PHYSICS

WORKBOOK

AND

ACTIVITIES OF INTEGRATION

SENIOR FOUR



LOWER SECONDARY

NEW CURRICULUM

1ST EDITION

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NEXT GENERATION LEARNER

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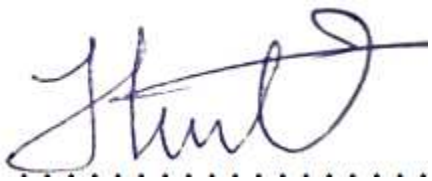
Preface

This Learner's workbook has been written in line with the revised Physics syllabus for the new lower secondary curriculum. The revision questions, worksheets and activities of integration have been incorporated into this workbook. Through those activities of integration provided at the end of each chapter the learner is able to produce new knowledge, values and skills are required in the 21st century.

This has been done by providing a range of activities of integration which will enable the learner to research more through the internet in order to understand the applicability of knowledge learned at his or her respective school.

The learner is expected to be able to work as an individual, in pairs and groups according to the nature of the activities in order to be able to share learning experiences with their colleagues.

This Learner's workbook is one of the materials which are to be used to support the teaching and learning process of the new lower secondary curriculum.



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Acknowledgements

I would like to express a sincere appreciation to all those who worked tirelessly towards the production of this Learner's workbook.

First and foremost, I would like to thank my family and friends for supporting all my initiatives both financially and spiritually. I would like to thank my wife Awino Christine for helping me in printing and selling the books. I would also like to thank my parents Mr. Omwandi Philemon, and Mrs. Akoth Rose Mary, my siblings Atosa Jonathan, Omwandi Philemon Junior, Adikini Esther lucy and Akoth Georgina. My friends Ashraf, Ntambi and Genza.

My gratitude also goes to the various institutions which provided staff who natured and supported me to become the physics teacher I am today. My thanks go to Mandela S.S Hoima, Kakungulu memorial school Kibuli and Greenhill academy. These schools have provided me with enough working experience to write these books together with a supportive staff and colleagues.

I would like to thank Mr. Centenary, Mr Akol Patrick, Mr. Joab M, Mr. M.mathias, Mr. Barongo Ronald and Madam Robinah from Mandela S.S Hoima

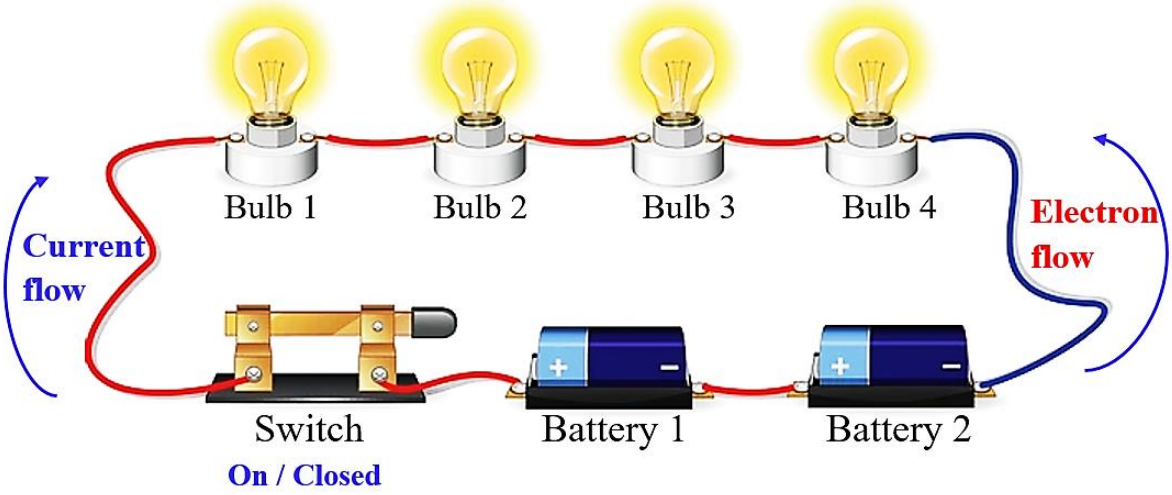
I would like to thank Mr. Hassan, Mr. Mukiibi, Mr. Abiib, Tr Gilbert, Mr. Kintu from Kakungulu Mermorial school Kibuli for the experience we have shared.

Last but not least, I would like to acknowledge Greenhill Academy Kibuli for the good environment that enabled me to get used to the next generation teachers like Mr. Bemba, Mr. Amayo, Mr. Guma, Tr. Moses and Mr. Sunab

I welcome any suggestions for improvement to continue making my service delivery better. Please get to me through kennethonderi@gmail.com or contact **0705476300** or **0771940855**

Chapter 1

Introduction to Current Electricity



KEY LEARNING OUTCOMES

By the end of this chapter, the learner should be able to:

- Understand what e.m.f is
- Understand that cells convert chemical energy into electrical energy, producing current and also the force needed to create a flow of current in a circuit (u, s)
- Understand that electric cells are very useful but have their limitations (u, v/a)
- Understand the nature of electric current, its sources, what makes it flow around circuits and how it is measured (u, s)
- Know that some materials are electrical conductors and others are insulators (k)
- Recognise, understand and apply knowledge of series and parallel circuits (k, u, s, v/a)
- Appreciate that circuits may be represented as circuit diagrams consisting of an agreed set of symbols to represent components (k, u, s)

Introduction

One of the primary branches of physics is Electricity. There are two types of electricity which include static electricity and current electricity. In book 2, we learnt about static electricity (electrostatics) where all charges were considered to be **at rest**. In book 4 we shall study about current electricity where charges are in **motion**. But in our everyday life we see many devices where charges flow in a steady manner, like water flowing smoothly in a river. Torches, radios, cell-driven clocks are some of the examples of such devices.

