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Foreword

Education and development are closely related endeavours. This is the main reason why it is said that education is the key instrument in Ethiopia's development. The fast and globalised world we now live in requires new knowledge, skills, attitudes and values on the part of each individual. It is with this objective that the curriculum, which is a reflection of a country's education system, must be responsive to changing conditions.

It is more than fifteen years since Ethiopia launched and implemented the *Education and Training Policy*. Since then our country has made remarkable progress in terms of access, equity and relevance. Vigorous efforts also have been made, and continue to be made, to improve the quality of education.

To continue this progress, the Ministry of Education has developed a Framework for Curriculum Development. The Framework covers all pre-primary, primary, general secondary and preparatory subjects and grades. It aims to reinforce the basic tenets and principles outlined in the *Education and Training Policy*, and provides guidance on the preparation of all subsequent curriculum materials – including this teacher guide and the student textbooks that come with it – to be based on active-learning methods and a competency-based approach.

Publication of a new Framework and revised textbooks and teacher guides are not the sole solution to improving the quality of education in any country. Continued improvement calls for the efforts of all stakeholders. The teacher's role must become more flexible ranging from lecturer to motivator, guide and facilitator. To assist this, teachers have been given, and will continue to receive, training on the strategies suggested in the Framework and in this teacher guide.

Teachers are urged read this guide carefully and to support their students by putting into action the strategies and activities suggested in it. The guide includes possible answers for the review questions at the end of each unit in the student textbook, but these answers should not bar the students from looking for alternative answers. What is required is that the students are able to come up with, and explain knowledgeably, their own possible answers to the questions in the textbook.

Contents

I. Introduction

This teacher guide is specific and an integral part of the main instructional materials. The main instructional materials of physics course for Grade 7 are:

1. *The Curriculum Guide (CG)*
2. *The Minimum Learning Competencies (MLCs)*
3. *The Student Textbook (TB) and*
4. *The Teacher Guide (TG)*

This teacher guide is specific in that it deals with the grade 7 units and topics in the student textbook.

This means that it is also specific in that it deals with the related and specific elements in the curriculum guide and the minimum learning competencies. The four instructional materials or documents are not only compatible and complementary, but very essential to facilitate and enhance quality learning-teaching processes. So that you could attain the intended objectives of teaching physics in grade 7.

General outcomes of grade 7 physics

After completing grade 7 physics lessons, the students will be able to:

- understand basic concepts of **Measurements**, **Force**, **Motion**, **Mechanical energy**, **Work**, **Power**, **Heat**, **Temperature**, **sound** and **Electricity.**
- develop basic manipulative skills related to Measurements, Force, Motion, Mechanical Energy, Work, Power, Heat, Temperature, Sound and Electricity.

- develop basic skills of performing practical activities in physics.
- develop skills of applying physical principles in the production and evaluation of an engineering design project.
- develop positive interest and attitude for physics.

Main contents of grade 7 physics

Units	Contents	Periods allotted
1	Physics and Measurement	7
2	Motion in a Straight Line	8
3	Force and Newton's Laws of Motion	10
4	Work, Energy and Power	8
5	Simple Machines	7
6	Temperature and Heat	9
7	Sound	5
8	Electricity and Magnetism	14

II. The Grade 7 physics Teacher's Guide

This specific teacher guide is intended modestly to help you the teacher, to be effective and efficient in the quality of teaching and learning processes. Attempts are made in this teacher guide to help you in many ways. Most if not all of the ways are directed towards the implementations of the intended learning out comes and Minimum Learning Competences.

This teacher guide follows the same order as the student's textbook. At the beginning the overall objectives of the unit, advanced

warning of any equipment needed to complete the work in the unit and a short introduction to the topics covered in the unit are given.

Each topic/section of the textbook is then elaborated with explanatory notes, answers to questions raised and further background information. The competencies of each section are listed. A suggested method of organizing the work is given, as well as ideas for **Further Activities** and **projects**. Finally there is a way of stabilizing the skills and knowledge explored.

General suggestions to prepare lessons

When you are preparing lessons, first read the introductory page for the unit and check if any special equipment is needed. Then turn to the relevant section in the curriculum guide and MLCs document. Read the **'objectives'** and the **'suggested activities'**. Then read through the teacher's guide and the student text book. Make sure that you know what the students have to do and are clear about points being made. Then prepare your lesson plans.

Take note of any further activities or projects and decide how to fit them into your lesson times. Finally, check the summary paragraph and satisfy yourself that all the points have been covered.

Always prepare a lesson plan in advance, so that you can allow your time to collect materials and make other arrangements which may be necessary.

III. Back ground information for the teacher

1. ***Your students are beginners***

   In line with the new curriculum, physics is given as a linear course for grades 7-12. Hence grade 7 physics is the beginning course.

   Having this in mind, you must take care of how to introduce your students to the subject. You need to focus on the student's back- ground and their day to day experiences. Try to start from what they know. Let the students extend their knowledge of integrated science in grades 5 and 6. Tell your students some discovery stories in physics and mathematical skills, so that they would be motivated to learn physics.

2. ***Don't forget that there are three-groups of students (fast, average and slow learners)***

The other important issues to be underlined are that of individual differences. That is to mention that each student learns at a different pace; depending on his/her age, ability, learning patterns, and behavior. Therefore it is likely that different children will reach the suggested goals and objectives at different times in different learning methods.

Therefore, the issue of learners' individual differences need to get due attention throughout the process of facilitating the learning environment.

3. ***Be specific in your teaching***

Teaching only a specific skill at a time is the other important point to be remembered. Allowing students plenty of opportunities for

revision and practice is recommended. Students learn through using all their senses; i.e. listening, testing, doing, seeing, etc. Teaching should therefore engage the different senses so that students can learn holistically.

4. Let the students learn the lessons through activities:

Advice is given about how to organize each activity successfully. There may be problems with sharing equipment, dangers from fire or harmful materials, or you might need to have done something before the students begin the activity. The activities are the most important thing of all. So you must prepare them carefully to give your students the best chance of learning by doing.

Activities may produce results, even if they are not what you or the students expected. The teacher's guide has suggestions about how to make best use of students' results. Result should never just be collected and ignored.

The student textbook has numerous questions, activities and points of discussion aimed at the students. You need to prepare yourself to be able to use these questions and activities to help them think and to express their ideas. The teacher guide gives hints about asking other questions and following-up students' answers.

Some of the scientific concepts and ideas in the syllabus may be new to you as well as to your students. The teacher guide gives you some **background notes** to help you understand them better.

5. Suggested Methods and Strategies

Physics teaching methods may be stated as explanation, question and answer, demonstration, discussion, etc. However in a given

classroom teachers use a variety or spectrum of methods. A single method cannot be used for a practical subject like physics.

- The active learning approach requires students to be engaged in activities. So, give them the opportunity to discuss in a small group and then in a large group. Use think/pair/ share approaches.
- When you perform demonstrations ask students to observe, record data (information), analyze the data and draw conclusion.
- Students' individual or group practical work is recommended when you have enough materials for the groups. If there is a shortage, use a well drawn experimental diagram to explain the procedure, the material used. Use already recorded data for analyzing, interpreting information.
- Project works need to be given as homework to be done on weekends. Project works include: model making, research, problem solving, etc. The students have their books, they can be assigned or expected to read the unit ahead of the lesson.

Suggested pre-lesson preparation

Before the presentation of the lesson, make a pre-lesson preparation. You need to get different resource materials of the subject. Refer to the MLCs and the teacher guide in order to write the learning objectives and prepare teaching aids.

Suggested presentation of the lesson

Based on your lesson topic, the lesson presentation should include.

i. *Introduction of the lesson*

   In the introduction include motivational strategies of introducing the lesson. You may present a story of some physicists who built popular theories and laws. Revise topics that are prerequisite to understand the lesson.

ii. *Explanation, demonstration or discussion have to be staged after your introduction*: depending on the nature of the topic and learning objectives.

   Student should form groups for discussion and group work be encouraged to participate actively.

iii. *Make follow-up and assess the students while discussions and group work are Undergoing.*

iv. *Summarize the lesson before the period is over. This needs time to be allocated.*

v. *Make sure that the students have attained the lesson objectives by asking them do the check points and exercises given at the end of the unit.*

6) Assessment and Evaluation

Learning assessment is expected to be undertaken at all levels of the teaching learning processes. Learning assessment is a continuous process. It requires continuous follow up of the learner/student towards his/her progress and weakness. It also helps to clearly identify the interests and potentials of each student.

Assessment enables a teacher to make at least a statement about the student's learning and understanding of the content at hand. Assessment measures a pupil's progress while evaluation judges the achievements of the students at the end of the class or end of unit.

Assessment techniques are set in correspondence with the learning objectives and contents. The following assessment techniques can be used in continuous assessment; for grade 7 physics lessons.

i. Observation
ii. Presentation
iii. Participation in group work.
iv. Oral questions
v. Reports(written)
vi. Demonstration.

The purpose of continuous assessment is to identify learning problem and give feedback to students. Teachers also improve their teaching methods based on the continuous assessment.

Continuous assessment does not mean giving too many tests.

Assessment of individual learner is therefore a pre- condition for evaluation but evaluation also considers the role of the teacher and the effectiveness of curriculum itself.

Therefore, one of the main reasons for applying continuous assessment is to give remedy some of the short comings of traditional one-shot examinations which are hand-capped particularly for elementary level. Furthermore, continuous assessment is particularly useful for assessing practical skills and higher order cognitive skills of the student. So it is important to follow up each activity (both individual and group activities) of the student and collecting data regarding his/her progress and weakness in relation with the set objectives. This process needs to be followed by setting situations and implementing techniques in which the weaknesses identified are tackled.

UNIT ONE

PHYSICS AND MEASUREMENT

i) Time allotted to the unit: 7 periods

ii) Outcomes of the unit: After completing this unit the students should be able to:

- define physics and identify major branches of physics.
- relate physics with their daily activities and state its importance.
- give an examples of a career in physics
- define physical quantities and distinguish between fundamental and derived physical quantities.
- state the SI units of basic physical quantities.
- define vectors an scalars and give examples for each
- perform measurements of length, mass and time using appropriate measuring devices.
- use conversion factor of length, mass and time to convert from SI units to non-SI units.
- demonstrate the scientific enquiry /skills.
- develop scientific values and attitudes.

These learning objectives have to be implemented. To implement them, however, they have to be restated in *specific*, *measurable*, *attainable*, *realistic* and *time-bound* (**SMART**) way. The minimum learning competencies have to be achieved by the majority of

students. You have to make sure this happened through continuous assessment techniques.

iii) Contents of the unit

1.1. Definition of physics

1.2. Standardization and measurements

1.3. Measuring length, mass and time

- Explanation (lecture)
- Demonstration.
- Individual practical work.

iv) Teaching Aids

- Photographs of famous physicists.
- Measuring instruments of length-ruler, different size meter rulers, tape meter, etc.
- Measuring instruments of time: wrist watch, digital watch, etc.
- Measuring instruments of mass; beam-balance, weights.

v) Planning for teaching

Unit: Physics and Measurements

Period	*Content*	*Competencies*	*Suggested methodologies*	*Suggested follow up and assessment methods*
1st	**1.1 Definition of physics** a) Meaning of physics b) Objectives of studying physics c) Areas of study, where physics does not address	• Define physics. • State other discipline related to physics. • Describe the purpose of studying physics.	• Question and answer. • Discussion. • Explanation	• Ask students to define physics. • Let the students describe some disciplines related to physics. • Ask students to explain the purpose of studying physics.
2nd	d) The main goals of the study of physics e) Relationship to other science f) Branches of physics g) Relationship to technology	• Describe the relationship of physics to other sciences • List some branches of physics • Mention the relationship of physics to technology.	• Question and answer. • Discussion. Explanation	• Ask students to describe interrelation of sciences. • Let them list the branches of physics. • Mention the relationship of physics and technology.

3rd	**1.2 Standardization and measurements** • Physical quantities. • Fundamental and derived quantities	• Define physical quantities. • Distinguish between fundamental and derived physical quantities. • List the fundamental physical quantities with their SI units.	• Question and answer. • Discussion. • Explanation	Ask to define and give examples of: • physical quantities. • fundamental and derived quantities • SI units
4th	Scalars and vectors -Definition, -Examples.	• Define vector and scalar. • Mention some examples of vector and scalar.	• Question and answer. • Discussion. • Explanation	Ask students to • describe scalars and vectors • give examples of vectors and scalars
5th	**1.3 Measuring length, mass and time** Length • definition • symbols, units • measuring length.	• Name the measuring device of length. • Perform measurements of length. • Convert K mention cm and mm.	• Demonstration • Individual practical work. • Explanation	Ask students to • describe measurement • define standard units • distinguish traditional and standard unit • define length • explain units of length • observe students practical work. • assess students' presentation

6th	Mass • definition • symbols • unit • measuring mass	• Define mass • Name some measuring devices of mass. • Measuring the mass of a body. • Convert kg into g, mg	• Demonstration • Question and answer. • Explanation	Ask students to • define mass • name measuring devices of mass • convert kg into g, mg. • observe students practical work. • assess students' presentation
7th	Time • definition • symbols • unit • measuring time.	• Define time • Mention the measuring devices of time • Convert 1 day into hour, min and sec.	• Demonstration • Individual practical work. • Explanation	ask students to • define time • mention the measuring devices of time, • convert units; one day into hour, minuet and second.. • Observe students practical work. • assess students' presentation.

