ELECTRICTY AND MAGNETISM

ELECTRICITY AND MAGNETISM

Contents:

ELECTRICITY AND MAGNETISM

Main Objectives:

1. To understand the properties of repulsion and attraction that rule electricity and magnetism.

2. To show understanding of what the electric current is and how different electric circuits work.

3. To learn that electricity can produce heat, light and motion.

4. To learn and observe how magnets produce magnetic fields, and so does Earth.

Useful Websites

http://www.andythelwell.com/blobz/guide.html Excellent, children friendly interactive site with the basics on circuits, conductors and insulators, batteries, and symbols for circuits.

http://gwydir.demon.co.uk/jo/elect/info.htm An interactive page where you can build electric circuits, using close to official symbols for the circuit components. For more advanced students.

http://www.proteacher.com/cgi-bin/outsidesite.cgi?id=9250&external=http://www.amphi.com/~tlcf/schaefer/web1/elec.html&original=http://www.proteacher.com/110016.shtml&title=Electrical%20Appliances interactive time line showing and describing electrical appliances, from 1901 to 1999.

http://www.energyquest.ca.gov/story/chapter02.html informative site on electricity, very detailed. Useful as a teacher resource if you need to brush up concepts.

http://www.enchantedlearning.com/physics/Staticelectricity.shtml information on static electricity, inventors, parts of a light bulb and more.

http://www.weatherwizkids.com/lightning1.htm information on lightning. How it happens and safety measures. Easy to read and illustrated. Uses fahrenheit and miles.

ELECTRICITY AND MAGNETISM

atom

attraction

balance

battery

circuit

connect

device

electricity

electron

energy

magnetic field

magnetic pole

mains

parallel

proton

repulsion

search

series

series

switch

volt

wire

Vocabulary Cards

atom	**n.** the smallest particle of a chemical element, consisting of a positively charged nucleus surrounded by negatively charged electrons. **" Negative electrons and positive protons attract each other to keep the balance."**
attraction	**n.** a force under the influence of which objects tend to move towards each other. **" The force of attraction makes a magnet stick to the fridge".**
balance	**n.** a condition in which different elements are equal or in the correct proportions. **"When an atom has the same number of protons as of electrons, it is balanced, or neutral".**

battery	**n.** a device containing one or more electrical cells, for use as a source of power. **"Some toys are run by batteries".**
circuit	**n.** a system of conductors and components forming a complete path for an electric current. **"An electric circuit needs to be closed in order to work".**
connect	**v.** join together so as to provide access and communication. **"When all the parts of a circuit are connected, we say it is closed".**

device	**n.** an invention serving a particular purpose, especially a machine used to perform one or more relatively simple tasks. **" A light bulb, a buzz, or a computer, are devices that can be connected to an electric circuit".**
electricity	**n.** a form of energy resulting from the existence o charged particles (such as electrons or protons), either statically as an accumulation of charge or dynamically as a current. **" We use electricity to light our houses, and play music".**
electron	**n.** a negatively charged particle found in all atoms and acting as the primary carrier of electricity. **"When you rub a balloon against your hair, the electrons in your hair move to the balloon, and the balloon gets negatively charged".**

energy	**n.** the capacity to do work. **"Energy makes our bodies work, plants grow, and the central heating in our homes work".**
magnetic field	**n.** region around a magnet within which the force of magnetism acts. "**The Earth is surrounded by magnetic fields, and so is a magnet".**
magnetic pole	**n.** 1. each of the points near the extremities of the axis of rotation of the earth where a magnetic needle points. 2. each of the two points of a magnet to which the lines of magnetic force are directed. **"The magnetic poles of a magnet and of the earth are called South pole and North pole".**

mains	**n.** (the mains) public water, gas, or electricity supply through pipes or cables to our homes. The wall outlets for electricity. **" The voltage coming from the mains of your home is 220 volts, and it's very dangerous".**
parallel	**n.** (of electrical components or circuits) connected to common point at each end, so that the current is divided between them. **"Parallel circuits are made with two wires running side by side".**
proton	**n.** a particle in the nucleus of an atom, with a positive electric charge equal in magnitude to that of an electron. **"When protons and electrons are the same number in an atom, the atom is neutral".**

