8th Class

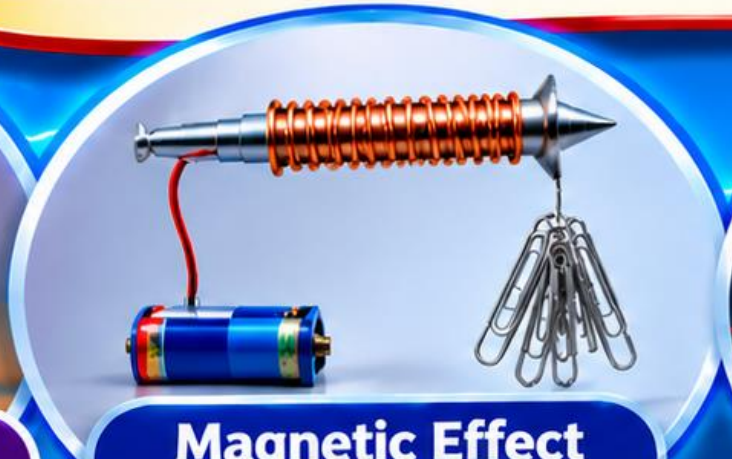
Chapter – 6

Effects of Electric Current

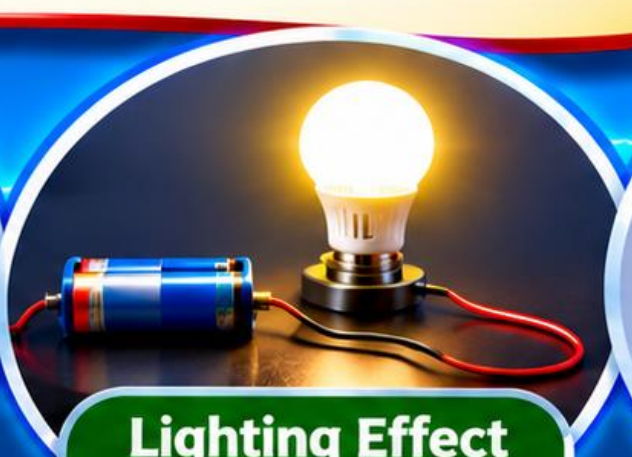
Physical Science



Heating Effect
(e.g., Nichrome Wire)



Magnetic Effect
(e.g., Electromagnet)



Lighting Effect
(e.g., Electric Bulb)



Chemical Effect
(e.g., Electrolysis)



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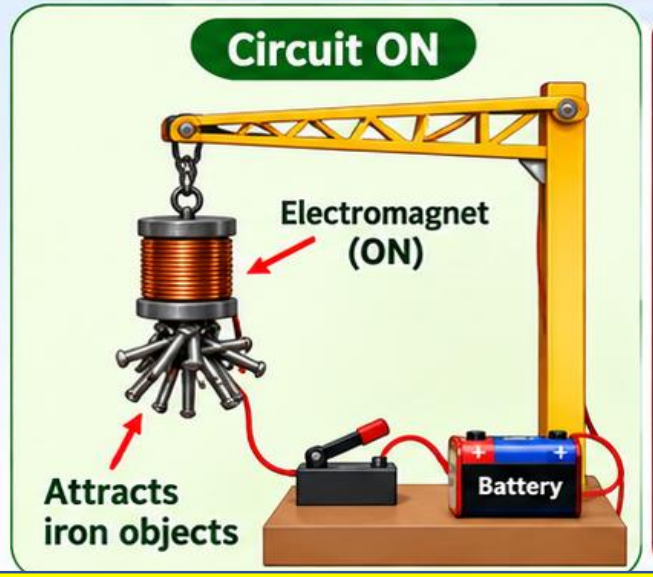
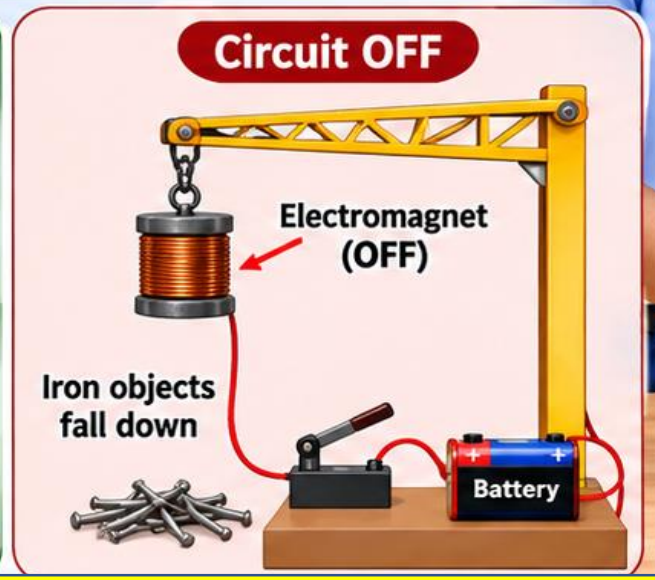
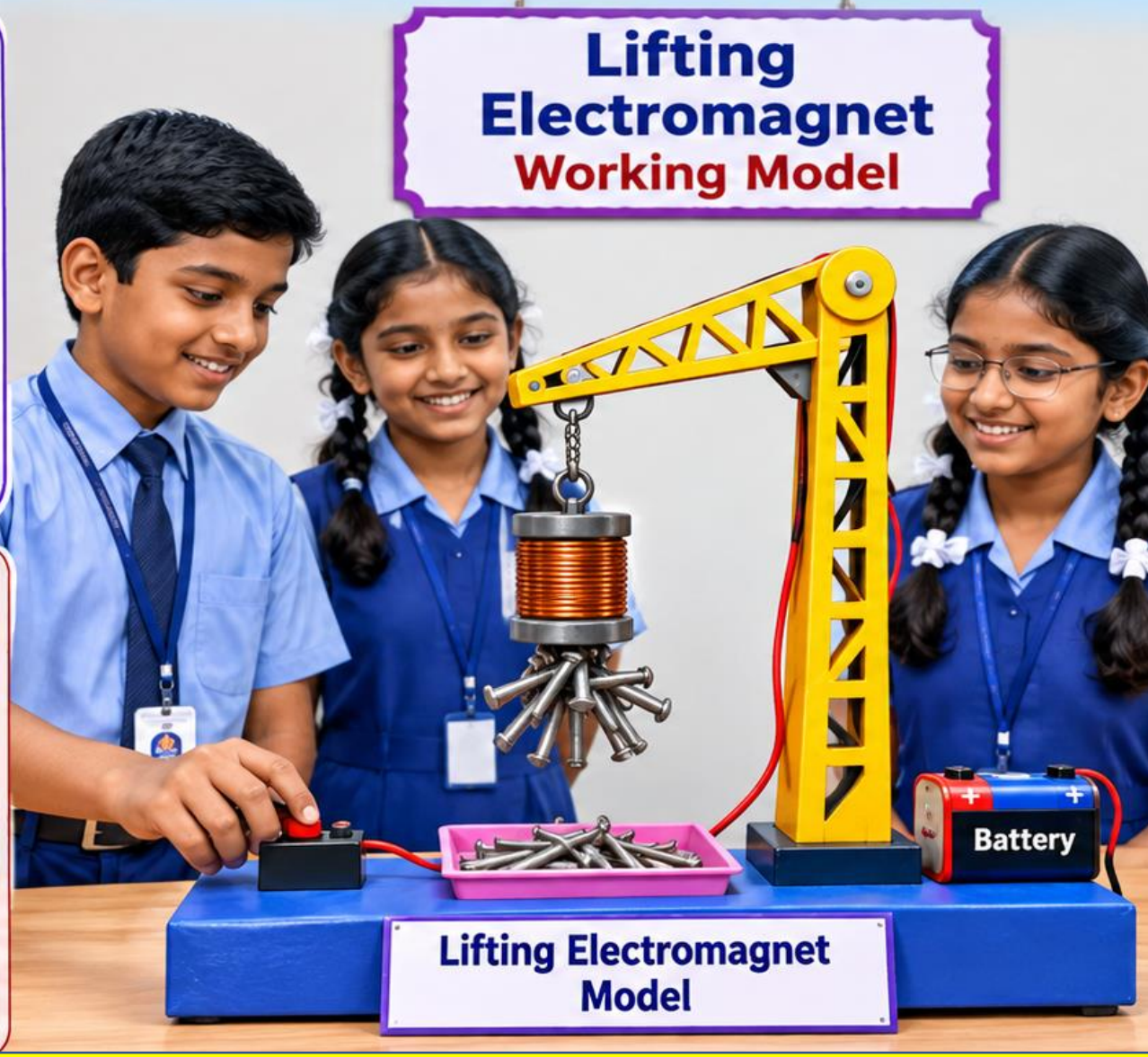
Visit: srini science mind

Science Exhibition – Lifting Electromagnet

- A school science exhibition displays a working model of a **lifting electromagnet**.
- A coil of wire is connected to a battery.
- When electric current flows through the coil, it produces a **magnetic effect**.
- The electromagnet **attracts iron objects**.
- When the circuit is opened, the magnetic effect **disappears**.







Does Electric Current Have a Magnetic Effect?

- Electric current flowing through a conductor produces a magnetic effect.
- This effect can be detected using a magnetic compass.
- A compass needle changes its direction when placed near a current-carrying wire.
- This phenomenon is called the **magnetic effect of electric current.**



(a)

(a) Circuit open (current **not flowing**)



(b)

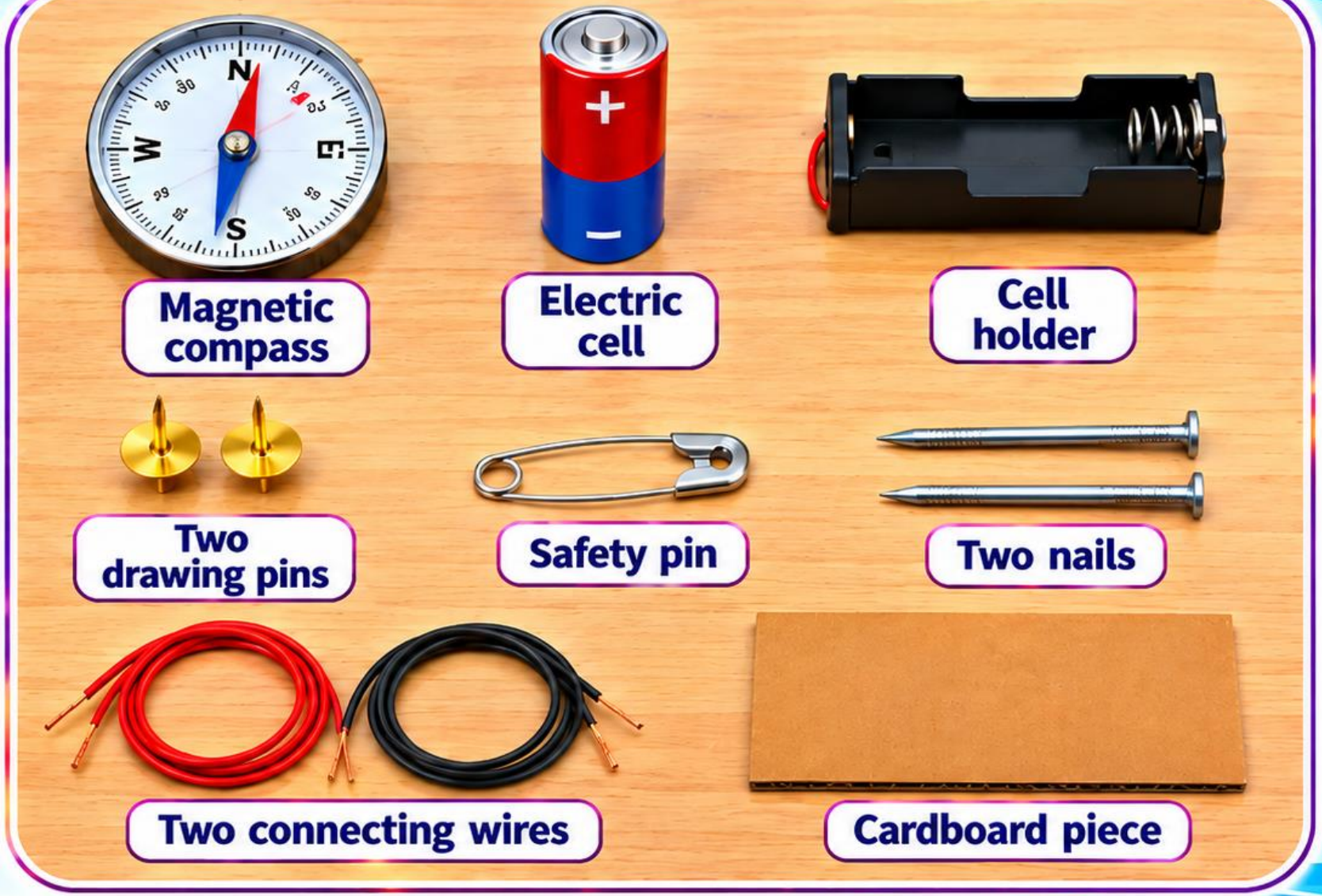
(b) Circuit closed (current **flowing**)

Key Concept: The deflection of the compass needle shows that electric current has a **magnetic effect.**

Activity 4.1 – Materials Required

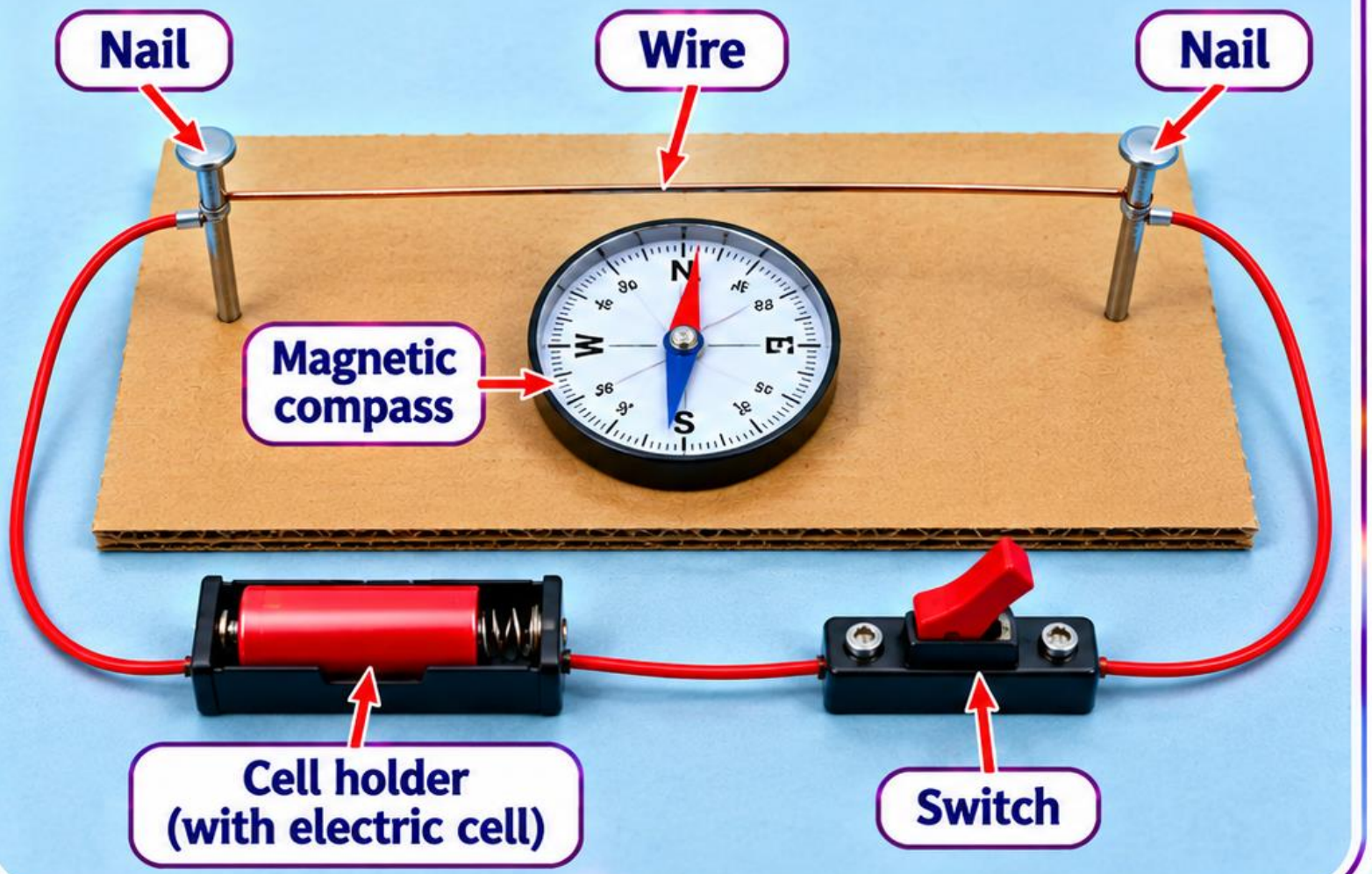
Materials:

- Magnetic compass
- Electric cell
- Cell holder
- Two drawing pins
- Safety pin
- Two nails
- Two connecting wires
- Cardboard piece



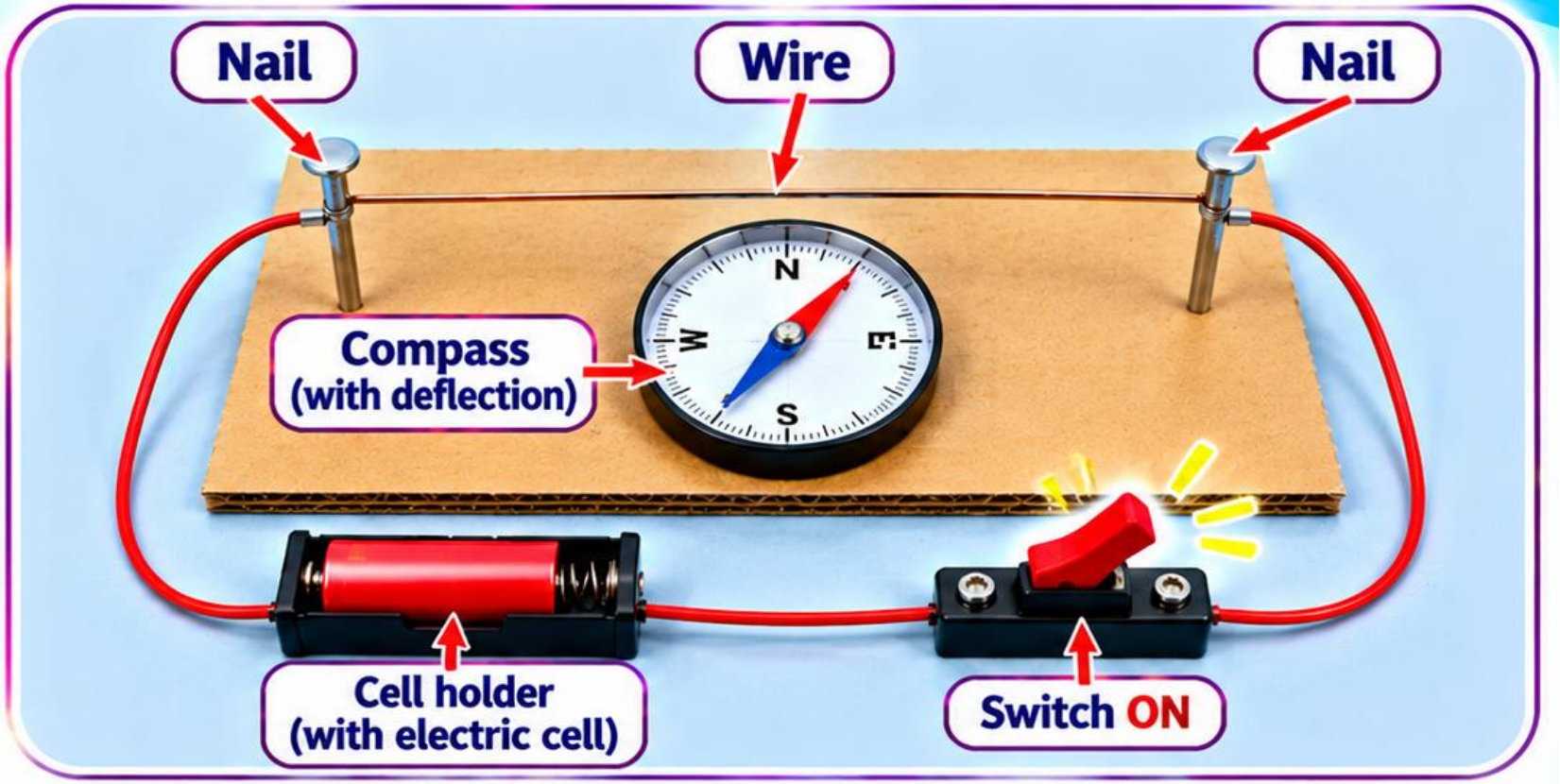
Activity 4.1 – Experimental Setup

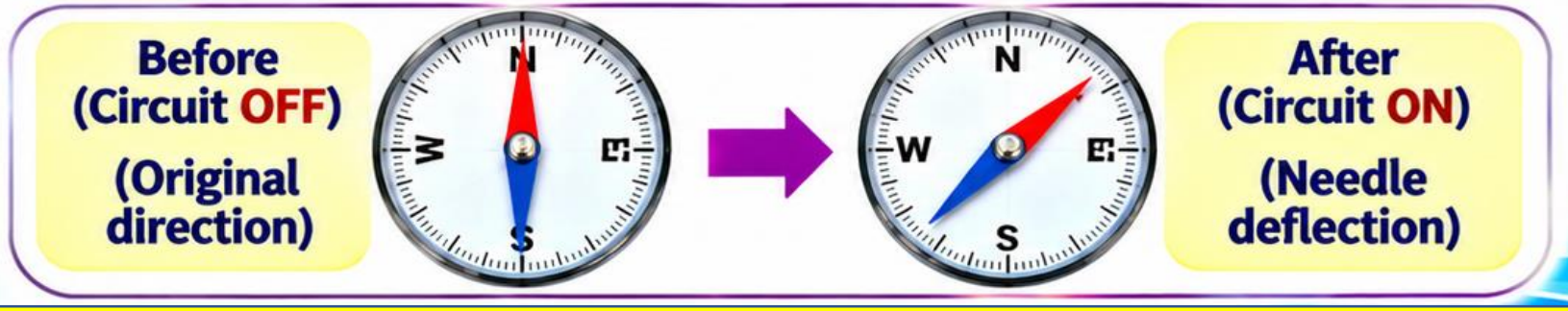
- Fix two nails on a cardboard piece.
- Stretch a wire between the nails.
- Connect one end of the wire to the cell holder.
- Connect the other end through a switch.
- Complete the circuit.
- Place a compass beneath the wire.



Observe the Compass Needle

- Place the compass beneath the wire.
- Switch **ON** the circuit.
- Observe the compass needle.
- The compass needle **deflects** from its original direction.
- This indicates that the current-carrying wire produces a **magnetic effect.**





What Happens When the Switch is OFF?

- Open the switch.
- Electric current **stops flowing** through the wire.
- The compass needle **returns** towards its original direction.
- The magnetic effect **disappears** when current stops flowing.

Switch ON (Current flows)



Switch ON:

The compass needle deflects (shows a magnetic effect).

Switch OFF (No current)



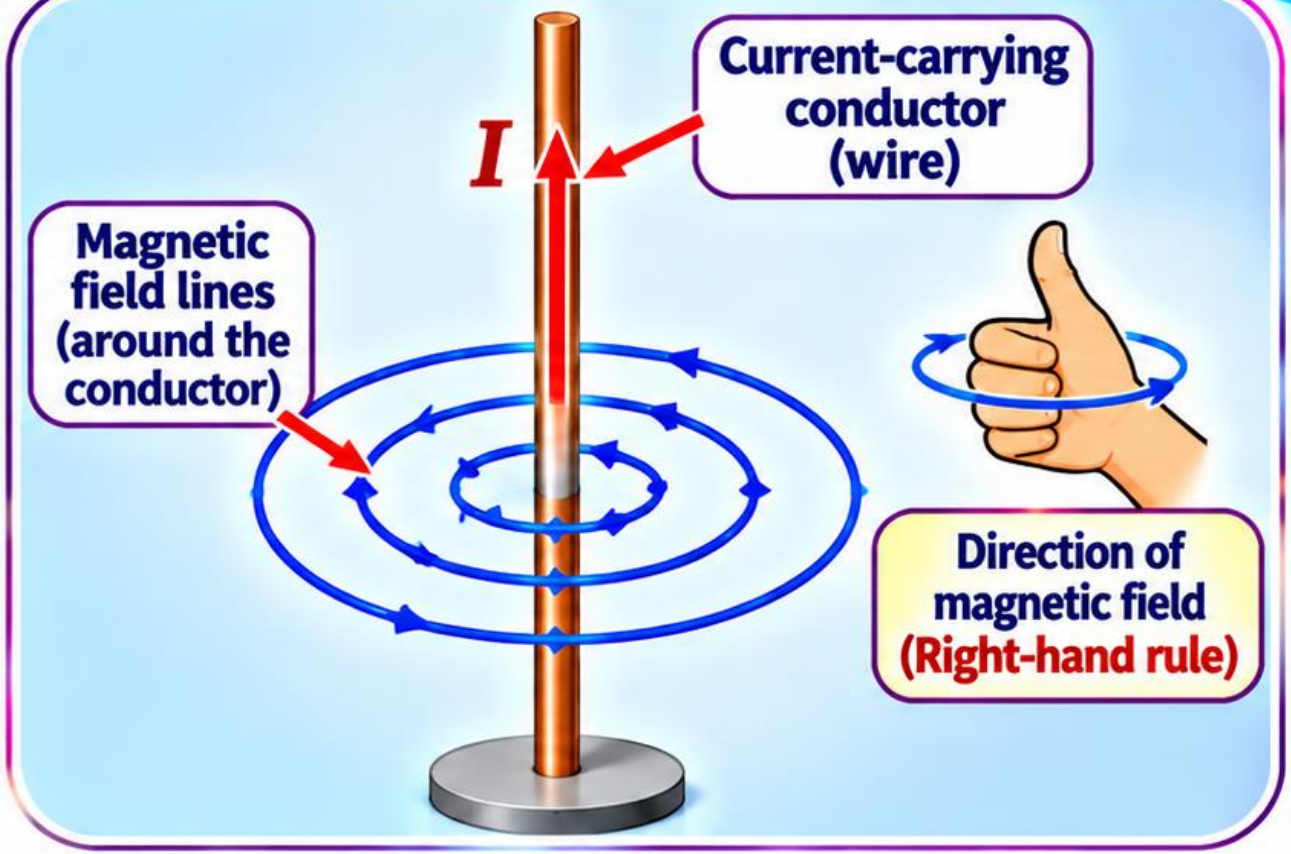
Switch OFF:

The compass needle returns to its original direction (magnetic effect disappears).

https://youtu.be/J8ko1nLusDc?si=66mBd5uMKr2h6mQu

What is the Magnetic Effect of Electric Current?

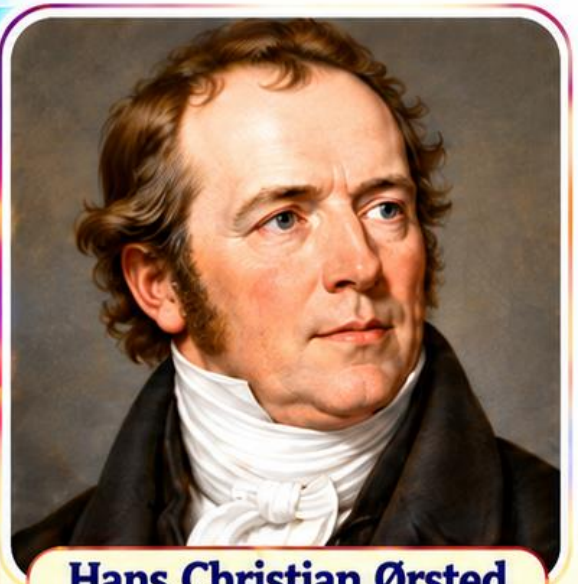
- When electric current flows through a conductor, it produces a **magnetic field** around the conductor.
- This phenomenon is called the **magnetic effect of electric current**.
- The magnetic field **disappears** when the current stops flowing.



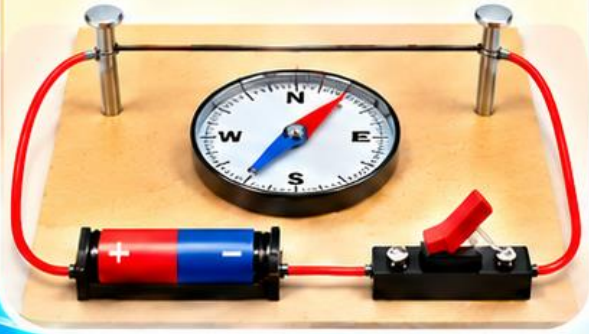
Key Definition: A current-carrying conductor produces a **magnetic field** around it.

Hans Christian Ørsted

The Scientist Who Discovered the Connection



Hans Christian Ørsted
(1777 – 1851)



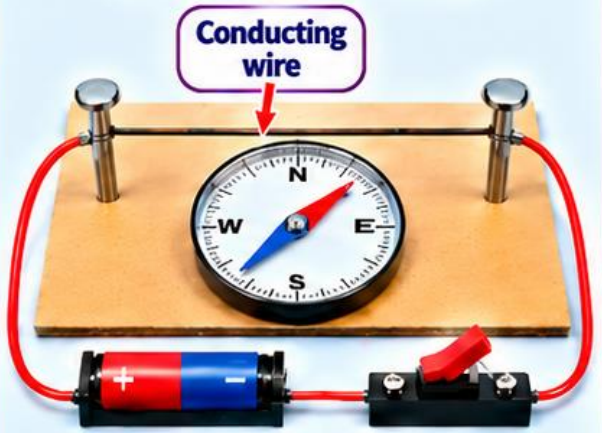
- Hans Christian Ørsted was a Danish scientist.
- He discovered the connection between electricity and magnetism in 1820.
- During an experiment, he observed the deflection of a compass needle near an electric circuit.
- His discovery helped establish the relationship between electricity and magnetism.

https://youtu.be/RwilgsQ9xaM?si=3CSL3_A8hTG1c3hy

Ørsted's Experiment

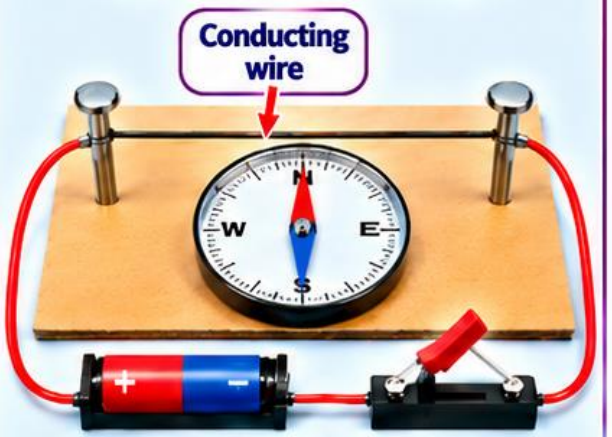
- Ørsted placed a compass near a conducting wire.
- When electric current flowed through the wire, the compass needle deflected.
- When current stopped, the needle returned.
- This observation showed that electric current produces a magnetic effect.