1.1 Definition of Physics

1. ***Proposed No of periods = 2 periods***
2. ***Competencies***

   At the end of this lesson the students should be able to:

   - define physics.
   - state other disciplines related to physics.
   - describe the purpose of studying physics.
   - describe the relationship of physics to other sciences.
   - list some branches of physics.
   - mention the relationship of physics and technology.
   - mention the criteria for evaluation of good design in engineering.

3. ***Suggested teaching methods;***
   - Discussion
   - Explanation(lecture) and
   - Questioning and answering.
4. ***Teaching aids***
   - Photographs of famous physicists
   - Chart showing branches of science.
   - Photographs of technological products

5. ***Facilitating the learning process***

   Students would acquire scientific knowledge and skills through observations and experimentations. Therefore practical activities are very important in teaching physics.

Before defining physics directly, let the students say something (brainstorm) about **Science** and **Classification of Science** by discussing Activity 1.1 in the textbook.

Science is the study of the world and the universe around us. It is based on natural laws. All the living and non living things making up our **environment** act according to **natural laws**. The accurate and orderly arrangement of the known facts, concepts and natural laws is considered as scientific knowledge.

Science is divided into two broad categories:

I. ***Natural Science***: the study of nature.

II. ***Social science***: Studies about people and their interaction.

Natural science includes, **chemistry, biology physics, Geology, Astronomy**, etc.

Based on this discussion let the students answer Activity 1.2

Write on the black board student's answers for Activity 1.2 then give summary and precise definition of physics.

Physics is the branch of natural science. It is the study of the nature of matter, energy and their interactions. The word 'physics' has its origin in the Greek word meaning 'nature '.

Supplementary activity 1.1

To increase the motivation of students, let students form groups of their own and produce paper on the works and biography of famous physicists. Like Albert Einstein, Sir Isaac Newton, Galileo Galilee, etc. And present in class.

In the definition of physics, you have used key words like ' **matter**' and **'energy'**. Through exercise TQ1 students should be able to grasp the basic concepts of these key words.

Activities 1.4 -1.7 help students to understand;

- Purposes of study of physics.
- Areas of study where physics does not address.
- The main goal of the study of physics.
- Relationship to other science and disciplines.
- Branches of physics.
- Relationship of physics and technology.

Let them do these activities in groups and report to the class. Give one period for these activities.

At the end of every lesson let the students attempt relevant questions in Check point 1.1. Do not keep the check point questions until you finish the topics in the section. The questions in the check points are directly derived from the lesson learning objectives and MLCs. Failure in answering correctly these questions, indicates students have not attained the learning objectives. You need to help those students who failed to achieve them.

6. ***Stabilization***

- Summarize the lesson by giving them short notes. Ask them to do selected questions from the check points and unit exercises as class work and home works and further reading assignment,
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the checklist questions.

1.2 Standardization and Measurement

1. ***Proposed No of periods*** *: 2 periods*
2. ***Competencies:*** *students should be able to*
   - define physical quantities.
   - distinguished between fundamental and derived physical quantities.
   - list the fundamental physical quantities with their SI units.
   - list some derived physical quantities
   - define vector and scalar quantities
   - list some examples of vector an scalar quantities
3. ***Teaching methods;***
   - Discussion
   - Explanation (lecture)
   - Questions and answers

4 Teaching aids

- Display the real measuring instruments if available.
- Show drawings of different measuring instruments.
- Show drawings of traditional measuring instruments.

5 ***Facilitating the learning process***

In this section the lessons have to focus on different measurements, generalizing that physics is inherently a science of measurements.

Let the students do Activity 1.8 so that they can develop skill of measuring some materials. They learn about measuring instruments and units.

Try to point out some traditional measuring units. Activities 1.9 and 1.10 are planned to teach the existence of traditional units and unreliability of them.

Because of unreliability of traditional units, scientists developed standard and reliable units. This gave rise for the **System of International units (SI units).**

Let students focus on the basic concepts such as:

i) **Measurements:** It simply is the comparison of something with a given standard units.

ii) **Standard units:** They are conventional units which are used to measure physical quantities scientifically.

iii)Let the students discuss the difference between **traditional units** and **standard units**.

Ask your students to describe what physical quantities are. Based on Activity 1.8, let the students notice two groups of physical quantities. Some are directly measurable, while others are indirectly computed by using measurable quantities, which we call;

1. Fundamental (basic) physical quantities, and
2. Derived physical quantities,

Basic (fundamental) physical quantities are limited in numbers (They are only 7). They can be described only by themselves, while derived physical quantities are computed by combining two or more fundamental physical quantities. They can be described in terms of basic physical quantities.

Lastly introduce the idea of scalar and vector physical quantities. For simplicity list two groups of physical quantities.

Group 1	Group 2
i) 5 oranges	i) 10 Newton force pulling down word.
ii) 2 kg of sugar	ii) A car speeding 50km/h to East.
iii) the number of students in your class is 50.	iii) An object displaced 10m from its origin to north.
iv) 4 hours	

Ask students to identify the differences between group - 1 and group - 2.

Group 1 indicates that the materials are described only by their size (magnitude). These are called **Scalars.**

Group 2. In addition to magnitude they have also direction. These are called **vectors.**

Let the students list a number of examples for each.

To wind up the lesson of the section, again make sure that all students have answered the questions in Check point1.2.

Supplementary activity 1.2

Let the students describe some basic properties of scalar and vector quantities.

7. ***Stabilization:***
   - Summarize the lesson by giving them short notes. Ask them to do selected questions from the check point and unit exercises as class work and home works and further reading assignment.
   - Give them feedbacks to their class work and home work activities.
   - Support students who failed to answer the checklist questions.

1.3 Measuring Length, Mass and Time

1. ***Proposed No of periods*** *: 3 periods*
2. ***Competencies:*** *Students would be able to:*
   - name the measuring device of length.
   - perform measurements of length.
   - express the relationship between meter and mm, cm, km units.
   - convert meter into cm, mm, and km.
   - define mass.
   - name some measuring devices of mass.
   - measure the mass of a body using a beam balance.
   - Convert kg into g, mg, Quintal, and tone and vice versa.
   - define time.
   - mention the measuring device of time.
   - convert day into hr, min and sec.

3. ***Suggested teaching methods***

   Length: individual and group practical work.

   - Let students read the scales on their rulers and use the ruler to measure the length of different bodies like their physics textbook and the sides of a black board.
   - Explain the relationship between meter and centimeter.

   Mass: group practical work, discussion,

   - Let students estimate the masses of two different bodies. You have to discuss the findings with the class.
   - Finally let students check their proposal by measuring the masses using the beam balance.

   Time: group practical work, discussion

- Mention the different time measuring devices like the clock and the wrist watch.
- Let students discuss how time is important in their daily life like being punctual during appointment.
- You ask students measure the rates of their heart beats (pulses) using a clock.

4. Teaching aids

- Ruler
- Measuring tape
- Vernier caliper
- beam balance and weights
- different watches (wrist watch, stop watch)

5. Facilitating the learning process

Pre – planning

Allocate one period each for length, mass and time.

Tell the students to bring different measuring instruments of length. Let them do Activity 1.12 and 1.13. Students develop their skills of measuring length and different distances.

Let students exercise on conversion of units of length.

You can follow the same procedure to teach measuring time and mass.

You need to make follow up seriously the students' performance for all given activities.

Throughout the lessons check whether all the set learning objectives are attained completely by using Check point 1.3

6. Stabilization:

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check point and unit exercises as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the checklist questions.

Answers to Review Questions and Problems

I. True and False questions

1. False
2. True
3. False
4. False
5. True

II. 1. Density
2. Force
3. Newton
4. 141 min
5. Mass

III. 1. Our physical body is not uniform for all of us. It is different from person to person.

2. 930 cm

3. a) Physics is the branch of natural science. It is the study of the nature of matter, energy and their interactions.
   b) Standard units are conventional units which are used to measure physical quantities scientifically
   c) Measurement is the comparison of an unknown quantity with a known, fixed unit quantity.
   d) Fundamental physical quantities are those quantities which can be measured directly. They are not defined in terms of other physical quantities

e) A vector quantity is a physical quantity which has both magnitude and direction.

f) Length is a fundamental physical quantities that describe the distance between two points

g) Time is one of the fundamental physical quantities. If measures the duration of any change in physical processes.

h) Mass of certain body denotes the quantity of mass particles (matter) in a body

4. Given **Required**

- Mass of all tablets in the bottle = 0.5kg — Number of tablets in the bottle
- Mass of each tablet = 250 mg

Solution

$$\text{Number of tablets} = \frac{\text{Mass of tablets in the bottle}}{\text{mass of each tablet}}$$

$$= \frac{(0.5 \times 1000 \times 1000)\,\cancel{mg}}{250\,\cancel{mg}}$$

$$= \frac{500{,}000}{250}$$

$$= 2{,}000$$

UNIT TWO

MOTION

I) *Time allotted to the unit: 8 periods.*

ii) *Out comes of the unit:* After completing this unit students should be able to:

- define motion and describe types of motion.
- define distance, displacement, speed, velocity, acceleration and state their SI - units.
- distinguish between distance and displacement, speed and velocity, uniform motion and accelerated motion.
- apply $\vec{v}_{av} = \frac{\vec{s}_T}{t_T}$ and $\vec{v}_{av} = \frac{\vec{v}_t - \vec{v}i}{\Delta t}$ to solve problems involving. linear motion with uniform acceleration.
- identify that any freely falling bodies fall with constant acceleration due to gravity ($9.8\ m/s^2$).
- demonstrate the scientific enquiry/ skills.
- develop scientific attitudes and values.

These learning objectives have to be implemented. To implement them, however, they have to be restated in *specific*, *measurable*, *attainable*, *realistic* and *time-bound* (**SMART**) way. The minimum learning competencies have to be achieved by the majority of students. You have to make sure this happened throughout the lessons. Do not wait until the end of the lessons.

iii) Contents of the unit

2.1 Definition of motion.

2.2. Motion along a straight line.

2.3. Qualitative exploration of constant velocity and accelerated motion.

iv) Teaching aids

- Spring mass system.
- Different weights/ masses (blocks).
- Pendulum
- Rotating objects.
- Well illustrated diagrams on uniform motion (and uniformly accelerated motion) of objects.
- Trolley – (in the lab) and stop watch.
- Different diagrams showing the difference between distance and displacement.
- Graph papers (squared papers).
- Ruler

v) Planning for teaching

Unit: Motion ***Number of given periods: 7***

Period	*Contents*	*Competencies.*	*suggested methods*	*suggested follow up and assessment methods*
1st	**2.1 Definition of motion** • Types of motion	• Define motion. • Describe the type of motion. • Give examples for each type of motion.	• Explanation • Discussion • Question and answer	• Oral questions: Ask students to define motion and describe types of motion.
2nd	**2.2 Motion along a straight line** • Distance • Displacement	• Define the terms distance and displacement. • Distinguish between distance and displacement.	• Explanation • Discussion think/ pain/ share • Question and answer	• Oral question: • Ask students to define the terms distance and displacement • relate distance and displacement
3rd	• Average speed • Velocity • Measuring velocity	• Define the term average speed, $v_{av} = \frac{s_T}{t_T}$ • Apply to v_{av} to solve problems • Define the term average velocity, Apply $\vec{v}_{av} = \frac{\vec{s}_T}{t_T}$ to solve problems	• Explanation. • Discussion • Question and answer • Problem solving.	• Ask students to: answer questions or do checklist questions. • solve related problems.

4th	**2.3 Qualitative exploration of constant velocity and accelerated motion** • Uniform motion • Dot plot representation of constant velocity • Average speed on any interval	• Demonstrate the understanding of uniform motion using the human line! • Identify average velocity as the slope of distance Vs time graph.	• Discussion • Explanation • Group on individual work.	• Ask your students to: Demonstrate the concept of uniform motion using the human line • Identify average velocity as the slope of distance Vs time graph.
5th	• Average velocity is the slope of a distance Vs time plot. • Steeper lines have higher velocities. • More horizontal lines have lower velocities • Segmented graphs. Constant velocity with stopping.	• Interpret graphs by associating the slope with the velocity.	• Discussion • explanation • group or individual work	• Ask your students to interpret graphs by associating the slope with the velocity.

6th	• acceleration • Uniformly accelerated motion	• Define the term acceleration. • State the SI unit of acceleration to solve numerical problems • Describe the motion of a freely falling body. • Define accelerated motion. • Distinguish between acceleration and velocity. • Distinguish between uniform and accelerated motion.	Explanation Discussion Group or individual work	• Define the term acceleration • State the SI unit of acceleration to solve numerical problems. • Describe the motion of a freely falling body. • Ask students to define accelerated motion. • Organize students in groups and let them distinguish between • Acceleration and velocity • Uniform and accelerated motion
7th	• Representation of uniform motion and accelerated motion qualitatively using dot plots and qualitatively using tables.	• Represent uniform and accelerated motion graphically.	• Explanation • Discussion • Group or individual work	Ask student to: • Represent uniform and accelerated motion graphically.

2.1 Definition of Motion

1. ***Proposed No of periods = 1 period.***

2. ***Competencies****:*

After completing this unit the students should be able to:

- define motion as the change of position with time.
- describe the types of motion.
- give examples for each type of motion.

3. ***Suggested teaching Methods***

- Before starting this unit give a reading assignment for the students to read the first part of the unit.
- In the class, raise the question which is asked in activities part on student's text. (The teacher can also ask more questions for discussion).
- If the discussion leads to a conclusion that somebody simply sitting in a moving car is at rest relative to the car and at the same time he/she is in motion relative to the ground, then the teacher can arrive at the conclusion that a body is said to be in motion when it changes its position relative to other bodies or frame of references.
- Ask the questions in Activity 2.1 to identify different types of motion around them.
- Before explaining the different types of motion you have to do simple demonstrations to show different types of motion. After each demonstration ask the students to group the motion as rectilinear, curvilinear, rotary, and vibratory motion. Finally you should summarize the lesson by repeating each type of motion.