repulsion	**n.** a force which makes objects to move away from each other, e.g. through having the same magnetic polarity or electric charge. **" Two positive atoms and two negative atoms experience repulsion".**
search	**n.** try to find something by looking carefully and thoroughly. **"Electrons travel through the electric current searching for protons".**
series	**n.** (of electrical components or circuits) arranged so that the current passes through each component successively. **"A circuit in series has a continuous circle of wire with the components connected to it".**

switch	**n.** a device for making and breaking an electrical connection. **"We add a switch to electric circuits to be able to turn on and off the electric current".**
volt	**n.** the International System Unit of electric potential. **"A 9 volt battery is safe to handle, but the mains voltage is much higher and dangerous".**
wire	**n.** metal string, used for fencing, to carry an electric current, etc. **"If the wires aren't properly connected to the battery, your circuit won't work."**

ELECTRICITY AND MAGNETISM

Glossary

atom: n. the smallest particle of a chemical element, consisting of a positively charged nucleus surrounded by negatively charged electrons.
attraction: n. a force under the influence of which objects tend to move towards each other.
balance: n. a condition in which different elements are equal or in the correct proportions.
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volt: n. the International System unit of electric potential.

wire: n. metal string, used for fencing, to carry an electric current, etc.

KEY QUESTION CARDS

What are the parts of an atom?

What is energy?

How is an electron charged?

How is a proton charged?

How does a magnet work?

How can you build an electric circuit?

What types of electric circuits do you know?

What is a battery?

Does electricity pollute?

What is a magnetic field?

Which materials stick to a magnet?

How does attraction work in a magnet?

How does repulsion work in a magnet?

Can you give

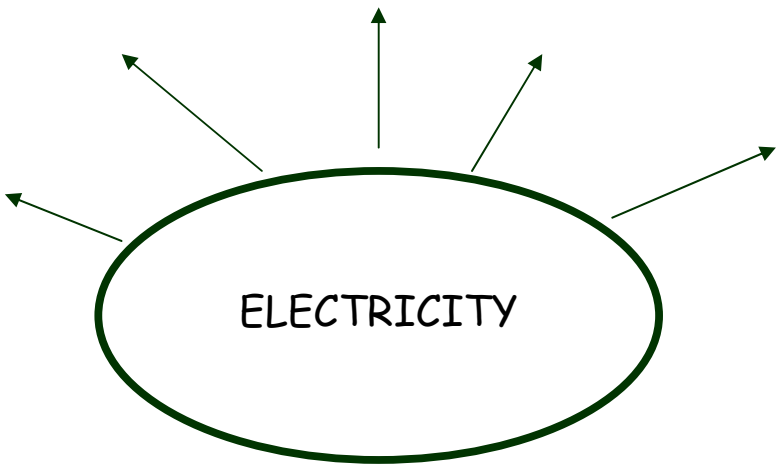
an example of static electricity?

an example of dynamic electricity?

What objects use electricity?

PRIOR LEARNING

Write 5 facts you know about electricity.
Add more arrows if you know more.



ELECTRICITY AND MAGNETISM: HANDS-ON ACTIVITIES

- Objectives
- Balloons: static electricity
- Electric Circuits: dynamic electricity
- Pictures of Magnetic Fields: magnetism
- Facts Sheet: Electricity and Magnetism; put it to the test.
- Record Sheet

Hands on Activity

Electricity and Magnetism:
Put it to the Test!

1. **Balloons: static electricity**
2. **Electric circuit: current electricity**
3. **Magnetic fields prints: magnetism**

The purpose of this activity is to prove right the facts sheet Electricity and Magnetism: Put it to the Test, by carrying out three experiments.
Every experiment should begin with the reading of this fact sheet, and it should end with checking if the experiment proves some of the facts. The survey sheet and record sheet can also be used with either activity.

