



Module 1

Upper Primary Science
My Built Environment



THE COMMONWEALTH *of* LEARNING

Science, Technology and Mathematics Modules
for Upper Primary and Junior Secondary School Teachers
of Science, Technology and Mathematics by Distance
in the Southern African Development Community (SADC)

Developed by
The Southern African Development Community (SADC)

Ministries of Education in:

- **Botswana**
- **Malawi**
- **Mozambique**
- **Namibia**
- **South Africa**
- **Tanzania**
- **Zambia**
- **Zimbabwe**

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Published jointly by The Commonwealth of Learning and the SADC Ministries of Education.

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ISBN 1-895369-67-3

SCIENCE, TECHNOLOGY AND MATHEMATICS MODULES

This module is one of a series prepared under the auspices of the participating Southern African Development Community (SADC) and The Commonwealth of Learning as part of the Training of Upper Primary and Junior Secondary Science, Technology and Mathematics Teachers in Africa by Distance. These modules enable teachers to enhance their professional skills through distance and open learning. Many individuals and groups have been involved in writing and producing these modules. We trust that they will benefit not only the teachers who use them, but also, ultimately, their students and the communities and nations in which they live.

The twenty-eight Science, Technology and Mathematics modules are as follows:

Upper Primary Science

- Module 1: *My Built Environment*
- Module 2: *Materials in my Environment*
- Module 3: *My Health*
- Module 4: *My Natural Environment*

Junior Secondary Science

- Module 1: *Energy and Energy Transfer*
- Module 2: *Energy Use in Electronic Communication*
- Module 3: *Living Organisms' Environment and Resources*
- Module 4: *Scientific Processes*

Upper Primary Technology

- Module 1: *Teaching Technology in the Primary School*
- Module 2: *Making Things Move*
- Module 3: *Structures*
- Module 4: *Materials*
- Module 5: *Processing*

Junior Secondary Technology

- Module 1: *Introduction to Teaching Technology*
- Module 2: *Systems and Controls*
- Module 3: *Tools and Materials*
- Module 4: *Structures*

Upper Primary Mathematics

- Module 1: *Number and Numeration*
- Module 2: *Fractions*
- Module 3: *Measures*
- Module 4: *Social Arithmetic*
- Module 5: *Geometry*

Junior Secondary Mathematics

- Module 1: *Number Systems*
- Module 2: *Number Operations*
- Module 3: *Shapes and Sizes*
- Module 4: *Algebraic Processes*
- Module 5: *Solving Equations*
- Module 6: *Data Handling*

A MESSAGE FROM THE COMMONWEALTH OF LEARNING



The Commonwealth of Learning is grateful for the generous contribution of the participating Ministries of Education. The Permanent Secretaries for Education played an important role in facilitating the implementation of the 1998-2000 project work plan by releasing officers to take part in workshops and meetings and by funding some aspects of in-country and regional workshops. The Commonwealth of Learning is also grateful for the support that it received from the British Council (Botswana and Zambia offices), the Open University (UK), Northern College (Scotland), CfBT Education Services (UK), the Commonwealth Secretariat (London), the South Africa College for Teacher Education (South Africa), the Netherlands Government (Zimbabwe office), the British Department for International Development (DFID) (Zimbabwe office) and Grant MacEwan College (Canada).

The Commonwealth of Learning would like to acknowledge the excellent technical advice and management of the project provided by the strategic contact persons, the broad curriculum team leaders, the writing team leaders, the workshop development team leaders and the regional monitoring team members. The materials development would not have been possible without the commitment and dedication of all the course writers, the in-country reviewers and the secretaries who provided the support services for the in-country and regional workshops.

Finally, The Commonwealth of Learning is grateful for the instructional design and review carried out by teams and individual consultants as follows:

- Grant MacEwan College (Alberta, Canada):
General Education Courses
- Open Learning Agency (British Columbia, Canada):
Science, Technology and Mathematics
- Technology for Allcc. (Durban, South Africa):
Upper Primary Technology
- Hands-on Management Services (British Columbia, Canada):
Junior Secondary Technology

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ACKNOWLEDGEMENTS

The Science Modules for Upper Primary and Junior Secondary Teachers in the Southern Africa Development Community (SADC) were written and reviewed by teams from the participating SADC Ministries of Education with the assistance of The Commonwealth of Learning.

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UPPER PRIMARY SCIENCE PROGRAMME

Introduction

Welcome to the programme in Teaching Upper Primary Science. This series of four modules is designed to help you to strengthen your knowledge of science topics and to acquire more instructional strategies for teaching science in the classroom.

Each of the four modules in the science series provides an opportunity to apply theory to practice. Learning about science entails the development of practical skills as well as theoretical knowledge. Each science topic includes an explanation of the theory behind the science, examples of how the science is used in practice, and suggestions for classroom activities that allow students to explore the science for themselves.

Each module also explores several instructional strategies that can be used in the science classroom and provides you with an opportunity to apply these strategies in practical classroom activities. Each module examines the reasons for using a particular strategy in the classroom and provides a guide for the best use of each strategy, given the topic, context, and goals.

The guiding principles of these modules are to help make the connection between theory and practice, apply instructional theory to practice in the classroom situation, and support you, as you in turn help your students to apply science theory to practical classroom work.

Programme Goals

This programme is designed to help you to:

- strengthen your understanding of science topics
- expand the range of instructional strategies that you can use in the science classroom

Programme Objectives

By the time you have completed this programme, you should be able to:

- develop and present lessons on environmental resources, needs and conservation, materials in the environment, health issues, and natural ecosystems
- guide students as they work in teams on practical projects in science, and help them to work effectively as a member of a group
- use questioning and explanation strategies to help students learn new concepts and to support students in their problem solving activities
- guide students in the use of investigative strategies to learn more about particular scientific concepts, and to find out how tools and materials are used in scientific inquiries
- prepare your own portfolio about your teaching activities
- guide students as they prepare their portfolios about their project activities

The relationship between this programme and the science curriculum

The science content presented in these modules includes some of the topics most commonly covered in the science curricula in southern African countries. However, it is not intended to cover all topics in any one country's science curriculum comprehensively. For this, you will need to consult your national or regional curriculum guide. The curriculum content that is presented in these modules is intended to:

- provide an overview of the content in order to support the development of appropriate teaching strategies
- use selected parts of the curriculum to develop specific teaching strategies
- explain those elements of the curriculum that provide essential background knowledge, or that address particularly complex or specialised concepts
- provide directions to additional resources on the curriculum content

How to Work on this Programme

As is indicated in the programme goals and objectives, this programme allows you to participate actively in each module by applying instructional strategies when exploring science with your students and by reflecting on that experience. There are several different ways to do this.

Working on your own

You may be the only teacher of science in your school, or you may choose to work on your own so you can accommodate this programme within your schedule. If this is the case, these are the recommended strategies for using this module:

1. Establish a schedule for working on the module: choose a date by which you plan to complete the first module, taking into account that each unit will require between six to eight hours of study time and about two hours of classroom time for implementing your lesson plan. For example, if you have two hours a week available for study, then each unit will take between three and four weeks to complete. If you have four hours a week for study, then each unit will take about two weeks to complete.
2. Choose a study space where you can work quietly without interruption, for example, a space in your school where you can work after hours.
3. If possible, identify someone who is interested in science or whose interests are relevant to science (for example, a mathematics or science teacher in your school) with whom you can discuss the module and some of your ideas about teaching science. Even the most independent learner benefits from good dialogue with others. It helps us to formulate our ideas—or as one learner commented, “How do I know what I’m thinking until I hear what I have to say?”

Working with colleagues

If you are in a situation where there are other teachers of science in your school or in your immediate area, then it is possible for you to work together on this module. You may choose to do this informally, perhaps having a discussion group once a week or once every two weeks about a particular topic in one of the units. Or, you may choose to organise more formally, establishing a schedule so that everyone is working on the same units at the same time, and you can work in small groups or pairs on particular projects. If you and several colleagues plan to work together on these modules, these are the recommended steps:

1. Establish and agree on a schedule that allows sufficient time to work on each unit, but also maintains the momentum so that people don't lose interest. If all of you work together in the same location, meeting once a week and allocating two weeks for each unit, this plan should accommodate individual and group study time. If you work in different locations and have to travel some distance to meet, then you may decide to meet once every two weeks, and agree to complete a unit every two weeks.
2. Develop and agree on group goals, so that everyone is clear about the intended achievements for each unit and for each group session.
3. Develop a plan for each session, outlining what topics will be covered and what activities will be undertaken by the group as a whole, in pairs, or in small groups. It may be helpful for each member of the group to take a turn in planning a session.

Your group may also choose to call on the expertise of others, perhaps inviting someone with particular knowledge about teaching or about a specific science topic to speak with the group, as long as this is in keeping with the goals of the module and of the group.

Your group may also have the opportunity to consult with a mentor, or with other groups, by teleconference, audioconference, letter mail, or e-mail. Check with the local coordinator of your programme about these possibilities so you can arrange your group schedule to be compatible with these provisions.

Colleagues as feedback/resource persons

Even if your colleagues are not participating directly in this programme, they may be interested in hearing about it and about some of your ideas as a result of taking part. Your head teacher or the local area specialist in science may also be willing to take part in discussions with you about the programme.

Working with a mentor

As mentioned above, you may have the opportunity to work with a mentor, someone with expertise in science education who can provide you with feedback about your work. If you are working on your own, your communication with your mentor may be by letter mail, telephone, or e-mail. If you are working as a group, you may have occasional group meetings, teleconferences, or audioconferences with your mentor.

Using a learning journal

Whether you are working on your own or with a group, it is strongly recommended that you use a learning journal. The learning journal serves a number of different purposes, and you can divide your journal into compartments to accommodate these purposes. You can think of your journal as a "place" where you can think out loud by writing down your ideas and thoughts, and this "place" has several "rooms".

Ideas/Reflections/Questions

In one part of your journal, you can keep notes and a running commentary about what you are reading in each unit, write down ideas that occur to you about something in the unit, and note questions about the content or anything with which you disagree. You can use this part to record general ideas about how to use some of the content and strategies in the classroom. If you consistently keep these notes as you work through each unit, they will serve as a resource when you work on the unit activity, since you will have already put together some ideas about applying the material in the classroom. This is also the section of the journal for your notes from other resources, such as books or articles you read or conversations with colleagues.

Plans

This is the section where you work on your activity for each unit. At the start of each unit, you should start considering what activity you will choose to do, and then develop your ideas as you go along. Each activity will also have specific guidelines.

Observations/Reflections

This is the section where you record your observations about classroom experiences, how students seem to tackle various situations and how each instructional strategy works in practice. This is the place to record your notes after you implement the unit activity about what you feel worked well and what could be improved. If you are part of a group, you can keep your notes about good practice and effective group dynamics, based on the group experience, in this section.

Resources available to you

Although these modules can be completed without referring to additional resource materials, your experience and that of your students can be enriched if you use other resources as well. There is a list of resource materials for each module provided at the end of that module. You can also identify other resources that can enhance the teaching/learning experience, from among materials that may be locally available. These include:

- human needs and caring for the environment
- magazines that have articles about environmental sciences
- books and other resources (including the internet) about science that may be available in your school or community library

Tips for selecting resources

Working with locally available resources may require selecting those that are most appropriate from among materials that may not be complete or relevant. When reviewing materials to see if they will help you with the module, consider:

- Which module topics does this material address?
- Is it possible the ideas in this material are transferable to the science classroom?
- Is it possible the ideas in this material are transferable to the technologies included in the module?

ICONS

Throughout each module, you will find some or all of the following icons or symbols that alert you to a change in activity within the module.

Read the following explanations to discover what each icon prompts you to do.

	Introduction	Rationale or overview for this part of the course.
	Learning Objectives	What you should be able to do after completing this module or unit.
	Text or Reading Material	Course content for you to study.
	Important—Take Note!	Something to study carefully.
	Self-Marking Exercise	An exercise to demonstrate your own grasp of the content.
	Individual Activity	An exercise or project for you to try by yourself and demonstrate your own grasp of the content.
	Classroom Activity	An exercise or project for you to do with or assign to your pupils.
	Reflection	A question or project for yourself— for deeper understanding of this concept, or of your use of it when teaching.
	Summary	Synthesis of the module or unit
	Unit or Module Assignment	Exercise to assess your understanding of all the unit or module topics.
	Suggested Answers to Activities	Answer keys
	Time	Suggested hours to allow for completing a unit or any learning task.
	Glossary	Definitions of terms used in this module.

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Module 1

My Built Environment



Module 1 Overview

The aim of this module—“My Built Environment”—is to create awareness among your pupils and to enable you to use the local environment as your resource for teaching and learning various aspects of the built environment.

The module has four units:

Unit 1: Human Needs.

Our discussion focuses on the human basic needs: food, transport, warmth, and shelter.

Unit 2: Human Activities

In order to satisfy our needs as humans, the environment has had to be tempered through activities like agricultural and mining as a way to sustain our lives.

Unit 3: The Effect of Human Needs and Activities on the Environment

Human activity can have both positive and negative effects. This unit examines the necessity of balancing activities that have a positive effect on human productivity and a negative effect on the environment.

Unit 4: Protecting the Environment

After we have been made aware of the damage being done to the environment arising from human activities, we will discuss some corrective and preventive measures.

This module focuses on the way we use the environment to meet human needs and how those activities affect the environment. While we recommend a variety of teaching strategies, we encourage you to use your local environment as a learning resource.