Current electricity is the flow of electrons through a conductor, which powers electrical devices such as torches, radios, bulbs etc. Current electricity is named for the way electrons move. They "flow" in one direction - like a river current.

- The quantity of electricity is measured in a unit called **Coulombs** (**C**) and this quantity of electricity flowing through a conductor/wire is called **charge** (**Q**)
- Electric **current** is the rate of flow of electric charges through a conductor. S.I unit of current is Ampere (A). The instrument used to measure current is Ammeter
- A **circuit** is a closed path in which electric current travels from a power source.
- In this chapter, we shall study about sources of electricity, what makes it flow around circuits? What are the uses of electricity? What are the safety precautions against electricity? What are the conductors and insulators of electricity? What symbols are used in electric circuit diagrams and? What is the significance of parallel and series arrangements in electric circuits?

- Electric current often travels through conductors or wires. Materials that can conduct electricity are able to have an electric current flowing through them. The best known material for conducting electricity is **metal**.
- **Insulators** are materials electrons do not flow through easily. These can also be called **non-conductors**. Rubber, plastic, glass, paper and air are insulators.
- The word **resistance** describes how easily an electric current can pass through a material. Conductors have **low resistance**. Insulators have **high resistance**.
- **Resistance** is the opposition to the flow of electric current through a conductor.
- If a current travels through your body by accident, it is called an **electric shock**. If the current is strong, it could cause serious injury or death. This is why you need to follow **safety rules** when working with electricity. You may need to wear clothes or gloves made of insulating materials. Or you may need to stand on an insulating surface. These can protect you because they don't allow current to flow through your body.

WORKSHEET (SHORT ANSWER QUESTIONS)

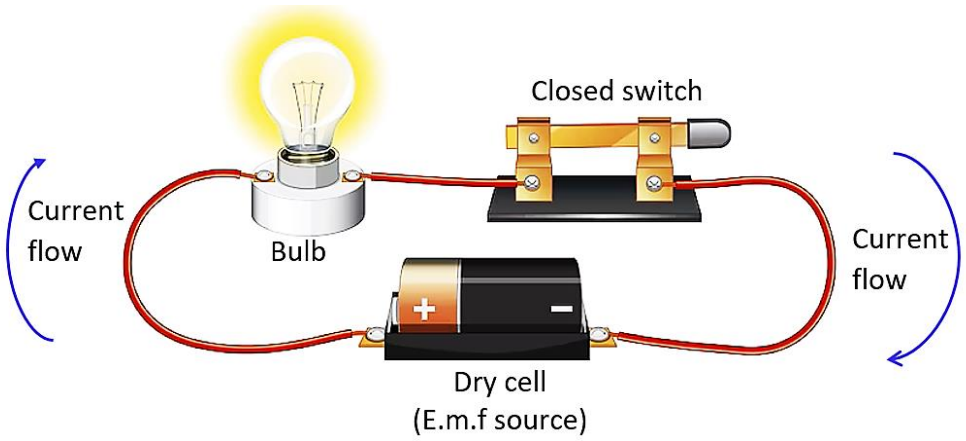
Competency. Learners should appreciate that electric current is the transfer of charge through a conductor, either by electrons or by ions.

Electromotive force (e.m.f)

- In pairs, learners research for the meaning of e.m.f
- In pairs, learners research about sources of e.m.f
- In groups, learners investigate sources of e.m.f experimentally in the laboratory.

Energy is converted from one form to another in the generator or battery as the device does work on the electric charge being transferred within itself. The battery is a two-terminal device with one terminal having a higher potential than the other. The **positive terminal** is commonly called the positive terminal because it has more significant electric potential and is generally represented by a **plus sign**. The lower-potential terminal is the **negative terminal**, denoted by a **minus sign**.

After the battery is connected to the bulb, charges travel from one terminal to the next, passing through the bulb. The bulb shines as a result of this. In positive current flow, also referred to as conventional current flow, positive charges leave the positive terminal, flow through the bulb, and reach the negative terminal of the emf source. This is how an emf source is set up.



ACTIVITY 1 : Using a dry cell, a cell holder, a switch, a bulb and 3 pieces of connecting wires of about 30 cm each, connect the circuit as shown above.

(a) In which direction does current flow? .....

(b) In which direction does electrons flow? .....

(c) State what is observed when:

(i) Switch is open (OFF)

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(ii) *Switch is closed (ON)*

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(d) *Briefly explain your observation in (a) (i) and (ii) above*

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(e) *State the possible energy changes which take place in a (ii)*

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(f) *Name any other three sources of e.m.f besides the above used in the circuit.*

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(g) *State what will happen to the brightness of the bulb when the dry cells are doubled*

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(h) *Briefly explain your observation*

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GUIDING NOTES 

Despite its name, electromotive force is not actually a force, It is energy transfer per unit charge around an electric circuit in which a battery is connected. It is commonly measured in units of volts (V), or joule per coulomb (JC^{-1}). **Alternatively**, e.m.f is the total work done per unit charge in moving a unit charge (1 coulomb) around a circuit in which a battery is connected
The e.m.f of a battery /cell can be measured using an instrument called voltmeter.

NOTE:

Although voltage and potential difference are the same thing, make sure not to confuse them with e.m.f, which is slightly different.

Question: *Name devices that convert chemical energy to electrical energy*

……

Electric Cells.

- In groups, learners research and explain using diagrams:
  (i) The structure of a simple cell and how chemical reactions can produce electricity
  (ii) The flow of electricity around a circuit powered by an electric cell in terms of both the current / flow of charge and the potential difference created by the cell.
- In pairs, learners brainstorm, research and report on:
  (i) Common applications of electric cells
  (ii) Recent advancements in cell technology
  (iii) Applications for which cells are not appropriate and reasons why.

ICT Support

- The learner can use an online simulation to understand how electric cells operate.

