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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.

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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 8 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 8 units and corresponding 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 they are also very essential to facilitate and enhance quality learning teaching processes. So that you could attain the intended objectives of teaching physics in grade 8.

General objective of grade 8 physics

After completing grade 8 physics lessons the students will be able to:

- ✓ understand basic concepts of measurements, motion in one dimension pressure, heat energy Electricity and magnetism and Light.
- ✓ extend their basic manipulative skills related measurements motion, pressure, heat energy, Electricity and magnetism and Light.

- ✓ extend their basic skills of performing practical activities in physics.
- ✓ develop positive interest and attitude for physics.

Main contents of grade 8 physics

- ❖ Physics and measurement.
- ❖ Motion in one dimension.
- ❖ Pressure
- ❖ Heat energy
- ❖ Electricity and magnetism.
- ❖ Light

II. The Grade 8 physics Teacher 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 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 specific objectives of each section are listed. Suggested methods of organizing the work are 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 guide and the student textbook. 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 yourself time to collect materials and make other arrangements which may be necessary.

III. Background information for the teacher

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

   In line with the new curriculum physics is given as a linear course from grades 7-12. Hence grades 7 & 8 physics is the basis for secondary level courses.

   Having this in mind, you must take care of how to motivate your students to the subject. You need to focus on the student's back ground and their day to day experience. Try to start from what they know. Let the students extend their knowledge of

grade 7 physics. Tell your students some surprising stories in physics and physists, 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 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 home works 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 preservation 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. You need also to prepare charts, lab- demonstration, etc. It is important to collect some devices, which are relevant to the topics.

Suggested presentation of the lesson

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

- *Introduction of the lesson*

  In the introduction include motivational strategies of introducing the lesson. Revise some topics from lower grades that are pre requisite to learn the lesson topic.

- *Explanation, demonstration or discussion has 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.
- *Make a follow-up and assess the students while discussions and group works are undergoing.*
- *Summarize the lesson before the period is over. This needs time to be allocated.*
- *Make sure that the students have attained the lesson objectives by asking them do the checkpoints 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 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 8 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 remedy some of the short comings of traditional one-shot examinations which is 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: 8 periods.

ii) Outcomes of the unit: After completing this unit's lesson, students should be able to:

- understand concepts related to basic measurements.
- develop skill of measuring area, volume and density .
- develop skill of measuring displacement, velocity.
- develop skills in producing and evaluating of a design project applying the laws of physics in its construction.
- appreciate the interrelatedness of all things.
- Use a wide range of possibilities for developing knowledge of the major concepts with in physics.
- demonstrate the scientific inquiry.
- 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 the board (SMART). The minimum learning competencies described for the grade and unit have to be achieved by the majority of the students. You have to make sure this happens through different assessment techniques.

iii) Contents of the unit

- Measuring area
- Measuring volume
- Measuring density
- Dimensional expression of physical quantities.
- Scientific notation.

iv) Teaching Aids

- Different shaped 2D and 3D materials. (2D: two dimension, 3 D = three dimensions)

  e.g. - rectangle, circle, triangle are 2D.

  - rectangle block, cube, pyramid are 3D material.
- Measuring instruments of length, mass and volume of a liquid (ruler, beam balance, measuring cylinder)
- Different size measuring cylinders.
- Hydrometer
- Charts showing multiple and sub-multiplier prefixes.
- Water, different liquids, irregular shaped, and solid regular shaped bodies.

iv) Planning for teaching

Lesson: Physics and Measurements

Period	*Content*	*Specific learning outcomes*	*Suggested methodologies*	*Suggested follow up and assessment methods*
1st	**1.1 Measuring area** • Area of rectangle, square, triangle and circle.	Students will be able to: • Apply the concept of area as measure of squared units to many situations including 2D and 3D. • Measure the sides of a rectangle, square and triangle. • Calculate the areas of a rectangle, square and triangle. • Measure the diameter of a circle, infer its radius and calculate its area.	• Demonstration • Individual or group work • Explanation	• Ask students to define area • Let the students describe how to measure area of rectangle, square, triangle, circle. • Ask students to calculate the area of rectangle, square etc. • Observe students individual/ group work. • Ask them to present their work to the class.

2nd	Surface area of a solid.	• Calculate the surface area of simple solids like the cube, the rectangular prism and the square pyramid. • Convert the area in m^2 to km^2 and vice versa.	• Demonstration • Individual and group work • Question and answering • Explanation	• Ask students to describe method of calculating the area of simple solids. • Let the students convert m^2 in to cm^2 and mm^2.
3rd	**1.2.Measuring volume** • Volume of regular shaped solid bodies.	• Measure the sides of a rectangular block. • Calculate the volume of a rectangular block using measured values. • Measure the height and radius of a cylinder.	• Demonstration • Individual group work • Explanation	Ask students to define: • Volume. • SI units of volume. • Explain methods of measuring volume of regular shaped bodies. • Observe students individual and group work • Present their work to the whole class. • Calculate the volume of regular shaped bodies.

4th	• Volume of liquids. • Volume of irregular shaped solid bodies.	• Calculate the volume of a cylinder using measured values. • Measure the volume of a liquid using measuring cylinder. • Measure the volume of irregular shaped solid bodies.	• Demonstration • Group work • Discussion • Explanation	• Ask students to: • Describe how to measure the volume of irregular shaped solid bodies • Calculate the volume of an irregular shaped body using given data.
5th	**1.3.Measuring density** • Density of regular shaped solid bodies	• Define the term density • Determine the density of a given body by measuring its mass and volume. • Use the definition of density to calculate the density of a body.	• Explanation • Demonstration • Individual and group work • Question and answer	Ask students to • describe what density is. • write SI unit of density. • calculate the density of regular shaped solid bodies. • describe how to measure the density of a regular shaped solid body.
6th	• Density of irregular shaped bodies • Density of liquids • Hydrometer.	• Measure the density of irregular shaped bodies using displacement method. • State the use of a hydrometer. • Measure the density of a liquid.	• Explanation • Demonstration • Individual group and work • Question and answer	Ask students to describe • how to measure the density of irregular shaped body. • how to use a hydrometer . • Ask students to calculate the density of irregular shaped solid body using given data.

7^{th}	**1.4 Dimensional expression of physical quantities**	• Define what a dimensional expression is. • Express the dimensions of area, volume, density, speed, acceleration, force, work and power.	• Explanation • Demonstration	Ask students to: • Describe what a dimensional expression of physical quantities is. • Express the dimensions of some physical quantities.
8^{th}	**1.5 Scientific notation.** • Scientific notation. • Prefixes of units	• Define the scientific notation. • Use scientific notation to write very large or small numbers. • Define the term prefix. • Use prefixes to write very large or small numbers. • Identify common quantities with the appropriate unit that will measure them.	• Discussion • Explanation • Demonstration	Ask students to: • write very large and small number using scientific notation. • state prefixes of units • explain why to use scientific notations. • write numbers in scientific notation and express. • measured values of physical quantities using prefixes.

1.1 Measuring Area

1. ***Proposed number of periods:*** *2 periods*
2. ***Competencies*** After completing this unit students should be able to:
   - measure the sides of a rectangle, square and triangle.
   - calculate the areas of a rectangle, square and triangle using the measured values.
   - measure the diameter of a circle infer its radius and calculate its area.
   - calculate the surface area of simple solids like the cube prism and pyramid.
   - convert the area in m^2 to cm^2 mm^2 km^2 and vice versa.
3. ***Suggested teaching methods***
   - Discussion.
   - Explanation.
   - Question and answer**.**
   - Individual work based on the activities.
   - Group work based on the activities given.
4. ***Teaching aids***
   - Measuring instruments of length e.g ruler
   - Different surfaces (2D) like, square, rectangle, triangle and circle.
5. ***Facilitating the learning process***

   Pre – planning

   Active learning (student-center) method of teaching is the preferred teaching methodology among all the others. Here

students must do different activities. You need to create conducive classroom environment suitable for continuous discussions. Ask students to relate their mathematic knowledge to the area in physics.

Ask them to revise their mathematics knowledge and skills in measuring area and using area formula.

Before describing the concept area, let students do activity 1.1. Arrange them in group of 3-5 students. Each group should measure the sizes of grade 8- Physics text and the sides of the class room. Let them compute the product "$\ell \times w$". Ask them to discuss on this product and what meaning does it give for them.

Based on their discussion- Summarize the definition of 'area' and its 'SI' unit.

Different surfaces such as the floor of a class room, the roof of a hall, a football field, etc have their own surface area. Surface areas are of two types, **regular** or **irregular** surfaces. There are simple equations used to find the area of regular surface mathematically.

For example

The area of a circle is $\pi r^{2.}$

The area of a triangle is 1/2 *bh* and.

The area of rectangle is ℓw.

Put emphasis on these equations and give some assignments for the students to find the area of different shapes. Ask them to practice converting units of area from SI to non-SI and vice versa.

Activity 1.3 is very important for students to understand the concept of area.

Supplementary activity 1.1

Arrange the students in a group of 3-5 and let them do the following experiment.

Title: Measuring the sides of a match box.

Outcome: To be able to determine the length, breadth and height of a match box.

Theory: The SI unit of length is meter (m). There are objects whose sides are less than a meter. In this case we use a ruler having centimeter or millimeter scale. How can we measure the length, breadth and height of a match box?

Apparatus: A ruler and match box.

Procedure: i) Identify the length, breadth and height of a match box.
ii) Measure the sides of the match box using your ruler..
iii) Using the formula of an area, calculate the area of the match box.

1.1 Make sure that all students have attained the minimum learning competencies set in the section. In addition use your own means of assessing their work i.e, to confirm that students have attained all the competencies of the lesson.

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 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

1.2 Measuring Volume

1. ***Proposed number of periods:*** *2 periods*
2. ***Competencies****:*

   After completing this unit students should be able to:

   - measure the sides of a rectangular block
   - calculate the volume of a rectangular block using measured values.
   - calculate the volume of a cylinder using measured values.
   - measure the volume of a liquid using measuring cylinder.
   - measure the volume of irregular- shaped solid bodies using displacement method.
   - convert the unit m^3 to cm^3, mm^3, and liter and vice versa.

3. ***Suggested teaching Methods***
   - demonstrate to the students that liquids occupy space.
   - demonstrate the difference between liquids and solid in terms of volume and shape.

- encourage the students to measure the volumes of different irregular bodies using measuring cylinder
- explain that an empty bottle, a classroom and the space outside the class room is filled with air.

The question and answer method may be used within the demonstration and group discussion. It is advisable to let students do simple experiments individually and in groups.

To make the lesson more lively and interesting, do some more activities related to the determination of the volume of irregular shaped bodies.

4. Teaching aids

- Regular wooden or metal solid blocks, measuring instruments like ruler, cylinder, and plastic jug, irregular-shaped- bodies such as stone, string, syringe and water.

5. Facilitating the learning process

Pre- Planning:

It is necessary to collect regular and irregular solids and liquids (like water) so as to prepare for the measurement of volume of a regular and irregular solid and liquid bodies.

Based on the suggested teaching methods, you may give emphasis to the following points.

1. You may introduce the lesson by demonstrating and asking question like what do you observe as a spoon is immersed in cup of tea. Is there an over follow of tea? Why?
2. You can revise the properties of substance as follows.

A. Solids

When you put a stone in any container at different places, the shape does not change, because, it is a rigid substance. When you immerse it in different liquids the volume of the stone can't be changed. This is because the stone completely be submerged in a liquid displaces its own volume of liquid.

Solids have definite shape and definite volume.

B. Liquids

Take a bottle of water and pour it in differently shaped containers and in a measuring cylinder. The shape of water changes according to the shape of the container. But the volume is fixed unchanged as it is measured by a measuring cylinder. Liquids have definite volume but not definite shape.

C. Gases

Take a syringe and close the open end of it by one of your hands and push the plunger by the other hand. At this time you can easily observe the compressibility of air. This is a simple demonstration to show that gases do not have a definite volume and shape.

Ask students to brainstorm on questions in Activity 1.4. After their discussion demonstrate Activities 1.5 and 1.6.

Later do sample worked examples on volume of rectangular blocks and conversion of one unit of volume into another non- SI-units.

You may try to coach students to read the volume of water in a measuring cylinder using different measuring cylinders having different ranges and scales.

Throughout the lesson assess students learning using Check point 1.2: Make sure that all students have attained the minimum learning competences set in the section.

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 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.

1.3 Measuring Density

1. ***Proposed number of periods:*** *2 periods*
2. ***Competencies:***

After completing this unit students should be able to:-

- define the term density.
- determine the density of a given regular shaped body by measuring its mass and volume.
- use the definition of density to calculate the density of a body.
- measure the density of irregular shaped solid bodies using displacement method.

3. Suggested teaching methods

- Ask students to discuss on the concepts of mass and density
- Introduce the idea of density as the amount of matter in unit volume.
- Simple demonstration on determination of density can help students grasp the lesson. Use measured data for students to calculate.
- Give the expression and the SI units of density
- Do one or two calculations as an example using the expression and let the students solve more additional problems as class work and home work.

It is advisable to present the lesson in more of discussion on simple experiments done by the students. Based on this general method the teacher should give emphasis on the experiments and worked examples mentioned on the student textbook.

4. Teaching Aids

- Different sizes of rectangular blocks, or squares.
- Measuring cylinder.
- Irregular shaped solid body.
- Beam balance.

5. Facilitating the learning process

Per- planning

It is advisable to gather materials which are used for practical activities on determining the density of different substances.

Demonstrate Activity 1.7 comparing an iron and wooden block of the same shape and volume.

Give them the definition of density and its formula. Do sample worked examples as class work. Use Table 1.2 to compare the densities of different substances. Let them answer questions and problems of density. Demonstrate how to measure the density of an irregular shaped solid body and of liquid using the mass and volume relationship. Ask them how they measure the volume of an irregular shaped solid body and mass of a liquid.

Hydrometer: It is an instrument used to measure the density of a liquid. For higher density liquids, the hydrometer sinks a small depth, and the hydrometer sinks a large depth for a small density liquids.

Supplementary activity 1.2

Objective: to determine the density of substances (an irregularly shaped solid, a regularly shaped solid and liquid.

Theory: There are physical bodies that have the same volume, but different masses, and there are also bodies that have the same mass but different volume. The relationship between mass and volume is given by a physical quantity called density. Density is a physical quantity of which a body is made and it is calculated by dividing the mass of the body by its volume.

Mathematically $\rho = m/V$

The unit of density is kg/m^3 or g/cm^3.

Apparatus: ruler, beam balance, a set of standard masses, different materials, measuring cylinder .