- You can demonstrate the following activities.
  i. An object sliding down over an inclined plane. (Rectilinear motion)
  ii. Rotate a ball which is tied to a string. (Curvilinear motion)
  iii. A disk made from card bard rotating on an axis or nail. (Rotary motion)
  iv. Simple pendulum made from locally available material (Vibratory motion)

4. Teaching aids

- Spring -mass system
- Different weights (blocks)
- Pendulum
- Rotating objects.
- Alternatives: Well illustrated diagrams on motion of objects.

5. Facilitating the learning process:

Pre- planning

It is advisable to refer to different books, to present the concept "motion" in a meaningful and simplified way. Design a situation in which students can observe clearly different types of motion. For example

- For motion in a straight line ⟶ A person walking in a straight. path.
- For curvilinear motion ⟶ Round about.
- For vibratory motion ⟶ Spring - mass system and pendulum.

6. Stabilization

- Summarize the lesson by giving them short notes. Ask them to do selected questions from the check point and unit exercises as class work and home work and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the checklist questions.

2.2 Motion Along a Straight Line

1. ***Proposed No of periods*** *=2 periods*

2. ***Competencies****.*

After completing this unit students should be able to:-

- define the terms distance, displacement, speed, velocity.
- acceleration, uniform motion and uniformly accelerated motion.
- distinguish distance and displacement.
- distinguish speed and velocity.
- distinguish uniform motion and uniformly accelerated motion.

3. ***Suggested teaching methods***

- Before explaining each term (concept) in motion, ask the students to discuss and report on each term to find their background knowledge.
- In the explanations you should give emphasis on the difference between distance and displacement, speed and velocity.

- In the discussion, you may also ask questions like “what is the difference between ‘20km’ and ‘20km due west’?” “What is the difference between ‘20m/s’ and ‘20m/s due east’?
- In the discussion you should also give emphasis on uniform motion and uniformly accelerated motion. Use tables/charts to write their differences.
- You may do some of the worked examples from the text in the class and leave the remaining for the students as a class work or homework.

4. Teaching aids

- Trolley – (in the lab) and stop watch.
- Diagrams showing the difference between distance and displacement; speed and velocity
- Diagrams showing uniform and uniformly accelerated motion.

5. Facilitating the learning process

Pre- planning

To make the students visualize the concept, it would be advisable to do activities inside and outside the laboratory.

Prepare a field activity in which 3 or 4 students move from one point **A** to another point **B**, but following different paths. Let the students discuss in group on their paths.

Similarly prepare a situation in which you can demonstrate the difference between speed and velocity.

6. Stabilization

- Summarize the lesson by giving them short notes.

- Ask them to do selected questions from the check point and unit exercises as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the checklist questions.

2.3 Qualitative Exploration of Constant Velocity and Accelerated Motion

1. Proposed No of periods *= 4 periods*

2. Competencies.

After completing this unit students should be able to:

- Demonstrate uniform motion.
- Identify average velocity as the slope of distance Vs time graph.
- Interpret graphs by associating the slope with the velocity.
- Define accelerated motion
- Distinguish between velocity and acceleration.
- Distinguish between uniform and accelerated motion .
- Represent uniform and accelerated motion graphically.
- Define the term acceleration.
- State the SI unit of acceleration.
- Apply the definition of acceleration to solve numerical problems.
- Describe the motion of freely falling body.

3. Suggested teaching methods:

- Before starting this section, give an assignment for the students to read the topic and attempt activities 2.11 and 2.12
- In the class, raise the questions which were asked in the activities, so that, students can share their understanding. (the

teacher needs to ask more questions to make the class interactive and live.)

- While discussing on activity 2.11 – make sure that students have got clear idea of uniform velocity and uniform motion.
- Based on activity 2.12 guide the students to draw the graph of s against t.
- Ask students what type of motion they will get, if it is not a uniform motion.
- Activity 2.13 is helpful to introduce acceleration and accelerated motion.
- You can mention the motion of freely falling bodies, as a typical example of uniformly accelerated motion.

4. Teaching aids

- Trolley and stop watch (in the cob).
- Different graphs showing s against t, v against t for uniform motion
- Different graphs showing s against t, v against t for uniformly accelerated motion.

5. Facilitating the learning process

Pre-planning

Prepare activities which students can do outside the class so that they can visualize the concepts of uniform motion and uniformly accelerated motion. Design a lab- demonstration on freely failing bodies. Draw the necessary graphs ahead of the class. You can prepare a number of exercises and problems on this topic.

6. Stabilization

Summarize the lesson and give them short notes. Ask the students to do selected questions on the topic. Make sure that all the check point questions are answered by all the students.

- Plan a special support for those students who failed to answer (understand) the checklist questions.

Answers to Review Questions and Problems

1. Given

$\vec{v}_{av} = 15\text{km/h North}$

t = 20 min

Required

$\vec{s} = ?$

Solution

$\vec{s} = \vec{v}_{av}\ t$

$= 15\text{ km/h North} \times \frac{20}{60\text{hr}}$

= 5 km, North

2. Given

$\vec{v_i} = 0$

$\vec{v_f} = 90\text{ km/h} = 25\text{ m/s}$

t = 8.0s

Required

$\vec{a} = ?$

Solution

$\vec{a} = \frac{\vec{v_f} - \vec{v_i}}{t} = \frac{25\text{m/s} - 0}{8}$

$= 3.125\text{m/s}^2$

3. Given

$\vec{v_i}$ = 215km/h

= 59.6m/s

$\vec{v_f} = 0$

t = 2.7s

Required

$\vec{a} = ?$

Solution

$\vec{a} = \frac{v_f - v_i}{t}$

$\frac{0 - 59.6\text{m/s}}{2.75}$

$= -22.08\text{ m/s}^2$

4. Given | Required | Solution

$\vec{a} = 2.4\text{m/s}^2$ | $t = ?$ | $t = \dfrac{\vec{v}_f - \vec{v}_i}{\vec{a}} = \dfrac{25\text{m/s} - o}{2.4\text{m/s}^2} = \dfrac{250}{24}\text{s} = 10.42\text{s}$

$\vec{v}_i = 0$

$\vec{v}_f = 90\text{km/h} = 25\text{m/s}$ | $s = ?$ | $\vec{s} = \vec{v}_{av}t = \left(\dfrac{\vec{v}_i + \vec{v}_f}{2}\right)t$

$= \left(\dfrac{0 + 25\text{m/s} \times 10.42\,\text{s}}{2}\right) = 130.25\text{m}$

5. a) $\vec{v} = \dfrac{\Delta\vec{s}}{\Delta t} = \dfrac{30\text{ m} - 0\text{ m}}{5\text{ sec} - 0\text{sec}} = \dfrac{30\text{ m}}{5\text{ sec}} = 6\text{m/s}$

b) $\text{slope} = \dfrac{\Delta s}{\Delta t} = 6\text{m/s}$

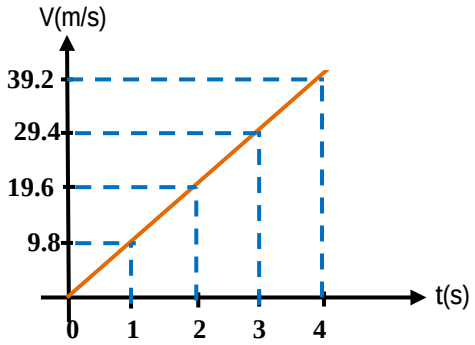
c) at t = 6 second, the distance is 35 m

6. a) $a = \dfrac{\Delta v}{\Delta t} = \dfrac{40\text{ m/s} - 0\text{ m/s}}{4\text{ sec} - 0\text{ sec}} = \dfrac{40\text{ m/s}}{4\text{ sec}} = 10\text{m/s}^2$

b) $\text{slope} = \dfrac{\Delta\vec{v}}{\Delta t} = \vec{a} = 10\text{ m/s}^2$

c) $\text{at } t = 8\text{ s}\ \vec{v} = \vec{a}t = 10\text{m/s}^2 \times 8\text{ s} = 80\text{m/s}$

7. a)



b) $\dfrac{\Delta v}{\Delta t} = \dfrac{39.2\text{m/s} - 0}{4\text{s} - 0} = 9.8\text{m/s}^2$

c) The acceleration is constant.

8. Acceleration is the rate of change of velocity.

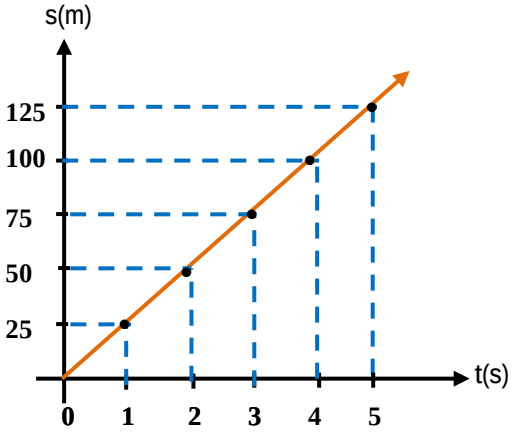
9. For a freely falling body.

- The velocity increases by 9.8 m/s every second.
- The distance it has fallen is computed by the equation $\frac{1}{2}gt^2$
- The acceleration is constant and has a value of 9.8m/s^2

10. a) $s = vt = 25\text{m/s} \times 5\text{s} = 125\text{m}$

b)

t(s)	1	2	3	4	6
s(m)	25	50	75	100	125



Graph of distance versus time

$$\text{c) slope} = \frac{\text{change in distance}}{\text{change in time}} = \frac{(125-0)\text{m}}{(5-0)\text{s}} = 25\text{m/s}$$

11. Given

$\vec{v}_i = 0$

$\vec{a} = 0.5 m/s^2$

$t = 15$ sec

$\vec{v}_f = 25 m/s$

Required

$\vec{v} = ?$

$t = ?$

Solution

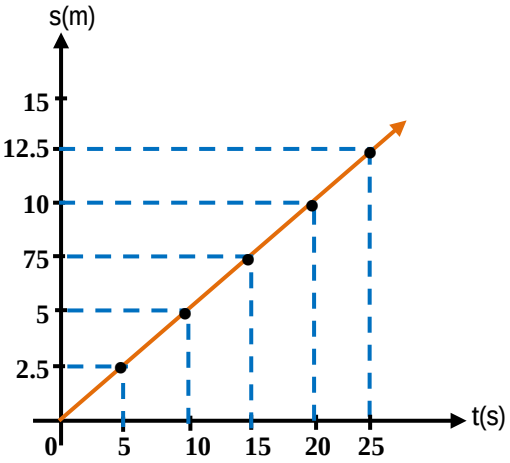
a) $\vec{v} = \vec{a}\, t = 0.5\ m/s^2 \times 15 sec$

$= 7.5\ m/s$

b) $\dfrac{\vec{v}_f - \vec{v}_i}{\vec{a}} = \dfrac{25\ m/s - 0\ m/s}{0.5\ m/s^2} = 50\ sec$

c)

t(s)	0	5	10	15	20	25
v(m/s)	0	2.5	5	7.5	10	12.5



Graph of speed against time

UNIT THREE

FORCE AND NEWTON'S LAWS OF MOTION

I) Time allotted to the unit: *10 periods*

ii) Outcomes of the unit: After completing this unit the students should be able to:

- define force and state the SI unit of force.
- describe and explain the effects of force and methods of measuring force.
- state the three Newton's laws of motion and predict the motion of a body acted by an external force.
- solve numerical problems involving Newton's laws of motion.
- relate some physical phenomena in your daily life with Newton's laws of motion.
- distinguish between mass and weight of an object.
- describe and explain how friction is generated, advantage and disadvantage of friction, and methods of reducing friction.
- state in words and in mathematical symbols that friction depends on the nature of surface and the normal contact force.
- demonstrate the scientific enquiry/ skills.
- develop scientific attitudes and values.

These learning objectives have to be implemented. To implement them, however, they have to be restated in *specific*, *measurable*, *attainable*, *realistic* and *time-bound* (**SMART**) way. The minimum

learning competencies have to be achieved by the majority of students. You have to make sure this happened throughout the lessons. Do not wait until the end of the lessons..

iii) Contents of the unit

3.1. Force

3.2. Newton's laws of motion.

3.3. Frictional force

iv) Teaching Aids

- Different force measuring devices; spring balances, newton-meter
- beam balances
- Different masses
- Springs, stand
- Diagrams
- String
- Ruler

v) Planning for teaching

Unit: Force and Newton's Laws of Motion

Number of given period: 10

Period	*Content*	*Competencies*	*Suggested methodologies*	*Follow up and assessment methods*
1st	**3.1 Force** • Definition of force • Types of force	• Define force as a push or pull. • Mention some types of forces in nature.	• Explanation • Discussion • Question and answer	• Ask them to answer or do checklist questions and selected review exercises.
2nd	• Effects of force • Measuring force	• Describe the effects of forces. • State the SI unit of force. • Name the measuring devises of force .	• Discussion • Demonstration • Explanation • Question and answer	• Instruct them to answer or do checklist questions and selected review exercises.
3rd	• Spring scales • Balancing scales • Beam (lever) balance • Inertia balance	• Measure the mass of a body using a pan balance. • Define inertia. • Give example of forces that can act on an object without touching.	• Demonstration • Discussion • Group work • Question and answer	• Ask them to answer or do checklist questions and selected review exercises.

