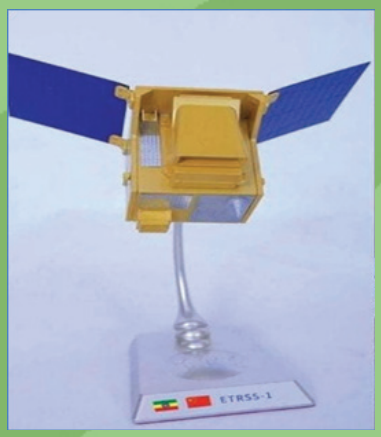
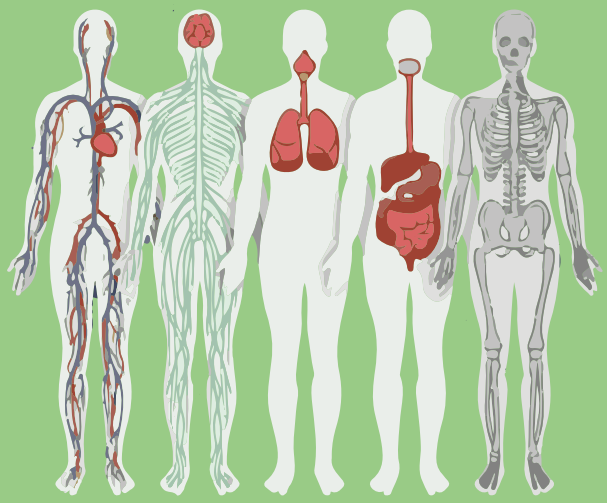
General Science

Teacher's Guide







Grade 8

General Science

Grade 8 TEACHER'S GUIDE

Authors:
Yonas Nibret (BSc., MA)
Sefiw Melesse (Msc.)
Abebe Habte (Msc)

Editors and Evaluators:
Getahun Getachew (BEd)
Muluneh T/Birhan (BEd)
Ali Kemal (MEd)

Team Leader
Getachew Talema (MA)

Illustration and Layout Design
TMS

Acknowledgement

Above all, Ato Zelalem Mulatu, AAEB Head, should receive the most acknowledgements for his outstanding leadership from the outset to the end of the Textbook and Teacher's guide preparation. Just to mention his chief roles but a few: he generated valuable ideas, shared his vast experience during most panels, initiated and convinced his conviction to all stakeholders that the Addis Ababa City Government School teachers have to take the lion's share in the Textbook and Teacher Guide development. His unabated inspiration and urge to the team for diligence, deep sense of patriotism, synergy and true professional ethics has been energy to all actors partaking in the task.

The next bottom-heart gratitude has to be extended to the following management members of the bureau: Ato Admasu Dechasa, Deputy Head of the Curriculum Division, Ato Dagnew Gebru, Deputy Head of the Education Technology, Ato Samson Melese, deputy Head of Teacher Development Division, W/ro Abebech Negash, Bureau Head Advisor, Ato Desta Mersha, Bureau Technical Advisor and Ato Sisay Endale, Head of Education Bureau Office. Members of the AAEB management, have to be commended for their painstaking efforts in addressing instantly each issue of challenge, reviewing all drafts and providing immediate feedbacks. Without their unreserved devotion, the timely and successful realization of this huge work would not have been possible.

The Last deepest acknowledgement needs to go to the school principals for allowing the textbook writers to be free of their regular job of teaching and to focus on the material preparation. Moreover, their earnest and consistent moral support deserves special words of praise.

Table of Contents

UNIT ONE

Basics of Scientific Investigation.....5

1.1 Scientific Measurements.....7

1.2 Doing Scientific Investigation.....17

UNIT TWO

Composition of Matter.....26

2.1 Early Thinking about the Composition of Matter.....27

2.2 Inside of an Atom.....30

2.3 Molecules.....35

UNIT THREE

Classification of Compounds.....39

3.1 Introduction.....40

3.2 Organic Compounds.....43

3.3 Inorganic Compounds.....48

3.4 Neutralization Reaction and Salts.....64

UNIT FOUR

Human Body Systems and Health.....70

4.1 Integumentary.....72

4.2 Muscular.....76

4.3. Skeletal.....81

4.4. Digestive.....84

4.5 Respiratory.....87

4.6 Circulatory.....90

4.7 Reproductive.....93

UNIT FIVE

Ecosystem and Conservation of Natural Resources.....98

5.1 Definition and Components of ecosystem.....100

5.2. Conservation of Natural Resources.....107

UNIT SIX

The Solar System.....118

6.1 Family of the Solar System.....120

6.2 Formation of the Solar System.....124
6. 3 Earth in Comparison with Solar System.....126
6. 4 Our planet's Suitability for Life (uniqueness).....127
UNIT SEVEN
Physical Phenomena in the Surrounding.....134
7.1 Phenomena of Light.....141
7.2 Vision and Imaging.....144
7.3 Sound.....146
7. 4 Heat.....149
7. 5 Simple Circuit.....151
7. 6 Magnetism.....153

Instructions to use this Teacher's Guide

The new syllabus of the ministry of education of the Federal Democratic Republic of Ethiopia, for the subject of General Science for grades 7 and 8 is going to be implemented from the year 2014 E.C. From then onwards, the teachers will use this teachers' guide. The syllabus is included in the teachers' guide to make the process easy for the students.

This teachers' guide consists of a compilation of instructions given to the teachers to make use of in the classroom to achieve specific competencies. Further, the specific competencies thus highlighted are included in the teachers' guide with time suggested for each of the topics.

Learning outcomes to be achieved at the end of each lesson are mentioned clearly in the teachers' guide and it is expected that the teachers will be guided to arrive at a comprehensive conclusion on the behavioral changes expected of the children based on the three domains, knowledge, attitudes and skills.

The teachers' guide also includes the basic concepts and essential technical terms the students are expected to acquire. Whether the students have achieved expected competencies has to be determined by way of assessment and evaluation.

Compared to the other subjects, teaching of the subject science involves the use of a wide range of equipment and tools since it should be taught with practical activities. The requirement instruments are then given in this guide.

At the end of each unit there are suggested evaluation and assessment procedures suitable for the said purpose. Here it is expected to examine whether the students have achieved the minimum learning competencies. Assessment process may happen during the lesson or at the end of the lesson.

At the end of each unit a check list is presented so that students them selves can check whether they have acquired the expected competencies. This would help students to evaluate themself and revise the parts of topics for which the competencies are not met.

Introduction

This teachers' guide is prepared based on the new textbook of general Science for grade 8. The new general science textbook in turn is based on the new instructional materials of general science for Grades 7 and 8. These materials are the flow chart, the minimum learning competencies and the syllabus. Which are prepared based on the general curriculum framework.

The core skills of the twenty first century such as learner-centered learning, diverse skills, use of indigenous knowledge and values, citizenship and cultural identity, learning to learn, critical thinking and problem solving, have been adequately addressed in all components of the General Curriculum framework.

At the beginning the learning outcomes of the unit, the key terms are given. Then a short introduction to the topics covered in the unit is given. Each topic/section of the textbook is then elaborated with explanatory notes, answers to questions raised and further background information. The competencies of each section are listed. Finally there is a way of stabilizing the skills and knowledge explored.

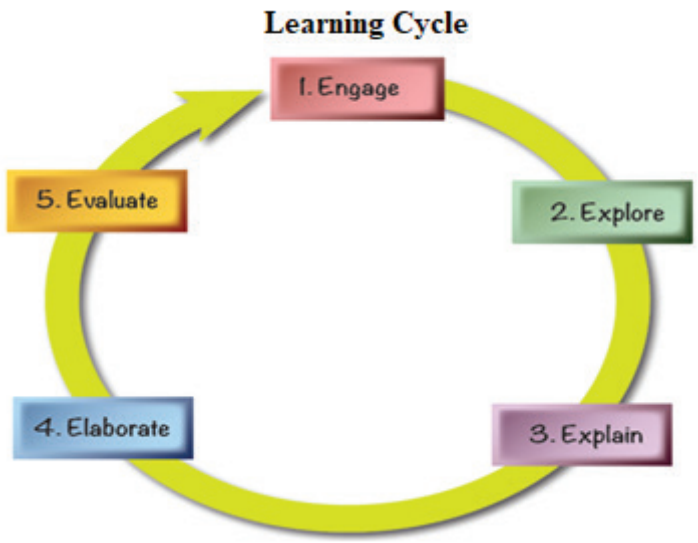
Main contents of grade 8 general science

Units Contents Periods allotted

No.	Unit	Periods allotted
1	Basics of Scientific Investigation	18
2	The Composition of Matter	12
3	Classification of Compounds	23
4	Human Body Systems and Health	32
5	Ecosystem and Conservation of Natural Resources	35
6	the Solar System	24
7	Physical Phenomena in the Surrounding	24

General suggestions to prepare lessons

The following learning cycle which is known as the 5E's instructional model is recommended for teachers to use it. Teachers use the 5E Model of Instruction to sequence lessons and activities which provide best first instruction for all stdents.



"The 5E Model of Instruction promotes active learning. Students are involved in more than listening and reading. They learn to ask questions, observe, model, analyze, explain, draw conclusions, argue from evidence, and talk about their own understanding. Students work collaboratively with peers to construct explanations, solve problems, and plan and carry out investigations." –Rodger Bybee

ENGAGE: In this phase a teacher engages students by having them mentally focus on a phenomenon, object, problem, situation, or event. The role of the teacher in the Engage phase is to present a situation, identify the instructional task, and set the rules and procedures for the activities.

EXPLORE: Once students have engaged in activities, they need time to explore ideas. Explore activities are designed so all students have common, concrete experiences. As a result of their mental and physical involvement in these activities, students question events, observe patterns, identify and test variables, and establish causal relationships.

EXPLAIN: The Explain phase consists of two parts. First, the teacher asks students to share their initial models and explanations from experiences in the Engage and Explore phases. Second, the teacher provides resources and

information to support student learning and introduces scientific or technological concepts. Students use these resources and information, as well as ideas of other students, to construct or revise their evidence-based models and explanations.

ELABORATE: Once students have constructed explanations of a phenomenon or design solutions for a problem, it is important to involve them in further experiences that apply, extend, or elaborate the concepts, processes, or skills they are learning.

EVALUATE: It is important that students receive feedback on the quality of their explanations. Informally, this may happen throughout the learning sequence. Formally, the teacher can also administer a summative evaluation at the end of the learning sequence. The following assessment techniques can be used in continuous assessment; for grade 8 general science lessons.

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

UNIT ONE

BASICS OF SCIENTIFIC INVESTIGATION

Time allotted to the unit: 18 periods

Learning Competencies for unit one:

By the end of this unit, learners will able to:

- identify the basic and derived units of measurements;
- explain the concept of measuring how physical quantities;
- describe the components of a scientific investigation;
- demonstrate ability to work effectively and respectfully with others in performing fair testing.