Procedures

i. Determine the mass of the bodies by using a beam balance.
ii. Determine the volume of the bodies by using measuring cylinder if the material is irregular shaped solid body or liquid.
iii. Calculate the density of the substance form " i" and " ii"
iv. Using the table of densities tell the type of the substances.

Supplementary activity 1.3

Outcome: Measuring density of a liquid using a Hydrometer

Theory: There are liquids that have different buoyant forces. This difference in buoyant force is caused due to difference in density. Hence by using a Hydrometer we can be able to measure the density of liquids.

Apparatus: Calibrated glass tube heavier at its one end (flask) cylinder, any kind of liquid (water, oil, alcohol)

Procedure:

1. Pour the three types of liquids in flasks a, b, and c
2. Insert the hydrometer (calibrated glass tube) in to the three flasks.
3. Observe in which flask the water, oil or alcohol will the tube sinks more
4. Draw a concluding which one of them, the water, oil or the alcohol do have a higher density.

Throughout the lesson assess students learning using **Check point 1.3.** 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 points 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.

1.4 Dimensional Expression of Physical Quantities

1. ***Proposed number of periods:*** *1 period*

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

- define what a dimensional expression is.
- express the dimensions of area, volume, density, speed acceleration, force, work and power.

3. Suggested teaching methods

- Let the students discuss about the interrelation of physical equations and fundamental quantities.
- Explain how the dimension of a physical quantity is determined.
- Let the students do exercises on determining the dimensions of different physical quantities.

4. Teaching aids

- You can use different reference book as a resource of different approaches.

5. Facilitating the learning process

Pre – planning

It is preferable to prepare a number of equations so that students would be able to exercise, the application of dimensional expressions.

Revise fundamental and derived physical quantities and their respective units. Use Table 1.3.

Do worked examples as demonstrations for expressing dimensions of common physical quantities indicated on Table 1.4. Brainstorm students on the uses of dimensions in physics and other sciences.

Throughout the lesson assess students learning using **Check point** 1.4. 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 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

1.5 Scientific Notation

1. ***Proposed number of periods:*** *1 period*

2. Competencies

After completing this unit students should be able to:-

- define the scientific notation as a simple method of writing very large and very small numbers.
- use scientific notation to write very large or small numbers.
- define the term prefix.
- use prefixes to write very large or small numbers.
- identify common quantities with the appropriate unit that will measure them.

3. Suggested teaching methods

Let the students write very large and very small numbers. Ask them what the discomfort in writing them is.

Ask them to revise their mathematics knowledge on scientific notation simplifying exponential notion.

4. Teaching aids

- Charts

5. Facilitating the learning process

Pre- Planning

Do Activity 1.9 ahead of the class and collect very large and very small numbers. Ask them what discomfort they feel in writing them.

Discuss the shortest means of writing these numbers. Revise mathematical properties of exponential writing of numbers. Step by step introduce scientific notations and prefixes for small and big numbers. Ask students to practice writing numbers using scientific notations and prefixes.

Give students numerous exercises on writing numbers using scientific notation and prefixes.

Start using scientific notations and prefixes in the coming units and lessons consistently.

Throughout the lesson assess students learning using Check point 1.5. 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 points 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 check list questions.

Answers to review questions and problems

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

II. 1. a) Area of a surface the space bounded by a certain carve.

b) Volume of a body is the space occupied by the body.

c) Density is the amount of mass in a unit volume.

d) Dimensional expression of a physical quantity is the expression (representation) of physical quantity interims of the basic or fundamental quantities.

e) Scientific notation is representation of a quantity in the form of "$a\times10^{n}$" were 'a' is a number lying between 1 and 10 and 'n' is an integer number.

2. i) area of rectangle = $\ell\times w$

area of triangle = ½ $b\times h$

ii) Volume of irregular shape solids is computed by immersing the solid in to liquid in a measuring cylinder.

iii) To measure the density of liquid, you need to know its mass and volume or by using an instrument called hydrometer.

3. Hydrometer is used to measure the density of a liquid.
4. Scientific notation is a convenient way of representing values of measurements in order to perform mathematical operations.
5. Prefixes are powers of 10, written before units.

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

w = 30 cm a) A = ? a) $A = \ell \times w = 40cm \times 30cm$

ℓ = 40cm b) v = ? $= 1200cm^2$

h = 25cm b) $V = \ell \times w \times h$

$= 40cm \times 30cm \times 25cm$

$= 30{,}000\ cm^3$

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

Number of coins =10 V of coin = ? V of 10 coins $= V_f - V_i$

V_i = 75mL $= 100mL - 75mL$

V_f = 100mL $= 25mL$

$\therefore$ V of coins $\frac{\text{V of 10 coins}}{\text{no of coins}} = \frac{25mL}{10}$

$= 2.5\ mL$

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

ℓ = 27.3cm A = ? $A = \ell \times w = 27.3cm \times 17.5\ cm$

w = 17.5 cm $= 477.75\ cm^2$

4. a) $2.7\times10^2 N \div 3.6 \times 10^{-4} m^2 = \frac{2.7\times10^2\ N}{3.6\times10^{-4} m^2} = \frac{2.7}{3.6} \times 10^{2-(-4)}\ \frac{N}{m^2}$

$= 0.75 \times 10^6\ \frac{N}{m^2}$

b) $3.9\times10^{-2}\ m - 2.3\times10^{-3} m = 39\times10^{-3} m - 2.3\times10^{-3} m$

$= (39 - 2.3)\times10^{-3} m$

$= 36.7 \times 10^{-3} m$

5. i) a) 1.5×10^{10}kg
   b) 1.89×10^{-6}m
   c) 3.0×10^{-21} second
   d) 6×10^{24}km.

   ii) a) 15 Tg
   b) 1.89 μm
   c) 3 × pn second
   d) 6TT km

6. Given

$[(8.60 \times 10^5) \times (6.17 \times 10^{-2})] \div (1.79 \times 10^{-4})$

$= [8.60 \times 6.17 \times 10^{(5-2)}] \div (1.79 \times 10^{-4})$

$= [53.062 \times 10^3] \div (1.79 \times 10^{-4})$

$= (53.062 \div 1.79)10^{3-(-4)}$

$= 29.64 \times 10^7$

$= 2.964 \times 10^8$

7. Given

$$F = \frac{Gm_1m_2}{r^2} \Rightarrow G = \frac{Fr^2}{m_1m_2}$$

$$= \frac{[MLT^{-2}][L^2]}{[M^2]}$$

$\therefore$ Dimension of $G = M^{-1} L^3 T^{-2}$

8. i) Given $s = v_o t + \frac{1}{2} a t^2$

Where dimension of S is [L], $V = [LT^{-1}]$, t = [T] and $a = [LT^{-2}]$

$\Rightarrow$ $[L] = [LT^{-1}][T] + [LT^{-2}][T^2]$

$L = 2[L]$

$\therefore$ The left and right side dimensions are the same.

ii) Given $v^2 - v_o^2 + 2as$

$[LT^{-1}]^2 = [LT^{-1}]^2 + 2[LT^{-2}][L]$

$L^2T^{-2} \cong L^2T^{-2}$

$\therefore$ it is consistent.

UNIT TWO

Motion in One Dimension

i) Time allotted: ***10 Periods***

ii) Outcomes: After completing this unit's lesson, students should be able to:

- differentiate uniform motion from uniformly accelerated motion and give examples for each.
- solve further problems on average speed, average velocity and acceleration.
- draw graphs to show the variation with time of distance, velocity and acceleration.
- find and interpret the slope of s against t, v against t, a against t and area of v against t.
- demonstrate scientific enquiry skills.

These learning outcomes 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 provide hints or clues to the learning objectives.

iii) Contents of the unit

- Forces in physics
- Motion in one dimension
- Graphical representation of motions

iv. Teaching aid

- Ruler, squared paper, pencil
- Bar magnets
- Spring balances
- Graphs showing different kinds of motions
- Meter timer

iv. Planning for teaching

Unit: **Motion in one dimension**

Number of periods 10

Period	*Content*	*Specific Outcomes*	*Suggested Methods*	*Suggested evaluations & follow up methods*
1st	**2.1 Forces in physics** - Kinds of forces	Students will be able to • name the types of forces in nature • distinguish between contact and non- contact forces.	• Question and answer. • Discussion. • Explanation • Demonstration	Ask students to: • name example of contact and non contact forces.
2nd	Newton's 1st law and 3rd law	• describe Newton's first law • state Newton's third law • identify the state of 'no motion' and 'balanced forces'	• Question and answer. • Discussion. • Explanation	Ask students to: • state newton's first and third laws. • explain the condition for a body to have no motion.
3rd	**2.2 Motion in one dimension** **2.2.1 Uniform motion** • Average speed • Velocity	• define the terms average speed, velocity, uniform motion,	• Question and answer. • Discussion. • Explanation	• Ask students to define speed and velocity, distinguish between speed and velocity • explain Uniform motion

4th		• solve further problems on average speed, and average velocity	• Explanation • Demonstration • Individual or group work • Question and answer	• Ask students to solve problems using definitions of speed and velocity.
5th	**2.2.2 Uniformly** accelerated motion • acceleration	• Define the term acceleration and uniformly accelerated motion.	• Question and answer. • Discussion. • Explanation	• Ask students to distinguish between: Uniform motion and accelerated uniform motion. • Describe acceleration
6th		• Solve further problems on acceleration.	• Explanation • Demonstration • Individual or group work • Question and answer	• Ask students to solve problems using definition of acceleration.
7th	**2.3 Graphical representation of motions** • Uniform motion	• Draw graphs to show the variation distance and veracity with time.	• Explanation • Demonstration • Individual or group work • Question and answer	• Check students graphs of distance against time, and velocity against time

8th	Uniform motion (continued)	• Find and interpret the slope of s against t, v against t and area of v against t.	• Explanation • Demonstration • Individual or group work • Question and answer	• Ask students what slope of s against t graph represent and make them find the slope of the s against t graph. • Ask students what area of v against t graph represents. • Ask them to find distance from v against t graph.
9th	• Uniformly accelerated motion	• Draw graphs to show the variation of acceleration with time	• Explanation • Demonstration • Individual or group work • Question and answer	• Check students graphs of distance against time, and velocity against time
10th	Uniformly accelerated motion (continued)	• Find and interpret the slope of v against t and a against t and area of v against t.	• Explanation • Demonstration • Individual or group work • Question and answer	• Ask students what slope of v against t graph represent and make them find the slope of the v against t graph in uniformly accelerated motion. • Ask students what area of a against t, graph represents.

2.1 Forces in Physics

*1. **Proposed number of periods:** 2 periods*

*2. **Competencies***

After completing this unit students should be able to:-

- describe forces in physics.
- name the types of forces in nature.
- distinguish between contact and non-contact forces.
- state Newton's third law.
- identify the state of ' no motion' and ' balanced forces'.

*3. **Suggested teaching methods***

- Discussion
- Explanation (lecture) and
- Questions and answers.

*4. **Teaching aids***

- Two bar magnets
- Spring balances

5. Facilitating the learning process

a. Pre – planning

The period allotted for this section is two. You are expected to revise the idea of force and Newton's first and third laws in the same period. So, let the students read and answer questions in Activities 2.1 to 2.4 ahead of time with their parents and friends.

Prepare the materials required for Activity 2.2 prior to the class.

b) Presentation

Ask students to discuss the idea of force, Newton's first and third laws in groups step by step and report their findings. Give them summary of the lesson.

Students need to differentiate between the idea of "no motion" and balanced forces". To ensure this ask them to explain:

- When does a body said to be at rest?
- What are the conditions that keep it at rest?

During their discussion, help them to explore Newton's first law of motion and its implication to the idea of "rest" or "no motion" and "balanced force".

Finally, make sure that they realized that a body at rest is a body with "no notion" and a body under balanced forces can be either at rest or moving to uniform velocity.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the **Check point 2.1** and unit exercises as class work and home works and further reading assignment. Make sure that all students have attained the set minimum learning competences in the section.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions

2.2 Motion in one Dimension

2.2.1 Uniform Motion

1. ***Proposed number of periods:*** *2 periods*
2. ***Competencies:*** After completing this unit students should be able to:

- define the terms average speed, velocity and uniform motion.

- solve further problems on average speed, and average velocity.

3. Suggested teaching methods

- Discussion
- Explanation (lecture) and
- Questions and answers.

4. Teaching aids

- Chart showing uniform motion
- Meter
- Timer

5. Facilitating the learning process

a. Pre- planning

The period allotted for this section is two. You are expected to revise the terms speed and velocity and do sample work out problems in the given periods. Prepare a place where students can do Activities 2.5 in groups outside of their classroom.

Collect the necessary exercises and arrange them from simple to complex. These exercises are to be given as an assignment (home work).

b) Presentation

Arrange students to perform Activity 2.5 outside a classroom in a group. Let them complete the Table given under Activity 2.5. Ask them to make differences between speed and velocity. Velocity in a straight line motion is the same as speed.

Let the students use the Dot plot of uniform motion to discuss how speed or velocity varies with time.

Do sample word problems related to speed and velocity in a class and ask them to do the rest by themselves.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the **Check point 2.2** and unit exercises as class work and home works and further reading assignment. Make sure that all students have attained the set minimum learning competencies in the section.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the checklist questions

2.2.2 Uniformly Accelerated Motion

1. Proposed number of periods: *2 periods*

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

- define the term acceleration, and uniformly accelerated motion.
- solve further problems on acceleration.

3. Suggested teaching methods

- Discussion
- Explanation (lecture) and
- Questions and answers.

4. Teaching aids

- Charts showing uniformly accelerated motion.
- Dot plot diagram for uniformly accelerated motion.

5. Facilitating the learning process

a. Pre – planning

The period allotted for this section is two. You are expected to revise the term acceleration and equation of acceleration in terms of change in velocity divided by time.

Prepare a chart that shows uniform change of velocity in given time interval.

Collect the necessary exercises and arrange them from simple to complex.

b) Presentation

Let the students use the Dot plot of uniformly accelerated motion to discuss how velocity varies with time. Ask students to state the definition of acceleration and write the unit of acceleration. Explain what a deceleration means.

Ask students to make differences between uniform and uniformly accelerated motion.

Do sampled word problems related to speed and velocity in a class and ask them to do the rest by themselves.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the **Check point 2.2** and unit exercises as class work and home works and further

reading assignment. Make sure that all students have attained the set minimum learning competencies in the section.

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

2.3 Graphical Representation of Uniform Motion and Uniformly Accelerated Notion

2.3.1 Uniform Motion

1. ***Proposed number of periods:*** *2 periods*

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

- draw graphs to show the variation of distance and velocity with time.
- find and interpret the slopes of s against t, v against t and area of v against t.

