



Grade 6 Term 3 Natural Sciences and Technology Summary

Electrical Circuits Simple Circuits

How Energy Moves in a System

- A system is a group of parts that work together to do a specific job.
- For example, when a toaster makes toast, all its parts help it heat up the bread. In an electrical circuit, the system moves electricity from a power source to a device, like a light bulb.
- That device then turns the electrical energy into something useful—like light.
- Every electrical system needs three main parts to work: an input (the power source), a device (like a light or motor), and an output (the result, such as light or movement). If one part is missing, the system won't work.



Parts of a Basic Circuit

Energy Source:

- The energy source is where the device gets its power.
- This power can come from things like batteries or electricity from a wall socket.
- The energy can only flow and be used when the source is properly connected to the rest of the circuit.



Conductors:

- Some materials allow electricity to flow through them easily.
- Most circuits use wires made of copper because copper is a good conductor of electricity.

Device:

- There are many kinds of devices that turn electrical energy into something useful.



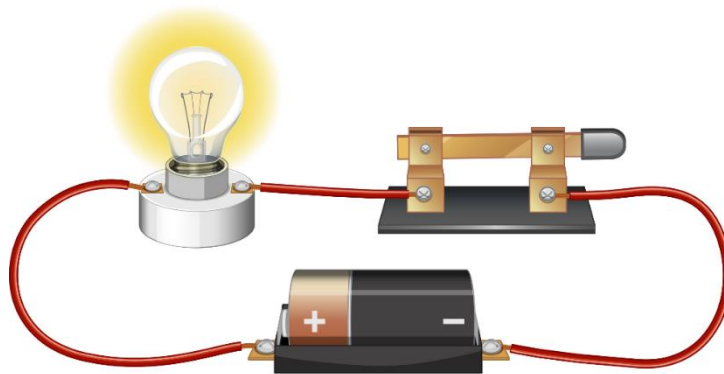
- This useful energy could be light (like from a lamp), heat (like from a heater), movement (like in a fan), or sound (like from a speaker).

A Complete Path for Electricity

- When all the parts of a circuit are connected, they form a system that lets electricity move through it.
- The electricity travels along this path.
- If the path is closed, we call it a closed circuit.
- This means the path is complete and the electricity can flow without stopping.




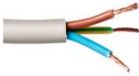





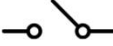
A Broken Path for Electricity

- When a circuit is fully connected to a power source, electricity can flow the whole time.
- But sometimes, something blocks or interrupts the flow of electricity.
- One way to do this on purpose is by using a switch.
- A switch is a helpful part of a circuit.
- When the switch is on (closed), electricity flows.
- When the switch is off (open), the flow of electricity stops.

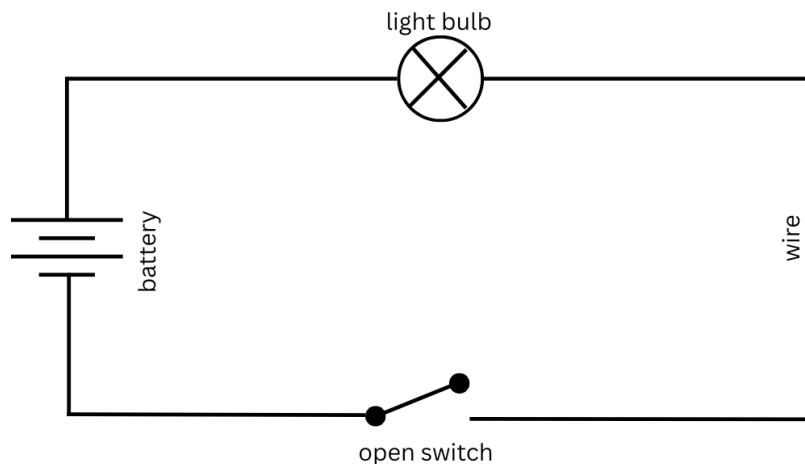


Circuit Diagrams

- People who work with electricity, like electricians, use basic drawings to show how circuits are set up.
- These drawings don't use pictures of things like batteries or light bulbs.
- Instead, they use special symbols to represent each part of the circuit.

| IMAGE | SYMBOLS | |
|--|---|---|
| battery  | cell  | battery  |
|  |  | |
|  |  | |
|  | closed  | open  |

