Anton N KUZMIN

lecturer of life safety discipline
postgraduate student at the Department of “Road transport”
of Nizhny Novgorod State Technical University

Contacts:

603950, Russia, Nizhny Novgorod, Minin st., 24, of.1161

phone: +7 905 668 11 98 e-mail: kuzmin1anton@mail.ru

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Life safety discipline

The content of the course:

Part I. Introduction to the subject of study

Part II. **Electrical safety**

Part III. Oil & gas safety

Part IV. Fire safety

Part V. Information technologies in safety

Part VI. Lean Management 5S-system

Part VII. Personal protective equipment and safe condition signs

Part VIII. First aid and injuries

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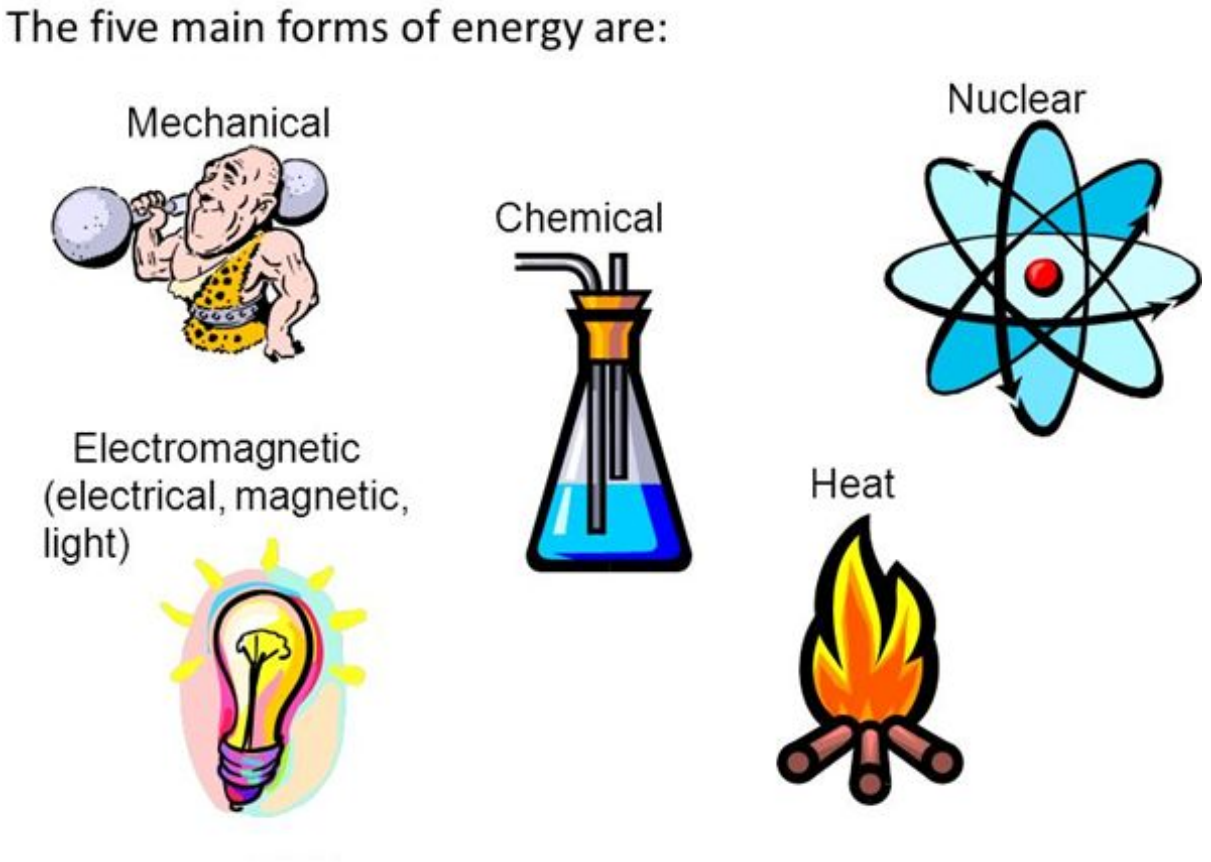
Life safety

2. Electrical safety

Matter is defined as any substance which has *mass* (or weight) and *occupies space*. This definition should be broad enough to cover all physical objects in the universe.
Wood, water, iron, and paper are some examples of matter. Energy is closely related to, but not to be confused with, matter.
Energy does not have mass, and it does not occupy space. Heat and light are examples of energy.



