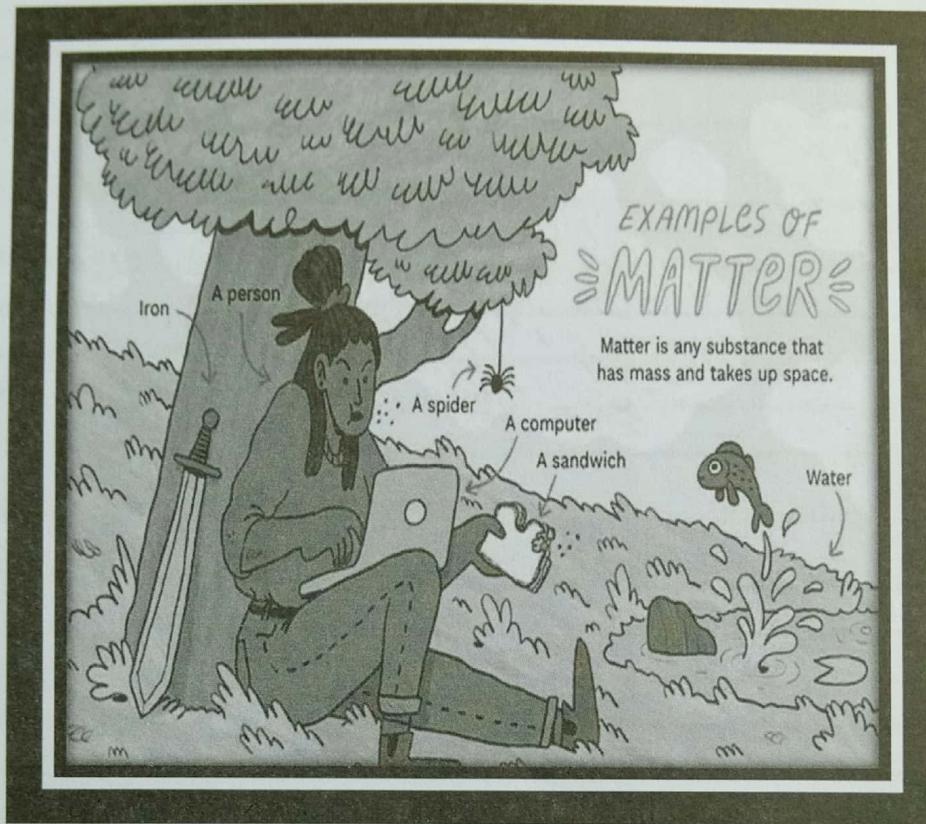


# SENIOR ONE PHYSICS PROTOTYPE



NCDC

# Contents

PREFACE .....	VI
ACKNOWLEDGEMENTS .....	VII
INTRODUCCTION TO THE LEARNER'S BOOK.....	VII
CHAPTER 1: INTRODUCTION TO PHYSICS .....	1
WHAT IS PHYSICS? .....	3
BRANCHES OF PHYSICS AND WHAT THEY DEAL WITH .....	3
THE IMPORTANCE OF STUDYING PHYSICS.....	5
CAREERS IN PHYSICS .....	6
THE PHYSICS LABORATORY .....	6
CHAPTER 2: MEASUREMENTS IN PHYSICS.....	9
ESTIMATION AND MEASUREMENT .....	10
SCIENTIFIC MEASUREMENTS .....	10
MEASURING LENGTH .....	11
MEASURING AREA .....	14
MEASURING MASS .....	16
VOLUME OF IRREGULAR SOLIDS .....	21
MEASURING TIME.....	23
THE USE OF SCIENTIFIC NOTATION AND SIGNIFICANT FIGURES IN MEASUREMENTS.....	25
THE SCIENTIFIC METHOD .....	27
MEANING OF DENSITY.....	29
THE DENSITY OF DIFFERENT SUBSTANCES.....	30
CHANGES IN DENSITY .....	32
DENSITY AND ITS APPLICATION TO FLOATING AND SINKING .....	33
OCEAN CURRENTS AND WATER DENSITY.....	37
DENSITY AND PURITY .....	38
DENSITY AND RELATIVE DENSITY .....	38
CHAPTER 3: STATES OF MATTER .....	41
WHAT IS MATTER?.....	42
STATES OF MATTER .....	43
WHAT ARE PROPERTIES OF SOLID, LIQUID AND GAS? .....	43
THE ARRANGEMENT OF PARTICLES IN THE DIFFERENT STATES OF MATTER .....	45
THE PARTICLE THEORY OF MATTER.....	47
WHAT EVIDENCE IS THERE FOR PARTICLES? .....	49