3. Suggested teaching methods

- Discussion
- Explanation and
- Questions and answers.

4. ***Teaching aids***

- Squared paper

5. Facilitating the learning process

a) Pre – planning

The period allotted for this section is two. You are expected to revise the graphs of s against t and v against t and find their slopes. Prepare graphs that show s against t and v against t.

Collect the necessary data tabulated on tables for students to draw their graphs

b) Presentation

Ask the students to revise the properties of a linear graph from their mathematics lessons.

Remind students that graphs should have labeled axis with their units. Use the Cartesian coordinate system where y -axis represents s or v and the x -axis represents time. Give names to the graphs and be drawn on squared paper so the graphs drawn to scale.

Demonstrating the s against t and v against t graphs ask students how the s and v varies with time in uniform motion using Figures 2.3 and 2.4.

Let them define what a slope is in s-t graph and v against t graph. Tell them that slope in s against t graph is the velocity and the area under the v against t graph is the distance traveled.

The slope of v against t graph in uniform motion is zero. Ask the students what zero velocity means.

Ask them to do selected questions from the Check point 2.2 and unit exercises as class work and home works.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the **Check point 2.3** and unit exercises as class work and home works and further

reading assignment. Make sure that all students have attained the set minimum learning competencies in the section.

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

2.3.2 Uniformly Accelerated Motion

1. ***Proposed number of periods:*** *2 periods*

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

- draw graphs to show the variation of velocity and acceleration with time.
- find and interpret the slope of v against t, and a against t.

3. ***Suggested teaching methods***

- Discussion
- Explanation (lecture) and
- Questions and answers.

4. ***Teaching aids***

- Squared paper

5. Facilitating the learning process

a) Pre – planning

The period allotted for this section is two. You are expected to revise the graphs of v against t and a against t and find their slopes.

Prepare graphs that show v against t and a against t.

Collect the necessary data tabulated on tables for students to draw their graphs

b) Presentation

Ask the students to revise the properties of graphs in uniform motion.

Demonstrating the v against t and a against t graphs ask students how the 'v' and 'a' vary with time in uniformly accelerated motion using Figure 2.5.

Let them define what a slope is in v against t graph and a against t graph. Tell them that slope in v against t graph is acceleration and the area under the v against t graph is the distance traveled. Inform students that distance in uniformly accelerated motion is calculated as $s = \left(\frac{V_i + v_f}{2}\right) t$.

The slope of a against t graph in uniformly accelerated motion is zero. Ask the students what zero acceleration means.

Ask them to do selected questions from the **Check point 2.3** and unit exercises as class work and home works.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the **Check point 2.3** and unit exercises as class work and home works and further reading assignment, make sure that all students have attained the set minimum learning competences in the section.
- 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 problem

1. a) a = slope = $\frac{\Delta v}{\Delta t} = \frac{80m/s - 20m/s}{40s - 10s} = \frac{60m/s}{30s} = 2\ m/s^2$

   b) S = area under the curve

   $= \frac{1}{2}\Delta v \times \Delta t = \frac{1}{\cancel{2}} \times 80\ m/\cancel{s} \times 40\cancel{s}$

   = 1600m

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

   v_1 = 6km/h graph of

   t_1 = 5min v against t

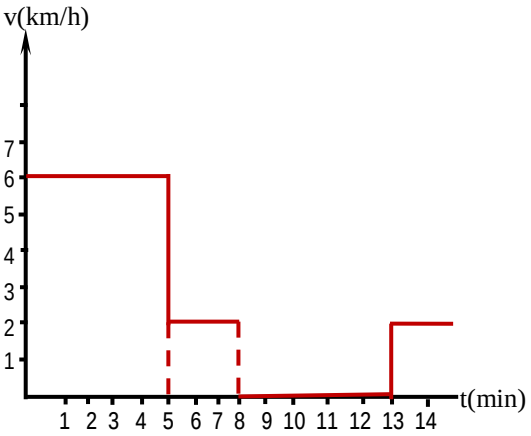
   v_2= 2km/h

   t_2 =3min

   v_3 =0

   t_3 =5min

   v_4 =2km/h



3. a) 6 kilometer
   b) 3kilometer
   c) 2 kilometer

4. a) $t = \frac{s}{v} = \frac{1\cancel{m}}{10\cancel{m}/s} = 0.1\,sec$

   b) $t = \frac{s}{v} = \frac{5\cancel{m}}{10\cancel{m}/s} = 0.5\,sec$

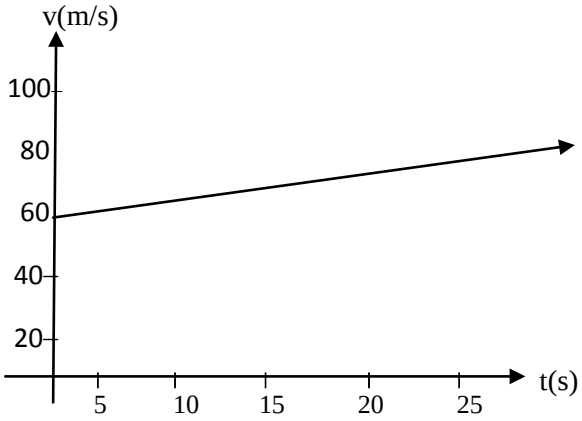
   c) $t = \frac{s}{v} = \frac{20\cancel{m}}{10\cancel{m}/s} = 2\,sec$

   d) $t = \frac{s}{v} = \frac{100\cancel{m}}{10\cancel{m}/s} = 10\ sec$

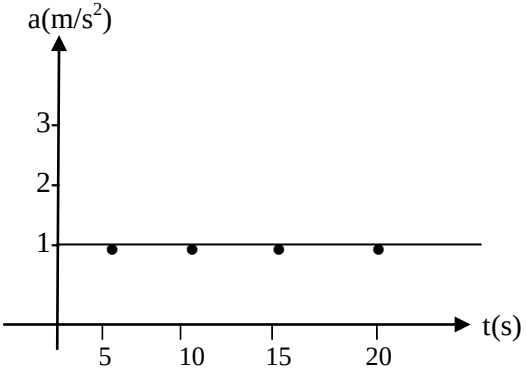
5. Students are expected to draw this graph based on their individual speed

6. i)

T(s)	0	5	10	15	20
V(m/s)	60	65	70	75	80



Velocity against time graph



Acceleration against time graph

UNIT THREE

PRESSURE

i) Time allotted: 9 Periods.

ii) Outcomes: After completing this unit's lesson, students should be able to:

- define pressure and state dimension and SI unit of pressure.
- use the formula P =F/A to solve numerical problems.
- describe factors that affect liquid pressure.
- demonstrate how liquid pressure varies with depth.
- apply P =ρgh, to solve the pressure exerted by liquids.
- State the Pascal's principle and demonstrate the existence of atmospheric pressure using crushing can experiment.
- explain how siphons & pumps function and demonstrate how they transfer liquids from one container to another.
- demonstrate the scientific inquiry.
- develop scientific attitudes and values.

iii) Contents of the unit

3.1 Definition and unit of pressure

3.2 Liquid pressure

3.3 Pascal's principle

3.4 Atmospheric Pressure

3.5 Measuring atmospheric pressure

3.6 Applications of pressure

iv) Teaching Aids

- Wooden blocks (bricks), 1-3 in number. (for activity 3- 2)
- Different shape containers (as in fig 3.4)
- Drawing of hydraulic press
- Materials for crushing can experiment
- U- tubes
- Balloons
- Mercury barometer
- Siphons
- Syringe
- Rubber sucker
- Drinking straw
- Diagram of lift pump

iv. Planning for teaching

Unit: Pressure

Number of periods 9

Period	*Content*	*Competencies*	*Suggested Methods*	*Suggested evaluations & follow up methods*
1st	**3.1 Definition and unit of pressure**	• Define the term pressure • State the dimension of pressure and state its SI units. • Use the definition of pressure P = F/A to solve problems	• Discussion • Explanation • Demonstration • Individual or group work	• Ask students to: define pressure and state its SI unit. • Solve problems related to the definition of pressure.
2nd	**3.2 Liquid pressure**	• State the factors that affect pressure due to a liquid at rest.	• Explanation • Discussion • Demonstration • Individual or group work	• Ask the students to: • State the factors that affect pressure due to a liquid at rest. • Demonstrate the dependence of pressure on depth of liquid.
3rd	**Liquid pressure (continued)**	Use the relation P = ρgh to calculate the pressure due to a liquid at rest.	• Explanation • Discussion • Individual or group work • Question and answer.	• Calculate the pressure due to a given liquid at rest at given height.

4th	**3.3 Pascal's principle** • The hydraulic press • Braking system	• State Pascal's principle in words • Use Pascal's principle to describe the working of a hydraulic press.	• Explanation • Discussion • Demonstration • Individual or group work	• State Pascal's principle in words • Use Pascal's principle to solve related problems • Draw and describe how Pascal principles is used in hydraulic brake
5th	**3.4 Atmospheric pressure** • Source of atmospheric pressure • Barometer	• Relate atmospheric pressure to an observable force.	• Discussion • Demonstration • Explanation • Individual or group work	• Relate atmospheric pressure to air around us • Ask questions raised during demonstration.
6th	**3.5 Measuring atmospheric pressure**	• Tell how atmospheric pressure is measured	• Explanation • Discussion • Demonstration • Individual or group work	• Tell the use of a mercury barometer • Explain how a mercury barometer is used to measure the atmospheric pressure in a give place.

7th	**3.6. Applications of pressure** • Siphons • Lift pump	• List some applications of pressure caused by liquids • Demonstrate the effect of atmospheric pressure on siphons.	• Explanation • Discussion • Demonstration • Individual or group work	• List some applications of pressure caused by atmospheric pressure. • Ask them to explain how siphons work.
8th	• Lift pump	• Demonstrate the effect of atmospheric pressure of Lift pump	• Explanation • Discussion • Demonstration • Individual or group work	• Ask them to show and explain the effect of atmospheric pressure on lift pump
9th	• Syringe • Rubber sucker • Straw	• Explain some applications involving atmospheric pressure	• Explanation • Discussion • Demonstration • Individual or group work	• List some applications of atmospheric pressure

3.1 Definition and unit of pressure

*1. **Proposed number of periods**: 1 period*

*2. **Competencies***

After completing this unit students should be able to:

- define the term pressure
- state the dimension of pressure and define its SI units
- use the definition of pressure P = F/A to solve problems

*3. **Suggested teaching methods***

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

*4. **Teaching aids***

- Wooden blocks (bricks)1-3 in number (For activity 3- 2)
- Ruler
- Spring balance

5. Facilitating the learning process

a. Pre – planning

The period allotted for this section is only one. You are expected to introduce the idea of pressure within the same period. So, let the students read and answer questions in Activities 3.1 and 3.2 ahead of time with their parents and friends.

Prepare the materials required for Activity 3.2 prior to the class. Collect the necessary exercises and arrange them from simple to complex. These exercises are to be given as an assignment (home work).

b) Presentation

If you did your pre – planning tasks accordingly, ask the students to brainstorm on Activity 3.1 and forward their ideas (answers) for Activity 3.1. Based on the discussion of Activity 3.1 you can introduce the idea of pressure as the effects of a force on unit area.

Activity 3- 2 is designed to demonstrate and to enable the students understand the interrelation between area and pressure. Ask them how pressure varies as force and area vary. Introduce the formula $P = F/A$. Let the students realize the effects of one quantity on the others. Ask the students also to derive the dimension and the units of pressure. Do sample worked examples and ask students to do selected problems on pressure.

Let students, realize that an object such as a rectangular block will exert a different pressure on the ground depending on which of its sides it is placed. Using the general definition let the students calculate the pressure of some boxes, a brick, or other regular shaped solids on the floor. Ask students to describe which parts of the structure or design of a given body make the pressure high and what elements make the pressure low.

Throughout the lesson assess students learning using Check point 3.1. 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 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

3.2 Liquid Pressure

1. Proposed number of periods*: 2 periods*

2. Competencies

After completing this unit students should be able to:

- use the relation $P = \rho gh$ to calculate the pressure due to a liquid at rest.
- state the factors that affect pressure due to a liquid at rest

3. Suggested teaching methods

- Demonstration
- Discussion
- Questioning and answering
- Group and individual work
- Explanation

4. ***Teaching aids***

- Differently shaped containers (as ing Fig. 3.4)
- Chart (drawing) which compares characteristics of liquids and solids.
- Plastic bags
- water or any other liquid

5. Facilitating the learning process

a) Pre – planning

Prepare the necessary materials for Activity 3.3, 3.4 and 3.5. Tell the students to perform Activity 3.3, 3.4 and 3.5. prior to their class. Make ready, numerical problems, arranging them from simple to complex. Arrange lab demonstrations, on the factors affecting pressure in liquids.

b) Presentation

When you start discussion of this section, tell your students that, it is a direct continuation of section 3.1. Activity 3.3. is designed to enable students visualize the differences and similarities of solids and liquids.

In Activity 3.3 and 3.4. let the students observe the shape of the container, it will have no effect on the pressure. Based on this activity students should identify the factors that affect the pressure in liquids. Use Figure 3.3,3.4 and 3.5 to illustrate the properties of pressure in liquids at rest. Introduce the equation $P= \rho gh$ and perform sample worked examples. Let the students do selected problems related to liquid pressure. ***Do not derive the equation $P = \rho gh$, leave it for challenging students.***

Make sure students have understood that, in a liquid;

1. Pressure increases with depth, because the deeper you go down in a liquid the greater the weight of liquid above you. To demonstrate this, you can use a tall can, with several holes drilled at different levels on its sides and filled with water. The water spurts out fastest

and furthest from the lowest hole because the pressure there is the greatest.

2. Pressure at one depth acts in all direction.

   Demonstrate this, using a can, again with several holes drilled in it at the same level, filled with water. The water spurts out equally fast and fare from each hole because the pressure at this depth is the same in all directions.

3. Pressure depends on the density of the liquid.

   The more dense the liquid the greater the pressure at a given depth.

   Based on these discussions and demonstrations wind-up your explanation by the basic formula $P = \rho gh$.

   Ask the students to carry out calculations to find the pressure exerted by columns of liquids.

   Throughout the lesson assess students learning using Check point 3.2. 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 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

3.3 Pascal's Principle

*1. **Proposed number of periods**: 1 period*

*2. **Competencies***

After completing this unit students should be able to:-

- state Pascal's principle in words.
- use Pascal's principle to describe the working of a hydraulic press.
- use Pascal's principle to solve simple problems.