Contents of the Unit

1.1 Scientific Measurement (8 periods)

1.2 Doing Scientific Investigation (10 periods)

Unit Overview

This unit deals about scientific measurement and scientific investigation. So, students have to explore the importance of scientific measurement. Not only stating the importance of scientific measurement, but also measure available physical quantities using available measuring instruments. They should be able to compare the indigenous and scientific methods of measurement. Students should also be able to apply the recommended steps used to make scientific investigations.

Planning for teaching

	Content	Competencies	Suggested methodology	Suggested assessment
2 Periods	Indigenous methods of measurement	Explain the concept of measuring physical quantities. Describe the various indigenous methods of measurement	• Discussion • Field trip • Question and answer	Ask students to explain the importance of measurement. Let students to do Activity 1.1 and summarize their findings.
1	Physical quantities and modern methods of measurement	Distinguish between the basic and derived physical quantities	• Discussion • Question and answer • explanation	Ask students to categorize physical quantities into basic and derived quantities
2	Basic physical quantities and their units. Derived physical quantities and their units.	Categorize the basic and derived units of measurements	• Discussion • Question and answer • explanation	Ask students to write the units of the four basic quantities and derive the units of some common derived quantities.

2	Prefix and conversion of base units	Identify prefixes and perform conversions among units of measure-ments	• Discussion • Question and answer • explanation	Ask students to name common pre-fix and convert basic units
1	Accuracy and precision in measure-ment	Distinguish between accuracy and precision in measurements	• Discussion • Question and answer • explanation	Ask students to ex-plain the difference between accuracy and precision.

1.1 Scientific Measurements (8 periods)

Learning Competencies

By the end of this section students should be able to:

- explain the concept of measuring Physical Quantities;
- describe the various indigenous methods of measurement;
- distinguish between the basic and derived physical quantities;
- categorize the basic and derived units of measurement;
- identify prefixes and perform conversions among units of measurement;
- distinguish between accuracy and precision in measurement.

Contents of the sub unit

1.1 Scientific Measurements

- Indigenous methods of measurement.

- Physical quantities and modern methods of measurement.
- Basic physical quantities and their units.
- Derived physical quantities and their units.
- Prefixes and conversion of units.
- Accuracy and precision in measurement.

Forward Planning

Learning has to be effective in enhancing students' knowledge, skill and attitude. Thus, students have to use all possible ways to acquire these learning outcomes. The knowledge part should be developed through discussion, doing the activities and exercises. The skill part should be developed by doing hands on activities. The attitude part could be improved by appreciating the work of scientists.

The focus of this section is the measurement of physical quantity. It is basic because science is based on measurement. Both indigenous and modern methods of measurements have to be discussed in detail. The advantages and disadvantages of each have to be seen. Students' should finally be able to conclude why the scientific method is preferred than the indigenous methods of measurement.

The indigenous method have its own advantages and disadvantages. From the advantage side, its availability with minimum cost could be mentioned. Its weak side is the reliability. Because it varies from person to person its reliability is questioned.

The advantages of the modern method of measurement is, it is accepted word wide. Hence, if carefully used, no reliability problem. The problem here is it has a cost of buying the instruments.

Before going to measure something students have to define and understand what a physical quantity is. They should also be able to differentiate between fundamental and derived physical quantities and their corresponding units. How to measure the length, mass, time, and temperature using the appropriate devices

should be discussed.

Students should be able to write large and small numbers using prefixes and practice them by converting one unit to the other.

Finally the difference between accuracy and precision in a measurement should be discussed.

Teaching Aids

The following teaching aids are suggested to be used.

- Indigenous and modern measuring instruments of length.
- Display the real measuring instruments if available.
- Show drawings of different measuring instruments.
- Show drawings of traditional measuring instruments.

Suggested teaching methods;

- Discussion
- Field trip
- Explanation (lecture) and
- Questioning and answering.

Subject matter presentation (Teaching Note)

Start the topic by asking students, what do they know about physical quantity, measuring physical quantity, units of physical quantity? Have they ever used prefixes? What about accuracy and precision?

These diagnostic questions will help you to know the prior knowledge of students. Then you can prepare your lessons accordingly.

Start the lesson by introducing the key terms that students are going to learn in the coming classes. Then, try to point out some traditional measuring units discussed in the textbook plus what you know from experience.

Activities 1.1 and exercise 1.1 are planned to explore the pros and cons of indigenous methods of measurement. From the observation of activity 1.1 students should be able to mention the weaknesses of the indigenous methods of measurement. This is important.

Students have to reach to a conclusion about the importance of the scientific methods of measurement. The main problem of indigenous measurement is reliability. All the discussions and measurements made should lead you to this conclusion. The conclusion is stating this reliability problem of the indigenous method for scientific measurements.

The traditional methods of measuring time, using the shadow of a tree (activity 1.2), is very interesting. It reminds the history of time measurement. Project 1.1 also reminds the history of measuring time.

In the indigenous methods of measurement it is advisable if students could visit markets where these measurements are in use. Project 1.2 is introduced for this purpose. Then let students present a report to their class. After hearing the report of each group you can then generalize by jotting down new findings.

In the modern methods of measurement some practical activities have to be made. At least using a ruler, students should be able to measure any quantity available in their class. They could measure the different sizes of their textbook, desk, blackboard or white board, class room and the like. Encourage students to make group discussions.

Activity 1.3: the importance of scientific measurement is very crucial. After each group have made their discussions, class level discussions are worthy. Then you make the summary of all the points raised about the importance of scientific measurement.

Students have to develop reading habits. For this purpose you can use project 1.1. They can prepare a report in group or individually.

In the measurement of mass, length, time, and temperature hands activities are

mandatory. In addition to Activity 1.4, Using any of the devices mentioned in the textbook, practical measurements have to be made.

Content Background Information

It is because of unreliability of traditional units, scientists developed standard and reliable units. This gave rise for the **System of International units (SI units).** Let students focus on the basic concepts such as:

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

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

Physical quantities are grouped into two:

1. Fundamental (basic) physical quantities, and

2. Derived physical quantities,

Basic (fundamental) physical quantities are limited in numbers (They are only 7). They can be described only by themselves, while derived physical quantities are computed by combining two or more fundamental physical quantities. They can be described in terms of basic physical quantities. The units of fundamental quantities are called fundamental units. These are standard units defined by scientists agreement from all over the world.

On the other hand the units of derived quantities are called derived units. They are derived by combining the fundamental units.

The result of a measurement could be very small or very large. Hence, prefix, a method of writing very small and very large quantities need to be discussed. Examples 1.2 and 1.3 and exercise 1.3 will help you to accomplish this.

Accuracy refers to how a measurement is closed to the accepted value while precision refers to how measurements are close to each other.

Stabilization:

- Summarize the lesson by giving them short notes. Ask them to do selected questions from the end of unit questions 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 these questions.

Suggested answer for activities and projects.

Activity 1.1: The size of students span, cubit and digit are not equal. This has to be seen from the measurements taken by the students themselves. This fact can be used to discuss the importance of the scientific methods of measurement.

Activity 1.2: At different times of a day the height of a shadow is different. This can be used to have a traditional shadow clock in your school compound. Invite the school community to use this clock. Finally conclude by discussing the reliability problem of this clock. At different seasons of a year, the duration of day and night is different, which affects the height of the shadow of a tree.

Activity1.3: Scientific measurement has the following importance.

- By taking these measurements we can better understand the world around us.
- Measurement is necessary for sharing information between scientists around the world.
- Measurements are useful to do basic tasks in our daily life such as buying and selling. Knowing the temperature of the day, measure the time taken for an event etc.
- Measurements can also allow us to make decisions based on the outcome of the measurement.

Project 1.1:

Sundial

In 1500 B.C simple sundials were used to divide the time interval between sunrise and sunset in 12 different parts. The Ancient Egyptian were known to use it. The shadows that move to different marks enabled the Egyptians to calculate time which helped to divide day into two parts. It also solicited summer and winter.



Sundial

Sand-clock

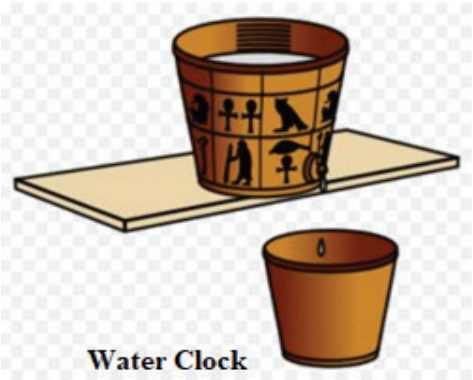
The sand-glass/ hourglass, made up of two conical glass connected vertically by the narrow neck, came into being in the 14th Century. It could measure passage of specific time period depending upon the size and width of the glass and the quantity of sand in it.



Sand Clock

Water clock

Water clock was known to have existed in Babylon in Egypt around 16th Century. It was used to measure time observing steady flow of water from or into a container. Measurements were marked on the container but there were variations due to the pressure of water flow.



Water Clock

Project 1.2: Seeing is better that hearing. So, arrange your students to visit a nearby market and investigate different indigenous measuring method used. Let each group representative present a report. In addition to the knowledge they got, this will improve students' communication skill.

Answer key to Exercises

Exercise 1.1: This exercise has two way uses. One students practice measurement, two students could see the problem with the indigenous methods of measurement, simply comparing their measurement with their friends measurement.

Exercise 1.2: One quntal is not strictly equal to 100 kg, it could be less than 100 kg or greater than 100 kg. This shows that this traditional measurement have a reliability problem.

Exercise 1.3: The problems with the indigenous methods of measurement are already discussed. The advantages of the indigenous measurement methods are: it is cost free and available at any time.