Learning Outcomes

After completing this module you should be able to:

- demonstrate knowledge and understanding of the various components of the units
- put into practice the acquired teaching skill
- develop a positive attitude towards the care of the local environment

Unit 1: Human Needs



Introduction

You as a human being, like other animals, have basic needs. You need water, air, food, and shelter for you to survive and have an acceptable quality of life.

Our basic needs also constitute some of the rights that each of us is entitled to. However, it is not always possible for you to realise all your basic needs. As you know, in situations of war or famine, many millions of people may be displaced, thereby lacking food, clean water, and shelter. You may have heard or read about countless human beings who do not have adequate shelter, lack clean water, and may go without food due to poverty.

The aim of this unit is to increase your awareness of the needs of human beings in their environment. To achieve this objective the teaching strategy that we will use is based on the local environment as a teaching and learning resource. You will practice using and making worksheets which you will use in your local environment. The activities in this unit will focus on the topic **Human needs**.



Unit Objectives

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

- name the basic human needs in terms of food, water, shelter, transport, and warmth
- discuss why transport is an important human need
- list the types of food that humans need and how the body uses this food
- state the deficiency diseases that result when one type of food is lacking in the diet
- explain the importance of correct food handling and storage
- list the most common cooking fuels in your region and state their advantages and disadvantages
- explain why humans need shelter
- explain why humans live in certain places
- make and use worksheets to teach about human needs



What are Basic Human Needs?

The main objective of this unit is to make you aware of the needs of human beings in the environment. Although our needs as humans vary, the basic needs for our lives are the same. In order for us to have a wholesome life, we need **food, fuel, shelter, water, and transport**.

Food

You will realise all animals, including yourself, need food. However, the food you take in is complex and has to be broken down to smaller units which your body uses as a source of energy to build, repair, and maintain body tissues and also to keep your body healthy and free from dietary deficient diseases.

Foods needed

All animals, including us, must eat food but have you ever thought why we must eat, what we must eat and what the food does to our bodies?

The food that humans eat differs a great deal in different parts of the world, and generally people choose to eat food they enjoy. The food we enjoy is not necessarily healthy food. However, when choosing food, it is very important not only to choose what we enjoy but also to choose foods that will keep us healthy, help our bodies grow, and give us energy.

It is important that we take in a daily supply of food that is required and this food must be in the correct proportion. We call a meal with adequate nutrients in correct proportion a **balanced diet**.

What type of food do you think constitutes a balanced diet? We will consider this aspect in the next section.

Types of food needed

Humans need a daily supply of water, energy, roughage, and growth-promoting foods. In this section, you will examine the foods needed for a balanced diet.

Energy giving foods

We often refer to energy giving food as consisting of **carbohydrates**, fats, and oils. Fats and oils, as you know, are also called **lipids**.

Sometimes we call energy foods fuel foods because when they are broken down they give out energy or fuel which is used to drive our body reactions and activities.

Fats and oils are much more concentrated in terms of energy they produce. As a result, it is better to eat less fatty foods, but more carbohydrates. Since fats and oils are not always broken down by our bodies easily, they are usually converted to fatty tissue which is stored as a layer of fat beneath the skin.

Fat layers are also deposited around our vital organs like the heart and kidneys. This fatty layer acts as a cushion that prevents injury, and also helps “insulate” the body against heat loss.

Some examples of foods that give us energy are:
Carbohydrates—which we find in sugar, rice, bread, potato.
Oils and fats (lipids)—such as margarine, cooking oil.

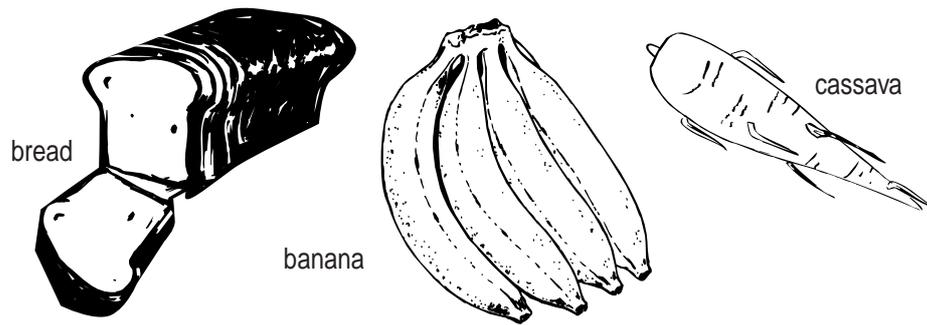


Figure 1.1: Energy-Giving Foods.

In some African countries fatness is considered as a symbol of well being but biologically, excessive fat is not healthy.

Body-building foods

Body-building foods contain **proteins** and these foods are also known as growth foods.

When digested (broken down) proteins are converted to amino acids which are used as body-building blocks. Amino acids not only build our bodies, they also repair the wear and tear of our bodies.

Although we obtain proteins from animal and plant food, animal foods have all the necessary amino acids. Thus animal proteins are said to be first class proteins while plants are second class proteins.

Except for soya beans which have a high proportion of amino acids, all vegetable proteins have small quantities of amino acids which are rarely in the required proportion. Therefore, there is a danger for vegetarians to have insufficient proteins, which can lead to malnutrition. A good vegetarian will include a wide range and variety of vegetable foods in order to get the required proteins. You are familiar with examples of protein foods such as meat, fish, eggs, beans, and nuts.

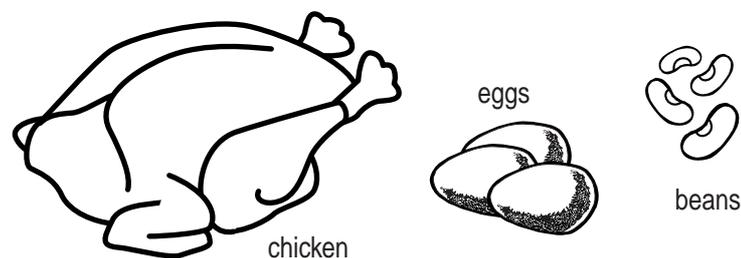


Figure 1.2: Body-Building Foods.

Protective foods

We often refer to vitamins, minerals, and salts as **protective foods** because they help the body to prevent specific dietary deficiency diseases.

Minerals and Salt

Why are minerals and salt (meaning table salt, or sodium chloride) important in our diet? Mineral salts are a wide variety of inorganic elements that are present in most natural foods. These elements are required in small amounts for many of the body's metabolic activities and as constituents of complex body tissues and substances.

For example:

- Calcium is important for the growth of bones and teeth.
- Haemoglobin in the red blood cells contains iron. If there is not enough iron, our blood will have fewer red blood cells. This will lead to a condition known as anaemia. If you suffer from anaemia, you look pale and feel tired. All natural foods, fruits, and vegetables are a rich source of minerals.

Vitamins

Vitamins are complex organic compounds present in small quantities in natural foods. We require vitamins in small amounts and they are absorbed in the small intestines.

Vitamins have no energy value, but they are essential for maintaining normal metabolic activities. If our diet is deficient in vitamins, we will have impaired metabolic reactions and the result will be disorders which are referred to as deficiency diseases. For example, vitamin C deficiency causes scurvy, a disease that makes gums swell and bleed, and wounds will be slow to heal.

Food rich in vitamins, minerals, and salt are fresh fruits and vegetables, fish, and meat.

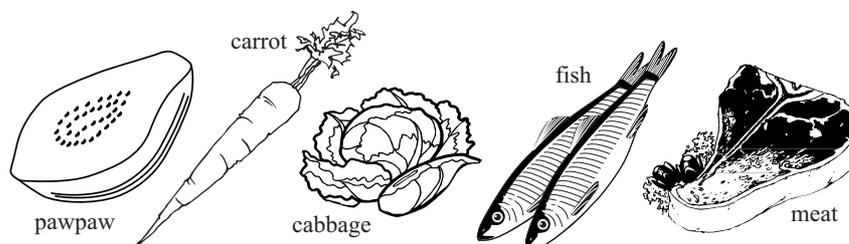


Figure 1.3: Foods rich in vitamins, minerals, and salts.

Water

Water is essential for all living things. Water makes up a large proportion of the human body, and it is estimated that 65% to 70% of total body weight is water. We cannot over emphasise the importance of water because all chemical reactions of the body take place in a solution. If we were deprived of food we would live for more than 60 days, but deprived of water we will only live a few days.

Roughage

Roughage (dietary fibre) is made up of the cell walls of plants which pass through our digestive system without being digested or absorbed.

Dietary fibre improves digestion, can help lower cholesterol, improve the way the body metabolises glucose, and eliminate constipation. On average, adults need about 30 g of fibre in their daily diet.

The absence of dietary fibres or roughage leads to **constipation** and other disorders of the large intestine.

Dietary deficiency diseases

When we do not take in food in the correct proportion and of the right type we suffer from deficiency diseases.

Deficiency diseases are caused by **malnutrition**. Malnutrition may arise when an organism does not get sufficient amounts of some types of foods or has an excess of one or more nutrients.

Even in industrialised countries, people suffer the effects of improper diet. For example, over-consumption of highly refined foods or foods with high fat content or low dietary fibre can result in obesity, heart disease, digestive disorders, and reduced life expectancy. In developing countries, malnutrition and undernourishment lead to weakened immune systems and pose many serious health problems. The following table outlines the causes and symptoms of some of the diseases caused by malnutrition.

Figure 1.4: Examples of Nutritional Disorders

Disease	Symptoms*	Causes (deficiency in diet)
Kwashiorkor	<ul style="list-style-type: none">• Poor health• Blubbery cheeks• Bloated belly• Dry, dark and wrinkled/blotchy skin that may flake off• Wiry hair that is lighter in colour than normal (kwashiorkor affects children)	Lack of Proteins
Marasmus	<ul style="list-style-type: none">• Extreme loss of weight• Extreme weakness• Lack of growth• Diarrhoea (marasmus affects children)	General lack of food (starvation)

Figure 1.4: Examples of Nutritional Disorders (continued)

Disease	Symptoms*	Causes (deficiency in diet)
Pellagra	<ul style="list-style-type: none"> • A smooth, red tongue • A sore mouth, and ulceration of the inside of the cheeks hence sore, cracked, dry skin on cheeks • The skin on the neck, chest, and back of the hands may become brown and scaly • Digestive problems: most likely nausea, vomiting, and diarrhoea • Insomnia, depression, confusion, and rapid changes of mood • Untreated, pellagra can result in dementia and death 	<p>Vitamin deficiency disease caused by a lack of niacin, an element found in the B-group vitamins.</p> <p>Pellagra most commonly occurs in those whose staple diet is corn. It also may result from alcoholism, cirrhosis of the liver, and non absorption of food, which is often caused by chronic diarrhoea due to malnutrition or other diseases.</p>
Anorexia	<ul style="list-style-type: none"> • Loss of weight, possibly extreme • Poor health and weak with low immunity to diseases • Permanent physical and brain damage may result • Women may become sterile 	<p>A person, very often teens, begins a strict slimming diet leading towards self-starvation and ends up with a total aversion to food. Possibly parental pressure and society standards (peer influence). An extreme desire to perfectionism with high standards and low self-esteem.</p>
Bulimia	<ul style="list-style-type: none"> • Hidden habit of cyclic pattern of overeating and purging (self-induced vomiting) • Such a person gradually becomes thinner and thinner • Displays poor health, possibly suffers from hernias, ulcers, a dependence on laxatives or diuretics, damage to tooth enamel due to the acid in the digestive fluids of the vomit, ruptured esophagus due to repeated vomiting, the sufferer may even bleed to death. The purging may cause heart failure in extreme cases. • Depression and permanent physical and brain damage may result 	<p>Possibly parental pressure and society standards (peers, usually teens, influence). An extreme desire to perfectionism with high standards and poor self-esteem.</p> <p>The cycle of bingeing and purging involves consumption of a large amount of food in a rapid and automatic process over which the bulimic feels no control. He or she then deals with the resulting physical discomfort and anxiety about weight gain by inducing vomiting, resorting to a combination of restrictive dieting, excessive exercising, use of laxatives, and diuretics agents/products.</p>

Figure 1.4: Examples of Nutritional Disorders (continued)

Disease	Symptoms*	Causes (deficiency in diet)
Rickets	<ul style="list-style-type: none"> • Softening and bending of bones • Other signs include: bony lumps on skull, swelling of wrists and ankles, swollen abdomen, bowlegs, slow in learning to crawl and walk 	Rickets is due to a dietary lack of vitamin D or to lack of sunlight which stimulates vitamin D formation in the skin. Regular milk or infant formula and commercially available milk are a good source of adequate amounts of vitamin D.
Scurvy	<ul style="list-style-type: none"> • Swelling and bleeding of gums, low resistance to infectious disease • Bleeding under the skin, particularly under the nails. Bruising may occur spontaneously and wounds may not heal. • Poor maintenance of the normal structure of the connective tissues resulting in weakening of the blood capillaries, with subsequent bleeding, and defects of the bones • Other possible symptoms include irritability, fever, loss of appetite, lethargy, weight loss, and aching of the joints. 	Lack of vitamin C
Night-blindness	<ul style="list-style-type: none"> • Inability to see at low light intensities. Vision is abnormally impaired in dim light or at night. 	Can be due to a lack of vitamin A. A deficiency of visual purple (rhodopsin) in the light-sensitive rod cells of the retina at the back of the eye. Vitamin A is its principal constituent.
Beriberi	<ul style="list-style-type: none"> • Disorders of the nervous and blood systems, retarded growth. The disease involves nerve degeneration (peripheral neuritis) and muscle disease (myopathy), particularly affecting heart muscles. The patient displays the following symptoms: fatigue, diarrhoea, loss of weight, and heart failure 	Deficiency of vitamin B1 (thiamine) in the diet. Like many dietary diseases, Beriberi is sometimes associated with chronic alcoholism because many alcoholics fail to eat a balanced diet.