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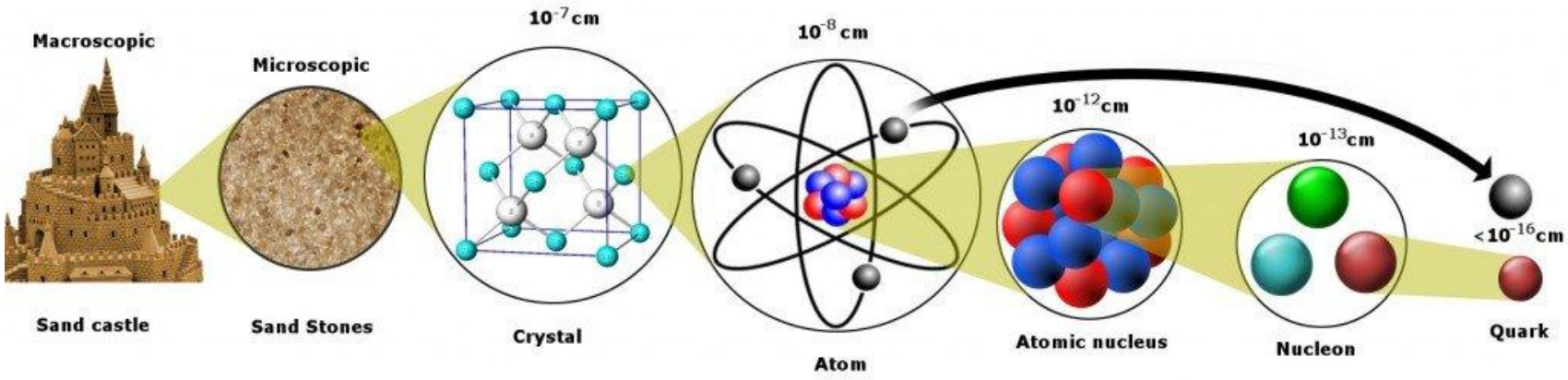
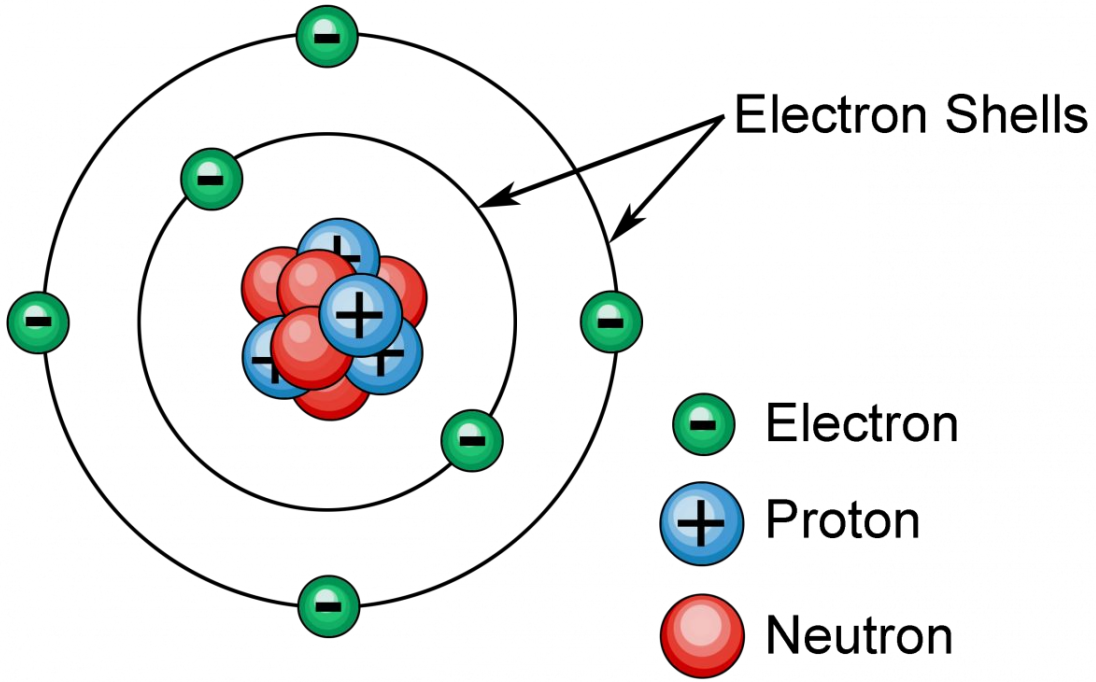
Life safety





The smallest particle of matter which can be recognized as an original substance was thought to be a unit called **the atom**. Recently scientists have found particles even smaller than atoms, but our theories are still based on the atom.

The atom consists of a **nucleus** and a cloud of **electrons**.

It is generally agreed that *the electrons are small particles of electricity, which are negative in nature.*

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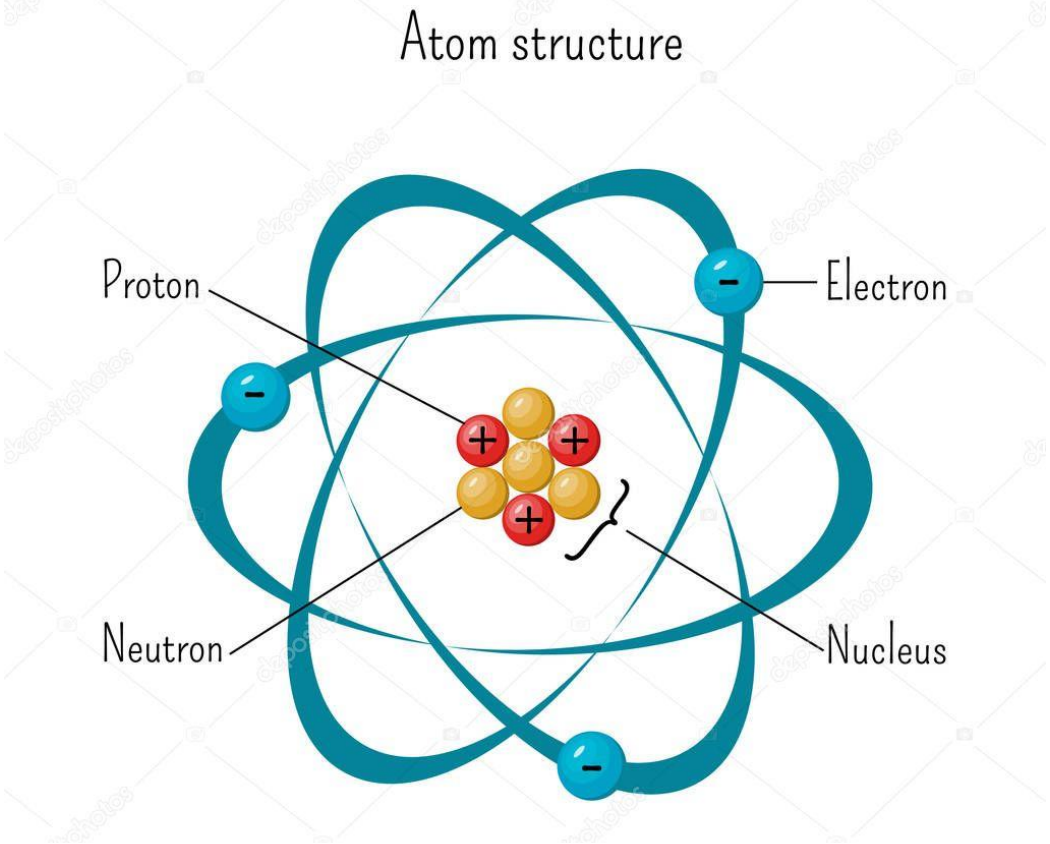
Practical **electricity** is produced by small atomic particles known as electrons. **It is the movement of these particles which produces the effects of heat and light.** These particles orbit the nucleus in much the same fashion that planets orbit a sun.
Accepted atomic theory states that all matter is electrical in structure.
Any object is largely composed of a combination of positive and negative particles of electricity.



