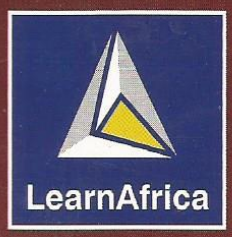
Basic Science 1

An Integrated Science Course for Junior Secondary Schools



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Basic Science

for Junior Secondary Schools

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Theme 1

Learning about our environment

Chapter 1 Orientation about science

Introduction

The process of science is a way of building knowledge about our environment and discovering new ideas that shed light on the world around us.

These ideas are initially unreliable, but as they cycle through the process of science and are tested and re-tested in different ways, we become increasingly confident in them.

The knowledge of science is useful for all sorts of things: designing bridges, slowing climate change, prompting frequent hand washing during flu season, etc. Scientific knowledge also allows us to, develop new technologies, solve practical problems and make informed decisions.

Objectives

By the end of this chapter, you will be able to:

1 give the meaning and definition of science;
2 list the branches of science and science-related occupations; and
3 state the various scientific methods, e.g. observation, hypothesis and experimentation.

Learning about science

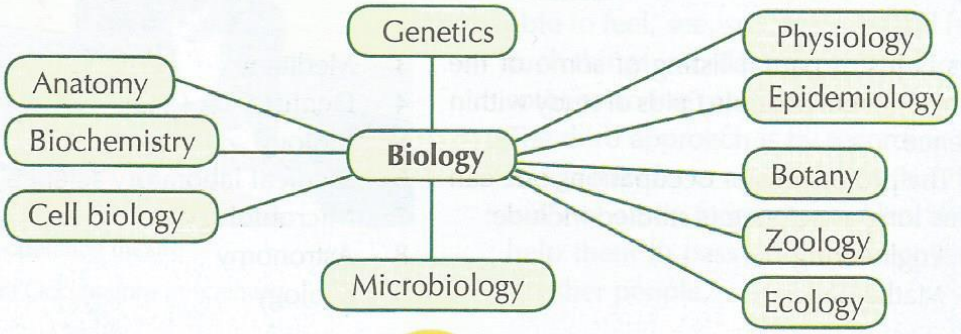
Science refers to a system of acquiring knowledge, using observation and experimentation to describe and explain natural phenomena. Science, as defined above, may be called pure science or applied science.

Fields of science are commonly classified along two major lines:

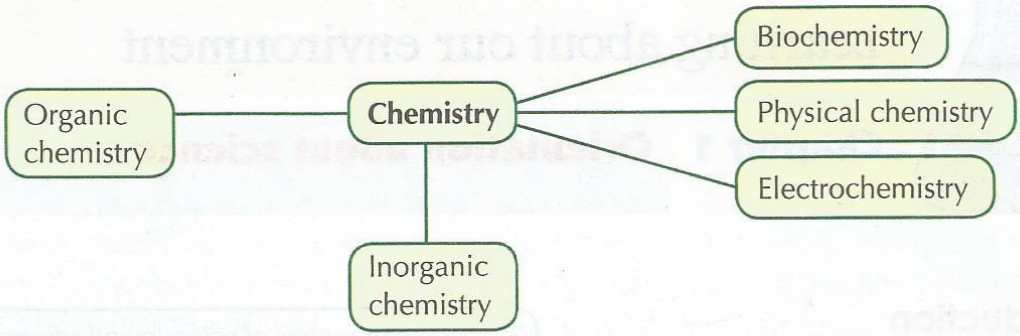
1 **Natural science**: The study of the natural world. It is further divided into biological science and physical science.
2 **Social science**: The systematic study of human behaviour.