BROWNIAN MOTION .....	52
DIFFUSION IN GASES .....	52
CHANGES OF STATE .....	55
<b>CHAPTER 4: EFFECTS OF FORCES.....</b>	<b>58</b>
MEANING AND MEASUREMENT OF FORCE .....	59
TYPES OF FORCES .....	61
FORCE OF GRAVITY AND WEIGHT.....	62
EFFECTS OF FORCES .....	63
BALANCED AND UNBALANCED FORCES.....	64
FRICTION BETWEEN SURFACES .....	68
INTERMOLECULAR FORCES.....	74
SURFACE TENSION.....	76
CAPILLARITY .....	78
CAPILLARY RISE OF LIQUIDS IN TUBES .....	78
<b>CHAPTER 5: TEMPERATURE MEASUREMENT .....</b>	<b>82</b>
HEAT AND TEMPERATURE .....	83
MEASURING TEMPERATURE .....	83
TYPES OF THERMOMETERS.....	85
TEMPERATURE SCALES .....	87
CALIBRATION OF THE THERMOMETER.....	90
THERMOMETRIC LIQUIDS .....	92
VARIATIONS IN DAILY AND ATMOSPHERIC TEMPERATURE .....	93
<b>CHAPTER 6: HEAT TRANSFER .....</b>	<b>95</b>
METHODS OF HEAT TRANSFER .....	96
CONDUCTION .....	97
GOOD AND BAD CONDUCTORS OF HEAT .....	98
FACTORS AFFECTING RATE OF HEAT CONDUCTION.....	99
CONVECTION .....	102
RADIATION .....	107
FACTORS THAT AFFECT THE EMISSION AND ABSORPTION OF THERMAL RADIATION .....	108
APPLICATION OF THERMAL RADIATION .....	112
THE VACUUM FLASK .....	113
GREENHOUSE EFFECT .....	115
<b>CHAPTER 7: EXPANSION OF SOLIDS, LIQUIDS AND GASES.....</b>	<b>121</b>
EXPANSION OF SOLIDS .....	118
EXPANSION OF LIQUIDS .....	121
ANOMALOUS EXPANSION OF WATER.....	123

EXPANSION OF GASES .....	125
<b>CHAPTER 8: NATURE OF LIGHT; REFLECTION AT PLANE SURFACES .....</b>	<b>128</b>
WHERE DOES LIGHT COME FROM? .....	129
HOW LIGHT TRAVELS .....	130
HOW SHADOWS ARE FORMED .....	131
REFLECTION OF LIGHT BY PLANE SURFACES.....	136

# Preface

This Learner's Textbook has been written in line with the revised Physics syllabus. The knowledge and skills which have been incorporated are what is partly required to produce a learner who has the competences that are required in the 21st century.

This has been done by providing a range of activities which will be conducted both within and outside the classroom setting. The learner is expected to be able to work as an individual, in pairs and groups according to the nature of the activities.

The teacher as a facilitator will prepare what the learners are to learn and this learner's book is one of the materials which are to be used to support the teaching and learning process.

**Hon. Janet K. Museveni**  
First Lady and Minister for Education and Sports

# Acknowledgements

National Curriculum Development Centre (NCDC) would like to express its appreciation to all those who worked tirelessly towards the production of the Learner's Textbook.

Our gratitude goes to the various institutions which provided staff who worked as a panel, the Subject Specialist who initiated the work and the Production Unit at NCDC which ensured that the work produced meets the required standards. Our thanks go to *Enabel* which provided technical support in textbook development.