*3. **Suggested teaching methods***

- Demonstration
- Discussion
- Questioning and answering
- Explanation

*4. **Teaching aids***

- Drawings of hydraulic press.
- Different size plastic syringes, for constructing a model of hydraulic press

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

a. Pre – planning

- Prepare the necessary materials which are required for demonstrations, priors to the class.
- Draw (prepare) a hydraulic press model, which helps you to demonstrate and explain Pascal's principle. Ask your students to make discussion with in their family about the idea of Pascal's principle.
- Prepare numerical problems

b. Presentation

Ask your students to brainstorm and share their findings on Activity 3.6. From their daily experiences let them explain some applications of hydraulic systems such as lifts for automobiles.

Students should realize that, when two cylinders are connected the pressure is the same in both. Use Fig 3.6 to illustrate Pascal's principle and introduce the equation. They need to observe that using these linked cylinders, a smaller force raising a much larger load or force.

Students should understand that a hydraulic press works using Pascal's principle, i.e. a force is applied to a piston with a small area, producing a pressure that is transmitted through a liquid. The liquid pressure acts on a piston with a much larger area producing a much larger force.

Throughout the lesson assess students learning using Check point. 3.3. 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 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.

3.4 Atmospheric Pressure – Air pressure

*1. **Proposed number of periods**: 1 period*

*2. **Competencies***

After completing this unit students should be able to:-

- relate atmospheric pressure, which generally is invisible to an observable force.
- show how atmospheric pressure is measured in terms of the columns of liquids it supports.
- explain the variation of atmospheric pressure with altitude

*3. **Suggested teaching methods***

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

*4. **Teaching aids***

- Materials for can crushing experiment (Fig 3.7 and Activity 3.7) source of heat, water, can with lid, and stand for can
- U tubes (as in Activity 3.8)
- Balloons
- Diagram of a mercury barometer

5. Facilitating the learning process

a) Pre – planning

In this section, you have a number of activities to be done as demonstrations. Therefore, before starting the class you have to collect all the necessary materials and arrange the demonstrations.

Tell the students to try Activity 3.7, 3.8 and 3.9 and prepare themselves for active discussion before they come to the class.

b) Presentation

To begin the lesson, ask your students to explain what they understand by the term 'Atmosphere'. Ask them also to explain Atmospheric pressure' and its causes.

Fig 3.9. (in the text) shows that air has weight, consequently it exerts pressure. Students should appreciate that it is the weight of the air around us that presses object found under it that produces atmospheric pressure. Atmospheric pressure is a pressure due to the air around us and it is also called air pressure.

Activity 3.7 is designed to demonstrate the effects of atmospheric pressure on vacuum can. Motivate students to answer questions like:

What crushed the can?
What was the function of the heat and the steam inside the can?
What happened in the can?

Similarly Activity 3.8 also shows the impact of atmospheric pressure on the level of the liquid.

Throughout the lesson assess students learning using Check points 3.4. 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 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.

3.5 Measuring Atmospheric Pressure

1. Proposed number of periods*: 1 period*

2. Competencies

After completing this unit students should be able to:-

- show how atmospheric pressure is measured in terms of the columns of liquids it supports.
- explain the variation of atmospheric pressure with altitudes.

3. Suggested teaching methods

- Demonstration
- Discussion
- Questioning and answering
- Explanation

4. Teaching aids

- Diagram of mercury barometer

5. Facilitating the learning process

a) Pre- planning

Prior to the beginning of the lesson, you need to draw models of mercury barometer and water barometer.

Inform the students to discuss diagrams indicated in their text book ahead of time.

Prepare also numerical problems arranging them from simple to complex.

b) Presentation

Ask students to brainstorm on how to measure atmospheric pressure. Demonstrate the mercury barometer diagram and explain how it is used to measure the atmospheric pressure at a give place.

Tell them that: 760mm of Hg = (0.76m of Hg)

$= 1.01\times10^{5}N/m^{2}$

= 1 atmosphere

Students should realize that why mercury was selected for barometers. They need to mention the following four advantages of mercury:-

- It is dense and therefore only a relatively short column is needed.
- It is easy to see.
- It doesn't freeze in very cold weather.
- Very little is lost by evaporation.

Let also students interprets what a Standard Atmospheric Pressure (SAP) is.

Throughout the lesson assess students learning using Check point 3.5. 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 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.

3.6 Applications of Pressure

1. Proposed number of periods: *3 periods*

2. Competencies

After completing this unit students should be able to:-

- List some applications of pressure caused by liquids.
- List some applications involving atmospheric pressure.

3. Suggested teaching methods

- Demonstration
- Discussion
- Group and individual works
- Explanation

4. Teaching aids

- Siphons
- Diagram of lift pump
- Syringe
- Rubber sucker
- Drinking straw

5. Facilitating the learning process

a) Pre – planning

- Collect materials needed for demonstrations.
- Prepare a drawing (model) for lift pump.
- Arrange the demonstration.
- Ask students to visit a local water pump station and observe the working of a lift pump and later do the **project work on construction of lift pump** and its uses in the community. Instruct the students to read on the topic ahead of the class.

b) Presentation

This section is basically demonstrative experiment. You need to show the students so many applications of pressure. Students can bring some of the materials, so ask them to explain how it is related to the topic.

The better way of presenting this lesson is divide every application to groups of students. Let the groups explain the uses and working principle of the applications. The students do their project in groups and present to the classroom.

Throughout the lesson assess students learning using Check point 3.6. 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 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.

Supplementary Exercise

1. Calculate the total pressure (atmosphere plus water) on Almaz swimming 20m below the surface of the swimming pool? (density of water is 1000 kg/m^3)
2. A girl of mass 40kg is wearing high heeled shoes with heels of total area $4cm^2$ (the area of the two shoes). What pressure will she exert when all her weight rests on the heels?
3. What must be the density of a liquid in a container if a pressure of 6,000pa is exerted on the base due to a height of 30cm of a liquid?
4. What is the pressure exerted by a column of sea water 10m high? (density of sea water = $1030kg/m^3$)
5. A boy of mass 54 kg balances evenly on two supports each having an area of $8cm^2$ in contact with the ground. What is the pressure exerted on one support?

Answers to review questions and problems

I. 1 Pascal (N/m^2)

2. Depth and density

3. Barometer

4. 1.01×10^5 pa or 76 cm of Hg

II. 1 Pressure is force per unit area.

2. Pressure in solids depends on the area and the magnitude of force.

Pressure liquids depends on the depth and density of the liquid

3. $P = \rho gh$ where ρ is the density of the liquid

g is gravitational acceleration

h is the depth of the liquid

4. When an external pressure is applied to a confined fluid the pressure will be transmitted to every point in the fluid. Based on this principle, in hydraulic press a small force is exerted on small piston. The pressure due to this small force is trans mitted throughout the fluid and exerted on the larger piston

5. Applications of atmospheric pressure.

Lift pumps, syringes, siphons, rubber- suckers

III. Solutions to Problems

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

weight = 20N P = ? $P = \frac{F}{A} = \frac{mg}{A} = \frac{20N}{0.6m^2} = \frac{200N}{6m^2}$

$A = 1m \times 0.6m$ $= 33.3\ N/m^2$

$g = 10\ m/s^2$ $= 33.3Pa$

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

A= 50cm×30cm P = ? P = ρgh

h = 5cm =1000kg/ m^3 × 10m/s^2 $\frac{5m}{100}$

ρ_w=1000kg/m^3 = 500 N/m^2

= 500 Pa

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

A= 1mm^2 P = ? $P = \frac{F}{A} = \frac{24N}{10^{-6}m^2} = 24 \times 10^6 N/m^2$

F= 24N $= 2.4 \times 10^7 Pa$

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

$\rho_\ell = 2\rho_{Hg}$ h_ℓ = ? $1.01 \times 10^5 = \rho_\ell . g\, h_\ell$

SAP =1.01×10^5 N/m^2 $h_\ell = \frac{1.01 \times 10^5 N/m^2}{\rho_\ell g}$

ρ_{Hg} = 13.6×10^6 kg/m^3 $= \frac{1.01 \times 10^5 N/m^2}{2 \times 13.6 \times 10^3 \times 10 N/m^3}$

$= \frac{1.01 \times 10^5 N/m^2}{27.10^4 N/m^3} = \frac{10.1}{27.2} = \frac{101}{272}$

h_ℓ = 0.37m = 37cm

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

h = 0.32 m ρ_o = ? $\rho = \frac{P}{gh}$

P = 2560 pa $= \frac{2560\ Pa}{10\frac{m}{s^2} \times 0.32\ m}$

g = 10 m/s^2 = 800 kg/m^3

UNIT FOUR

HEAT ENERGY

i) Time allotted: **8 Periods.**

ii) Outcomes: *After completing this unit's lesson, students should be able to:*

- identify heat as a form of energy
- describe mechanisms of heat transfer
- classify materials as good conductors of heat and poor conductors of heat (Insulators)
- describe methods of controlling heat lost in cooking devices.
- describe the factors affecting the amount of heat energy of a body
- define the specific heat capacity of a substance and use $Q = mc (T_2 - T_1)$ to solve numerical problems.
- state the dimension and SI unit of specific heat capacity.
- demonstrate scientific enquiry skills.
- develop scientific attitudes and values

iii) Contents of the unit

4.1 Transfer of heat
4.2 Quantity of heat

iv) Teaching Aids

- Different conducting materials
- Sources of heat (candle, alcohol or gas burner)
- Convection expt. apparatus (Smoke box)

iv. Planning for teaching
Unit: Heat Energy

Number of periods 8

Period	***Content***	***Competencies***	***Suggested Methods***	***Suggested evaluations & follow up methods***
1st	**4.1 Transfer of heat** • Conduction of heat	• define the term heat. • describe the mechanisms of heat transfer. • Explain the difference between heat *and* temperature.	• Discussion • Explanation • Individual or group work	Ask students to: • define the term heat • distinguish between heat and temperature. • State and describe the three mechanisms of heat transfer.
2nd	• Conduction • Conductors and insulators of heat	• Describe conduction as method of heat transfer. • Classify materials as good and poor conductors of heat.	• Discussion • Explanation • Demonstration • Individual or group work	• Demonstrate how to classify materials as conductors and insulators of heat.

3rd	• Method of controlling heat loss.	• Explain how insulation is used to reduce heat loss from buildings and human body.	• Discussion • Explanation • Demonstration • Individual or group work	Ask students to: • observe their home and report how insulation is used to reduce heat loss from buildings, human body and cooking utensils body.
4th	• Convection	• State convection as the mechanism of heat transfer. • Describe the role of convection in everyday phenomena.	• Discussion • Explanation • Demonstration • Individual or group work	Ask students to: • State convection as the mechanism of heat transfer. • Describe the role of convection in everyday phenomena
5th	• Radiation	• State radiation as the mechanism of heat transfer • Describe how the heat from the sun reaches the earth surface.	• Discussion • Explanation • Demonstration • Individual or • group work	• State radiation as the mechanism of heat transfer • Describe how the heat from the sun reach the earth surface.

6th	**4.2. Quantity of heat** • Specific heat capacity	• Define the term specific heat capacity of a body.	• Discussion • Explanation • Individual or group work	Ask students to define: • specific heat capacity of a body. • Instruct them to list specific heat capacities for common substances
7th	• Quantity of heat	• State the dimension and unit of specific heat capacity	• Discussion • Explanation • Individual or group work	• Ask students to mention the dimension and unit of specific heat capacity. • Ask students to solve some exercises and about specific heat capacity and derive the unit.
8th	• Quantity of heat (continued)	• Use the formula $C = \frac{Q}{m\Delta T}$ to calculate the specific heat capacity of a material.	• Discussion • Explanation • Individual or group work	• Give exercises and ask students use the formula $C = \frac{Q}{m\Delta T}$ and calculate the specific heat capacity of a substance,

4.1 Transfer of Heat

*1. **Proposed number of periods:** 5 periods*

*2. **Competencies***

After completing this unit students should be able to:

- define the term heat.
- identify and describe the difference between heat and temperature.
- name and describe the three mechanisms of heat transfer.
- classify materials as good and poor conductors of heat.
- describe methods of controlling heat lost in cooking devices.
- describe the role of convection in every day phenomena
- identify that energy transfer may take place by conduction, convection, and radiation.
- explain how insulation is used to reduce heat losses from buildings and human body.

*3. **Suggested teaching methods***

- Discussion
- Explanation
- Question and answer
- Demonstration
- Group and individual practical activity

*4. **Teaching aids***

- Conductors and Insulators
- Different sources of heat
- Smoke box

5. Facilitating the learning process

a. Pre – planning

- Collecting materials for demonstration.
- Ask students to discuss Activity 4.1 and attempt Activities 4.2, 4.3 and 4.4. Give assignment for students to read on the topic.
- Select and prepare exercises and activities which are suitable for group and individual works.
- Select suitable reference books and inform the students.

b. presentation

For this section you have five periods allotted. In the first period let the students discuss and explain about heat and temperature. Activity 4.1 is designed and prepared to facilitate such discussions.

Ask the student to describe how heat is transferred. Arrange the remaining four periods for the three mechanisms of heat transfer, that is two periods for conduction and one period each for convection and radiation.

4.1.1 Conduction

Activity 4.2 is designed to enable the students observe the transfer of heat by conduction. Students need to observe and discuss what is really happening in conduction.

Ask the students to explain what they understand by the terms ‘conductor’ and ‘insulators’. Activity 4.3 helps them to classify materials as good conductors and poor conductors (insulators) of heat. Make difference between conductors of heat and conductors of electricity.

Activity 4.4 enables the students to observe how conduction of heat is applied to cooking pan. They should also observe the importance of insulating materials in reducing heat loss.

4.1.2 Convection

Activities 4.6 and 4.7 are designed to help the students understand "convection".

Let the students do Activity 4.6 and then discuss their observations with friends and groups.

Demonstrate Activity 4.7 in the class and ask students to observe and explain what happens. Ask students to produce a labeled diagram, using the correct words, to show their understanding of convection currents.

Students should notice that

- Convection takes place in fluids (liquids and gases).
- When a fluid is heated it expands.
- The fluid becomes less dens and rises.
- The warm fluid is replaced by cooler, denser fluid.
- The resulting convection current transfers heat throughout the fluid.

Using a smoke box in which a burning candle is placed in one side of the container. Cold air is drawn down in one chimney and hot, smoky air rises out of the other chimney.

Ask the students to mention some common happenings of convection.

4.1.3 Radiation

The 5th period will be spent on the discussion of radiation. Activity 4.8 enables you to introduce the idea of radiation. Let the students brainstorm on what they found about their discussion on Activities 4.8 and 4.9.