The fields of science can be grouped into

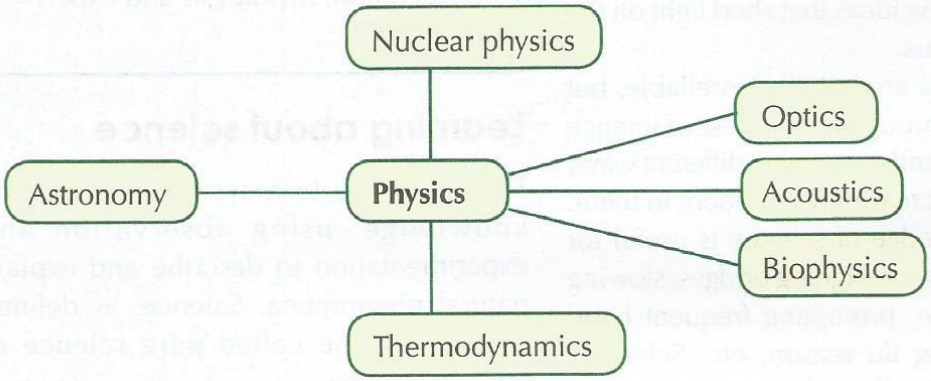
1 Biology



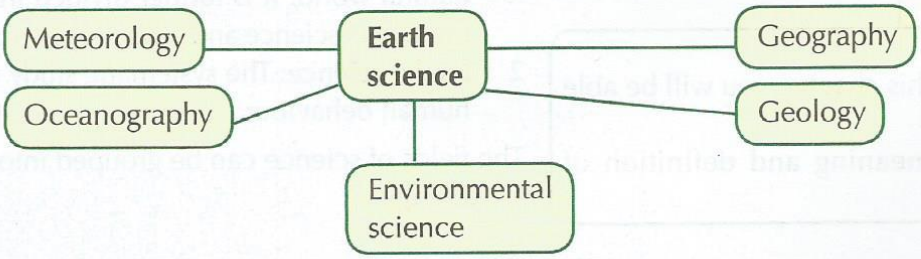
2 Chemistry



3 Physics



4 Earth science



This is just a partial listing of some of the many different possible fields of study within science.

The professions or occupations one can do as long as science is studied include:

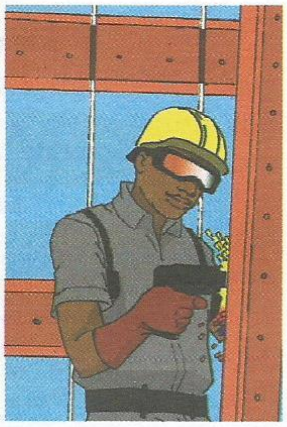
1 Engineering
2 Mathematics
3 Medicine
4 Dentistry
5 Biology
6 Medical laboratory science
7 Microbiology
8 Astronomy
9 Ecology

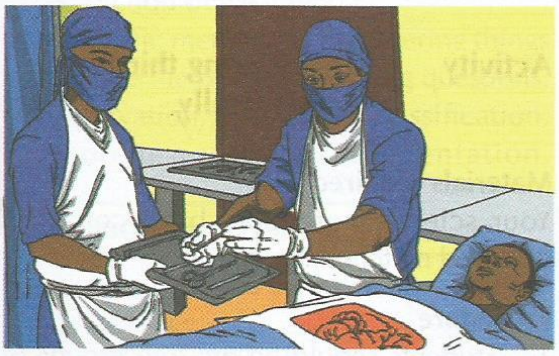
10 Oceanography
11 Chemistry
12 Physics
13 Geology
14 Geography
15 Pharmacy
16 Nursing

Benefits of science

1 The knowledge of science has made it possible to produce drugs for diseases like malaria, and vaccines for vaccine-preventable diseases.
2 The knowledge of science has made the discovery of new galaxies, planets and perhaps, existence of life on them, possible.

a) An astronaut


b) An engineer


c) Doctors in operating theatre

Figs. 1.1 (a)-(c) Occupations in science

3 The knowledge of science helps us to have intelligent respect for nature, which then helps us to take decisions on the uses of technology to improve the world for humans and all living things.
4 The knowledge of science has improved the art of making fire and creating more modernised equipment instead of-hand-crafted tools used in the olden days.
5 Science has helped us to genetically modify crops, making it more resistant to spoilage.
6 The knowledge of science has also helped in the area of agriculture by facilitating the production of high-yieding seeds and disease-resistant crops.

Scientific methods of discovering things

In science, we try to solve problems, using the scientific approach. Those who study science are called **scientists**.

1 The first approach (by scientists) to solving scientific problems is by asking questions, e.g. 'How can we make water clean and fit for drinking? 'Why do some objects float on water and others sink in it?' For each question, they then try to find possible answers.
2 Another way of finding out about things is to observe them closely and properly. In doing this, scientists make use of their senses. This means that they will be able to feel, see, smell, touch and hear such things in order to get a clue to the solution to the problem.
3 The third approach is by recording the things they have observed, so that they will not easily forget them. Also, it will help them to pass on their discoveries to other people.

4 Also, scientists, sort out things according to their colour, size, weight, roughness, sound, odour, etc. This method is known as **classification**, and it leads to finding the different properties of such things.