Exercise 1.4:

(a) Volume = length x width x height = m x m x m = m^3

(b) $density = \frac{mass}{volume} = \frac{kg}{m^3}$

(c) Force = mass x acceleration = $\frac{kg}{m/s^2}$

Exercise 1.5

1. **a)** 0.6 km = 0.6 x 1000 m = 600m = 600x100cm = 60, 000 cm

b) $500g = 500 \times \frac{1}{1000} kg = 0.5 kg$

c) $30\,\text{min} = 30 \times \frac{1}{60}\,hr = 0.5\,hr$

d) 50 m = 50 x 1000 mm =50,000 mm

e) 0.25 kg = 0.25 x 1000 g = 250 g

f) 0.5 hour = 0.5 x 60 min = 0.5 x 60 x 60 second = 1800 second

2. a) 3500 m = 3.5 x 1000m = 3.5 km

b) 0.0012 sec = 1.2 x 0.001sec = 1.2 µs

c) 0.01 g = 0.01 x 1 g = 1 cg

Exercise 1.6: Convert the following measurements:

(a) 2.5 kg = 2.5 x 1000 g = 2 500 g

(b) 200 g = 200 x 1000 milligram = 200,000 mg

Exercise 1.7: Convert the following into the required measures:

(a) 8 m = 8 x 1000 mm = 8, 000 mm

(b) $5500\,m = 5500 \times \frac{1}{1000}\,km = 5.5\,km$

Exercise 1.8:

(a) 1 day = 24 hours = 24 x 60 minutes = 1440 minutes

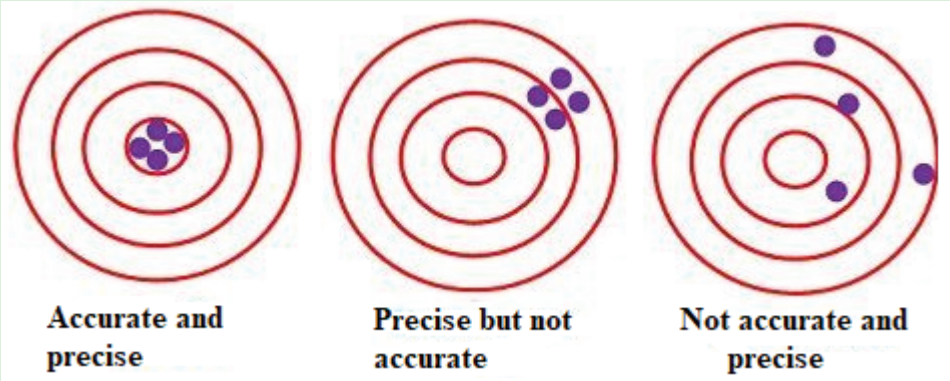
(b) 1 day = 24 hours = 24 x 60 minutes = 1440 x 60 seconds = 86,400 seconds

Exercise 1.9:

0.6 liter = 0.6 x 1000 cc = 600 cc = 600 ml

Exercise 1.10: When the player shoots with accuracy, his/her aim will always take the dart close to or into the target. If the player shoots with precision, his/her aim will always take the dirt to the same location which may or may not be

close to the target. A good player will be both accurate and precise by shooting the dart the same way each time and each time striking the target.



Exercise 1.11: Accuracy reflects to how close a measurement is to a known or accepted value, while precision refers to the closeness of the measurements to each other.

Exercise 1.12:

1.

- Physical quantity is any quantity that could be measured.
- Fundamental quantity or base quantity that is defined by itself.
- Derived quantity is a quantity that that is defined in terms of fundamental quantities.
- Fundamental unit is the unit of fundamental quantities.
- Derived unit is the unit of derived quantities.
- Prefix is a symbol used to represent small or large values.
- Accuracy refers how close a measurement is to the true value.
- Precision refers to how close measurements are to each other.

2. Measuring a physical quantity is comparing it with a standard.
3. The commonly used indigenous methods of measurement used in Addis Ababa local markets are: cubit, span, foot and pace.
4. Length, mass, time and temperature are basic quantities. Whereas area, volume, density and force are derived quantities.

5. SI unit of Length is meter (m), mass is kilogram (m), time is second (s), temperature is Kelvin, area is meter squared (m^2), volume is meter cubed (m^3), density is kilogram per meter cube (kg/m^3) and that of force newton (N).
6. A prefixes is a symbol used to represent small or large quantities.
7. Accuracy reflects to how close a measurement is to a known or accepted value, while precision refers to the closeness of the measurements to each other, even if they are far from the accepted value.

1.2 Doing Scientific Investigation

Number of periods allotted: 10 Periods

After completing this section, students will be able to:

- describe the components of a scientific investigation;
- demonstrate ability to work effectively and respectfully with others in performing fair testing;
- practice scientific investigation procedures using appropriate contents to their age levels.

Forward Planning

Read about scientific investigation from the student's text book, reference books and other resources. Design a plan to cover the content of the section within a given period. In your plan, show the time allotted for group discussion on the activities, project work, presentation, for harmonizing concepts and other activities. Prepare yourself on the activities, project work and exercise.

Teaching Aids

- Diagram that shows the steps of scientific method
- Locally available materials those are used to doing scientific investigation

Subject Matter Presentation

It is advisable to use question and answer, group discussion, role play model and presentation as methods of teaching.

You may start this lesson on dealing with introduction of scientific method and give for students **Activity 1.6** The activity is designed to helps students to realize the applications of scientific investigation. Let them discuss this activity in groups for a few minutes and invite some students from different groups present the group ideas to the class. After their presentations, you may summarize concepts as follows.

The scientific method can be used to help an individual or groups logically or reasonably come to a conclusion concerning a specific subject or topic. The scientific method is used by many people such as scientists, historians, investigators, doctors, engineers, students, as well as anyone else who wants to rationally solve a problem. The scientific method will not be able to answer every single question or solve every problem that someone might have, but it has been proven to be very useful in countless situations.

Then, continue on dealing with steps of scientific method. Describe each step of scientific method and give illustrative example. Then let them form groups and do **Activity 1.7**. This activity helps students to motivate to say "**I will be a scientist or investigator …**" for the future. Facilitate group discussions by clarifying methods or questions raised during their discussion. After the discussion, encourage them to present their findings to the class. Harmonize their discussions by providing possible answers for activity1.7.

Activity a

1. **Ask Question:** What is the effect of sunlight on the growth of bean plant?
2. **Do back ground Research**: Water, fertilize soil and sunlight are necessary for the growth of plants.
3. **Formulate Hypothesis:** The null hypothesis is that there will be no difference between growing a bean plant in the absence of sunlight (indoor) or presence of sunlight (outdoor). The alternative hypothesis is that there will be a colour and a statistically significant difference between the two growing situations for bean plants.

4. **Test Hypothesis by Experiment and Collect Data:**

Planting two bean plants in separated pots using the same type of soil. Place one of these in an outdoor location, and place the other one in an indoor location. Care for the plants in an identical way, like giving the same amount of water. Then, each day for the three-week experimental period, observe and measure plant growth. Carefully record your observation and the size of each plant in a notebook.

5. **Analyze the Results and Draw Conclusion:**

Review the data and determine how the plants in both environments progressed over the course of the three weeks. Based on the data you collected, draw the conclusion including the following.

- The colour of bean plant indoor location is yellow.
- The colour of bean plant outdoor location is green.
- Sunlight is necessary for the growth of plants.

6. **Communicate Results**: Report their findings in the form of a written report as an oral presentation. Sunlight is necessary for the growth of plants.

Activity b

1. **Ask Question:** Does a coiled nail act like a magnet?
2. **Do Background Research**

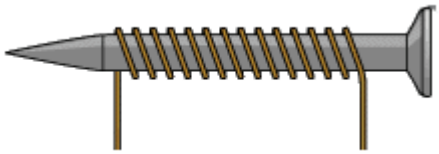
If a coiled nail acts like a magnet, a compass placed near it should be deflected and the piece of metal like iron fillings should be attracted to it.

3. **Establish your Hypothesis**. Yes a coiled nail act like a magnet.
4. **Test your hypothesis.**

Bring a compass near the coiled nail or sprinkle iron filings on it. If the compass is deflected and the iron filings are attracted to the coiled nail then it act like a magnet. If not the hypothesis is wrong. You need to change your hypothesis.

5. **Analyze the Result**

A compass needle placed near a coiled nail doesn't show a deflection and iron filings sprinkle on it are not attracted.



Since the hypothesis is incorrect try another hypothesis

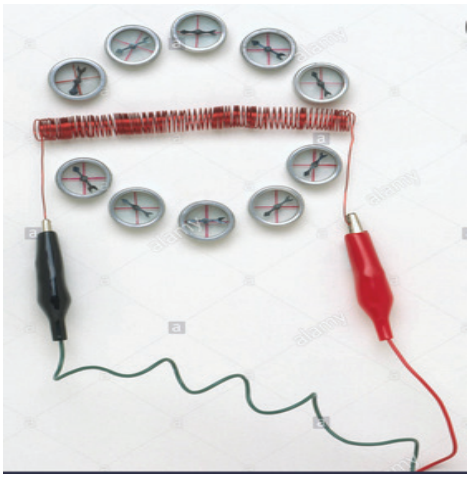
Hypothesis-2: Acurrent carrying coiled nail act like a magnet.

4. Test your Hypothesis.

Bring a compass near a current carrying coiled nail or sprinkle iron filings on it.

5. Analyze the result

A compass needle placed near a current carrying coiled nail show a deflection and iron filings sprinkle on it are attracted by the nail. See the figure.





6. Communicate the result

Since the hypothesis is correct we can communicate the resuls as follows.

Result: A current carrying coiled nail act like a magnet.

Activity c

1. **Ask Question**: How do plants store their food in their leaf?
2. **Do Background Research**

Within plants, sugar made during photosynthesis converts to starch which is stored in various parts of the plant. The cells use it for energy to drive all life processes. Iodine is an indicator to find starch and it turns dark blue/purple when starch is present. This change of color shows the presence of starch that is stored in that part of the plant.

3. **Formulate Hypothesis**

The null hypothesis is that there will be no food stored in plant leaf. The alternative hypothesis is that there will be food stored in plant leaf.

4. **Test Hypothesis by Experiment and Collect Data:**

Procedures

1. Remove a green leaf from a plant that has been exposed to sunlight for a few hours.

2. Half-fill a 250cm^3 beaker with water. Heat the water until it boils. Keep the water at boiling point.

3. Use the forceps to place the leaf in the boiling water. Boil for 2 minutes.

4. Turn off the Bunsen Burner. (If you are using a heat source without a naked flame - electric water bath or hot plate - this step is unnecessary.)

5. Place the boiled leaf in a boiling tube containing 90% ethanol.

6. Place the boiling tube in hot water and boil for 10 minutes or until the leaf decolourizes. (It may be necessary to replace the ethanol).

7. Gently remove the leaf and wash with a fine trickle of cold tap water.

8. Spread the leaf evenly on a white tile.

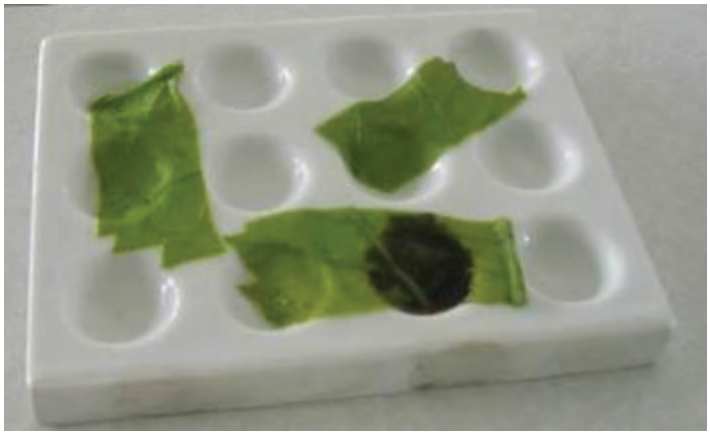
9. Add a few drops of iodine/potassium iodide solution to the leaf and note any observations.