Current ON
(Needle deflects)



Switch ON
(Current flows)

Current OFF
(Needle returns)

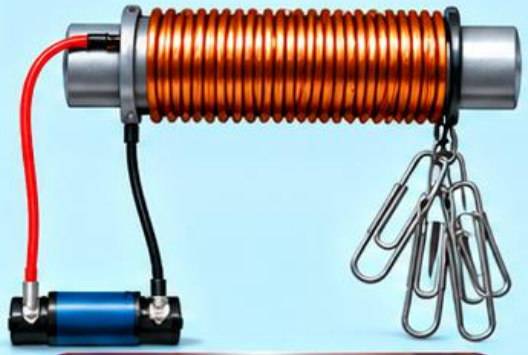


Switch OFF
(No current)

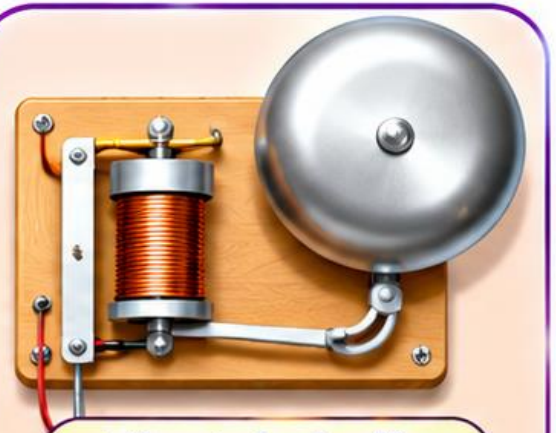
Applications of the Magnetic Effect

The magnetic effect of electric current is used in:

- Electromagnets
- Electric bells
- Electric motors
- Loudspeakers
- Magnetic cranes
- Relays



Electromagnets



Electric bells



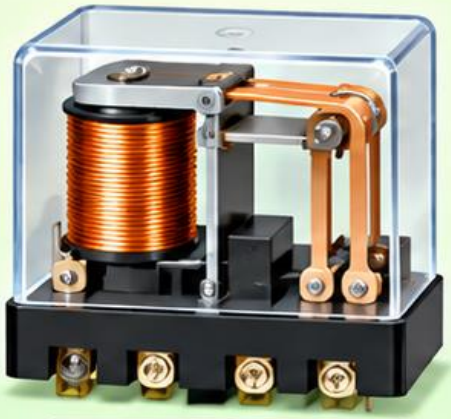
Electric motors



Loudspeakers



Magnetic cranes



Relays

Activity 6.2 – Let Us Explore
(Making an Electromagnet)

Materials Required


Around 50 cm of flexible insulated wire


Iron nail


Electric cell


A few iron paper clips



1. Tightly wrap the insulated wire around the iron nail in the form of a coil.
2. Secure the coil using adhesive tape.
3. Connect the two ends of the wire to the electric cell.

Safety: Do not keep the wires connected to the cell for more than a few seconds.

Observation and Conclusion

- Bring the nail close to the iron paper clips and lift it.
- When electric current flows through the coil, the paper clips cling to the nail.
- Disconnect the wire from the cell to stop the electric current.
- When the current stops, the paper clips no longer cling to the nail and fall down.

https://youtube.com/shorts/u5l6qD51_a8?si=7MawOQJQ0RUZ1ugT

Current ON



Paper clips cling to the nail
(magnetic effect present)

Current OFF



Paper clips fall down
(magnetic effect disappears)

Conclusion: When electric current flows through the coil, the iron nail behaves like a magnet. When the current stops, its magnetic effect disappears or reduces, and the paper clips fall.

Activity 6.3 – Let Us Experiment

Materials Required:

- Around 100 cm of flexible insulated wire



- Chart paper



- An iron nail



- An electric cell



- Two magnetic compasses



- A few iron/steel paper clips



Procedure:

1. Roll chart paper into a cylinder approximately the width of a pencil and secure it with adhesive tape.
2. Tightly wind about 50 turns of insulated wire around the cylinder to form a coil.
3. Secure the wire with adhesive tape.
4. Place magnetic compasses near the two ends of the cylindrical coil.

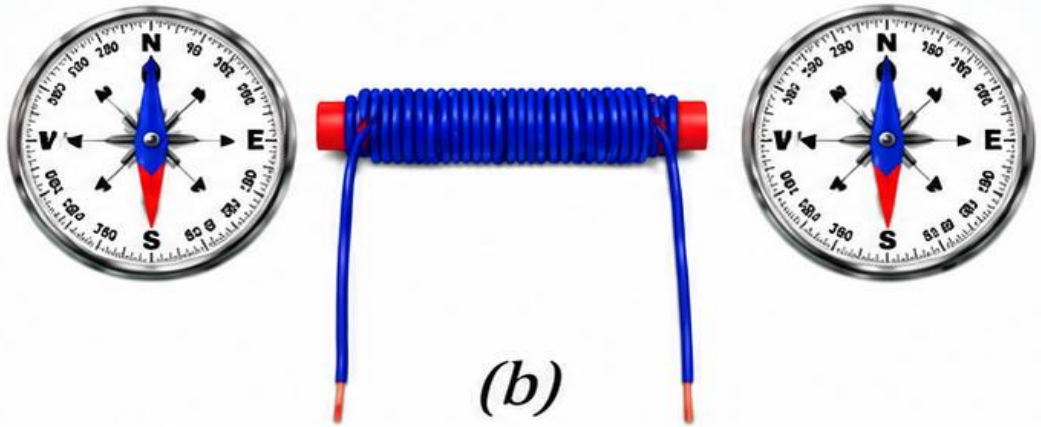
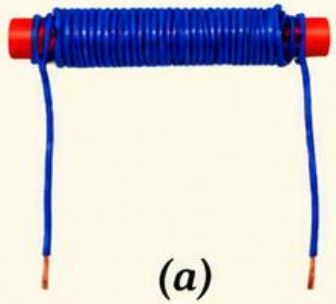


Fig. 6.3: (b) Coil and magnetic compasses

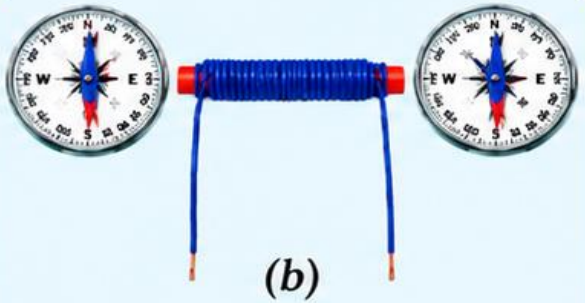
Observation and Conclusion

Observations:

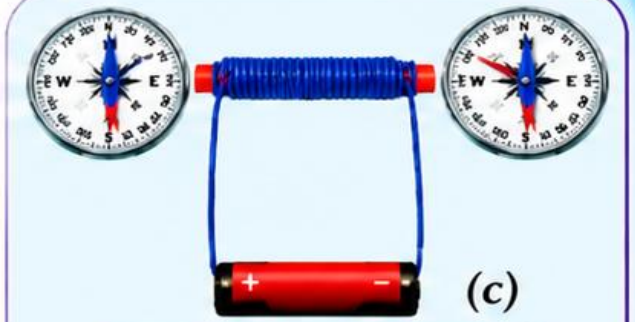
- Connect the two ends of the coil to the electric cell and observe the compass needles.
- When current flows through the coil, the compass needles deflect.
- Disconnect the wire from the cell. The compass needles return to their original positions.
- Insert an iron nail into the paper cylinder and repeat the experiment. The compass needle deflection becomes greater.
- Iron paper clips are attracted to the ends of the nail.



(a) A coil of insulated wire



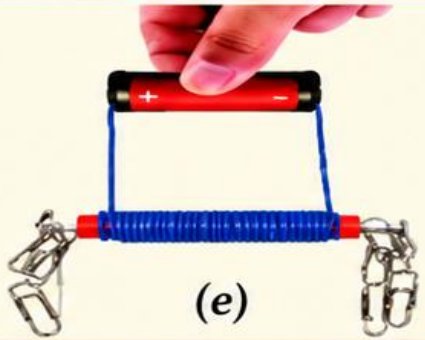
(b) Coil and magnetic compasses



(c) Coil connected to a cell



(d) Coil with iron nail inserted



(e) Coil with iron nail and clips

Conclusion:

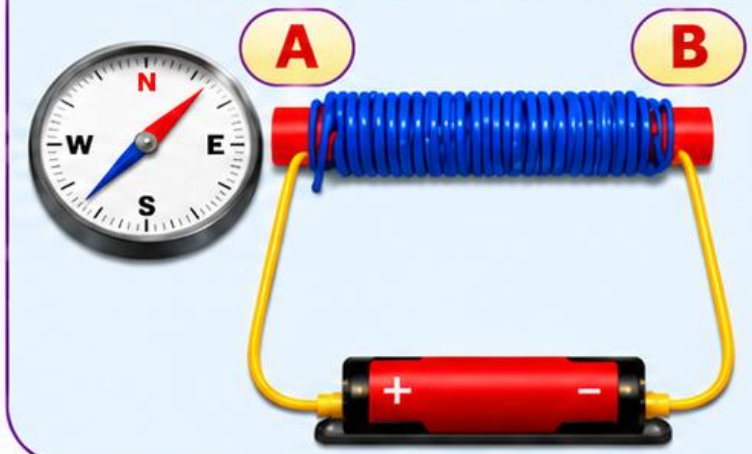
A current-carrying coil behaves like a magnet and is called an **electromagnet.** Inserting an iron nail into the core makes the electromagnet stronger. When the current stops, the coil loses its magnetic effect.

Activity 6.4 – Investigating the Poles of an Electromagnet

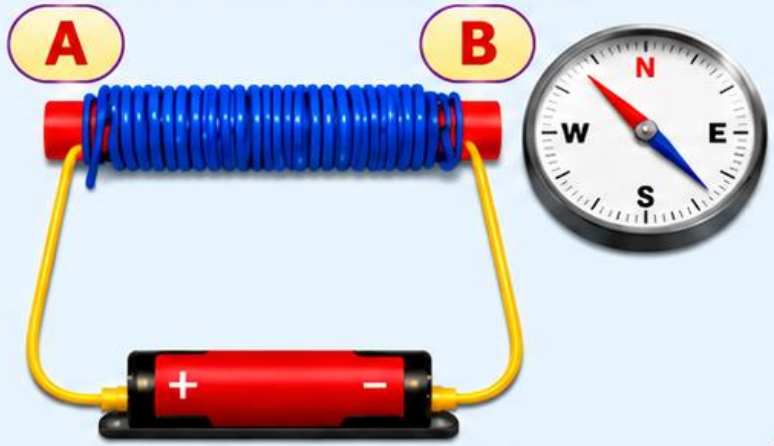
Procedure:

1. Take the electromagnet prepared in Activity 6.3 and a magnetic compass.
2. Label the two ends of the coil as **A** and **B**.
3. Place the magnetic compass near end **A** of the coil.
4. Connect the coil to the electric cell and observe the compass needle.
5. Note which pole of the compass is attracted to end **A**.
6. Repeat the procedure near end **B** and observe the compass needle.

Compass near end A



Compass near end B



Observation & Conclusion:

- The two ends of an electromagnet have opposite magnetic poles.
- An electromagnet has two poles: **North pole** and **South pole**.
- Unlike poles (North and South) attract each other.
- If the **North pole** of the compass is attracted to end **A**, then end **A** is the **South pole**.
- End **B** has the opposite polarity to end **A**.

https://youtu.be/FrLVwJzyONM?si=RkUmnAFCQ2BqSUOg

Think Like a Scientist – Factors Affecting Electromagnet Strength

- Repeat Activity 6.3 using 2 and 4 electric cells with the same coil.
- Observe the deflection of the compass needle and the number of paper clips attracted.
- A single cell produces a smaller current and a weaker magnetic field.
- More cells produce a larger current, a stronger magnetic field and greater compass needle deflection.
- Repeat the experiment using 2 cells but different numbers of turns of the coil.
- Increasing the number of turns of the coil also makes the electro-magnet stronger.
- Changing the direction of electric current reverses the poles of the electromagnet.

Effect of number of cells (same coil)

With 2 cells



Smaller deflection and fewer paper clips

With 4 cells



Greater deflection and more paper clips

Effect of number of turns (with 2 cells)

20 turns of coil



Less deflection and fewer paper clips

50 turns of coil



Greater deflection and more paper clips

Conclusion: The strength of an electromagnet can be increased by increasing the electric current, increasing the number of turns of the coil, or both. Its magnetic poles can be reversed by changing the direction of electric current.

6.1.2 Lifting Electromagnets

- Lifting electromagnets are strong electromagnets that may be hung from cranes.
- The crane operator controls the electromagnet by switching the electric current **ON** and **OFF**.
- When the current is switched **ON**, the electromagnet lifts iron and steel objects.
- When the current is switched **OFF**, the magnetic field disappears and the objects are released.
- Lifting electromagnets are widely used in factories and scrapyards to move, lift and sort heavy metal items efficiently.





https://youtube.com/shorts/1CaQMY8Vpfs?si=f1NDxev_hO-FLJ0e

Uses:

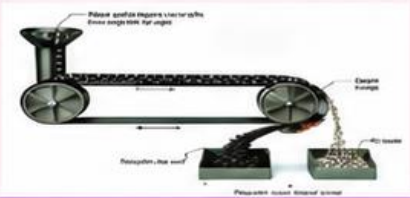


In factories – to move and lift heavy metal items.



In scrapyards – to lift, sort and load scrap metal.

Applications of Electromagnetic Devices in Daily Life

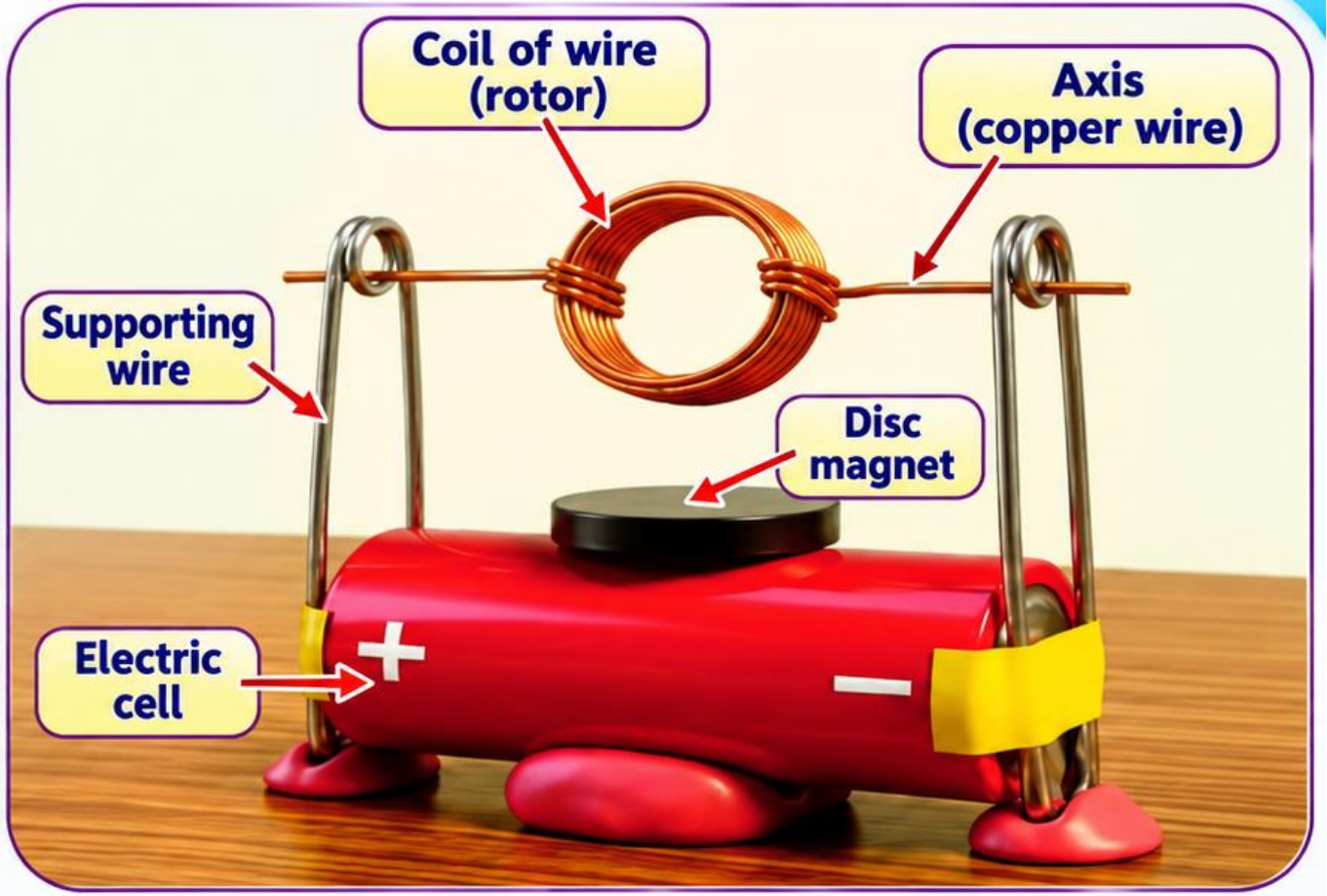
Sl. No.	Electromagnetic Device	Image	Application
1.	Maglev Train		Uses magnetic forces to levitate and move the train with reduced contact with the track.
2.	Electric Bell		Uses an electromagnet to operate the hammer and produce sound.
3.	Electromagnetic Crane		Lifts, moves and releases heavy iron and steel objects.
4.	Loud Speaker		Uses magnetic effects to convert electrical signals into sound.
5.	Electric Motor		Converts electrical energy into mechanical energy using the interaction of electric current and magnetic fields.
6.	Magnetic Separation		Uses magnetic attraction to separate magnetic materials from non-magnetic materials.