4th	**3.2 Newton's laws of motion** • Newton's first law of motion • Mass and Inertia	• State Newton's 1st law. • Relate mass and inertia.	• Explanation • Discussion • Question and answer • Demonstration	• Ask them to answer or do checklist questions and selected review exercises
5th	• Newton's second law of motion	• State Newton's 2nd law in words. • State the relationship between F, m and a. • Solve simple problems.	• Discussion • Demonstration • Explanation- • Question and answer	• Ask them to answer or do checklist questions and selected review exercises • Solve problems related to Newton's second law of motion.
6th	• Mass an weight • Application	• Distinguish between mass and weight. • Apply the formula W = mg in solving problems.	• Explanation • Discussion • Question and answer • Demonstration	• Ask them to answer or do checklist questions and selected review exercises • Solve problems related to weight.
7th	• Newton's third law	• State Newton's third law of motion • Relate some physical phenomena in their daily life activities with Newton's three laws of motion.	• Explanation • Discussion • Question and answer • Demonstration	• Ask them to answer or do checklist questions and selected review exercises.

8th	**3.3 Frictional force** • Definition of Friction • Types of frictional forces.	• Define normal force. • Show the relationship between frictional force and normal force . • Explain static and kinetic (sliding) friction. • Apply the formula $F_f = \mu F_N$ to solve problems. • Explain factors affecting friction.	• Explanation • Discussion • Question and answer • Demonstration	• Ask them to answer or do checklist questions and selected review exercises. • Solve problems related to friction
9th	• Advantages and disadvantages of friction	• Describe the advantage and disadvantage of friction.	• Explanation • Discussion • Question and answer	• Ask them to answer or do checklist questions and selected review exercises. • Assess their presentation.
10th	• Methods of reducing friction	• Describe methods of reducing friction.	• Discussion • Demonstration • Explanation	• Ask them to answer or do checklist questions selected review exercises.

3.1. Force

1. ***Proposed No of periods = 3 periods***
2. ***Competencies***

After completing this unit students should be able to:-

- define force as a push or pull.
- mention some types of forces in nature.
- name the measuring device of a force and its SI units.
- give examples of forces that can act on an object without touching.
- give examples of forces that act only on contact.
- describe the effects of force.
- state the SI Unit of force.
- name the measuring devices of force.
- measure the mass of a body using a pan balance.

3. ***Suggested teaching methods;***

- Discussion
- Explanation
- Questioning and answering.
- Group and individual works (based on the given activities).
- Demonstration

4. ***Teaching aids***

- Force measuring devices
- Springs
- Different masses and beam balances

5. ***Facilitating the learning process***

Pre-planning

Ask students to discuss Activity 3.1 to 3.6 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom. Ask students who can get spring balance or borrow spring balances and other teaching aids from nearby secondary school.

The suggested method of teaching is active learning method. Therefore, your basic role would be to lead the students to discuss on the given topic and guide the students on practical works.

Based on Activity 3.1, let students discuss about motion of bodies. Guide them to discuss the importance of force relation to motion. In Activity 3.2, let students discuss in with their friends about "what a force is?" just for one or two minutes. Let every group, forward its summarized idea of force. Write down their ideas on the black board. It is important to be completely non-judgmental about their responses. Surely you will get different categories of force: such as, political force, military force, and many others. Do not discourage any of them.

After you put their responses on the board, let them discus on their categories (i.e. let them group the different forces as non-physical and physical. Finally guide them to focus and understand that 'force' in physics is a technical term that is not always directly related to common uses of the word "Force"

During the 2nd period of this unit, try to manage Activity 3.3 and 3.4.

Based on Activity 3.3, students need to build knowledge of contact and non – contact force,

Activity 3.4, (which is based on activities in Fig 3.3) is designed to discuss different effects of force. You can summarize the discussion of the students in two major terms (effects of forces)

i) Deformation (ii) Change of states of motion

In the 3rd period, let the students do activity 3.5. Here, students are expected to gain the basic knowledge of measuring forces, identify the SI – unit of force and devices used to measure force. Demonstrate how spring balance is constructed and used. Let the students draw and label parts of the spring balance. Ask students to measure the force required to raise a mass of a body in air.

Throughout the lessons assess students learning using Check list 3.1, make sure that all students have attained the set minimum learning competences.

6. ***Stabilization***

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the checklist questions.

3.2. Newton's Laws of Motion

1. ***Proposed No of periods*** *: 4 periods*

ii) ***Competencies:*** After completing this unit students should be able to:-

- define the term inertia.
- relate mass with inertia.
- state Newton's first law of motion.
- state Newton's second law of motion in words.
- state the relationship between force, mass and acceleration.
- solve simple numerical problems by applying Newton's law of motion.
- distinguish between mass and weight.
- apply the formula W = mg to calculate the weight of a body.
- state Newton's third law of motion.
- relate some physical phenomena in their daily life activities with Newton's three law of motion.

2. ***Teaching methods;***

- Discussion
- Questioning and answering
- Explanations
- Group and individual practical activities
- Demonstration

4 Teaching aids

- Different masses
- Balloons (for 3rd law demonstration)
- Newton meters

5 *Facilitating the learning process*

Pre-planning

Ask students to discuss Activity 3.6 to 3.9 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom.

For this section, the periods allotted are four. The suggested distribution of the topics is indicated in the table of planning for teaching.

The teacher is expected to introduce the contribution of Galileo and Newton, for the development of laws of motion.

Activities 3.6, 3.7 and 3.8 are planned to help students understand, the first law of motion, the interrelation between mass and inertia and the concept of "state of rest"

Based on Activity 3.9 and Fig 3.8 students need to realize the effects of inertia.

From Activity 3.11 and 3.12, students need to realize the effect of force on the states (acceleration) of a given mass. Through these activities, you can introduce Newton's second law of motion. Do sample worked examples given in the textbook. Let the students try to solve the problems in check list.

In our daily life everyone uses the terms 'mass' and 'weight' interchangeably. Let the students do, Activity 3.14. They are expected to understand the distinction between mass and weight.

Activity 3.16 helps you to introduce the law of action and reaction force.

- ***Mass is constant regardless of its location. But weight varies depending on its location.***
- ***Mass is a scalar quantity, while weights a vector quantity***

Let the students mention some examples of “action and reaction forces” from their daily experience. You can also discuss,

- Motion of air filled but untied balloon
- Motion of air plane
- When a gun fires a bullet (recoiling)
- Swimming and boating activities are examples of action and reaction forces.

Throughout the lessons assess students learning using Check points 3.2. Make sure that all students have attained the set minimum learning competences.

6. Stabilization:

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the checklist questions.

3.3. Frictional Force

1. ***Proposed No of periods*** *: 3 periods*
2. ***Competencies:*** After completing this unit students should be able to:-
   - define friction as a force that resists motion
   - give every day examples of frictional force
   - define normal force.
   - show the relationship between frictional force and normal force
   - identify friction as static or kinetic (sliding)
   - explain static and kinetic (sliding) friction
   - apply the formula $F_s = \mu_s F_N$ and $F_k = \mu_K F_N$ to solve numerical problems.
   - explain the factors affecting friction
   - describe the advantage and disadvantage of friction
   - describe methods of reducing friction
3. ***Teaching methods***
   - Discussion
   - Questioning and answering
   - Explanation
   - Group and individual practical activities
   - Demonstration
4. ***Teaching aids***
   - Different bodies (with different shapes – sphere, cylinder rectangular blocks, etc
   - Lubricant substances

- Match and other local materials which generate fire by friction.

5 Facilitating the learning process

Pre-planning

Ask **students** to discuss Activity 3.17 to 3.19 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom.

The periods allotted for this section are -3 periods. Hence you need to distribute the topics proportionally.

Activities 3.17, 3.18 and 3.19 are means of introducing friction, and causes of friction. Let the students respond to the questions in each activity. You are required to facilitate the discussion, by asking the students to defend their responses by supplementing it with real examples.

During the second period of this section, students are introduced to the different types of friction.

Activities 3.20 and 3.21 are designed to enable the students understand

- The existence of static and kinetic (sliding) force.
- The factors affecting the frictional force.
- The existence of normal force.
- To derive and apply the formula $f_s = \mu_s F_N$ and $f_k = \mu_K F_N$ in solving related problems.

In the last period of this section, you need to treat:

- Effects of friction
- Advantages and disadvantages of Friction
- Methods of reducing friction.

Based on Activity 3.22 let students mention some common examples of “advantages of friction”.

Activity 3.23 helps the students in discussing some examples of disadvantages of friction.

Smoothing, lubricating, using bearings, and rolling bodies are methods of reducing friction.

Throughout the lessons assess students learning using Check list 3.3. Make sure that all the students have attained the set minimum learning competences.

6. Stabilization:

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the checklist questions.

Answers to Review Questions and Problems

I.

1. Unbalanced force
2. Mass and acceleration
3. Equal in magnitude and opposite in direction
4. 9.8 newton
5. Weight

II.

1. A force is a push or a pull exerted on a body.
2. The gravitational acceleration of the earth decreases as the height from the surface increases. Therefore since weight is department on the gravitational acceleration it also varies with attitude.
3. i. Unit of g is m/s^2
   ii. unit of F_N is newton
   iii. μ is unit less.
4. Friction is opposing force against the relative motion of the objects. The root cause of friction is the roughness of surfaces brought in to contact because of the interlocking of the irregularities of the rubbing surfaces and the adhesion of the surface to the other.

III.

1.

Given	**Required**	**Solution**
m=8kg	F= ?	F= ma
a= $2m/s^2$		= $8kg \times 2m/s^2$
		= 16N

2.

Given	**Required**	**Solution**
m=20kg	a= ?	F= ma $\Rightarrow$ a=$\frac{F}{m}$
$v_i = 0$		$\Rightarrow a=\frac{22N}{20kg} = 1.1\frac{m}{s^2}$
F = 22N		

3. **Given** **Required** **Solution**

m = 60kg weight = ? $w = mg = 60kg \times 10m/s^2$

$g = 10\ m/s^2$ $= 600N$

4. **Given** **Required** **Solution**

m = 90 kg $w_p = ?$ $w_p = mg_p = 90kg \times 2m/s^2$

$g_p = 2.5 \times g_E$ $= 2250\ N$

$= 25\ m/s^2$

5. **Given** **Required** **Solution**

m = 1500 k F = ? $F = ma = m\left(\frac{v_f - v_i}{t}\right)$

$v_i = 0$ $= 1500kg\left(\frac{20m/s - 0}{10s}\right)$

$v_f = 20m/s$ $= 15{,}000N$

t = 10s

6. **Given** **Required** **Solution**

m = 40kg a = ? $F_1 = ma_1 = 40kg\ a_1$

$F_2 = 2F_1$ $F_2 = ma_2 = 40kga_2$ (but $F_2 = 2F_1$)

$\Rightarrow 40kga_2 = 2\ (40kga_1)$

$\Rightarrow a_2 = 2a_1$

$\therefore$ The acceleration will be doubled

7. **Given** **Required** **Solution**

m = 5kg $N_F = ?$ $N_F = mg = 5kg \times 10m/s^2 = 50N$

$\mu = 0.25$ $F_f = ?$ $F_f = \mu F_N = 0.25 \times 50N = 12.5N$

8. **Given** **Required** **Solution**

$F_f = 75N$ $\mu = ?$ $\mu = \frac{F_f}{F_N} = \frac{75N}{150N} = 0.5$

$F_N = 150N$

9. **Given** **Required** **Solution**

m = 65kg $w_E = ?$ $w_E = mg_E = 65kg \times 10m/s^2 = 650N$

$g_E = 10\ m/s^2$ $w_m = ?$ $w_m = mg_m = 65kg \times 1.6 = 104N$

$g_m = 1.6\ m/s^2$

UNIT FOUR

WORK, ENERGY AND POWER

i) *Time allotted to the unit: 8 periods*

ii) Outcomes of the unit: After completing this unit the students should be able to:

- define work, energy and power and state their dimension and SI units.
- use the mathematical formulas to solve numerical problems related to work, energy and power.
- state in words the laws of conservation of energy.
- distinguish between potential energy and kinetic energy.
- explain the energy changes when a body falls.
- demonstrate the scientific enquiry/ skills.
- develop scientific attitudes and values.

iii) Contents of the unit

4.1. Work
4.2. Energy
4.3. Transformation and conservation of energy.
4.4. Power

iv) Teaching Aids

- Drawings showing force applied on mass 'm'
- A pendulum
- A mass of a body
- Picture of water fall and wind turbine
- Drawings showing Energy transformation

v) Planning for teaching

Unit: Work, Energy and Power

Period	*Content*	*Competencies*	*Suggested methodologies*	*Follow up and assessment methods*
1st	**4.1Work** • Definition of Work	• Define work • Express the units of work	• Discussion • Question and answer • Explanation	• Assess their ideas on definition of Work • Ask the units of work express in N.m
2nd	• Work done in the direction of force	• Apply the formula $W = F \times s$	• Discussion • Explanation • Individual work	• Observe how they apply the formula $W = F \times S$ in solving problems
3rd	**4.2. Energy** • Definition of energy • Forms of energy	• Define the term energy. • Explain how work and energy are related. • List forms of energy	• Discussion • Explanation • Demonstration • Question and answering	• Oral report on definition of energy • Ask the forms of energy
4th	• Kinetic energy	• Define the term kinetic energy • Apply $KE = \frac{1}{2} mv^2$	• Discussion • Explanation • Demonstration • Individual work	• Ask them define the term kinetic energy. • Give examples of bodies possessing KE • And apply $KE = ½ mv^2$ in solving problems

5th	• Potential energy	• Define potential energy. • Give examples of bodies possessing PE. • Apply PE = mgh	• Discussion • Explanation • Demonstration • Individual work	• Ask them to define potential energy. • Give examples of bodies possessing PE. • Apply PE = mgh.
6th	**4.3. Transformation and conservation of energy** • Laws of conservation of energy	• Explain how energy is transformed from one form to another. • State the law of conservation of energy.	• Discussion • Explanation • Demonstration	• Ask them to state the Laws of conservation of energy.
7th	• Energy of falling bodies (water) • Other sources of energy (wind and solar energy).	• Explain how energy is obtained from falling water. • Mention some other sources of energy.	• Discussion • Explanation • Demonstration	• Let them explain how energy is obtained from falling water and wind turbine.
8th	**4.4. Power** • Definition of power. • Units of power • Solving related problems	• Define power and state its SI unit • Use the definition of power to solve numerical problems.	• Discussion • Explanation • Individual work	• Ask them define power and state its SI unit • Use the definition of power to solve numerical problems.