The Centre is indebted to the learners and teachers who worked with the NCDC Specialist and consultants from Cambridge Education and Curriculum Foundation.

Last but not least, NCDC would like to acknowledge all those behind the scenes who formed part of the team that worked hard to finalise the work on this Book.

NCDC takes responsibility for any shortcomings that might be identified in this publication and welcomes suggestions for effectively addressing the inadequacies. Such comments and suggestions may be communicated to NCDC through P. O. Box 7002 Kampala or email: admin@ncdc.go.ug.

**Grace K. Baguma**

Director National Curriculum Development Centre

# Introduction to the learner's book

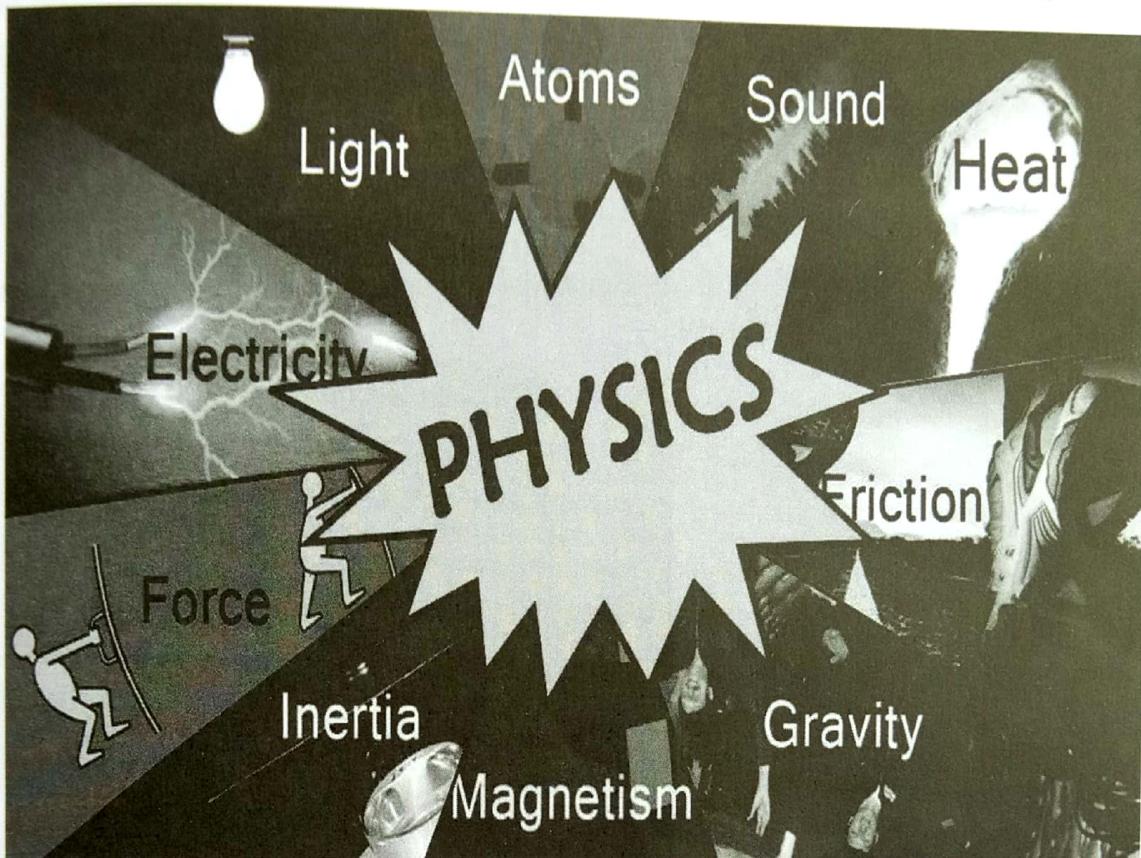
This learner's book has been written in line with the revised Physics in the Lower Secondary Curriculum.

The book consists of eight chapters that comprise the Physics for Senior One. Various illustrations are provided in the book. The book has various activities that will help you to have hands on experience in the study of Physics.