Activity 6.5 – Let Us Construct a Simple Electric Motor

Procedure and Observation:

- Construct a simple electric motor using a disc magnet, a coil of wire and an electric cell, with the help of your teacher.
- Observe how the motor works and how the coil rotates.
- When electric current flows through the copper coil, it produces a magnetic field around the coil.
- The natural disc magnet also produces a magnetic field.
- The interaction between these two magnetic fields causes a force on the coil, making it rotate.

https://youtube.com/shorts/dVCBhBkTWko?si=Mck-epwlynw9euL7



Key Concept: The interaction between the magnetic field produced by the current-carrying coil and the magnetic field of the disc magnet makes the coil rotate.

Activity 6.6 – Let Us Observe

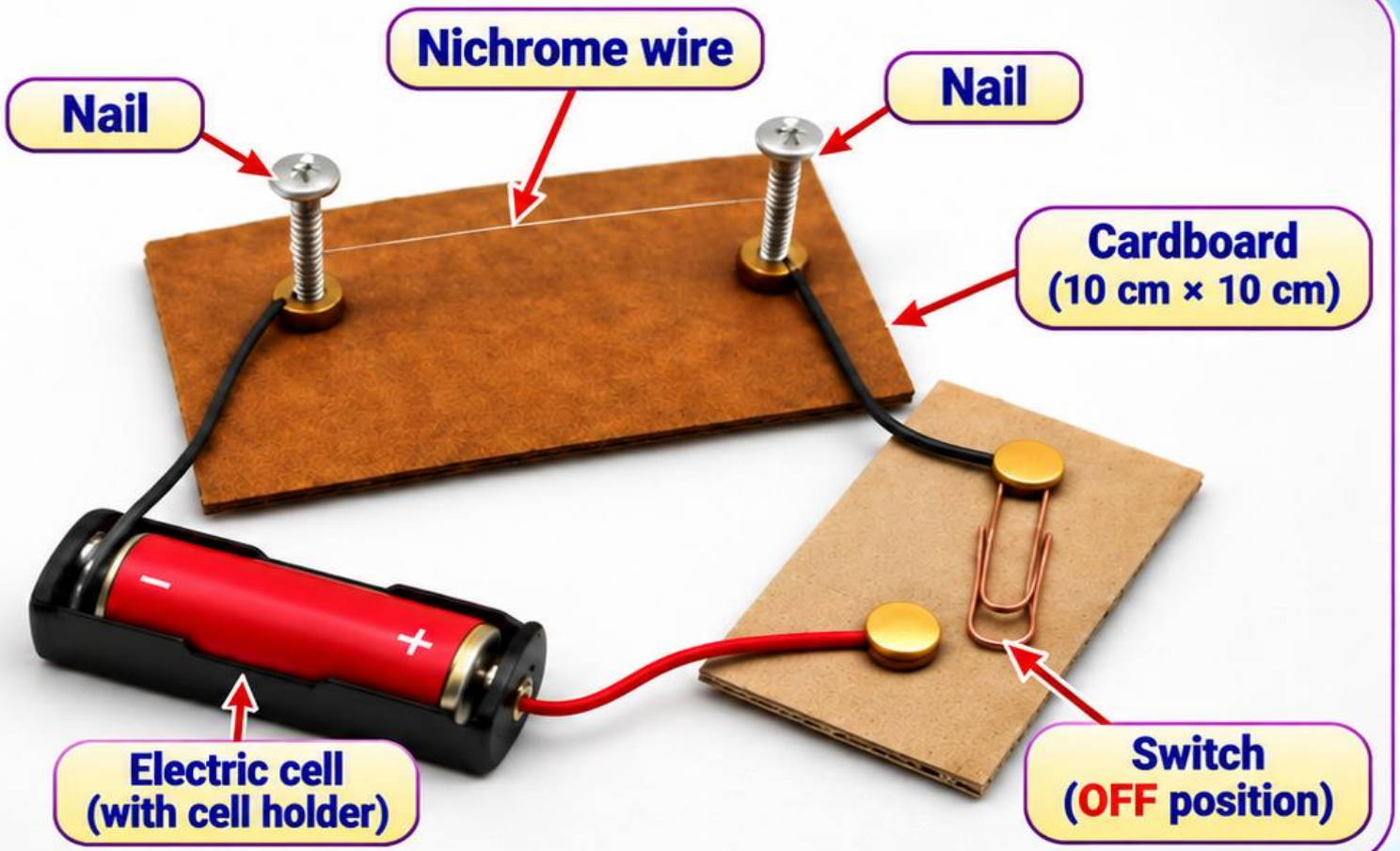
(Heating Effect of Electric Current)

Materials Required:

- Nichrome wire, cardboard piece (about 10 cm × 10 cm), two nails, electric cell, cell holder, switch and connecting wires.

Procedure:

1. Fix the two nails on the cardboard about 5 cm apart.
2. Tie the nichrome wire between the nails.
3. Connect the circuit as shown in the figure, keeping the switch in the OFF position.
4. Touch the nichrome wire and observe what you feel.



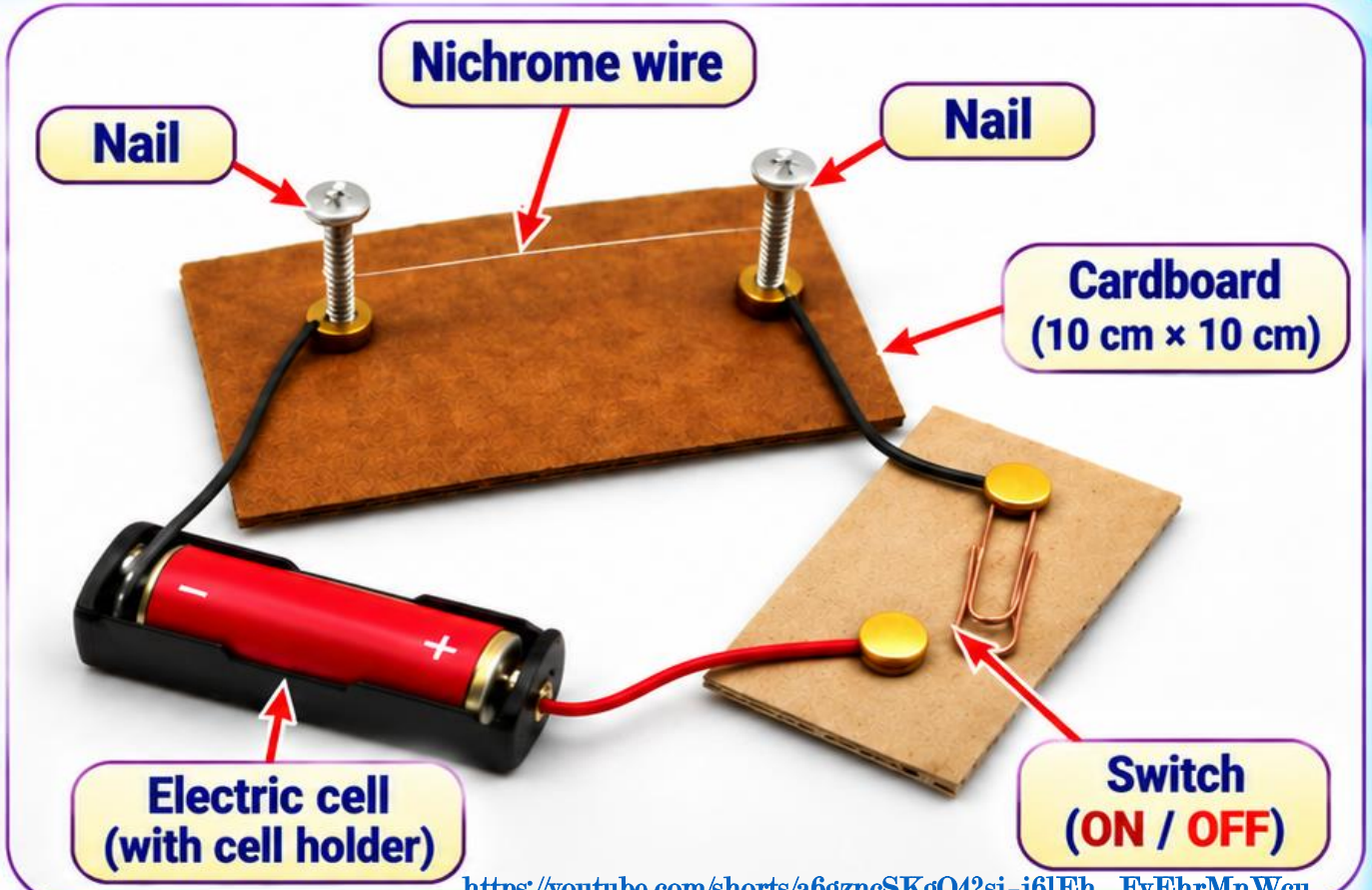
Observation:

Touch the nichrome wire and observe what you feel.

Activity 6.6 – Heating Effect of Electric Current

Observation:

- Switch ON the circuit for about 30 seconds and then switch it OFF.
- Carefully touch the nichrome wire again. (Do not hold the wire.)
- Observe the difference in temperature.
- Nichrome wire becomes warm when electric current passes through it.
- A conductor offers resistance to the flow of electric current.
- Nichrome has higher resistance than copper wire of the same size and length.
- Some electrical energy is converted into heat energy.



https://youtube.com/shorts/a6gzncSKgO4?si=j6lEh_FvEhrMnWcu

Conclusion:

When electric current passes through a conductor, it gets heated. This warming of a conductor is called the heating effect of electric current.

Think Like a Scientist – Effect of Increasing the Number of Cells

- Repeat Activity 6.6 using a battery of 2 cells, strictly under the supervision of a teacher.
- Compare the heating of the nichrome wire using one cell and two cells for the same duration.
- Observe whether the wire heats up more with two cells.
- More heat is generated when the experiment is performed with two cells.
- The heat generated depends on the magnitude of the electric current.
- Heat generated also depends on the material, thickness and length of the wire, and the duration for which current flows.

(A) With One Cell



(B) With Two Cells



Conclusion: The amount of heat produced in a wire depends on the electric current, the material, thickness and length of the wire, and the duration of current flow.

Heating Effect of Electric Current – Household Appliances

- An incandescent lamp glows because its **filament** is heated by electric current.
- Many household appliances work on the **heating effect of electric current.**
- These appliances contain a rod or coil of wire called a **heating element.**
- In some appliances, the heating element becomes **red hot** and can be seen glowing.



Examples of Heating Appliances:

- Electric room heater
- Electric stove
- Electric kettle
- Electric iron
- Water heating immersion rod
- Hair dryer



(a) Electric room heater



(b) Electric stove



(c) Electric kettle



(d) Electric iron



(e) Water heating immersion rod



(f) Hair dryer

A Step Further – Electrical Safety

- The heating effect of electric current is useful in many everyday appliances.
- However, it can also cause problems such as **energy loss** in wires during transmission.
- Overheating in appliances may damage **plugs** and **sockets**.
- Plastic parts may **melt** due to excessive heating.
- Overheating may even lead to **fires**.
- Use appropriate wires, plugs and sockets **rated** for the specified electric current.
- Household circuits use **safety devices** to minimise such incidents.



Appropriate (well-rated) insulated wire



Correctly rated plug



Correctly rated socket



Safety devices (MCB / RCCB)

Safety Message: Use **properly rated** electrical wires, plugs and sockets to prevent unnecessary heating and electrical hazards.

Activity 6.7 – Let Us Find

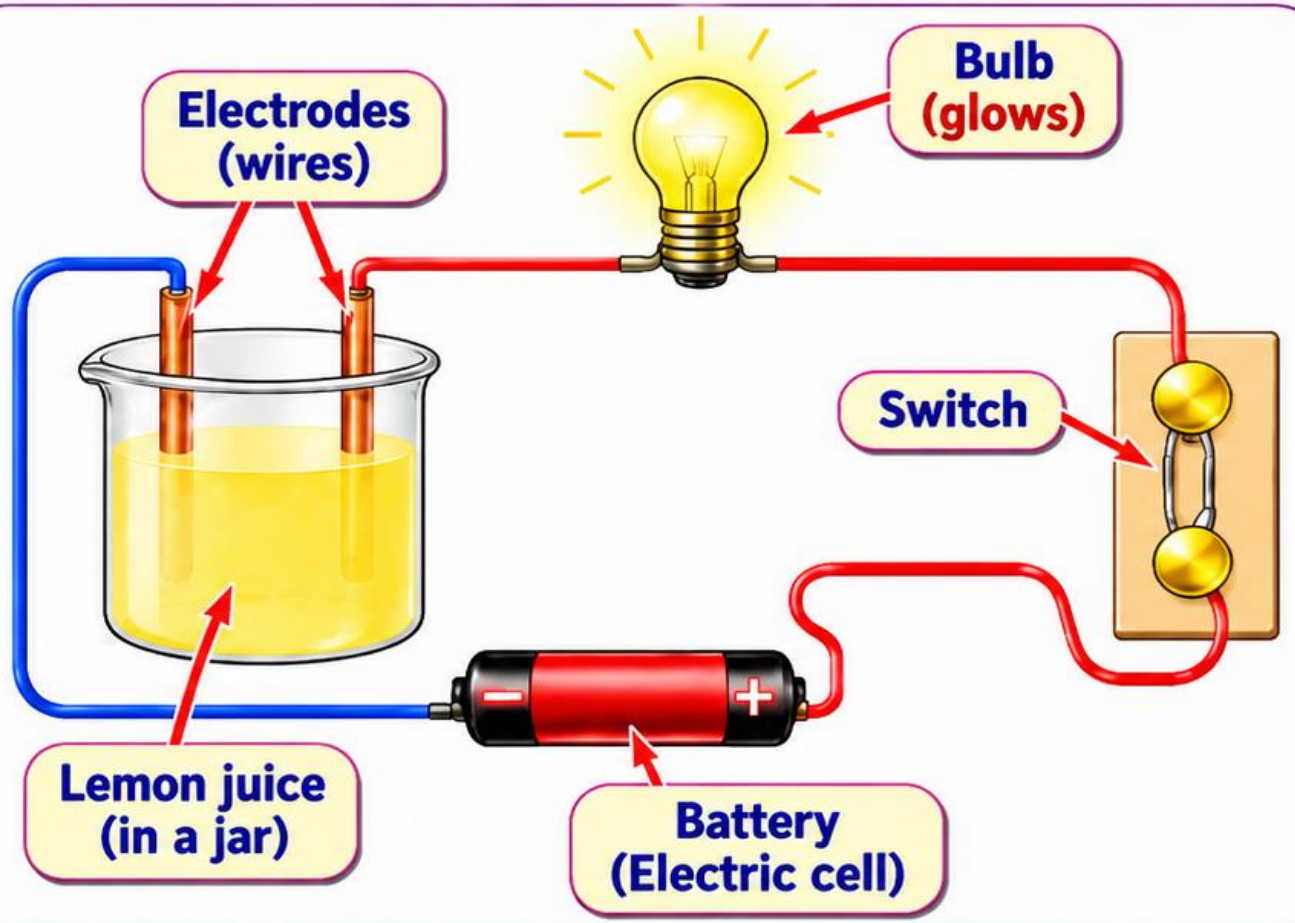
(Do Liquids Conduct Electricity?)

Procedure:

1. Make a simple electric circuit using a battery, connecting wires, switch and a small bulb.
2. Take a small jar filled with lemon juice.
3. Dip the two free ends of the wires into the lemon juice, as shown.
4. Observe the bulb. **Does the bulb glow?**

Observation:

- You may be surprised to find that **it does!**
- This shows that electric current can flow through liquids.