4.1. Work

1. ***Proposed No of periods: 2 periods***
2. ***Competencies:*** After completing this unit students should be able to:
   - define work as the product of force and distance in the direction of force.
   - express the units of work.
   - apply the formula "Work = Force × Distance" to solve numerical problems.
3. ***Suggested teaching methods;***
   - Discussion
   - Explanation
   - Questioning and answering.
   - Group and individual works
   - Demonstration
4. ***Teaching aids***
   - Different objects having different masses.
   - Force measuring instrument.
   - Drawings (Pictorial presentations related to work done)
5. ***Facilitating the learning process***

Pre-planning

Collect the teaching aids from your locality or nearby secondary school, and ask students to discuss activities ahead of time with their friends and parents.

You are advised to spend two periods on this section. In the first period, let the students discuss on Activity 4.1. During their discussion invite them to define "work". Emphasize on the definition of 'work' in physics, and help the students to understand that 'work' has a very different meaning in physics.

- Work is said to be done when energy is transformed from one form in to others. Introduce equation W = Fs and its SI unit. The unit of work is joule, and that the symbol for this is *J*. 1J =1N.1m

You can spent the second period on computing work done, using the formula W = F × S. do worked examples 1 and 2 and let them do individually.

Throughout the lessons assess students learning using Check point 4.1, make sure that all students have attained the set minimum learning competencies.

6. ***Stabilization***

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the checklist questions.

4.2. Energy

1. Proposed *No of periods: 3 periods*

2. Competencies: After completing this unit students should be able to:-

- define the term energy.
- explain how work and energy are related.
- list the forms of energy.
- define the term kinetic energy.
- apply the formula KE = $\frac{1}{2}mv^2$ to solve numerical problem.

- define the term potential energy.
- give examples of bodies possessing potential energy.
- apply the formula PE = mgh to solve numerical problems.

3. Teaching methods

- Discussion
- Explanations
- Questioning and answering
- Group and individual works (Based on the given activities)
- Demonstration

4 Teaching aids

- Different masses, and mass measuring devices
- Trolley
- Meter
- Diagrams of moving objects and objects raised in air

5 Facilitating the learning process

Pre-planning

Collect the teaching aids from your locality or nearby secondary school or construct them and ask students to discuss activities ahead of time with their friends and parents.

Three periods are the allotted time for this section hence you need to distribute the topics as in the table of planning for teaching.

Activity 4.3 helps the students realize that different objects have different forms of energy.

Based on the discussion of Activity 4.4 students need to understand that there are different forms of energy. But, focus on mechanical energy.

Make sure that the students have understood and developed basic skills of computing kinetic and potential energies. Do the worked examples in the class and let the students attempt the remaining worked examples.

Throughout the lessons assess students learning using Check point 4.2, make sure that all students have attained the set minimum learning competencies.

6. Stabilization:

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment.,
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the checklist questions.

4.3. Transformation and Conservation of Energy

1. Proposed No of periods *= 2 periods*

2. Competencies: After completing this unit students should be able to:

- explain how energy is transformed from one form to another.
- state the law of conservation of energy
- explain how energy is obtained from falling water
- mention some other sources of energy.

3. Teaching methods

- Discussion
- Questioning and answering
- Explanation
- Group and individual works
- Demonstration on the transformation of energy (simple pendulum)

4. Teaching aids

- Springs
- Simple pendulum
- Pictures of water fall and wind turbine

5. Facilitating the learning process

Pre-planning

Find pictures of water fall and wind turbine, collect the teaching aids from your locality or nearby secondary school, and ask students to discuss activities ahead of time with their friends and parents.

The total period assigned to this section is only two periods. Hence the teacher needs a systematic approach to the topic. Activity 4.6. is an activity designed to enable the learners realize the transformation of energy.

In the textbook Fig 4.4 and 4.5 are also very helpful to teach the transformation of energy.
Similarly Activity 4.7. is also helpful to observe the transformation of energy from one form to the other.

- It is very important to focus the direction of discussion about the energy from falling water.

- Throughout the lessons assess students learning using Check point 4.3, make sure that all students have attained the set minimum learning competences.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the checklist questions

4.4 Power

1. Proposed No of periods*: 1 periods*

2. Competencies: After completing this unit students should be able to:-

- define power and state its SI unit.
- use the definition of power to solve numerical problems.
- demonstrate their understandings to energy transformation.

3. Teaching methods

- Discussion
- Explanation

4. Teaching aids

5. Facilitating the learning process

Pre-planning

Ask students to discuss Activity 4.9 ahead of time with their friends and parents.

Let the students realize that, as work, the word ‘power’ has a particular meaning in physics. Ask them to list common meanings of power.

Throughout the lessons assess students learning using Check point 4.4. Make sure that all students have attained the set minimum learning competencies.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the checklist questions.

Answers to Review Questions and Problems

I.

1. Force and displacement
2. Joule
3. Energy
4. Derived
5. Same
6. The law of conservation of energy
7. Power
8. Watt (J/s)
9. Kinetic energy and potential energy

1.	**Given**	**Required**	**Solution**
	F= 200N m= 18kg s= 6m	W = ?	W= F.s. = 200N× 6m = 1200J

2. **Given** **Required** **Solution**

m = 20kg P.E= ? P.E= mgh = 20kg

$\times 10 m/s^2 \times 25m$

h = 25m = 5000J

g = 10 m/s^2

3. **Given** **Required**

m = 450 kg a) P.E = ?

h = 50m b) power = ?

t = 5s

g = 10 m/s^2

Solution

a) P.E = mgh = 450kg $\times 10 m/s^2 \times 50m$ = 225000J

225 KJ

b) $P = \frac{P.E}{t} = \frac{225{,}000J}{5s} = 45{,}000\ W$

= 45 KW

4. **Given** **Required** **Solution**

m = 900 kg h = ? $E.K = \frac{1}{2} mv^2$

v = 11,000 m/s $= \frac{1}{2} \times 900kg \times (11{,}000 m/s)^2$

g = $10 m/s^2$ = 54,450MJ

5. **Given** **Required** **Solution**

m = 2kg h = ? M.E at top = ME at bottom

v = 15 m/s $K.E_T + P.E_T = K.E_b + PE_b$

g = $10 m/s^2$ $O + mgh = \frac{1}{2} mv^2 + 0$

$\Rightarrow mgh = \frac{1}{2} mv^2$

$gh = \frac{1}{2} v^2$

$\Rightarrow h = \frac{v^2}{2g} = \frac{1}{2} \frac{(150\ m/s)^2}{10\ m/s^2}$

= 11.25m

6. **Given** **Required** **Solution**

m = 200 kg power = ? $P = \frac{mgh}{t}$

h = 6 m , g = $10 m/s^2$ $= \frac{200kg \times 10 m/s^2}{2s} \times 6m$

t = 2s = 6000W

7.Given **Required** **Solution**

P = 1000w = 1KW E = ? E = p×t = 1KW × 1hr

t = 1 hr = 1kwhr

UNIT FIVE

SIMPLE MACHINES

i) Time allotted to the unit: 7 Periods

ii) Outcomes of the unit: After completing this unit the students should be able to:

- define simple machines and describe their purposes.
- define Mechanical Advantage, Velocity Ratio and efficiency (η) for simple machines and describe the types of simple machines.
- discuss the significance of simple machines in your daily life.
- calculate the MA, VR and η of simple machines.
- construct and demonstrate some simple machines from locally available materials.
- demonstrate the scientific enquiry/ skills
- develop scientific attitudes and values.

iii) Contents of the unit

5.1. Definition of machine

5.2. Definition of MA, V.R and η

5.3. Types of simple machines

iv) Teaching Aids

- Different types of locally available simple machines. (e.g lever, knife, axle, pulleys, scissor, hammer, inclined plane.)
- Diagrams of different simple machines.

v) Planning for teaching

Unit: Simple machines **Number of given periods: 7 periods**

Period	*Content*	*Competencies*	*Suggested methodologies*	*follow up and assessment methods*
1st	**5.1. Definition of machines** • Uses of machines	• Define machines. • Describe the purpose of simple machines.	• Discussion • Demonstration • Explanation • Question and answer	• Ask students to describe the purpose of simple machines and identify machines as force and velocity multipliers and direction changer.
2nd	**5.2. Definition of MA, VR and η** • Mechanical advantage • Velocity ratio	• Define MA, VR of a machine. • Apply the definition of MA & VR to solve problem.	• Discussion • Demonstration • Explanation • Question and answer	• Ask the students to define and apply the definition of MA & VR to solve problem related to lever, inclined plane and pulley.
3rd	• Efficiency of a machine	• Define efficiency of a machine. • Apply the definition of η to solve problems.	• Discussion • Demonstration • Explanation • Question and answer	• Ask students to define efficiency of a machine and apply the definition of η to solve problems.

4th	**5.3. Types of simple machines** • Lever	• List simple machines • Define the terms effort, load & fulcrum	• Discussion • Demonstration • Explanation • Question and answer	• Ask students to list simple machines and define the terms effort, load & fulcrum for a lever.
5th	• Pulleys • Fixed pulley • Movable pulley.	• Explain how to determine the VR of fixed and movable pulleys.	• Discussion • Demonstration • Explanation • Question and answer	• Ask students to explain how to determine the VR of fixed and movable pulleys.
6th	• Inclined plane	• Determine the VR of an inclined plane using VR = ℓ/h	• Discussion • Demonstration • Explanation • Question and answer	• Ask students to determine the VR of an inclined plane using VR = ℓ/h.
7th	• Torque	• Define the term torque. • Identify that torque produces a turning effect .	• Discussion • Demonstration • Explanation • Question and answer	• Ask students to define the term torque and identify that torque produces a turning effect.

5.1. Definition of Machines

1. ***Proposed No of periods = 1 periods***
2. ***Competencies:*** After completing this unit students should be able to:
   - define machines as simple devices that help us do work easily.
   - describe the purpose of simple machines as direction changer, force multiplier and distance or speed multiplier.
3. ***Suggested teaching methods;***
   - Discussion
   - Demonstration
   - Questioning and answering.
   - Explanation
4. ***Teaching aids***
   - Different types of simple machines (lever, inclined plane, and pulley)
5. ***Facilitating the learning process***

   Pre-planning

   Ask students to discuss Activities 5.1 and 5.2 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom. You borrow teaching aids from nearby secondary school.

   For this section the period allotted is only one period. Hence you (the teacher) are expected to manage it wisely.

   Activities 5.1 and 5.2 are designed to explore different locally available simple machines and understand the concept of "machines" Let the students mention some examples of

machines and describe how the machines make their work easier. based on the discussion of Activity 5.3. Reason out why we use machines. Before you get in to deep discussion, let the students understand the key terms like ‘effort’ and ‘Load’

Using inclined plane, bicycle, pulley and lever identify machines as force, velocity multipliers and as direction changer.

Throughout the lessons assess students learning using Check points 5.1 make sure that all students have attained the set minimum learning competencies.

6. ***Stabilization***

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment,
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the checklist questions.

5.2. Mechanical Advantage, Velocity Ratio and Efficiency of Machines

1. Proposed No of periods: *2 periods*

2. Competencies: After completing this unit students should be able to:

- define M.A, V.R and efficiency (η) of a machine.
- apply the definition of M.A, V.R and η to solve numerical problems.

3. Teaching methods

- Discussion
- Explanations (lecture)
- Questioning and answering
- Group and individual practical works
- Demonstration

4 Teaching aids

- Different simple machines which can be used as examples for calculating M.A., V.R and η.

5 Facilitating the learning process

Pre-planning

Ask students to discuss Activity 5.5, 5.6 and 5.7 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom. You borrow teaching aids from nearby secondary school.

Here the periods allotted are two periods. As indicated in the table of "planning for teaching" spend the one period on the discussion of MA & VR of machines. Activity 5.5 is designed, to enable the students understand the idea of MA. Similarly Activity 5.6 helps the students understand VR of a machine. The second period of this section is reserved for the discussion of efficiency of a machine.

MA, VR and η are dimensionless physical quantities.

Based on the discussion of Activity 5.7, students will be able to build their knowledge about, 'input work', 'output work', 'wastage energy' and efficiency.

Throughout the lessons assess students learning using Check points 5.2. Make sure that all students have attained the set minimum learning competencies.

6. Stabilization:

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the checklist questions.

5.3. Types of Simple Machines

1. Proposed No of periods*: 4 periods*

2. Competencies: After completing this unit students should be able to:

- define the terms effort, load and fulcrum.
- list simple machines.
- describe lever and determine its MA, VR and efficiency.
- determine the velocity ratio of an inclined plane using VR = ℓ/h.
- explain how to determine the VR of fixed and movable pulley up to two movable pulleys.
- construct some models of simple machines using locally available materials.
- define the term torque.
- identify that torque produces a turning effect.