Figure 1.4: Examples of Nutritional Disorders (continued)

Disease	Symptoms*	Causes (deficiency in diet)
Goiter	<ul style="list-style-type: none"> • Swelling of the thyroid gland 	<p>Lack of iodine (e.g., found in iodized salt)</p> <p>Iodine is the principal component of thyroxine, the thyroid gland's hormone. When there is lack of iodine in the diet, the pituitary gland responds by releasing more thyroid-stimulating hormone. This causes enlargement of the thyroid gland. There are other non-dietary causes of Goiter.</p>
Anaemia	<ul style="list-style-type: none"> • Tiredness, weakness, depleted oxygen supply 	Lack of iron
Obesity	<ul style="list-style-type: none"> • Overweight or excessive weight for height and bone structure • High blood pressure • Shortness of breath, and recurrent respiratory disease in general • Diabetes (high blood sugar) • Heart trouble such as atherosclerosis (hardening of the arteries). If the arteries become blocked, the sufferer has a heart attack • Knock-knees (the lower legs are curved outward so that the knees touch each other and the ankles are apart; backache) 	<p>Over-indulgence of calories rich foods such as fat, butter, cream, red meat, sweets, chocolates, and the so-called 'junk foods' or 'fast foods'. These foods are high in fat and carbohydrate content and low in fibre.</p> <p>Fats may be deposited as cholesterol in the arteries. The arteries taking oxygen and nutrients to the heart then become clogged up with fatty deposits.</p>

*Some symptoms in the table can be brought about by other health problems. Only trained health care service personnel can make a precise and definitive diagnosis.

Food handling

Although you have looked at the different types of food that are essential for a healthy body, you must bear in mind that food must be handled and prepared correctly so the natural goodness and nutrients are preserved.

You know that food nutrients can be destroyed by exposure to heat, over-cooking, or storage for too long. Therefore, we must plan our food preparation in such a way that we do not lose any nutrients through poor or inappropriate handling.



Individual Activity 1

1. What do you think the energy is used for? Some of the energy is converted to heat energy which helps to keep us warm. Can you list other uses of energy produced from food?
2. Can you give some reasons why fatness is not healthy?
3. Can you list the foods that give us roughage?
4. How important are vitamins in your diet?



Classroom Activity 1

Worksheet – Foods

Complete the following Nutrients Worksheet with the nutrient function in the body and examples of corresponding food sources available in your region.

Here is an example:

Nutrient type: Protein

Function: Essential for growth (body building), it provides the building blocks for making new cells/tissues

Example of food source: Fish

Nutrient type	Function	Example of food source
Proteins		
Carbohydrates		
Fats		
Vitamins		
Salts and Minerals		
Fibre/Roughage		
Water		

Fuels

Cooking fuel

We cook food to make it palatable and more appealing. Cooked foods tend to have better flavours and tastes than uncooked foods.

Firewood

Since prehistoric times, humans have burned firewood for warmth and to cook their food. Firewood was used as source of fuel because it was plentiful, easy to carry and it burned well. However, with modernisation, industrialisation and an increase in population, firewood is no longer plentiful. In most of our rural communities, women are the ones who collect firewood and they have to walk many kilometres to collect firewood.

Problems of firewood

Apart from firewood being a diminishing resource, wood is not easily available in many villages and towns. In your area, do you see signs of deforestation resulting from using wood as a source of fuel?

Using wood for cooking fuel has a number of other disadvantages. Wood contains many impurities and produces excessive amounts of smoke and ash. For this reason, charcoal is a better source of fuel.

Charcoal

Charcoal is a hard black substance that is produced when wood is heated at very high temperatures (275°C) with a controlled supply of air. For example, most of the charcoal in Zambia is produced by traditional methods.

Traditional method of making charcoal

The information below should give you some idea of how charcoal is made. Trees are cut into logs of about two metres in length. These logs are piled up to 1.5 metres high and covered with a layer of grass and a layer of earth. The whole pile is completely covered leaving a small opening on the windward side where a fire is lit. The amount of air entering is carefully controlled. The wood is burned for a few days to a week.

Through this process, impurities in the wood are burned off and the carbon becomes concentrated. The resulting charcoal has less volume than wood, burns with a hotter flame, and produces less smoke than burning wood.

Problems of charcoal

Is charcoal a common source of cooking fuel in your area? How do you think charcoal production affects forests and woodlands?

Forests are considered to be a renewable resource, however we need to keep in mind that every time we cut down a tree, it takes many years to grow a replacement. Deforestation results in the erosion of topsoil, reduced water retention in soil, and can eventually lead to the formation of deserts.

Fossil fuels

What are fossil fuels? Fossil fuels are hydrocarbon deposits formed from plant and animal remains that have been buried in the earth's crust. As a result of high burial temperature and pressure, these organic remains have undergone physical and chemical changes, resulting in the formation of coal, petroleum, and natural gas. Due to the long timeframe required for the formation of fossil fuels, they are considered to be a non-renewable resource.

Problems with fossil fuels

Fossil fuels contain high amounts of carbon, as well as impurities such as sulphur, and burning them releases carbon dioxide and sulphur dioxide into the atmosphere. Carbon dioxide, a greenhouse gas, contributes to global warming. Sulphur dioxide is converted to sulphuric acid in the atmosphere and returns to earth in the form of acid rain.

On a global scale, our rapid consumption of fossil fuels is depleting the resource and contributing to environmental problems. Many countries are beginning to look at other forms of energy that are renewable, economical, and less harmful to the environment.

Electricity

It has long been thought that hydroelectric power plants provide a clean, safe source of energy. It is true that the generation hydroelectricity does not result in the emission of pollutants, such as carbon dioxide and sulphur dioxide. However, damming rivers affects watersheds, fish migration, and restricts the siltation of floodplains, greatly reducing their fertility. The creation of large reservoirs results in the loss of land previously occupied by forests or used for agriculture, and it is even thought that the vast amounts of rotting vegetation in these reservoirs releases significant amounts of greenhouse gases.

The Kariba Dam is an example of a large hydroelectric project. Built in the late 1950s on the Zambesi River along the border of Zambia and Zimbabwe, it created a reservoir (Lake Kariba) that covers more than 5000 square kilometres.

One alternative to large-scale hydroelectric projects is the **run-of-the-river** plant. Run-of-the-river hydro plants use the natural flow of river water to generate electricity. Sometimes a small dam or weir is built but relatively little water needs to be stored. However, many run-of-the-river plants would be needed to generate the same amount of electricity as one large hydroelectric dam, making them less economically viable. As a comparison, the Kariba Dam has a generating capacity of 1300 megawatts, while a run-of-the-river plant might produce as little as several hundred kilowatts.

Alternative energy sources

Nuclear energy is expensive and not readily available in developing countries. Generating electricity with nuclear energy does not release pollutants into the atmosphere, however, there is a problem with safe, long-term disposal of nuclear waste.

Renewable and non-polluting energy sources are being studied more closely. Solar energy is a renewable resource. Among the many solar technologies that have been developed are devices to heat homes, dry crops, and cook food. The sun is Earth's primary source of energy.

Wind energy is a renewable energy source that is receiving more consideration as an alternative source of electrical energy. Wind turbines are being built to reduce sound emissions and minimise their visual impact on the landscape.

Warmth

Humans and other organisms are unlike machines which are capable of working under a wide range of conditions. Living things are more sensitive and if the conditions vary too much, humans, animals, and other living organisms cannot function and will die.

When our bodies lose heat quickly, our internal body temperature falls to dangerous levels. We can also suffer from hypothermia when the temperature becomes too low. Keeping ourselves warm is important, hence our bodies have devised natural methods to retain body heat.

Another method of staying warm is to keep our homes warm and to wear warm clothes.

Water

Water is essential for the biological and physical activities of living organisms. To lead a healthy lifestyle, humans require a reliable source of clean, fresh drinking water. In this section, we will briefly examine how water becomes contaminated, and the effects of contamination. You will learn more about the importance of water in Module 4 of this programme.

Contamination of water

Not all the water around us is safe to drink because it can be contaminated by harmful substances. How does this happen? Water is contaminated when we allow animal and industrial wastes into the source of water. When there are a large number of people living near a water source, water can be easily contaminated because waste disposal becomes difficult. In such cases, sewerage materials are released into rivers and underground water sources. Water is also contaminated by bathing, swimming, urinating, and defecating in the water.

Our use of fertilisers, pesticides, and other chemicals contribute to contamination of water. Poor handling and storage of water can also lead to contamination of water. Another term for contaminated water is polluted water.

Effect of contamination of water

Polluted or contaminated water can give rise to diseases such as dysentery, diarrhoea, and typhoid. Water contamination affects our quality of life.

Industrial wastes and chemicals released into the water are poisonous. This contaminated water may poison fish and even us.

Our waste may contaminate water and cause water borne diseases such as cholera. This disease can be fatal.

In order to secure our well-being and improve our quality of life, it is important to treat water and make it safe to drink.

Shelter

Shelter is our basic need as humans because it protects us from harsh environmental conditions such as cold, rain, and heat. However, due to economic, social, and political reasons, not everyone has shelter.

Due to urbanisation and modernisation, many rural people have migrated into towns and cities in search of better quality of life. However, not all the people that have moved to towns and cities have adequate shelter. Some of them have ended up in shanty compounds where the conditions are squalid.

When people get together in a particular area, they form a settlement. A settlement is any place where people live, this can range from a homestead to a huge industrial centre. A settlement can be permanent or temporary.

In developing countries, many people live in rural communities. The pattern of settlement differs from region to region, depending on factors such as relief, soil type, drainage, occupation, and history.

In most urban areas, human settlements may be displaced by road construction and industries. Such displacements will force people to move into shanties or they become homeless.

Transport

Transportation is a vital basic need that ensures our other needs are met. Transportation can be by rail, road, or air. Railway, road, and air transportation is very important to keep produce moving to the markets and raw materials to factories.



Figure 1.5: Types of transport.

The most common means of transport in developing countries are the ox-drawn cart, the bicycle, wooden scooters, or travel by foot.

Although roads can be a rapid means of transport, there is little cross frontier road transport between countries in Africa.

If you made a survey on railway transport, you would see that it is the most suitable and inexpensive form of transport for moving heavy, bulk goods over a long distance. Unfortunately the railway system does not form a network as it was built to tap the rich mineral resources.

Air transport is a rapidly expanding transport system for carrying both passengers and freight.

If you consider river transport it is the cheapest but, unfortunately, our rivers in Africa have limited use for transport.

Worksheets

When you use worksheets on the local environment, you will find them ideal as they reduce the amount of explanation and guidance that you will give to your pupils while in the field.

You will also find worksheets or work cards useful for your pupils because they can cater to mixed ability groups. The worksheet or cards allow your pupils to work at their own pace. This gives you some freedom to move around and give individualised instructions.

You should not limit the use of worksheets or work cards to field work only. You can also use them for other activities such as group discussion, question and answer, project work, observation, and assessment and evaluation.

Before you begin to construct a worksheet/card, consider the following:

The worksheet must meet your lesson objectives.

- It caters to a range of abilities, your slow and fast learners alike. Your worksheets should be set at a pace that caters to different ability groups.
- The language you use should not be ambiguous or too difficult.
- The quality and layout should appeal to your pupils. You do not need to be an artist or graphic designer to make good worksheets. Some ways to produce a good worksheet are: ask pupils who are good artists to draw the diagrams, cut out pictures or diagrams from old books and magazines and photocopy from books that give permission to photocopy.
- Your worksheet must encourage the use of a variety of locations. The pupils should not be desk bound, they should be able to use the worksheet in their local environments.
- Design your worksheet in such a way that a variety of resources are used.
- Your worksheet should also cover a variety of learning/teaching situations and methods.
- You can design a specific worksheet to support each of the following types of classroom activities.
 - exposition
 - demonstration
 - reading
 - writing

- research
 - discussion
 - seminar
 - case study
 - role playing
 - debate
 - simulation
 - practical work
 - document handling
 - programmed instruction
- Your worksheets should address special needs, such as group interests, gender, and ability.
 - You should have a variety of activities covered in worksheets.
 - Your pupils can easily be discouraged and become disinterested if every time they are presented with a worksheet, they only must do field work.
 - Your worksheet should allow pupils to think and process information.

Worksheets will help you to interpret the syllabus and enhance your general view of teaching and learning.



Individual Activity 2

In this activity you will be expected to construct a worksheet. You will use the topic of food as a basic human need to construct the worksheet.

Making worksheets and work cards is one teaching strategy or method that you can use to teach the topic of human needs. In this activity you will learn how to construct good worksheets and cards.

Activity 1

In this activity, you will explore the technique of collecting information.

Go into your local community and collect some information on foods. Find out what types of food they eat, how many different types of foods are available to that community, and why they eat these foods. Enter the information on the worksheet below:

Type of food available	Class of food	Food eaten	Reason

Activity 2

In this worksheet, you will be required to do some fieldwork. This teaching strategy is covered in detail in Unit 4.4 of this Module. While doing fieldwork, you will concentrate on the skills of collecting, observing, and comparing.

Visit your local clinic or health centre and collect the following information which you will enter into the worksheet.

Find the number of children suffering from dietary deficiency disease. Find out the ages of these children and the occupation of their parents or guardians. Identify the most common dietary deficiency disease in your area. How does it relate to the occupation of the local people? What conclusion do you draw about the diet needs with regard to the individual's age and the occupation?

