

Paper Circuit

**Curriculum
Levels 5-6
Science**

Activity Description

Students will make a simple electric circuit using the Paper Circuit House template, a light emitting diode (LED), a resistor and a coin battery. The School-gen Paper Circuit House template illustrates a solar PV powered house that generates electrical energy during the day and can be used to run household appliances such as lights. The activity is targeted at students doing Level 5-6 Science and incorporates the 'Physical World' strand.



Teaching rationale

Students will:

- Learn about electrical circuits, how to make one, how they work and the principles behind them

Curriculum Links

SCIENCE	Level 5-6 Achievement Objectives	Specific Learning Outcomes
Physical World	<ul style="list-style-type: none"> • Physical inquiry and physics concepts • Identify and describe the patterns associated with physical phenomena found in simple everyday situations involving movement, forces, electricity and magnetism, light, sound, waves, and heat. For example, identify and describe energy changes and conservation of energy, simple electrical circuits • Using physics • Explore a technological application of physics 	<ol style="list-style-type: none"> 1. Make a simple electrical circuit on the supplied paper template 2. Identify the battery as the energy source of the circuit 3. Identify the LED as the transformer of electrical energy into light energy 4. Describe LEDs as being the most energy-efficient form of electric lighting (about 10 times more efficient than incandescent) 5. Identify the copper tape as the conductor of electrical energy (current) in the circuit 6. State the physical properties of copper metal which make it fit for purpose (conductivity, ductility, malleability) 7. Identify the switch as having two states on and off (and representing generation state of solar panels tied to diurnal cycles) 8. Identify the resistor as a regulator of current in the circuit (too much would destroy the LED and flatten the battery). 9. Describe solar panels as only generating electricity during the day through the transformation of radiant energy into electrical energy. 10. Describe electrical current as being the flow of electrons around the circuit. 11. Describe voltage as the amount of energy carried by the current

Useful topic background

- Electrical circuits underlie virtually all modern technologies from toasters to televisions, cars and computers. Electricity is the pre-eminent modern energy source as it can be generated in power stations and transported thousands of kilometres through power lines, or it can be generated in smaller quantities on-site using solar PV panels and other micro-generators (see Supporting Resources below). Storage of electrical energy is also becoming more economically viable with the rise of electric cars and cheaper battery storage.

The Paper Circuit House demonstrates that an electrical circuit requires:

- An energy source (in this case the coin battery but it could be a solar cell)
- An energy transformer - in this case an LED transforms electrical energy into light energy
- A conductive path to allow the energised electrons to flow around the circuit (copper metal is a very good conductor) back to the start
- Energy control - the switch to turn it off and on, and the resistor which makes sure not too much energy flows from the battery into the LED

Other connected facts:

1. Copper belongs to a family of elements known as metals
2. Metals have physical properties like malleability, durability, reflectivity, conductivity etc.
3. Metals like copper are very good conductors of electricity
4. Electrical current in circuits is a flow of electrons
5. Electrons are negatively charged bits of matter that occupy the outer space of atoms.
6. Resistors restrict the amount of current that can flow in the circuit.
7. LEDs transform electricity into light (in a very efficient way)
8. LED's are a kind of diode.
9. A diode is an electronic component that only allows current to flow in one direction (and blocks it from the other direction)
10. Vinegar contains diluted acetic acid which reacts with the tarnished copper to make a compound called copper acetate which is soluble in water.

Running the activity

- See 'How to Make a Paper Circuit House' video and steps on schoolgen.co.nz.
- Print out the Paper Circuit House template
- Purchase copper tape, LED and resistors (Note cost per circuit is low when doing it as a group)

Extending your students

- Make your own paper circuit that will switch between two appliances (LEDs)
- Make your own battery to power the circuit
- Use a small solar panel to power a paper circuit

Supporting resources

- View the solar graphs on schoolgen.co.nz.
- See the Solar energy for all your energy needs (Level 5 poster) on schoolgen.co.nz.
- Learn more about renewable energy by making a hydro turbine or wind turbine on schoolgen.co.nz.