Here you need to make sure that, students have understood that:-

- heat radiation is the transfer of energy by infra- red waves.
- infra-red waves are part of the electromagnetic wave.
- all objects emit heat radiation.
- the hotter an object the more radiation it emits.
- heat radiation can travel through a vacuum such as space.
- this is the method via which we get heat from the sun.

Arrange a demonstrative experiment Activities 4.10. to find out which surface is the best absorber of radiation and the best emitter of radiation using two identical cans, one polished and shiny and the other covered with rug black paint.

Throughout the lesson assess students learning using Check point 4.1. Make sure that all students have attained the set minimum learning competencies in the sections.

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.

4.2 Quantity of Heat

1. Proposed number of periods: *3 periods*

2. Competencies

After completing this unit students should be able to:

- define the term 'specific heat capacity' of a body
- state the dimension and unit of specific heat capacity,
- use the formula $c = \frac{Q}{m(T_2 - T_1)}$ to calculate the specific heat capacity of a substance.

3. Suggested teaching methods

- Discussion
- Explanation
- Question and answer
- Demonstration

4. Teaching aids

Chart showing of specific heat capacity of different substances

5. Facilitating the learning process

a) Pre – planning

- As usual tell your students to revise terms temperature and heat, unit and measuring scale of temperature.
- Prepare the necessary equipment to demonstrate Activity 4.11.
- Prepare numerical exercises and arrange them according to their level of difficulties.

b) Presentation

There are three periods arranged for this section. In the first period you need to revise the differences between temperature and heat and their respective units.

Activity 4.11 enables the students understand that the dependence of quantity of heat on the mass of a body.

Define the specific heat capacity of a substance as the amount of heat energy needed to raise the temperature of 1kg of the substance by 1K (or 1 °C). Using degree centigrade or Kelvin unit as unit of temperature is possible at this level.

Using the chart of specific heat capacity of common substances explain how to calculate the heat needed to raise the temperature of a substance of given mass by certain degree temperature. Let the students explain what is meant by the specific heat capacity of a substance.

Do worked examples on quantity of heat using the chart and let the students do some related problems.

Throughout the lesson assess students learning using Check point 4.2. Make sure that all students have attained the set minimum learning competences in the section.

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 homework activities.
- Support students who failed to answer the checklist questions.

Answer to review questions and Problems

I. 1. Temperature
2. Joule
3. Conduction
4. Insulators
5. Specific heat capacity.

II. 1. Convention is the way of heat transfer from one place to another by the actual movement of particles of the medium

2. Practical examples of use of insulators
   i. use of mats (furs) which are used in rooms
   ii. Thermo flax.

3. The three methods of heat transfers are
   i. conduction ii. Convection iii. Radiation

4. Specific heat capacity of a substance is defined as the heat required to raise the temperature of 1kg of mass by 1^0C. The SI unit is J/kg k.

5. The formula $Q = mc (T_2 – T_1)$ is described as the quantity of heat which is lost of gained by a body is equal to the product of mass of substance, specific heat capacity and change in temperature.

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

$m = 0.5kg$ $Q = ?$ $Q = mc\Delta T$

$T_i = 15°C$ $= 0.5kg \times 400\ J/kg$

$°C \times 5°C$

$T_f = 20°C$ $= 1000J$

$C = 400\ J/kg°C$

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

$m = 2kg$ $Q = ?$ $Q = mc\Delta T$

$\Delta T = 20\ °C$ $= 2kg \times 20°C \times 4200J/kg°C$

$C = 4200\ J/kg\ °C$ $= 168{,}000J$

$= 168KJ$

3. Given **Required**

$Q = 5400J$ $\Delta T = ?$

$m = 3kg$

$C_{A\ell} = 900\ J/kg°C$

Solution

$Q = mc\Delta T$

$\Rightarrow \Delta T = \frac{Q}{mc} = \frac{5400J}{3kg \times 900J/kg^{\circ}C}$

$\therefore \Delta T = 2°C$

UNIT FIVE

Electricity and Magnetism

i) Time allotted: 21 periods.

ii) Outcomes of the unit:

Part One. Current Electricity

After completing this unit students should be able to:

- measure current and potential difference using an ammeter and voltmeter respectively.
- state the relationship between current and voltage in words and mathematical symbols.
- define resistance and state its dimension and its SI units.
- state ohm's law and apply it to solve numerical problems.
- explain the factors that affect the resistance of a conductor.
- distinguish between series and parallel connection of resistors and calculate current, voltage and resistance in each circuit connection.
- discuss the advantages of connecting resistors in series and parallel.
- identify resistors using color codes.

Part Two. Electromagnetism

After completing this part of the unit students should be able to:

- describe magnetic effect of current carrying conductor;
- demonstrate magnetic lines of force (field lines) around straight current carrying conductor and solenoid using a compass needle.
- show the direction of magnetic filed, current and magnetic force by applying the “right hand rule”.
- construct simple electromagnet and identify its polarity;
- explain the function and the principle used in electric motor;
- construct simple electric motor.
- define electromagnetic induction and describe the Faraday's experiment.
- explain alternating current and distinguish between alternating current and direct current.
- describe the working principle of Generator.
- Show the difference between AC and DC generators. And list their main components.
- explain the uses and the types of transformers.
- list the main power plants in Ethiopia.
- discuss the transmission and conversion of electric energy.
- state the electrical safety rules.
- demonstrate scientific enquiry skills.
- develop scientific attitudes and values.

iii) Contents of the unit

5.1 Modeling Electric Current, a Circuit Loop and Voltage

- Modeling motion of charge.
- Modeling a closed current loop.
- Modeling thicker wires.
- Modeling a broken circuit.

5.2 Modeling Qualitatively an Electric Light Bulb

- Explore the structure of real light bulb.
- Modeling current flow in a circuit with a bulb.
- Modeling a fuse.
- Building a parallel circuit.

5.3 Relationship of voltage, Current and Resistance

- Definition of Ampere
- Definition of volt.
- Definition of ohm and resistance
- Ohm's law
- Validity of ohm's law.

5.4 Measuring Electric Current, Resistance and Voltage

- Measuring electric current with an Ammeter.
- Measuring voltage with a Voltmeter.

5.5 Formulae to Calculate Series and Parallel Combinations of Resistors

- series combinations of resistors.
- parallel combinations of resistors

5.6 Electro-magnetism

- Magnetic effect of a current.
- Magnetic Field due to a straight current carrying wire.

5.7 Electric motor

5.8 Electromagnetic Induction

5.9 Generator

- AC and DC Generator

5.10 Transformers

5.11 Power Transmission and Conversion of Energy

- Power plants in Ethiopia.
- Electric safety rules.

iv. Teaching aids

- Classroom students
- Science kit
- Electric bulbs,
- Batteries (dry-cells).
- Conducting wires,
- Thin and thick copper conductors
- Switch.
- Fuses.
- Diagrams showing different connections of resistors
- Coiled resistor (wire)
- Color coded resistors
- Pocket size compasses.
- Bar magnets.
- Solenoid
- Voltmeter.
- Ammeter.
- Electromagnet
- Electric motor -
- Model of a generator
- Transformers.

iv) Planning for teaching

Lesson: Electricity and Magnetism

Period	*Content*	*Competencies*	*Suggested methodologies*	*Follow-up and assessment*
1st	**5.12 Modeling electric current, a circuit loop and voltage** • Modeling motion of charge. • Modeling a closed current loop. • Modeling thicker wires. • Modeling a broken circuit.	• Demonstrate understanding of electric current using 'the human wire' simulation. • Differentiate between closed and broken circuit.	• Discussion • Explanation • Demonstration • Role play as human wire	Ask students to: • explain electric current using 'the human wire' model. • differentiate between closed and broken electric circuit. • explain purpose of thicker wire using human wire model
2nd	**5.2 Modeling qualitatively an electric light bulb.**	• Describe what light bulbs look like. • Draw a light bulb circuit. • Compare filaments in light bulbs.	• Discussion • Explanation • Demonstration • Individual or group work	• Ask students to label and describe the parts of an electric bulbs

3rd	• Explore the structure of real light bulb. • Modeling current flow in a circuit with a bulb. • Modeling a fuse. • Building a parallel circuit	• Show a filament and bulb structure. • Describe the role of a fuse.	• Discussion • Explanation • Demonstration • Role play	• Instruct and motivate students to draw an electric circuit connecting light bulb. • describe the role of a fuse in a circuit. • draw an electric parallel circuit using human wire as model.
4th	**5.3 Relationship of voltage, current and resistance** • Definition of Ampere. • Definition of volt.	• Define the terms; electric current and voltage. • define the term ampere	• Discussion • Explanation • Demonstration • Individual or group work	• Define electric current and voltage. • State the units of current and voltage
5th	• Definition of ohm and resistance. • Ohm's law • Validity of ohm's law.	• Define the term resistance. • State ohms law • Show the electrical symbol of a resistor • Use ohm's law in the solution of simple circuit problems.	• Discussion • Explanation • Demonstration • Individual or group work	Ask your students to: • state ohms law. • define electric resistance • use ohm's law in the solution of simple circuit problems.

6th	**5.4 Measuring electric current, resistance and voltage** • Measuring electric current with an ammeter. • Measuring voltage with a voltmeter.	• Read measurements in ammeters and voltmeters. • Draw circuit diagrams using symbol of an ammeter & voltmeters. • Connect ammeters and voltmeters correctly in simple circuit.	• Discussion • Explanation • Demonstration • Individual or group work	Instruct your students to: • demonstrate the correct connection of ammeters and voltmeters in simple circuit. • read measurements in ammeters and voltmeters.
7th	• Measuring resistance with voltmeter and ammeter. • Factors affecting resistance	• Read color code of resistors • List the factors that affect resistance of a conductor	• Discussion • Explanation • Demonstration • Individual or group work	Ask your students to: • identify and read color code of resistors • list and describe the factors that affect resistance of a conductor.
8th	**5.5 Formulae to calculate series and parallel or combinations of resistors.** • Series combinations of resistors.	• Identify series and parallel connections of resistors. • Calculate the equivalent resistance of resistors connected in series.	• Discussion • Explanation • Demonstration • Individual or group work	Ask students to: • describe series connections of resistors. • calculate the equivalent resistance of resistors in series connection • explain the variation of current and voltage in series circuit

9th	• Parallel combination of resistors.	• Calculate the equivalent resistance of resistors connected in parallel. • Describe the advantages of series and parallel combinations of resistors.	• Discussion • Explanation • Demonstration • Individual or group work	Ask students to: • identify series and parallel connections of resistors. • calculate the equivalent resistance of resistors in parallel connection. • explain the variation of current and voltage in parallel circuit. • describe the advantages of series and parallel combinations of resistors.
10th	• Calculating resistance of series and parallel combination of resistors by replacement of equivalent values. • Energy and power in an electric circuit.	• Define the term electric power. • Use the relations $P = VI = I^2R = \frac{V^2}{R}$ in the solution of simple circuit problems.	• Discussion • Explanation • Demonstration • Individual or group work	Ask student to: • define electric power. • state the unit of electric power. • use the relations $P = VI = I^2R = \frac{V^2}{R}$ in solving simple circuit problems.

11th	**5.6 Electro-magnetism** • Magnetic effect of a current • Magnetic field due to a straight current carrying wire.	• Describe in words or by sketch the general shape and patterns of magnetic field lines around a straight current carrying wire. • Show that current carrying wires act as a magnet. • Use the right hand rule to determine the direction of the magnetic field lines around a straight current carrying wire.	• Discussion • Explanation • Demonstration • Individual or group work	• Describe and sketch the shape and patterns of magnetic field lines around a straight current carrying wire. • Use the right hand rule to determine the direction of the magnetic field lines around a straight current carrying wire
12th	Magnetic field around a solenoid.	• Define the term solenoid. • Sketch the pattern of magnetic field lines around a solenoid. • Compare the magnetic field lines around a bar-magnet and a solenoid.	• Discussion • Explanation • Demonstration • Individual or group work	Ask your students to: • Define solenoid. • Sketch the pattern of magnetic field lines around a solenoid. • Arrange your students in a group and instruct them to:

13th	• Electro magnet.	• Use the right hand rule to specify the polarity of an electromagnet. • Explain what makes an electromagnet strong.	• Discussion • Explanation • Demonstration • Individual or group work	• demonstrate an electromagnet using iron nail, battery and wires • state what makes an electromagnet strong. • compare the magnetic field lines around a bar-magnet and a solenoid
14th	5.7 **Electric motor**	• Explain the turning effect produced in a motor. • Label the parts of a motor and show its symbol.	• Discussion • Explanation • Demonstration • Individual or group work	Ask students to: • state the purpose of an electric motor. • describe the turning effect produced in a motor. • draw and label the parts of a motor
15th	• Electric motor	• Identify electrical appliances that contain motors.	• Discussion • Explanation • Demonstration • Individual or group work	• demonstrate that current carrying wire in magnetic field experiences a force. • use right hand rule to indicate the directions of current, force and magnetic field.

16th	**5.8 Electromagnetic Induction**	• Define the terms; induced current, and voltage. • List the factors that affect the size and direction of induced voltage. • Describe the generation of electricity by the rotation of a magnet within a coil and of a coil of wire within a magnetic field.	• Discussion • Explanation • Demonstration • Individual or group work	Arrange the class in groups and ask the students to: • demonstrate the generation of electricity by the motion of a magnet within a coil and of a coil of wire within a magnetic field. • define induced current, and induced voltage. • list the factors that affect the size and direction of induced voltage.
17th	• Bicycle dynamo	• Explain the working principle of a bicycle dynamo.	• Discussion • Explanation • Demonstration • Individual or group work	Ask your students to: • explain the working principle of a bicycle dynamo.
18th	**5.9 Generator** • AC and DC current	• Label the parts of an AC generator and its symbol. • Distinguish between AC & DC.	• Discussion • Explanation • Demonstration • Individual or group work	Ask students to: • state the purpose of a generator. • draw and label the parts of a generator.

19th	**5.10 Transformers**	• Describe what a transformer is. • Give lists of an electrical appliances in home that have transformers.	• Discussion • Explanation • Demonstration • Individual or group work	Instruct students to: • State the purpose of a transformer. • Draw and label the parts of a transformer.
20th	• Step-up transformers • Step-down transformers	• Identify transformers as a step-up and step down. • Use the formula power in primary= power in secondary to solve problems related to transformers. • Apply $\frac{Vp}{Vs} = \frac{Np}{Ns}$ to solve problems related to transformers.	• Discussion • Explanation • Demonstration • Individual or group work	• identify transformers as a step-up and step down. • Organise the class in groups and ask students to make their own transformers. Tell them to show clearly the primary and secondary coils.
21th	**5.11 Power transmission and conversion of energy** • Power plants in Ethiopia. • Electric safety rules.	• Give reasons why high voltages are used to transmit electricity. • indicate what kind of transformers are used for in power transmission. • Label the parts of a transformer and show its electrical symbols.	• Discussion • Explanation • Demonstration • Individual or group work	Ask the students to: • identify what kind of transformers are used for in power transmission. • write field report on visits to power transmission plant. • name some electric power plants in Ethiopia.