5 Scientists also make guesses. After sorting out things according to their properties, they now make guesses, e.g. in trying to make water fit and clean for drinking, they can guess different ways of making a particular type of water fit for drinking, or guess why some objects float on water, while others sink in it. Such guesses are called **hypotheses**.

6 After stating a hypothesis, scientists can now carry out a test based on the hypothesis to see if they are right in their guess. This test is called an **experiment**.

In the case of dirty water that you want to make clean, you can decide to boil it up to a temperature of 100°C. Still, you cannot be sure that all the germs in the water have been killed, so you now do another thing which will confirm to you that all the germs have been killed, and that is by adding a few drops of chlorine to the boiled water to kill off all the germs.

The boiling of water you did is the experiment while the chlorination (addition of chlorine) is the confirmation and the conclusion of your work.

We can sum up what we did, therefore, as follows: we had a problem, we asked questions and tried to answer the questions, we observed, we recorded the things we observed, we made guesses (hypotheses), we carried out experiments, we confirmed our guesses and finally, we made our conclusions.

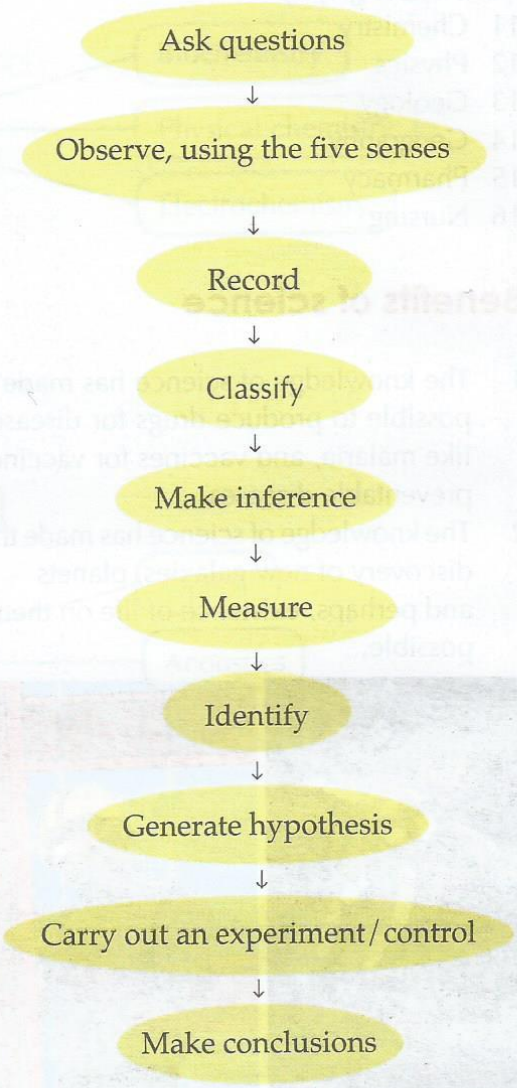


Fig. 1.2 Chart showing the scientific methods

Activity Discovering things scientifically

Materials required

Your science notebook, biro, colourful wrapped matchboxes

Procedure

1 Students should be put into groups of five.

2 Each group will lift and shake the different matchboxes.
3 Write down what you noticed without taking off the wrappers as shown in the table below.
4 Submit your report to your teacher.

Box	Weight	Inference
1	heavy	
2	heavier	
3	heaviest	

Result
You must have noticed that the blue box is the heaviest because it contains sand and made sound, the yellow box is heavier with a small stone and no sound while the red box (control) is heavy and contains nothing.

Summary

1 Science refers to a system of acquiring knowledge, using observation and experimentation to describe and explain natural phenomena.
2 The field of science can be grouped into different branches of biology, chemistry, physics and earth science.
3 The knowledge of science is useful for all sorts of things, e.g. in medicine, construction, engineering, agriculture, and prediction of weather.
4 Scientific methods of discovering things include the process of asking questions, observation, recording, classification, hypotheses and experimentation.

Revision questions 1

1 _____ is a system of acquiring knowledge.
A Science
B Technology
C Art
D Sport
E None of the above

2 Natural science is the study of _____.
A wood
B metal
C mineral
D sound
E the natural world

3 _____ is a branch of biology.
A Oceanography
B Physical chemistry
C Astronomy
D Geology
E Genetics

4 Those who study science are called _____.
A dentists
B nurses
C technicians
D scientists
E economists

5 The first approach to solving scientific problems is by _____.
A asking questions
B observation
C counting
D recording
E experimenting

6 What is science?
7 List and explain four benefits of science.
8 Highlight the scientific methods of discovering things.
9 List the different branches of Earth science.
10 Draw a chart showing the scientific methods.