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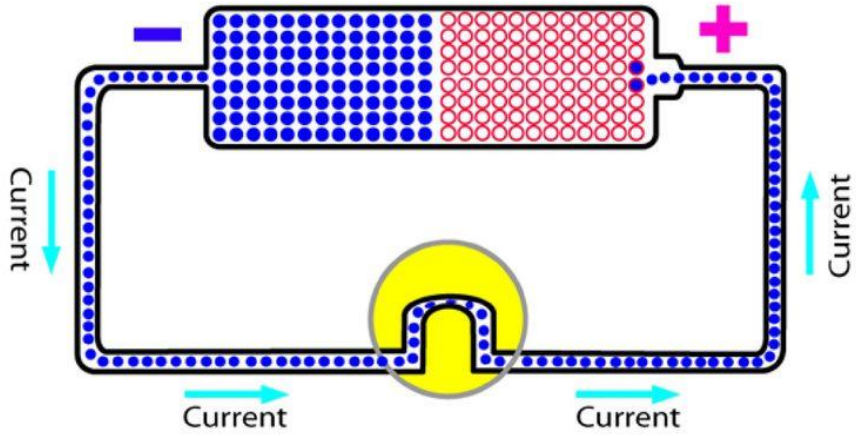
The concepts of potential difference and electric circuit are very important in the study of electrical safety.

The wire and the electric source together form an electric circuit, the electrons are drifting around it as long as the conducting path is maintained.

The potential difference must be maintained by some electric source such as electrostatic generator or a battery or a direct current generator.

Electric Circuits

An electric circuit allows electrons to flow from a negative pole (excess electrons) to a positive pole (deficient in electrons)



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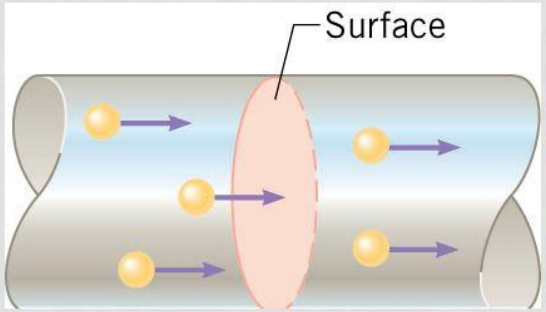
The electric current is a quantity of electrons flowing in a circuit per second of time.

The unit of measure for current is **ampere**. If one coulomb passes a point in a circuit per second then the current strength is 1 ampere.

The symbol for current is **“I”**.

The current which flows along wires consists of moving electrons. *The electrons move along the circuit because the electromotive force drives them.*

The ***electric current*** is the amount of charge per unit time that passes through a surface that is perpendicular to the motion of the charges.



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

One coulomb per second equals one ***ampere*** (A).