Activity 3

Instructions:

Copy the following exercise into your workbooks. Answer the questions by filling in the blank spaces with one of following words:

rickets, kwashiorkor, marasmus, malnutrition, deficiency disease, roughage/dietary fibre

1. Constipation is a condition a person may suffer from when they do not have enough _____ in the diet.
2. _____ is when you do not have the right kind of food in the diet.
3. Children suffering from _____ have soft bones which bend as they grow.
4. A child who has poor growth, skin that looks cracked, and hair that has lost its colour may be suffering from _____.
5. A child who does not eat enough food rich in carbohydrates, proteins, and fats, and at times spend days starving may suffer from _____.
3. Anaemia is a type of _____.

Activity 4

Work card

In this work card the main teaching strategy is group discussion. Another teaching strategy used is report presentation.

Topics for group discussion or report presentation:

Discuss and describe the main diseases resulting from malnutrition in your community. Advise how they can be avoided by using locally available foods and resources.

Group discussion

Group discussion requires careful organisation, otherwise most of your pupils will sit idle without participating. To organise a group discussion effectively, take the following into account:

- Arrange your class into small groups of four to five pupils.
- When grouping pupils, take into account gender and abilities.
- Hand out the worksheet or write the topics for discussion on the chalkboard. Make sure that pupils understand the question.
- Apart from the main topic of discussion, include questions that will stimulate and guide their discussion.
- The pupils should elect someone to lead the discussion and someone else to record it. Make sure that the same pupil is not always chairing or recording. Rotate the responsibilities.
- While the discussions are going on, observe and assess the pupils discussions. Some of the points to consider would be: are the pupils participating, are they focused on the topic, do they agree/disagree, do they respect other people's ideas, and are they taking turns?
- Give pupils as much guidance as possible and give them feed back during their discussion.
- Let pupils record their findings and let them select one pupil who will present their ideas to the rest of the class.

Activity 5

Work card

- Identify the foods that are eaten in your area. In your group, discuss the food values, why that community eats that particular food, and discuss some of the tradition beliefs related to foods.
- Write your findings in a report and prepare to present your findings to the whole class.
- To assist with your discussion, here are some questions:
 1. List the foods that are eaten in your area.
 2. Classify these foods into energy-giving, body-building, and protective foods.
 3. Where do members of the local community get their food?
 4. What foods are commonly grown in this area and what foods are usually bought?
 5. What is the cost of the food that is bought?
 6. Find out some of the traditions and beliefs that relate to food.
 - Do these relate to the food eaten in the area?
 - Do these traditions and beliefs explain why certain foods are not eaten?

Write your findings in a short report.



Individual Activity 3

Now that you have practised how to use a worksheet, in this section you will practice the skills of writing good, effective worksheets. The worksheet that you design should be used by your pupils in class.

Use your knowledge of human needs to prepare a series of worksheets that cover the topics of warmth, shelter, transport, and water. Also plan a series of lessons where you would use the worksheets you have just prepared.

Activity 1

Worksheets on warmth

Design a worksheet which can be used by either grade 5, 6, or 7 pupils to find out more about warmth.

The classroom activity you should use is question and answer technique. Include the following questions:

What is warmth?

Why is it important to keep warm?

How can you keep warm?

What happens to the body when it fails to keep warm?

Activity 2

Worksheets/cards on shelter

Design a worksheet that uses the investigation method. Pupils should find out as much information as possible on shelter. Let your pupils work in groups or pairs and come up with a short report that gives the type of shelter commonly found in the locality, factors that influence human settlement, and the effect of human settlement on the environment.

Worksheets/cards on transport

For this worksheet, design activities that will cause your pupils to collect information from the **local environment**. The pupils should collect information on the type of transport that is readily available, what it is used for, alternative means of available transport, and the impact of the transport industry on the environment.

Worksheet on water

Design a series of worksheets to teach about the human need for water, its importance, its source, its use, and the effects of contamination.



Self-Marking Exercise

In this section, you as a teacher should assess the knowledge and skills you have acquired after going through this unit and undertaking practice activity.

Below are some questions that will help to assess yourself.

1. List the five basic needs that are considered important for human life.
2. Give reasons why the above needs are considered to be important.
3. List at least three types of foods that are required for the good health of every human being.
4. Why is it wrong to say that vitamins, minerals, and salt protect the body from diseases?
5. Give at least two reasons why undernourishment is common in developing countries.
6. List some types of classroom activity that can be supported by a worksheet.
7. Why is transport considered to be a basic need?
8. What points did you consider when constructing your worksheets/cards?
9. What do you look for to ensure that pupils group discussion is effective?
10. Why should pupils collect information from the local environment?



Summary

In this unit, we have looked at human needs. The most important needs that we have identified are water, shelter, warmth, transport, and food.

We have also looked at problems associated with acquiring and using these resources.

The teaching strategies you used in this unit were work cards and worksheets. Worksheets can include a variety of teaching methods, such as project work, fieldwork, investigation, observing, classifying, question and answer, and many more. There are many other methods or strategies you can use to teach this topic, but we chose worksheets to illustrate how you can vary the activities.

Another teaching strategy you can use is group discussion. If you do not plan a group discussion well, the groups can become noisy and a breakdown in discipline will result. However, if you plan the discussion well, you will reap the following results:

- a large number of pupils participating
- shy pupils becoming assured and confident
- the faster learners will help the slower learners
- learning becomes more relaxed and interesting
- your pupils can handle tasks
- you will have an opportunity to attend to slower learners



Reflection

In this unit you considered some work that you would cover with upper primary classes and you were able to plan lessons for your classes.

With your colleagues, discuss how you would use the same strategies for a higher or lower grade. Also discuss other teaching strategies you would use to cover the same topic.



Unit Assignment

1. What is a balanced diet?
2. Why is it important that one day's food supply should not have more or less of the requirements of energy food, body-building, and protective food?
3. Why is adequate shelter often absent in urban shanty compounds?
4. Define what is meant by renewable and non-renewable energy.
5. What are the disadvantages of using charcoal and firewood as a source of energy?
6. Why should you use a variety of teaching strategies?
7. When would you use group discussion as a teaching strategy?
8. Give one indicator you would use to measure the success of a particular teaching strategy.
9. Give reasons why, despite the world increase of food production, countries still do not have enough food.

Unit 2: Human Activities



Introduction

In this unit you will study ecology which is the study of relationships of living organisms with each other and their environment. Ecology is a science that provides the foundations of our understanding of agriculture, forestry, and fisheries. Ecology is often called upon to predict the effect of everything from pollutants to the construction of dams. When we engage in these activities we manipulate the ecosystem.



Unit Objectives

After studying this unit you should be able to;

- identify some important human activities
- build a model of a local area using appropriate materials
- state that people need materials from the environment
- explain why people live in certain areas
- use role play as a way to present problems or controversial situations
- explain how the quality of human life has been affected by modernisation and industrialisation
- demonstrate how scientific research has led to increased food production
- state the effect of agricultural practices on increased food production



Human Activities and the Environment

The study of energy flow in an ecosystem is important because it has implications for the ways we obtain our food and energy requirements, and the way we obtain food and energy constitutes some of our activities.

We will discuss some of the activities that we are involved in.

Industries

There has been a dramatic rise in the human population in recent years and demand for natural resources has increased enormously. Modernisation and industrialisation have resulted in the establishment of permanent settlements in which large areas of land are used for industry and agriculture.

You may be aware that breakthroughs increased in various areas of science and technology have resulted in increased industrial activities. These have been set up to improve the quality of our lives.

Some types of industries that have been set in our areas include:

Electricity Production

The various ways to generate electricity were covered in the previous unit. Modern society depends on electrical devices. They make our work easier, whether in our homes or in industry, and have contributed to the expansion and modernisation of industry.

No matter how we generate electricity—whether we use solar collectors, wind turbines, nuclear reactors, power stations that burn coal or oil, or build hydroelectric dams—we have an impact on the landscape and the environment.

How is electricity produced in your region?

Which methods have the greatest impact on the landscape? Which have the least impact?

Which methods release pollutants into the environment?

When the Kariba Dam was completed and formed Lake Kariba, about 50 000 people were displaced from their homes and villages. Have similar situations occurred in your region?

Manufacturing Industries

Many types of manufacturing industries produce goods and services that improve the quality of our lives. Industry also results in the construction of factories, road building, expanding human settlements, and creates a demand for fuel.

Has a manufacturing industry located in your area had an impact on the local environment? What is the evidence of this? Now look around your home and school, and identify manufactured items that make your life more enjoyable and your work easier. If some industries had to be closed due to fuel shortages or lack of other resources, which of these items would you be prepared to live without?

Mining industries

Many countries in Africa have mineral deposits, such as copper, diamonds, zinc, and gold. These minerals have to be mined, concentrated, and refined.

Abandoned mines, mining waste, and mining-related industries can contaminate surrounding soil and water supplies. In many parts of the world, mining companies must undertake reclamation projects that include restoring the local environment to a usable state and conducting periodic tests to ensure that plants, fish, livestock, and wildlife are not exposed to toxic substances, and that the area is suitable for human habitation.

Agriculture activities

Widespread implementation of the results of technological and scientific research have resulted in an increase of and advancement in crop production. Areas of agriculture that have been increased and expanded include:

Fish farming and fish management

Fisheries are an important source of food and, unlike other food species, fish have not been domesticated. The amount of fish we catch depends on biological, economic, social, and political factors, and a quota system. If there is a fishery and/or a fish hatchery, find out how it is managed. Are there measures in place to prevent over-fishing?

Over-fishing in some parts of the world has resulted in depleted stocks of wild fish and in recent years, fish farms have been developed. The structure and operation of fish farms vary, depending on the area and the type of fish being farmed. Do you have a fish farm in your area? If so, try to arrange a visit so you and your pupils can learn how it is managed.

Crop farming

Our crop production has increased due to improved irrigation methods, use of fertilisers, and the successful breeding of drought resistant, early maturing, and high yielding varieties.

If you do research on crop production, you will find that genetic engineering has resulted in favourable genes, such as disease resistance, being transferred into host plants.

Other developments in crop farming that may interest you are the development of salt tolerant plants for semi-arid regions.

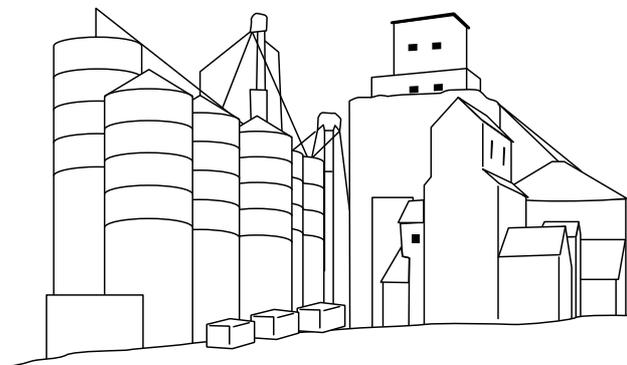


Figure 2.1: An example of a European/North American grain elevator.

Our use of intensive farming programmes based on artificial optimising of the environmental conditions has resulted in higher crop yields. You may be familiar with green houses and hydroponics as some of the many methods used for intensive agricultural programmes.

However, we must not forget that food production methods in many parts of the world remain undeveloped and the final crop yield depends on climatic factors, particularly rainfall. Most farmers in southern Africa still depend on traditional methods of agriculture, making our food very expensive. What traditional methods are used by farmers in your region?

Livestock farming

Improved methods of livestock farming, including disease control and selective breeding, have led to well developed systems for rearing poultry, cattle, and other livestock.

The distribution of cattle depends on climate. Some areas are not favourable because there is too much rainfall or the environment promotes disease. In some African cultures, cattle are a symbol of wealth and are not readily sold. Owners are more interested in numbers than in specific breeds, and overstocking can occur.

In some parts of Africa, raising sheep is not possible because conditions are too hot and wet. In hot, dry areas, non-wool bearing sheep can be reared. Can you name countries in Africa where sheep farming is practised?

Goats, pigs, and chickens are kept by both commercial and subsistence farmers.

Increased industrialisation and the expansion of cities have taken over areas previously used for pastoral farming. What are the implications for farmers? Identify a livestock area in your region. How much land is available for this type of farming?



Classroom Activity

In this section you will have an opportunity to use role play. Role play is a dramatic presentation of a problem arising from conflicting views. In role play you ask your pupils to choose roles and they are then to behave exactly as they would if they were that person.

In role play you can have a number of actors or one main actor who will role play until the whole situation is presented or they can stop just before they make a point. The pupils who watch are then given a chance to decide what they would do in that situation.

Activity

A new investment company has approached your village. The company would like to get 500 hectares of land on which they would grow cotton, and build a ginnery and a textile industrial. The village headman has called for a meeting to discuss the issue.

You will need to select six pupils to role play this very important meeting. Each pupil will be given a card that contains the main points. The selected pupils will be briefed and allowed to practice before they role play. At the end of the role play, participants will have to answer the following questions:

- What are the ways in which the village uses the land?
- After listening to the arguments, do you think the company should go ahead and invest? Give reasons.
- What are the effects of the investment on the environment?

