ZIMBABWE

MINISTRY OF PRIMARY AND SECONDARY EDUCATION

CURRICULUM DEVELOPMENT AND TECHNICAL SERVICES

PHYSICS

SECONDARY SCHOOL LEVEL
FORM 3 - 6
2015-2022

TEACHER'S GUIDE

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1.0 ORGANISATION OF THE TEACHERS' GUIDE

This is a document intended for you,to realise the expected conduct towards the fulfillment of the new curriculum demands in Physics learning area. It guides you to understand and engage in the participation to implement the new curriculum.

This teachers' guide is divided into two parts.

Part A focuses on the critical documents you must have as a teacher. Part B deals with curriculum delivery which has the content, objectives, methodology, instructional materials, class management and assessment.

- Part A- Critical Documents
- Part B-Curriculum Delivery

PART A

2.0 CRITICAL DOCUMENTS

Introduction

As a teacher it is important for you to have the critical documents for effective curriculum implementation in the Physics learning area.

Rationale

Modern day economies, Zimbabwe included, are driven by Technology and Physics concepts form part of the basis. The study of Physics enables learners to be creative and innovative in industry and society that can promote the application of Physics in industrial processes for value addition. The learning of Physics concepts promotes value addition and beneficiation of natural resources and the harnessing of available opportunities for enterprise skills.

Objectives

By the end of part A on critical documents you should be able to

a) Identify the critical documents
b) Show understanding of each document
c) Interpret the National Syllabus
d) Develop the school syllabus
e) Develop preparatory documents
f) Develop progress records

You are expected to have the following critical documents

- Curriculum Framework
- National Syllabus
- School syllabus
- Scheme cum plan or Schemes of Work and lesson plans
- Progress Records
- Register of Attendance
- Learner profiling guide

UNIT 1

Curriculum for Primary and Secondary Education

Introduction

This is a policy document that outlines the underpinning national philosophy, principles, learning areas, the description and expectations of Ministry of Primary and Secondary Education (MoPSE) at policy level. It outlines what the government expects you to implement.

Objectives

By the end of this unit you should be able to:

- identify key elements of the new curriculum
- demonstrate understanding of the values that define the new curriculum

Key Elements of the Curriculum

The following are the key elements of the curriculum framework

- Background
- Principles and values guiding the curriculum
- Goals of the Curriculum
- Learning areas
- Teaching and learning methods
- Assessment and learning
- Strategies for effective curriculum implementation
- The future

Unit 2:

Syllabus Interpretation

Introduction

A syllabus is a key document to you as a teacher and as such your ability to deliver effective lessons depends on careful planning. Planning begins with national syllabus interpretation which forms the basis for:

- Development of school syllabus
- Development of scheme of work
- Development of lesson plan

Objectives

By the end of this unit on syllabus interpretation you should be able to:

- Interpret the national syllabus
- Create the school syllabus

TYPES OF SYLLABI

There are two types of syllabi, that is, the National Syllabus and the SchoolSyllabus. The national syllabus is distributed by the ministry whilst the school syllabus is constructed at departmental level in your physics learning area.

2.1 National Syllabus

Definition

It is a policy document that outlines and specifies the Learning area philosophy, aims and objectives, Learning/teaching concepts and content, suggested methodology and assessment criteria at every secondary level. As a teacher, you should always have it to guide you in your day to day teaching and learning activities.

Elements of the Physics National Syllabus

The national syllabus includes the following topics:

- Cover page
- Acknowledgements
- Preamble
- Presentation of Syllabus
- Aims
- Syllabus Objectives
- Methodology and Time Allocation
- Topics

- Scope and Sequence
- Competency Matrix
- Assessment
- Glossary/Appendices

Content

The content of the national syllabus are in the respective documents:

Refer to Physics Syllabus Form 3-4 and Form 5-6

School Syllabus

Definition

It is the interpretation of the national syllabus taking into account local school factors. The Physics school syllabus must be drawn at school level from the National Syllabus by reorganising content taking into account local factors.(see section on Syllabus Interpretation)

Factors Influencing Drafting of the School Syllabus

The school syllabus is drafted taking into consideration different factors;