Simple Diagram



Electrical Conductors and Insulators

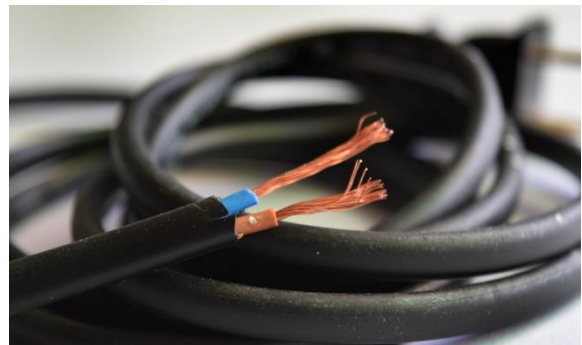
Conductors

What Are Conductors?

- Conductors are materials that let electricity pass through them easily.
- They work in a similar way to how heat can move through certain materials.
- Just like a metal spoon gets hot when left in a pot of soup, electricity can move through a conductor in a circuit.

Why Copper Is Commonly Used

- Many metals can carry electricity, including copper, silver, gold, and aluminium. Out of these, copper is the most commonly used.
- That's because copper is a great conductor—it lets electricity flow through it easily—and it doesn't cost too much.
- Silver and gold are even better at conducting electricity than copper, but they are very expensive.
- Because of this, we don't use them in everyday wiring.
- Aluminium is cheaper than copper, but it's not as good at conducting electricity, which is why copper is usually the best choice.



Insulators

What Are Insulators?

- Insulators are materials that do not let electricity pass through them easily.
- That's why they are sometimes called poor conductors of electricity.
- They help keep us safe when working with or near electrical systems.

How Insulators Protect Us

- Electricity can be very dangerous. People have been seriously hurt or even killed by touching live (powered) wires with bare hands.
- This happens because the human body can conduct electricity, meaning electricity can flow through it.
- Insulators act like a barrier between us and the electricity.
- They stop the electric current from flowing where it shouldn't.
- This is why they are used to cover wires and tools used by electricians.



Examples of Insulators

- Insulators are usually non-metal materials.
- Common examples include plastic, rubber, wood, glass, and ceramic.
- These materials don't let electricity flow through them, making them perfect for safety equipment.

Plastic as a Common Insulator

- Plastic is one of the most used insulators.
- You may notice that electric wires are covered in plastic—this is to stop the electricity from escaping and to protect people from getting shocked.
- We say these wires are insulated.

People use insulating materials in many ways. For example:

- The handles of electric kettles are often made of plastic or rubber.
- Electric tools, like drills or hairdryers, are covered with insulating material.
- Power lines are sometimes coated or wrapped in insulating layers, like ceramic, to prevent accidents.



Systems to Solve Problems

Using Electrical Circuits

- So far, we've learned about simple circuits.
- But in real life, many electrical circuits are more complex.
- These more advanced circuits were created to help solve everyday problems by using energy in useful ways.

Examples of Problem-Solving Circuits:

- **Traffic Lights:** These were made to control traffic safely and prevent accidents at busy roads and intersections.
- **Cooling Fans in Machines:** These fans were designed to stop machines from overheating while they are being used.
- **Heaters:** Heaters help warm up spaces, especially in cold weather, making homes and buildings more comfortable.



Mains Electricity

Fossil Fuels and Electricity

Where Fossil Fuels Come From

- Fossil fuels were created deep inside the Earth over millions of years.
- They come from the remains of plants and animals that lived long ago.
- When these living things died, their bodies were buried by layers of sand, mud, and rocks.
- Over time, the pressure and heat from the Earth changed this buried matter into fossil fuels like coal, oil, and natural gas.
- Fossil fuels are found in many places around the world, including under the land and sea.
- In oceans, tiny plants and animals died and sank to the bottom. Over millions of years, they formed thick layers of mud.
- More layers of sand, rocks, and soil built up on top, pressing down and turning the mud into oil and natural gas.
- Sometimes fossil fuels are close to the surface and can be collected easily.
- This happens when oil and gas move upward through cracks in the Earth.
- But most fossil fuels are buried deep underground and are harder to reach.

