



Ohm Comforts



Oh no! You come home from work to discover there is no electricity! Its winter and the days are getting short. You need to rig up some form of lighting so you can see what's gone wrong (or at least find your mobile to call the electricity company!). Luckily, you have items about the house to help you do this.....

Alessandro Volta was a 19th Century Italian scientist. He made the first true cell that gave a controlled current. This was an electro-chemical cell. He realised that if you have two metals (**electrodes**), separated by a liquid (an **electrolyte**), electrical energy is produced as a result of a chemical reaction between the electrodes and electrolyte. Volta used paper soaked in salty water sandwiched between circles of zinc and copper for his cell - and piled many layers up to make a battery which is known as the **Voltaic Pile**.

How do these cells work?

There is a chemical reaction between two different types of metal electrodes and the electrolyte that connects them. Electrolytes include salty water and acids (like in car batteries). Metal electrodes pass electrons to each other through conducting wires if they are connected in a circuit. Some metals give energy away more easily than others. The electrolyte completes the circuit. This means we have a voltage because the electrical energy is flowing.

Different combinations of metal electrodes will give different voltages. Even different sizes of the same metals used will affect the voltage. The electrolyte may also affect the voltage produced. The number of cells joined together is the final factors that will affect your voltage output.

After having a look around the house, you have gathered the following equipment together:

Paper towels, selection of coins, salt, water, a lemon; a lime, an orange, a potato, a tomato, various strips of different metals, a selection of light bulbs, crocodile clips, connecting wires, a voltmeter.

Your task is to make two kinds of cells (or batteries) - a **voltaic pile** and a **fruit battery**. You will need as bright a light as possible to find the fault in the house, so you need to provide as much electrical energy to the lamp as you can. Use the voltmeter to measure the voltage from your 3 best combinations of cells/batteries. Complete the table below.



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Fruity batteries

1. Experiment with different combinations of electrode and electrolyte to find the cell that produces the highest voltage. You should work methodically and only change one variable at a time. Why is this important?
2. When you have found the best combination of fruit and electrodes, complete a table in your book to show the results from your 3 best combinations:

Highest voltages produced from electrode and electrolyte combinations

Fruit/vegetable used	Electrodes used	Voltage (V)

Voltaic pile

3. Experiment with different combinations of metals to find the battery that produces the highest voltage. Again, make sure you only change one variable at a time to help you work out the best combination.
4. When you have found the 3 best combinations of metals, complete the table to show your results:

Highest voltages produced from different metal combinations

Combination of metals	Voltage (V)

5. For each of the batteries/cells, explain how you could increase the voltages produced. Now try out your ideas and make a record of whether they worked.
6. What energy change takes place inside the batteries when they are operating?
7. Your batteries will eventually stop working. Explain why.

Homework/Extension

Find out how the following people were involved in the discovery and development of batteries:

- Ω Benjamin Franklin
- Ω Luigi Galvani
- Ω William Cruickshank
- Ω John Daniell

Describe their observations, experiments, problems encountered and how they were overcome.