5. Analyze the Results and Draw Conclusion:

The leaf was flaccid (soft) after being boiled in water. The ethanol changed from colorless to green. The leaf was brittle after being boiled in ethanol. The leaf becomes flaccid once more after being rinsed in cold water. After iodine solution was added:

i. No colour change (Iodine Solution remains brown), this indicates that starch is not present in the plant leaf.

ii. Iodine /potassium iodide solution changed from brown to blue black this indicates that starch is present in the plant leaf. Therefore, plants store their foods in their leaf.

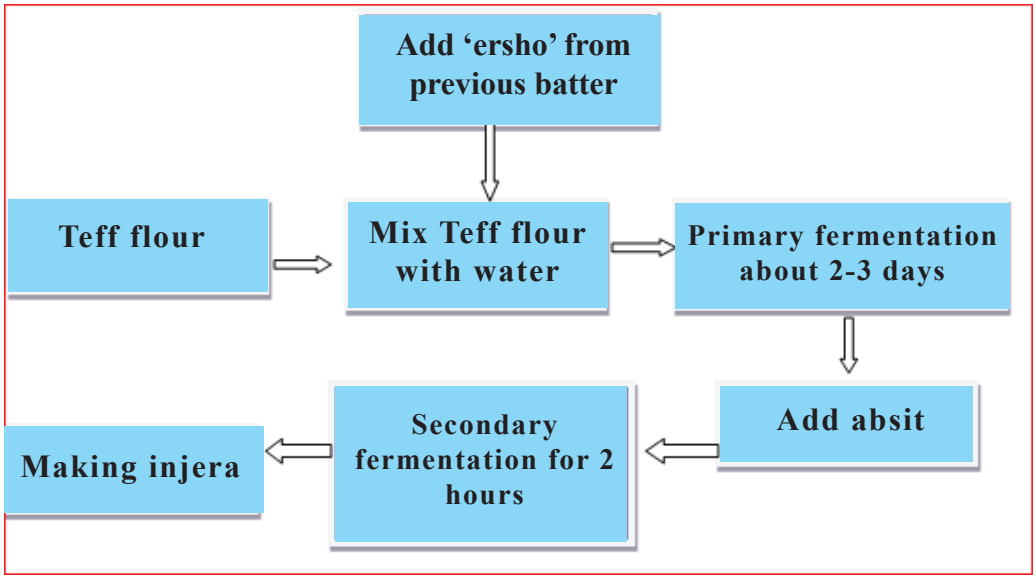


6. **Communicate Results**: Report your findings in the form of a written report as an oral presentation. Plants store their foods in their leaf.

Finally, give **Exercise 1.13** as homework.

Finally, let them do **project work** in groups. This project work is designed to

help students to realize indigenous actions or local procedures and materials used for investigation. Here it is advisable for you to allow students to do project work on their own in groups. Give enough days for students. Assist them whenever they are in need. When they complete the project work, tell group representatives to reflect their project work to the rest of the class. After their reflections, you may harmonize the procedures for making injera as follows.



Assessment

Assess each student's work throughout section 1.2.You can assess students' performance based on your record about each student's performance during the teaching learning process. Your records can be based on the participation of each student in:

- discussing the activity 1.6-1.7
- presenting their views after discussion,
- answering questions during mini-lecture.
- answering exercise 1.13
- project work
- answering questions given as quiz or test.

Appreciate students working above the minimum requirement and encourage them to continue working hard. For low achievers, identify their learning difficulties and help them to achieve the minimum requirement.

Answers to Exercise 1.13

1. Ask Questions
2. Do back ground Research
3. Formulate Hypothesis
4. Test Hypothesis by Experiment and Collect Data:
5. Analyze the Results and Draw Conclusion:
6. Communicate Results

Answers to end of Unit Questions

1. (c) temperature
2. (c) derived units are derived from base units
3. (b) area is a derived quantity
4. The SI unit of density is (b) kg/m^3
5. The prefix that represents $\frac{1}{1000}$ is (d) milli

II. Fill in the blank spaces with an appropriate word.

6. fundamental
7. derived
8. One thousand
9. centi
10. Kg/m^3

III.

11. (c) m^2
12. (a) K
13. (e) kg/m^3
14. (b) m3

15. (d) kg

IV. Give short answer

16. Mass - kilogram (kg), length - meter (m), time - second (s) and temperature – kelvin (K).
17. Speed = m/s, area = m2, volume = m3 and density = kg/m^3.
18. 0.005 m = 5 x 0.001 m = 5 mm.
19. $1000\,cm = 1000 \times 0.01m = 10m = 10 \times \frac{1000}{1000}m = \frac{10}{1000}km = 0.01km$.
20. This measurement is not accurate because its average value (12.17 m/s^2) is far from the accepted value (9.81m/s^2). But it is precise because the results are close to each other.

UNIT TWO
COMPOSITION OF MATTER

Number of periods allotted: 12 periods

Unit Overview

This unit deals with the composition of matter. It an abstract concept because it requires convincing students about the presence of extremely small particles which millions of them collected together cannot even is seen by our naked eye.

The first section discusses early thinking about the composition of matter by comparing and contrasting the discreteness and continuity theory of matter.

In the second section inside of an atom is presented. It explains first about parts of an atom (nucleus and electron Shells). Next the Subatomic particles of the atom, relative mass, the charge and location of sub-atomic particles, atomic number and mass number and determination of the electrons, protons and neutrons are described here.

The last section describes the molecules. It gives emphasis to differentiate molecules of elements from molecules of compounds.

Unit Outcomes:

At the end of this unit, learners will able to:

- narrate the historical development of the atomic nature of substances;
- appreciate that atoms are the building blocks which make up all substances;
- demonstrate understanding of the idea that the identity of a substance is determined by its atomic structure;

- differentiate molecules of elements from molecules of compounds;
- demonstrate scientific inquiry skills along this unit: communicating, asking questions, drawing conclusions, applying concepts.

Main contents

2.1 Early thinking about the composition of matter

2.2 Inside of an atom

- ✓ Parts of an atom (nucleus and electron Shells)
- ✓ The Subatomic Particles of the atom
- ✓ Relative mass, the charge and location of sub-atomic particles
- ✓ Atomic number and mass number
- ✓ Determination of the electrons, protons and neutrons

2.3 Molecules

- ✓ Molecules of elements
- ✓ Molecules of Compounds

2.1 Early Thinking about the Composition of Matter

Number of periods allotted: 3 Periods

After completing this section, students will be able to:

- give a short history of the concept of the atom;
- compare and contrast the continuity and discreteness (discontinuity) theory of matter;
- compare earlier conceptions of the structure of matter with their conceptions.

Forward Planning

Read about early thinking about the composition of matter from the student's text book and other reference books. Design a plan to cover the content of the section within a given period. In your plan, show the time allotted for group discussion on the activities, presentation, for harmonizing concepts and other activities. Prepare yourself on the activities and exercise.

Teaching Aids

- Table chart that shows comparison between the discreteness and continuity theory of matter.
- Periodic table

Subject Matter Presentation

It is advisable to use question and answer, group discussion, and presentation as methods of teaching.

You may start this lesson with the **Activity 2.1**. The activity is designed to brainstorm students on matter and matters made up of. Let them discuss this activity in groups for a few minutes and invite some students from different groups present the group ideas to the class. After their presentations, summarize concepts as follows.

1. Matter is anything that has mass and takes up space.
2. Matter is made up of tiny particles with spaces in between them.

Then, continue on dealing with thoughts of ancient Greek philosophers (Aristotle and Democritus) on composition or nature of matter. Describe their thoughts and give for students' **Activity 2.2**. This activity is designed for students to forward their ideas on the two thoughts (continuous and discrete nature of matter). Let them discuss in groups for a few minutes. Invite two students from two groups to debate their ideas. After their debate harmonize as follows:

Aristotle and Democritus replied the question in two opposing ideas.

a. **Aristotle's believe**

Matter can be divided and subdivided infinitely. According to Aristotle, matter is continuous. For example, take some aluminum foil. Cut it in half. Cut one of the pieces in half again. Cut one of those smaller pieces in half again. Continue cutting, making smaller and smaller pieces of aluminum foil. These smallest pieces are still aluminum foil; they are just becoming smaller and smaller.

b. **Democritus's believe**

Matter can be divided and subdivided up to a certain point. Beyond this point, we would obtain the smallest indivisible particles called atoms. According to Democritus, matter is discrete. For example, take some aluminum foil. Cut it in half. Cut one of the pieces in half again. Cut one of those smaller pieces in half again. Continue cutting, making smaller and smaller pieces of aluminum foil. These smaller particles are ''atoms'' from which the aluminum foil is built up.

Tell students the invisibility of particles to the naked eye and that is way we perceive materials as continuous. Explain that even scientists themselves did not understand about particles until quite recently. They had been work for 2000 years before the idea of atoms was accepted in the early 19th century.

Like students who debate on the two different ideas mentioned in activity 2.2, for many centuries there were two different theories about the nature of matter. Some people believed that matter is continuous, that is, the same all through without any spaces. Others held that matter is discrete or particulate- that is, made up of tiny particles with spaces in between them.

Finally give **Exercise 2.1** as homework.

Assessment

Assess each student's work throughout section 2.1. You can assess students' performance based on your record about each student's performance during the teaching learning process. Your records can be based on the participation of each

student in:

- discussing the activity 2.1 and 2.2.
- presenting their views after discussion,
- Answering questions during mini-lecture.
- Answering exercise 2.1.
- Answering questions given as quiz or test.

Appreciate students working above the minimum requirement and encourage them to continue working hard. For low achievers, identify their learning difficulties and help them to achieve the minimum requirement.

Answers to Exercise 2.1

Discreteness Theory	Continuous Theory
➢ Proposed by Democritus	Proposed by Aristotle
➢ There is a limit to which matter is broken	Matter is infinitely divisible
➢ Believed in the existence of atoms	Rejected the idea of atoms

2.2 Inside of an Atom

Number of periods allotted: 6 Periods

After completing this section, students will be able to:

- Describe the structure of an atom as a nucleus containing protons and neutrons, surrounded by electrons in shells (energy levels);
- State the relative charge and approximate relative mass of a proton, a neutron and an electron;
- Draw hydrogen atoms, including the location of the protons and electrons, with respect to the nucleus;
- Differentiate between mass number and atomic number;
- Determine the number of protons, neutrons, and electrons in an atom.