How Fossil Fuels Are Collected

- To get fossil fuels from deep underground, people build mines to dig out coal, or use drilling machines to reach oil and gas.
- When oil and gas are buried far below the ocean floor, huge machines called oil rigs are built in the ocean to drill down and collect them.
- These fossil fuels are then used to create electricity, which powers homes, schools, and businesses.



Coal and Electricity in South Africa

- South Africa has a lot of coal, especially in the province of Mpumalanga.
- This coal is very important because it is used to make most of our electricity.
- In fact, about 80% of the coal we mine is used in power stations to produce electricity.

How Coal is Used to Make Electricity

Even though we use coal to make electricity, that energy originally came from the Sun. Here's how the process works:

1. The Sun's energy is absorbed by plants as they grow.
2. When the plants die, they get buried and, over millions of years, turn into coal.
3. Coal is mined and burned in a boiler at a power station to heat up water.
4. The water turns into steam, which pushes blades like a fan inside a turbine.
5. The spinning turbine powers a generator, which changes the moving energy into electricity.
6. The electricity goes to a step-up transformer, which increases its power so it can travel long distances through power lines.
7. When the electricity gets close to homes and buildings, it reaches step-down substations, which lower the power to make it safe for use.
8. Finally, the electricity travels through wires and powers the devices we plug in at home, like TVs, fridges, and lights.



Cost of Electricity

- Making and delivering electricity to places like our homes, schools, shops, and factories costs a lot of money.
- This is because electricity needs many different systems and machines to produce it and send it where it's needed.

Why Coal Mines Are Expensive to Run

- Coal is used in many power stations to make electricity.
- But running a coal mine also costs a lot.
- This is because money is needed for things like:
 - Paying the workers who work in the mine
 - Buying and using mining machines and equipment
 - Fixing and repairing the equipment when it breaks



The Cost of Transporting Coal

- Even though many of South Africa's coal power stations are built close to coal mines, transporting coal still costs a lot of money.
- Coal has to be moved in large amounts from the mines to the power stations, usually by trucks, trains, or conveyor belts.
- These transport systems need fuel, maintenance, and workers to operate them.
- The more coal that needs to be delivered, and the farther it has to travel, the more expensive it becomes.

The Cost of Building Power Stations

- Making electricity doesn't just happen—it takes huge buildings called power stations to produce it.
- Building a new power station costs billions of Rands.
- For example, two of the largest power stations in South Africa—Medupi in Limpopo and Kusile in Mpumalanga—are expected to cost between R116 billion and R158 billion to complete.



- By the year 2026, South Africa's electricity company, Eskom, is expected to have spent close to one trillion Rand on creating and supplying electricity across the country.
- This shows how expensive it is to keep the electricity system working.

The Cost of Pylons, Substations, and Wiring

- Once electricity is made at power stations, it still needs to be sent to homes, schools, businesses, and other buildings.
- To do this, we need a grid system. This includes:



- Pylons (tall towers that carry power lines)
- Substations (places where the power is adjusted to make it safe to use)
- Wires and cables that carry electricity across the country

The Cost of Using Electrical Appliances

- Electricity is measured in watts, and different appliances use different amounts of power.
- Some appliances need only a small amount of electricity to work, while others use a lot more.
- The more electricity your appliances use, the higher your electricity bill will be at the end of the month.

Why We Should Save Electricity

- When we use a lot of electricity, our power stations have to burn more coal to produce it.
- Coal is a non-renewable resource, which means it will eventually run out and cannot be replaced quickly.
- By saving electricity, we help protect the environment and use less coal.

Solar Water Heaters Can Save Energy

- Geysers (water heaters) use a large amount of electricity to heat water.
- To save energy, you can do one of two things:
 - Turn down the thermostat so the water is not overheated.
 - Install a solar water heater, which uses energy from the Sun to warm up the water.



Energy-Saving Light Bulbs

- Older light bulbs waste a lot of energy.
- They turn only 20% of the electricity into light, and the other 80% is lost as heat, which we don't actually use.
- Newer bulbs, called compact fluorescent lamps (CFLs), do a much better job.
- They turn 80% of the electricity into light and only 20% into heat, so they waste much less energy.
- Even though energy-saving bulbs cost more to buy, they last much longer and use less electricity, which helps save money over time.