Key Concept:

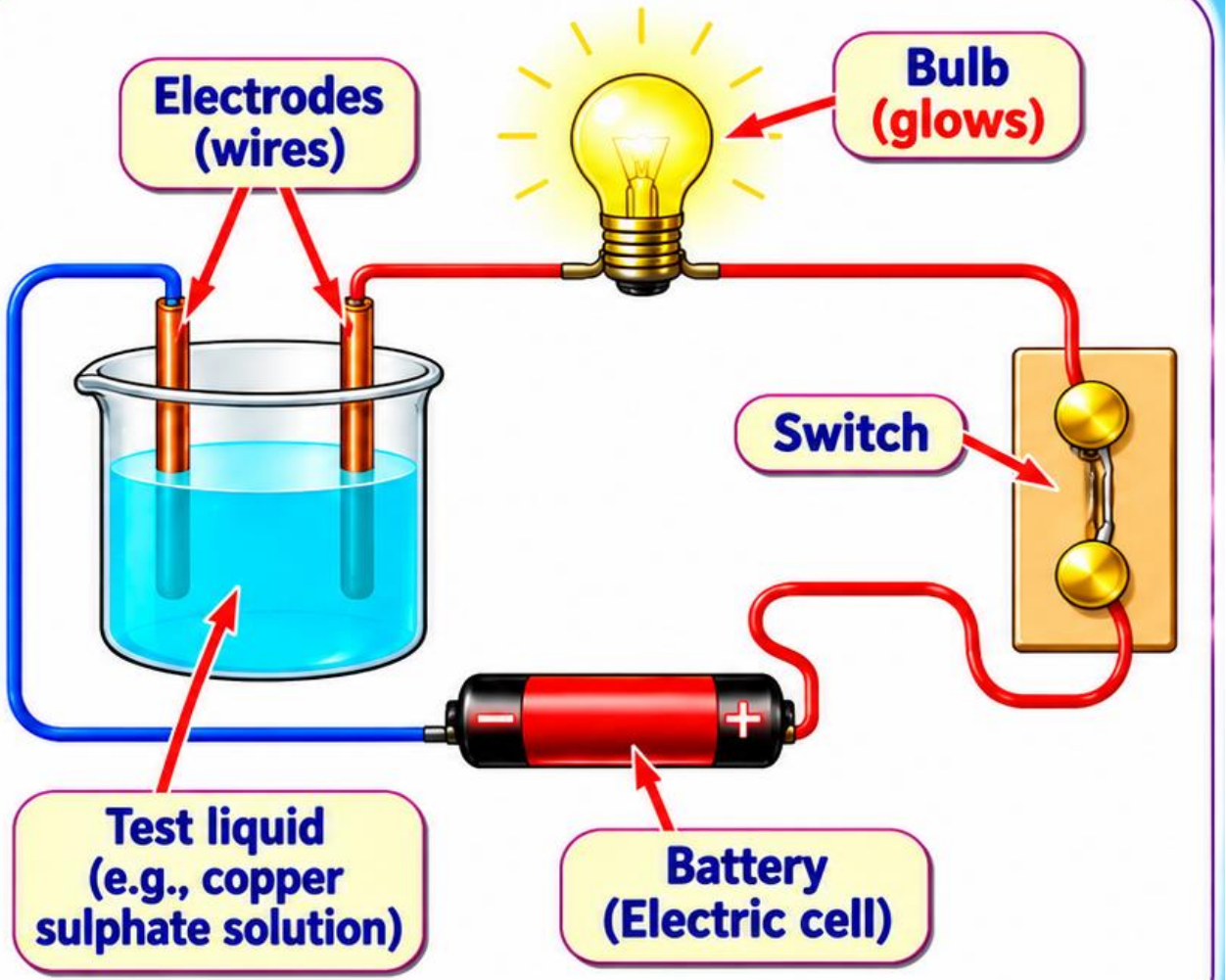
Electric current can flow through liquids. **Do all liquids allow electric current to pass through them?**

Activity 6.8 – Let Us Explore

(Conductivity of Different Liquids)

- Repeat Activity 6.7 using different liquids.
- Test each liquid using the same electric circuit with a battery, bulb, switch and electrodes.
- Observe whether the bulb glows or does not glow.
- Record your observations in the table.

S.No.	Liquid	Observation (Bulb glows / Does not glow)
1	Copper sulphate solution	
2	Distilled water	
3	Vegetable oil	
4	Vinegar	
5	Sugar solution	



Conducting and Non-Conducting Liquids

- Lemon juice, salt water, vinegar and copper sulphate solution allow electric current to pass through them.
- Liquids that allow electric current to pass through them are called **conducting liquids** or **electrolytes.**
- Distilled water, vegetable oil and sugar solution do not allow electric current to pass through them easily.
- Such liquids are called **non-conductors or insulators.**
- Not all liquids conduct electricity. Liquids containing **free ions (electrolytes)** conduct electricity.

Conducting Liquids (Electrolytes)

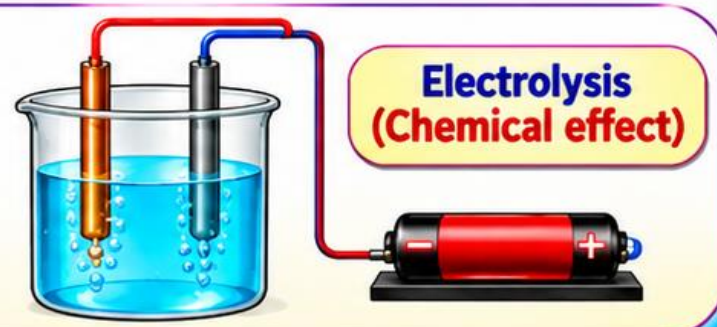


Non-Conducting Liquids (Insulators)



Chemical Effects of Electric Current:

When electric current passes through a conducting liquid (electrolyte), it may bring about chemical changes. These chemical changes caused by electric current are called the **chemical effects of electric current.**



Activity 6.9 – Let Us Investigate

(Chemical Effect in a Potato)

Materials Required:


Fresh Potato

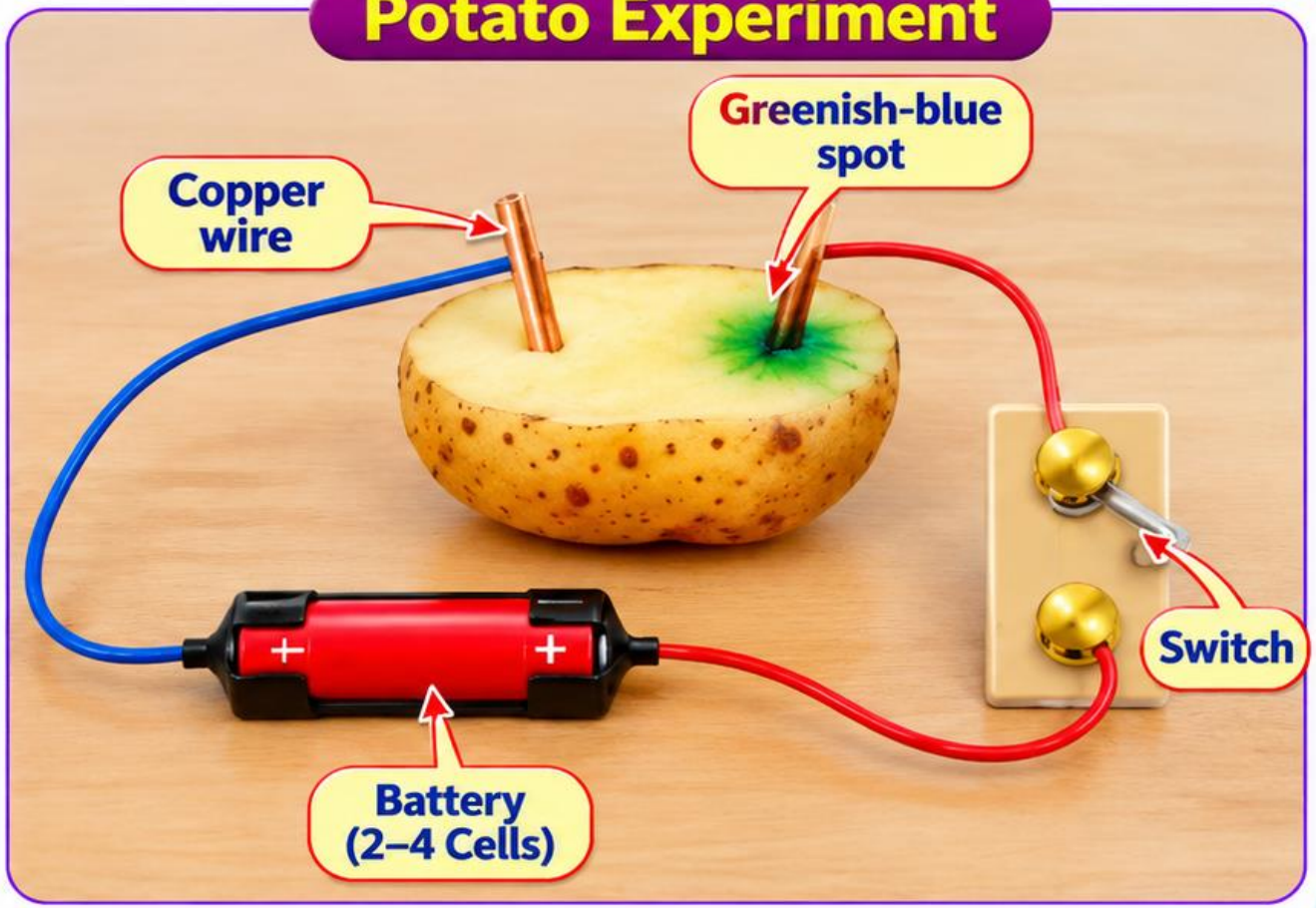

Two Copper Wires


Battery (2–4 Cells)


Switch

- Insert two copper wires into a potato and connect them to a battery and switch as shown in the picture.
- Observe the wires inserted into the potato before switching ON the circuit.
- Switch ON the circuit and observe the changes around the wires.
- A greenish-blue spot appears around the wire connected to the positive terminal of the battery.
- This happens because electric current causes copper ions (Cu^{2+}) to react with starch and other substances in the potato, forming a coloured compound.

Potato Experiment



Conclusion: Electric current passing through substances can produce chemical changes. This is an example of the chemical effect of electric current.

Activity 6.10 – Let Us Experiment

(Electrolysis of Water)

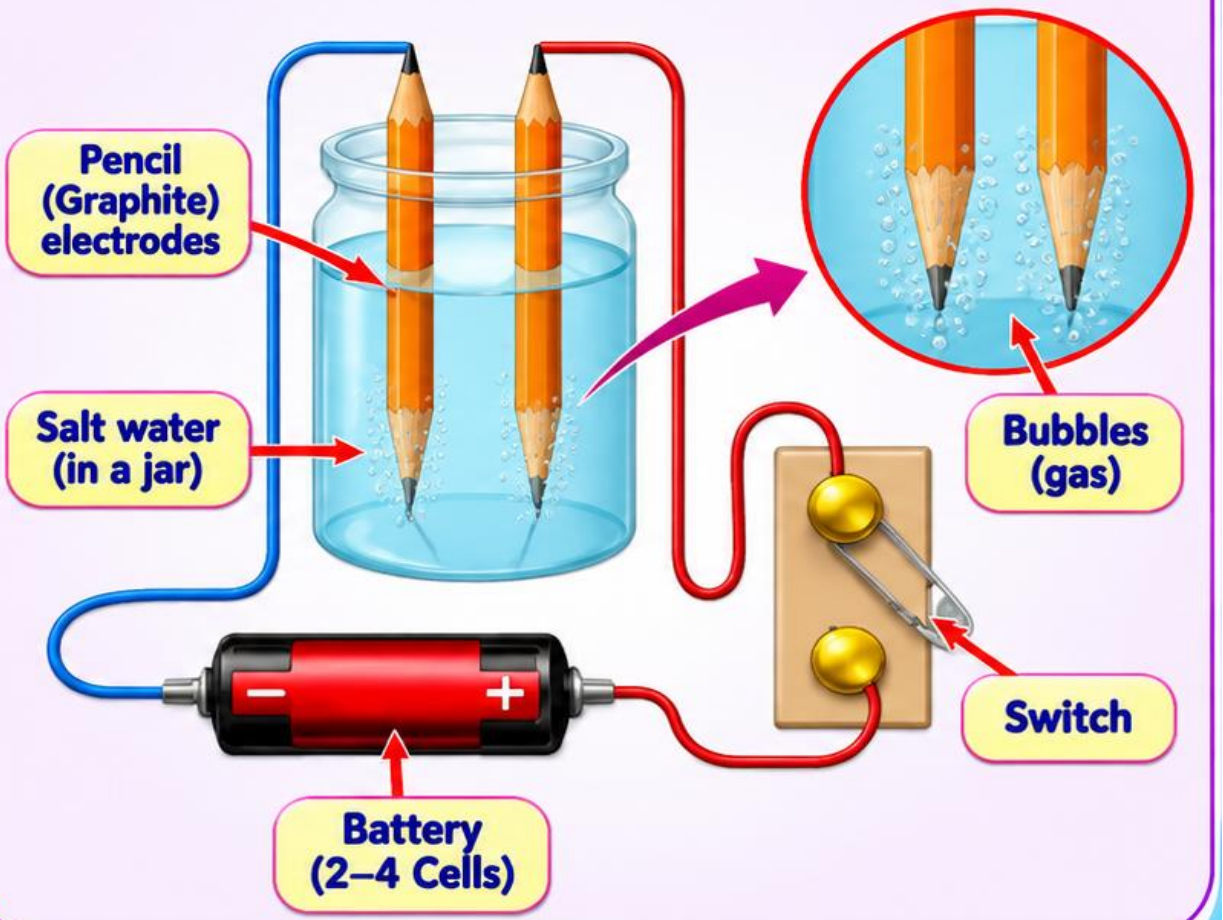
Materials Required:



Procedure:

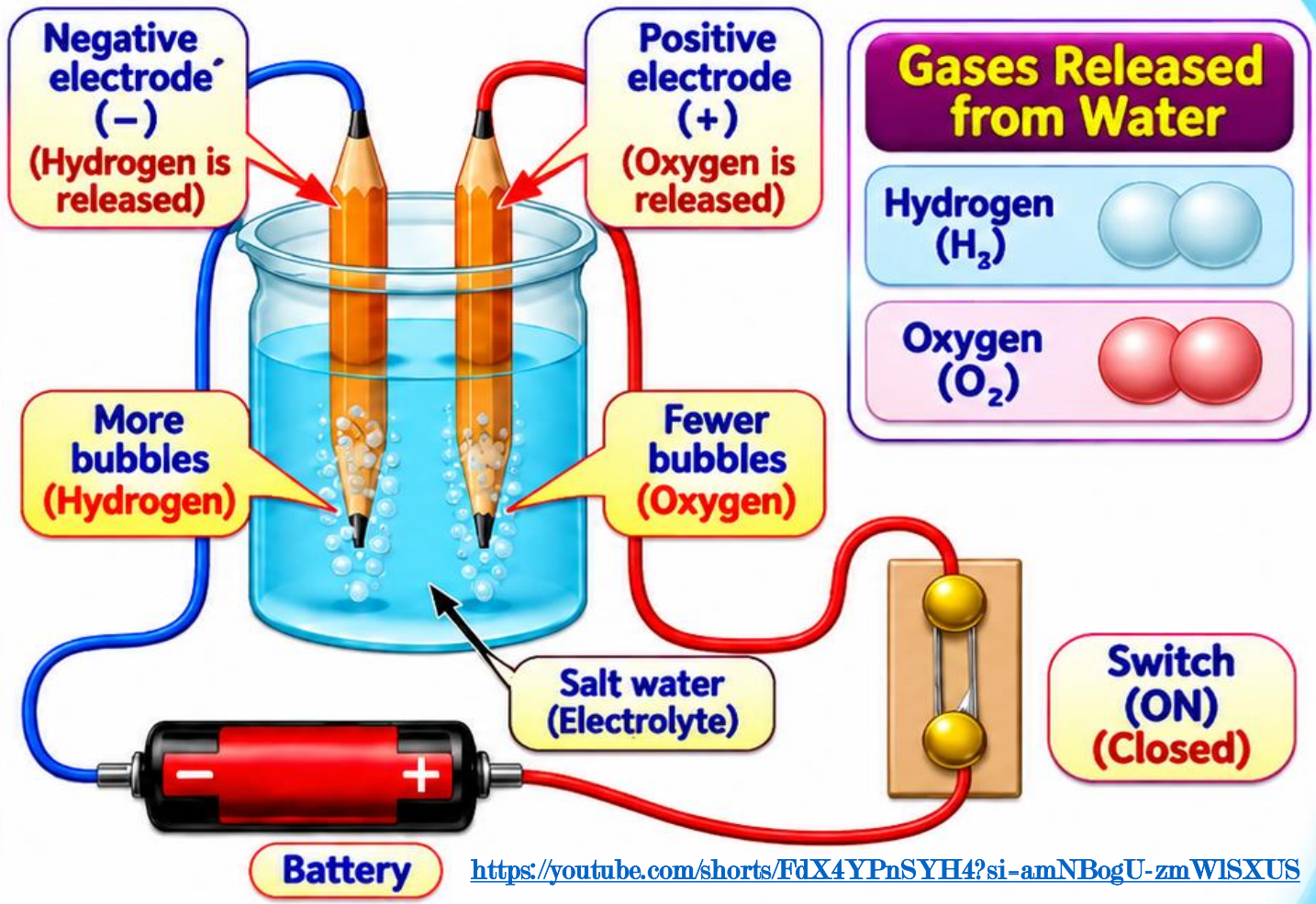
1. Sharpen both ends of the pencils to expose the graphite.
2. Fill the jar with salt water.
3. Dip the graphite tips into the salt water, keeping them apart.
4. Connect the other ends of the pencils to the battery and switch, keeping the switch in the **OFF** position initially.
5. Switch **ON** the circuit and observe the changes in the liquid.