You should try to go through all the activities; make observations and conclusions. This will help you acquire the required Physics competences at this level. At the end of each chapter are activities of integration which will guide in assessing the acquisition of the competences in the chapter.

# **Chapter 1:**

## **INTRODUCTION TO PHYSICS**



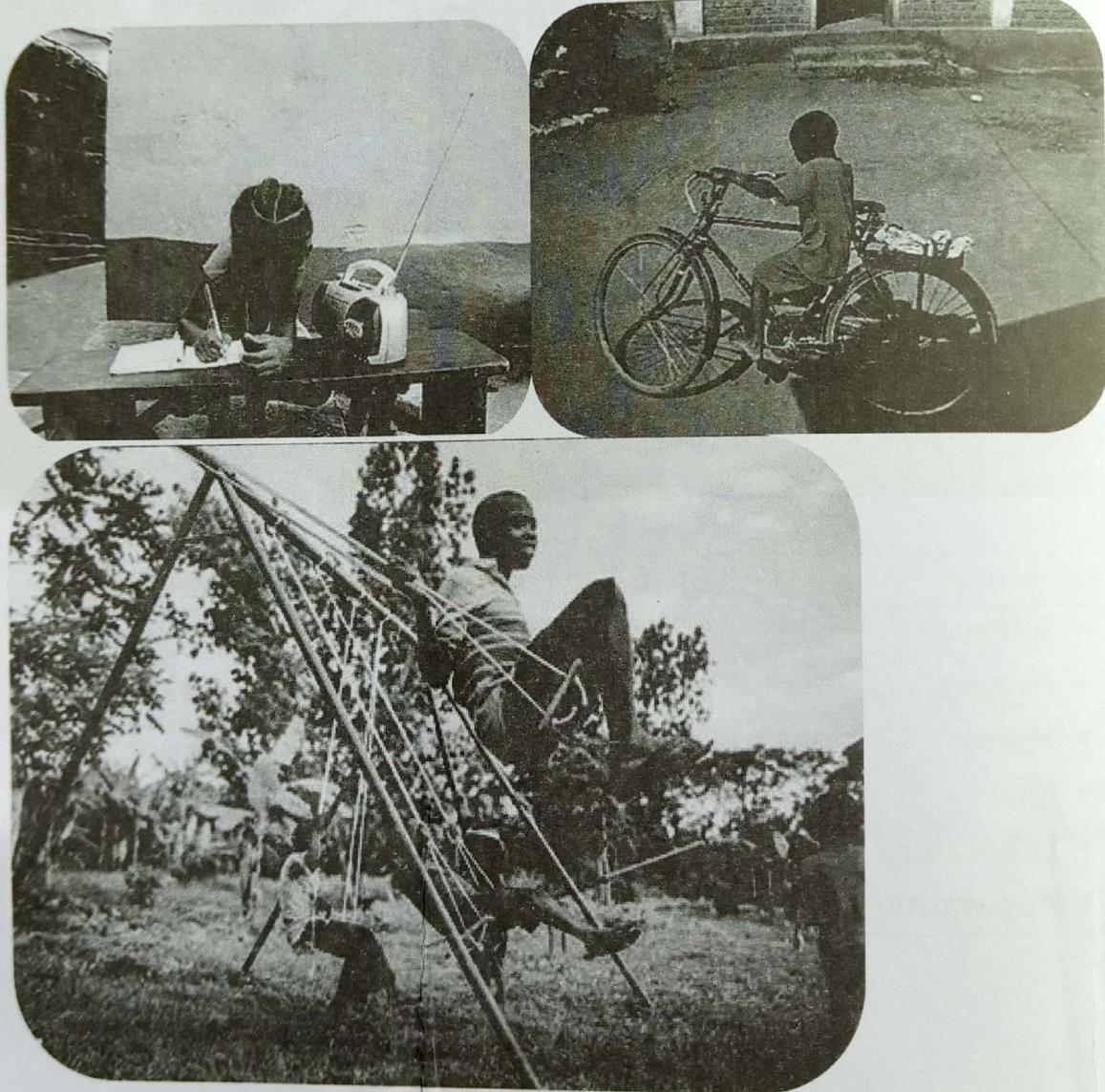
Key words	<i>By the end of this chapter, you will be able to:</i>
<ul style="list-style-type: none"><li>▪ Science</li><li>▪ Physics</li><li>▪ Matter</li><li>▪ Energy</li><li>▪ Laboratory</li><li>▪ Apparatus</li></ul>	<ul style="list-style-type: none"><li>▪ understand the meaning of physics.</li><li>▪ understand why it is important to follow the laboratory rules and regulations.</li></ul>

