
Volta's Experiment — How It Works (Version 1.0)

Young Einstein Science Kits

Ages 7+

1. Introduction

This kit recreates **Alessandro Volta's 1800 discovery** that electricity can be produced chemically using two different metals and a salty liquid. Pupils build a real working **galvanic battery** using copper, zinc, and saltwater — the same principle behind every modern battery.

Designed for **KS2–KS3**, this activity supports science lessons, STEM days, clubs, and home learning.

2. The Science Behind the Experiment

2.1 Chemical Electricity

Volta discovered that electricity can be made when **two different metals** are placed in a salty or acidic liquid.

This creates a **chemical reaction** that pushes electrons from one metal to the other.

- Zinc releases electrons
- Copper receives electrons
- Saltwater allows ions to move between them

This flow of electrons is **electric current**.

2.2 Why Two Metals Are Needed

Different metals hold onto electrons with different strengths.

- **Zinc** gives up electrons easily
- **Copper** holds electrons more tightly

When connected through the salty water, electrons move from zinc → copper, creating a **voltage**.

This difference in electron “pull” is called **electrode potential**.

2.3 What Happens Inside Each Cell

Each test tube in your kit is a **single battery cell**.

Inside each cell:

- Zinc metal **loses electrons** (oxidation)
- Copper metal **gains electrons** (reduction)
- Saltwater allows ions to move so the reaction can continue
- Electrons travel through the wires to the LED or voltmeter

Only **electrons** move through the wires.

Protons and neutrons stay tightly packed in the nucleus and do not take part.

2.4 Adding Cells Together

One cell produces a small voltage.

When you connect **four cells in series**, the voltages **add together**.

This is why your kit can produce enough power to flash a bright red LED.

This is the same principle used in:

- AA batteries
 - Phone batteries
 - Electric car battery packs
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2.5 Real-World Applications

Volta's discovery led directly to:

- Batteries
- Electrochemistry
- Portable electronics
- Early telegraphs
- Modern rechargeable systems

Every battery today still uses **two different materials** and a **conductive liquid or solid** to move ions.

3. What Pupils Will Learn

Pupils will understand:

- How electricity can be created chemically
- Why two different metals are needed
- How electrons move through a circuit
- How ions move through the liquid
- How battery cells add together to increase voltage
- How Volta's discovery links to modern batteries

A printable **Pupil Worksheet** is included.

4. Curriculum Links (KS2–KS3)

KS2

- Electricity: simple circuits, current, components
- Materials: metals, conductivity
- Working Scientifically: prediction, observation, recording

KS3

- Chemical Reactions: oxidation and reduction
 - Electricity: current, voltage, series circuits
 - Energy: chemical → electrical energy transfer
 - Scientific Enquiry: variables, fair testing, data interpretation
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5. Enquiry-Based Learning Sequence

Predict — What will happen when the metals are placed in salty water?

Observe — Watch the voltmeter reading or LED behaviour.

Test Variables — Metal type, salt concentration, number of cells.

Explain — Use electron movement, ion movement, and energy conversion.

6. What's Inside the Kit

- Copper plates (x4)
 - Zinc plates (x4)
 - Test tubes with screw caps (x4)
 - Salt for making electrolyte
 - Connecting wires
 - LED with spade connectors
 - Voltmeter (no batteries required)
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7. Age & Safety Guidance

Designed for ages 7+ with normal classroom or home supervision.

All components are safe for handling, and the activity uses low-risk materials and simple circuits.

Caution: Contains small parts. Individuals with pacemakers or implanted medical devices should avoid close, prolonged contact with magnets (if used in extensions).

8. Extension Activities

- **Stronger Electrolytes** — Test lemon juice, vinegar, or salty water
 - **Metal Combinations** — Try different metal pairs
 - **Series vs Parallel** — Compare voltage and brightness
 - **Electroplating** — Explore how metals can coat each other
 - **Battery History** — Research Volta, Galvani, and early telegraphs
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9. Historical Timeline

1790s — Galvani observes “animal electricity”

1800 — Volta builds the first chemical battery

1830s — Telegraphs powered by voltaic cells

1850s — Daniell and Leclanché cells improve stability

1900s — Dry cells and rechargeable batteries

Today — Lithium-ion batteries power modern devices

10. Summary

This kit gives pupils the chance to build a real working battery using simple materials. They learn how chemical reactions can produce electricity, how electrons and ions move, and how modern batteries evolved from Volta's original design.

Includes:

- Full Teacher's Guide
 - Printable Pupil Worksheet
 - Clear safety notes
 - Extension activities
 - Curriculum alignment
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