Experimental Setup (Electrolysis of Water)



Observations – Electrolysis of Water

- Bubbles of gas are seen at both pencil. electrodes when electric current passes through salt water.
- More bubbles are observed at the negative electrode (connected to the negative terminal of the battery).
- The gas released at the negative electrode is Hydrogen.
- Fewer bubbles are observed at the positive electrode.
- The gas released atthe positive electrode is Oxygen.
- These gases are formed by the electmposition of water inte its constituents by passing electricity.

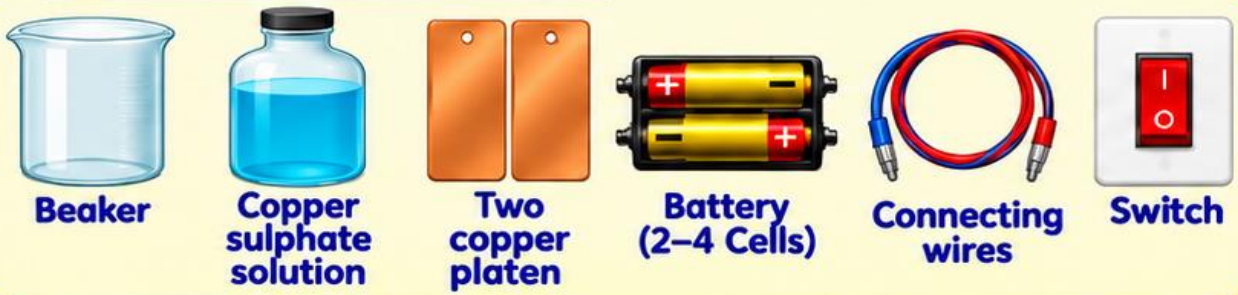


https://youtube.com/shorts/FdX4YPnSYH4?si=amNBogU-zmWlSXUS

Key Concept: The decomposition of water into hydrogen and oxygen by electric current is called electrolysis of water.

Activity 6.11 – Let Us Observe (Electroplating)

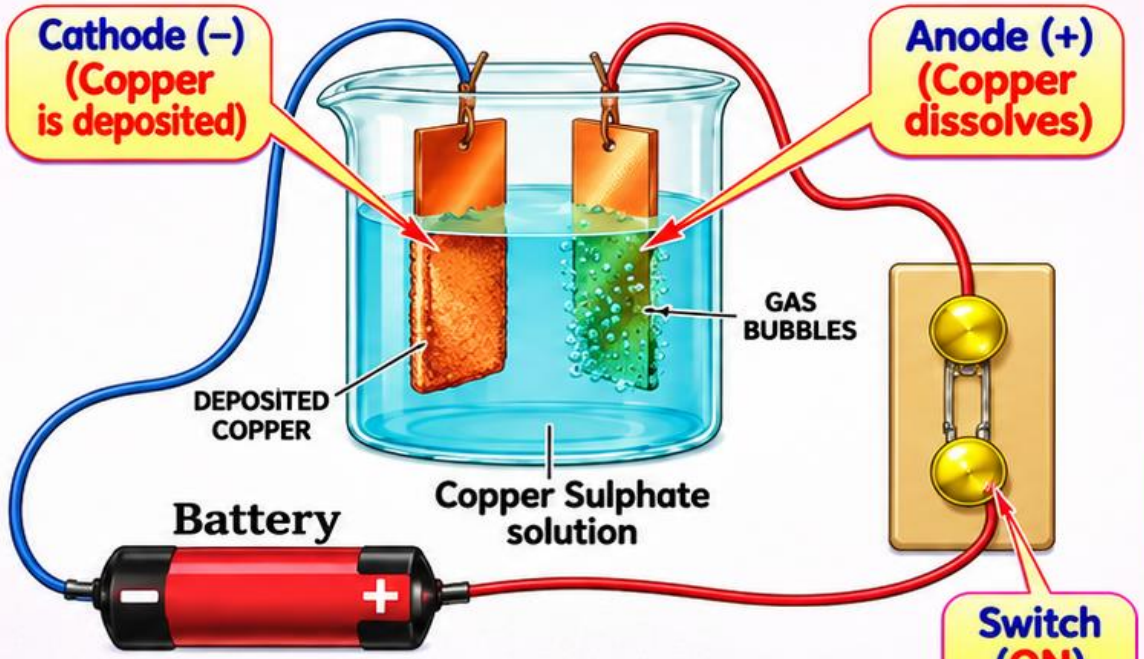
Materials Required:



Procedure:

1. Pour copper sulphate solution into the beaker.
2. Connect one copper plate to the positive terminal of the battery (Anode).
3. Connect the other copper plate to the negative terminal of the battery (Cathode).
4. Dip both copper plates into the copper sulphate solution.
5. Switch ON the circuit and allow the experiment to continue for 15–20 minutes.
6. Observe the changes in the copper plates.

Experimental Setup (Electroplating)



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Key Concept:

The process of depositing a thin layer of a metal on the surface of another material by using electric current is called **electroplating.**

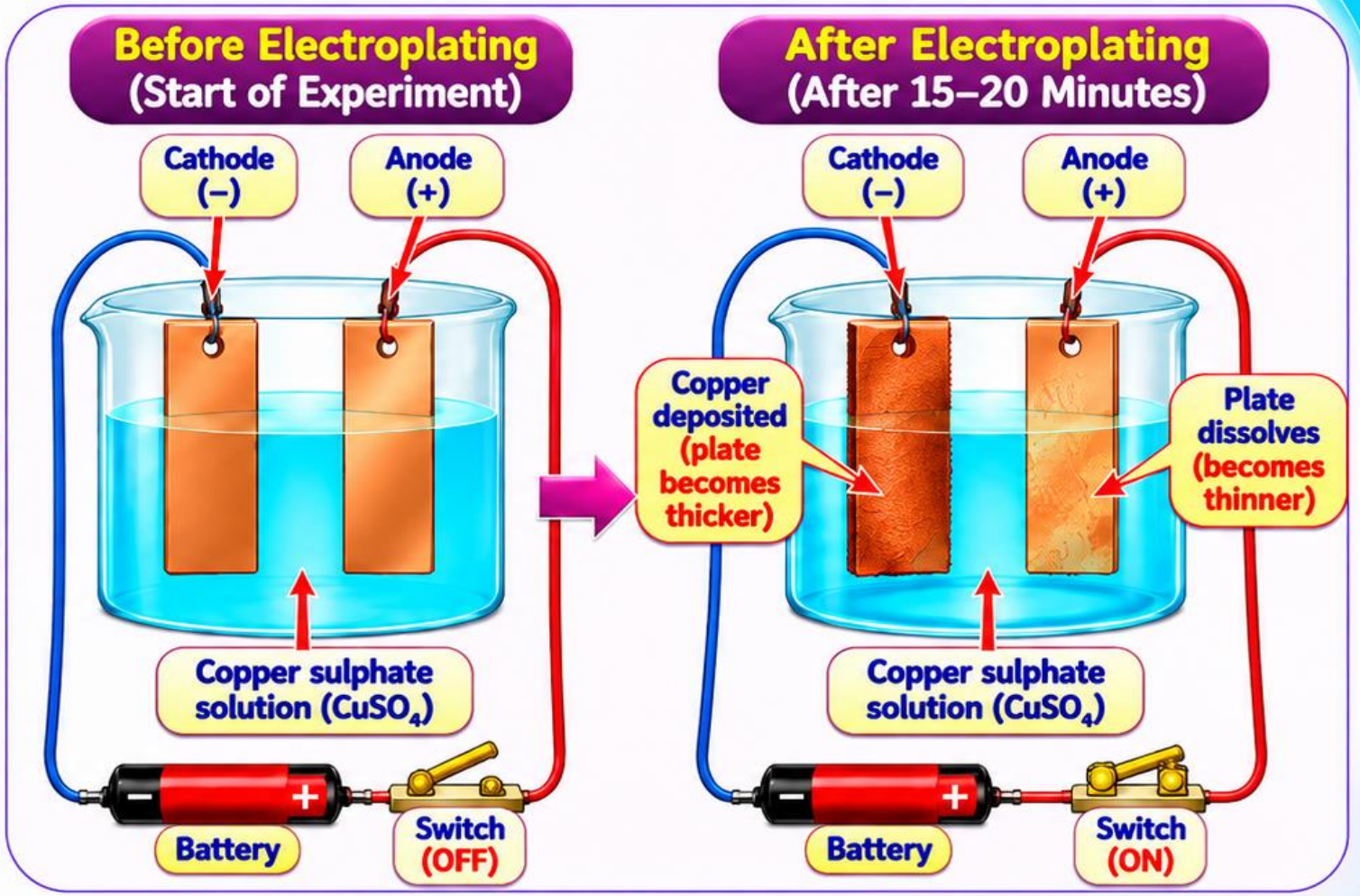
Observation and Conclusion – Electroplating

Observations:

- The copper plate connected to the negative terminal (Cathode) becomes thicker due to the deposition of reddish-brown copper.
- The copper plate connected to the positive terminal (Anode) gradually dissolves.

Conclusion:

- Copper ions (Cu^{2+}) from the solution move towards the cathode and get deposited as copper metal.
- At the same time, the anode releases copper ions into the solution to maintain balance.



Key Concept: The process of coating one metal on another using electricity is called **electroplating.**

Applications of Chemical Effects of Electric Current

Electroplating

- Electroplating is used to coat one metal with another metal using electricity.
- It helps protect iron objects from rusting.
- Chromium or zinc plating is used to protect iron objects.
- Gold or silver plating is used to make artificial jewellery attractive.
- Electroplating makes surfaces shiny and durable.



Chromium-plated tap
(shiny and rust-resistant)



Zinc-coated iron objects
(protected from rusting)



Gold-plated jewellery
(attractive and durable)

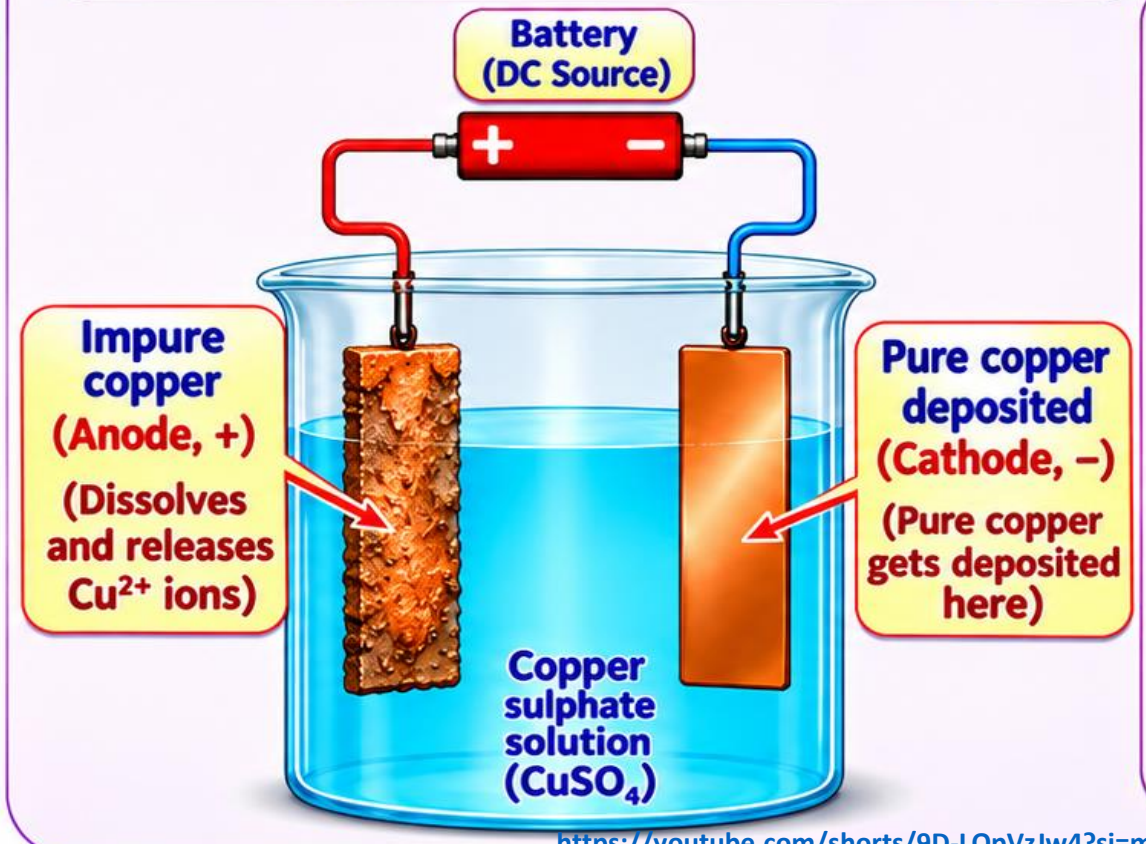


Silver-plated items
(shiny and attractive)

Application – Purification of Metals

- Electrolysis is used in the purification of metals.
- It helps extract impurities from metals.
- Impure metals can be purified using the process of electrolysis.
- For example, impure copper is purified by electrolysis to obtain pure copper.