Card I - Village Headman

As a village headman you are expected to:

- make arrangements for the meeting
- chair the meeting, and maintain order during the proceedings
- explain the main purpose of the meeting before the meeting starts

In the course of discussion you must emphasise that:

- the investment will mean the villagers have less land
- although the investment will create jobs, improve roads, and bring development to the area, the villagers should also consider its effect on the environment

Card II - Company spokesman

The company spokesman will argue that such an investment will:

- result in improved quality of life
- bring industrialisation and modernisation. There will be factories, this will result in the village having access to piped water and electricity.
- make the village more accessible because roads will be built. Improved roads will result in the introduction of bus services, better health facilities and education.
- allow villagers to transport their produce to market
- create employment

Card III - One of the Villagers

This person will speak on behalf of the other villagers against the idea and express his reservations because:

- part of the 500 hectares of land includes the only river to the village and an old disused cemetery
- although the cemetery is not in use, building over it will disturb the spirits of the ancestors, displacing them from their resting place
- there is fear that the village will lose access and rights to the river, their only source of water
- there will be too many foreigners in the area who will corrupt the morals of the young men and women
- land available for food crops will be reduced, leading to hunger

Card IV - An environmental conservationist

The conservationist argues that the investment will have the following impact:

- The project will result in environmental degradation because species will become extinct as the land is cleared. The fumes from the factory will pollute the air and chemical waste will pollute the water.
- Presence of heavy earth-moving vehicles in the construction stage will disturb the plants and animals of the area. Noise will chase away some animals, and will cause deafness. The development is incompatible with the village way of life.

Card V - A school teacher who also acts as a consultant

- The role of the teacher is to offer guidance.
- When the discussion is not proceeding according to the expected, the consultant intervenes and asks questions and guides the proceedings.

Card VI - Villager Two

Villager Two supports the investment and represents a group of villagers who support the idea because:

- The investment will bring health facilities and schools very close to the village.
- Although people will stop growing food crops, they will work at the factory and earn money that they can use to buy food.
- There will be better housing facilities and a general improvement in the standard of living.

To begin, the village headman will open the meeting and the investor will be asked to present his proposal. This will be followed by arguments for and against. You must ensure that the expected outcome is achieved, so you may introduce other facts and relevant materials for discussion.

Confine the role play activity to about fifteen minutes. This should allow sufficient time for each player to make their points. To expand the activity, you can assign two pupil assistants to each player. Before beginning the role play, give these small groups about fifteen minutes to prepare their statements and arguments. This will take more time, but will allow more pupils to participate.

At the end of the role playing, let the whole class discuss the arguments. After class discussion in groups, pupils answer the questions.

After participating in role play you will be confident to use this strategy as a teaching method. What do you think are the advantages of role play from your observation? You may have observed that the role play activity:

- is motivating
- allows pupils to relate what they have learned to real-life situations
- helps pupils focus on the problem and find solutions
- stimulates participation, promotes group learning

- narrows the gap between classroom practice and everyday life
- encourages pupils to read/research for information



Individual Activity

Plan and prepare a lesson on human activity. In this lesson use role play as the main classroom activity. You will need to do the following:

- Formulate a problem that relates to an aspect of human activity or identify a controversial or topical issue related to human activities in your local environment.
- Select the pupils who will participate in the role play.
- Give each participating pupil information about their role.
- Allow these pupils time to discuss, research and have some time to practice.
- Let pupils role play in front of the whole class.
- Discuss the role play afterwards.
- Ask pupils to answer questions that result from the role play and questions that you have designed.



Self-Marking Exercise

1. What problems did you encounter in using role play?
2. List four advantages of role play. Which one did you find was the most important?
3. List four main human activities that are used to meet human needs.
4. Give two advantages of the results of the advancement in science and technology research.
5. What incentives can be put in place to assist farmers to:
 - (i) improve their livestock
 - (ii) sell livestock more readily



Summary

In this unit we have looked at some of the human activities that have taken place in the last twenty years, resulting in great urbanisation. Modernisation and improved quality of life have resulted in an increase in human population, which in turn has made demands on the natural resources, leading to more industries and more agricultural activities.



Reflection

In addition to what has been discussed in this unit, many more types of human activity take place, and these will vary from region to region. With your pupils or colleagues, reflect on both the positive and negative aspects of human activity in your community. How have these activities affected the people and the environment?



Unit Assignment

1. List at least two advantages and two disadvantages of modernising fishing.
2. State some advances that have been made in agriculture.
3. What are some of the benefits of scientific advancements to the quality of human life?
4. An increase in population has led to an expansion of housing: this has led to a need for waste disposal. The community has opened a large rubbish dump for domestic waste disposal. How will this affect the environment?
5. When do you use role play as a teaching strategy?
6. Give two advantages and two disadvantages of role play.

Unit 3: The Effect of Human Needs and Activities on the Environment



Introduction

In recent years, the dramatic rise in human population has created an increased demand on natural resources. This demand has, in turn, led to an increase in the activities aimed at meeting human demands.

Our manipulation of the environment has had both positive and negative effects. These changes may not be immediately obvious and in fact, it is believed that we are only beginning to realise the long-term consequences of many human activities. Some of these consequences include:

- global warming due to increased atmosphere carbon dioxide
- ozone hole or depletion due to the action of CFCs (chlorofluorocarbons)
- pollution of air, land, and water
- acid rain due to air pollution



Unit Objectives

At the end of this unit, you should be able to:

- describe the improvement of soil fertility as a result of using fertilisers
- describe the effect of human settlement on the environment
- identify and list ways of conserving plants, animals, fish, and the environment
- state the importance of conserving plants and animals
- explain the role that humans play in the balance of nature
- describe the impact of irrigation on the environment
- discuss the effects of agricultural practices on the environment
- discuss the effect of overcrowding of fish to their food supply
- explain how water can be polluted
- state how water pollution can be reduced
- discuss the effect of pests on food production and the environment



Human Population and its Effect on the Environment

In Units 1 and 2, we identified human needs and the activities associated with meeting those needs. Before we examine the effects of our activities on the environment, it is helpful to put these needs into a larger context.

The following graph illustrates that global human population has been increasing, and continues to increase, at a rapid rate. In 1930, the world's population was two billion. By 1999, it had tripled to six billion, and the human activities required to meet the needs of this population increased accordingly. If population growth continues at its present rate, it will double to twelve billion by 2050.

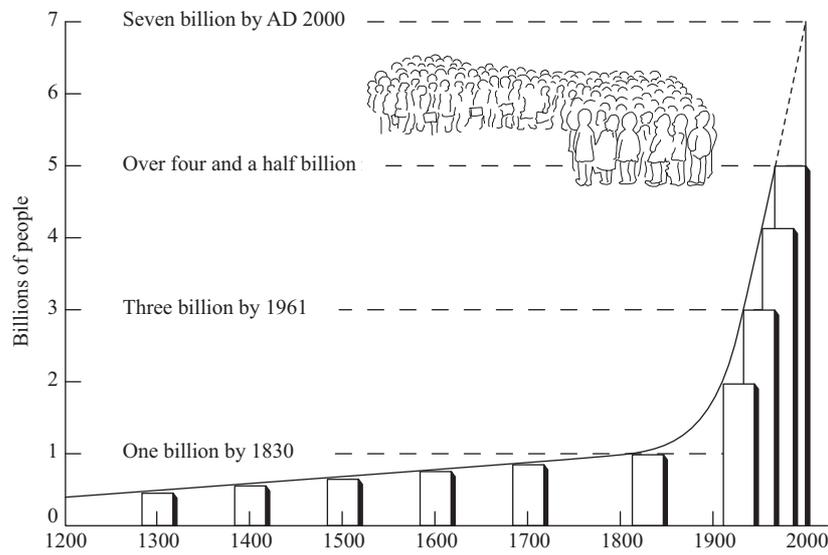


Figure 3.1: Human population growth curve.

Do you think the earth's resources can sustain this many people? In sub-Saharan Africa, the average annual increase in population is currently about three per cent, but the increase in food supply is only one per cent.

Effects of industrial activities on the environment

In spite of the Earth's vast size, only a small fraction of the planet, plus the atmosphere that extends about 10 km, can support human activity. If we pollute or destroy any part of this, it reduces the portion available to sustain life.

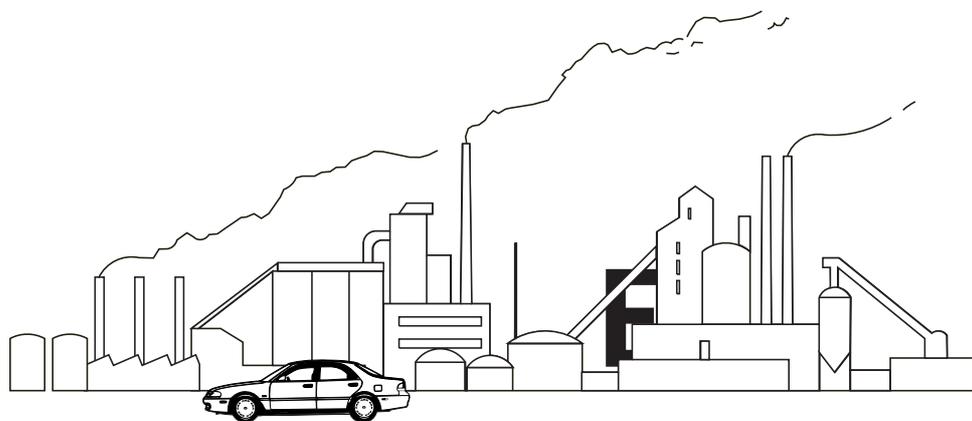


Figure 3.2: Exhaust fumes contain invisible and visible gases.

Burning Fossil Fuels

The burning of fossil fuels releases small particles of ash into the atmosphere, as well gases such as carbon dioxide, sulphur dioxide, and oxides of nitrogen. These materials can remain suspended in the atmosphere for long periods of time and can be transported hundreds of kilometres by wind currents. Some of these gases will also dissolve in water vapour droplets and eventually fall back to Earth's surface as acid rain.

Carbon dioxide, often referred to as a greenhouse gas, accumulates in the atmosphere and contributes to climate change and global warming.

Acid rain knows no borders and it can be a global problem. Where it falls, acid rain increases the acidity of topsoil and the water in lakes and rivers. If the acidity reaches a high enough level, plants and animals begin to die. Acid rain can also erode the surfaces of buildings.

Particles of ash and soot can fall as a dry deposit that blackens buildings, masonry, and washing on the line. Dust and soot settling onto plants can cut off the sunlight and reduce respiration and photosynthesis. Inhaled in large amounts, these particles cause serious respiratory ailments in humans.

Other industrial pollutants and their effects:

- (i) Sulphur dioxide corrodes metal railings, balustrades and bridges, and kills plants.
- (ii) Oxides of nitrogen corrode metals and stone and can have harmful effects on people, especially those with anaemia or lung disease.
- (iii) Lead poisoning.

Mining and Industrial Waste

In addition to atmospheric pollution, the disposal of solid and liquid industrial wastes also creates a problem. Some manufacturing industries produce toxic and non-biodegradable by-products that can pollute waterways and topsoil. Mining operations leave behind abandoned strip mines, slag heaps, and settling ponds that can introduce heavy metals into the surrounding topsoil and water supply.

Effect of agricultural activities on the environment

Fish farming

Advancement and modernisation of our fishing industry has resulted in better and more efficient methods of fishing.

We now use larger nets, faster and more powerful vessels that are less dependant on the weather, and have access to larger areas. Improved methods of detecting and transporting fish have resulted in more fish being caught. All these improved methods have threatened fish with extinction because young and old fish are caught. Spawning fish are caught which results in fewer fish being reproduced. On the other hand, fish in small bodies of water, if left to multiply would become overcrowded.

Overcrowding causes shortages of food, oxygen, and space. Food shortage will result in death of fish and over crowding will make it difficult for fish to find an area to lay its eggs. In an overcrowded pond, the spread of disease is increased. To reduce overcrowding, some fish are removed, a process known as cropping.

Overfishing can be reduced by putting restrictions on the amount of fish caught, giving fishermen quotas and closing the fishing season during the breeding season.

Livestock farming

There have been many improvements in the management of livestock, including selective breeding and better medical care. As a result, the quality of the meat and dairy products available to consumers has been greatly improved. In some areas, however, increased size of herds combined with unfavourable climatic conditions has led to overgrazing and the deterioration of pasture land.

Crop farming

Advancements in food production include improved methods of irrigation, an increase in the use of herbicides, pesticides, and fertilisers, and developments in the area of genetic engineering. Some consider the use of fertilisers to be crucial for guaranteeing sufficient food supplies for an increasing population. On the other hand, the careless overuse of fertilisers causes problems with nearby lakes and rivers. The run-off of excessive amounts of fertiliser stimulates the growth of algae in water supplies, ultimately reducing oxygen levels in the water and destroying habitats of aquatic plants and animals.



Individual Activities

Activity 1

In this unit you will be “using the local environment”. You have done this before. You will be required to observe and collect information which you will use in writing a report. Individually or in pairs, go into your community to collect information.

Find out the main activity of the community.

Decide on whether you would classify that community as industrial, agricultural, or mining.

List the ways in which the community benefits from the activity.

How would you classify the community—rural/urban, wealthy/poor?

Are the basic needs of transport, shelter, warmth, food, and clean water being met?

What danger does the activity pose to the environment?

How would you reduce or minimise the risks to the environment (use factors you have identified).

Write a report on your findings.

Activity 2

You, as a teacher, will be required to design a lesson in which using the local environment will be the main classroom activity.

Your pupils will be expected to work in small groups, in their environments. They will be required to make observations, collect information, discuss their findings, and present their report.

Before you ask your pupils to do the exercise, survey the area in which pupils will carry out their investigation.

If possible, one group of pupils should survey a river or pond, another should visit a commercial farm, another an industry, and the last group should survey the area around the school.

If your class is large you will need to include more areas.

Prepare a worksheet which pupils will use to carry out this activity.

Plan a group activity in which pupils will carry out an investigation in a specified area in the environment.