- **Objectives: 1. To understand the properties of repulsion and attraction that rule electricity and magnetism. 2. To show understanding of what the electric current is and how an electric circuit works. 3. To learn that magnets produce magnetic fields and so does the Earth.**

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- Objectives
- Balloons: static electricity
- Electric Circuits: dynamic electricity
- Pictures of Magnetic Fields: magnetism
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- Record Sheet

Hands on Activity

Electricity and Magnetism:
Put it to the Test!

4. **Balloons: static electricity**
5. **Electric circuit: current electricity**
6. **Magnetic fields prints: magnetism**

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1. BALOONS

- **Before you start:** With this activity, the children will prove that objects can become electrically charged, and that this will produce an attraction or repulsion effect upon other objects. They will make a balloon move around following their hands but without touching, and they will see that two charged balloons will repel each other.

You will need:

- Two balloons of two different colours per group
- String or yarn to tie the balloons
- Sticky tape
- Two pegs per group
- A duster or wool cloth per group

Procedures: part I

1. Give each group two balloons, each of a different colour, two pieces of string or yarn, and two pieces of sticky tape.

2. Ask the children to inflate the balloons (not too much) and **tie a knot at the open end. Inflate both balloons to a similar size to make the test fair.**

3. Tie the string to the knots, and stick them separately to the table, so you don't have all the balloons rolling around the classroom.

4. Explain the children that they will test how the two balloons behave, after they rub one of them with the wool cloth but not the other. Write this question on the board: Will the two balloons behave the same way? Have children write the question and prediction on the experiment record sheet.

5. Ask the children to rub one of the balloons with the wool cloth, but not the other.

6. Now ask the children to move their open hand near the **balloon they didn't rub, but without touching it. Demonstrate if necessary (nothing should happen). Then ask them to do the same with the balloon they rubbed (the balloon should follow their hand and spin around as they move their hand.**

7. **Complete the record sheet.**

Procedures: part II

1. With drawing pins, tie a string from the back of one chair to the back of another chair (approximately 1 meter distance).

2. Hang the two balloons with the pegs.

3. Write this question on the board: Will the balloons behave the same way when I rub only one of them and when I rub both? Have the children write the question on record sheet.

4. Ask the children to rub only one balloon and write observations on record sheet (the balloons will attract each other).

5. Now ask them to rub both balloons and write their observations (the balloons will move away from each other).

6. Ask the children to hold their hand between both balloons, and write their observations (both balloons will be attracted to the hand).

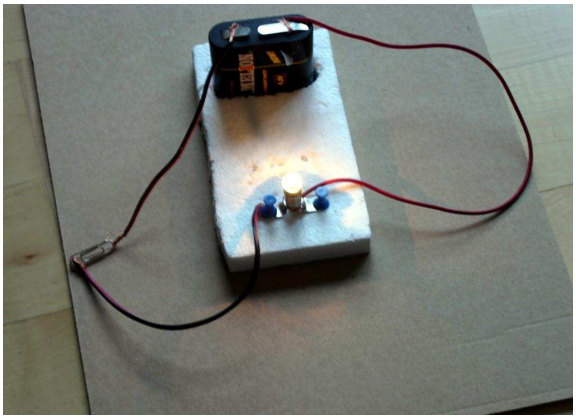
7. Have children write their conclusion on the record sheet.

2. ELECTRIC CIRCUIT

- **Before you start:** This activity will demonstrate how an electric circuit works, and what elements are necessary. The children will also see that electricity can produce light and heat (by touching the light bulb).

You will need:

- A 'D' battery or 9v battery per group
- Two pieces of insulated wire per group
- A cutter to strip the plastic off the end of the wire
- A 2.5 volts light bulb per group (have extra ones)
- A light bulb holder per group
- Two pins or screws to hold the bulb holder in place
- A Styrofoam plank or thick cardboard to make a base
- Sticky tape to fix the battery
- Diagram sheet per group



Procedures:

1. Write this question on the board: Will the light bulb light up?

2. Give each group a Styrofoam or cardboard plank (20cm x 10cm aprox) to make a base for the circuit. With blunt scissors, they can carve a bed at one end of the base for the battery, or stick it to the base with tape.