Electrolytic Purification of Copper



https://youtube.com/shorts/9D-LOpVzJw4?si=mRB005b4D1NFCIXs

Process:

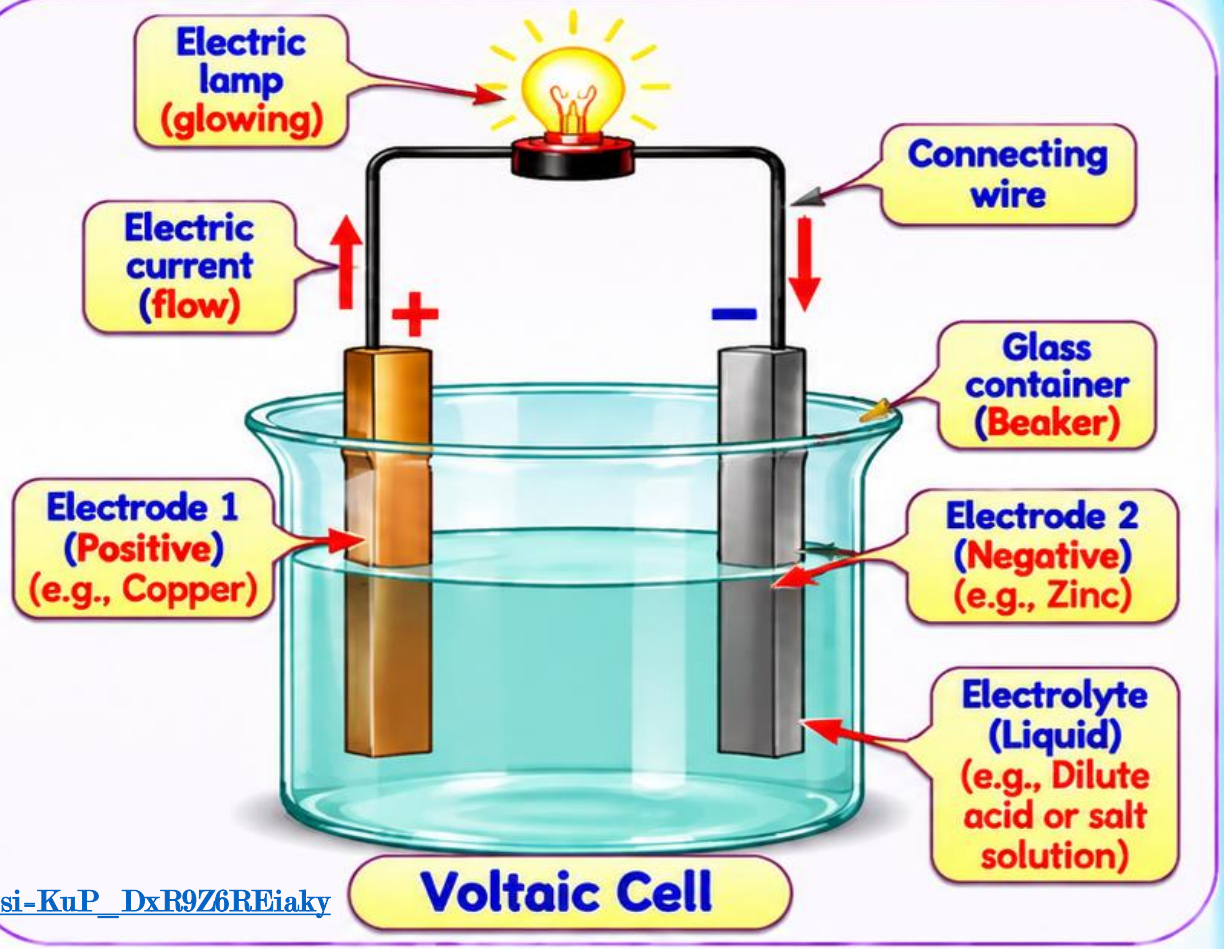
1. Impure copper is connected to the positive terminal (anode).
2. A thin sheet of pure copper is connected to the negative terminal (cathode).
3. On passing electric current, pure copper gets deposited on the cathode and impurities settle at the bottom (anode mud).

Key Concept: Electrolysis is used to purify metals by removing impurities.

6.4 – How Does a Battery Generate Electricity?

6.4.1 Voltaic Cell

- A **voltaic cell**, also known as a **galvanic cell**, is one of the earliest types of electric cells.
- It contains two metal rods made of different materials and a liquid called an **electrolyte** in a glass or plastic container.
- The metal rods, called **electrodes**, are partly dipped in the electrolyte.
- The electrolyte is usually a weak acid or salt solution.
- A chemical reaction between the electrodes and the electrolyte produces electricity.
- When the circuit is connected, electric current flows from the **positive** terminal through the circuit to the **negative** terminal.
- Over time, the chemicals get used up and the cell stops working. It is then called a **dead cell** and cannot supply electricity.



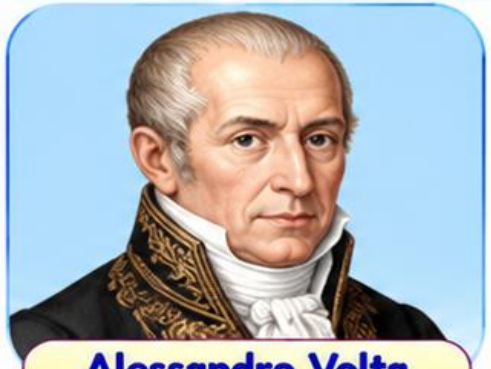
Voltaic Cell

https://youtu.be/oW4UQP07YQw?si=KuP_DxR9Z6REiaky

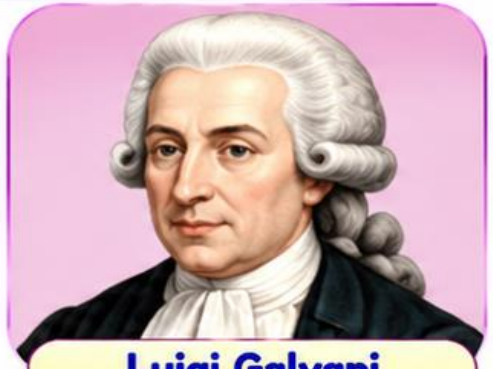
Key Concept: A voltaic cell produces electricity through a chemical reaction between its electrodes and the electrolyte.

Ever Heard of...? – The Story Behind the Voltaic Cell

- Voltaic or Galvanic cells are named after two Italian scientists: **Alessandro Volta** and **Luigi Galvani**.
- In the late 1700s, Galvani noticed that a **dead frog's leg** kicked when touched with two different metals, **copper and iron**.
- Galvani believed that electricity came from the **frog itself**.
- Volta believed that electricity came from the combination of **metals and liquid**.
- To test his idea, Volta used **saltwater-soaked paper** instead of a frog's leg and still obtained electric current.
- This experiment showed that the combination of metals and liquid could generate electric current.
- This discovery led to the invention of the **first battery**.

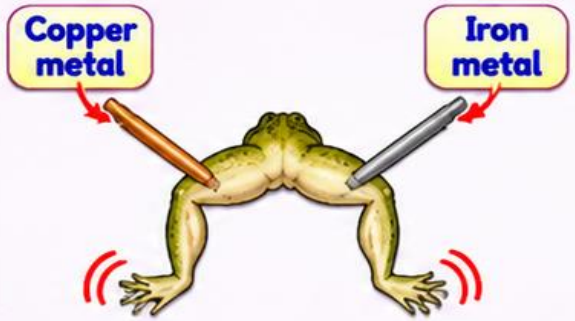


Alessandro Volta
(1745 – 1827)



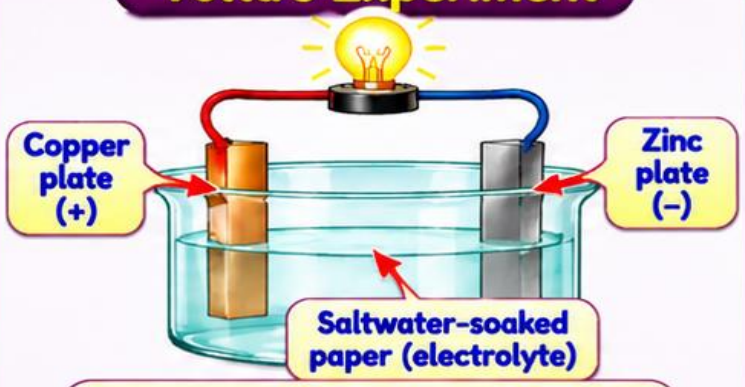
Luigi Galvani
(1737 – 1798)

Galvani's Experiment



A dead frog's leg kicked when touched with two different metals.

Volta's Experiment



Volta obtained electric current using two metals and a liquid (saltwater-soaked paper).

Key Concept: A voltaic cell generates electric current through the combination of two different metals and a liquid (electrolyte).

Activity 6.12 – Let Us Construct

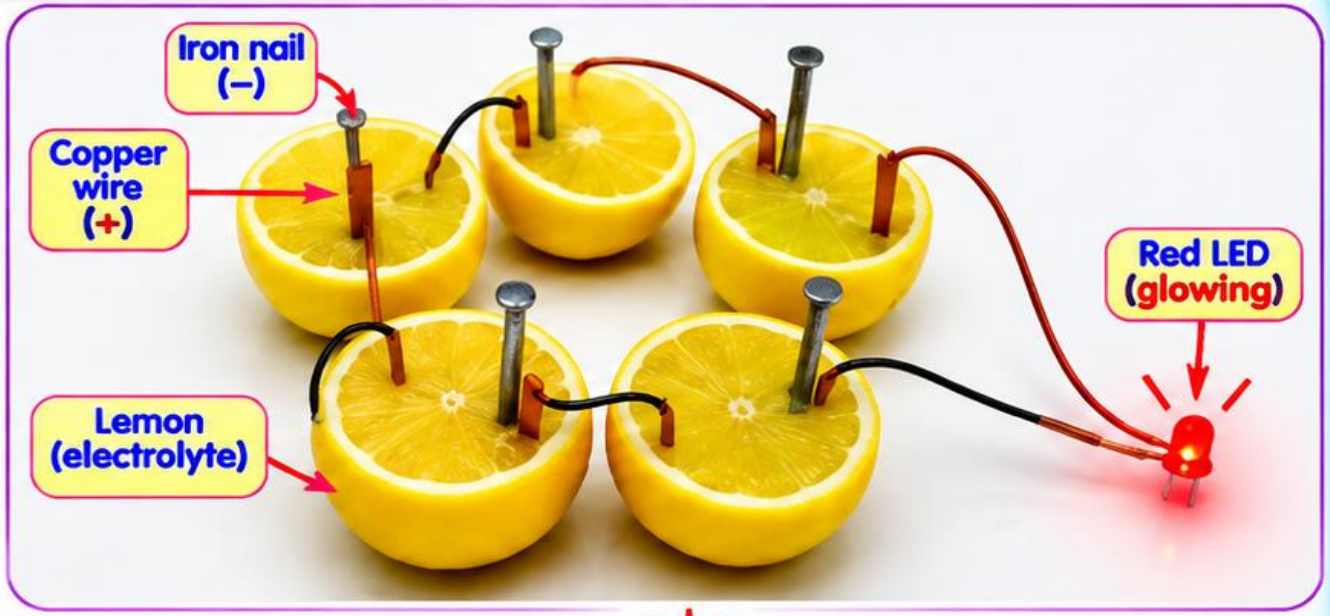
Making a Voltaic Cell Using Lemons

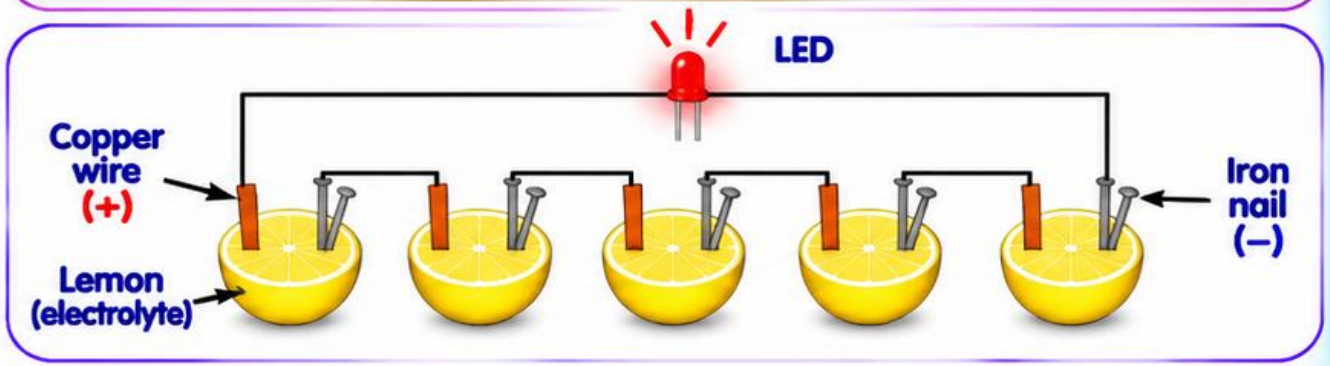
Materials Required:



Procedure:

1. Insert a copper wire and an iron nail into one lemon, keeping them apart.
2. Repeat the same procedure for all the remaining lemons.
3. Join the copper wires and iron nails of the lemons as shown in the textbook diagram.
4. Connect the lemons in series to make a lemon cell arrangement.
5. Finally, connect the two free ends to a red LED and observe it glowing.





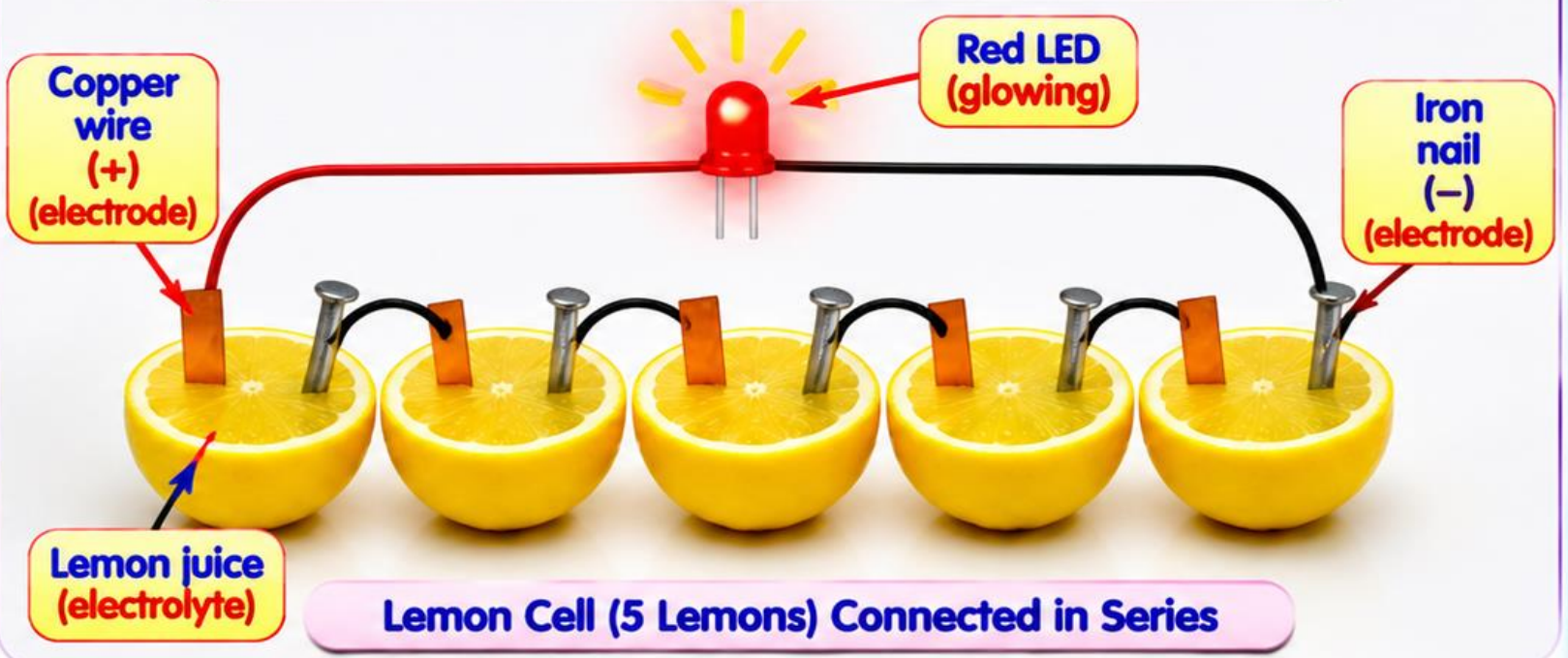
Key Concept: Lemons can act as an electrolyte. When connected in series, they form a voltaic cell arrangement that can glow a red LED.