- Level of learner performance (knowledge they already have)- make use of progress reports and evaluation reports
- Relevant facilities and resources (in physics one may consider expensive practicals being done in January capitalizing on using left over materials from previous external examination)
- Time allocation in the official syllabus
- Local conditions that affect the choice and sequencing of topics
- Education technology
- Community influences

Elements of the School Syllabus

The following are the key elements of the school syllabus:

- Topic/content
- Activities
- Time allocation
- Methodology (NB learner – centred)
- Instructional or teaching materials

UNIT 3

SCHEMES OF WORK

Definition

Scheme of work is a result of your interpretation of the syllabus which shows the content to be covered and its sequencing. This is a document that you as a teacher should draw from the national and school syllabus.

You should outline the objectives, activities, content and methodologies (see schemes of work/ scheme cum plan template on page …).You should draw your scheme of work/scheme cum plans at least two weeks ahead of lesson delivery date. (Use of ICT tools in drawing the documents is encouraged, avoiding the temptation to copy ready-made documents, but ensuring to make a document that suitsyour learners).

Components of Schemes of Work

- Week ending
- Topic/Content
- Objectives
- Competencies
- Source
- Methods
- Activities
- Evaluation

EXAMPLE

Aims

This scheme aims at

1. Introducing students to physical quantities
2. Relating physical quantities to measuring units
3. The use of measurement in the community

WEEK ENDING (2016)	TOPIC/ CONTENT	OBJECTIVES By the end of the lesson pupils should be able to	COMPETENCIES/ SKILLS/ KNOWLEDGE	SOM/MEDIA	FACILITY /EQUIPMENT	METHODS/ACTIVITIES	WEEK ENDING
13-12	**Measurement-** Measurement of physical quantities. • Derived quantities • Use of S.I. units	- measure accurately - record results - critically analyse results - apply the results wherever appropriate	-scientific /attitudes -decision making -accurate observation -being meticulous -consistency -objective	• National Syllabus page… • School syllabus page…. • The web for example http:youtube.com materials	• Metre rule • Measuring tape • Ticker tape • Stopwatch • Ammeter • voltmeter	METHODS • Demonstration, Command, Practice, Guided Discovery ,Group Work, Pair work, Tasking ACTIVITIES • Collecting materials • Measuring the dimensions of the materials • Computer simulations on projectiles 1.0 Describing natural and man-made materials	13-12-2016

UNIT 4

LESSON PLAN

Definition

This is a detailed daily plan of what you intend to deliver and how it will be done. This is to be used in the event of you having drawn a scheme of work rather than a scheme cum plan. (See Detailed Lesson Plan Template on page…..)

Components of a Lesson Plan

The lesson plan consist of the following components:

- Date and time
- Learning area
- Topic
- Class
- Sources of materials and/or media
- Textbooks
- Assumed knowledge
- Objectives
- Competencies
- Introduction
- Lesson development
- Conclusion
- Evaluation

EXAMPLE

Date:	22 April 2016
Level:	Form 3
Time:	10:40-11:50
Number of students:	70
Learning Area	Physics
Topic/Content:	Physical quantities
Sub-Topic:	Measurement
S.O.M:	National syllabus 8.3.1 page 12
	School syllabus
	Textbook page ….
Media	Various measuring instruments

Equipment: Objects and apparatus

Assumed Knowledge: learners are able to identify dimensions or physical quantities of objects.

Lesson Objectives

By the end of the lesson, learners should be able to:

- Measure physical quantities that is length and mass
- Read an instrument scale to the nearest fraction of a division
- Identify S.I. units for length and mass

STAGE/TIME	TEACHER ACTIVITIES	LEARNER ACTIVITIES	POINTS TO NOTE
Introduction 5minutes	Monitors activities in groups	In pairs they estimate length and mass of given blocks.	Units of length and mass
15 minutes	Facilitates presentations	Each pair presents on estimations and a rival pair measures the estimated blocks.	accuracy
10 minutes	Facilitates discussion	Compare estimates versus accurate measurements	Note sources of errors in measuring.
5 minutes	Monitors order and attentiveness	Watch a video on how to take measurements	Measuring to the nearest fraction
Skill Development 30 minutes	Rotates materials to be measured	Practice measuring using different instruments and recording results	Use of measuring instruments
Conclusion 5 minutes	Corrects and concretise main points	Selected pupils summarise the lesson	• How to measure • Units • accuracy