3. Give each group the rest of materials and diagram.

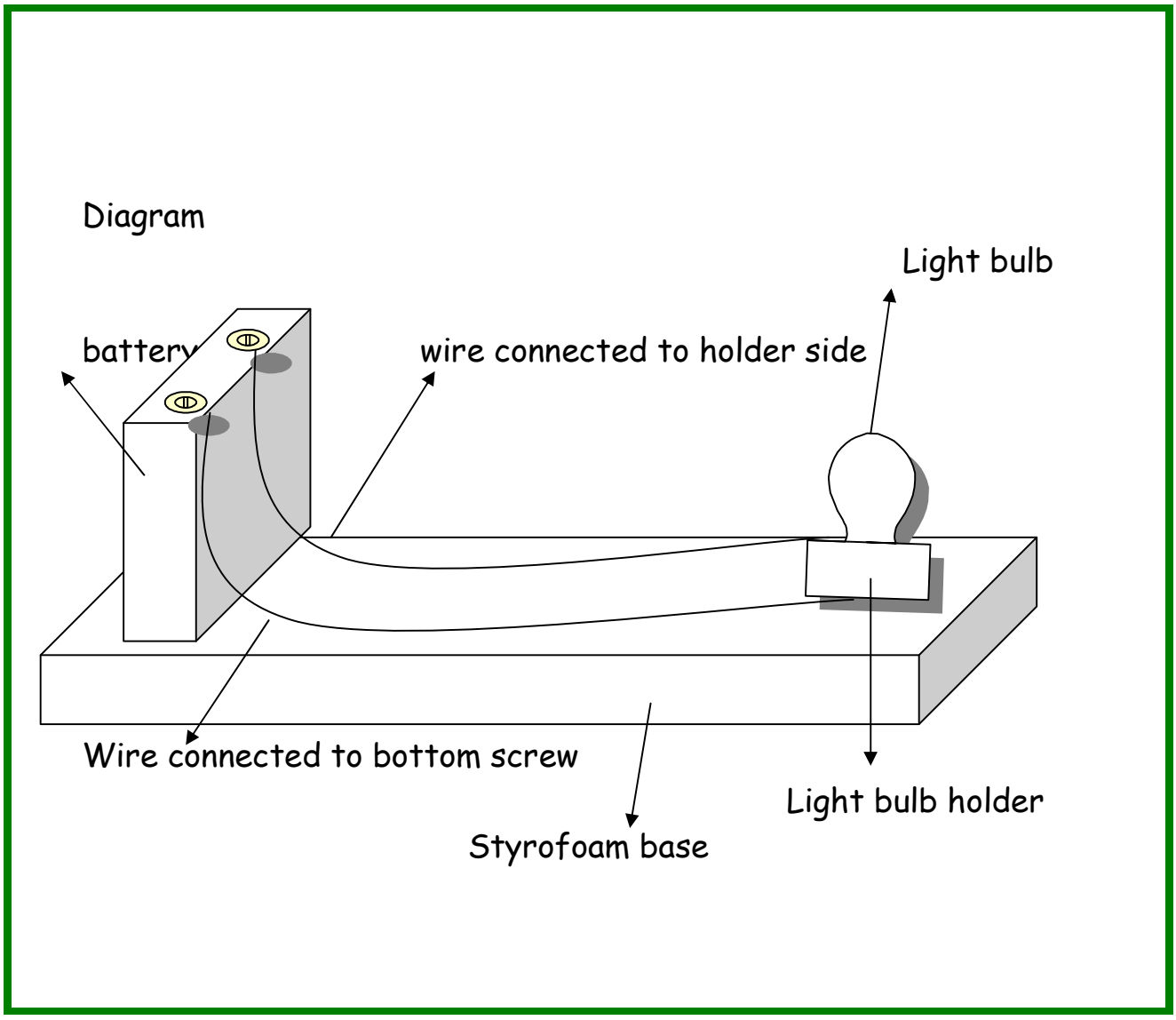
4. Tell the children to coil the stripped end of one of the wires around the screw underneath the light bulb holder, and to coil the other wire around the side of the light bulb holder.