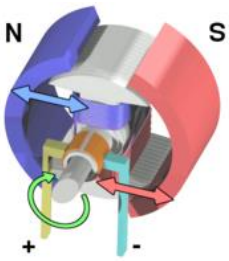
ACTIVITY 2: Identifying and naming sources of electricity

Electricity many come from various sources such as batteries, generators, solar panels, and electric power station and many others.

Question: From the images presented above, identify and write down the name of the sources of electricity below each image.

ACTIVITY 3: Identifying devices that convert electrical energy

	
Figure A	Figure B
	 
Figure C	Figure D
	
Figure E	

Question: From the images presented above in figure A, B, C and D, Name the device which converts:

(i) Electrical energy to mechanical energy .....

(ii) Mechanical energy to electrical energy .....

(iii) Light energy to electrical energy .....

(iv) Electrical energy to light energy .....

(v) Chemical energy to electrical energy .....

GUIDING NOTES ON CELLS

Currently the major sources of electricity are chemical cells, batteries, generators and solar panels and others.

Definition: A cell is a device which directly changes chemical energy to electrical energy.

Alternatively, a cell is a single electrical energy source that uses chemical reactions to produce a current.

ACTIVITY 4 (Identifying primary and secondary cells)

Cells that are **non-rechargeable** are known as **primary cells**. Cells that are **rechargeable** are known as **secondary cells**.

(a) From the following pictures, identify the primary cell and secondary cell. Mark Primary cell as **'P'** Secondary cell as **'S'**

	
Lithium – ion battery used in mobile phones	Dry cells used in flashlights, radios e.t.c
	
Lead – acid battery used in cars	Button cells used in watches, calculators e.t.c

(b) Name the type of cell with reversible electrochemical reaction

.....

(c) Name the type of cell with irreversible electrochemical reaction

.....

(d) List down examples of primary cells

.....

(e) List down examples of secondary cells

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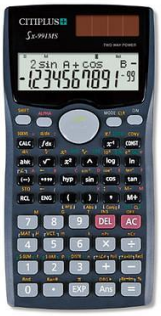
ACTITITY 5 (Identifying uses of primary and secondary cells)

(a) From the following pictures, identify those devices which use primary cell and secondary cell. Mark Primary cell as **'P'** Secondary cell as **'S'**. (Watch, car, remote, emergency lamp, mobile phone, calculator

NOTE: Cells are used in electrical circuits, and a combination of several cells together forms a battery. **Button cells** are used to power small portable devices such as wrist watches, pocket calculators, toys, hearing aids etc.

WHAT MAKES UP A SIMPLE CELL or VOLTAIC CELL?

Simple cells are made up of two electrodes and an electrolyte.
An electrolyte is a substance when in solution/molten form produces ions that conduct electricity.Two different metal plates of different reactivity are inserted into the electrolyte as electrodes to form a cell. The electrodes chemically react with the electrolytes to produce charges which flow as current through the circuit.

Due to chemical reactions, one electrode gets positive charge and the other gets negative charge producing a continuous flow of electric current. The **positive** electrode gains electrons whereas the **negative** electrode loses electrons.
The electricity (current) flows from the cell's positive electrode to its negative electrode.

Activity 6 (Producing electricity using a simple cell)

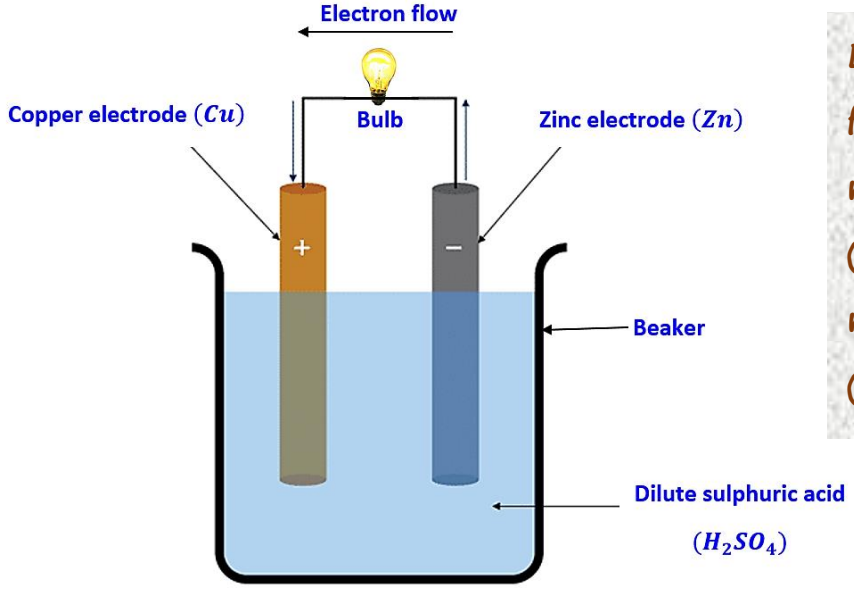
Materials required:

Electrodes: copper plate and zinc plate
Electrolyte: dilute sulphuric acid or lemon solution
Connecting wires, a beaker, crocodile clips

Warning/ precautions:

Do not touch he acid, do not use concentrated sulphuric acid.
Use gloves while working with the set up.

Set up of apparatus



Electrons flow from a more reactive metal (zinc) to a less reactive metal (copper)

Procedures

(a) Arrange copper and zinc plates in series as shown in the figure.
(b) Half fill a beaker with dilute sulphuric acid.

(c) Connect the copper plate with the positive of the bulb and zinc to the negative. Observe what happens.

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(d) Now you can replace dilute sulphuric acid with lemon juice and observe what happens.

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(e) With the aid of relevant ionic equations, describe what happens inside the simple cell to support the observations made in (c) above.

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(f) Suggest two defects of a simple cell

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(g) How can the above two defects be minimized?