Connecting and Testing the Lemon Cell

- Connect the red LED between the copper wire of the first lemon and the iron nail of the last lemon using connecting wires.
- Observe whether the LED glows.
- If the LED does not glow, reverse its connections.
- A glowing LED indicates that the lemon cell is working.
- Copper wires act as one electrode and iron nails act as the other electrode.
- Lemon juice acts as the electrolyte, helping conduct electricity.
- Salt solutions may also be used instead of lemon juice.

https://youtube.com/shorts/3vOA1DqLnuU?si=Ep3urycx-4sBG1St

Lemon Cell in Series – Testing with LED



Lemon Cell (5 Lemons) Connected in Series

Electrodes and Electrolyte

- Copper wire – one electrode (positive)
- Iron nail – other electrode (negative)
- Lemon juice – electrolyte (conducts electricity)

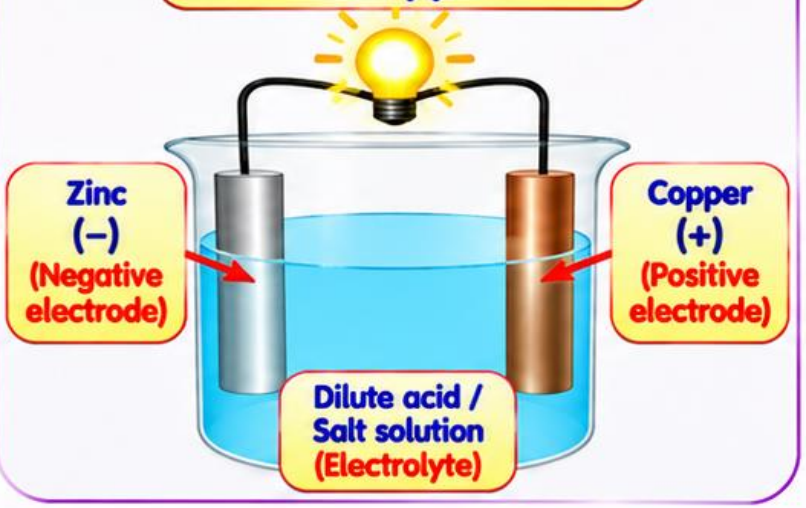
Key Concept: A lemon cell generates electricity through the combination of two different metal electrodes and an electrolyte.

A Step Further – Common Metal Pairs in Voltaic Cells

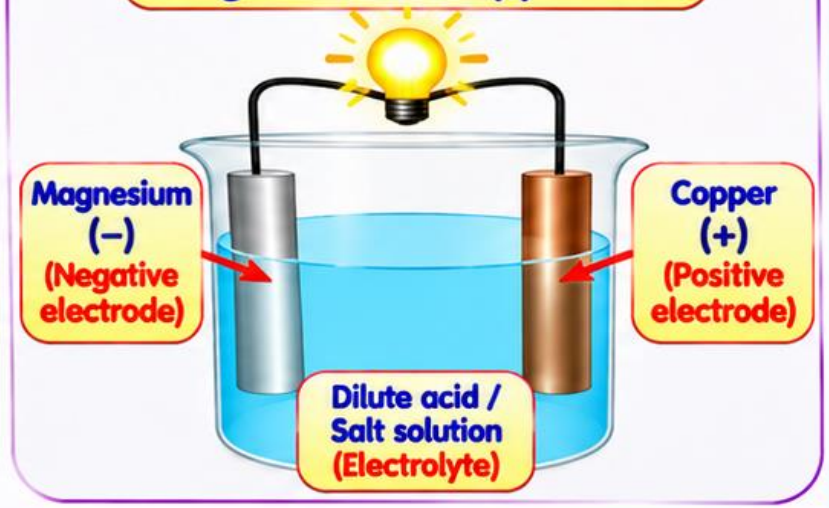
- Some common metal pairs used in voltaic cells are:
  - Zinc and copper
  - Zinc and silver
  - Aluminium and copper
  - Iron and copper
  - Magnesium and copper
  - Lead and copper
- Some metals, like copper, act as positive electrodes.
- Some other metals, like zinc, act as negative electrodes.
- The role of metals as electrodes depends on their chemical properties.

Examples of Voltaic Cells with Different Metal Pairs

Zinc – Copper Cell



Magnesium – Copper Cell



Common Metal Pairs Used in Voltaic Cells

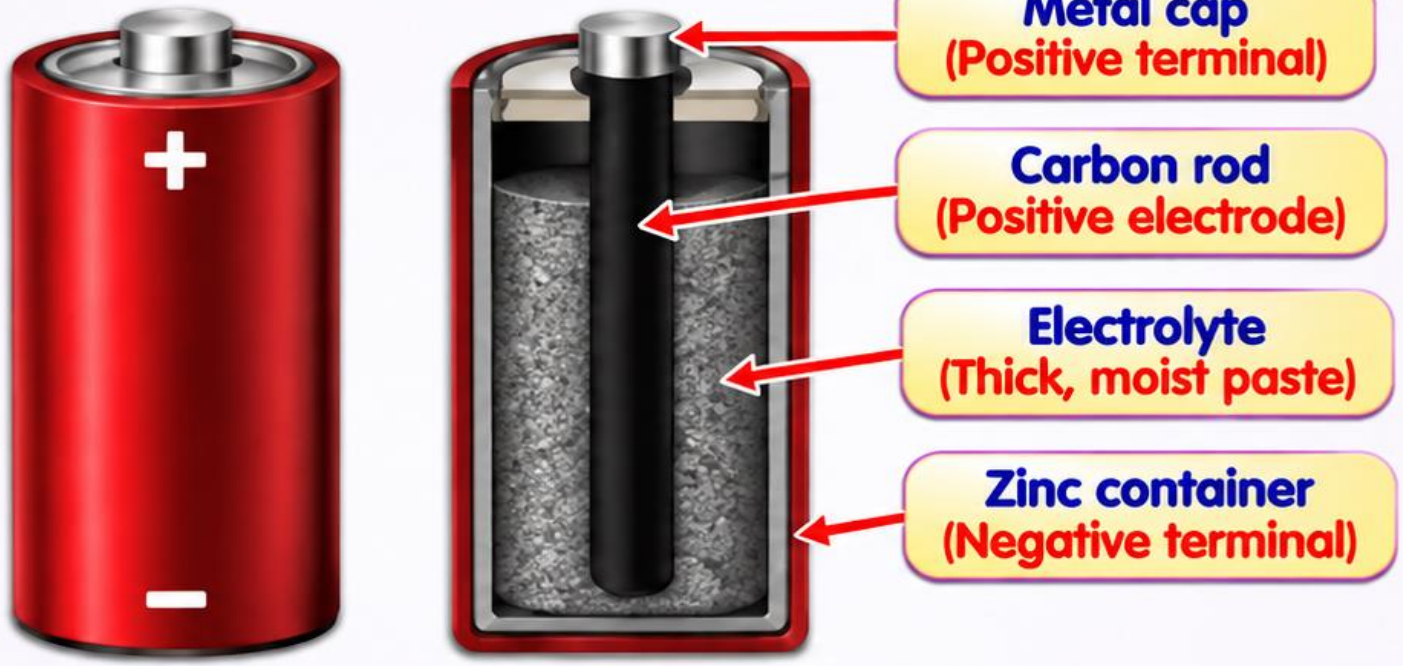
S. No.	Metal Pair	S. No.	Metal Pair
1.	Zinc and copper	4.	Iron and copper
2.	Zinc and silver	5.	Magnesium and copper
3.	Aluminium and copper	6.	Lead and copper

Key Concept: Different metal pairs can be used to make voltaic cells because of their chemical properties.

6.4.2 – Dry Cells

- Voltaic cells were an important discovery, but they are not convenient for everyday use.
- **Dry cells** are among the most widely used electric cells today.
- They are called dry cells because the electrolyte is not a liquid; it is a **thick, moist paste.**
- A dry cell consists of a zinc container and a carbon rod at the centre.
- The zinc container acts as the **negative terminal.**
- The carbon rod, covered with a metal cap, acts as the **positive terminal.**

A Dry Cell and Its Internal Structure



(a) Dry cell (External view)

(b) Internal structure of a dry cell

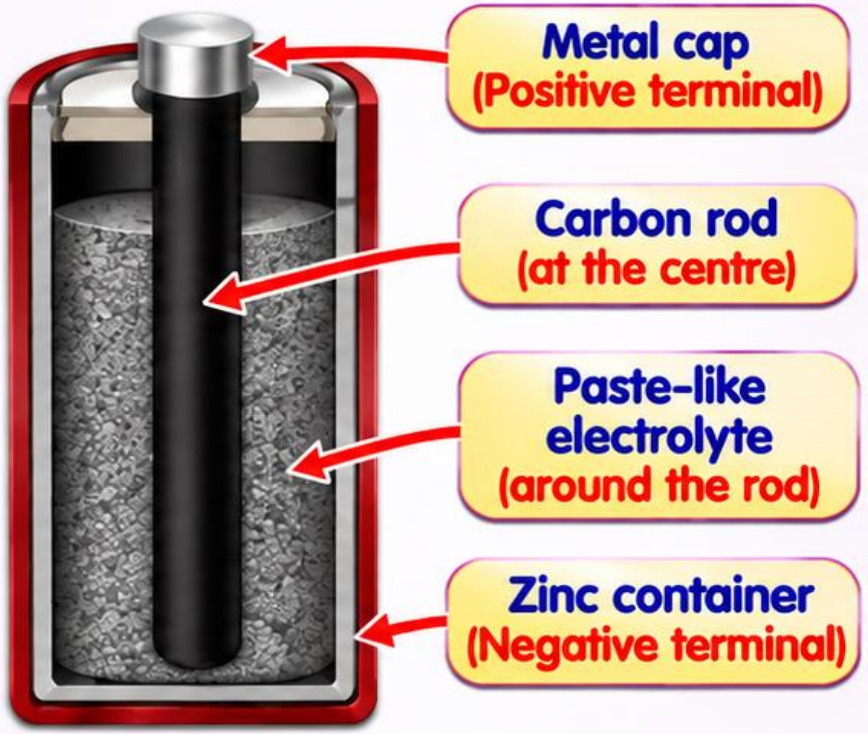
https://youtube.com/shorts/W7ro1KL9r-s?si=-TCwjtVQPstgMPsxN

Key Concept: A dry cell consists of a zinc container (**negative terminal**) and a carbon rod (**positive terminal**) with a thick, moist paste as **electrolyte.**

Structure and Uses of a Dry Cell

- The carbon rod is located at the centre of the dry cell.
- The carbon rod is surrounded by a paste-like electrolyte.
- The zinc container acts as the negative terminal.
- The metal cap covering the carbon rod acts as the positive terminal.
- A dry cell is a single-use cell.
- Once it is used up, it has to be disposed of.
- Rechargeable batteries are increasingly being used for several applications.

Structure of a Dry Cell



Internal structure of a dry cell

Uses of Dry Cells


Torch


Toys


TV Remote


Wall Clock


Radio


Calculator

Key Concept: A dry cell contains a paste-like electrolyte, a zinc container (negative terminal) and a carbon rod with a metal cap (positive terminal).

6.4.3 – Rechargeable Batteries

- **Rechargeable batteries** can be recharged and reused multiple times.
- They are used in many different devices and applications.
- Rechargeable batteries are available in different sizes and capacities.
- They are used in **laptops**, **mobile phones**, **cameras**, **inverters** and **electric vehicles**.

Examples of Rechargeable Batteries



Laptop Battery



Mobile Phone Battery



Camera Battery



Inverter Battery



Electric Vehicle Battery

Key Concept: **Rechargeable batteries** can be recharged and reused multiple times, and are used in many electronic devices.

Uses and Limitations of Rechargeable Batteries

- Rechargeable batteries are used for different applications, from small batteries in watches and phones to large batteries used in laptops, tablets, inverters and electric vehicles.
- Rechargeable batteries can be charged and used many times.
- However, rechargeable batteries do not last forever.
- After being charged and used repeatedly, they slowly wear out.
- Mobile phones need to be charged more frequently as their batteries gradually wear out.

Applications of Rechargeable Batteries



Watch



Mobile Phone


Laptop


Tablet



Inverter


Electric Vehicle

A Battery Wearing Out with Repeated Use


New Battery
(High capacity)


After Many Uses
(Reduced capacity)


Worn-out Battery
(Needs charging more frequently)



Key Concept: Rechargeable batteries can be reused many times, but their capacity and performance gradually decrease with repeated charging and use.

A Step Further – Lithium-Ion Batteries

- Lithium-ion (Li-ion) batteries are the most common type of rechargeable battery used today.
- They are found in almost all electronic devices that use batteries.
- These batteries rely on special metals such as lithium and cobalt.
- Lithium and cobalt are mined and processed in limited parts of the world.
- Countries are working to secure supplies of these metals and recycle old batteries.

https://youtube.com/shorts/A0gnIR5c1nY?si-6VuUCpuy3Nu_3O4p

Lithium-Ion Batteries and Their Uses



Lithium-Ion Batteries (Li-ion)



Mobile Phone | Laptop | Tablet | Smart Watch | Camera | Earbuds

Source of Raw Materials



Lithium (Li) | Cobalt (Co)

Lithium and cobalt are mined and processed in limited parts of the world.

Recycling of Batteries

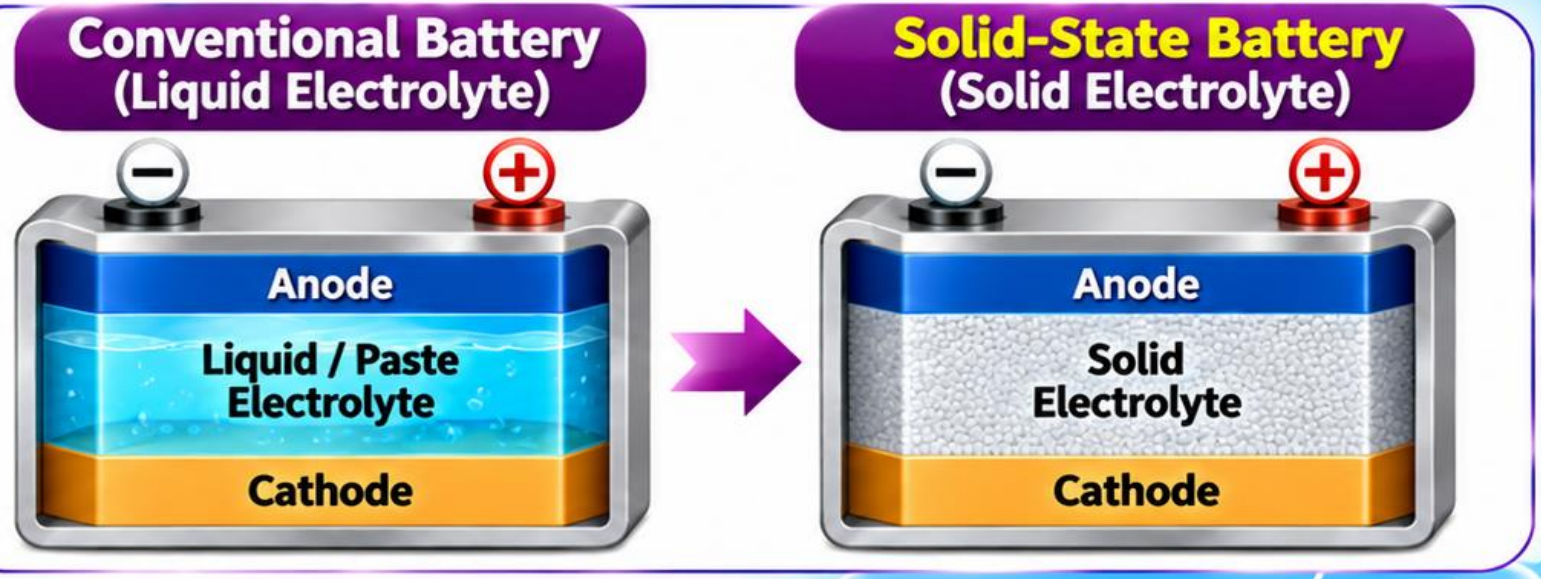


Countries are working to secure supplies of these metals and recycle old batteries.

Key Concept: Lithium-ion batteries are the most common rechargeable batteries, made using lithium and cobalt, and are being increasingly recycled.

Future of Rechargeable Batteries – Solid-State Batteries

- Scientists are developing a new generation of batteries called **solid-state batteries.**
- Solid-state batteries replace liquid or paste-like electrolytes with solid materials.
- These future batteries may be:
  - ✅ Much safer
  - ✅ Faster to charge
  - ✅ Longer-lasting
- Improved rechargeable batteries are important for environmentally friendly electrical power.
- Battery technology is helping the world move towards cleaner energy and sustainable transportation.



Advantages of Solid-State Batteries





Key Concept: Solid-state batteries are a promising future technology that may improve battery safety, charging speed and performance.


thank you