Part 1. Electricity

5.1 Modeling Electric Current, a Circuit Loop and Voltage

1. ***Proposed Number of period****: 1 period*
2. ***Competencies****:*

   After completing this unit students should be able to:-

   - demonstrate understanding of electric current using 'the human wire' simulation.
   - define the term EMF.
   - state the role of EMF.
   - differentiate between closed and broken circuits.

3. ***Suggested teaching methods***

   - Discussion.
   - Demonstration.
   - Role play
   - Question and answer.
   - Explanation.

4. ***Teaching aids***

   - Drawings for comparing water flow in pipe and electron flow in wire.
   - A box which is used as a battery.
   - About 100 small marbles (pointed with an "e" on them.)

5. Facilitating the learning process

a) ***Pre – planning***

In this section there are many practical activities. For this reason, arrange the students in different groups and assign them to play different roles.

Ask the students to revise about electric current from grade 7 physics. Let them answer questions indicated in Activity 5.1.

Prepare the necessary diagrams required for the demonstration of ‘’the human wire’’.

b) ***Presentation***

As it is indicated in the pre-planning, you have already divided students in groups and assigned to play different roles.

In this period try to concentrate on the demonstration of ‘the human wire activity’. Let the students relate these modeling activities to the actual flow of charges.

The discussion on Activity 5.1 will enable the students to revise some basic concepts about electric current. Use the classroom students to play a role representing conductors- human wire. Figures 5.2 to 5.6 represent students acting as human wires.

1. Modeling motion of charges
2. Modeling thicker wires
3. Modeling closed circuit
4. Modeling a broken electric circuit
5. Modeling a parallel circuit

These five demonstrations are expected to be managed within a period.

6. ***Stabilization***
   - Summarize the lesson by giving them short notes.
   - Ask them to do selected questions from the Check point 5.1 and unit exercises as class work and home works and further reading assignment.
   - Give them feedbacks to their class work and home work activities. Make sure that all students have attained the set minimum learning competencies.
   - Support students who failed to answer the checklist questions

5.2 Modeling an Electric Light Bulb

1. ***Proposed number of periods: 2 periods***
2. ***Competencies:*** After completing this unit students should be able to:
   - show with the help of a diagram a filament and bulb structure:
   - describe the role of a fuse.
3. ***Suggested teaching methods***
   - Demonstration.
   - Discussion.
   - Group and individual practical activities.
   - Questioning and answering
   - Explanation.

4. Teaching aids

- Incandescent lamp
- Small size electric bulbs, switch, connecting wires and battery.
- Fuse

5. Facilitating the learning processes

a) Pre-planning

You have two periods for this sub unit. Hence it is important to arrange one period for the discussion of bulb and the remaining one period for discussion on fuse.

- Prepare two incandescent lamps (one burnt and the other normal).
- Tell students to identify the parts of a bulb before class.
- Fuse, switch, connecting wire and batteries, need to be prepared before the class.
- Advise your students do Activity 5.2 ahead of time. Ask them to present their findings in the classroom discussion.

b) Presentation

You have two periods for this sub unit. Hence it is important to arrange one period for the discussion of bulb and the remaining one period for discussion on fuse.

Activity 5.2. is designed to enable the students recognize the parts of a bulb.

Let the students explain what filaments are. They have to observe the complete circuit within the parts of a bulb.

Ask the students to draw carefully the structure of the light bulb

In the second period of this sub unit, let the students discuss what they know about a fuse.
Ask them to explain the use of a fuse.

Activity 5.3 is planned to enable the students practice how to build a parallel circuit. Let students use wires, a battery and two bulbs to build a parallel circuit. They remove one bulb and observe the results. Let them explain why there is a difference in brightness.

6. ***Stabilization***

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the Check point 5.2 and unit exercises as class work and home works and further reading assignment. Make sure that all students have attained the set minimum learning competencies.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the checklist questions.

5.3 Relationship of Voltage, Current and Resistance

1. ***Proposed number of periods: 3 periods***
2. ***Competencies:*** After completing this unit students should be able to:-
   - define the terms: electric current and voltage.
   - define the term ampere.
   - define the term resistance.
   - state ohm's law.
   - show the electrical symbol of a resistor.
   - use ohm's law to solve simple circuit problems.

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

4. ***Teaching aids***
   - Bulbs, switches, dry cells.
   - Ammeter.
   - Voltmeter.
   - Conductors (coiled wire, or color coded resistors)
   - Drawings for parallel and series circuits.
   - Drawings of electric symbols.

5. Facilitating the learning process

a) Pre planning

- Prepare the necessary materials indicated above. (circuit elements)
- Organize an experiment (Activity 5.4) and record data to demonstrate Ohm's law application.
- Tell the students to revise definition and unit of electric current and voltage.
- Prepare a chart (drawing) showing the symbols of electrical circuit elements.

b) Presentation

You can organize your class presentation as follows:
In the first period discuss on electric current, unit and electric symbols, voltage and unit. Make distinctions between voltage, potential difference and an electromotive force.

Students need to realize that:

- Current is number of charges passing a point per second through a conductor. Charge is measured in coulombs. One ampere of current represents one coulomb of electrical charge moving past a specific point in one second.
- Voltage is a measure of the ability to do work.

In the second period concentrate on Ohm's law. Demonstrate Activity 5. 4 and use already collected data to show the relationships between voltage and current.

Resistance of an object is the electrical opposition to the passage of current. It is measured in Ohms. Let them realize that the quantities V, I and R are related V = IR. (Ohms' law)

The third period is allotted for doing sample problems on Ohm's law. Let the students apply ohm's law in solving simple problems.

6. ***Stabilization***
    - Summarize the lesson by giving them short notes.
    - Ask them to do selected questions from the Check point 5.3 and unit exercises as class work and home works and further reading assignment. Make sure that all students have attained the set minimum learning competencies.
    - Give them feedbacks to their class work and home work activities.
    - Support students who failed to answer the checklist questions.

5.4 Measuring Electric Current, Resistance and Voltage

1. ***Proposed number of periods: 3 periods***
2. ***Competencies:*** After completing this unit students should be able to:
    - read measurements in ammeters and voltmeter.
    - draw circuit diagrams using symbols of an ammeter and a voltmeter.
    - connect ammeters and voltmeters in a simple circuit.

- measure the resistance with a voltmeter and an ammeter
- read color code of resistors.
- List the factors that affect resistance of a conductor.

3. Suggested teaching methodologies

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

4. Teaching aids

- Ammeter, voltmeter.
- Color coded resistor
- Conductors with different length and area.
- Bulb, connecting wires and dry cells
- Different circuit diagrams.

5. Facilitating the learning process

a) Pre-planning

- Borrow and organize lab-equipments to demonstrate reading of ammeter and voltmeter.
- Prepare a color code resistor for teaching reading color codes of resistors.
- Tell the students to bring some locally available resistors from old radio, TV, etc appliances and read their textbook ahead of time.

b) Presentation

Activity 5.5. is designed to enable students to measure electric current. Here they should understand how to connect ammeter, and how to measure current in parallel circuit.

In activities 5.5 and 5.6 they should practice measuring voltage. They need to understand how to connect a voltmeter. In addition measuring resistance of a bulb is another important activity you need to focus on. Following this, you can introduce Ohm's law.

Use Activity 5.7 and illustration Fig 5.17 to discuss how to measure the resistance of a conductor using ammeter and voltmeter. Use color coded resistor to measure the value of the resistance of a given conductor.

Let the students discuss on the factors affecting resistance of a conductor. Indicate the dependence of resistance on length and cross sectional area theoretically. Give them practical examples on where tin and thick wires are used in home circuit.

6. ***Stabilization***

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the Check point 5. 4 and unit exercises as class work and home works and further reading assignment. Make sure that all students have attained the set minimum learning competencies.

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

5.5 Formulae to Calculate Series and Parallel or Combinations of Resistors

1 Proposed number of periods: 3 periods

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

- identify series and parallel connections of resistors.
- calculate the equivalent resistance.
- tell the advantages of series and parallel connection of resistors.
- define the term electric power.
- use the relations $P=VI=I^2R=\frac{V^2}{R}$

3. Suggested teaching methods

- Demonstration
- Discussions
- Group and individual work
- Questioning and answering
- Explanation
- Problem solving.

4. Teaching aids

- Resistors, ammeter, voltmeter, battery,
- Circuit diagrams of parallel and series.

5. Facilitating the learning process

a) Pre-planning

- Collect a number of resistors and other circuit elements.
- Draw a circuit diagram for demonstrating series and parallel circuits
- Organize numerical problems for applying the formulae.
- Tell the students to discuss Activity 5.8 and read their textbook.

b) Presentation

Arrange the periods allotted to the section, as, one period for the discussion of series circuits, the second period for parallel circuits and the last period for electric power.

In general students should realize that two or more resistors may be connected in series and in parallel and that this affects the total resistance of the circuit.

Activity 5.9 is designed to enable students observe the series connection. In series connection discuss the properties of current and voltage. And then tell them that the total or equivalent resistance is the sum of the resistances. Use only two resistors connected in series. Then do worked examples on series connection.

Activities 5.10 and 5.11 are designed to enable students observe parallel connection of resistors. In parallel connection discuss the properties of current and voltage. Tell them that the total or equivalent resistance is the sum of the

reciprocals of the resistances. Then do worked examples on parallel connection.

Lastly ask students to define power and state the unit of power. Relate the definition of power in mechanics to power in electricity. Introduce the equation of power P = IV and use Ohm's law to derive other formulae of power. Do sampled problems on electric energy.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the Check point 5.5 and unit exercises as class work and home works and further reading assignment. Make sure that all students have attained the set minimum learning, competencies.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the checklist questions.

Part two- Electromagnetism

5.6 Electromagnetism

Magnetic effect of Electric Current

1. ***Proposed number of period: 3 period***
2. ***Competencies:*** After completing this unit students should be able to
   - describe in words or by sketching the general shape and patterns of magnetic field lines around a straight current carrying conductor.
   - explain that current carrying wires act as a magnet.

- use the screw rule or right hand rule to determine the direction of the magnetic field lines around a straight current carrying wire.
- define the term solenoid.
- sketch the pattern of magnetic field lines around a current carrying solenoid.
- compare the magnetic field lines around a bar magnet and a solenoid.
- use the right hand rule to specify the polarity of an electromagnet.

3. Suggested teaching methods

- Demonstration.
- Discussion
- Group and individual work.
- Explanation.

4. Teaching aids

- Science kit
- Solenoid- coiled wire
- Electromagnet – iron nail and long wire
- Simple electric circuit
- Drawings of right hand rule.
- Bar magnet.

5. Facilitating the learning process

a) Pre-planning

- Prepare the necessary materials for demonstration, such as simple circuit, solenoid, electromagnets, bar magnets.
- Tell the students to revise unit 7 of their grade 7 physics, and discuss and do Activity 5.12 and read their textbook ahead of time. Ask the student to make a simple electromagnet by winding plastic coated copper wire around an iron nail.
- Prepare drawings that help you to demonstrate magnetic effect of electric current.

b) Presentation

In the first period of this sub unit, try to discuss on Activities 5.12, 5.13 and 5.14 to explain the magnetic effect of a current and magnetic field due to a straight current carrying wire.

Students should appreciate that a wire carrying a current has a magnetic field around it. They should be able to sketch the pattern of the magnetic field lines using right hand rule.

Let students observe the shape of the magnetic field by using a wire pushed through a hole in a piece of card board. Ask them to connect the wire to a cell and a switch. Iron filings are sprinkled on to the card. Then, let them switch on and gently tap the card. The iron fillings will line up to show the shape of the magnetic field.

Ask them to use the same method and observe the shape of the magnetic field around a loop of current carrying wire.

During the second period of this sub-unit, let the students discuss on the ‘’magnetic field around a solenoid’’. Ask them to sketch the pattern of field lines around a solenoid.

In the third period of the sub unit you need to focus on the topic of ‘electromagnet’.

Let the students observe that an electromagnet consists of a coil wound on a soft iron core. Use iron nail as a core for the electromagnet. Show them that when current flows in the coil the core is magnetized. They should see that an electromagnet behave as a temporary magnet.
Students should be able to apply the right-hand grip rule to predict the magnetic polarity of the solenoid.

- Ask the students, to explain the factor affecting the strength of the electromagnet.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the Check point 5.6 and unit exercises as class work and home works and further reading assignment. Make sure that all students have attained the set minimum learning competencies.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer the checklist questions.

5.7 Electric Motor

1. ***Proposed number of periods: 2 periods***
2. ***Competencies:*** After completing this unit students should be able to:
   - explain the turning effect produced in a motor.
   - label the parts of a motor.
   - identify electrical appliances that contain motors.
3. ***Suggested teaching methods***
   - Demonstration
   - Discussion
   - Project work
4. ***Teaching aids***
   - Model of electric motor.
5. ***Facilitating the learning process.***

   a) Pre-planning
   - Collect old simple model of an electric motor- check your school pedagogical center for a motor.
   - Prepare a drawing to illustrate the main parts of a motor.
   - Tell the students to investigate the uses of electric motors in homes and industries.

   b) Presentation

   Ask students to discuss on the following questions
   - What is an electric motor?
   - How does an electric motor works?
   - What principle is used in a motor?
   - What are the major parts of a motor?

Students should observe that a current carrying conductor placed in a magnetic field will experience a force due to the field. They need to connect or relate this effect to the motion of an electric motor.

Project work

Ask students to build a simple electric motor- Arrange students in group, so that they can do the project work. Let them use their school pedagogical center.

Check the website on: ‘’paper clip motor’’ **http:// motors. ceressoft.org/.**

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the Check point 5.7 and unit exercises as class work and home works and further reading assignment. Make sure that all students have attained the set minimum learning competencies.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

5.8 Electromagnetic Induction

1. *Proposed number of periods: 2 periods*

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

- define the terms: induced current and voltage.
- tell the factors that affect the size and direction of induced voltage.

- describe the generation of electricity by the rotation of a magnet with in a coil and of wire with in a magnetic field.
- explain the working principle of a bicycle dynamo.