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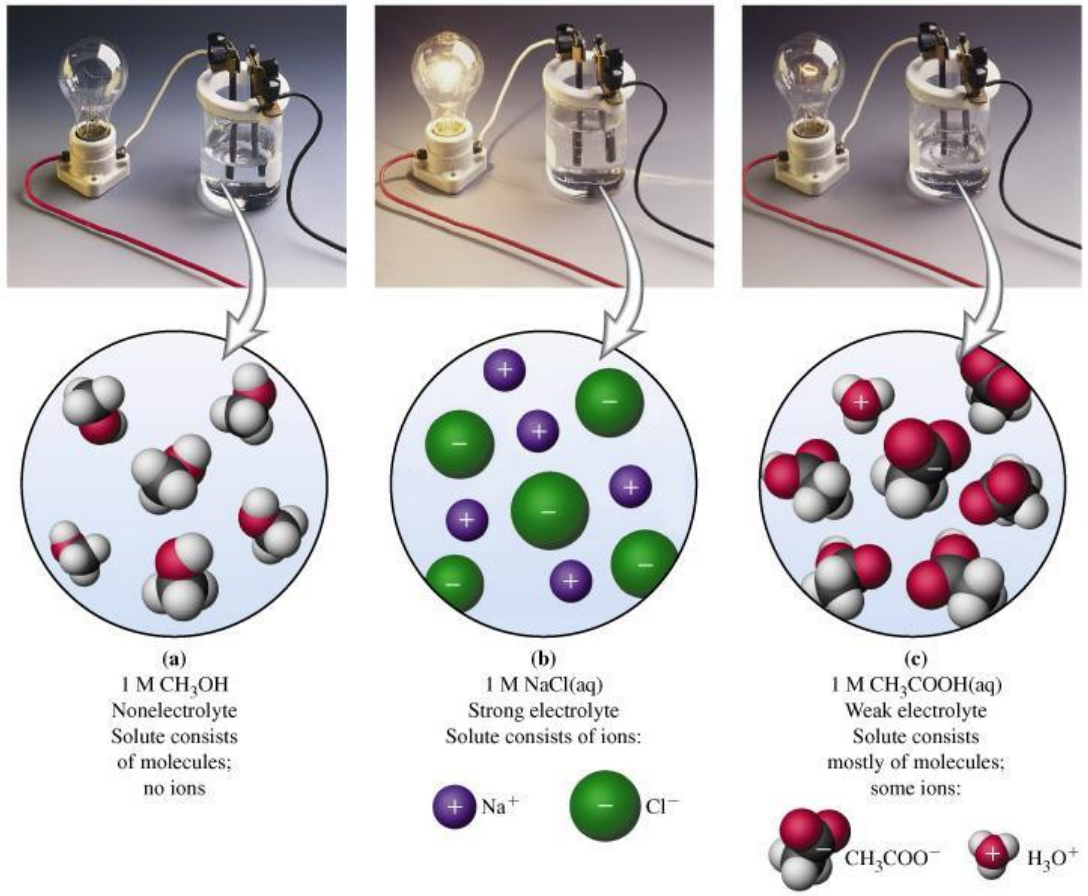
In addition to traveling *through solids,* however, the electric current can flow *through liquids as well and even through gases.* In both cases it produces some most important effects to meet industrial requirements.

Some liquids, such as melted metals for example, conduct current without any change to themselves. Others, called **electrolytes**, are found to change greatly when the current passes through them.



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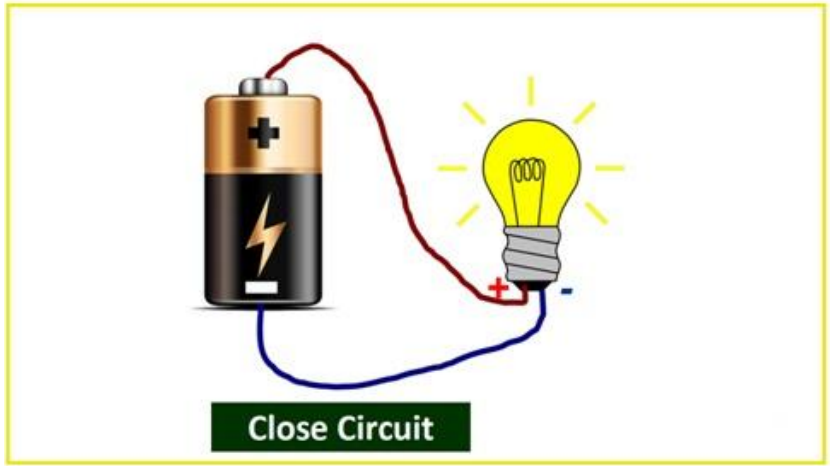
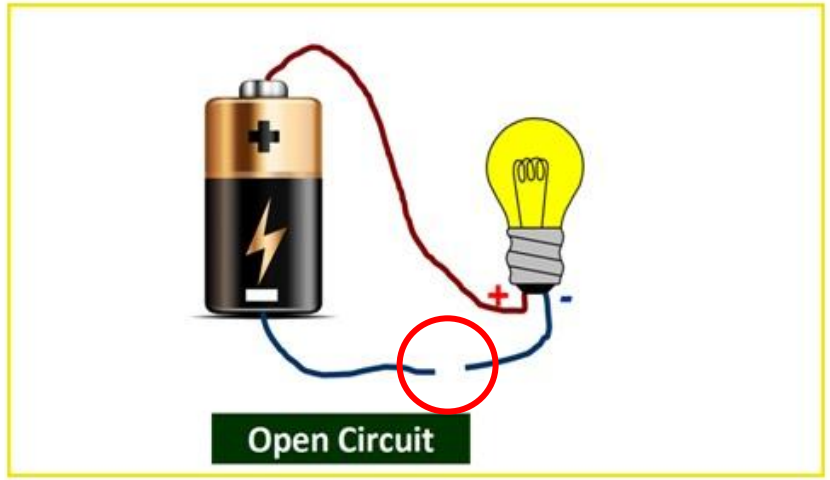
There are various kinds of electric circuits such as:
open, closed, series, parallel and short circuits.
The path along which the electrons travel must be complete otherwise no electric power can be supplied from the source to the load. Thus the circuit is “closed” when an electric device is switched on.
If the circuit is broken or “opened” anywhere, the current is known to stop everywhere. The circuit is broken when an electric device is switched off.