Forward Planning

Take enough time to prepare for this section. Read the contents on inside of an atom from the student's text book and other reference books to well understand the subject matter. Make a plan of your own on how to manage students during group discussion, presentation and assessment. In your plan show the time allotted for each activity and exercise. Prepare charts that show the diagrammatic representation of atoms. Prepare also a table chart that shows the nature and location of subatomic particles.

You are advised to read this guide before the lessons to get more information about the activities and the methodologies you follow.

Teaching Aids

- Chart that shows the diagrammatic representation of the atom (Figure 2.1)
- A table chart that shows nature and location of subatomic particles (Table 2.2).
- Periodic table.

Subject Matter Presentation

You are advised to use group discussion, question and answer and gapped lecture as teaching methodology.

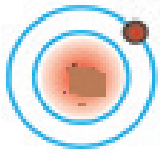
Parts of an Atom

You can start this topic by asking students to tell the two parts of an atom. After their attempts, describe the two regions (atomic nucleus and atomic shell) of an atom diagrammatically.

Subatomic Particles

You can start this topic by asking students to tell the three fundamental subatomic particles. Then let the students discuss **Activity 2.3** in groups. This activity is designed to help students practice drawing model of atoms and realize the location of subatomic particles. After they draw the model of hydrogen on their exercise book, invite some of the groups to draw the mode on the board using

colour calk based on the instruction described in text book. Then harmonize concepts as follows:



After activity 2.3, describe the subatomic particles and then discuss the location, charge and relative mass of subatomic particles.

You can summarize this topic by using **Table 2.2** from the student's text book.

After that, let them do **project work** in groups. This project work is designed to help students develop their skills and creativity in preparation of hydrogen model from locally available materials. Here it is advisable for you to allow students to do project work on their own in groups. Give enough days for students. Assist them whenever they are in need. When they complete the project work, tell group representatives to show and describe their project work to the rest of the class.

Atomic Number and Mass Number

You can start this lesson with the **Activity 2.4**. The activity is designed to brainstorm students on atomic number and mass number. Let them discuss this activity in groups for a few minutes and invite some students from different groups present the group ideas to the class. After their presentation, harmonize concepts using periodic table. (Refer **activity 2.5**.

Then, continue by defining 'atomic number' and 'mass number' and showing their symbolic notation. Then illustrate how they are written or described with the symbols of elements as shown below.



Determination of the electrons, protons and neutrons

Here you are also advised to give **Activity 2.5**. Let them do this activity in groups for a few minutes and invite some students from different groups present the group ideas to the class. After their presentation, harmonize **activity 2.4** and **activity 2.5** using periodic table as follows:

Atoms	Atomic number	Mass number	Proton number	Neutron number	Electron number
H	1	1	1	0	1
He	2	4	2	2	2
Li	3	7	3	4	3
Be	4	9	4	5	4
B	5	11	5	6	5
C	6	12	6	6	6
N	7	14	7	7	7
O	8	16	8	8	8
F	9	19	9	10	9
Ne	10	20	10	10	10

Next show how number of protons, electrons and neutrons are determined (calculated) from atomic number and mass number using examples.

Finally give **Exercise 2.2** as a home work.

Assessment

Assess each student's work throughout section 2.2. You can assess students' performance based on your record about each student's performance during the teaching learning process. Your records can be based on the participation of each student in:

- discussing the activity 2.3 and 2.4,

- presenting their views after discussion,
- Answering questions during mini-lecture,
- Answering exercise 2.2,
- Project work,
- Answering questions given as quiz or test.

Appreciate students working above the minimum requirement and encourage them to continue working hard. For low achievers, identify their learning difficulties and help them to achieve the minimum requirement.

Additional Questions

1. What are the atomic numbers and mass numbers of elements whose atoms are made up of
   a. 13 protons, 14 neutrons and 14 electrons.
   b. 16 protons, 16 neutrons and 16 electrons.
2. How many protons, neutrons and electrons are there in atoms of the following elements?
   a. Calcium (Z =20, A = 40)
   b. Sodium (Z = 11, A =23)

Answers to Additional Questions

1. a. Atomic number = 13, mass number = 27

   b.. Atomic number = 16, mass number =32

2. a. 20 protons, 20 neutrons and 20 electrons

   b.. 11 protons, 12 neutrons and 11 electrons

Answers to Exercise 2.2

Particle' Name	Location	Actual Mass (g)	Relative Mass (amu)	Relative Charge
Proton	Nucleus	$1.673\ 10^{-24}$	1	+1
Electron	Outside nucleus	$9.109\ 10^{-28}$	0	-1
Neutron	Nucleus	$1.675\ 10^{-24}$	1	0

1. i. fluorine ii. 19
2. neutron = 7, proton = 7, and electron = 7

2.3 Molecules

Number of periods allotted: 3 Periods

After completing this section, students will be able to:

- define molecules;
- give examples of monatomic, diatomic and polyatomic molecules;
- use models or particles model diagram to represent molecules of elements and compounds.

Forwarding Planning

Prior reading about molecules from the student's text book and other reference books is very useful for the teacher. This section contains one exercise only. Do it before the lesson and check the answers from this guide. Prepare charts that show diagrammatically monoatomic, diatomic and polyatomic molecules. Make a plan of your own how to manage this section. In your plan show the time allotted for your presentation and exercise given to students.

Teaching Aids

- Charts that show diagrammatically monoatomic, diatomic and polyatomic molecules.

Subject Matter Presentation

To teach this section, it is advisable to use brainstorming, question and answer, and presentation as methods of teaching.

Molecules of Elements

You can start this lesson with the **Activity 2.6**. The activity is designed to brainstorm students on molecules and examples of molecules. Let them discuss

this activity in groups for a few minutes and invite some students from different groups present the group ideas to the class. After their presentation, harmonize concepts as follows:

1. A molecule is the smallest particle of an element or a compound that can exist freely in nature.
2. Monoatomic molecules: He, Ne, Ar, etc.
   Diatomic molecules: H_2, Cl_2, F_2, etc.

Then, explain about molecules of elements by giving examples of monoatomic, diatomic and polyatomic molecules those are not mentioned by students. Here it is advisable to use the diagrams of monoatomic, diatomic and polyatomic molecules that you brought to the class.

Molecules of Compounds

Continue teaching by asking students what molecules of compounds are and giving examples. After their attempts, tell them the appropriate definition and examples by referring student's text book.

Finally give them **Exercise 2.3** as homework.

Assessment

Assess each student's work by observing how a student is involved in discussing the **Activity 2.6**, in her or his groups, answering questions raised during presentation. Your assessment should be based also on their trial to do questions given in exercise 2.3.

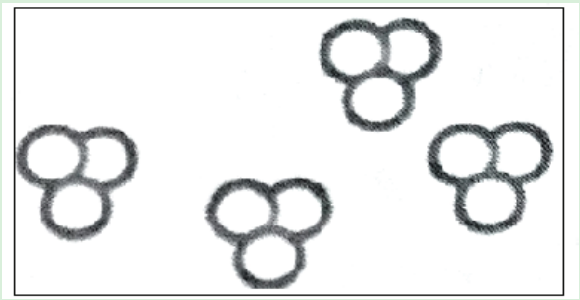
Appreciate students working above the minimum requirement and encourage them to continue working hard. For low achievers, identify their learning difficulties and help them to achieve the minimum requirement.

Answers to Exercise 2.3

1. A molecule is the smallest particle of an element or a compound that can exist freely in nature.

2.

a. Monoatomic molecule
b. Diatomic molecule
c. Polyatomic molecule
d. Polyatomic molecule
e. Monoatomic molecule
f. Diatomic molecule



3.

a. Molecule of element
b. Molecule of compound
c. Molecule of compound
d. Molecule of element
e. Molecule of compound
f. Molecule of element

Answers to the Review Exercises on Unit Two

I. True/ False

1. True
2. True
3. False
4. False
5. False**Multiple choices**
6. B
7. D
8. B
9. C

10. A
11. C
12. A
13. C
14. C

II. Give short answers

15. Atomic nucleus and atomic shell (electron)
16. Proton, neutron and electron
17. Atomic number = 8, number of protons = 8, number of neutrons =8, number of electrons = 8 and mass number = 16.

References

1. Darrel D. Ebbing, Steven D. Gammon, General Chemistry, 9th edition, 2009, Houghton Mifflin company, Boston New York.
2. Edward W. Pitzer, Introductory Chemistry, 1st edition, 2014.
3. H. Stephen Stoker, General Organic and Biological Chemistry, 5th edition, U.S.A
4. Paula Yurkanis Bruice, Organic Chemistry, 4th edition.
5. Peter Atkins, Julio de Paula, Physical Chemistry, 9th edition, 2010, W.H. Freeman and company, New York.
6. Raymond Chang, General Chemistry: the essential concepts, 3rd edition, 1988, Random House, New York.
7. Steven S. Zumdahl, Susan A. Zumdahl, Chemistry, 8th edition.

UNIT THREE

CLASSIFICATION OF COMPOUNS

Number of periods allotted: 23 periods

Unit Overview

This unit deals with the classification of compounds. It is divided in to four subunits. The firs subunit tries to introduce the classification of compounds as organic and inorganic.

The second subunit discusses organic compounds. The simplest type of organic compounds that contain carbon and hydrogen only are hydrocarbons. It only gives much emphasis to the following three major types of hydrocarbons: alkanes, alkenes and alkynes. Even through the chemistry of these hydrocarbons is very vast, it focuses on the formulas and names of the first eight alkanes, alkenes and alkynes. Some of the uses of hydrocarbons such as methane, propane and butane and ethyne are discussed. In addition, the importance of some oxygen containing derivatives of hydrocarbons such as ethanol, ethanoic acid and formalin are also explained.

The third subunit describes inorganic compounds. First, it presents classification of inorganic compounds. Next, it presents the definitions and properties of oxides, acids and bases. In this section, some experiments are also designed to be conducted to show the properties of acids and bases, and preparation of sulphur dioxide and magnesium oxide.

The fourth subunit describes neutralization reaction and salts. First, it presents some uses of neutralization in daily life. Next it presents the definitions, naming and writing formulas and uses of some common salts.

Unit Outcomes:

At the end of this unit, learners will able to:

- explain the classification of compounds into organic and inorganic;
- write the formulas and names the first ten alkanes, alkenes alkynes and list the uses some important common organic compounds;
- classify oxides into different groups and give examples of each group;
- develop skills in identifying acidic, basic and neutral solutions;
- define, and apply the concept of neutralization;
- explain the safety precautions while working with acids and bases;
- demonstrate scientific inquiry skills along this unit: Observing, classifying, comparing and contrasting, communicating, asking questions, designing experiment, drawing conclusion, applying concepts and problem solving.