3. Suggested teaching methods

- Demonstration
- Discussion
- Questioning and answering.
- Explanation

4. Teaching aids

- Galvanometer, U-shaped magnet, conducing wires

5. Facilitating the learning process

a) Pre-planning

- Tell the students to read the topic prior to the period.
- Prepare the necessary equipment to demonstrate Activity 5.15.

b) Presentation

Activity 5.15 is designed to enable students observe the electromagnetic induction process. Students should observe that if conductor cuts the lines of a magnetic field a voltage is induced across the ends of the conductor. If the conductor is part of a complete circuit an induced current can flow in the circuit. Tell them that this effect is known as the electromagnetic induction or Michael Faraday's experiment.

Introduce the terms induced current and induced voltage. Explain the differences between Alternating current (AC) and Direct Current (DC).

Ask students to explain the effect on the voltage while moving the wire/magnet at different speed and in different directions and using a stronger magnet. \

6. ***Stabilization***

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the Check point 5.8 and unit exercises as class work and home works and further reading assignment. Make sure that all students have attained the set minimum learning competencies.
- Give them feedbacks to their class work and homework activities. Support students who failed to answer the checklist questions.

5.9 Generator

1. Proposed number of periods: 1 period

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

- label the parts of an AC generator.
- distinguish between AC and DC current.

3. ***Suggested teaching methods***

- Demonstration
- Discussion
- Group and individual practical work
- Questions and answers
- Explanation.

4. Teaching aids

- Model generator
- Diagram of a generator

5. *Facilitating the learning process*

a) Pre-planning

- Arrange a program for a visit of a generator. (If your school has its own generator).
- Tell the students to discuss the parts and functions of generator from the diagram Fig 5.45 ahead of time.
- Inform students to read their textbook ahead of class for active discussion.

b) Presentation

Ask the students to forward their idea about generator how it works and its uses from their discussion. Students should be able to label the parts of a simple AC generator consisting of a coil rotating within the poles of a fixed U shaped magnet. Let them observe that as the coil rotates, magnetic field lines are cut and a voltage is induced.

Draw a graph to show the output of a simple generator over one complete cycle and match it with diagrams to show the positions of the coil during the cycle.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the Check point 5.9 and unit exercises as class work and home works

and further reading assignment. Make sure that all students have attained the set minimum learning competencies.

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

5.10 Transformer

1. ***Proposed number of periods: 2 periods***

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

- explain what a transformer is.
- list electrical appliances in home that have transformers.
- identify transformers as a step up and step down.
- use the formula power in primary equals power in secondary to solve problems related to transformers
- apply $V_p/V_s = N_p/N_s$ of solve related problems to trans former where N stands for number of turns.

3. ***Suggested teaching methods***

- Demonstration
- Discussion
- Group and individual practical work
- Explanation

4. Teaching aids

- Sample transformers (step- up and step- down)

5. Facilitating the learning process

a) Pre- planning

- Collect step up and step down types of transformers e.g mobile charger.
- Instruct the students to observe transformers from old tape recorder, radio or TV appliances.
- Tell them to visit a transformer fixed on electric poles along streets and read ahead of time about transformers
- Select and organize different numerical problems from review exercises and worked examples.

b) Presentation

You have two periods allotted for this sub unit. Therefore you can arrange an observation activity to transformers collected from old appliances and one found outside the school. Discuss on the purposes and types of transformer. In the second period discuss on the parts of a transformer, symbol and work out problems.

- Let students observe that a transformer is used to increase or decrease the value of an AC voltage.
- Ask them to list some common electrical appliances in the home, such as mobile phone chargers that use transformers.
- Ask students the difference between step-up and step- down transformers
- Let students practice using the equation $V_p \times I_p = V_S \times I_S$, to solve simple problems

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the Check point 5.10 and unit exercises as class work and home works and further reading assignment. Make sure that all students have attained the set minimum learning competencies.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

5.11 Power Transmission and Conversion of Energy

1. Proposed number of periods= 1 period

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

- give reasons why high voltages are used to transmit electricity.
- tell what kind of transformers are used in power transmission.
- label the parts of a transformer and show its electrical symbols.

3. Suggested teaching methods

- Demonstration
- Discussion
- Group and individual practical work
- Explanation

4. Teaching aids

5. Facilitating the learning process

a) Pre-planning

- Arrange a visit to a nearby electric power sub-station (Activity 5. 17)
- Tell students read the electric power plants found in Ethiopia and the regions where they are found and the amount of electric power they produce in **Megawatt.**
- Collect some pictures and films which show power transmission lines in Ethiopia.

b) Presentation

Let the students discuss on the visit reports and number of electric power stations found in Ethiopia. Ask them which power plant is the source of electricity for their living area.

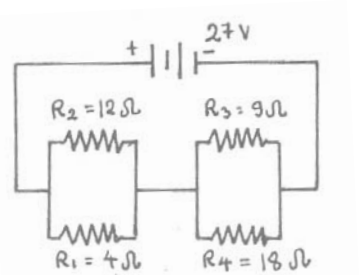
- Ask them to describe how the electric power generated from a station reaches their home and city.
- Let them mention and explain the electric safety rules.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the Check point 5.11 and unit exercises as class work and home works and further reading assignment. Make sure that all students have attained the set minimum learning competencies.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

Supplementary Exercise

1. Find the equivalent resistance and the current through the circuit for the following arrangement.



2. 20 Christmas tree light bulbs are connected in series. When they are plugged into 120V supply, the current flowing through the bulbs is 0.5A. What is the resistance of each light bulb.

3. For each one of the following statement, write series or parallel, in the space provided connection.

_____ a) The current is the same throughout

_____ b) The total resistance equals the sum of the individual resistances

_____ c) The voltage drop is the same across each resistor

_____ d) Adding resistors decrease the total resistance

_____ e) Adding resistors increases the total resistance

_____ f) If one resistor is turned off or broken, no current flows in the entire circuit.

_____ g) If one resistor is turned off or broken, the currents through all other resistors remain the same.

_____ h) Suitable for house wiring.

Answer to review questions and Problems

I 1. False 2. True 3. True 4. True 5. True
6. True 7. False 8. False 9. False 10. True

II. 1. b 2. b

III.

1. Perpendicular 2. Forward 3. Electrical→mechanical

IV.

1.

Given	**Required**	**Solution**
I = 15A	Q = ?	$I = \frac{Q}{t} \Rightarrow Q = It$
t = 1 hr		$\Rightarrow Q = 15\frac{C}{\cancel{s}} \times 3600\cancel{s}$
= 3600s		= 54,000C

2.

Given	**Required**	**Solution**
$R_1 = R_2 = 40\Omega$	a) R_t=?	a) $R_t = R_1 + R_2 = 40\Omega + 40\Omega = 80\Omega$
V= 120*v*	b) I = ?	b) $I = \frac{V}{R_t} = \frac{120v}{80\Omega} = 1.5A$
		c) V_1= ? , V_2= ?
		d) $V_1 = IR_1 = 1.5A \times 40\ \Omega = 60$ v
		$V_2 = IR_2 = 1.5A \times 40\Omega = 60$ v

3.

Given	**Required**	**Solution**
R_ℓ =75Ω	a) R_t = ?	a) $\frac{1}{R_t} = \frac{1}{R_\ell} + \frac{1}{R_H}$
R_H =150Ω	b) I_ℓ = ? I_H = ?	$R_t = \frac{R_\ell . R_H}{R_\ell + R_H} = \frac{(75\Omega)(150\Omega)}{225\Omega}$
V= 150v	c) I = ?	= 50Ω
		b) $I_\ell = \frac{V}{R_\ell} = \frac{150V}{75\Omega} = 2A$
		$I_H = \frac{V}{R_H} = \frac{150V}{150\Omega} = 1A$
		c) $I = I_\ell + I_H = 2A + 1A = 3A$
		d) $I = \frac{V}{R_t} = \frac{150v}{50\Omega} = 3A$

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

$R_1 = 6\Omega$ a) R_t = ? and I = ? a) $R_t = R_1 + R_2 = 6\Omega + 4\Omega = 10\Omega$

$R_2 = 4\Omega$ b) R_t = ? I_1 = ? I_2 = ? $I = \frac{V}{R_t} = \frac{30V}{10\Omega} = 3A$

V= 30v b) $R_t = \frac{R_1 \times R_2}{R_1 + R_2} = \frac{(6)(4)\Omega^2}{10\Omega} = 2.4\Omega$

$I_1 = \frac{V}{R_1} = \frac{30v}{6\Omega} = 5A$ and

$I_2 = \frac{30v}{4\Omega} = \mathbf{7.5A}$

v) 1. To protect the flow of charges.

2. To increase the magnetic field strength

3. See Fig 5. 43

4. Grasp the current carrying wire in your right hand with the thumb extended in the direction of current. The figures will then point in the direction in which the field lines encored he wire (Fig 5.34 in the text)

5. Forays law of electromagnetic induction states that the rate of change of a magnetic flux in a coil of wire produces an emf in the coiled

6. Electromagnetic induction is the process of inducing electromotive force (emf) I n a coil by moving it relative to magnet.

7. **Step up transformer** is a transformer in which the output coils (secondary coils) have more turns than the input coils. It change an voltage to a highs value.

   Step down transformer is a transformer in which the output coils have fewer turns. It changes a voltage to a lower value.

8. Fuse is a piece of wire made of metal alloy having low melting point. A fuse melts and breaks the circuit when excess current flows through it.

UNIT SIX

LIGHT

i) ***Time allotted:*** 12 Periods.

ii) Objective: *After completing this unit's lesson, students should be able to:*

- classify materials as transparent, translucent and opaque.
- construct a pinhole camera and demonstrate the propagation of light in straight line.
- define reflection of light and state the laws of reflections in words.
- apply the law of reflection to solve numerical problems.
- define incident ray, reflected ray, normal line, angle of incident and angle of reflection.
- define principal axis, focal point, focal length, radius of curvature, vertex (pole) of mirror.
- describe the nature of image formed by a plane and curved mirrors by using ray diagrams.
- describe the importance of periscope and construct it by using locally available materials.
- define refraction of light.
- draw and describe ray diagram to illustrate how light travels from one medium to another.
- relate the formation of mirage to refraction of light.
- distinguish between concave and convex lenses.

- define the optical center, focal length, focal point, radius of curvature and principal axis of lenses.
- describe the nature of image formed by concave and convex lenses by using ray diagrams.
- explain the importance of lenses in technology.
- define dispersion of light and name the spectrum of light (color).
- demonstrate scientific enquiry skills.
- develop scientific attitudes and values.

iii) Contents of the unit

6.1 What is Light?

- Kinds of light
- Usage of "light"

6.2. How does Light Travel?

6.3. Reflection of Light

- Reflecting surface
- Laws of reflection
- by curved mirrors.

6.4. Image Formation by Curved Mirrors

6.5. Refraction of Light

- Metaphor for refraction.

6.6. Lenses

- Convex lens
- Concave lens
- Image formation by a convex lens and concave lens

iv)Teaching Aids

- Source of light (such as candle)
- Card boards (as in Fig 6.1 for Activity 6.2)
- Science kit
- Torch
- Different reflecting surfaces (for regular & diffused refer)
- Plane mirrors
- Curved mirrors (concave & convex)
- Lenses (convex and concave)
- Model of telescope
- Camera
- Magnifying glass- simple microscope
- Eye glasses

iv. Planning for teaching

Unit: **Light**

Number of periods 12

Period	*Content*	*Competencies*	*Suggested teaching methods*	*Suggested evaluations & follow up methods*
1st	**6.1 What is light?** • Kinds of light • Usage of "light"	• Give examples of translucent, transparent and opaque materials.	• Explanation • Discussion • Demonstration	Ask your students to • Identify and give examples of translucent transparent and opaque materials.
2nd	**6.2. How does light travel?**	• Tell that light is propagated in a straight line.	• Explanation • Discussion • Demonstration • Individual and group work	Ask students to state that: • light is propagates in a straight line.

3rd	**6.3. Reflection of light** • Reflecting surface • Laws of reflection	• Define the term reflection of light. • Identify reflection as regular and diffuse. • Define the terms; angle of incidence, angle of reflection and normal line. • State the laws of reflection	• Explanation • Discussion • Demonstration • Individual and group work	Ask students to: • define the reflection of light, angle of incidence, angle of reflection and normal • demonstrate reflection of light, angle of incidence, angle of reflection and normal using diagrams • identify reflection as regular and diffuse • state the laws of reflection of light

4th	• Image formation by a plane mirror • Periscope	• Construct a ray diagram to illustrate the formation of a virtual image in a plane mirror. • State the properties of an image in a plane mirror, • Distinguish between real and virtual images. • Draw a diagram to show how two mirrors can be used to make a periscope.	• Explanation • Discussion • Demonstration • Individual or group work	Instruct students to: • Illustrate the formation of a virtual image in a plane mirror. • state the properties of an image in a plane mirror, • distinguish between real and virtual images. • make a periscope and explain how it works
5th	**6.4. Image formation by curved mirrors.**	• Define the terms focal point, vertex (pole), principal axis, focal length, radius of curvature of curved mirrors • Construct a ray diagram to illustrate the formation of an image in curved mirrors.	• Explanation • Discussion • Demonstration • Individual and group work	Ask your students to: • define the terms: focal point, principal axis, focal length,
6th	**Concave mirror**	• State the properties of an image formed by a concave mirror.	• Explanation • Discussion • Demonstration	• Illustrate the formation of an images in concave

			• Individual and group work	mirror using ray diagram
7th	**Convex mirror**	• State the properties of an image formed in a convex mirrors	• Explanation • Discussion • Demonstration • Individual and group work	Instruct students to: • illustrate the formation of an images in convex mirror using ray diagram
8th	**6.5. Refraction of light** • Metaphor for refraction	• Define the term refraction • Explain what happens when light crosses a boundary	• Explanation • Discussion • Demonstration • Individual or group work	Ask students to: • define refraction of light • explain what happens when light crosses between air and water boundary
9th	**Fermat's least time principle**	• State Fermat's least time principle.	• Explanation • Discussion • Demonstration • Individual or group work	Ask students to state Fermat's least time principle.