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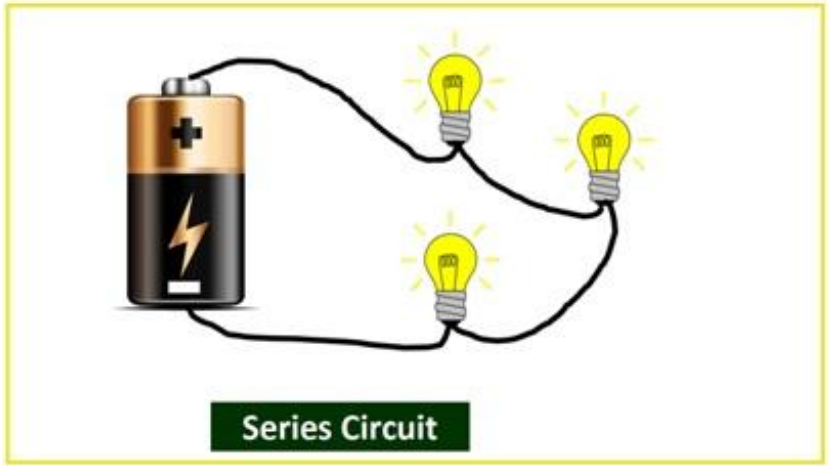
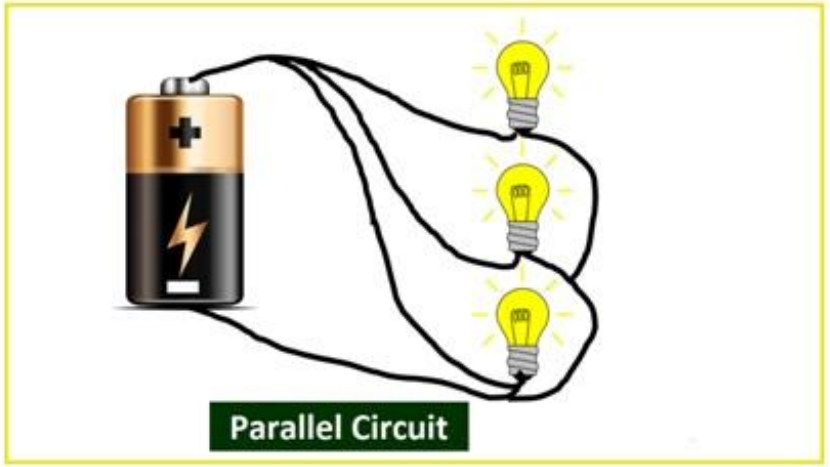
Electrical devices can be connected so that the current flows from one device to another (“to be connected in series”). Under such conditions **the current flow is the same in all parts of the circuit** as there is only a single path along which it may flow.

The “parallel” circuit provides two or more paths for the passage of current. The circuit is divided in such a way that **part of the current flows through one path and part through another.** The lamps in the houses are connected in parallel.





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The “short” circuit is produced when the current can return to the source of supply without control. **The short circuits often result from cable fault or wire fault.**

Under certain conditions the short circuit may cause fire because the current flows where it was not supposed to flow. If the current flow is too great a fuse is used as a safety device to stop the current flow.

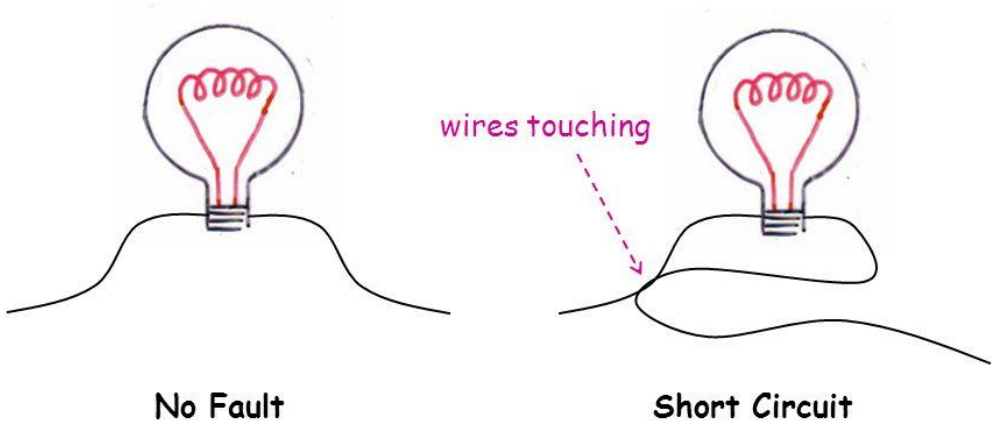
Short Circuit

Current flows from one wire to the other not reaching the lamp.

The lamp is off.

Short circuit faults have a lower resistance than expected.

Electrical current will always try and follow the path of least resistance.



10 minute break

(please, come back on time)

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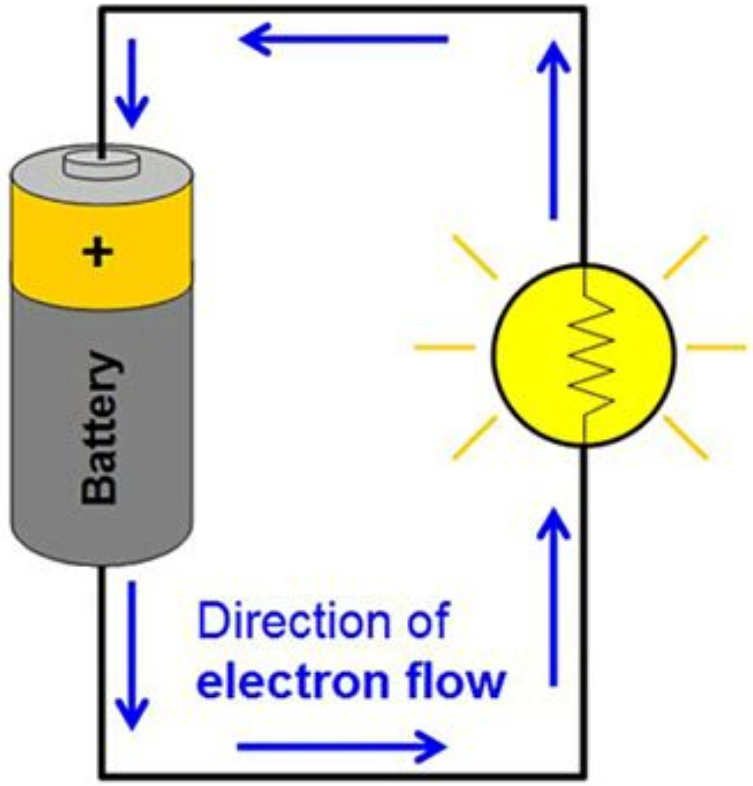
When the electrons flow in one direction only, the current is known to be **d.c.**, that is, **direct current.**