Unit 5

RECORD – KEEPING

Definition

Records are critical documents about teaching-learning process which you must keep as a teacher. They should be accurate and up to date. The following are some of the reasons why you should keep records:

- They help you to track learner's performance
- They help you in planning and re-adjustment of plans
- They are essential for assessment
- They are the basis for counseling

In addition to critical documents you are expected to keep the following records in your file:

- Class attendance register
- Teacher's Guide
- Social record
- Progress record
- Remedial record
- Asset and stock control registers
- Circulars

Conclusion

All these documents are important for your delivery of the new curriculum.

3.0 PART B

Curriculum Delivery

Introduction

This section covers content, objectives, methodology, learning-teaching materials, evaluation and assessment, and class management.

3.1 Objectives (examples from forms 3 and 4 topics)

3.2 Content

3.3 Methodology (examples)

The following approaches and methods are recommended in the teaching and learning of Physics.

Approaches

You are the facilitator and the learner is the doer. Minimize methods that makes a learner a passive participant. Use learner-centered and interactive approaches, which include discovery, inquiry and problem-solving.

These approaches foster scientific skills such as observation, accuracy, objectivity, honest and group skillsThey include demonstrations, field work, games, simulations, debates, laboratory work and experiments, group work and discussions, role-play, case studies, project based learning and educational tours.

Objectives

Syllabus and learning objectives should be SMART. They are more specific statements that include both an action verb and a content reference. They should provide a clear statement of intended learning outcomes.In the formulation of objectives keep in mind the following questions:

- What do you want your learners to learn? (What are the learning outcomes which you expect from the learning and teaching process?)
- What assignments, classroom activities, and pedagogical approaches will help your learner acquire the identified knowledge, skills, or attitude changes (competences)?
- How will you determine that learners have accomplished what you set out to teach them? (How will you evaluate their achievements?)

3.4 Teaching-learning Materials

Teaching-learning materials are the tools you should use during the learning and teaching process. Learning materials should concretise the concepts and engage the learner.The following should help you choose appropriate teaching-learning material.

- capture learners' interest and create virtual reality.
- promote meaningful communication, hence effective learning.
- ensure better retention, thus making learning more permanent.
- provide direct or first-hand experience with the realities of the social and physical environment.
- help overcome the limitations of the classroom
- stimulate and motivate students to learn.
- help develop interests in other areas of learning.
- encourage active participation, especially if learners are allowed to manipulate materials used.

Types of Teaching-Learning Materials

Visual materials

Three Dimensional Materials

- **Objects:** real things-e.g. Jars, cooking utensils etc.
- **Models:** are recognisable representation of a real thing
- **Specimens:** are objects which are representative of a group or a class of similar objects e.g. flowers, fish, frogs etc.
- **Printed materials:** Textbooks, Workbooks, Handbooks and Modules
- **Chalkboards**
- **Flannel or felt boards**
- **Bulletin boards**
- **Still pictures:** Non-projected (photographs, illustrations) and Projected (slides, filmstrips, overhead projectors)
- **Graphics:** Charts, Graphs, Maps and globs, Posters and diagrams.
- **Audio Aids:** Radio and Recorded audio

Audio-Visual Teaching-learning Materials

- Motion pictures such as Television and video clips

3.4 Assessment and Evaluation

Assessment

Assessment is both continuous and summative (see the physics syllabus)

Evaluation

You are supposed to evaluate at the end of each lesson and in the case of the scheme at the end of the week. When you evaluate you are looking at the extent to which the objectives have been achieved and this is usually measured by learners' performance. You should also evaluate the teaching –learning methods, this encompasses the strength and weaknesses of the methods used. You should evaluate the suitability of the equipment used. It is also important to evaluate the timing of activities and class management. You should also bring out the way forward in terms of areas of improvement and areas you can capitalise on.