3. Teaching methods

- Discussion
- Explanation
- Questioning and answering
- Group and individual works
- Demonstrations

4. Teaching aids

- Lever, pulleys, inclined plane, screw, scissors, hammer, axel, and other locally available machines.

5. Facilitating the learning process

Pre-planning

Ask students to discuss activity 5.8 and 5.9 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom. Ask students who can get some simple machines indicated in the Teaching aids or you borrow them from nearby a secondary school. Let the students discuss the given project ahead of time like at the end of the second period in class and perform it on weekends in their homes.

You have four periods to spend on this section. The suggested distribution of the topics to the given periods is indicated in the table of planning the unit. Let the students discuss on Activity 5.8. Guide them to identify the six types of simple machines. Activity 5.9 is planned to enable students understand 'lever'. Seesaw is a good example to introduce the learners the concept of lever. The second period of this section is arranged to discuss 'pulleys'. Let the

students describe by their own words what pulleys are. Similarly ask them to explain about fixed pulleys and movable pulleys.

The third period of the section is allotted for the discussion of ‘Inclined plane’.

Let the students do a number of practical problems to build their computational skills.

The last period is assigned for the discussion of ‘torque’. Let the students mention a number of examples where a torque is used in our daily life. Ask them to solve some problems in order to grasp the basic idea of a torque.

Throughout the lessons assess students learning using Check points 5.3. Make sure that all students have attained the set minimum learning competencies.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

Answers to Review Questions and Problems

I. 1. d 2. a 3. b 4. A

II. 1. Direction changing machine 2. Effort
3. Velocity ratio 4. Mechanical advantage
5. Efficiency

III. 1. No. There is always energy dissipation by friction. Hence the efficiency is less than 100%
2. (i) to multiply force
(ii) to multiply speed (distance).
(iii) to change the direction of force .

IV.

1.

Force multiplier	Speed multiplier	Change direction of effort
Inclined plan		
Lever		
Movable pulley		Fixed pulley

2. Given **Required** **Solution**

Load = 24N M.A = ? M.A.= $\frac{\text{load}}{\text{effort}}$

Effort = 6N $= \frac{24N}{6N} = 4$

3. Given **Required**

Load = weight = 500N a) VR = ?
length = 20m b) MA= ?
height = 5m c) In put work = ?
effort = 150N d) out pout work = ?
e) efficiency = ?

Solution

a) VR = $\frac{\text{lenght of inclined plane}}{\text{height of inclined plane}} = \frac{20m}{5m} = 4$

b) MA= $\frac{\text{load}}{\text{effort}} = \frac{500N}{150N} = \frac{10}{3} = 3.33$

c) W_i = Effort $\times$ S_E = 150N $\times$ 20m = 3000J

d) Wo = load $\times$ S_L = 500N $\times$ 5m = 2500J

e) $\eta = \frac{W_o}{W_i} \times 100\% = \frac{2500J}{3000J} \times 100\% = 83\%$

UNIT SIX

TEMPERATURE AND HEAT

i) *Time allotted to the unit*: *9 periods*

ii) Outcomes of the unit: After completing this unit the students should be able to:

- define temperature and express the SI unit of temperature.
- name different thermometer scales and show their relationship.
- apply the mathematical relationship between temperature scales to convert one scale to another.
- list some sources of heat and describe effects of heating.
- differentiate between heat and temperature.
- demonstrate the change of state of ice.
- demonstrate scientific inquiry.
- develop scientific attitudes and values.

iii) Contents of the unit

6.1 Definition of Temperature
6.2 Measuring temperature
6.3 Temperature scales
6.4 Conversion of temperature scales
6.5 Source of heat
6.6 Effect of heating

iv) Teaching Aids

- Different types of thermometers
- Illustration to show the three states of substances
- Illustration to show the three states temperature scales
- Sources of heat
- Ball and ring (for activity 6.9)
- Different sizes and shapes of flasks

v) Planning for teaching

Unit: Temperature and Heat

Number of given period: 9 periods

Period	*Content*	*Competencies*	*Suggested methodologies*	*Follow up and assessment methods*
1st	**6.1. Definition of Temperature**	• Define temperature • Describe temperature as the measure of average kinetic energy of particles.	• Discussion • Question and answer • Explanation	• Ask students to define temperature into two ways. • distinguish between heat and temperature
2nd	**6.2. Measuring temperature**	• Name the measuring devices of temperature.	• Discussion • Explanation • Demonstration	• Ask students to name the measuring device of temperature. • Observe students labeling parts of a thermometer.
3rd	**6.3. Temperature scales** • Fahrenheit scale • Celsius scale • Kelvin scale	• State the SI unit of temperature. • Name the different temperature scales.	• Discussion • Explanation • Demonstration • Individual work	• Ask students to state the SI unit of temperature and name the different temperature scales.

4th	• Reading on thermometer scale	• Read temperature readings	• Discussion • Explanation • Demonstration • Individual work	• Ask students to read temperature readings in heating water in a beaker, or measure their body temperature. • Check their recording method.
5th	**6.4. Conversion of temperature scales**	• Show the relationship of Celsius, Fahrenheit and Kelvin scales • Convert one temperature scale to another.	• Discussion • Explanation • Demonstration • Individual work	• Observe students individual work on converting one temperature scale to another.
6th	**6.5. Source of heat**	• Define heat • Distinguish between heat and temperature • List some sources of heat.	• Discussion • Question and answer • Explanation	• Ask students to define heat and distinguish between heat and temperature. • Ask them to make list of some locally available sources of heat and report in the classroom.

7th	**6.6. Effect of heating** • Temperatures rise • Expansion	• Describe the effects of heating	• Discussion • Question and answer • Explanation	• Ask students to describe the effects of heating like temperature rise and expansion
8th	• Change of state	• Explain the difference between evaporation and boiling.	• Discussion • Question and answer • Explanation	• Ask students to describe the effects of heating like change of state. • Ask students to tell the difference between boiling and evaporation.
9th	• Evaporation	• State the factors affecting the rate of evaporation	• Discussion • Demonstration • Explanation	• Ask students to state the factors affecting the ate of evaporation.

6.1. Definition of Temperature

1. ***Proposed No of periods : 1 periods***
2. ***Competencies:*** After completing this unit students should be able to:
   - define temperature as the measure of coldness or hotness of a body.
   - describe temperature as the measure of average kinetic energy of particles.
3. ***Suggested teaching method***
   - Discussion
   - Demonstration
   - Questioning and answering.
   - Explanation(lecture)
   - Group and individual works
4. ***Teaching aids***
   - Heater (Source of heat)
   - Water
   - Beaker
5. ***Facilitating the learning process***

   Pre-planning

   Ask students to discuss Activity 6.1 and 6.2 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom.

   Invite your students to report their discussion on temperature and heat. Ask them to explain the difference between temperature and heat.

Also do not forget to mention the interrelation between temperature and average molecular kinetic energy. Explain what average kinetic energy of molecules of a body means.

Mention that a temperature is an intensive quantity. It is a property of the substance as a whole. All parts of the substance have the same temperature. Heat is an extensive quantity. It depends on the amount of the substance. For example, 100 liters of boiling water and a drop of boiling water have the same temperature.

Throughout the lessons assess students learning using Check points 6.3. Make sure that all students have attained the set minimum learning competencies in this section.

6. ***Stabilization***

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment,
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

6.2 Measuring Temperature

1. ***Proposed No of periods*** *: 1 periods*
2. ***Competencies:*** After completing this unit students should be able to:

- name the measuring device of temperature.

3. Teaching methods

- Discussion
- Demonstration
- Questioning and answering
- Explanations

4 Teaching aids

- Different thermometers (Mercury, alcohol, clinical)

5 Facilitating the learning process

Pre-planning

Ask students to discuss Activity 6.3 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom. Ask students who can get a thermometer indicated in the teaching aids or you borrow them from nearby a secondary school.

One period is allotted for the discussion of measuring temperature. Activity 6.3 helps the learner to develop the method of measuring temperature. Let the students mention the local method of measuring temperature. And also let them compare the local methods and the scientific method.

Students need to realize the advantage and disadvantage of mercury thermometer compared to alcohol thermometer.

Throughout the lessons assess students learning using Check points 6.2 make sure that all students have attained the set minimum learning competences.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment,
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

6.3 Temperature Scales

1. ***Proposed No of periods*** *= 2 periods*
2. ***Competencies:*** After completing this unit students should be able to:

- state the SI unit of temperature.
- name the different temperature scales.
- read temperature readings.

3. Teaching methods

- Discussion
- Demonstrations
- Questioning and answering
- Explanation
- Group and individual Practical works

4. Teaching aids

- Drawings (to compare the 3 - scales)
- Thermometers with different scales.

5. Facilitating the learning process

Pre-planning

Ask students to discuss Activity 6.4 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom. Activity 6.5. Will help students to measure temperature of a body practically. So arrange this activity before you enter the class.

Begin by introducing Celsius scale and then the Fahrenheit scale and finally Kelvin scale. Let the students notice that 'Kelvin scale' is the SI unit used scale in science labs/ research. Activity 6.5 is designed to enable the students to read the thermometer. Ask them to do it in groups.

Throughout the lessons assess students learning using Check points 6.3. Make sure that all students have attained the set minimum learning competencies.

6 Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

6.4. Conversion of Temperature Scales

1. ***Proposed No of periods*** *= 1 periods*
2. ***Competencies:*** After completing this unit students should be able to:
   - show the relation of Celsius, Fahrenheit and Kelvin scale
   - convert one temperature scale to another

3. Teaching methods

- Problem solving
- Questioning and answering
- Explanation

4. Teaching aids

- Prepare a chart which consists of the 3-scales and conversion formulas.

5. Facilitating the learning process

Pre-planning

Before introducing the conversion formulae between one temperature scale to another, let the students forward their means of converting one scale to the other.

If their means of conversion is similar to the given formulae, appreciate them. If it deviates from the standard formulae, guide their discussion so that their final destination will be the given formulae. Do worked examples on each scale conversion, then allow the students to practice a number of exercises related to conversion of one scale to another. Challenge more able students to derive expressions for converting Centigrade scale to the Fahrenheit scale.

Throughout the lessons assess students learning using Check points 6.4. Make sure that all students have attained the set minimum learning competences.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

6.5. Sources of Heat

1. *Proposed No of periods* *: 1 periods*

2. *Competencies:* After completing this unit students should be able to:

- define heat as a form of energy that flows from one body to another due to temperature difference.
- distinguish between heat and temperature.
- list some sources of heat.

3. Teaching methods

- Discussion
- Questioning and answering
- Explanation

4. Teaching aids

- Simple locally available sources of heat.

5. Facilitating the learning process

Pre-planning

Ask students to discuss Activity 6.6 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom.

Activity 6.6 will help the students to discuss with each other about heat, its importance, its sources and then its relation with temperature.

At this level your students must be able to describe what a temperature is. Now let them compare and distinguish the concepts temperature and heat.

Students should appreciate that heat is a form of energy and it flows from a warmer body to a colder body.

Let the students carry out an experiment in which they place a metal block from hot water into cold water and confirm that the metal block cools while the temperature of the cold water increases. From this they can deduce the direction of heat flow.

Students need to discuss every day examples of sources of heat.

Throughout the lessons assess students learning using Check points 6.5. Make sure that all students have attained the set minimum learning competencies.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment

- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

6.6. Effects of Heating

1. ***Proposed No of periods*** *: 3 periods*
2. ***Competencies:*** After completing this unit students should be able to:
   - describe expansion, temperature rise and change of states as the effects of heating.
   - explain the difference between evaporation and boiling.
   - state the factors affecting the rate of evaporation.

3. ***Teaching methods***
   - Discussion
   - Demonstrations
   - Questioning and answering
   - Explanation
   - Group and individual Practical works

4. ***Teaching aids***
   - Ball and ring apparatus,
   - Beaker,
   - water
   - thermometer
   - Dish,
   - sources of heat,
   - Charts showing changes of states

5. Facilitating the learning process

Pre-planning

Ask students to discuss Activity 6.7, 6.9 and 6.10 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom.

For this sub unit you have only three periods allotted. Hence you need to manage the topic (lesson) distribution and coverage.

Let the students discuss the effects of heat on bodies. Activity 6.7 is basically designed for this discussion. Adjust the discussion of the students so that it includes:

i) **Temperature rise:** this can be investigated by heating a beaker of water and measuring its temperature at regular intervals.

ii) **Expansion:** this can be investigated using a ball and ring as in Fig 6.7 and Activity 6.8

iii) **Change of state:** this can be investigate by heating an ice cube until it becomes water and heating water until it becomes steam

Students should be aware that water can turn to steam by two different processes **boiling** and **evaporation.** Make sure that students have realized that:

- Boiling of a liquid occurs only at a specific temperature called the boiling point, where as evaporation takes place at any temperature.
- Boiling occurs throughout a liquid while evaporation occurs only at the surface of a liquid. Use Table 6.2 to observe the differences between boiling and evaporation.

Activity 6.9 helps you observe the cooling effect of evaporation. State the factors which increase the rate at which water evaporates. These include temperature, surface area and windy/ still air.

Throughout the lessons assess students learning using Check points 6.6. Make sure that all students have attained the set minimum learning competencies.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

Answers to Review Questions and Problems

I. 1. True 2. False 3. True
4. True 5. False 6. True

II. 1. d 2.a 3.b 4.c
5.f 6.e 7.g 8. i 9. h

III. 1. Thermometer
2. 100 °C and 0 °C
3. Temperature rises, it can also expand or it may change its state.
4. Celsius, Fahrenheit and Kelvin scales.
5. Melting is the process of changing a solid to a liquid state. While boiling is the process of changing a liquid into gaseous state.
6. Expansion effect of heat is the increase in size of a body due to the supply of heat energy.
7. - Boiling happens throughout the liquid, whereas evaporation takes place on the surface of a body.
   - Evaporation has a cooling effect on a body but boiling is not.