The simplest source of power for the direct current is a battery, for a battery pushes the electrons in the same direction all the time (i.e., from the negatively charged terminal to the positively charged terminal).



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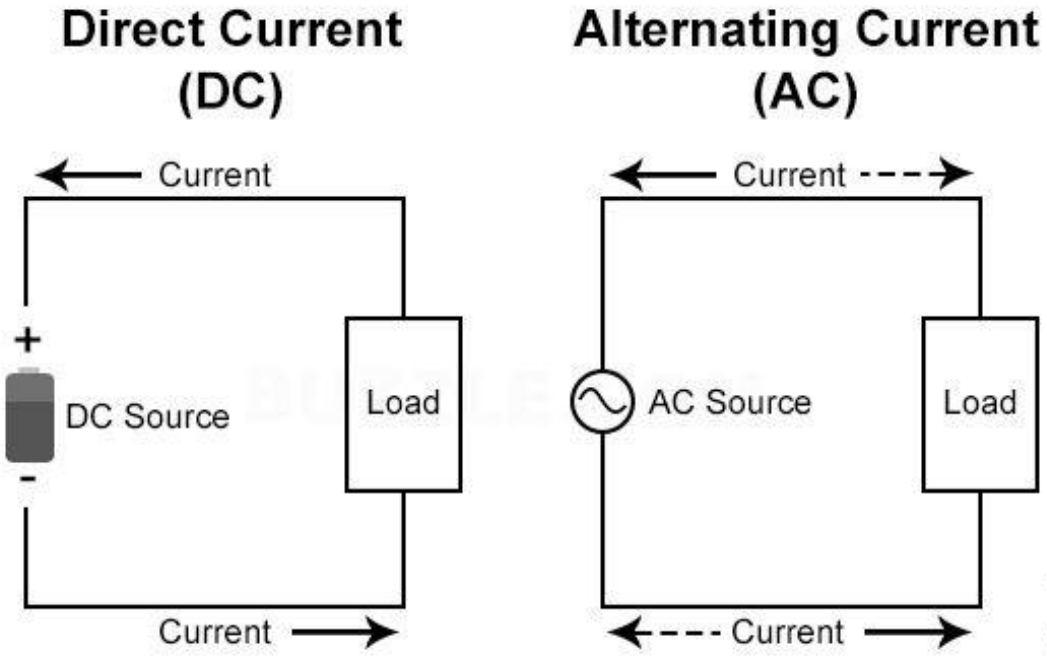
The letters **a.c.** stand for **alternating current.** The current under consideration flows *first in one direction and then in the opposite one.*
The a.c. used for power and lighting purposes is assumed to go through 50 cycles in one second.
One of the great advantages of a.c. is the ease with which power at low voltage can be changed into an almost similar amount of power at high voltage and vice versa.



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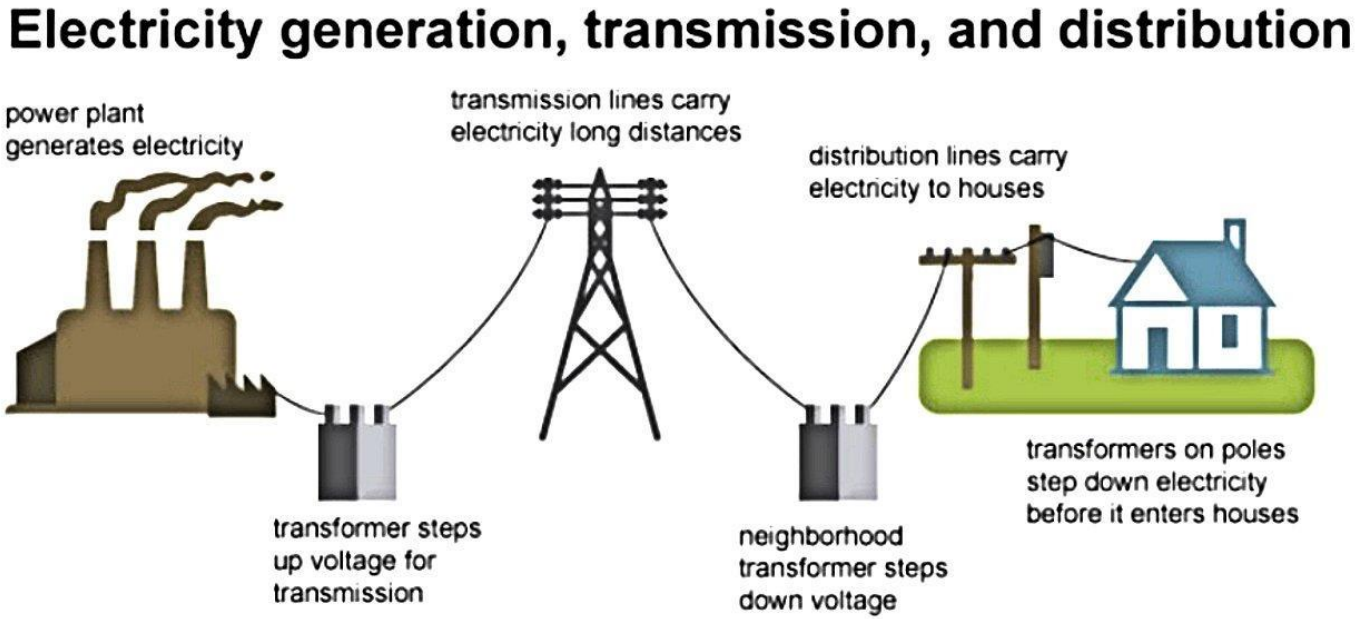