# Introduction

In primary school level, you studied science as a single subject. However, at secondary school level, science is split into independent subjects like physics and biology. Can you name other science subjects? In this chapter you will understand the meaning of physics and why it is important to study physics.

You will also learn the safe practices of conducting science experiments in the laboratory.

Look at the pictures below:



*Fig. 1.1: Science is all around us!*

## What is happening in each picture in Figure 1.1?

To answer this questions and many more, you need knowledge of a new subject known as physics.



Are there some things that you have always wondered about how they work, or how they happen?  
Make a list of those things and ask your teacher for explanation.

## What is physics?

The word physics comes from the Greek word “physis” which means “nature”.

*Physics* is a branch of natural science that deals with the study of matter and how it is related to **energy**.

*Natural science* deals with the physical and natural world. Can you identify the other branches of science?

*Matter* refers to anything which occupies space and has weight.

*Energy* is the ability of the body to do work.

## Branches of physics and what they deal with

Physics is divided into several branches or themes as indicated in Table 1.1 below. Each branch deals with different aspects of Physics.

**Table 1.1: The branches of Physics and their meanings**

Branch	What it deals with
<i>Mechanics</i>	It deals with the behaviour of physical objects or particles under the action of forces.
<i>Heat</i>	It deals with heat, as a form of energy, its transmission and applications.
<i>Light</i>	It deals with the nature of light and its properties, how it travels and its applications.
<i>Electricity</i>	It deals with the production of electricity, its transmission and

Branch	What it deals with
	applications.
<i>Magnetism</i>	It deals with the properties of magnets, their production, properties and applications.
<i>Wave motion</i>	It deals with the transfer of energy from one point to another without movement of substances.
<i>Modern physics</i>	It deals with recent developments in physics and their applications

## Activity 1.1: Identifying the applications of the different branches of physics

### What to do

Look at the pictures in Figure 1.2 and:

- i) identify the branch of physics being applied.
- ii) explain what is happening in each picture.



*Fig. 1.2: Applications of the different branches of physics*

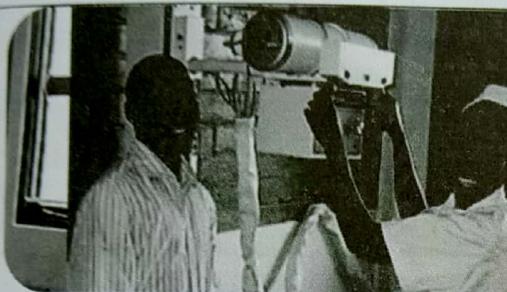
# The importance of studying physics

Think:

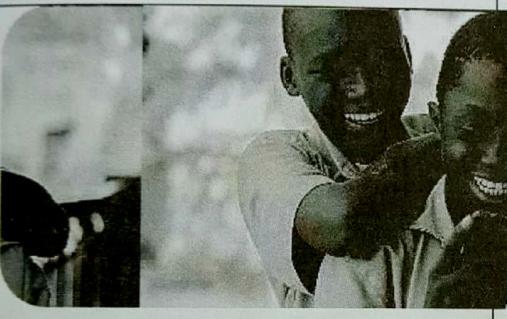


Now that you know what physics is and what it involves, why do you think we need to study physics?

Can you think of ways in which physics is important to you, your family or the community?



**Physics is important for good health**  
Machines in hospitals such as those used to treat cancer and to study the brain, broken bones and babies developing in the womb are made using knowledge gained from the study of physics.



