to the other, causing attraction or repulsion effects between them (static electricity).



Alternative ways to separate electrons farther from positive charges are chemically (in batteries) or by electromagnetism (in alternators or dynamos). Consequence of this separation process is the creation of an **imbalance** between two 'points' or **poles**: the **negative pole**, the 'point' where electrons has been moved, and the **positive pole**, the 'point' where the positive charges remain.



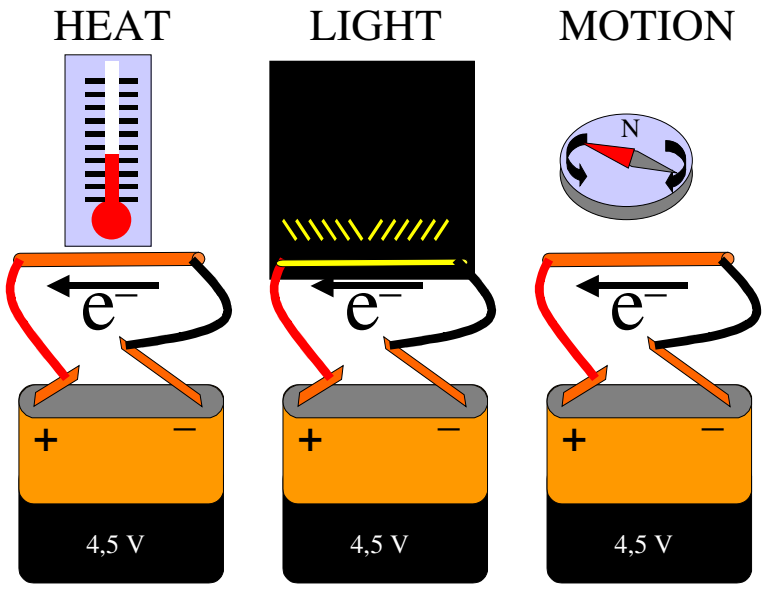
The energy needed to separate an electron farther away from positive charges is called voltage and is represented by the letter **U** or **V** and is measured in **volts** (V).

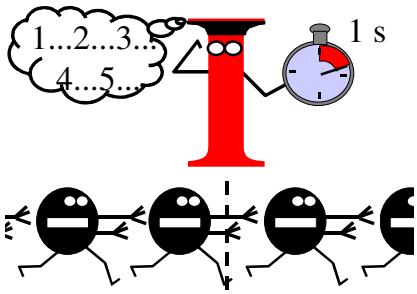
6.1.2. Electric current

An electric current is a continuos movement of electrons, from the **negative pole** to the **positive pole**.

Some materials (**conductors**), such as metals, allow electrons to pass through them; others (**insulators**), such as plastic, wood and ceramics, do not.

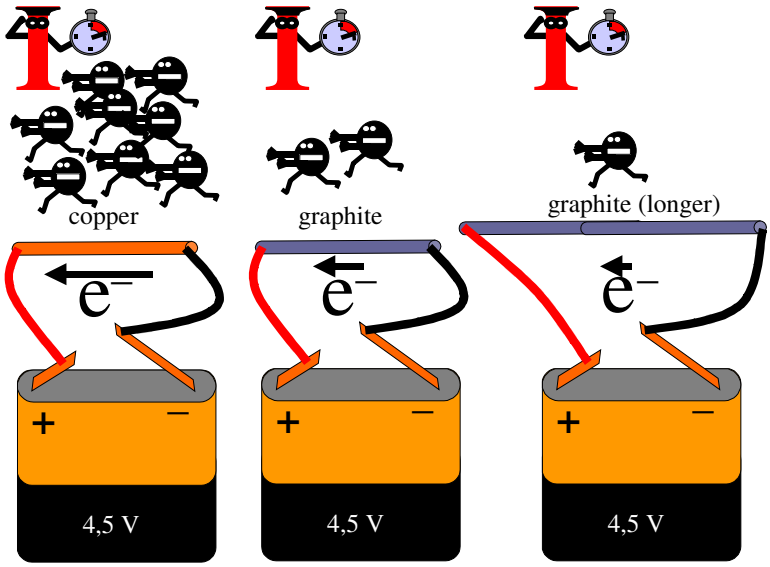
Putting a conductor between a negative pole (+) an a positive pole (-), causes an electric current, that has effects, such as **heat**, **light** and **motion**.