On the one hand alternating voltage is increased when it is necessary for long-distance transmission and, on the other hand, one can decrease it to meet industrial requirements as well as to operate various devices at home.

Although there are numerous cases when d.c. is required, **at least 90% percent of electrical energy to be generated at present is a.c.**

In fact, it finds wide application for lighting, heating, industrial, and some other purposes.

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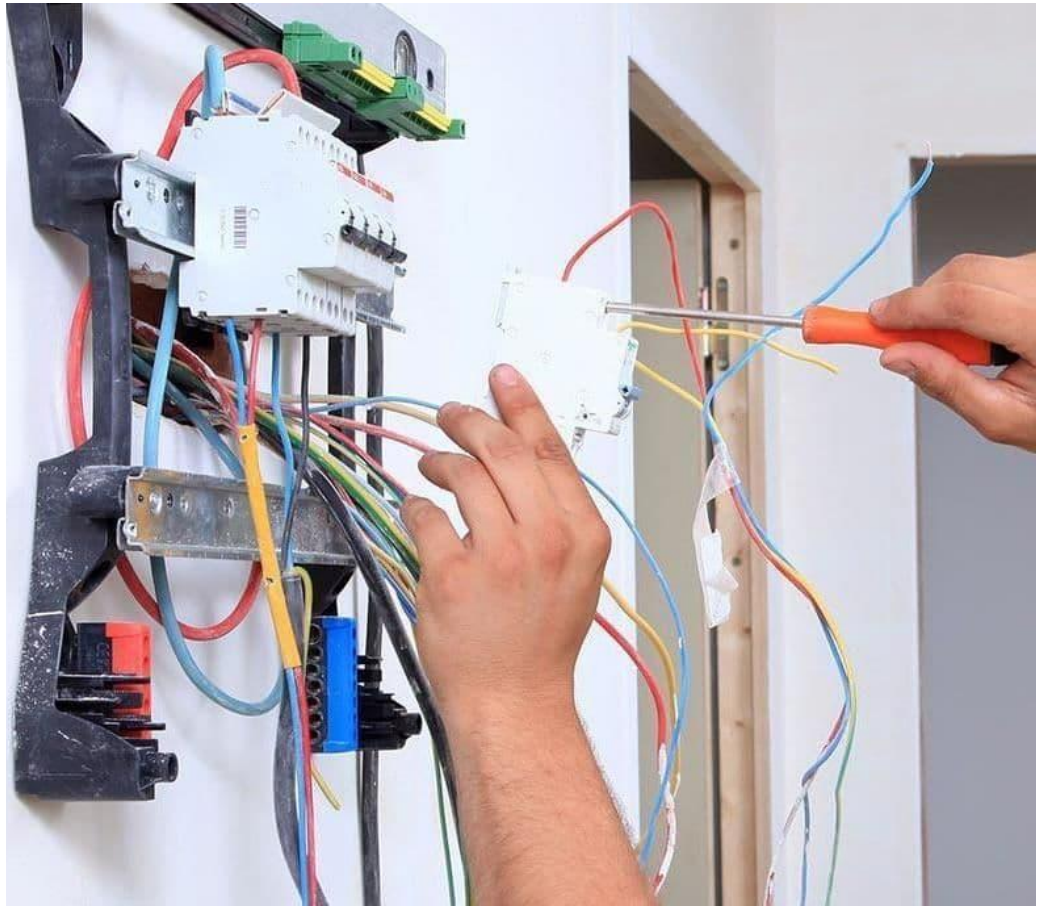
People use electricity in their homes every day but sometimes forget that it is a form of power and may be dangerous.

Many people have had strong shocks from the electric wires in a house.

The wires seldom carry current at a higher voltage than **220V**, and a person who touches a bare wire or terminal may suffer no harm *if the skin is dry.*