3.6 Class Management

This is the process of planning, organizing,leading and controlling class activities to facilitate effective and efficient learning. This should help you to create an effective learning environment, motivate the learners, maintain class discipline and supervise class activities. Classroom organisation is critical for an effective learning environment. Classroom management covers: physical environment, emotional environment, grouping the learners, class control and discipline and supervision.

UNIT 6

SCOPE OF THE GUIDE

Topics to be covered

1.0 Measurement and physical quantities

2.0 Kinematics

3.0 Forces

4.0 Machines

5.0 Mechanical structures

6.0 Work, energy and power

7.0 Thermal physics

8.0 Internal combustion engines

9.0 Waves

10.0 Optics

11.0 Electricity

12.0 Magnetism

13.0 Electromagnetism

14.0 Electronics

15.0 Atomic and nuclear physics

Topic/: 1.0 Measurement and physical quantity

a. Measurement and base quantities
b. Measurement and derived quantities
c. SI Units

Sub topic: Measurement and base quantities

Objectives

By the end of the lesson pupils should be able to;

- measure length and mass
- read an instrument scale to the nearest fraction of a division

Content

Measuring length using meter rule vernier calipers and micrometre screw gauge

Methods and Activities

The learners measure the length using meterrule ,vernier calipers and micrometre screw gauge
The learners measure mass using triple beam balances and electronic balances
Learners to tabulate results

Materials

Meter rule
Vernier calipers
Micrometre screw gauge
Electronic balance
Triple beam balance

Evaluation

To what extent have the objectives been achieved?
How effective were the teaching – learning activities
How effective was your class management in terms of time management, order and clarity of instructions
How the learners responded

Conclusion

This guide is not exhaustive, your initiative and creativity is of paramount importance in the successful implementation of the new curriculum .You need to embrace the new paradigm which puts the learner at the centre of all class activities and encourages learning that is relevant to the learner's environment and the outcome should move Zimbabwe to a higher level in terms of socio-economic status.

The learning of Physics should be done with the following cross cutting issues in mind: inclusivity, environmental issues, indigenous knowledge system, financial literacy, enterprise education, gender, HIV and life skills, child protection, team work, food security, safety health issues and disaster risk management

Annexture scope and sequence

TOPIC	FORM 3	FORM 4
1.0 **MEASUREMENT AND PHYSICAL QUANTITIES** **1.1 Measurement**s	• Measurement of physical quantities. • Derived quantities • Use of S.I. units	• Definition of voltage, resistance and current • Experiments to measure voltage, current and determine resistance for ohmic conductors
1.2 Scalars and vectors	• Definitions and examples • Resultant of coplanar vectors using graphical method • Applications	
2.0 **KINEMATICS** **2.**1 Speed, velocity, distance, displacement and acceleration	• Definitions of terms • Equations of linear motion and application	
2.2 Graphs of motion	• Drawing and interpretation of graphs	
2.3 Motion under gravity	• Definition of free fall • Calculations and applications	
3.0 FORCES 3.1 Effect of force on materials	• Types of forces • Interpretation of force extension-graphs	• Application of forces on beams, trusses and mechanical large structures
3.2 Effect of force on motion	• Definitions of weight, momentum and inertia • State and apply Newton's laws of motion • Circular motion	
3.3. Friction and circular motion	• Effects of friction • Methods of friction • Centripetal acceleration and force	
3.4 Turning effects of a force	• Moments of a force • Turning effect of a force • Principles of moments • Application of moments	
3.5 Centre of mass/centre of gravity	• Definitions of terms • Determination of centre of mas • Stability	

TOPIC	FORM 3	FORM 4
3.6 Pressure	• Definition • Calculations • Pressure in fluids and applications	
4.0 Machine	• Definition • Experiments involving inclined planes, levers and pulleys	
4.1. Simple machines	• Definitions • Experiments involving: -inclined plane -levers -pulleys -calculation of velocity ratio. Mechanical advantage and efficiency.	
5.0. MECHANICAL STRUCTURES		
5.1 Mechanical structures	• Beams, trusses, joining materials and large structures	
6.0 WORK, ENERGY AND POWER		
6.1 Work	• Definition • Calculation of work done	
6.2 Energy	• Definition • Types and sources of energy • Energy conversion • Law of conservation and conversion of energy • Calculations involving energy	
6.3 Power	• Definition • Calculations involving power	.
7.0 THERMAL PHYSICS 7.1 Kinetic theory of matter	• Definition of matter • States of matter and their physical properties	