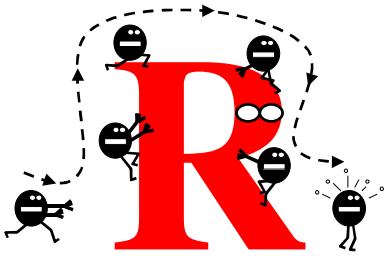




The amount of electrons that pass through a specific point in one second is called current. It is represented by the letter **I** and is measured in **amperes** (A; 1 A = 1 C / 1 s).

Of course the current depends on the quality and lenght of the conductor put between both poles.





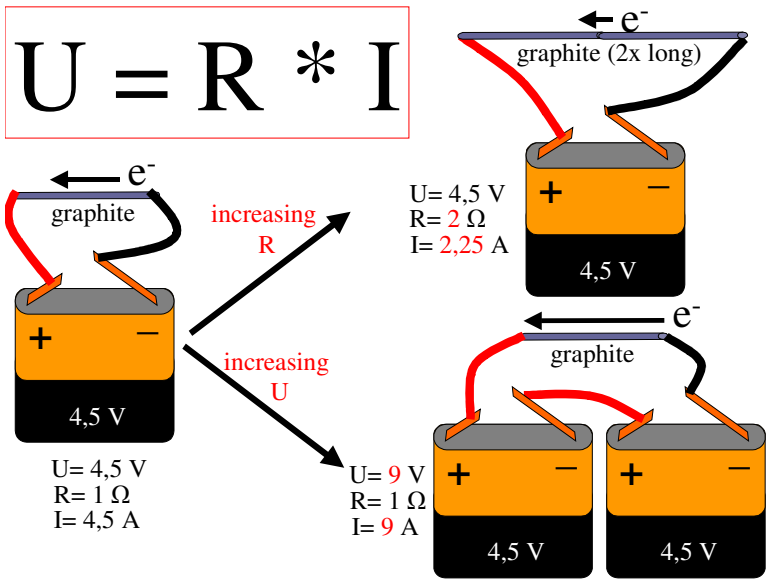
The opposition or obstacles that hinder the flow of electrons through a conductor is called resistance. It is represented by the letter **R** and is measured in **ohms** (Ω; 1 Ω = 1 V / 1 A – see Ohm's law).

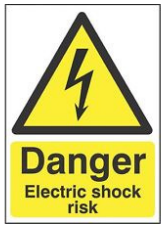
Ohm's law

George Ohm concluded in 1822 that there was a proportional relationahip between voltage **U**, the current **I** and the resistance **R**, which is expressed mathematically as:

$$U = R * I$$

So, if **R** stays the same, doubling **U** means **I** will also double; if **U** stays the same, doubling **R** means **I** will be reduced to the half.





The flow of electric current in your body gives an electric shock. Electric shock can be highly dangerous (burns, muscular paralysis, loss of conciousness, heart attack). Therefore:

DO NOT work inside an electrical appliances if connected to the electrical grid .
DO NOT touch electrical switches or appliances with wet hands.

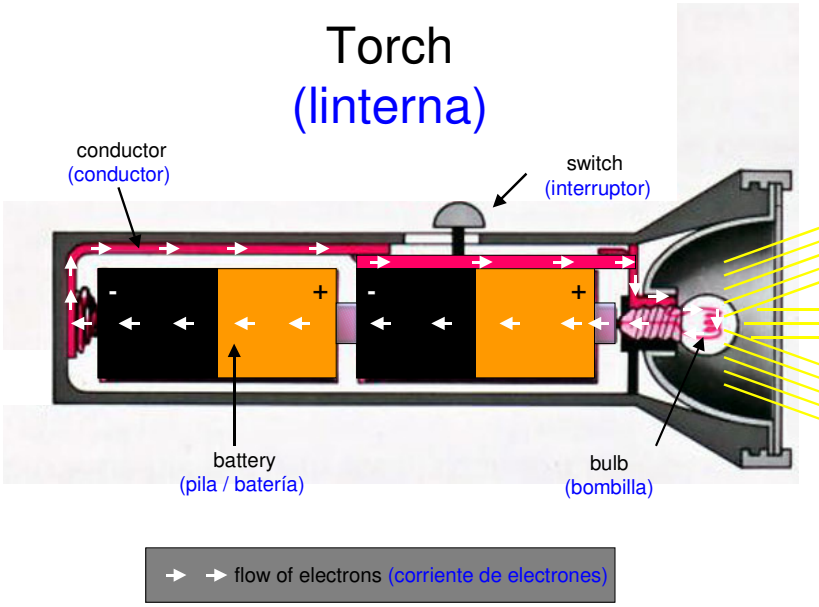
Activities: Copy following exercises and solve them in your notebook