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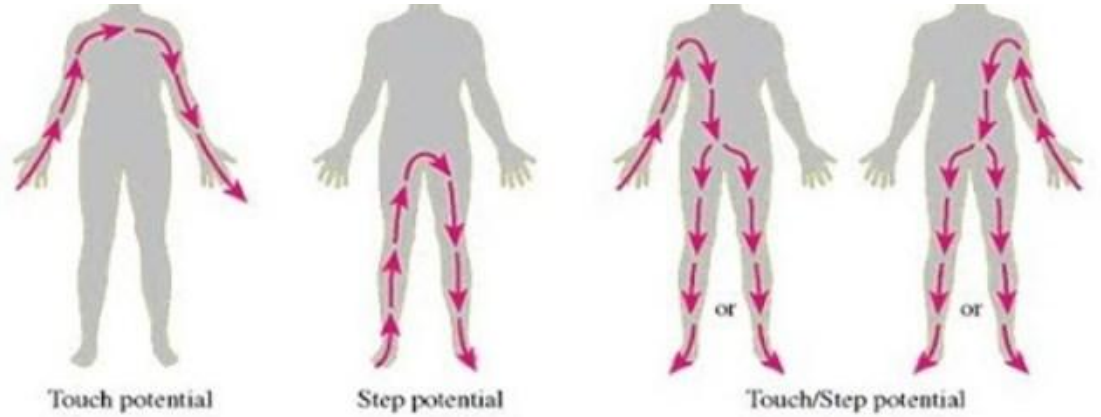
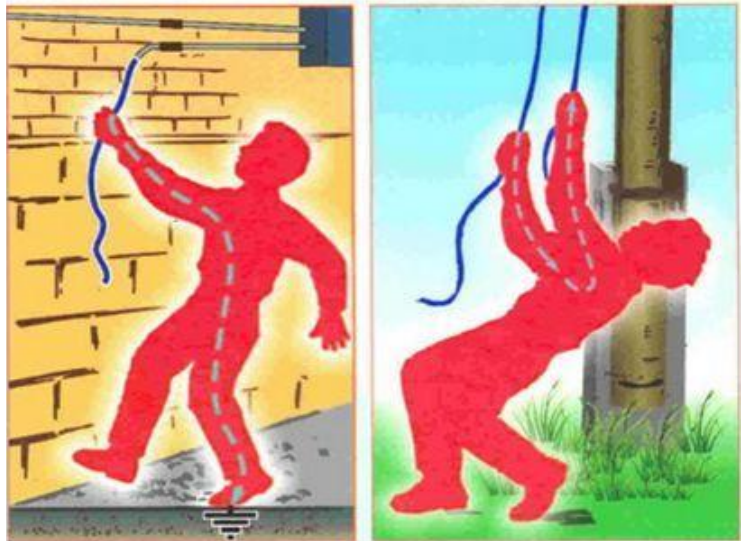


But *if the hand is wet,* he may be killed. Water is known to be **a good conductor of electricity** and provides an easy path for the current from the wire to the body.

One of the main wires carrying the current is connected to earth, and if a person touches the other one with a wet hand, a heavy current will flow through his body to earth and so to the others. **The body forms part of an electric circuit.**



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When dealing with wires and fuses carrying an electric current, it is best to wear **rubber gloves.** Rubber is **a good insulator** and will not let the current pass to the skin.

If no rubber gloves can be found in the house, dry cloth gloves are better than nothing.

Never touch a bare wire with the wet hand, and *never,* in any situation, *touch a water pipe and an electric wire at the same time.*

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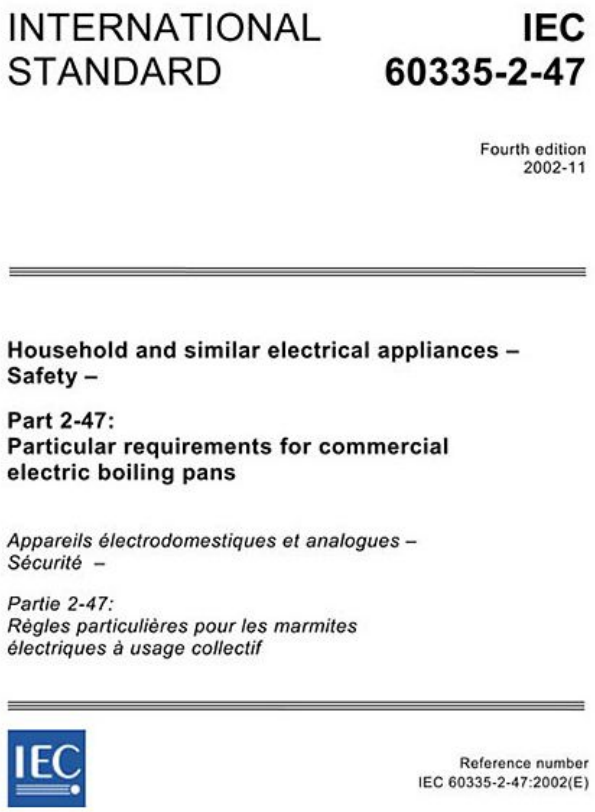
Various governments and agencies have developed stringent requirements for electrical products that are sold world-wide. In most markets it is mandatory for a product to conform to **safety standards.**

To conform to such standards, the product must pass safety tests such as the **High Voltage Test**, **Insulation Resistance Test**, Ground (Earth) Bond & **Ground Continuity Test**.

These tests are described in **IEC 60335**, IEC 61010 and many other national and international standards.



INTERNATIONAL STANDARD **IEC 60335-2-47**

Fourth edition
2002-11

Household and similar electrical appliances – Safety –

Part 2-47: Particular requirements for commercial electric boiling pans

Appareils électrodomestiques et analogues – Sécurité –

Partie 2-47: Règles particulières pour les marmites électriques à usage collectif

IEC

Reference number
IEC 60335-2-47:2002(E)

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Watch the video "Bill Nye the Science Guy – Electricity"

https://www.youtube.com/watch?v=gixkpsrxk4Y.

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Thank you for your attention!

Contacts:

603950, Russia, Nizhny Novgorod, Minin st., 24, of.1161

phone: +7 905 668 11 98 e-mail: kuzmin1anton@mail.ru