Main contents

1.1 Introduction
1.2 Organic compounds
1.3 Inorganic compounds
1.4 Neutralization reaction and salts

3.1 Introduction

Number of periods allotted: 2 Periods

After completing this section, students will be able to:

- define organic compounds as carbon containing compounds and give examples;
- define inorganic compounds as compounds of elements other than carbon.

Forward Planning

Dear teacher, since students will learn using active learning methods, it is advisable to plan group formations. In addition, prior reading about classification of compounds from the student textbook or other reference books is worthwhile.

Teaching Aids

- Charts that show the classification of chemical compounds and the different classes of organic compounds.
- Sodium chloride (common salt) and sugar (sucrose)

Subject Matter Presentation

For this subunit, brainstorming, group discussion, gapped lecture and presentation can be used as active learning methods.

You can start this topic by grouping students and letting them discuss the **Activity 3.1** for a few minutes. The activity 3.1 helps them to brainstorm about the classification of substances which they learned in grade 7 chemistry. The activity also helps students to realize the earlier and modern concepts of organic and inorganic compounds. You can facilitate their discussion by clarifying misconceptions (if any). Some students may not be active in group discussions due to various reasons. It would, therefore, be better to identify these students and encourage them to participate in their respective groups. After their discussion, allow them to present their ideas to other group members. Then, harmonize their discussion by providing the following answers.

1. Organic compounds are compounds derived from living things. Early chemists believed that organic compounds differed from inorganic compounds because living things had a special 'life force' within them, which was invisible and hard to detect. According to the theory of 'life force', the only source of organic compounds was nature itself (*plants* and *animals*). Inorganic compounds are compounds derived from non-living things.

2. No. Inform them that the "life force" theory was disproved by Friedrich Wohler after he synthesized urea in 1828 for the first time.
3. Organic compound currently refers to the compounds contained in and derived from plants and animals as well as those synthesized by man artificially. Inorganic compounds are the compounds consisting of mineral constituents of the earth or generally found in non-living things.

You can use gapped lecture to discuss historical classifications of compounds as organic and inorganic. To illustrate organic and inorganic compounds, you can use familiar examples like common salt for inorganic compounds and sugar for organic compounds.

Assessment

You assess each student's work continuously throughout the subunits. This can be done by preparing a performance sheet and recording the performance of every student. You can make records based on the students' performance in discussing the activity 3.1, presenting their views after discussion and answering the questions in exercise 3.1.

By observing their performances from the record, provide them with feedback to improve students' learning (formative assessment). Appreciate students why are working above the minimum requirement and encourage them to continue working hard. For low achievers, identify their learning difficulties and help them to achieve the minimum required level for this subunit.

Additional Questions

*1. Classify each of the following compounds as organic or inorganic.

a. Glucose
b. Sodium hydrogen carbonate
c. Acetic acid
d. Carbon dioxide
e. Marble

f. Magnesium sulphate
g. Citric acid
h. Copper oxide

Answers to Additional Questions

a. Organic
b. Inorganic
c. Organic
d. Inorganic
e. Inorganic
f. Inorganic
g. Organic
h. inorganic

Answers to Exercise 3.1

a. Organic
b. Inorganic
c. Inorganic
d. Organic
e. Organic
f. Organic

3.2 Organic Compounds

Number of periods allotted: 7 periods

After completing this section, students will be able to:

- define hydrocarbons and mention at least one source of hydrocarbons;
- write the general formula of alkanes, alkenes and alkynes;
- write the specific chemical formulas of the first eight members of alkanes, alkenes and alkynes;

- describe a homologous series and its general characteristics;
- name the first eight members of alkanes, alkenes and alkynes;
- identify some common uses of organic compounds.

Forward Planning

Prior reading about the formula and naming of hydrocarbons as well as the uses of organic compounds is very useful. This subunit also contains a significant number of activities. Hence, it is advisable to refer to the answers of these activities from this teacher's guide; you also need to make a plan that shows the topic and activity you are going to deal with during each period. Your plan should be prepared in a manner that enables you complete the contents in this section within a given periods. Moreover, you need to prepare a chart that shows the classifications of hydrocarbons. You may also need a lighter to explain the importance of gaseous hydrocarbons.

Teaching Aids

- Lighter and a chart that shows the classification of hydrocarbons.

Subject Matter Presentation

Hydrocarbons

For this subtopic, gapped lecture, group discussion, presentation, and independent work can be used as active learning methods.

You can start teaching this topic with **Activity 3.2.** This activity lets them to draw their attention to the topic under discussion and realize the sources of hydrocarbons. Thus, let them do the activity in groups for some minutes. Facilitate group discussions by clarifying ideas that are not clear to them. When they complete, give chance to some group representatives to present the answers to the class. Next, harmonize ideas by telling to them the following information.

1. Hydrocarbons are compounds of carbon and hydrogen. Therefore, they

are classified as organic compounds.

2. The sources of hydrocarbons are natural gas, petroleum and coal.

The chart you prepared can be used to illustrate the classification of hydrocarbons.

Inform to students the general formula of alkanes. Use gapped lecture to introduce to students what homologous series, homologues and alkanes are. Give them **Exercise 3.2** as class work and check their work. After that, help the students to know about alkenes and give them **Exercise 3.3** as class work. Finally, let the students distinguish alkynes from alkenes and alkanes. After they do so, you may give them **Exercise 3.4** as homework.

Nomenclature (Naming) of Hydrocarbons

For this subtopic, it is better to use gapped lecture, group discussion and presentation as active learning methods.

Start teaching the contents in this topic using **Activity 3.3**. This activity helps students to understand the purpose of naming hydrocarbons and guess how one can give name to hydrocarbons. Then let them form groups and do activity 3.3. Facilitate group discussions by clarifying questions raised during their discussion. After the discussion, encourage them to present their answers to the class. Harmonize their discussions by providing answers for activity 3.3.

1. We give specific name to a hydrocarbon using a prefix that indicates the number of carbon atoms it contains and a suffix to show the group it belongs to or functional groups of molecules.
2. The names of hydrocarbons are given systematically. This means that we have to follow certain rules developed by chemists.

After summarizing concepts on activity 3.3, you can briefly introduce to students the prefixes used to indicate the number of carbon atoms in the name of alkanes, alkenes and alkynes as well as their corresponding suffixes. Let them do **Exercise 3.5** as class work independently. After each student completes the exercise, invite some students to come forward and, write their answers on the board. Finally, let

other students discuss on the answers given.

Uses of common organic compounds

For this subtopic, brainstorming, gapped lecture and group discussion can be used as active learning methods. You can start this subtopic by asking mention some important organic compounds in our daily life. The students could mention useful organic compounds such as:

- Vinegar (acheto) used to flavour salad;
- Polyvinyl chloride (PVC) and polyethylene used as plastic bottles, bags, cups, plates, shoes, pipes, etc.
- Cow dung used as a fuel for cooking and ass fertilizer;
- Soaps and detergents used for cleaning purpose;
- Pain killers and antibiotics used as medicine.

Then, continue to introduce to students the importance of methane, propane and butane, ethyne and ethanol.

Continue teaching using **Activity 3.4**. This activity helps students to understand the purpose of adding of ethanoic acid to salad. Then let them form groups and do activity 3.4. Facilitate group discussions by clarifying questions raised during their discussion. After the discussion, encourage them to present their answers to the class. Harmonize their discussions by providing answers for activity 3.4.

We add vinegar to the salad for flavoring and disinfectant purposes.

After that, continue to introduce to students the importance of formalin.

Finally, you may give **Exercise 3.6** as homework.

Assessment

You can assess students' performance based on your record about each student's performance in discussing from activity 3.2 to activity 3.4, presenting their views after discussion, and answering the question in exercise 3.2 to 3.6.

By observing their performances from the record, provide them with feedback to improve students' learning. Appreciate students why are working above the minimum requirement and encourage them to continue working hard. For low achievers, identify their learning difficulties and help them to achieve the minimum required level for this subunit.

Additional Questions

*1. Classify each of the following compounds as alkane, alkene or alkyne.

a. C_9H_{20}
b. $C_{10}H_{20}$
c. $C_{12}H_{26}$
d. $C_{10}H_{18}$

2. Write the formula of each of the following compounds.

*a. An alkane containing twenty two hydrogen atoms.

*b. An alkene containing twenty six hydrogen atoms.

*c. An alkyne containing twenty four hydrogen aatoms.

d. An alkane containing six carbon atoms.

Answers to Additional Questions

1. a. alkane b. alkene c. alkane d. alkyne
2. a. $C_{10}H_{22}$ b. $C_{13}H_{26}$ c. $C_{13}H_{24}$ d. C_6H_{14}

Answers to Exercise 3.2

1. The formula of alkanes containing 5, 7 and 9 carbon atoms are C_5H_{12}, C_7H_{16}, and C_9H_{20} respectively.

Answers to Exercise 3.3

1. The formula of alkenes containing 6, 8 and 10 carbon atoms are C_6H_{12},

C_8H_{16}, and $C_{10}H_{20}$, respectively.

Answers to Exercise 3.4

1. The formula of alkynes containing five, six, seven and eight carbon atoms are C_5H_8, C_6H_{10}, C_7H_{12}, and C_8H_{14}, respectively.

Answers to Exercise 3.5

1. The students may fill in the Table as shown below.

Number of carbon atoms	Formula of alkane	Name of alkane	Formula of alkene	Name of alkene	Formula of alkyne	Name of alkyne
5	C_5H_{12}	Pentane	C_5H_{10}	Pentene	C_5H_8	Pentyne
6	C_6H_{14}	Hexane	C_6H_{12}	Hexene	C_6H_{10}	Hexyne
7	C_7H_{16}	Heptane	C_7H_{14}	Heptene	C_7H_{12}	Heptyne
8	C_8H_{18}	Octane	C_8H_{16}	Octene	C_8H_{14}	Octyne
9	C_9H_{20}	Nonane	C_9H_{18}	Nonene	C_9H_{16}	Nonyne
10	$C_{10}H_{22}$	Decane	$C_{10}H_{20}$	Decene	$C_{10}H_{18}$	Decyne

Answers to Exercise 3.6

1. a. Alkene b. Alkane c. alkyne d. Alkane e. Alkyne f. Alkene
2. Refer from student's text book.