8. i. source of heat ii. wind iii. surface area.

IV. 1. Expand 2. Temperature 3. Kelvin

4. Joule 5. Temperature 6. Evaporation

V. 1. Given **Required** **Solution**

$T_c = 50°C$ $T_k = ?$ $T_k = T_c + 273°$

$= 50° + 273° = 323K$

2. Given **Required** **Solution**

$Tc = 40°C$ $T_F = ?$ $T_F = \frac{9}{5}T_c + 32°$

$= \frac{9}{5} \times 40° + 32°$

$= 72° + 32° = 104°F$

3. Given **Required** **Solution**

$T_K = 310K$ $T_F = ?$ $T_F = \frac{9}{5}T_c + 32°$

But $T_c = T_k - 273°$

$\therefore T_f = \frac{9}{5}(T_{k-273°}) + 32°$

$= \frac{9}{5}(310° - 273°) + 32°$

$= 66.6° + 32°$

$= 98.6°F$

UNIT SEVEN

SOUND

i) *Time allotted to the unit: 5 periods*

ii) Outcomes of the unit: After completing this unit the students should be able to:

- define sound as a form of energy produced by the vibration of bodies and cause sensation of hearing.
- identify that sound needs material medium for its propagation.
- describe and explain an experiment to determine the speed of sound in air.
- explain the factors affecting the speed of sound in air.
- define echo and discuss its application.
- calculate the distance of sound source using the echo sounding method.
- give example of sound reflectors and absorbers.
- demonstrate the scientific inquiry.
- develop scientific attitudes and values.

iii) Content of the unit

7.1. Definition of sound
7.2. Production and transmission of sound
7.3. Speed of sound in different media
7.4. Reflection of sound
7.5. Application of echo sounding

iv) Teaching Aids

- Tuning forks.
- Ruler.
- Simple pendulum
- Pith ball, thread and hammer (For activity, show in fig 7.5)
- Diagram on propagation of sound
- Bell jar experiment diagram

v) Planning for teaching

Unit: Sound

Period	*Content*	*Competencies*	*Suggested methodologies*	*follow up and assessment methods*
1st	**7.1. Definition of Sound**	• Define sound as a form of energy which arise the sensation of hearing.	• Discussion • Explanation • Question and answer	• Ask students to describe sound and Importance of ears.
2nd	**7.2. Production and transmission of sound** • In solids, liquids, and gases	• Explain how sound is produced. • Realize that, sound needs material medium for its propagation.	• Discussion • Demonstration • Explanation • Group and individual work.	• Demonstrate and explain how sound is produced. • Explain the demonstration on the need of a material medium for its propagation.
3rd	**7.3. Speed of sound in different media**	• Compare the speed of sound in air, solids and in liquids.	• Discussion • Demonstration • Explanation • Group and individual work	• Compare the speed of sound for different materials from Table 7.1

4th	**7.4. Reflection of sound** • Sound reflector and absorber materials • Echo	• Define the term echo. • Give examples of good absorbers and reflectors of sound.	• Discussion • Demonstration • Explanation • Group and individual work	• Define echo • Give examples of good absorbers and reflectors of sound.
5th	**7.5. Application of echo sounding.**	• List some application of echoes • Use v = $2s/t$ to calculate numerical problems related to echo.	• Discussion • Demonstration • Explanation • Group and individual work	• List some application of echoes Use v = $2s/t$ to calculate numerical problems related to echo.

7.1. Definition of Sound

1. ***Proposed No of periods = 1 periods***
2. ***Competencies:-*** After completing this unit students should be able to:-
   - define sound as a form of energy which arise the sensation of hearing.
3. ***Suggested teaching methods;***
   - Discussion
   - Explanation
   - Questioning and answering.
   - Demonstration
4. ***Teaching aids***
   - Tuning fork
   - Ruler
   - Diagram of sound propagation
5. ***Facilitating the learning process***

Pre-planning

Ask students to discuss Activity 7.1 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom.

To introduce the idea of sound and its definition, one period is allotted. Activity 7.1. is designed, to enable the students understand the definition of sound. Invite group leaders to list what they have discussed about sound.

Let the students realize that, sound is a form of energy. And sounds within a certain range can be detected by the ears. There are other kinds of sounds human cannot hear but animals can.

Throughout the lesson assess students learning using Check point 7.1. Make sure that all students have attained the set minimum learning competencies in the section.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

7.2. Production and transmission of sound

1. Proposed No of periods*: 1 periods*

2. Competencies: After completing this unit students should be able to:-

- explain how sound is produced.
- tell that sound needs material medium for its propagation.

3. Teaching methods;

- Discussion
- Explanations
- Demonstration
- Questioning and answering
- ***Group and individual works***

4 Teaching aids

- Turning forks
- Vibrating ruler
- String musical instruments (kirar, guitar).

*5 **Facilitating the learning process***

Pre-planning

Ask students to discuss Activity 7.2, 7.3 and 7.4 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom.

Activities 7.2, 7.3 and 7.4 need to be performed by students in group and individually in a class. After they do these activities, they will realize how sound is produced, Students should appreciate that sound is the result of objects vibrating in a medium.

Similarly Activity 7.6 is designed to enable the learners understand how sound is transmitted. Let them practice this activity outside the class. Students should be aware that sound travels through all materials like solids, liquids and gases. They could be shown that sound doesn't travel in a vacuum by demonstrating the Bell jar experiment in diagram.

Throughout the lessons assess students learning using Check point 7.2; make sure that all students have attained the set minimum learning competencies in the section.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment,
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the checklist questions

a. Speed of Sound in Different Media

1. ***Proposed No of periods****: 1 periods*

2. ***Competencies:*** After completing this unit students should be able to:
   - compare the speed of sound in air, solids, and in liquids.

3. ***Teaching methods***
   - Discussion
   - Explanation
   - Questioning and answering
   - Demonstrations

4. ***Teaching aids***
   - Chart showing speeds of sound in different media

5. ***Facilitating the learning process***

Pre-planning

Ask students to discuss Activity 7.7 and 7.8 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom.

Let the students discuss on Activity 7.7. After exhaustive discussion it will be easier for them to realize that the speed of sound in different media will vary accordingly. From Table 7.1 they should be aware that speed of sound in solids is greater than speed of sound in liquids and speed of sound in gases.

Give to the students some data on the speed of sound in different solids, liquids and gases and then ask them to look for the pattern. Throughout the lessons assess students learning using Check point 7.3. Make sure that all students have attained the set minimum learning competencies in the section.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

b. Reflection of Sound

1. Proposed No of periods: *1 periods*

2. Competencies: After completing this unit students should be able to:

- define the term echo as a reflection of sound from hard surfaces.
- give examples of good absorbers and reflectors of sound.

3. Teaching methods

- Discussion
- Explanation
- Questioning and answering
- Group and individual works
- Demonstrations

4. Teaching aids

- Absorber and reflectors of sound energy

5. Facilitating the learning process

Pre-planning

Ask students to discuss Activity 7.9 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom.

Students should appreciate that sound can be reflected in the same way as light and that a reflected sound is called **echo**.

Among the points which you need to focus in this section is about sound reflector and absorber materials. To enable students understand this idea, let them do experiment with different surfaces to see which make good reflectors absorbing little of the sound; and which are poor reflectors absorbing a significant proportion of the sound.

Throughout the lessons assess students learning using Check point 7.4. Make sure that all students have attained the set minimum learning competencies in the section.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home works and further reading assignment.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

c. Application of Echo – Sounding

1. Proposed No of periods: *1 periods*

2. Competencies: After completing this unit students should be able to:

- List some application of echoes
- Use $v = {}^{2s}/_{t}$ to calculate numerical problems related to sound.

3. Teaching methods

- Discussion
- Explanation
- Questioning and answering
- Group and individual practical works

4. Teaching aids

- Drawings

5. Facilitating the learning process

Pre-planning

Ask students to try Activity 7. 6 ahead of time with their friends or parents. This facilitates students' group discussion in a classroom

Ask students to revise their knowledge about speed, and equation of speed in terms of distance and time taken.

Do sample problems on echo method of finding the speed of sound in air. Ask students to do selected problems from the review exercises.

Throughout the lessons assess students learning using Check points 7.5. Make sure that all students have attained the set minimum learning competencies in the section.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

Answers to Review Questions and Problems

I. 1. True 2. False 3. False
4. False 5. False 6. False

II. 1. Source, media and receiver
2. 17m
3. 331m/s

III. 1. Sound is produce by the vibration of materials.
2. Sound is a form of energy
3. Echo is formed when the sound is bounced back to the source.
4. Since the particles in solid are close to each other they easily pass the found to the next particles by collision and the sound moves faster.

IV. 1. e 2 d. 3. c 4. a 5. f 6. b

V.

1. **Given** **Required** **Solution**

v_o= 331 m/s s = ? $2s = v_o t \Rightarrow s = \frac{V_o t}{2}$

t= 5.3s $\Rightarrow S = \frac{331 m/\cancel{s} \times 5.3\cancel{s}}{2}$ = 877.15m

2. **Given** **Required** **Solution**

t = 0.6s depth of ocean = ? $2s = vt \Rightarrow s = \frac{Vt}{2}$

v = 1450 m/s $\Rightarrow s = \frac{1450\frac{m}{\cancel{s}} \times 0.6\cancel{s}}{2} = 435m$

3. **Given** **Required** **Solution**

t = 4.5s s = ? you can take the time required

v= 331m/s for sound to travel from the train

Hence s = vt = 331m/s × 4.5s to the observer is equal to 4.5s

= 1489.5m

UNIT EIGHT

ELECTRICITY AND MAGNETISM

i) Time allotted to the unit: *14 periods*

ii) Outcomes of the unit: After completing this unit the students should be able to:

- describe magnet and its properties.
- state and demonstrate the law of magnetism.
- categorize substances as magnetic and non-magnetic substance.
- make their own magnet from an iron nail by stroking it against a permanent magnet.
- sketch magnetic lines of force between magnets.
- describe some important applications of a magnet in modern technology.
- describe and demonstrate the electric charging processes: charging by rubbing and charging by sharing.
- name the types of electric charges in nature and state the basic laws of electrostatics.
- explain the uses of electroscope.
- construct simple electroscope and use it to identify the types of charges.
- define electric current.
- state its dimension and SI unit (use I= Q/t to solve problems)
- distinguish between conventional and electron current.
- list elements of simple electric circuit and construct and sketch diagram of simple electric circuit using circuit elements; conductors, switch, dry cell, bulb.

- define conductors and insulators and classify materials into conductors and insulators.
- perform experiments to check whether materials are conductors or insulators.
- state the effects of electric current
- demonstrate the scientific inquiry.
- develop scientific attitudes and values.

iii) Contents of the unit

8.1 Magnets

8.2 Mapping magnetic lines of force

8.3 Uses of magnets

8.4 Electrostatics

8.5 Methods of charging

8.6 Law of electrostatics

8.7 Electric current and potential difference

8.8 Electric circuit

iv) Teaching Aids

- Different shaped magnets (as shown in Fig 8.1)
- Iron nail or bar (for magnetizing by stroking)
- Pins, needles, plastic, knife, wood stick, coins
- Compass
- Plastic rod and glass rods (For demonstration of Fig 8.11
- Locally made electroscope
- Primary and secondary cells
- Circuit elements (bulb, conductor, battery, ammeter, voltmeter and switch)
- Conductors and insulators

v) Planning for teaching

Unit: Electricity and Magnetism ***Number of period given: 14 period***

Period	*Content*	*Competencies*	*Suggested methodologies*	*Follow up and assessment methods*
1st	**8.1. Magnets** • Magnetic and non-magnetic substance	• Define magnet as a piece of metal that has a power to attract iron/steel. • Identify materials as magnetic or non – magnetic.	• Discussion • Demonstration • Explanation • Group and individual work	• Demonstrate magnets attract magnetic substances. • Classify substances as magnetic and non magnetic. • Reports on demonstrations and classification.
2nd	• Properties of magnets (magnetic poles, compass, Earth magnetism)	• Describe the properties of magnets. • Explain why a suspended magnet always points to the geographic north and south pole. • State the laws of magnetism • Make a magnet from a nail using stroking method.	• Discussion • Demonstration • Explanation • Group and individual work	Ask students to: • describe the properties of magnets. • explain why a suspended magnet always points to the geographic north and south pole. • State the laws of magnetism • Ask students to demonstrate how to magnetize an iron bar and report.