Organise the pupils to write a report on their findings



Classroom Activity

The following demonstration can be used to illustrate how much of the Earth's surface is available to provide a basic human need—our food.

You will need:

- apple, or another round, firm fruit (choose a firm fruit that does not contain a lot of juice, or a large central seed)
 - knife
 - cutting board or cloth
1. Hold up the whole apple and tell your pupils that it represents the planet Earth.
 2. Cut the apple into quarters.
 3. Tell your pupils that $\frac{3}{4}$ of the apple represents the surface of the planet that is covered with water and is therefore uninhabitable. Set the three pieces aside.
 4. Show your pupils the remaining $\frac{1}{4}$ and tell them it represents all the land surface of the earth.
 5. Cut the remaining $\frac{1}{4}$ of the apple lengthwise into four equal sections and remind your pupils that each of these pieces represents $\frac{1}{32}$ of the earth.
 6. Show three of these pieces ($\frac{3}{32}$) to your pupils and tell them this represents land that is either too cold, wet, rocky, steep, or is not fertile enough to raise food. Cities and industrial areas are also represented in these sections. Set these three pieces aside.

7. Show your pupils the remaining $\frac{1}{32}$ of the apple. Tell them it is this portion of the Earth's surface that can be used to produce the food for everyone on the planet.
8. Now carefully peel the $\frac{1}{32}$ slice and show the thin strip of peel to your pupils. Tell them this represents all the topsoil in which we can grow food.

Note—because topsoil is being depleted at a much faster rate than it can accumulate, it is now considered to be a non-renewable resource.



Self-Marking Exercise

1. Who will be affected by water pollution, such a waste contaminating a source of water near a village community?
2. Give the arguments that you would use to argue either for or against reforestation in an area with exotic timber trees.
3. How is wildlife destroyed?
4. How is acid rain produced?
5. List three ways to conserve the environment.
6. How did you help the pupils to write their reports in the practice activity?



Summary

In this unit, we have looked at some of the human activities that affect the environment. A dramatic increase in activities to meet our needs has led to pollution, global warming, and depletion of the ozone layer. Efforts have been made to conserve the environment. Some of these are short term while others are long term.



Reflection

With your pupils, look at various activities that are aimed at meeting our needs. Discuss different ways in which these activities could be carried out so they would have minimum effect on the environment.

With your colleague, discuss how your pupils can improve their skills in collecting information and report writing. In what ways can pupils use their local environment?



Unit Assignment

1. What makes pests resistant to pesticides?
2. What properties should a pesticide have?
3. Discuss the effect of wind on pollution.
4. Why are human settlements found in certain places?
5. Why is the continual use of fertilisers not an answer to food production?

6. List effects of agricultural activities (for increased food production) on the environment.
7. What is the environmental impact of mining?
8. If your pupils have learned to draw graphs, create an exercise based on the world population graph in this unit. Create a table containing dates and populations and have your plot this information on a graph. Based on the graphs they draw, ask them to predict what the world population will be in ten years, twenty years, fifty years, etc.
9. The classroom activity for this unit involved a demonstration (slicing an apple) that shows the fraction of the planet available for human activity. Design a worksheet or a set of questions as a follow-up to this demonstration.

Unit 4: Protecting the Environment



Introduction

Our environment consists of all the physical, chemical, and biological conditions around us—soil, air, plants, rivers, animals, buildings, etc. In this unit, we will look at the effects of pollution, the processes of conservation and restoration, and the importance of recycling.



Objectives

In this unit, you will:

- examine the environmental effects of pollution
- learn the importance of conservation and recycling
- plan a field trip for your pupils to observe your local environment
- identify sources of pollution in your local environment
- suggest measures that could be taken to conserve resources in your area



Understanding and Controlling Pollution

What is your definition of pollution? How do the following two definitions of pollution compare with yours?

“Pollution is the release into the environment of substances or energy in such quantities and for a such duration that they cause harm to people or their environment.” (Soper, Biological Science).

Oxford Concise Science Dictionary defines pollution as *undesirable change in the physical, chemical or biological characteristics of the natural environment brought about by man’s activities. It may be harmful to human or non-human life.*

Pollutants can be grouped into two categories:

- biodegradable (e.g., sewage)
- non-biodegradable (e.g., industrial wastes)

Water pollution

At present, rivers are being polluted by domestic, industrial, and agricultural waste. When solid organic matter such as sewage enters rivers, it is decomposed by bacteria that multiply and begin to use oxygen. The oxygen in the water is reduced, making it difficult for fish, insects, and worms to survive.

Industrial waste that contains certain chemicals (e.g., lead, mercury, copper, zinc) is toxic. These chemicals accumulate in fish and other aquatic organisms, and eventually spread through the food chain.

Chemicals such as insecticides, if washed into ponds and rivers, have the same effect as industrial waste.

Air pollution and acid rain

The main cause of air pollution is emissions from burning fossil fuels such as coal and oil. The smoke and fumes from factories, power stations, vehicles, and airplane engines contain toxic gases such as sulphur dioxide, carbon dioxide, and carbon monoxide.

These pollutants dissolve in water vapour to form acid solutions that fall back to earth as acid rain.

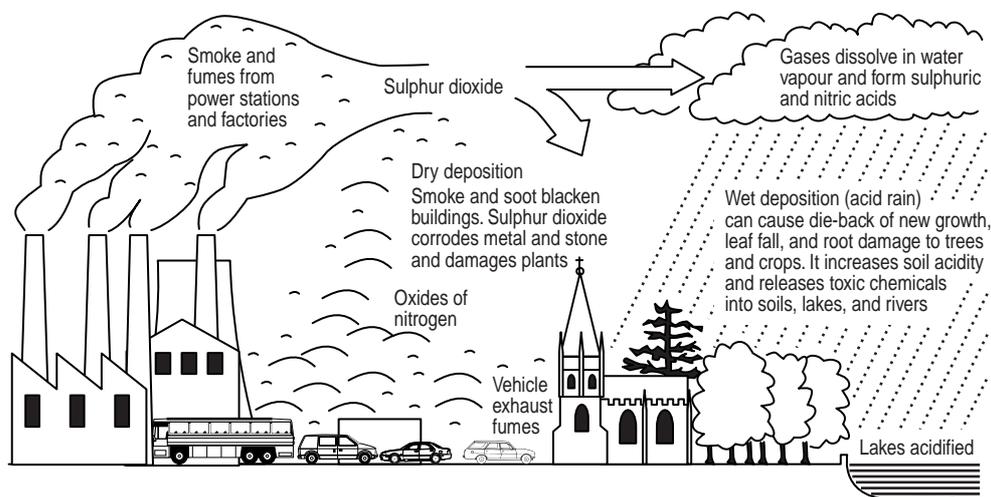


Figure 4.1: Acid rain.

What do you think acid rain does to plants? Acid rain affects young shoots and leaves causing them to fall off. The root structure is damaged and the plants eventually die.

Effects of acid rain include:

- acidification of lakes and streams
- damage to crops and trees
- contamination of soil
- acceleration of decay of building materials, paints
- severe impact on the terrestrial and aquatic ecosystem balance
- degradation and harm to public health (respiratory problems, contaminated food chain)

There can also be serious damage to crops, reducing yields. Acid rain makes soil more acidic and eventually the soil becomes less fertile and possibly toxic.

Other types of pollution

We do not normally consider noise from cars, motor cycles, airplanes, dogs, children, radios, television, etc., to be pollution. Prolonged loud noise from industrial machinery and discotheque clubs can damage the inner ear and cause partial deafness. Noises can also cause sleeplessness and mental depression.

Another type of pollution is radiation, which can cause cancer and blood disorders such as leukaemia. Radiation can also cause birth defects. Radiation can be caused by x-rays and testing of nuclear weapons.

Control of Pollution

How can we control pollution? The ultimate goal of pollution control should be a positive one that achieves a balance between the use and the preservation of the environment. Most countries attempt to achieve this balance through a combination of legislation and voluntary compliance.

Research has led to the design of automobile engines with reduced exhaust emissions. Factory and power station chimneys can be fitted with pollution reduction devices. New technologies in smokeless sources of power generation, such as solar and wind, are being developed. Plastic containers can be made from biodegradable materials that decompose naturally.

Conservation

Conservation may be defined as *“the human management of Earth’s physical and biological resources in such a way as to give all forms of life including humans, the best chances in a shared future”* (Soper, *Biological Science*).

The Oxford Concise Science Dictionary refers to conservation as *“the sensible use of the earth’s natural resources in order to avoid excessive degradation and impoverishment of the environment.”*

This implies that we should take action and express concern to protect the environment and keep it healthy. We believe that well managed resources of water, land and wildlife will continue to support our requirements for food, shelter, industrial products, recreation, knowledge and health well into the future. We need to understand what is happening in our environment to be able to know how to look after it.

Local and national non-government bodies

We know there are still people who depend on hunting for some of their livelihood, but more often killing is for pleasure and profit. Many rare species of snake, lizard and crocodile are killed to make handbags, belts and shoes. African elephants are hunted for their skin and tusks.

In most African countries, there are acts of parliament which protect animals and plants. Some governments help conserve wild life by creating forest and game reserves and national parks where cutting down of trees, hunting and buildings are restricted or forbidden.

Apart from acts of parliament, many individuals, groups, and organisations are concerned with conservation at both regional and international levels. The interests of these groups are specialised and diverse. For example:

- Environmental Council of Zambia (ECZ) deals with environmental issues.
- Zambia Environmental Education Programme (ZEEP) offers educational programmes on environmental issues.
- World Parks protects game parks and forest reserves.
- World Wildlife Fund (WWF) deals with the conservation of endangered species.

Many schools have formed conservation clubs, allowing teachers and pupils to take part in activities to change the way we think about and act towards the environment. What types of legislation and environmental organisations does your country have?

Recycling materials

Imitating the cycling processes in nature is an important aspect of conservation. How often do we discard something after we use it? There is no question that the amount of waste created by modern lifestyles is a serious problem.

The solution to this problem is obvious, even if it is not easy to achieve. Each of us must accept responsibility for disposing of waste properly. We should consider regular anti-litter campaigns. These often have a positive effect on changing our attitude towards the way we use packaging materials.

Instead of discarding valuable materials as waste we can reuse them, either in their present form or by recycling them for other uses. This has the added benefit of reducing the demand energy and raw materials.

One way to ensure that we re-use packaging materials is to have purchasers return empty containers to the supplier. We often do this with refillable bottles, either by leaving a deposit when purchasing which is collected after returning the bottles or offering a rebate on the next purchase if the empty containers are brought back. The other way involves separation of useful packaging materials from other waste just before it is discarded by burning, burying, or before collection by central garbage collectors. The separation involves all recyclable materials to be grouped separately from non-recyclable materials.

Before we look at recycling processes, we should consider the following problems:

- The recycling process uses energy and, therefore, costs money.
- Plastic objects must first be sorted and this can cost more money than the value of new plastic.
- Objects must be clean or the quality of the recycled product will be low.

Recycling of plastics

We will now discuss three different ways to recycle plastics.

Direct recycling involves melting and remoulding the plastics.

Indirect recycling involves crushing and moulding mixed plastic waste into a range of products such as plant pots and park benches. It can even be mixed with wood to make “chipboard”.

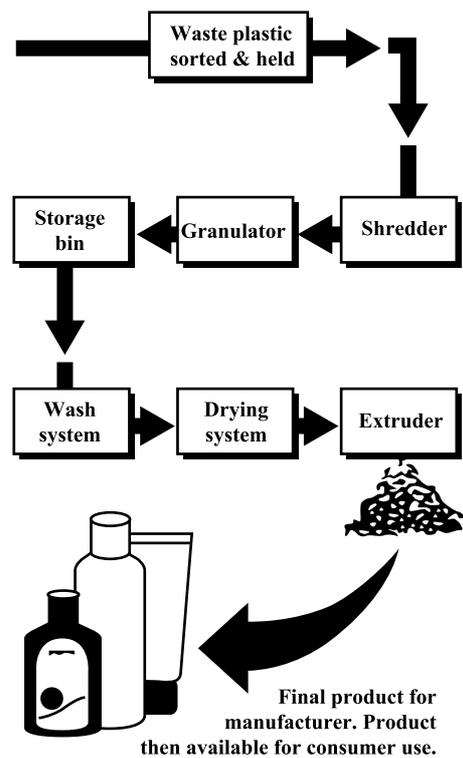


Figure 4.2: Recycling plastic.

Plastics can be burned as fuel, however, toxic gases are produced and the resulting sticky residue creates a problem. There is also a method for converting waste plastic into oil, as shown in the diagram in Figure 4.3. This is an expensive process, although it could lead to a method to preserve oil reserves.