3.3 Inorganic Compounds

Number of periods allotted: 10 Periods

After completing this section, students will be able to:

- classify oxides into metallic and nonmetallic;
- describe the properties of acidic oxides and basic oxides;
- predict the nature of common oxides;
- prepare sulphur dioxide in the laboratory by burning sulphur in air and

use moist blue litmus paper to test its acidic nature;

- prepare magnesium oxide in the laboratory by burning magnesium ribbon in air and use red litmus paper to test its basicity in water solution;
- define acid and base;
- describe properties a of acids and bases;
- relate acidic properties to the presence of hydrogen ions and basic properties to the presence of hydroxide ions;
- name and write formulas for some common acids (HCl, HNO_3, H_2SO_4) and bases (NaOH, KOH, NH_4OH), using the periodic table, a list of ions, and rules for naming acids;
- describe how indicators can be used to classify solutions as acidic or basic;
- investigate properties of bases/alkalis experimentally;
- in group, with guidance, prepare their own indicator by extracting the colour from a vegetable, such as beetroot, or flowers and evaluate the indicator;
- investigate household chemicals using locally prepared indicators;
- explain the safety precautions while working with acids and bases;
- create a safety booklet dealing with the handling of acids and alkali;
- identify some everyday uses of neutralization;
- define and give examples of salts.

Forward Planning

Read about inorganic compounds, oxides, types of oxides, properties of oxides,

preparation of oxides (SO_2 and MgO), acids, bases, naming and writing formulas of acids and bases, acid-base indicators and properties of acids and bases from the student's text, reference books and other sources to fully understand the subject matter of the lesson. Design a plan to cover the content of the section within a given periods. Make a plan of your own on how to manage students during discussion, presentation, and assessment. In your plan, show the time allotted for group discussion on activities, presentation, for harmonizing concepts, for experiments and other activities. Try out the experiment before the lesson by yourself. Prepare yourself on the activities and exercise before the class.

Teaching Aids

- Necessary chemicals and apparatus required to perform experiments.
- Chart of safety rules in working with acids and bases.

Subject Matter Presentation

You are advised to use discussion, gapped lecture, inquiry, demonstration and experiment as your teaching methods for this subtopic. Use these methods in a way that promotes active learning. Encourage your students to participate in the teaching learning process.

Next, introduce to students that the classification of inorganic compounds into groups (oxides, acids, bases and salts) is based on their composition and properties.

Oxides

For this lesson, inquiry, gapped lecture and group discussion can be used as active learning methods.

You can start this lesson by letting students do **Activity 3.5** in groups. Activity 3.5 is designed to help students to understand concepts of oxides. Facilitate group discussions by clarifying questions raised during their discussion. After the discussion, encourage them to present their answers to the class. Finally, harmonize their discussions by providing answers for activity 3.5.

1. Oxides are binary compounds containing oxygen with any other element. For example, SO_3, BaO, etc. are oxides.
2. No

To check whether or not students have understood the definition of an oxide, let them do **Exercise 3.7** as class work.

Types of Oxides

Continue teaching the lesson by asking students how they can group oxides. After their attempts, tell them the appropriate answer. Give the definitions of metallic and non-metallic oxides using some examples. In addition to that, inform to students the oxides considered as acidic or basic oxides. Give them **Exercise 3.8** as a class work.

Properties of Acidic oxides

You can start this lesson by letting students do **Activity 3.6** in groups. Activity 3.6 is designed to help students to understand the nature of acidic oxides. Facilitate group discussions by clarifying questions raised during their discussion. After the discussion, encourage them to present their answers to the class. Finally, harmonize their discussions by providing answers for activity 3.6.

Oxides of carbon are carbon monoxide (CO) its nature is neutral and carbon dioxide its nature is acidic.

Common oxides of phosphorus are phosphorus (III) oxide or tetraphosphorus hexoxide, P_4O_6 and phosphorus (V) oxide, P_4O_{10} both are acidic in nature.

After that, tell them the properties of acidic oxides by referring student's text book.

Properties of basic oxides

Continue teaching by letting students do **Activity 3.7** in groups. Activity 3.7 is designed to help students to understand the nature of basic oxides. Facilitate

group discussions by clarifying questions raised during their discussion. After the discussion, encourage them to present their answers to the class. Finally, harmonize their discussions by providing answers for activity 3.7.

Oxides of sodium, potassium and calcium are sodium oxide (Na_2O), potassium oxide (K_2O) and calcium oxide (CaO), respectively. All are basic in nature.

After that, tell them the properties of basic oxides by referring student's text book.

Finally, give them **Exercise 3.9** as class work.

Preparation of sulphur dioxide and magnesium oxide

You may use group discussion, experiment and presentation as methodology to teach contents in this topic.

Continue teaching the lesson by introducing the common method of preparing sulphur dioxide and magnesium oxide. This is direct combination of elements (sulphur and magnesium) with oxygen.

After you introduce the method, demonstrate **Experiment 3.1**. The experiment enables them to develop skills how they can prepare acidic oxides and identify their properties. During the demonstration, tell them to watch carefully and record their observations. When you complete the demonstration, tell the students write a laboratory report in groups and then let one or two group representatives present about the experiment to the rest of the class. Make sure that their laboratory report includes the following points on the observation and analysis part of the experiment.

a. Sulphur burns with a blue flame to form sulphur dioxide.
b. The gas changes moist blue litmus to red.
c. $S + O_2 \rightarrow SO_2$
d. Sulphur dioxide is an acidic oxide.

After that, continue to demonstrate **Experiment 3.2**. The experiment enables

them to develop skills how they can prepare basic oxides and identify their properties. During the demonstration, tell them to watch carefully and record their observations. When the demonstration is complete, allow them to write a laboratory report in groups and submit it to you for checking. When you check their laboratory reports, make sure that they respond to the questions in the observation and analysis part as follows.

a. To remove dirty particles.
b. Magnesium burns with a bright white flame forming white powder.
c. $2Mg + O_2 \rightarrow 2MgO$
d. Red litmus turns blue.
e. The solution of magnesium oxide is basic.

Finally, you can give them **Exercise 3.10** as homework.

Acids

You may use group discussion, gapped lecture and question and answer as methodology to teach contents in this topic.

You can start the lesson by introducing your students to the second group of inorganic compounds, acids. Bring sample of fruits such as orange, lemon and vinegar for **Activity 3.8**. It is designed for students to understand the prominent property of acids which is common to all. Then, let them form groups and do activity 3.8 in groups for a few minutes. Next, invite some of the group representative's to present their tasting feels to the class. After their presentations, harmonize concepts with the following fact.

1. It has sour taste.
2. It also has sour taste.
3. Yes
4. Yes, because they have sour taste due to the presence of citric acid.

Next, tell them the origin of the word "acid" and explain acids in terms of their properties to release hydrogen ions (H^+) when dissolved in water and give

examples.

Bases

Continue teaching the lesson by asking students what are bases. After their attempts, explain bases in terms of their properties to release hydroxide ions (OH^-) when dissolved in water and give some examples.

Naming and writing formula of acids and Bases

To begin to teach the contents of this subtopic, start with **Activity 3.9**. This activity is designed to help students realize formulas of some common acids and bases. Then, let them form groups and do activity 3.9 in groups for a few minutes. When they complete, let some students from different groups present their opinion to the class. After the presentations, harmonize concepts as follows.

1. The formulas of hydrochloric acid, sulphuric acid and nitric acid HCl, H_2SO_4 and HNO_3, respectively.
2. The formulas of sodium hydroxide, calcium hydroxide, potassium hydroxide and ammonium hydroxide are NaOH, $Ca(OH)_2$, KOH and NH_4OH, respectively.

Continue teaching the lesson by asking students what are the rules used for naming acids and bases. After their attempts, tell them the appropriate rules those are used to naming acid and bases by referring students' text or other reference books. Give some examples for each.

Finally, give them **Exercise 3.11** as a class work.

Additional Notes for the Teacher

Naming Acids

An ***acid*** can be described as a substance that yields hydrogen ions (H^+) when dissolved in water. Formulas for acids contain one or more hydrogen atoms as

well as an anionic group. Anions whose names end in "-ide" have associated acids with a "hydro-" prefix and an "-ic" ending, as shown in **Table 3.2** from text book. In some cases two different names are assigned to the same chemical formula. For instance, HCl is known as both hydrogen chloride and hydrochloric acid. The name used for this compound depends on its physical state. In the gaseous or pure liquid state, HCl is a molecular compound called hydrogen chloride. When it is dissolved in water, the molecules break up into H^+ and Cl^- ions; in this condition, the substance is called hydrochloric acid.

Oxoacids are acids that contain hydrogen, oxygen, and another element (the central element). The formulas of oxoacids are usually written with the H first, followed by the central element and then O. We use the following five common acids as our references in naming oxoacids:

- H_2CO_3 carbonic acid
- H_3PO_4 phosphoric acid
- $HClO_3$ chloric acid
- H_2SO_4 sulfuric acid
- HNO_3 nitric acid

Often two or more oxoacids have the same central atom but a different number of O atoms. Starting with our reference oxoacids, whose names all end with "-ic," we use the following rules to name these compounds.

1. Addition of one O atom to the "-ic" acid: The acid is called "per . . . -ic" acid. Thus, adding an O atom to $HClO_3$ changes chloric acid to perchloric acid, $HClO_4$.
2. Removal of one O atom from the "-ic" acid: The acid is called "-ous" acid. Thus, nitric acid, HNO_3, becomes nitrous acid, HNO_2.
3. Removal of two O atoms from the "-ic" acid: The acid is called "hypo . . . -ous" acid. Thus, when $HBrO_3$ is converted to HBrO, the acid is called hypobromous acid.

The rules for naming anions of oxoacids, called **oxoanions,** are

1. When all the H^+ ions are removed from the "-ic" acid, the anion's name ends with "-ate." For example, the anion CO_3^{2-} derived from H_2CO_3 is called carbonate.
2. When all the H^+ ions are removed from the "-ous" acid, the anion's name ends with "-ite." Thus, the anion ClO_2^- derived from $HClO_2$ is called chlorite.
3. The names of anions in which one or more but not all of the hydrogen ions have been removed must indicate the number of H ions present. For example, consider the anions derived from phosphoric acid:

- H_3PO_4 Phosphoric acid
- HPO_4^- Hydrogen phosphate
- HPO_4^{2-} Dihydrogen phosphate
- PO_4^{3-} Phosphate

Note that we usually omit the prefix "mono-" when there is only one H in the anion.

Additional questions

Name the following acids.

a. $HClO_4$
b. $HClO_3$
c. $HClO_2$
d. HClO

Answers to the additional questions

a. Perchloric acid
b. chloric acid
c. Chlorous acid
d. hypochlorous acid

Acid – Base Indicators

You can start this lesson by revising about acids and bases that they already learnt before this subtopic. Next, introduce to students the definition of acid-base indicators and common indicators used in school laboratories.