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SIMPLE CELLS (VOLTAIC CELLS) GUIDING NOTES

When the two electrodes are placed in dilute sulphuric acid, zinc being more reactive than copper dissolves forming zinc ions and loses 2 electrons thus making zinc electrode acquire negative charge. The copper electrode being less reactive acquires positive charge. Due to opposite charges on the two electrodes, a potential difference is set up between the two electrodes. The electrons then flow around the circuit from the zinc electrode (−) to the copper electrode (+).This flow of electrons makes the bulb to glow.

EQUATIONS OF REACTION WITHIN THE SIMPLE CELL

Dilute sulphuric acid (H_2SO_4) ionises to form hydrogen ions ($2H^+$) and sulphate ions (SO_4^{2-})

$$H_2SO_4\ (aq) \rightleftharpoons 2H^+\ (aq)\ +\ SO_4^{2-}\ (aq)$$

- Zinc is more reactive than copper, which means it loses electrons more easily. The zinc atoms lose 2 electrons to form positive ions which go into the aqueous solution and decrease the mass of the zinc electrode.
- $Zn(s) \longrightarrow Zn^{2+}(aq) + 2e$
- Zinc ions (Zn^{2+}) react with sulphate ions (SO_4^{2-}) to form zinc sulphate ($ZnSO_4$) leaving excess electrons on the zinc electrode.
- $Zn^{2+}(aq) + SO_4^{2-}(aq) \longrightarrow ZnSO_4\ (aq) + 2e$
- These electrons flow around the circuit, from the zinc electrode to the less reactive electrode (copper) setting up a charge difference between the two electrodes.
- The hydrogen ions gain electrons to form hydrogen gas at the copper electrode which may be seen as bubbles of a colourless gas.
- $2H^+(aq) + 2e \longrightarrow H_2(g)$

The chemicals in the cell eventually run out, so the reactions eventually stop. This means that the cell can only produce electricity for a limited period of time.

Question: Is a simple cell an example of a primary or a secondary cell?

……

Order of increasing reactivity among common metals

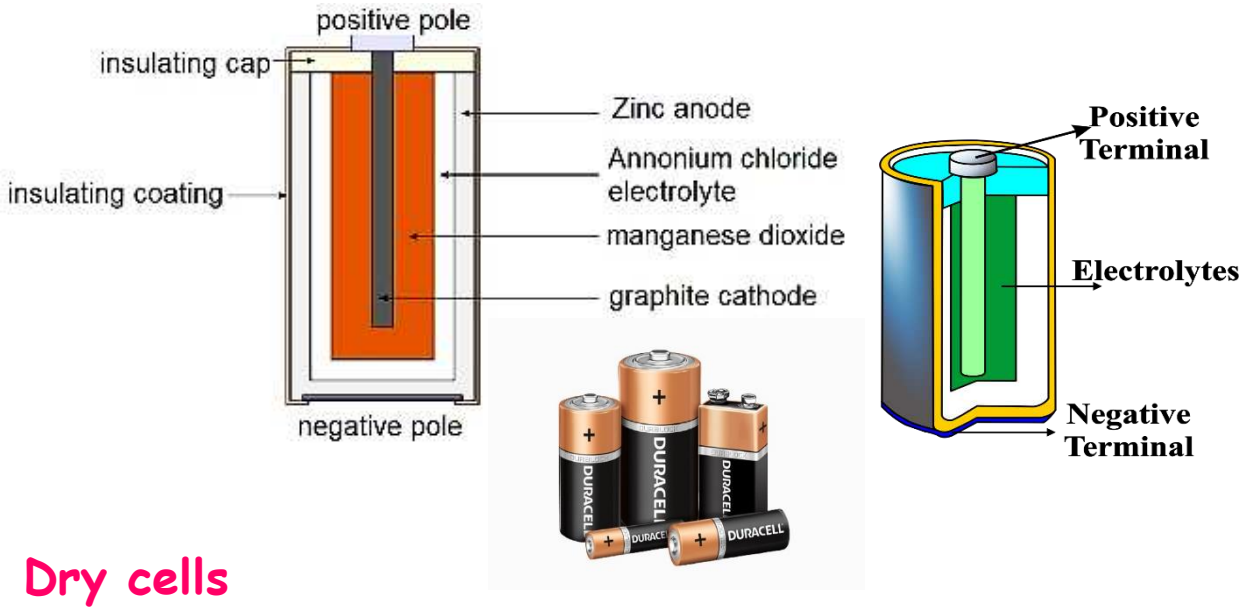
$Copper\ (Cu) < Lead(Pb) < Tin(Sn) < Iron\ (Fe) < Zinc\ (Zn) < Aluminium(Al) < Magnesium(Mg)$

The greater the difference in reactivity between the two metals, the greater the voltage.

DID YOU KNOW?

Most cells/batteries we use today are dry cells/batteries? This is because the electrolyte is in the form of a paste/gel not liquid however wet batteries are still seen in cars and inverters.

NOTE: Electric current flows in opposite direction to electrons



Dry cells

Unlike wet cells, which use a liquid electrolyte, dry cells use a **paste** as the electrolyte, making them more portable and convenient for everyday use. Dry cells are commonly used in small devices such as flashlights, remote controls, clocks e.t.c.

The dry cell consists of two electrodes, the negative electrode is made of zinc and forms the outer casing of the cell. The positive electrode is made of carbon rod surrounded by manganese oxide and it is centrally located.

The electrolyte is a paste made up of a mixture of salts and acids like ammonium chloride.

MODE OF OPERATION OF A DRY CELL

When a dry cell is connected to an external circuit, a chemical reaction occurs between the zinc anode and the electrolyte, generating electrons that flow through the external circuit, creating an electric current. The current flows from the **anode (zinc)** to the **cathode (carbon)**, powering any device attached to the circuit.