Chapter 2 Human development

Introduction

Human development is simply the process of growing to maturity. Development in humans starts from the growth of fertilised egg to zygote which later forms the embryo and then develops to foetus, and afterwards, a child is born.

The child develops and grows with the help of adequate nutrient/diet. This helps the child to increase in weight and height. The child develops from childhood to adolescence (puberty) and then adulthood.

Objectives

By the end of this chapter, you will be able to:

1 define puberty and adolescence;
2 identify the puberty changes in boys and girls;
3 explain personal hygiene;
4 explain menstruation, menstrual cycle and hygiene;
5 describe myths and facts about puberty changes (in boys and girls); and
6 state ways to cope with concerns of puberty changes in the adolescent.

Puberty and adolescence

Puberty

Puberty is the period (age) at which a child is capable of sexual reproduction and has mature physical characteristics; or a process of physical changes through which a child's body matures into an adult body capable of sexual reproduction. It is a stage of growth.

Puberty occurs due to hormonal signals which are sent from the brain to the gonads (reproductive organs). The gene, nutrition and gender determine the exact age a child reaches puberty.

During puberty, the endocrine gland produces hormones that cause body changes and the development of secondary sex characteristics.

Puberty years starts from 10/11 – 12 for girls and 12 – 14 years for boys. On the average, puberty ends around 15 - 17 years for girls and around 16 – 17 years of age for boys.

Fig. 2.1(a) A girl of about 10 – 12 years

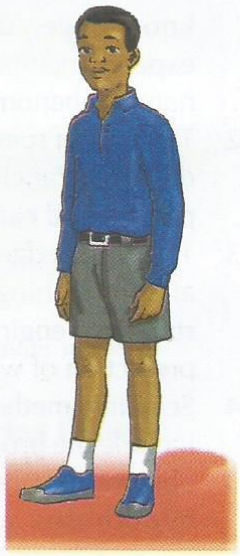


Fig. 2.1(b) A boy of about 12 - 14 years

Adolescence

Adolescence is the time between the beginning of sexual maturation (puberty)

and adulthood. It is a time of psychological (human behaviour) maturation in which a person becomes 'adult like' in behaviour. It is also the period of mental transition from childhood to adulthood.

Adolescence is considered to be the period between 14 and 19 years. The person in adolescence does not experience only physical growth and changes but also emotional, social and mental changes and growth.

Adolescence is a time of big social and emotional development for a child. It is important to know what to expect and how to support that child through the changes.

Physical changes

Physical changes are bodily changes that are seen in boys and girls during puberty stage. Girls usually mature faster than boys. As a result, girls reach puberty two years earlier than boys.

Different individuals reach this stage at different ages, and lateness in reaching this does not mean health problem all the time.

The noticeable external changes are as follows:

Puberty in boys

1 Enlargement of testicles
2 Faster growth especially in height
3 Voice change by deepening
4 Night time ejaculation
5 Increase in size of penis, scrotum and testes
6 Broad shoulders and chest
7 Hair growth in the armpits, on the face and in the pubic area
8 Pimples appear but later disappear
9 Acquisition of muscle mass
10 Distribution of body fat

Puberty in girls

1 Growth of pubic hair
2 Pimples appear but later disappear
3 Production of eggs (ova)
4 Menstruation
5 Increase in hip size
6 Clear or whitish vagina secretions
7 Hair growth in the armpits
8 Increase in the size of breasts
9 Premenstrual syndrome such as cramps in the lower back or bloating.

Emotional changes

1 Adolescents are curious and inquisitive.
2 Adolescents are more sensitive to their parents' emotions.
3 Adolescents are more conscious of their look and physical changes.
4 They associate more with friends than with families as they tend to identify more with friends going through the same changes.
5 They exhibit of the feeling of uncertainty about the future, that is, career, marriage and livelihood.
6 Likelihood of being influenced by what is seen in the media such as dressing and language which could build a gap between their choices and what is seen as appropriate by parents and friends.
7 They have frequent changes of mood.
8 Sexuality is triggered as a result of engaging in activities such as reading romantic novels and watching romantic films on television.

Social changes

1 Adolescents always want freedom.
2 They see adults as old-fashioned ('old school').

3 They constantly look for new experience.
4 They develop sexual curiosity, that is, the desire to explore sexual experience.