10th	**6.6. Lenses** • Convex lens • Concave lens • Image formation by a convex lens	• Distinguish between convex and concave lenses. • Define the terms, optical center, focal point, principal axis, focal length, radius of curvature of a lens.	• Explanation • Discussion • Demonstration • Individual or group work	• illustrate the difference between convex and concave lenses. • define and illustrate the terms: optical center, focal point, principal axis, focal length of a lens. • illustrate the formation of an images in convex lens using ray diagram
11th	Image formation by a concave lens	• Describe the nature of the image formed by convex and concave lenses.	• Explanation • Discussion • Demonstration • Individual or group work	Instruct your students to: • Illustrate the formation of images in concave lens using ray diagram
12th	• Mirage • Dispersion of light	• Describe mirage • Demonstrate dispersion of a white light using a prism	• Explanation • Discussion • Demonstration	Ask students to: • describe mirage • demonstrate dispersion of white light using different materials like glass prism, CD, etc.

6.1 What is Light?

1. ***Proposed number of periods:*** *1period*
2. ***Competencies***

After completing this unit students should be able to:-

- state kinds of light,
- list some sources of light
- state uses of light

3. ***Suggested teaching methods***

- Demonstration
- Discussion
- Questioning and answering
- Explanation

4. ***Teaching aids***

- Different sources of light

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

a) Pre – planning

- Ask students to discuss Activity 6.1 and report their findings in class discussion. Tell the students to read their textbook and other reference books about light.

b) Presentation

Use this topic and period for introducing and discussing about light. Activity 6.1 enables you to mobilize the students' attention and to know their background knowledge.

Ask them to mention some kinds of light. Light such as x- rays, infrared, ultraviolet are kinds of light not visible to human beings

Ask students to brainstorm on the sources of light. Let them list locally used sources of light. Introduce terms luminous and non luminous bodies. Give them examples.

Let the students brainstorm on the uses of "light". Light is used for seeing things. How do we see things around us? Discuss it.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the Check point 6.1 and unit exercises as class work and home works and further reading assignment, make sure that all students have attained the minimum learning competences set in the section.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

6.2 How Does Light Travel?

1. ***Proposed number of periods:*** *1 period*
2. ***Competencies***

After completing this unit students should be able to:-

- explain that light is propagated in a straight line.
- demonstrate the straight line motion of light using a pinhole camera.

- give examples of translucent, transparent and opaque materials.

3. Suggested teaching methods

- Demonstration
- Discussions
- Group and individual practical activities
- Questioning and answering

4. Teaching aids

- Transparent materials-air, plane glass,
- Translucent materials-frozen glass, oiled paper
- Opaque materials; card board, wall, wooden plate
- Sources of light
- Diagram of rays
- Pinhole camera

5. Facilitating the learning process

a. Pre – planning

- Collect the necessary material for performing Activity 6.2 and arrange a demonstrative experiment.
- Ask some students to construct pinhole camera Activity 6.3.
- Prepare a chart showing kinds of light rays (Fig 6.2)

b) Presentation

Students should observe that light travels in a straight lines. Ask them to carry out a simple experiment to verify this. Activity 6.2 is designed for this purpose.

Daily life experiences such as torch at night and car head light at night to relate the straight line motion of alight.

Let students make their own pinhole camera to observe an object found outside the classroom. Ask them to explain the type of image observed. They should realize that it is inverted.

Students should describe that light passes through some materials totally or partially or completely absorbed by others. Ask them to give some examples of translucent, transparent and opaque materials.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the Check point 6.2 and unit exercises as class work and home works and further reading assignment. Make sure that all students have attained the set minimum learning competencies in the section.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

6.3. Reflection of Light

1. Proposed number of periods: *2 periods*

2. Competencies

After completing this unit students should be able to:

- define reflection of light.
- identify reflection as regular and diffuse.
- define the terms angle of incidence, angle of reflection and normal line.

- state the laws of reflection.
- construct a ray diagram.
- state the properties of an image in a plane mirror.
- draw a diagram to show how two mirrors can be used to make a periscope.

3. Suggested teaching methods

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

4. Teaching aids

- Different reflecting surfaces (mirror, wall, paper etc.)
- Drawings for showing reflection of light
- Plane mirrors
- Model of a periscope

5. Facilitating the learning process

a. Pre – planning

- Collect different reflecting surfaces such as mirror, wall, paper.
- Draw a diagram to demonstrate incident ray, reflected ray normal line, incident angle and angle of reflection.
- Tell students to observe their image in plane mirror and record what they observed. Tell them to read the topic before class.

- Select and organize exercise on law of reflection.

b) Presentation

The periods allotted for this sub unit are two periods. In the first period you can discuss about reflection of light, terms used in reflection of light and reflecting surfaces' and 'laws of reflection'. In the second period your discussion should be on application of law of reflection, image formation by plane mirror' and periscope.

Let students revise that some surfaces do not allow light to pass through them but reflect it. Demonstrate reflection of light and introduce terms: incident ray and reflected ray. When light is reflected from an uneven surface, such as a sheet of paper, it reflects at different angles. Tell them this is a diffuse reflection. When light is reflected from an even surface, such as a mirror it all reflects at the same angle. This gives a regular reflection. Ask them to describe the terms angle of incidence, angle of reflection and normal line.

Demonstrate Activity 6.4 to investigate the laws of reflection. The angle of reflection equals the angle of incidence. Let them do applicable problems using the laws of reflection.

Let students investigate the formation of an image in a plane mirror using optical pins. Ask them to identify the position of the image on the other sides of the mirror. Guide them on Activity 6.5 to construct a ray diagram to illustrate the formation of a virtual image in a plane mirror.

They should be able to state that the image in a plane mirror is:

- the same size as the object
- upright or erect
- the same distance behind the mirror as the object is in front.
- virtual image
- laterally inverted (the left seems to be the right)

Ask students to construct a periscope as **a project work**. Arrange them in groups, so that they can build a model of periscope from two mirrors. Let them demonstrate and report their work in the classroom.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the Check point 6.3 and unit exercises as class work and home works and further reading assignment. Make sure that all students have attained the set minimum learning competencies in the section.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

6.4 Image formation by curved mirrors

1. ***Proposed number of periods:*** *3 periods*

2. ***Competencies***

After completing this unit students should be able to:-

- define the terms; focal point, vertex, principal axis, focal length, radius of curvature of curved mirrors.
- construct a ray diagram to illustrate the formation of an image in curved mirrors.
- state the properties of an image formed in a concave and convex mirrors.
- distinguish between real and virtual images.

3. ***Suggested teaching methods***

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

4. ***Teaching aids***

- concave and convex mirrors.
- drawings to show ray diagrams for curved mirrors
- drawings to show the formation of images by curved mirrors

5. Facilitating the learning process

a. Pre – planning

- Collect concave and convex types of curved mirrors

- Using Fig 6.10 prepare a diagram for defining the terms used with curved mirrors (principal axis, pole, focal point, etc.)
- Tell the students to read the topic before coming to the class.

b) Presentation

- Revise the formation of an image in a plane mirror, introduce them to the two types of curved mirrors
- Ask them to describe the distinction between the two mirrors: concave and convex mirrors.
- Ask them if they have ever come across in their life where they see curved mirrors are used- e.g mirrors in cars, mirrors in shops and beautify salon.
- Let them practice drawing ray diagrams e.g through a focal point and parallel to the principal axis.
- Let them practice using rays to locate the images of object at different positions relative to concave and convex mirrors.
- They should realize the nature and positions of images in concave and convex mirrors' Activity 6.6 is designed for this purpose.
- Use Fig 6.13 and Fig 6.15 to observe different images in concave and convex mirrors. Tell them how the image varies as the distance varies from infinite to close to the convex mirror. Do similarly for concave mirror.
- Let them do some drawings on finding the images of objects placed in front of a convex and concave mirrors.

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the Check point 6.4 and unit exercises as class work and home works and further reading assignment, make sure that all students have attained the set minimum learning competences in the section.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

6.5 Refraction of light

1. Proposed number of periods *= 2 periods*

2. Competencies

After completing this unit students should be able to:-

- define the term refraction of light.
- explain what happens when light crosses a boundary.
- state the law of refraction in terms of bending towards or away from the normal.
- state 'Fermat's least time principle.

3. Suggested teaching methods

- Demonstration
- Discussion
- Question and answer
- Group and individual practical work
- Explanation

*4. **Teaching aids***

- Different refracting surfaces
- Drawing to show incident ray, normal line, refracted ray.

5. Facilitating the learning process

a. Pre – planning

- Prepare demonstrative experiment on Activity 6.8 and drawing to illustrate refraction of light.
- Organize exercises on drawing refraction of light in different media.
- Tell the students to read their text prior to class
- Collect some refracting surfaces (such as prism, lenses, water etc.)

b) Presentation

Activity 6.8 is designed to enable the students to observe refraction of light between two media. Let them define refraction of light as the change of direction of light as it moves form one medium to another. They should observe that refraction takes place because of the speed of the light that changes as it crosses the boundary between the media.

Ask them to prepare short notes on the Fermat's least time principle.

Ask them to draw and describe the terms angle of incidence, angle of refraction and normal line.

They should be able to stated and describe the law of refraction of light as:

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the Check point 6.5 and unit exercises as class work and home works and further reading assignment. Make sure that all students have attained the set minimum learning competencies in the section.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

6.6 Lenses

1. Proposed number of periods: *3 periods*

2. Competencies

After completing this unit students should be able to:-

- distinguish between convex and concave lenses.
- define the terms, optical center, focal point, principal axis, focal length, radius of curvature of a lens.
- construct a ray diagram.
- describe the nature of the image formed by convex and concave lenses.
- describe the causes of a mirage.
- define the term dispersion.
- demonstrate dispersion of light using a broken CD.

3. Suggested teaching methods

- Demonstration
- Discussion
- Questioning and answering
- Group and individual practical work
- Explanation

4. Teaching aids

- Different lenses
- Drawings to show the formation of images in different lenses.
- Drawings to show dispersion.
- Glass prism, CD, plastic BIC pen case

5. Facilitating the learning process

a) Pre – planning

- Collect concave and convex lenses
- Using 6.19 prepare a diagram for defining the terms used with curved mirrors (principal axis, pole, focal point, etc.)
- Arrange Activity 6.11 and record your observation for classroom teaching. Identify places where mirage is observed and inform students to observe it.
- Tell the students to read the topic before coming to the class.

b) presentation

- Ask them to describe the distinction between the two lenses: concave and convex lenses.
- Ask them if they have ever come across in their life where lenses are used. e.g science laboratory, eye glass, camera, and in shops.

- Let them practice in drawing ray diagrams e.g through a focal point and parallel to the principal axis in convex and concave lenses.
- Let them practice using rays to locate the images of object at different positions relative to concave and convex lenses.
- They should describe the nature and positions of images in concave and convex lenses Activity 6.10 is designed for this purpose
- Use Fig 6.19 and Fig 6.20 to observe different images in concave and convex lenses. Tell them how the image varies as the distance varies from infinite to close to the convex lens. Do similarly for concave lens.
- Let them do some drawings to find the images of objects placed in front of convex and concave lenses.
- Demonstrate the dispersion of white light and ask students to list the names and draw the colors of light observed in prism. Relate the dispersion of light in prism to a rainbow colors. Are they similar? What material is used in a rainbow?

6. Stabilization

- Summarize the lesson by giving them short notes.
- Ask them to do selected questions from the Check point 6.6 and unit exercises as class work and home works and further reading assignment. Make sure that all students have attained the set minimum learning competences in the section.
- Give them feedbacks to their class work and homework activities.
- Support students who failed to answer the checklist questions.

Answer to review questions and Problems

I. 1. d 2. d 3. c 4. A

II.

1.

Materials	***Examples***
Transparent	1.wind screen of a car 2.ordinary clear glasses 3. Air
Trans lucent	1. glass sails used in toilet and bathrooms 2. Plastics 3 oiled write paper
Opaque	1. wooden materials 2. building 3. walls

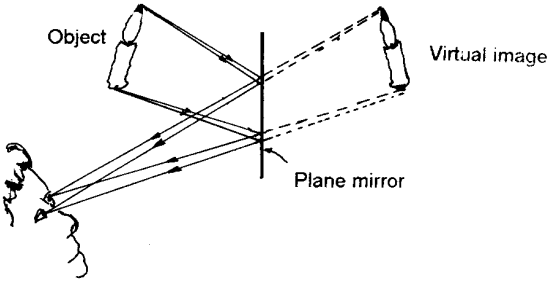
2. a) diverging rays
   b) parallel rays
   c) converging rays
3. If you open a window facing sun light, or walk under trees at sun rise or unset you will see light streaming through in straight lines as it passes through the window to the opposite wall, or between the branches of a tree to the ground. The same effect is also observed in cinema halls as light travels from the projector to the screen. These are practical examples that show light travels in straight lines.
4. a. Incident ray
   b. Reflected ray
   c. Normal line
   d. α - Incident angle
   e. β - Angle of reflection

5. a) reflection of light is the turning back or bouncing of light rays when it encounters a different medium

   b) Refraction of light is the bending of a light ray as it passes from one medium to another

   c) Dispersion of light is the separation of white light in to different colors. The band of colors is called spectrum

6. Concave mirrors converge parallel rays while convex mirror diverge parallel rays

7. 

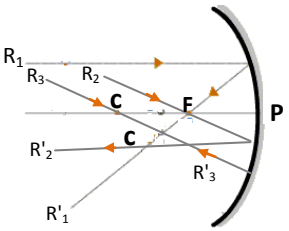
8.

Types of lens	Natures of Image
Convex lens	• Virtual • Erect • Diminished and located between 'F' (focus) and 'O'(optical center of the lense)
Concave lens	• Real • Inverted • The size of the image varies as the position of the object changes.

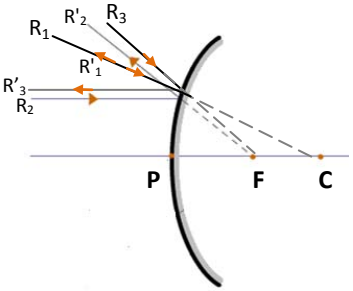
9. Real images can be detected on screens but virtual images are not.

10.

a)



b)



11.

Given	Required	Solution
f = 12cm	distance between O & C	Distance between the O & C = radius of curvature = 2f = 24 cm

12.

Given	Required	Solution
R = 30 cm	f = ?	$f = \frac{R}{2} = \frac{30cm}{2} = 15cm$

13.

Given	Required	Solution
Distance between man and mirror = 2 + 1 = 3m	Distance between the man and his image = ?	Distance between the man and his image = 2 (distance between the man and mirror) = 2 (3m) = 6m

14.

Given	Required	Solution
Angle between I and mirror = 30^o	a) $\hat{i}$ = ? b) $\hat{r}$ = ? c) angle between I & R = ?	a) $\hat{i} = 90° - 30^o = 60^o$ b) $\hat{r} = \hat{i} = 60^o$ c) angle between I + R $= \hat{i} + \hat{r} = 60^o + 60^o$ $= 120^o$

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