At the Anode (Zinc): The zinc metal is oxidized, releasing electrons.

$$Zn(s) \longrightarrow Zn^{2+}(aq) + 2e$$

At the Cathode (Carbon/Manganese Dioxide): The manganese dioxide reduces the hydrogen ions from the electrolyte, forming water and absorbing the electrons.

$$2MnO_2(s) + 2H^+(aq) + 2e^- \rightarrow Mn_2O_3(s) + H_2O(l)$$

Definition: a dry cell is a device that uses a paste electrolyte to convert chemical energy into electrical energy.

NOTE: The negative electrode is also called the anode and the positive electrode is also called the cathode.

Question: Is a dry cell a primary cell or a secondary cell? .....

.....

Battery

Often, we call cells as 'batteries'. However only when two or more cells are combined together they make a battery. A cell is a single unit that converts chemical energy into electrical energy, and a **battery is a collection of cells**.

Battery

RESEARCH WORK

The batteries used in most cars today are rechargeable meaning they can be reused multiple times. These batteries are include **lead – acid battery**, **Nickel – Cadmium alkaline batteries** e.t.c

(a) Research and make notes about how these batteries work.

(b) What are the **advantages** and **disadvantages** of alkaline batteries over lead acid batteries?

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Electric circuits and Arrangements

- In pairs, learners:
  - (i) Research and use diagrams to explain symbols used in circuit diagrams.
  - (ii) Research and use diagrams to explain the differences between series and parallel arrangements in circuits.
  - (iii) Investigate and report on the relationship between voltage and brightness of the bulb
  - (iv) Explain the practical implication of the relationship between voltage and brightness of the bulb.
- In groups, learners plan and report on an investigation using batteries, bulbs, and an ammeter to measure the current flowing through different parts of series and parallel circuits, and then explain why domestic circuits are in parallel.
- In pairs, learners research and contribute to a presentation to explain how an electric current involves the transfer of a charge by electrons or ions.

Electric Circuits

Grandfather asked Selvi to bring torchlight. While taking the torchlight, it fell down and the cells came out. She puts the cells back as shown in the **figure A** and switched it on. The torchlight did not glow. She thought the torchlight was worn out.

She was afraid that grandfather might scold her. She started crying. Her uncle came there and asked the reason for crying. She conveyed the matter. Her uncle removed the cells and reversed them as shown in the **figure B**. Now, the torch glows. Selvi's face also glows. Uncle told her the reason and explained her about electric circuits.

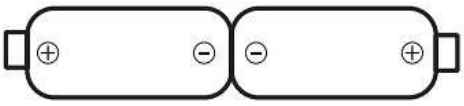	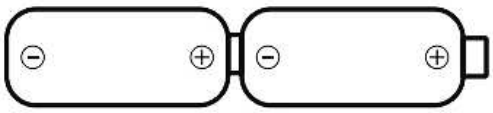
Figure A	**Figure B**

Question. Briefly explain why the cell arrangement in figure A did not make the torch glow while that in figure B caused it to glow

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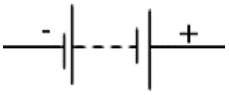
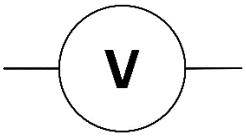
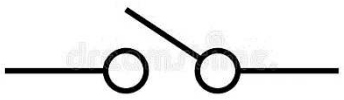
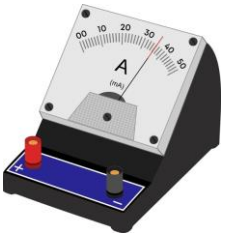
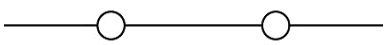
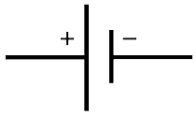
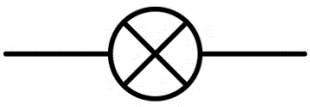
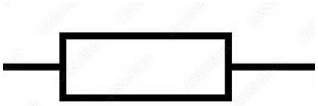
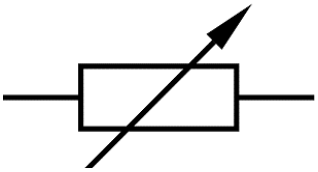
Electric Circuit symbols

scientists came up with a new way of showing the components of electrical circuit using special symbols. These symbols are used all over the world and help scientists, engineers and technicians to draw or record circuits more quickly and accurately.

ACTIVITY 7: Identifying symbols used in circuit diagrams

Research (using the internet) the circuit symbols for the following electrical components and us this knowledge to **match** each symbol with their picture and name.

Name and picture	Symbol
 Open switch	
 Closed switch	
 Cell	
 Battery	
 Ammeter	
 Voltmeter	

Name and picture	Symbol
 Resistor	
 Rheostat **OR** variable resistor	
 Bulb	
 Connecting wires	

Research (using the internet) the circuit symbols for the following electrical components:

Name	Symbol
Capacitor	
Diode	
A.C voltage source	
Transformer	
Fuse	
Earthing/Ground	

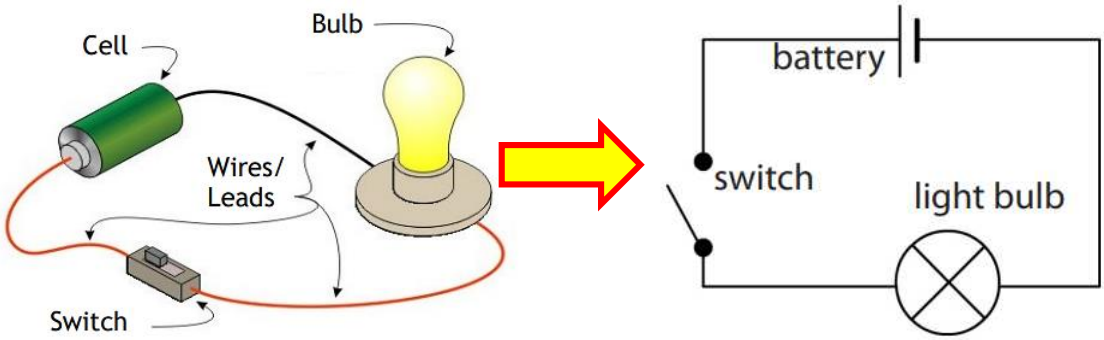
An **electric circuit** is the continuous or unbroken closed path along which electric current flows from the positive terminal to the negative terminal of the battery.