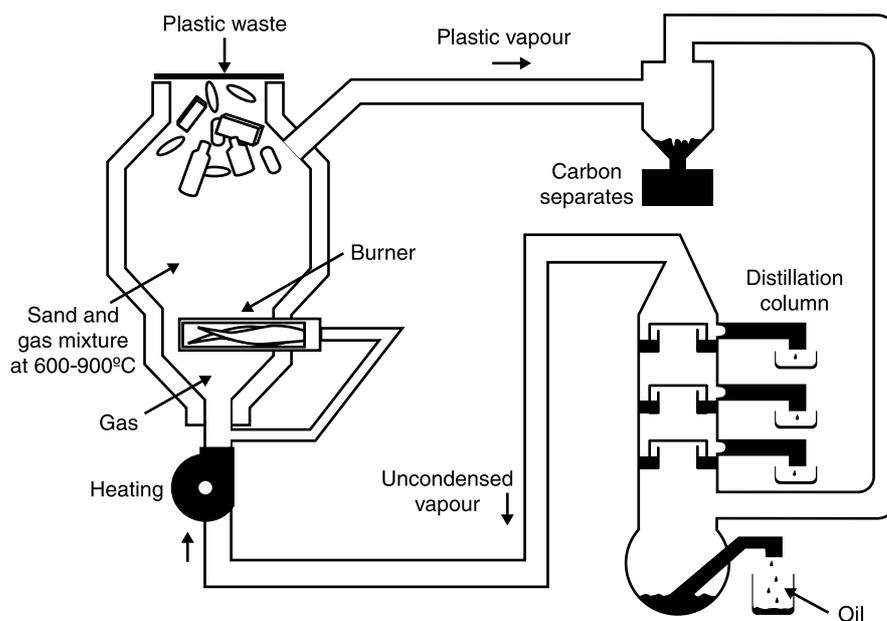


Figure 4.3: Recycling plastic waste into oil.

Sewage processing

During sewage processing, our waste is broken into a by-product nutrient called sludge. However, we discharge much untreated sewage into rivers and oceans. Sewage processing uses micro-organisms, normally present in the soil and fresh water, to break down human wastes.

Sewage sludge can be used as fertilizer and is also used in reclamation schemes since it improves “soil” structure as well as providing important missing nutrients. Energy from organic sewage may be used to generate methane to provide energy to run the sewage processing works.

The water we use in our homes runs into sewers. If we did not treat this water, the rivers and oceans would be unfit for us to use. For this reason sewage must first be treated at sewage treatment plants. Sewage treatment plants are designed to remove the solids in sewage. They also remove household detergents, grease, and other industrial wastes and harmful bacteria that cause illness. There are three basic stages in the treatment of sewage. Refer to figure 4.4 as you read about the stages.

1. Primary stage

Sewage is screened to remove metal, glass, and plastic waste.

In setting tanks, the sludge settles and grease and scum float to the top where they are skimmed off. The sludge goes to large covered digestion tanks where it is decomposed by micro-organisms and converted to methane, which can be burned as fuel, and the remaining material can be used as fertiliser.

2. Secondary stage

The effluent goes into concrete tanks filled with gravel. As the liquid trickles downward, it is broken down by aerobic bacteria. As the solid settles in settling tanks, it is pumped to the digestion tanks.

3. Tertiary stage

You will find variations in design at this stage. In some plants, the effluent is passed into large oxidation ponds with aerators where the action of the sun further reduces the organic content. Chemicals such as chloride may also be added. Waste water that is returned to inland rivers is treated to the secondary or tertiary stage, but where the sewage is pumped into the ocean, it sometimes receives only primary treatment. The ocean purifies the water by natural processes.

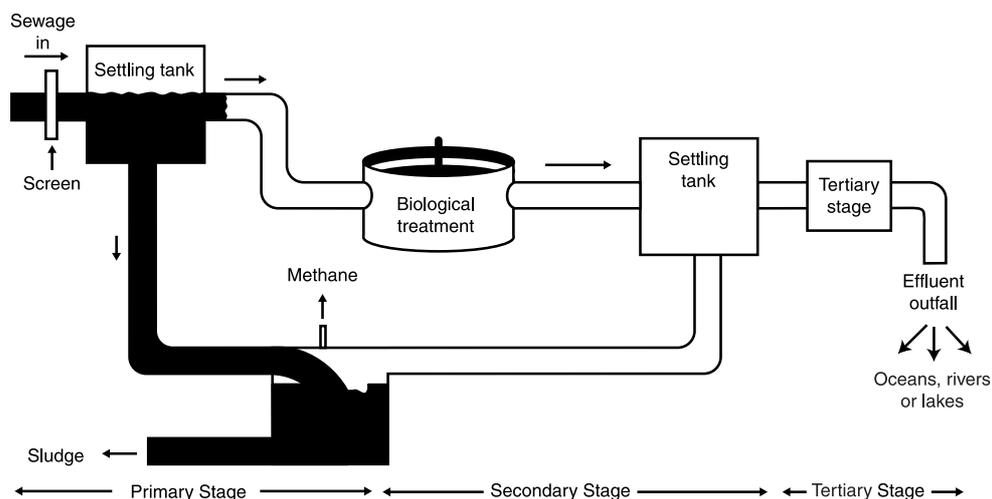


Figure 4.4: Three stages of treating sewage.



Individual Activity

There are many classroom activities you can use to teach ways to protect the environment. Some that we have mentioned in detail in this module are:

- worksheets
- group work
- role plays
- problem solving
- improvisation
- field work

Variety is necessary to maintain your pupils' interest and increase their desire for further study. This unit emphasises field trips in the environment. The purpose of the field trip is to:

- impart skills in designing, planning, and conducting field trips using our local school and community environment
- enable pupils to establish and develop appropriate activities that can be conducted as field trips at the appropriate learners level

A field trip can be any learning activity carried out by a group of pupils outside the classroom. It is a teaching method that enables pupils to gain first hand experience with the relationship between people and their environment. Field trips take pupils out of the classroom to observe real conditions and gather data. It is also important to realise that a field trip does not mean going to exotic places. Just going out of the classroom to look at a tree is a field trip. Studies show that some learning can be acquired more quickly and effectively in a favourable outdoor environment than in the indoor classroom.

A carefully planned and successfully carried out field trip can have the following advantages:

- provides the opportunity for your pupils to become keen observers
- develops the habit of enjoying the beauty and the order of naturally occurring events and circumstances
- enables pupils to apply classroom instructions, library reading, or laboratory exercises to real-life situations
- pupils take an active part in the lesson and become responsible members of the group

When you and your pupils plan the field trips properly, it will improve your relationship with pupils, make the pupils become highly motivated, and improve or enrich the classroom programmes.

How to conduct a field trip

You should survey all possible sites for a field trip to be aware of the community. The sites should not only include the nearby sites but the surrounding areas as well.

Explore a succession of widening environments from the home, school, community, village, region, and finally the global world. Examples of such places are banks, hospitals, industrial art workshops, ponds, rivers, wastelands, gardens, farms, etc.

Plan all trips in advance and follow up with meaningful discussions and continued investigations. Group work can be a good teaching strategy. You should inform your pupils of what materials and clothing to bring along. Be sure to get permission from your school headmaster and the parents of your pupils.

The purpose of the trip, whether to introduce a topic, to arouse interest, or to find answers to questions, must clearly be understood by the pupils. You can achieve this easily by preparing worksheets on selected topics being investigated on the field trip. Look at the example of the worksheet in Unit 1 of this module.



Individual Activities

After you have thoroughly gone through the activities, look at the examples below which can be very helpful in dealing with pupils.

Imagine your farm is located on a very large tract of land about 40 km along the road. You are practising mixed farming, with the following three being the major and prominent preoccupation.

- horticulture consisting of a nursery and a big garden. The main crops are tomatoes, cabbage, and strawberries. There is a nice irrigation system as well.
- poultry (chicken rearing)
- mushroom growing

Using each of the three groups, prepare worksheets for use on a field trip to the farm. Imagine you are teaching a grade 5 class, a grade 6, and a grade 7 class each at a different time.

Group 1: Horticulture section of the farm

- Identify the topics, objectives, and materials from the grade 5 syllabus that would be suitable for this action.
- Design activities that would be done to accomplish these objectives and write down the instructions together with any necessary leading questions to assist the pupils in affirming the stated concept.
- Include in your worksheets a proposal of the follow up actions.

Group 2: The poultry section

- Identify the topics, concepts, objectives, and materials from the grade 6 and 7 part of the syllabus that would be suitable for this section.
- Design activities that would be done to accomplish these objectives and write down the instructions together with any necessary leading questions to assist the pupils in affirming the stated concepts.
- Include in your worksheets a proposal of the follow-up actions.

Group 3: Mushroom growing

- Identify the topics, concepts, objectives, and materials from the grade 7 syllabus that would be suitable for this section.
- Design activities that would be done to accomplish these objectives and write down the instructions together with any necessary leading questions to assist the pupils in affirming the stated concept.
- Include in your worksheets a proposal of the follow-up actions.

Activity 1

- Find out if your area has untouched habitats such as woods, ponds, marshes, etc. Make a survey of plants and animals found in the habitat. Make regular checks for signs of pollution and industrial, housing, or agricultural developments. Take action by reporting signs of pollution to relevant regional authority.

Activity 2 (Choose one or more of the following suggestions)

1. Contact your local council to find out what recycling scheme operates in your area. Prepare a report on its methods and effectiveness. Issues you could consider include:
 - What restrictions are there on what can be included?
 - How many stages of separation occur and who is responsible for each stage?
 - What happens to the materials that are recycled?
 - Does the scheme generate income or cost money to operate?
 - Who manages the scheme?

- How is the system promoted?
 - What proportion of householders and businesses participate?
 - If there is no scheme currently operating in your area, you could develop a proposal to set one up.
2. Set up a recycling scheme in your school.
- Decide what to collect and where each type of article can be sold. You can look for local buyers (an example is done in the answers for self assessment).
 - Produce a short leaflet stating what you aim to collect and why.
 - It is best to have collections once a week or even monthly. Remind everyone the night before.
 - Take care storing inflammables, like paper. You may create a fire risk.

Let the pupils carry out a comprehensive survey of the packages in use in their homes. Classify them as:

- refillable (with the same contents)
- reusable (for another purpose)
- recyclable
- future land fill

Let them estimate the proportion of each category



Self-Marking Exercise

1. When planning a field trip, what aspects must be included?
2. If you chose to set up a recycling scheme in Activity 2, what items did the pupils collect?



Summary

In this unit you have learned the definition for types of pollution. The sources of pollution have been discussed fully.

The methods of conservation and the examples of those who can assist have been elaborated.

By this time, you should have come up with low-cost schemes for recycling, e.g., kitchen waste, or identified the local centres where they recycle paper, plastics, metals, etc.

Pupils can help control pollution by careful observation of their school environment. It is also possible, after going through this unit, to create a small but interesting nature reserve in a garden or, with permission, in your school grounds or even a local park.

You can also identify as many field trip topics in your local environment as possible so that your own environment is appreciated first.



Reflection

Look around your local environment. What do you find?

Is all that belongs to this environment useful? Explain.

What dangers does your litter pose?

Have you or your local people done anything about those dangers? Explain?

If there is a local scheme which collects litter, where does it take the litter, and for what purpose?

Identify as many groups as possible that show interest in protecting the environment. Explain how they do it.

Design a worksheet/card on a field trip using your local environment. State reasons why you have chosen that topic.

List ways in which you can influence the local people to appreciate their own environment?

Mention some of the clubs you can introduce in your school in order to sensitise pupils on how they can appreciate their own environment.



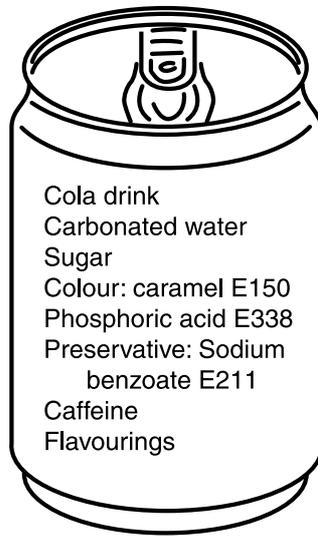
Unit Assignment

1. List some of the pollutants that are released into air and water from homes and farms. Explain how these pollutants endanger wildlife and humans.
2. Explain, with examples, what recycling is and why it is important.
3. List some of the ways in which governments, voluntary organisations, farmers, and you personally can help preserve wildlife.



Module Assignment

1. Study the information that is given on the canned drink and answer the questions.



What sort of substances are given an 'E' Number.

Of what use are these in the canned drink.

Name the food substances you consider useful to your body.

2. Define the following:
 - pollution
 - non-biodegradable
 - recycling
 - habitat
3. In each case, state two pollutants of:
 - air
 - water

Suggest ways each of the pollutants mentioned can be reduced.

Suggested Answers to Activities



Note: This section contains suggested answers to selected activities found in the module.

Unit 1: Human Needs

Suggested Answers to Classroom Activity 1

Answers will vary depending on the local examples of foods you choose. You may have filled your table in point form with required information.

The following paragraphs contain typical functions and examples of different groups of foods (nutrient type) listed in the worksheet.

Proteins

They are mainly the source of building blocks (amino acids) for growth and repair. Found in meat, fish, poultry, and various leguminous crops, such as peas, beans, or lentils.

Carbohydrates are the main source of the energy in our diets. Common forms of carbohydrates are sugars and starch. Foods rich in carbohydrates are usually the most abundant and cheapest when compared with foods high in protein and fat content. Carbohydrates are found in foods like potatoes, bread, rice, maize, wheat, and other cereal. Carbohydrates are digested by the body to produce energy, giving out carbon dioxide and water. Sugars are the smallest units of carbohydrates. A number of food sources contain sugars: fruits contain a form of sugar called fructose, milk contains a form of sugar called lactose. Starches are a form of carbohydrates made of a chain of sugar molecules joined together. They are found mainly in grains, legumes, and tubers. You may have given examples of foods made from primary sources of carbohydrates like cakes, foods made with flour, bread, biscuits, noodles, etc.

Fats

Also known as lipids, fats provide a reserve source of energy—fat is efficiently stored in the body for later use when carbohydrates are in short supply. Fats are necessary, but only in small amounts. They are used for growth and repair, cushion our bones and internal organs, and they also insulate the body against cold. Examples of food sources of fats include oils, margarine, butter, cheese, nuts, seeds, and avocados.