5. Now have them pin the holder to the Styrofoam.

6. Ask them to complete the circuit. If they finish quickly, help them to add a switch using paper clips. You can add a second light bulb to the circuit too.

7. Have the children complete the record sheet, and draw a labelled diagram on the back of it.

Simple Circuit Diagram



3. MAGNETIC FIELDS PRINTS

- **Before you start:** This activity will show the children what magnetic fields look like and how they operate. With a shoebox and a bar magnet underneath, they will create magnetic fields prints out of iron filings.

You will need:

- The top of a shoebox per group, or a piece of card.
- A bar magnet per group (you can buy them at the hardware shop).
- A small zip-lock bag with iron filings per group (ask for the filings at a place where they cut keys, possibly the hardware shop where you are buying the magnets).
- An aluminium baking pan, tray, or similar per group.
- Sticky tape to stick the card to the aluminium tray or pan.

Iron filings under magnetic field

Procedures:

1. Write this question on the board: What does a magnetic field look like?

2. Give each group the aluminium tray, the shoebox top, the magnet and the iron filings.

3. Ask the children to place the magnet in the centre of the tray, and the cardboard on top of the magnet.

4. Warn the children that if they let the iron filings get in direct contact with the magnet, they will spend a whole week's playtime clearing the filings off the magnet…

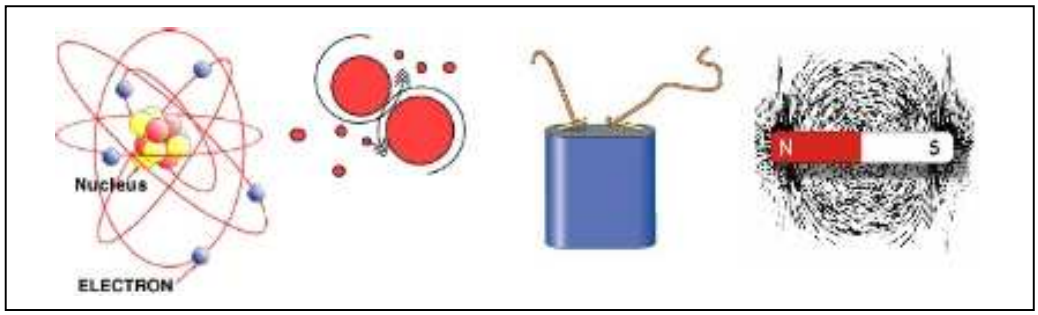
5. Tell the children to sprinkle the iron over the cardboard, to create a clear pattern. If necessary, remove the filings and try again until a clear pattern appears.

6. Ask the children to write their observations and conclusion on their record sheet, and ask them to draw a sketch of the magnetic fields on the back of the sheet.

Extension: have the children feel the magnetic field. Place one bar magnet on the aluminium tray, and ask the children to grab another magnet, place it above the one on the tray and move it slowly.

ELECTRICITY AND MAGNETISM

Put it to the test!



- **Electricity** is a type of energy. Energy is the capacity to do work. We use electricity for all sorts of works; get light in our homes, start the car, play music, watch television, and many more.
- **This is how electricity happens:** All matter is made out of incredibly tiny parts called **atoms**. Atoms have a **nucleus**, with neutrons, and protons. Neutrons are neutral, and **protons are positive**. Spinning around the nucleus, there is a cloud of tiny particles called **electrons, which are negative.**
- **Atoms like balance:** atoms like the same number of positive protons as of negative electrons. But electrons can move from one atom to another, creating an unbalance. When this happens, we say **there is a negative charge** in the atom that picked the new electron, and **a positive charge** in the atom that lost it.
- **Once the atom is negatively charged,** it will look for balance, and so the extra electron will begin to travel looking for a positively charged atom. **This is the electric current! Many electrons travelling in search of positive atoms.**
- In their search, **electrons will attract their opposite: negative and positive attract; positive and positive repel; negative and negative repel.**