A circuit generally has the following components:

- **A cell or battery** - a source of electric current
- **Connecting wires** - for carrying current
- **A bulb** - a device that consumes the electricity
- **A key or a switch** - this may be connected anywhere along the circuit to stop or allow the flow of current.

ACTIVITY 8. Understanding a Simple circuit diagram.

There is a simple and quick way to represent an electric circuit. The circuit has a battery, a bulb and a switch, which are all connected with electric wires.



(a) Using connecting wires, a switch, a bulb and a dry cell, Arrange a simple circuit as shown in the diagram above

(b) Indicate the following in the circuit diagram on the Right hand side.

(i) Direction of current flow and electron flow

(ii) Positive (+) and negative (−) terminals of the dry cell

(c) State what is observed when the switch is closed

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(d) State what is observed when the switch is opened

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(e) Explain your observations in (b) and (c) above

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Did you know? In a circuit if the Switch is **open (off),** then electric current will not flow and the circuit is called an **open circuit**. The bulb will **not glow** in this circuit.
In a circuit if the switch is **closed (on),** then electric current will flow and the circuit is called a **closed circuit**. The bulb will glow in this circuit.

Types of Circuits

1. Simple Circuit
2. Series Circuit
3. Parallel Circuits

Simple Circuit

A circuit consisting of a cell, switch, a bulb and connecting wires is called a simple circuit.

Series Circuit

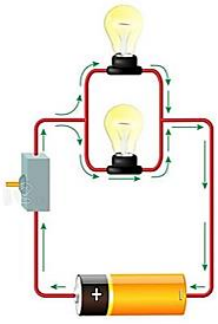
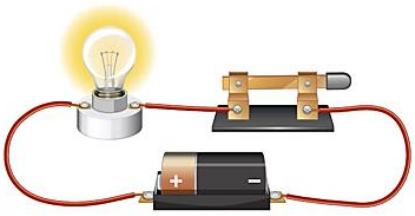
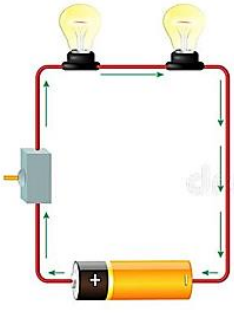
If two or more bulbs/components are connected in series to the battery/cell, meaning all components are connected end-to-end to form a single path for current flow, then that type of circuit is called series circuit.
If any one of the bulbs/components is damaged or disconnected, the entire circuit will not work.

Parallel Circuit

If two or more bulbs/components are connected in parallel to the battery/cell, meaning all components are connected to the same battery/cell but sit on separate branches.then that type of circuit is called parallel circuit. A parallel circuit has two or more paths for current to flow through from the same voltage source e.g battery.
If any one of the bulb is damaged or disconnected the other part of the circuit will work. So parallel circuits are used in homes.

ACTIVITY 9. (Identifying different types of circuits)

(a) Study the pictures of electrical circuits shown below and use it to identify and name a simple circuit, series circuit and parrallel circuit.

(b) Using electric circuit symbols, Draw and name each of the above three types of circuits in the space provided below.

(c) What are the advantages of a parrallel circuit over series circuit

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(d) If you happen to be a landlord in one of the rentals in your home town, what type of circuit would be best for connecting electrcity in your rentals and why is it so?

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(e) Now draw as many different circuits as you can. Here are some ideas:

(i) A circuit with 2 cells and 2 bulbs and open switch (bulbs in series)

(ii) A circuit with 3 cells and 3 bulbs and open switch (bulbs in parallel)

Warning/Precaution

All experiments with electricity should only be performed with batteries used in a torch or radio. Do not, under any circumstance, make the mistake of performing these experiments with the electricity supply in your home, farm or school. Playing with the household electric supply will be extremely dangerous!

Measurement of electric current

You can't see electricity flow with your own eyes and for that reason, specially designed measuring instruments are necessary in order to measure properties such as current. But why is it necessary to measure current in the first place? And how is that accomplished?

Definition; Current is the rate at which electric charge flows past a point in a circuit. Symbol is I and unit is amperes (A).

Why is necessary to measure current?

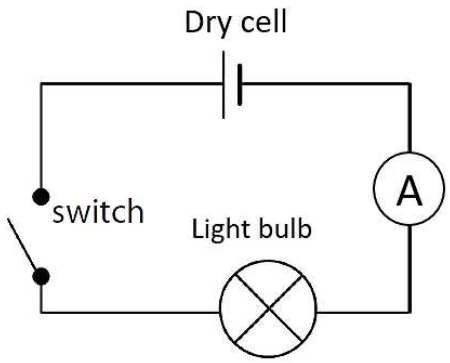
In case electronic devices breakdown/fail, measuring current flowing through the circuit is one way of pinpointing the source/cause of malfunction/failure of the device.

How is current measured?

Electric current is measured in amperes (A) using an ammeter. To measure current with an ammeter, connect the ammeter in series with the component in the circuit.

ACTIVITY 10: Measurement of current passing through a bulb.