Easy Ways to Save Electricity

- Use less hot water – Take a quick shower instead of filling up a bath. Showers use much less hot water.
- Switch off appliances when you are not using them, like TVs, computers, and game consoles.
- Put lids on pots when cooking – This helps the food cook faster and saves energy.
- Use a kettle instead of a pot to boil water. Only boil the amount of water you need.
- Start cooking on high heat, but once your food is boiling, turn it down to simmer. This saves electricity and still cooks the food well.
- Don't use the oven or stove to heat your home. They use a lot of power. A gas heater is better and usually costs less to run.
- Check the rubber seals on your fridge and oven. If they are worn out, they let heat in or out, which wastes energy.
- Turn off lights when you leave a room. There's no need to light an empty space!
- Unplug appliances on stand-by mode, like TVs or microwaves. Even when not in use, they still use a small amount of electricity.
- Use a geyser blanket to keep the heat inside your water heater. This means the geyser won't have to use as much power to keep the water hot.
- Turn off the geyser when you don't need hot water, like when you're away from home.

Illegal Connections

What Are Illegal Electricity Connections?

- Some people steal electricity by connecting to the main power lines without permission and without paying for it.
- This is called an illegal connection.
- To do this, they might dig holes or trenches to hide underground cables and wires.
- Sometimes, they also connect their wires directly to the overhead power lines.
- After setting it up, they often cover everything to try and hide it.



Why Illegal Connections Are Very Dangerous

- Illegal connections are not only unfair—they are extremely dangerous.
- These wires often connect to the main electricity lines before the power has been made safe at a substation.
- This means the electricity is still at a very high voltage, which can cause serious harm.
- Exposed wires from illegal connections can:
 - Electrocute or kill someone if they are touched
 - Cause serious burns from powerful electric shocks
 - Start fires that can damage homes and hurt people

Renewable Ways to Generate Electricity

Renewable and Non-Renewable Ways to Make Electricity

- Electricity can be made using different types of energy resources.
- These are divided into two main groups: non-renewable and renewable.

Non-Renewable Energy Resources

- Fossil fuels, such as coal, oil, and natural gas, are non-renewable energy sources.
- This means that once we use them, they cannot be replaced.
- They take millions of years to form, so when they run out, we won't be able to make more in our lifetime.
- Burning fossil fuels also creates pollution, which harms the air we breathe and contributes to climate change.
- Even though these fuels are useful for making large amounts of electricity, they are limited and can damage the environment.

Renewable Energy Resources

- Renewable resources are energy sources that do not run out and can be used again and again.
- These include the Sun, wind, and moving water.
 - **Solar energy:** Solar panels capture energy from the Sun and turn it into electricity.
 - **Wind energy:** Large wind turbines use the power of the wind to make electricity.
 - **Hydroelectric energy:** Power stations use flowing water from rivers or dams to spin turbines and produce electricity.

Wind Energy

- Wind energy is a type of renewable energy that uses the power of the wind to make electricity.
- Large machines called wind turbines are placed in open, windy areas.
- These areas are often grouped together and are known as wind farms.
- When the wind blows, it turns the big blades of the turbine.
- These spinning blades then turn parts inside the turbine that are connected to a generator.
- The generator is the part that creates electricity.
- Wind farms can have many turbines working together to produce a lot of electricity without causing pollution.
- However, they work best in places where it is windy most of the time.



Solar Panels

- Solar panels are devices that collect energy from the Sun.
- They are usually placed on rooftops or in wide open areas where they can get a lot of sunlight.
- The panels change the sunlight into electricity or heat.
- This energy is then carried through wires into buildings like homes or schools.
- For solar panels to work well, they need to be placed in spots where they get the most sunshine during the day.
- Even though solar panels cost money to install, they help save electricity in the long run and don't harm the environment.



Hydroelectric Power (Water Energy)

Hydroelectric power uses the movement of water to produce electricity. It is a clean and powerful way to make energy. Here's how it works:

1. Water is stored in a large dam.
2. The water flows through huge turbines (big spinning wheels) in the dam wall.
3. As the water flows, it spins the turbines.
4. The spinning turbines give energy to a generator, which makes electricity.
5. This electricity travels along power lines to homes, schools, and businesses.
6. After the water has flowed through the dam, it continues its journey to rivers and eventually back to the sea. Then, through the water cycle, it returns to the mountains and the process begins again.