- **Static electricity is** what happens when you rub an object against another, and one of them loses electrons and the other gains them. They will tend to stick together, to recover the balance in their atoms.
- **Electrons** travel well through **conductors**, and they find resistance in **insulators**. This is why the wires in an electric circuit are made of copper, but they are covered in plastic.
- **An electric circuit** needs a source of electricity, like the mains, or a battery, wires for the electric current to flow, and the device we want to make work; a light bulb, a motor, a buzz. All of it has to be connected.
- **The mains** get the electricity from a power station, and the current is very high (220 volts). This is a very strong voltage and it can kill a person, **so you mustn't experiment with this type of electricity**.
- **Batteries** produce electricity mixing chemicals, and they have a lower voltage. We can use them safely to learn how to make a circuit. **Batteries have a positive end and a negative end,** to allow the electrons (-) to flow in search of the positive end (+).
- **Magnetic attraction** is an energy that allows a magnet to pick up things made of iron or steel. Some rocks have this property naturally. These rocks produce a magnetic field, or area of attraction. The energy always flows from one end (pole) of the magnet to the other. Under this magnetic field, magnetized items will be attracted or repelled, depending on the pole they face, in a similar way to electricity.
- **The Earth is surrounded by magnetic fields**, and this is why a compass points north and south.

EXPERIMENT RECORD SHEET

Question: (What we want to test)

Procedures: (How we conducted the test)

Conclusion: (why)

ELECTRICITY: Go eco-logical. Read and understand.

Has there ever been a power cut in your house? Suddenly you can't watch your favourite cartoons, or play with your DS. There is no lighting to finish your homework, and your parents can't cook dinner in the electric cooker. Your brother can't listen to his mp3, or surf the net. The food in your freezer begins to thaw, and you can't wash your clothes in the washing machine. Your parent's mobile phone can't be charged, so it dies. Not a pretty prospect!

Yes, electricity is an extremely useful form of energy. It can give us light, heat, and motion. The lamp is an example of light electricity, the toaster is an example of heat electricity, and an electric fan is an example of motion electricity.

But is electricity clean energy or does it pollute the planet? When we use the car, we can see and smell the pollution, but when we turn on the lights, nothing bad seems to happen. This, however, does not mean that electricity is not polluting. Here is why.

The mains electricity that reaches your home, comes from a power plant. This is the place where electricity is produced. Most electricity is generated by burning coal, and by running nuclear plants. Coal is a fossil fuel, and it's non-renewable. Nuclear energy produces radioactive waste, which is very dangerous and cannot be recycled. Both energies pollute. So, every time you turn on the lights, you are creating a bit of pollution.

Now, are there any solutions to the problem?

Governments around the world are making an effort to promote other sources of energy, such as solar power and wind power. Hydro (water) energy is used to produce electricity whenever possible. Spain is a leading country in the use of wind power to generate electricity. Don Quijote would be only too happy to confront the new giants!

At home, there is also a number of things we can do to save on electricity. You can use fluorescent lights instead of regular light bulbs, which use less electricity to do the same job. You can make sure your heating is off before you leave the house, and use a ceiling fan instead of air conditioning in summer. Dry your clothes in the clothesline or laundry rack instead of using a drier, and if your fridge is older than 2001, it will be using up a lot more electricity than a new one.

All these things will not only help the environment, but also your pocket, since your electrical bill will be significantly reduced!

ANSWER THESE QUESTIONS

1. Name some household appliances that use electricity.

   _____

   _____

2. How is most electricity generated?

   _____

   _____

3. What are some alternative energies to produce electricity?

   _____

   _____

4. What is the problem with nuclear energy?

   _____

   _____

5. Name some ways in which you can save electricity at home.

   _____

   _____

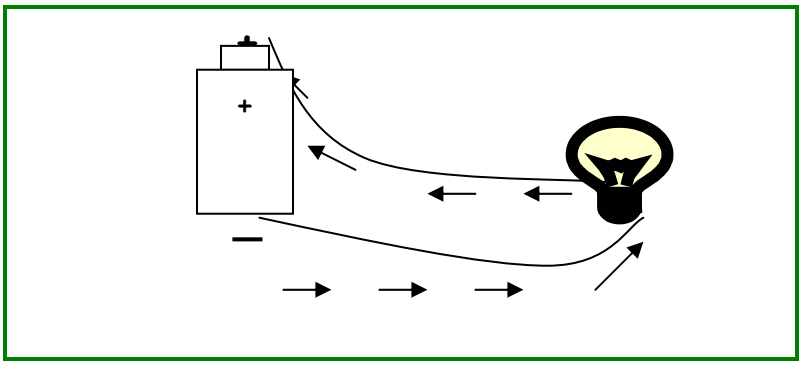
ELECTRIC CIRCUITS II

Using ELECTRIC CIRCUITS I, say if the following sentences are true or false. Write T for true, and F for false.