Set up of apparatus



Materials required

- ✓ Ammeter,
- ✓ switch,
- ✓ dry cells,
- ✓ a cell holder,
- ✓ a bulb
- ✓ connecting wires

PROCEDURES

a) Starting with 1 dry cell, connect the circuit as shown in the figure above

b) Close the switch and observe the pointer and bulb. State what is observed

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c) Deduce the ammeter reading (must include units) ……

d) Repeat procedures (a) but this time using two dry cells in a holder

e) State what is observed when the switch is closed

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f) Deduce the ammeter reading……

g) Comment on your results in (c) and (f) above.

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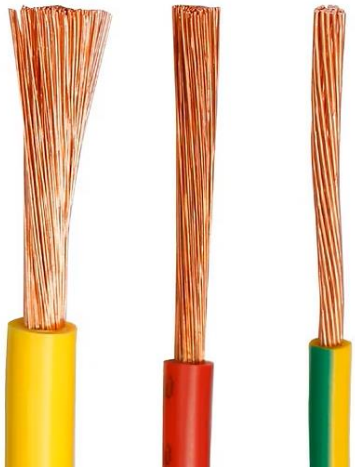
Did you know? Current is important for the performance of electrical and electronic devices. For example, A.C is used for power distribution because it can travel long distances with less energy loss. D.C is used in most electronic devices because it provides a stable and constant energy supply.

A.C in full is alternating current and D.C in full is direct current

Electrical Conductors and Insulators

In groups, learners plan and report on an investigation, using an electric circuit with batteries and bulbs, to explore the electrical conductivity of different materials (e.g. copper, wood, plastic, iron, aluminium, graphite, rubber, cardboard, glass, wool).

Will electric current pass throw all materials?



If an electric wire is cut, we could see a metal wire surrounded by another material. Do you know why it is so?

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Conductors

The materials which allow electric current to pass through them are called conductors. Examples: Copper, iron, aluminum, impure water, earth etc.

Insulators (Non-Conductors)

The materials which do not allow electric current to pass through them are called insulators or non-conductors. Examples: plastic, glass, wood, rubber, ebonite etc.

$$Current\ (I) = \frac{charge\ (Q)}{time\ (t)} \qquad I = \frac{Q}{t}$$

Question. Calucate the current that flows through a bulb if a charge of 18C flows through the bulb in 6 seconds.

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ACTIVITY OF INTEGRATION 1

In one of the villages in uganda, a farmer bought solar panels to be used for domestic energy consumption. The solar panels had a battery rated 12V which stores charge which can later help them provide electricity at night when the sun sets. He wanted to connect all the four rooms with solar electricity and each of the rooms had a bulb and a switch. He wanted to connect the electricity to all these rooms by himself but he had little knowledge of electric circuit diagrams.

TASK

As a learner of physics, help this man to succeed in his mission by;

(iii) Sketching a suitable circuit diagram which will be used as a roadmap for connecting solar electricity to the house
(iv) Enlightening him about the advantages of the type of circuit of have chosen
(v) Informing him about the satey precautions taken in this situation

ACTIVITY OF INTEGRATION 2

In one of the homes in Uganda, a man intends to buy a second hand battery to be used to light bulbs in his home but he was told by an expert that he must first test the working condtion of the battery before buying it. During the testing, 24C of charge flows from the battery rated 12V through the bulb in 9 seconds.

The man also wishes to use the battery to connect three bulbs in three different rooms with each bulb having a switch and one other main switch.

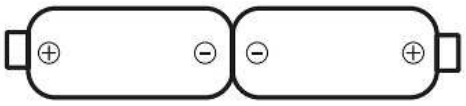
Hint: A seocnd hand battery is still in good working conditon if more than 2.5A of current flows when it is connected to a bulb.

TASK

(a) Help the home owner determine if the second hand battery he is buying is suitable to be purchased.
(b) Using circuit symbols, briefly descibe with the aid of a circuit diagram how the man should connect the different components/appliances for best operation to be attained.
(c) What saftey precautions should he install in his home?

ACTIVITY OF INTEGRATION 3

A tocrh fell off the hands of a student of S.4 and the dry cells got out of the torch. This student picked the dry cells and put them back in their holder inside the torch. Unfortunately the Torch did not give glow anymore.



This is how he put back the dry cells

He got confused and confronted you to help him figure out what could be the problem with his Torch. As a learner of physics in S.4, help him figure out the solution to this problem.