Vitamins

Vitamins assist in chemical reactions (metabolic activities) inside the body and help build resistance to disease. Food sources of vitamins include fresh fruits, vegetables, juices, water, and other beverages. By eating a variety of foods, we get the vitamins we need. For example, vitamin B is present in cereals, vegetables, and meat. Did you know that we obtain vitamin D from the sunlight?

Salts and Minerals

The inorganic nutrients we eat in small amounts our daily diet ensure normal growth and development because they are part of the structural composition of hard and soft body tissues. For example, calcium is involved in the

composition of bones. Apart from being used as building materials in the body, they participate in body processes such as oxygen transportation in the blood by oxygen facilitated by iron in red blood cells, zinc is useful in enzymes creation.

They are found in fresh fruits and vegetables. Salt (sodium chloride or table salt) is found in nature or can be produced from sea water. Examples of important mineral in our daily diet should include:

- iron
- calcium
- sodium
- magnesium
- iodine
- zinc
- potassium
- copper
- trace minerals

Fibres/Roughage

Roughage prevents constipation, cancer of the colon, and reduces risks of heart diseases. How does that happen? Fibre rich foods retain water, resulting in softer and bulkier stools that prevent constipation and haemorrhoids. A high-fibre diet also reduces the risk of colon cancer, most likely by speeding the rate at which stool passes through the intestine and by keeping the digestive tract clear of any cancer-causing agent. In addition, fibres bind with certain substances that would normally result in the production of cholesterol and eliminates these substances from the body. In this way, a diet rich in fibre helps lower blood cholesterol levels, reducing the risk of heart disease. Fibres are found in whole grains (e.g., bran cereal), dried beans, fresh fruits, and green vegetables, especially when eaten raw with their skins.

Water

Water plays a vital role in all body functions, including metabolism (reactions inside our bodies). Water is found in foods such as soup, fresh fruits, and vegetables as well as juices, milk, meat, drinking water, and other beverages.

Water is a good solvent for many chemicals, hence it is used in the transportation of many substances, and in many chemical reactions happening inside the body. It helps in carrying oxygen, nutrients from the foods we eat, and carbon dioxide and other waste products through the body cells. It also transports hormones and enzymes. Water acts as a cushion to protect body organs and participates in the lubrication of the joints. Your eyes are kept wet by water when you blink, preventing them from becoming dry. Water makes skin soft and prevents it from drying and cracking. Water also keeps the body temperature normal, when it is hot for example, we find ourselves sweating! Water plays an essential role in making the brain and other organ functions work better. In summary, your entire body (organs and cells) needs water and is made mainly of water!

Suggested Answers to Individual Activity 2

1. roughage/dietary fibre
2. malnutrition
3. rickets
4. kwashiorkor
5. marasmus
6. deficiency disease

Possible Answers to Self-Marking Exercise

1. Water, food, transport, warmth, and shelter.
2. If one or more of the above is missing, the human being may be:
 - unhealthy
 - sick
 - may die
3. Energy-giving, body-building, protective, roughage, or water.
4. Vitamins and mineral salts do not protect the body from disease but they prevent the person from getting dietary deficiency diseases.
5. Under-nourishment is common in developing countries because of
 - poverty
 - unequal food distribution
 - growing cash crops instead of food
 - eating more carbohydrates, unbalanced diets
6. A variety of activities can be supported:
 - role play
 - drawing
 - presenting reports
 - discussion
 - debate
7. Need to move produce to market and raw materials to factories.
8. You may have suggested that the worksheet should:
 - be well laid out
 - language should be easy to understand
 - objective should be clear
 - cater for different ability group
 - include a variety of learning situations
 - include a variety of resource

9. Should observe pupils and ensure that they are all:
 - participating
 - respect other pupils ideas
 - focus on the topics
 - taking turns at chairing, are presenting, etc
 - speaking clearly
10. Pupils may have found it more relevant, more interesting, more challenging, easily available, and may have a raised awareness about the need to protect it.

Possible Answers to Unit Assignment

1. A balanced diet has the right type of foods in the correct and adequate proportions.
2. Excess food is not used but stored. Excess mineral salts and vitamins are not stored but excreted. Excess proteins are converted to fat and stored.
3. Most occupants of shanty compounds are poor and do not have enough land to build on. They lack resources and often build on land that is illegally obtained. They migrate and do not settle permanently.
4. Renewable resources are sources of energy that do not get used up. Non renewable resources are usually fossil fuels that get used up and can not be replaced.
5. It is smoky, dirty, and causes forest destruction. It is non-renewable if more trees are not planted.
6. It makes teaching interesting and keeps the pupils interested. You can involve as many pupils as possible and cater to different ability groups
7. Group discussion can be used when you want to have more pupils participate or when the topic allows input from pupils. To get pupils' ideas and contributions.
8. A lot of pupil participation. Great interest from pupils. Answering most or all questions correctly.
9. Uneven world food distribution. Underdeveloped countries too poor to use modern technologies, fertilisers and irrigation methods. Poor food storage, lack of transport, etc.



Unit 2: Human Activities

Possible Answers to Self-Marking Exercise

1. You may have found it took too long or that pupils did not have enough information or some pupils did not take part fully.
2. It conveys appropriate facts and information.
It is motivating.
Stimulates participation.
Appropriate for dealing with controversial issues.
Allows pupils to research.
3. Fishing, farming, mining, manufacturing, building.
4. Improved food production.
High yield.
Urbanisation and industrialisation.
5. (i) Encourage farmers to make their cattle available for cross breeding.
(ii) Increase price of selling your livestock.

Possible Answers to Unit Assignment

1. Advantages

- better and faster ships
- stronger, lighter, and longer lasting nets
- refrigeration and freezing facilities lead to large scale fishing
- increased demand

Disadvantages

- over-fishing
 - danger of extinction
 - competition leads to catching poor quality fish
2.
 - Use of fertilisers increase yield.
 - Irrigation, crop can be grown all year round.
 - New varieties—new breeds of drought resistant, high yield crops.
 - Use of pesticides and other chemicals protect yield and crop storage.
 3.
 - improved health
 - more food
 - better communication
 - more leisure time
 4.
 - birds will eat scraps
 - smell from the area
 - increased number of birds—led to noise
 - non-biodegradable waste scattered all over

5.
 - when dealing with controversial issues
 - when you want pupils to feel the reality of a situation

6. **Advantages**

- stimulates oral participation
- narrows gap between every day life and science classroom
- encourages research
- helps change pupils' attitude

Disadvantages

- pupils do not have enough information
- time consuming



Unit 3: Effect on the Environment

Possible Answers to Self-Marking Exercise

1. The community will not have clean drinking water.
All life forms such as fish will die.
Communities that are downstream will have contaminated water.
2. **For**
Reforestation will prevent erosion.
Large amount of timber will be available for timber industry.
Job creation.
Local revenue.
Habitant diversity.
Against
Exotic conifer vulnerable to disease.
Ploughing leads to species loss.
Alien species introduced.
Changes of landscape may cause serious damage to the environment.
3. We are destroying the habitat of wildlife by clearing woodlands for road and buildings. Releasing pollutants to the environment which poison them. Killing wildlife for fun or luxury goods.
4. When gases such as sulphur dioxide, carbon monoxide and oxides of nitrogen are produced they dissolve in clouds to form acid rain.
5. Recycle materials and waste.
Maintain the forest.
Avoid over-cropping.
6. You may have provided guidance questions, provided a framework, or shown them examples.

Possible Answers to Unit Assignment

1. Natural variations in the species leave some survivors resistant.
Low toxicity level of pesticides which is sufficient only to damage and not kill.
Survivors that live to become resistant.
2. Specific so that it does not affect other species.
Inexpensive to manufacture.
Non-persistent.
3. Wind has an effect on air pollutants.
Air pollutants are carried by air over a long distance and high in the atmosphere.
Pollutants are distributed over a large area, affecting countries that are far away.
Damages buildings and plants, causes health hazards to humans and animals.
4. Settlement is dependent on water transport.
5. Continued use of fertilisers destroys the structure of the soil.
Nutrients leach out of the soil and cause eutrophication.
Clay particles that hold nutrients are destroyed.
6. Increased use of irrigation results in salts increasing, nutrients wash down the subsoil, soil becomes waterlogged.
Burning to prepare for cultivation exposes the soil to rain, water, and wind, resulting in erosion.
Overgrazing exposes soil to erosion, large numbers of livestock compact the soil reducing pore size, reduces aeration and drainage of soil.
Clearing crops after harvest leaves soil bare.
7. Mining activity may cause pollution.
When minerals are being refined, gases are released.
Gases cause air pollution.
Acid rain.
Land becomes barren, nothing grows.
Water in rivers is polluted.
Wastes are poured on land as large heaps or slag waste.
Slag takes up land meant for farming and building.



Unit 4: Protecting the Environment

Possible Answers to Self-Marking Exercise

1. Study all sites, and record the information collected. Prepare lessons and plan follow up.
2. Your pupils may have collected the following:
 - waste paper
 - plastics
 - aluminum foil
 - glass
 - food waste
 - garden clippings

You can collect these items to raise income for the school or to reduce pollution/litter in the surrounding area.

A table like the one given below can be drawn indicating the items collected, local authorities to be contacted for selling them, and finally the most common uses of the items after being recycled.

Item Collected	Place of Contact	Common Uses
1. Waste paper	Local sawmills	Wrappers/Newspapers
2. Waste plastic	Local Council	Plastic bags and films
3. Aluminum foil	Industries	Drink cans
4. Food waste	Local Council	Composite manure

Possible Answers to Unit Assignment

Pollutants are released into air and water.

1. *Air Pollution*

- The main cause of air pollution is the burning of fossil fuels such as coal and oil.
- Smoke and fumes contain sulphur dioxide, carbon dioxide, carbon monoxide, and oxides of nitrogen from the exhausts of cars, diesel engine lorries, buses, and trains.

Water Pollution

- Domestic waste, e.g., sewage waste, accumulations of minerals that promote plant growth (eutrophication) which reduces oxygen for fish.
- Industrial waste, e.g., chemicals, which are dangerous because they can accumulate in fish and then spread along food chains to other animals (cyanide, lead, mercury, copper and zinc).

- Agricultural waste, e.g., animal manure, which is disposed in rivers. Untreated animal manure decomposes causing reduced oxygen levels.
 - Chemicals sprayed to kill insects and fungal pests. If washed into rivers and ponds they disrupt food chains.
 - Oil spillage from tankers and offshore oil rigs. The oil kills sea birds.
2. Recycling means the re-use of waste paper, metal, glass, and other materials. It is important because it reduces pollution and conserves raw materials, thereby saving energy and money.

Governments

- creating game reserves
- national Parks
- stiff laws against poaching

Farmers

- planting trees and shrubs (creating new habitats)
- make ponds
- spray pesticides at the right time.

3. *Voluntary organisations*

- Formation of pressure groups to stop habitat destruction.
- Raise money for the conservation of threatened wild life, e.g. World Wildlife Fund (WWF).
- Purchase wildlife habitats (nature reserves).

You personally

- Learn to satisfy your own needs without polluting the environment.
- Find ways to use resources over and over again.
- Avoid needless destruction for fun and profit.
- Plant trees and shrubs which are useful (e.g. mango, citrus trees).

Glossary

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- Acid Rain:** chemicals (sulfuric, nitric, etc.) that dissolve in rain water to form acid. The chemicals arise from emissions released during the burning of fossil fuels or other pollutants.
- Biodegradable:** capable of being broken down into simpler harmless products by micro-organisms.
- Body building foods:** foods which are converted to smaller units used for repair, restoration, and building of body tissue.
- Decompose:** to decay.
- Degradable:** a type of organic chemical reaction in which a compound is converted into a simpler compound in stages.
- Ecology:** the study of relationships of living organisms with each other and with the environment.
- Ecosystem:** biological organisms and the environment in which they live.
- Energy foods:** when utilised by the body, this food produces the energy needed for body reactions and activities.
- Eutrophication:** over-enrichment of a lake or slow moving stream with nutrients, resulting in overgrowth of organisms and reduction of oxygen.
- Fossil:** the remains or traces of any organism that lived in the geological past (e.g. bones, teeth, shells, and wood).
- Genetic Engineering:** techniques involved in altering the characters of an organism by inserting genes from another organism into its DNA.
- Habitat:** the place where a plant or animal usually lives.
- Leukaemia:** cancer characterised by the abnormal increase in the number of white blood cells.
- Malnutrition:** incorrect and inappropriate absorption of food by the body, this often leads to a deficiency disease. Faulty and mainly inadequate nutrition.
- Non-biodegradable:** industrial effluents that cannot be broken down by bacteria, e.g., DDT.
- Organic:** substance produced by or found in animals or plants.
- Overnutrition:** a condition in which a person takes in more calories than needed by the body. The excess of calories are converted into fat that is deposited under the skin and around internal organs. This can result in the person becoming overweight and obese.

Phenomenon:	something that happens in nature science or society and can be seen.
Pollutants:	substances that affect the environment adversely.
Protective foods:	foods that are essential components of body tissues or chemical substances necessary for normal body reactions. The absence of these foods lead to dietary deficiency diseases.
Recycling:	to treat something that has already been used so it is fit for use again.
Roughage:	dietary fibres that assist in the elimination of body waste.
Sewage:	the waste material and water from industries or people carried in large pipes under the ground.
Sludge:	thick mud, dirty waste oil in an engine.
Spawning:	production of eggs by aquatic animals such as fish.
Undernutrition:	a condition in which a person does not take in an adequate amount of one or many of the essential food nutrients.

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