**Physics makes communication easy**  
Physicists play an important role in the manufacture of computers, radios, televisions and mobile phones. These make communication easy.

Figure 1.3: Importance of physics

## Activity 1.2: Identifying the applications of physics

### What to do

Look at the pictures in Figure 1.4 (a-d) below and explain how physics is applied in each case.



(a)



(b)



(c)



(d)

Figure 1.4: Some applications of Physics

*Did you know?*

Archimedes, Galileo, Isaac Newton are some of the personalities in physics, whose discoveries shaped what is done in physics today. What did they discover? Ask your teacher.

## Careers in physics

**Think:**



What would you like to become in the future?

What job or work would you like to do?

Talk to your friends in a discussion and then ask your teacher to find out which of the careers is related to physics.

## The physics laboratory

Most of the practical works in science, for example, experiments, tests, observations or investigations are conducted in a special place called a laboratory.

A *laboratory* is a building, part of a building or other place specifically designed for scientific work. It contains many pieces of apparatus and materials for practical use.

*Apparatus* is equipment or tools needed for a particular scientific activity or purpose. We use apparatus when we are carrying out an experiment.

*Experiment* is a scientific step-by-step process undertaken to make a discovery, test a proposed law or theory, or demonstrate a known fact.



**Fig. 1.5: Learners performing an experiment in the laboratory**

# Laboratory and its safety rules

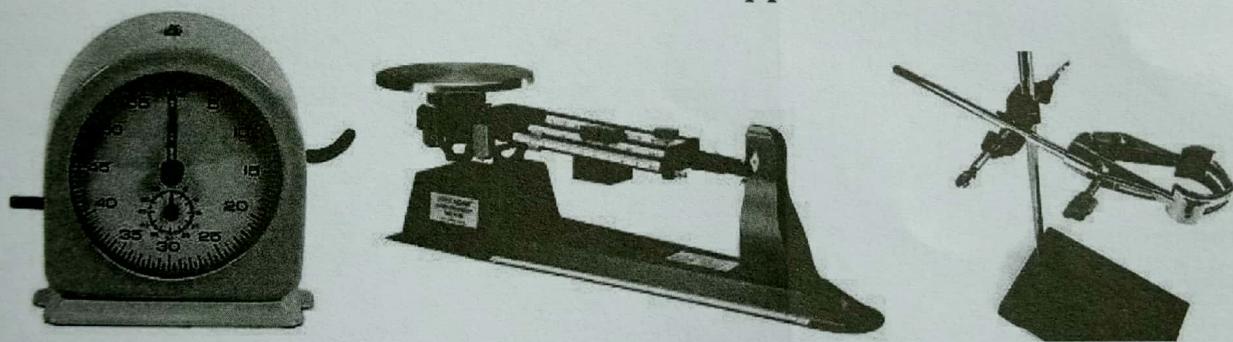
## Activity 1.3: A visit to the physics laboratory

### *What you need*

- Laboratory or room serving as the laboratory
- Variety of laboratory equipment

### *What to do*

- (a) The teacher will lead you on a guided tour of the laboratory and tell you how to behave in the laboratory; show you various apparatus and explain how they are used.
- (b) At the end of the lesson, discuss the following:
  1. Suggest some laboratory rules.
  2. What is the importance of laboratory rules and regulations?
  3. Give the name and importance of the apparatus shown below.



*Figure 1.6: Some laboratory apparatus*

## Activity of integration

You have been elected as the prefect in charge of the laboratory in your school. The S1 class is about to report for first term. Many of the students have not heard about the physics laboratory.

Prepare a short speech for the new S1 students about laboratory use. The speech should last not more than 10 minutes

### *Chapter summary*

*In this chapter, you have learnt that:*

- physics is a branch of science which deals with matter, energy and how they are related.
- the study of physics involves different branches such as mechanics, light, heat and others.
- physics helps us to explain the things around us such as sunshine, electricity, rainfall and many others
- the study of physics has applications in medicine, communication, agriculture, energy, entertainment and many others.
- a laboratory is a specialised place where scientific experiments are carried out.