Please contact the Author of this workbook

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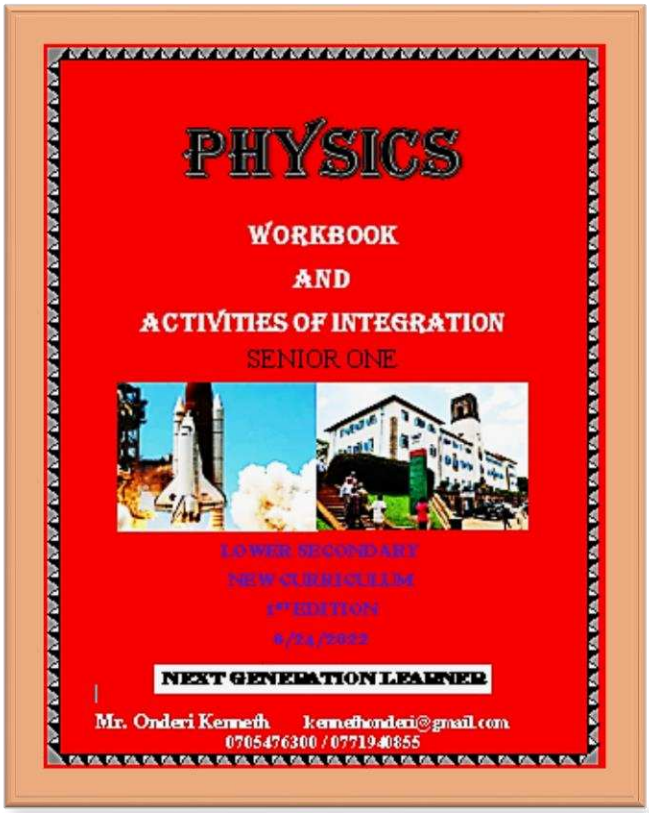
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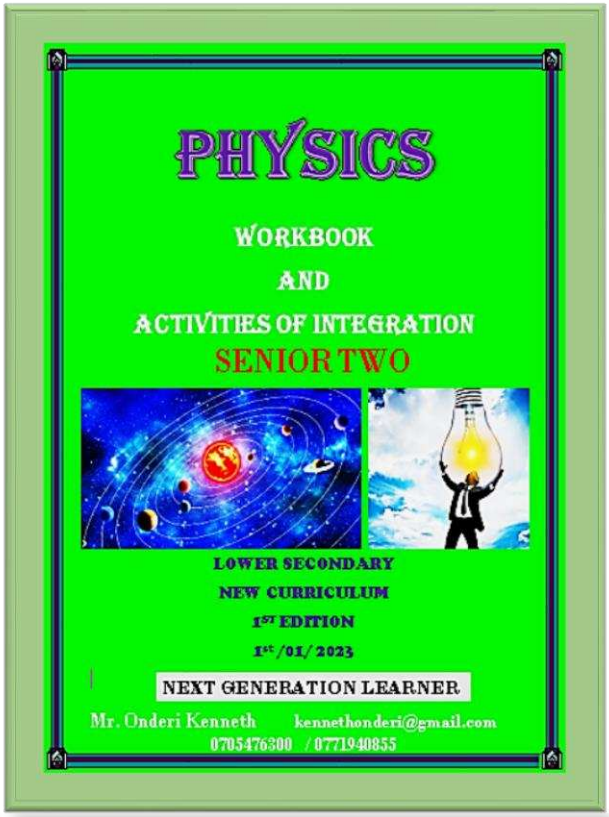
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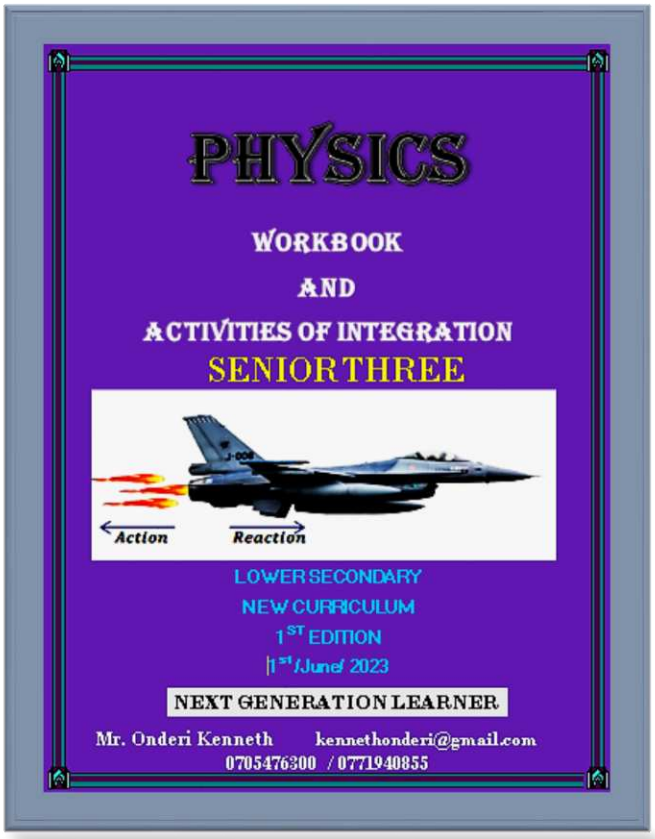
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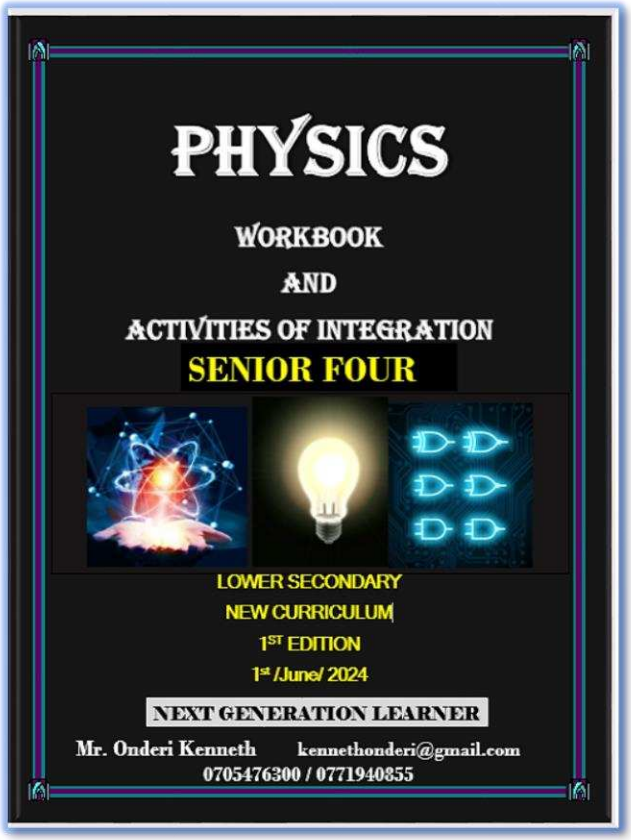
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- This book will ease your work as a teacher following competence-based curriculum.
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- The questions have been made as simple as possible to enable students easily understand (very many examples, pictures and illustrations)
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- The worksheet is to help students practice as many questions as possible. The space provided is just enough for each question asked.
- The books provide a brief introduction, short answer questions in the right sequence as it is recommended by other textbooks available in the market.
- **BOOK FOUR TO BE RELEASED IN JANUARY 2025**

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