S3 Physics. Lesson 2. Electric circuits

If you are continuing with Physics into S4 it will be assumed that you have worked through these lessons. It is important to do so as, depending on when we return to school, you may have less class time than usual in S4 to cover the course.

These first lessons are in part revision of electricity work which you will have done in S2. It is important that you fully understand the basics before we take electrical theory further. (It is a bit more difficult when we cannot actually make up the circuits!)

Read the following pages 1 to 3:

Electric Current (the letter I is used for this quantity when it appears in a formula).

An electric *current* is a flow of electrons (or often referred to as a flow of charge) around a circuit.

Electric current is measured in amperes, A, (usually just called *amps*) using an ammeter (words amp and meter run together). The ampere is named after Andre-Marie Ampere (1775-1836), a French physicist and mathematician.

Symbol for an ammeter

Conductors and insulators

Materials which allow electrons to move through them easily are called conductors. *Metals* ***are conductors and also carbon in the form of graphite***. Copper and gold are particularly good conductors. Most wires are made of copper.

Materials which do not allow electrons to move through them easily are called insulators. ***Non-metals are insulators*** such as glass, plastic, wood and air.

Voltage (the letter V is used for this quantity when it appears in a formula).

Electricity is a form of energy (electrical energy). *Voltage* is a measure of this energy. (Voltage is sometimes referred to as *potential difference*.)

Voltage is a measure of the energy supplied to a circuit by a battery or the mains supply, and it is also

a measure of the energy used up in an electrical component (e.g. a bulb).

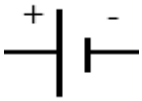
Voltage is measured in volts, V, using a voltmeter. The volt is named after Alessandro Giuseppe Antonio Volta (1745-1827), an Italian physicist and chemist and inventor of the first electric battery.

Symbol for a voltmeter

Some types of electrical supply

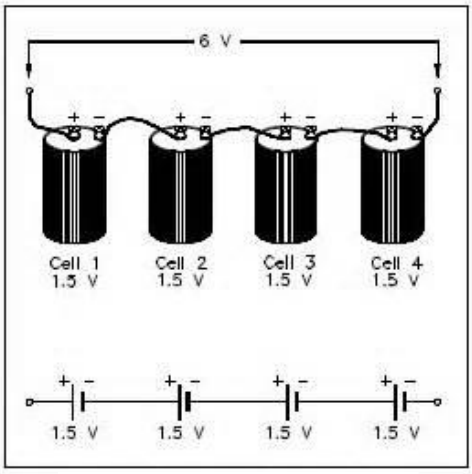
1. **Cells**. These transform chemical energy into electrical energy. They usually have a voltage of 1.5V – this is the voltage produced when the chemicals react.

Examples of cells (in everyday language we might call these 'batteries' but scientifically speaking, if they are '1.5V', they are cells.):

Symbols for a cell: 

or 

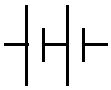
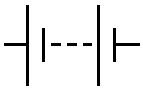
2. **Batteries**. A battery is made by connecting a number of cells together in series to create a higher voltage, e.g. a 6V battery is made by connecting together 4 cells of 1.5V each.



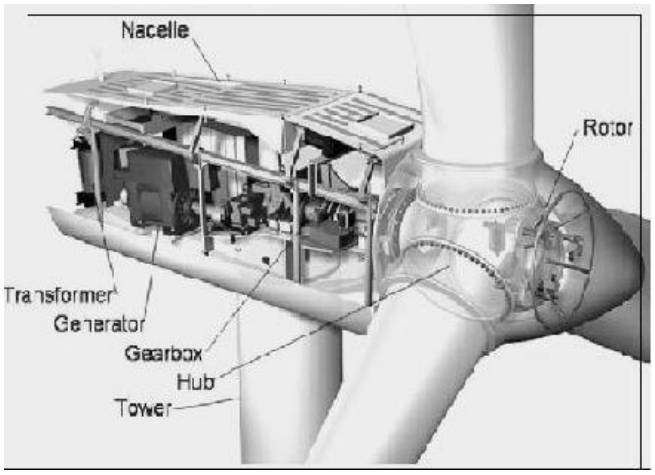
A 6V battery is made by connecting four 1.5V cells together

9V battery

12V car battery

Symbols for a battery: 
or 

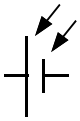
3. **Generators** at power stations, dynamos and alternators in cars are all machines that transform kinetic energy into electrical energy. They do this by turning magnets inside coils of wire.



Generator in wind turbine

Car alternator

4. A **Solar cell** (or photovoltaic cell) changes light energy into electrical energy.



Solar cell symbol

Copy the following note and fill in the blanks into your jotter (or onto a sheet of paper or Word file on ipad):

Electric Circuits

Electric current, I

Electric current is a flow of _____ (charge) around a circuit. It is measured in amps, A, using an _____.

Conductors and Insulators

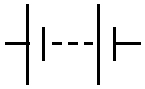
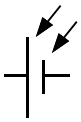
_____ are materials which electrons flow through easily. _____ are good conductors.

_____ are materials which do not allow electrons to flow through them. Non-metals are insulators.

Voltage (or potential difference), V

Voltage is a measure of the _____ in an electric circuit. The voltage of a supply is a measure of the energy given to the circuit. The voltage over a component in the circuit is a measure of the electrical energy used in the component. Voltage is measured in volts, V, using a _____.

Copy the following table into your jotter/sheet of paper/ipad:

Circuit component	**Symbol**
Ammeter	
Votmeter	
Cell	
Battery	
Solar cell	
Bulb	
Resistor