Properties of acids and bases

Properties of Acids

Continue teaching the lesson by introducing properties of acids. First, treat the effect of an acid on an acid-base indicator. Then, allow them to do **Experiment 3.3** in groups. When they complete, let them write laboratory report in groups and submit them to you for correction. Make sure that their reports in the observation and analysis part include the following points.

Acid	**Color of the indicator in the acid solution**		
	Litmus	**Phenolphthalein**	**Methyl orange**
Dilute HCl	Red	Colourless	Red
Dilute H_2SO_4	Red	Colourless	Red
Dilute HNO_3	Red	Colourless	Red

Next, proceed to deal with reaction of acids with metals. Write the general equation and give some examples. Then, allow them to do **Experiment 3.4** in groups. When they complete, let them write laboratory report in groups and some groups present their conclusions to the rest of the class. Make sure that their presentations in the observation and analysis part include the following points.

a. Zinc is cleaned with steel wool until it is shiny to remove any coating that hinders its reaction with HCl.
b. Zinc begins to react with the acid (HCl).
c. The formation of bubbles.
d. It is colourless.
e. A popping sound is produced.

f. $Zn\ (s) + 2HCl\ (aq) \rightarrow ZnCl_2\ (aq) + H_2\ (g)$
$Zn\ (s) + H_2SO_4\ (aq) \rightarrow ZnSO_4\ (aq) + H_2\ (g)$

Then, continue to deal with the reactions of acids with carbonates and hydrogen carbonates. Write the general word equation for the reaction and give specific examples. After that, continue with **Experiment 3.5**. This experiment is suggested to assist students develop skills in performing experiments and observe the reactions practically on their own. So, have the students do the experiment in groups. Provide them the materials required for the experiment and assist them whenever they are in need. Tell them to take care since they are working with acids.

When they complete the experiment, let them write laboratory reports in groups and submit them to you for correction. Check that they answered the questions in the observation and analysis part of the experiment as follows.

a. Yes, there is
b. The formation of bubbles indicates that a gas is released from the reaction mixture.
c. The lime water turns milky. This is due to the reaction of calcium hydroxide with carbon dioxide to form calcium carbonate.
d. 1. $CaCO_3\ (s) + 2HCl\ (aq) \rightarrow CaCl_2\ (aq) + CO_2\ (g) + H_2O\ (l)$
.2. $2NaHCO_3\ (s) + H_2SO_4\ (aq) \rightarrow Na_2SO_4\ (aq) + 2CO_2\ (g) + 2H_2O\ (l)$
.3. $Ca(OH)_2\ (aq) + CO_2\ (g) \rightarrow CaCO_3\ (s) + H_2O\ (l)$

Next, continue to deal with the neutralizing effect of acid on bases. Write the word equation for the general reaction and give them specific examples. Then, continue with **Experiment 3.6**. This experiment is designed to help students discover the fact about neutralization reaction on their own. So, let them do it in groups. When they complete, let them write laboratory report and present their findings to the class. Make sure that their presentations in the observation and analysis part include the following points.

a. The solution becomes pink when phenolphthalein is added to it.
b. The colour disappears as a result of complete neutralization.
c. Actually it should not. However, the presence of a single drop of excess acid may affect the colour of blue litmus and change it to red.
d. $NaOH\ (aq) + HCl\ (aq) \rightarrow NaCl\ (aq) + 2H_2O\ (l)$

Properties of Bases

Continue teaching the lesson by introducing properties of bases. First, treat the effect of a base on an acid-base indicator. Here it is advisable for you to allow students to perform **Experiment 3.7** on their own in groups. You need only to provide them the necessary materials for the experiment. You should also follow how every group is doing according to the suggested procedures. Help the groups who need assistance. When they complete the experiment, let them write a laboratory report and present their findings to the class. After their presentations, harmonize the concepts suggested by the students with the fact using the information given below.

Base	Color of the indicator in the base solution			
	Red litmus	Blue litmus	Phenolphthalein	Methyl orange
Dilute NaOH	Blue	No change	pink	yellow
NH_4OH solution	Blue	No change	pink	yellow

Therefore, Solutions of bases change the colour of indicators.

Then, continue dealing with the neutralizing effect of bases on acids. Write the general word equation for the reaction of a base and an acid and give them specific examples. Next, allow them perform **Experiment 3.8** in groups. They should do it under your supervision. Provide them with the materials required for the experiment. Assist them whenever they are in need. When they complete the experiment, tell them to write a laboratory report. Invite some students from different groups to present their findings to the rest of the class. After the presentation, harmonize concepts using the following information.

a. The solution stays colourless.

b. Because of complete neutralization of the base with the acid.
c. It does not affect the colour of either blue litmus or red litmus paper. However, addition of a single drop of excess base can cause colour change of red litmus paper to blue.
d. $NaOH\ (aq) + HCl\ (aq) \rightarrow NaCl\ (aq) + H_2O\ (l)$

After that, let them do **Project work** in groups. This project work is designed to help students develop their skills and creativity in preparation of indicators from locally available materials. Here it is advisable for you to allow students to do project work on their own in groups. Give enough days for students. Assist them whenever they are in need. When they complete the project work, tell them to write a project work report. Invite some students from different groups to present their findings to the rest of the class. After the presentation, harmonize concepts using the following information.

1. Light red
2. We have seen the colour changes because of the presence of acidic nature (citric acid) in lemon juice.
3. 'Yes' or 'No' depend upon your work.
4. Natural indicators can prepared from locally available materials.

Characteristics of Good Indicators

✓ **Valid**: accurate measure of behaviour, practice, task that is the expected output or outcome of the investigation.
✓ **Reliable**: consistently measureable over time, in the same way by different observers.
✓ **Measureable**: quantifiable using available tools and methods.
✓ **Timely**: provides a measurement at time intervals relevant and appropriate in terms of program goals and activities.
✓ **Programmatically important**: linked to the program or to achieving the program objectives.

Precautions while working with acids and bases

Continue teaching to deal with the safety precautions while working with both acids and bases. You better use question and answer methods during your explanation on the safety precautions. After your explanation, continue with **Activity 3.10**. This activity is designed to help students take care when they working with acids and bases. So, have them discuss this activity in groups by reading different chemistry reference books. Give enough time for students. Assist them whenever they are in need. When they complete activity 3.10, invite some students from different groups to present their findings to the rest of the class. After the presentation, harmonize concepts using the following information.

Common precautions when working with acids and bases (alkalis) include:

1. Wearing eye protection (goggle).
2. Wearing protective clothing such as an apron or laboratory coat.
3. Keeping reagent bottles stoppered when not in use.
4. Wiping up all spillages straight away with a wet cloth.
5. Wear shoes that cover your feet
6. Do not smell any chemicals directly!
7. Do not taste any chemical! Even food, drink and chewing gum are prohibited in the chemistry laboratory.
8. Never add water to concentrated acid solutions. Add acid to water carefully.

Finally, give them **Exercise 3.12** as a home work.

Assessment

Assess each students work throughout subunit 3.3. You can assess students' performance based on your record about each student's performance during the teaching learning process. Your records can be based on the participation of each student in:

- discussing activities 3.5 to activity 3.10.
- presenting their views after discussion.
- performing experiments 3.1 to 3.8.

- writing a laboratory report and presenting it to the class
- answering questions during mini-lecture
- answering the question in exercise 3.7 to 3.12.
- answering questions given as quiz or test.

By observing their performances from the record, provide them with feedback to improve students' learning. Appreciate students why are working above the minimum requirement and encourage them to continue working hard. For low achievers, identify their learning difficulties and help them to achieve the minimum required level for this subunit.

Additional Questions

1. Write the acid anhydrides of the following acids.
   a. H_2CO_3
   b. H_2SO_4
   c. HNO_3

2. Write the base anhydrides of the following bases.
   a. NaOH
   b. KOH

Answers to Additional Questions

1. a. CO_2 b. SO_3 c. N_2O_5, NO_2
2. a. Na_2O b. K_2O

Answers to Exercise 3.7

1. Oxides are binary compounds that contain oxygen.
2. c, d, f, g and h are oxides. a, b and e are not oxides.

Answers to Exercise 3.8

1. basic oxides: a, c and d
   acidic oxides: b, e and f
2. metallic oxides: b, d and f
   non-metallic oxides: a, c and e

Answers to Exercise 3.9

1. a. $CO_2 + H_2O \rightarrow H_2CO_3$

   .b. $CaO + H_2O \rightarrow Ca(OH)_2$

   c. $CaO + CO_2 \rightarrow CaCO_3$

Answers to Exercise 3.10

1. a. $2Mg + O_2 \rightarrow 2MgO$ b. $S + O_2 \rightarrow SO_2$

Answers to Exercise 3.11

1. a. An acid is a substance that releases hydrogen ions (H^+) when dissolved in water. For example, HCl, H_2SO_4, HNO_3,

   .b. A base is a substance that releases hydroxide ions (OH^-) when dissolved in water. For example, NaOH, KOH, $Ca(OH)_2$,

2. hydrogen ion (H^+)
3. The students may fill in the Table as shown below.

Name	Formula	Name	Formula
Hydrochloric acid	HCl	Calcium hydroxide	$Ca(OH)_2$
Nitric acid	HNO_3	Potassium hydroxide	KOH
Sulfuric acid	H_2SO_4	Sodium hydroxide	NaOH

Answers to Exercise 3.12

1. Indicators are substances that show the presence of an acid or a base by undergoing specific color changes when placed in a solution.

Indicator	Colour in acidi solution	Colour in basic solution
Litmus paper	Red	Blue
Phenolphthalein	Colourless	Pink
Methyl orange	red	Yellow

2. a. $2HNO_3 + Na_2CO_3 \rightarrow 2NaNO_3 + H_2O + CO_2$

   .b. $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

   .c. $2HCl + Zn \rightarrow ZnCl_2 + H_2$
3. a. Washing the eye with plenty of water and then seek medical treatment.
   .b. Drinking a base such as $Mg(OH)_2$ and then seek medical treatment.

3.4 Neutralization Reaction and Salts

Number of periods allotted: 4 periods

After completing this section, students will be able to:

- identify some everyday uses of neutralization;
- define and give examples of salts;
- name and write formulas for some common salts using the periodic table, a list of ions, and rules for naming salts.

Forward planning

Read the contents on neutralization reaction and salts from the student's text and other reference books to fully understand the subject matter of the lesson. Make a plan of your own plan on how to manage students during discussion, presentation, and assessment. In your plan show the time allotted for each activity you are going to perform during every period while you are dealing with this section. Prepare ahead the necessary teaching and learning materials for this topic. Prepare yourself on the activities and exercises before the class.

Teaching Aids

- Table chart that shows names of some acids and group names of their salts (Table 3.4)