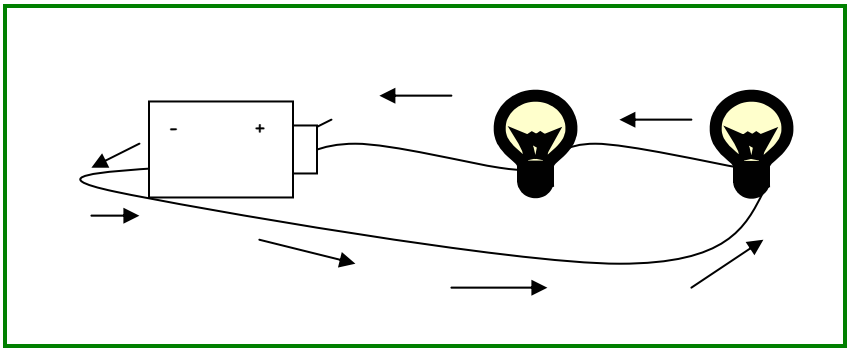
- A parallel circuit consists of a battery, a light bulb, and a wire. __
- Batteries in a series increase the voltage. __
- In a series circuit, you have more than one device connected to a continuous circle of wire. __
- In a parallel circuit, when a light bulb goes out, the rest of the light bulbs will go out too. __
- In a parallel circuit, the electricity flows from the positive end of the battery. __
- In any circuit, the electricity flows from the negative end of the battery to the positive end. __
- In a series circuit, when a light bulb goes out, the rest of the light bulbs will go out too. __
- In a parallel circuit, there are two wires running side by side. __
- A circuit can only work when all the parts are connected. __
- What flows in an electric circuit are electrons searching for protons. __

ELECTRIC CIRCUITS I

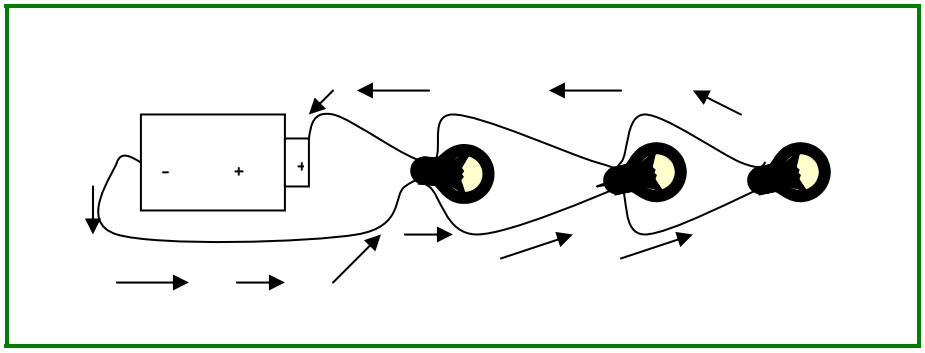
- ***A simple circuit*:** consists of a battery or electricity source, the device we want to make work, like a light bulb, and a wire that connects the positive and negative ends of the battery to the device.



- ***A series circuit*:** When you have more than one device connected to a continuous circle of wire, for example two light bulbs. The electricity must travel through everything in the circuit before it returns to the battery. When one light goes out in a series circuit, the other lights go out too.



- **Parallel Circuits:** are constructed with two wires running side by side. When one light goes out in a parallel circuit, the other lights remain illuminated.



- **Batteries in a series:** are two or more batteries connected to make a circuit. The negative electrode of one battery is connected to the positive electrode of the next battery. Batteries in a series will increase the voltage (there will be more electricity flowing).