Personal hygiene

Personal hygiene is the practice of maintaining cleanliness, i.e. keeping oneself clean. It should be done daily. It involves oral care, washing of the body, toilet hygiene, hair care and nail care.

Maintaining a high level of personal hygiene will help to increase a person's self-esteem and confidence while reducing the chances of developing fear and low esteem.

Poor personal hygiene can lead to low self-esteem among peers or in society. It can lead to the spread of diseases. It can also bring about social embarrassment, e.g. bullying the victim.

Personal hygiene is one aspect that has to do with one's life. Therefore, you must have your bath at least twice every day, wash your hair, brush your teeth at least twice every day, wash your clothes and clean personal utensils to prevent infection.

Menstruation and the menstrual cycle

Menstruation and the menstrual cycle occur only in girls and women.
Menstruation also known as 'period', is the regular release of bloody waste from the inner lining of the uterus through the vagina.

The menstrual cycle (period) occurs monthly as a result of changes in the ovaries and the lining of the uterus. It could be irregular at first, and then continue regularly until a woman reaches menopause which is around age 50 years. It also ceases during pregnancy.

The average menstrual cycle is 28 days between 28 and 32 days, and blood flows for 3 to 5 days except in abnormal cases.

Every month, an ovary releases an egg called ovum. The egg travels down a fallopian tube, which connects the ovary to the womb. When the egg reaches the womb, the lining of the womb becomes thick with blood and fluid. If the egg does not meet with sperm from a male and is not fertilised, it dissolves and forms menstrual blood flow, which passes out of the body through the vagina. During menstrual period, there may be whitish discharge. This is normal.

Menstrual cycle and hygiene

When a girl has her period for the first time, it is a distinct step into womanhood. Some wear a sanitary pad all through the day. This is unhealthy to the body. There is the need to maintain hygiene during your period.

How to maintain hygiene during menstruation

1 *Change regularly:* Sanitary pad must be changed as often as necessary to avoid vaginal infections.
2 *Wash yourself regularly:* This practice also helps to prevent bad odour from the vaginal region. Therefore, it is important to wash your vagina and labia (projecting part of female genital) well before you use a new pad.
3 *Do not use soap or vaginal hygiene products:* It is important to wash yourself regularly during this time. You can use soap to wash the external part and not the internal part because the soap can kill the good bacteria and create an avenue for infection to set in. All you need is some warm water.

4 *Dispose of your used sanitary pad properly:* Wrap your sanitary pad properly in a new paper and dispose of immediately. Do not flush the pad down the toilet since it is capable of blocking the toilet and causing the toilet to pack up.
5 *Take regular bath during menstruation:* Take your bath at least three times a day.
6 Wash or clean yourself from the vagina to anus and not from the anus to the vagina to prevent urinary tract infection.
7 Store the pads properly in a clean pouch or bag to prevent infections like urinary tract or vaginal infections.

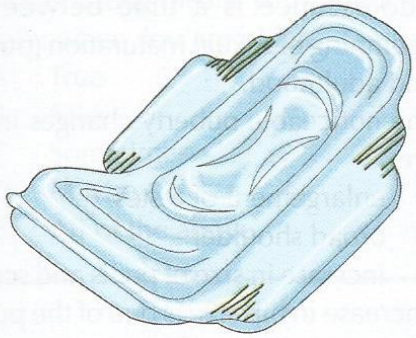


Fig. 2.2 A typical sanitary pad

Myths and facts about puberty changes

Myths about puberty changes are those beliefs that are not true concerning some changes that occur as a child's body matures into adulthood, while facts about puberty changes are the true things that happen as a child's body matures into adulthood.

Some of these myths and facts are as follows:

1 *Myth:* If you have started puberty by the age of 10, you should see a doctor.
Fact: Puberty starts at different times for different people.
2 *Myth:* Having mood swing constantly means there is something wrong with you.
Fact: Mood swings are a completely normal part of puberty. It is something you will outgrow as you mature.
3 *Myth:* Masturbating too much means you cannot have a baby when you are old.
Fact: Masturbating does not mean you cannot have a baby.
4 *Myth:* A girl's breasts stop growing once they start having their period.
Fact: A girl's breasts can keep growing until they are in their late teens.
5 *Myth:* If you do not shave your pubic hair, you could get lice or nits.
Fact: You would not get lice just because you have not shaved.
6 *Myth:* If a girl misses a period, it means she is pregnant.
Fact: If a girl misses a period, it does not always mean she is pregnant. But if she misses two to three periods, see a doctor.

