

## 6.1 Lessons on Electricity?

### Lesson 1 What is Electricity

Start by connecting a battery to a small light bulb or LED with three wires and a switch.

To make the circuit, you need to make a circle so that the wires, switch, bulb and battery all fit in that circle.

Electricity flows around the circle starting from the battery and finishing at the battery.

Of course the switch must be closed to work.

*Q. What is moving through the wires to make the light work?*



### Electrons

You need to start with the understanding of electrons inside atoms.

All materials are made up of atoms (very small particles) with a spinning electron inside. (A bit like a satellite spinning about the earth).

*Q. Draw a picture of an atom.*

There are millions of electrons moving through a wire when electricity flows.

The way they move around a circuit can be shown with a simple simulation using the teacher as the battery (or student) and a group of 6 students as atoms of the wire.

### Simulation:

- Have students sit in a circle with the teacher.
- Give each student a tennis ball.
- With two hands - left one empty to receive and the right one with ball ready to pass.
- The teacher starts by passing his/her ball to the student on the right. When the person on right receives that ball in his/her left hand, he passes the one in his right hand onto the next person and then the ball in his left hand to his right hand and repeat this.
- Keep doing this for at least 2 minutes.
- The teacher now fakes tiredness and says, "I'm flat!"

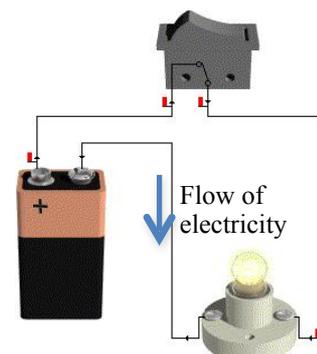
Explain that the students are atoms in a wire, the balls are electrons inside the atom and the teacher is the battery (starts the energy and keeps it going, but eventually gets all used up.)

### Simple Definitions:

#### Batteries

Store energy. They have a positive and a negative end. Electricity flows from the negative to the positive.

Energy is converted to electricity when materials are connected to the ends of the battery. Energy is measured in Volts. More volts means more power, not longer life. The quality and size of a battery determines its life. (You could relate this to the simulation



where the teacher who is the battery passes two balls at a time instead of one showing a battery with a larger voltage).

*Q Find a battery and write down its voltage.*

*Q Also how do you know which end is positive and which is negative?*

### **Conductors and Insulators**

Materials connected to a battery are good at letting electricity through, such as metal wires like copper and steel. These are called conductors.

Some materials, such as plastic and rubber, don't let much electricity through at all. These are called insulators. (You could relate this to the Simulation Model where metals pass the ball on quickly but plastic etc. hold the balls tight so it goes through very slowly.)

Wires often have a plastic covering because the plastic protects people from being electrocuted by the electricity in the wires.

*Q Why do electricians wear rubber gloves and rubber soled shoes?*

### **Electrical Converters**

These are devices that use up the electricity and convert it into a useful energy.

Can you name some?

e.g. heat (**heater**)    sound (**loud speaker**)    light(**lamp**)    movement (**motor**)

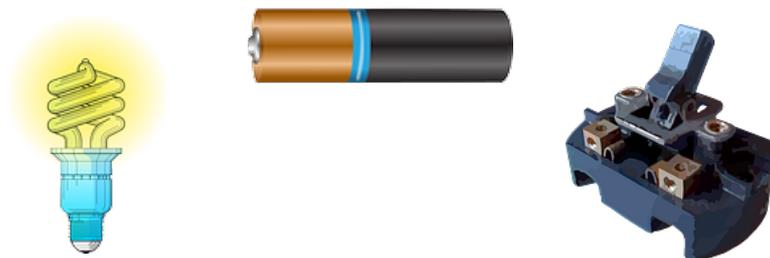
## **Lesson 2 Electric Circuits**

Electric circuits are like running tracks and the electrons are the athletes. It starts at one place and finishes at that same place. You can think of electricity as electrons going around a circuit which has energy draining devices that use up the electrons energy. So when the electrons get back to the start, they need more energy. This energy is given by the battery, so they can go around again (Like a drink station in a race). More energy for the electrons can be made by having more batteries.

Electrons need a clear path to go through. If there is a break or blockage anywhere, they won't be able to move. In fact it stops all of them like a traffic jam! Remember there is millions of them moving together.

So if you have a switch turned off or a broken wire, nothing will move, no electricity anywhere because everything is stopped (a massive traffic jam).

*Q. For the circuit shown, label the battery, the switch and the light bulb and draw in wires to make them all conduct electricity to turn on the light bulb.*



**Note: Electricity will only flow through wires and devices, if there are no breaks!**

*Do Investigations: 6.2 Making a Simple Torch 6.3 Investigating electric circuits*

## Lesson 3 Safety with Electricity

*Start with handing out the 6.4 "Are you safe at home investigation?"*

Some questions may have to be homework.

**Because electricity is very dangerous there are some very important rules and precautions we need to take:**

*(Reference [ausgrid.com.au](http://ausgrid.com.au) and [energex.com.au](http://energex.com.au))*

### ***Outside***

1. If you fly a kite and it gets caught in the overhead powerlines, live electricity could travel down the string and seriously hurt you. So don't fly kites near power lines and in storms.
2. Never climb a tree that is near powerlines. Look up before you climb.
3. After a storm if you see some fallen powerlines, stay well clear of them. There is a strong chance they are still "alive".
4. Never touch any electric devices with wet hands and stay out of the pool during storms.
5. Stay away from electricity substations.
6. Don't dig deep in the yard until your parents have checked where the underground cables are.

### ***Inside***

1. Never put a metal object, like a knife into a toaster. It is very dangerous!
2. Never put anything in a power point that's not meant for it. Electricity will travel right up the metal object into your body.
3. Don't touch electrical appliances that are on with wet hands.
4. Never have any electric appliances in or near the bath.
5. If an electrical appliance is faulty turn it off immediately.
6. It's illegal for anyone to try to repair or install electrical appliances and switches that use household electricity (240AC voltage) unless they are a qualified electrician.
7. Don't stack or piggyback power points or double adaptors. These can overheat and cause fires.
8. Keep electrical appliances clean.
9. Always turn appliances off at the wall before removing the plug.
10. When using extension leads, do not take them through doorways as a door closing on a lead can cause damage. Protect them from the weather and water, and ensure the lead is fully unwound to prevent overheating.
11. When purchasing second-hand appliances, always check for an "electrically safe" label.

*Discuss the above and finish with each student drawing a poster to warn people of one of these rules.*

## **Extension Lessons for Robotics**

*Use 6.9 Robotics Unit 1 Presentation for Introduction To Robotics and Control.*

*Do 6.10P Investigating Control Circuits (using the LEGO NXT or similar)*