TOPIC	FORM 3	FORM 4
7.2 Thermal properties	• Simple experiments to demonstrate thermal properties	• Calculation of heat capacity and latent heat • Measurement of temperature
7.3 Heat transfer	• Modes and mechanisms of heat transfer and their applications • Experiments on modes of heat transfer	
8.0 INTERNAL COMBUSTION ENGINES		• Describe the operations of a four stroke engine • Explain the role of the carburettor • State the advantage of multiple cylinders in an engine • Compare the operations of a diesel and petrol engine
9.0 WAVES 9.1 Types of waves	• Definition and classification of waves	
9.2 Wave properties	• Experiments to demonstrate wave properties and characteristics	
9.3 Sound	• Production and sound waves • Experiments to determine speed of sound	
9.4 Electromagnetic waves	• Electromagnetic spectrum • Application of electromagnetic waves	
10.0 OPTICS		Application of waves: light • Laws of reflection • Experiments using plane mirror • Ray diagrams • Laws of refraction • Experiments to demonstrate refraction • Snell's law and application Experiments on dispersion of light

TOPIC	FORM 3	FORM 4
11.0 ELECTRICITY		
11.1 Electrostatics		• Charging • Interaction between charges • Field lines • Application of electrostatics • Safety and hazards
11.2 Primary and secondary cells		• Definition of terms • Power sources • Measurement of electrical entities • Ohm's law and resistance • Safety
11.3 Current electricity		• Definition of terms
11.4 Electric circuits		• Electric components • Constructing simple circuits
11.5 Electricity in the home		• Wiring of three pin plugs • Use of two pin plugs • Safety precautions#
12.0 MAGNETISM		
12.1 Magnetic properties		• Properties and interaction
12.2 Application		
13.0 ELECTROMAGNETISM		
13.1 Magnetic effects of an electric current		• Field patterns • Hand rules
13.2 Force on current carrying conductor in magnetic field		• Factors • Hand rules • applications
13.3 Electromagnetic induction		• generator principle • Lenz's law • Applications
13.4 Transformers		• Transformer principle • Efficiency • AC transmission and power loses
14.0 ELECTRONICS 14.1Electronic components		• Carbon resistors and colour coding • Reed switch

TOPIC	FORM 3	FORM 4
14.2 Logic gates		• Circuit symbols • Construction of truth tables
15.0 ATOMIC AND NUCLEAR PHYSICS		
15.1. Atomic model		• Description of an atomic model • Isotopes
15.2 Radioactivity		• Definition • Types of radioactive emission and their characteristics • Use storage handling and impact of radioactive emission

TOPIC	FORM 5	FORM 6
General Physics	▪ Physical Quantities and Units ▪ Errors and uncertainties	
Newtonian Mechanics	▪ Kinematics ▪ Dynamics ▪ Forces ▪ Work, Energy and Power ▪ Circular Motion ▪ Gravitational Field	
Oscillations And Waves	▪ Oscillations ▪ Waves ▪ Superposition	
Electricity and Magnetism	▪ Electricity ▪ D.C. Circuits ▪ Electric fields ▪ Capacitance	
		▪ Electro magnetism ▪ Electromagnetic Induction ▪ Alternating Currents

TOPIC	FORM 5	FORM 6
Electronics		▪ Analogue Electronics ▪ Digital electronics
Matter		▪ Phases of Matter ▪ Deformation of Solids ▪ Temperature ▪ Thermal Properties of Materials ▪ Ideal gases ▪ Non-viscous Fluid Flow ▪ Transfer of Thermal Energy
Modern Physics		▪ Charged Particles ▪ Quantum Physics ▪ Atomic Structure ▪ Radioactivity ▪ Communication