1) What are the particles of atom? Where exactly are they? Which is their charge?
2) Rub a balloon against a cloth and then bring it near to your hair. Explain what happens with a drawing.
3) Rub a balloon against a cloth and do the same with a second ballon. Then bring both near to each other. Explain what happens with a drawing.
4) Complete: Sometimes, when we get out of the car we get an electric _____, because of static_____; the car chassis accumulates static electricity from _____. Because the car tyres are made of _____ the electricity can't pass though them to the ground. So the electric _____ go through us.
5) Which is the voltage of an electric shock coming out of the car? Can it be dangerous? Why / why not? And if you are in a fuel station? Why / why not.
6) Complete: _____ is a big flash caused by a huge build-up of electric _____ in the cloud. The flash can go from one _____ to another or from a cloud to the _____.
7) What material is used to make the inner and the outer part of electric cables? Why?
8) Complete : Electric currents are created by the movement of _____. The voltage is measured in _____, the current in_____, the resistance in _____.
9) Express Ohm's Law in three different ways: U = ?, I = ?, R = ?
10) Calculate the voltage if I = 1 A and R = 1 Ω.
11) Calculate the the resistance if I = 0,5 A and V = 4,5 V.
12) Calculate the current if V = 12 V and R = 100 Ω.

6.2. Electric circuits

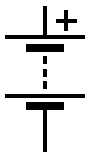
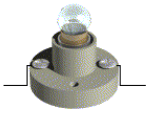
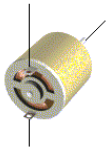
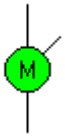
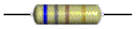
An electric circuit is a set of connected components through which an electric current flows.

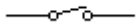
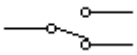
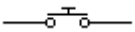
For example, the batteries, the conductor, the switch and the bulb are the components of the electric circuit of a torch.



6.2.1. Components

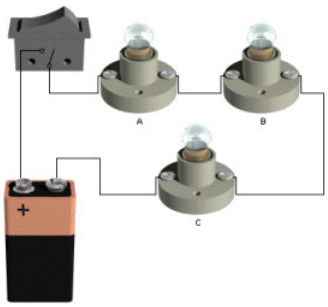
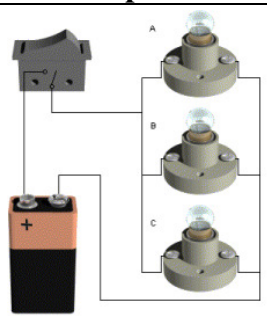
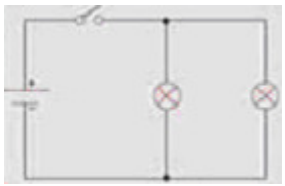
The components can be classified into generators, conductors, receptors, control components and protection components.

Type of component	component	Pictures	Symbol	Use
Generator (generador)	Battery (batería)			Generates current
Receptor (receptor)	Bulb (bombilla)			Produces light (heat)
	Motor (motor)			Produces motion
	Resistor (resistencia)			Produces heat
	Buzzer (zumbador)			Produces sound

Type of component	component	Pictures	Symbol	Use
Control component (componente de control)	Switch (interruptor)			Controls the flow of current
	3-way switch (conmutador)			Alternates the flow of current between two circuits
	Push button (pulsador)			Controls the flow of current
Protection component (componente de protección)	Fuse (fusible)			Protects the circuit

6.2.2. Types

Bulbs can be connected **in series** or **in parallel**.

	In series	In parallel
Example (3 bulbs; pictures)		
Example (2 bulbs; symbols)		
Connections	A single wire leads from one bulb into the next	Each bulb has it own branch
Voltage (**U**)	The voltage is distributed among the different bulbs	The voltage is the same across every bulb
Current (**I**)	The same current flows through all the bulbs	The current is distributed among the different branches
Bulb's brightness	Bulbs glow dimmer by increased number of bulbs	Bulb's brightness stays the same however bulbs you add
What happens if a bulb blows?	The rest stop glowing.	The rest continue glowing.

Activities: Copy following exercises and solve them in your notebook

13) Which control component are used for the light in the classroom and in a door bell?
14) How do you think the lights in the classroom are connected – in series or parallel? Why?
15) A 3-way switch allows you to control a light from two points. Have you got one in your house? Where? Draw the circuit.
16) Which is the effects of the electric current on following devices? Draw the diagrams of their electric circuits.

Device	Effect(s) of electric current	Diagram of electric circuit
Mixer		
Vacuum cleaner		
Sandwich maker		
Hairdryer		

17) Design and simulate different circuits with a simulator (e.g. Yenka; previously Crocodile Technology).