3th	**8.2. Mapping magnetic lines of force**	• Describe the magnetic properties of magnetic lines of force. • Sketch magnetic lines of force around a bar magnet and between two magnets.	• Demonstration • Explanation • Group and individual work	Ask students to: • describe magnetic field • represent magnetic field with lines of forces i) For single bar magnet. ii) Between two ends of two bar magnets.
4th	**8.3. Uses of magnets** • Navigation • Lifting • Separation of magnet and non-magnetic materials	• List some uses of magnet in technology	• Discussion • Demonstration • Explanation	• Ask students to state some uses of magnets
5th	**8.4. Electrostatics** • Where do charges come from?	• Define electrostatics as a science dealing with charges at rest • Describe the existence of electric charge	• Discussion • Explanation • Group and individual work	• Ask students to define the term electrostatics
6th	• Types of charges	• Identify the two types of charge	• Demonstration • Group and individual work • Discussion • Explanation	• Ask students to identify two types of charges

7th	**8.5 Methods of charging** • Charging by rubbing	• Describe the charging processes	• Demonstration • Group and individual work • Discussion • Explanation	• Ask students to demonstrate and describe charging a body by rubbing.
8th	• Charging by touching	• Describe the charging processes	• Demonstration • Group and individual work Discussion • Explanation	• Ask students to demonstrate and describe charging a body by conduction or sharing.
9th	**8.5. Law of electrostatics**	• State the laws of electrostatics	• Discussion • Demonstration • Explanation • Group work	• Ask students to demonstrate and state the laws of electrostatics
10th	• Electroscope and its use • Project work (Constructing an electroscope)	• Describe what an electro scope is • List the uses of electroscope • Construct a simple electro scope and use it	• Discussion • Demonstration • Explanation • Group and individual work	• Ask students to construct an electroscope in their free time and demonstrate their work in a class.

11th	**8.6.Electric current and potential difference** • Definition of current	• Define electric current, • SI unit of electric current	• Discussion • Demonstration • Explanation	• define electric current, • SI unit of electric current.
12th	• Source of p.d.	• Define potential differences (p.d) • List some sources of potential difference	• Discussion • Demonstration • Explanation	• define potential differences (p.d) • list some sources of potential difference.
13th	• Primary and secondary cells	• Distinguish between primary and secondary cells	• Discussion • Demonstration • Explanation • Group and individual work.	• Ask students to distinguish between primary and secondary cells.
14th	**8.7.Electric circuit.** • Circuit elements and electrical symbols • Direction of electric current • Conductors and insulators.	• Define electric circuit • List circuit elements • Show electrical symbols of circuit elements • Distinguish between conventional and electron current • Define the terms conductors and insulators	• Discussion • Demonstration • Explanation • Group and individual work	• Ask your students to list circuit elements • Show electrical symbols of circuit elements • Ask students to distinguish between conventional and electron current. • Define the terms conductors and insulators

8.1. Magnets

1. Proposed No of periods : 3 periods

2. Competencies: After completing this unit students should be able to:

- define magnet as a piece of metal that has a power to attract iron or steel objects.
- identify materials as magnetic and non – magnetic
- describe the properties of magnets.
- state the laws of magnetism.
- explain why a suspended magnet always points to the geographic north and south pole.
- make a magnet from a nail using stroking method

3. Suggested teaching methods

- Demonstration
- Discussion-small group
- Questioning and answering.
- Group and individual practical works
- Explanation

4. Teaching aids

- Science kit
- Different shaped magnets (as in Fig 8.1)
- Set of objects (magnetic and non – magnetic).
- Iron nails or iron bar (for magnetizing by stroking).
- Drawings (showing Earth's magnetic field)

5. Facilitating the learning process

Pre-planning

Ask students to visit shoe repair shops for Activity 8.1 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom. Find science kit in school pedagogical centers and bring bar magnets to classroom or borrow bar magnets from nearby secondary schools.

As this is the first section of the unit let the students share their idea generally about magnetism and ask to explain whether it is visible or invisible.

Activity 8.1 is designed to enable the students discuss about what a magnet is, what it can do and in what shapes can we get them.
Similarly let the students do Activity 8.2. as group class work. This helps them to identify materials as a magnetic or non- magnetic. Activity 8.3. can be done outside of a classroom. They will be able to magnetize iron/steel bar by stroking. Students should realize that magnets contain two poles.

Activity 8.4 and 8.7 can be done into two periods. Demonstrate the attraction and repuletion between two magnets. Let them do activity 8.4 with two magnets and from their observations, ask them to deduce the laws of magnetism.

Throughout the lesson assess students learning using Check point 8.1. Make sure that all students have attained the minimum learning competencies set in the section.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

a. Mapping Magnetic Lines of Force

1. Proposed No of periods *: 1 periods*

2. Competencies: After completing this unit students should be able to:-

- describe the magnetic properties of magnetic liens of force.
- sketch magnetic lines of force around a bar magnet and between two magnets

3. Teaching methods

- Demonstration
- Group and individual works
- Discussion- small and group
- Questioning and answering
- Explanations

4. Teaching aids

- Science kit
- bar magnets
- Iron fillings
- Pocket compasses

- Drawings (prepare a chart that show the magnetic lines of force around a bar magnet and between two magnets).

5. Facilitating the learning process

Pre-planning

Ask students to discuss Activity 8.8 so that they revise types of forces and do Activity 8.9 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom.

Arrange Activity 8.9 and demonstrate using iron filings or plotting compasses to map and draw the magnetic lines of force around a bar magnet.

Ask the students to use the same techniques to investigate the lines of force between two unlike and two like magnetic poles. Students should realize the following points from the discussion and the above demonstration that;

- lines of force run conventionally from north to south outside a magnet and from south to north inside a magnet.
- lines of force never cross each other.
- the strength of a magnetic field is indicated by the closeness of magnetic field lines.

Throughout the lesson assess students learning using Check point 8.2. Make sure that all students have attained the set minimum learning competencies in the section.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment.

- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

a. Uses of Magnets

***1. Proposed No of periods** : 1 periods*

2. Competencies: After completing this unit students should be able to:

- List some uses of magnet in technology

3. Teaching methods

- Discussion
- Demonstrations
- Explanation

4. Teaching aids

- Speakers (from radio or tapes)
- Mini motors or generators
- Compass

5. Facilitating the learning process

Pre-planning

Ask students to discuss activity 8.10 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom.

Ask your students, what uses do they know about magnets? Activity 8.10 is designed for this purpose. Students should appreciate how a magnet can be used in scrap yard to separate magnetic and non – magnetic materials.

Ask them also to do activities in the laboratory by using a magnet to separate objects made of iron/ steel and other materials.

Throughout the lesson assess students learning using Check point 8.3. Make sure that all students have attained the set minimum learning competences in the section.

6 Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

b. Electrostatics

1. Proposed No of periods *: 2 periods*

2. Competencies: After completing this unit students should be able to:-

- define electrostatics as a science dealing with charges at rest.
- describe the existence of electric charge.

3. Teaching methods

- Discussion
- Explanation
- Questioning and answering
- Group and individual works
- Demonstrations

4. Teaching aids

- Plastic rod , glass rod, woolen cloth
- Drawings of atomic structure

5 Facilitating the learning process

Pre-planning

Ask students to discuss Activity 8.11 and 8.12 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom. Find the teaching aids ahead of time and practice charging a body.

Part II of this unit is about electricity. Let your students realize that the topics in electricity are arranged in two sections. That is electro statics – which deals with charges at rest and 'current electricity' – the section which studies about charge in motion.

To introduce the idea of electrostatic charge, let the students discuss and explain how lightning occurs, let them realize that it occurs when electric charge builds up in cloud and eventually passes to earth.

Activity8.11. Is planned for discussing and introducing 'electrostatics. Ask students to describe what charges are. Similarly Activity 8.12 is helpful to investigate types of charges.

Throughout the lesson assess students learning using Check point 8.4. Make sure that all students have attained the set minimum learning competencies in the section.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions

Check point 8.4 help you to confirm that whether students attain the lesson objectives or not.

c. Methods of Charging

1. Proposed No of periods *: 2 periods*

2. Competencies: After completing this unit students should be able to:-

- describe the charging process, (Charging by rubbing and by sharing/contact)
- identify the two types of charge.

3. Teaching methods

- Demonstration.
- Discussion
- Explanation
- Questioning and answering

4. Teaching aids

- Plastic rod and fur, glass rod and silk cloth

5. Facilitating the learning process

Pre-planning

Ask students to discuss Activity 8.13 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom.

This section focuses on the methods of charging an object. To begin the discussions ask your students, what methods of charging do they know. Also let them describe (explain) what they understand by the term charging (electrification).

*Activity 8.*13 is designed to enable the students realize that rubbing (friction) results in the transfer of charges from one body to another. Demonstrate charging by conduction using a charged body and uncharged body like balloons or pith balls. Ask the students to distinguish the two methods of charging using Figure 8.12.

Throughout the lesson assess students learning using Check point 8.5. Make sure that all students have attained the set minimum learning competencies in the section.

6. ***Stabilization***

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

d. Laws of Electrostatics

1. Proposed No of periods *: 2 periods*

2 . Competencies: After completing this unit students should be able to:

- state the laws of electrostatics.
- describe what an electroscope is.
- list the uses of electroscope.
- construct a simple electroscope and use it.

3 Teaching methods

- Demonstration.
- Discussion
- Questioning and answering
- Explanation
- Group and individual works

4 Teaching aids

- Electroscope
- Charged and uncharged bodies

5 Facilitating the learning process

Pre-planning

Ask students to perform Activity 8.13 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom. Borrow an electroscope from nearby secondary school or construct one for yourself from local materials.

Project work:

Let the students attempt to build their own electroscope from locally available materials in their free time in groups.

Show an electroscope and demonstrate how it is used to detect electrostatic charges.

- They could use it to investigate charge on different materials.
- Students should investigate ways of charging an electroscope.
- Activity 8.14 is designed to enable the students to use their own electroscope to investigate whether a body is charged or not. Activity 8.15 is an activity which helps the students to learn how to detect the sign of charges on a charged body.
- Throughout the lesson assess students learning using Check point 8.6. Make sure that all students have attained the set minimum learning competences in the section.

6 Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

e. Electric Current and Potential Difference

1. Proposed No of periods *:2 periods*

2. *Competencies:* After completing this unit students should be able to:

- define an electric current as the flow of charge per unit time.
- list some sources of potential difference.
- distinguish between primary and secondary cells.

3. Teaching methods

- Discussion
- Demonstration.
- Explanation
- Group and individual practical works
- Questioning and answering

4. Teaching aids

- Battery, Dry cells
- Ammeter
- Voltmeter
- Primary and secondary cells

5. Facilitating the learning process

Pre-planning

Ask students to discuss Activity 8.16 and 8.17 ahead of time with their friends and parents. This facilitates students' group discussion in a classroom. Ask them to bring different types of electric cells from their surroundings.

This section starts studying about charges in motion. Hence, let the students realize the difference between the electrostatic and current electricity.

Activity 8.16 will be important to introduce electric current. After the discussion of this activity, introduce the definition of electric current, and the SI unit of electric current. Do sample worked examples in a class and let the students work some numerical

problems from the review exercises applying the formula for a current.

In the second period of this section you need to discuss about the sources of potential difference. Students should realize that charge flows in a circuit because there is a different in energy levels between two points called the potential difference. State that potential difference is also known as voltage, the unit of voltage is volt represented by V. Use gravitational potential energy difference as analogy for electric potential energy.

Ask students to mention sources of potential difference including the mains, cells and batteries.

- Let the students explain the difference between primary and secondary cells.

Throughout the lesson assess students learning using Check points 8.7. Make sure that all students have attained the set minimum learning competences in the section.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the checklist questions.

f. Electric Circuit

1. ***Proposed No of periods*** *: 2 periods*
2. ***Competencies:*** After completing this unit students should be able to:
   - define electric circuit.
   - list circuit elements of simple electric circuit.
   - show electrical symbols of circuit elements.
   - distinguish between conventional and electron current.
   - define the terms conductors and insulators.
   - identify materials as conductors and insulators.

3. ***Teaching methods***
   - Demonstration.
   - Discussion
   - Group and individual practical works
   - Questioning and answering
   - Explanation

4. ***Teaching aids***
   - Science kit
   - Circuit elements. (connecting wire, source, bulb, switch)
   - Diagram showing electrical symbols
   - Different materials for Activity 8.18.

5. ***Facilitating the learning process***

Pre-planning

Ask students to construct an electric circuit using Figure 8.18 ahead of time with their friends and parents. This facilitates students'

group discussion in a classroom. You need to collect the circuit elements and construct your own circuit for demonstration.

In this section the students must discuss about:

- Circuit elements, direction of current, conductors and insulators.
- Students demonstrate Activity 8.18 to test whether materials are conductors or insulators of electricity.
- Throughout the lesson assess students learning using Check point 8.8. Make sure that all students have attained the set minimum learning competencies in the section.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the check list and unit exercises as class work and home work and further reading assignment.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

Answers to Review Questions and Problems

I.	1. True		2. True		3. True
	4. False		5. Fals**e**		
II.	1. b	2. c	3.a	4. e	5.d
III.	1.d	2.a	3.c	4.c	5.c
	6.c	7.b	8.b		

IV.

1. Repel, attract
2. Lode stone
3. Iron or steel
4. Magnetic poles
5. bar, horse-shoe, U-shaped etc
6. Conductors
7. Current
8. Conduction
9. Negatively
10. Neutron

V. 1. By bringing it near a compass or by suspending it by a thin thread, and let it rotate freely.

2. "Like poles repel each other, unlike poles attract each other".

3. i. leaves ii. conductor rod iii. nob (metallic plate)
iv. the glass (metal) case …

4. Non – magnetic materials are substances which cannot be attracted by magnets.

5. Iron, steel , and nickel

6. Used for lifting up iron or steel to higher places.
   - used in the construction of electric bell, motors, radio
   - used to separate magnetic substance like iron from mixtures of different materials.

7. a) amount of charge b) current

8. **Given** **Required** **Solution**
   t= 2s I = ? $I = \frac{Q}{t} = \frac{10C}{2s} = 5\ C/s = 5A$
   Q= 10C

9. **Given** **Required** **Solution**
   I = 4A Q = ? Q= It = 4A×3sec = 12 coulombs
   t= 3s

10. Conductors are material which allow the flow of current through them. There electrons are free to move. But insulators are materials which do not allow the flow of current.

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