Coping with concerns of adolescents' social and emotional development

The following are general ways of dealing with concerns that arise from adolescents' social and emotional development; but they are specifically applicable for parents and guardians:

1 *Listen to your child's feeling:* If your child wants to talk, do not stop your child; give your child full attention to talk. If you are in the middle of something important, make specific time when you can listen.
2 *Be explicit and open about your feelings:* In particular, tell your child how you feel

when your child misbehaves. Be a role model for positive ways of dealing with difficulty, emotion and moods.

3 Talk with your child about relationships, sex and sexuality. Focus on the non-physical aspects. Teenagers are often self-conscious and anxious about their bodies and appearance, so reinforce the positive aspects of your child's social and emotional development.

4 *Get to know your child's friends and make them welcome in your home:* This helps to keep in touch with your child's social relationships. This also helps to monitor your child's movement.

5 *Maintain positive relationships with your friends, partner and colleagues:* Your child will learn from observing relationships where there is respect, empathy and positive way of resolving conflict.

Activity **Identifying the emotional and social changes in puberty**

Materials required

Your science notebook, biro

Procedure

1 Students should be put into groups of five.

2 Each group should write out their emotional and social changes.

3 They should discuss these changes.

4 Differentiate both changes as shown in the table below.

5 Submit your report to your teacher.

Identification of emotional and social changes

Emotional changes	Social changes

Summary

1 Puberty is a period at which a child is sexually and physically mature.

2 Adolescence is a time between the beginning of sexual maturation (puberty) and adulthood.

3 The noticeable puberty changes in boys are
   a) enlargement of testes
   b) broad shoulder
   c) increase in size of penis and scrotum

4 Increase in hip size is one of the puberty changes in girls.

5 Personal hygiene is the practice of maintaining personal cleanliness.

Revision questions 2

1 At puberty stage, the following physical changes occur except _____.
   A over-confidence
   B broader hip
   C breast enlargement
   D growing of hair in the armpits
   E premenstrual syndome

2 Which of the following is not personal hygiene?
   A Cleanliness of the nails
   B Doing exercise
   C Brushing of teeth
   D Washing of clothes
   E Taking bath

3 Which of the following is not a danger when persona! hygiene is not maintained?
   A Dirty road
   B Bad body odour
   C Skin disease
   D Infection
   E Low self-esteem

4 Masturbating means you cannot have a baby when you are older. _____
   A True
   B False
   C Sometimes
   D Maybe
   E All of the above

5 A change during puberty when adolescents become more self-conscious of their physical appearance is _____.
   A a physical change
   B a social change
   C a emotional change
   D a personal change
   E a confidential change

6 Define the following:
   a) Menstruation
   b) Menstrual cycle
   c) Adolescence

7 Write five (5) puberty changes in girls.

8 List four (4) facts and four (4) myths about puberty changes.

9 State five (5) ways of maintaining personal cleanliness.

10 Explain five (5) ways of coping with social and emotional development of adolescents.

Chapter 3 Sanitation (Family health)

Introduction

When we talk about our environment, we mean everything in the world around us that surrounds and affects all living organisms (persons, animals and plants).

The environment is made up of **biotic** components, which are all the living things around us and **abiotic** components, which are all the non-living things (air, water, rocks, soil, etc).

The environment of living things provides conditions for development and growth as well as for danger and damage. Harmony with the environment is important and the environment must be protected to keep it safe.

The environment can be further grouped into external environment and internal environment. A human being lives in a home. His or her external environment includes everything in the external surroundings, such as the things in the home, the buildings, plants, living things, other humans outside the home and vehicles on the roads, while the internal environment of a human being includes everything inside his or her body.

Taking good care of our external and internal environments is, therefore, very important. This is to ensure good health, growth and happiness.

Beginning from this chapter up till chapter 6, you will learn how sanitation, nutrition, as well as drug and substance abuse affect human health.

Objectives

By the end of this chapter, you will be able to:

1 define personal cleanliness and sanitation, and state its importance;
2 describe methods used for keeping the human body and the home clean; and
3 state the consequences of poor hygiene.

Personal cleanliness and sanitation

Sanitation means cleanliness. There is a saying that 'Cleanliness is next to godliness'. This saying means that cleanliness is so important that it is next in rank to godliness (good character) in importance. Sanitation is the hygienic means of promoting good health through prevention of human contact with the hazards of wastes as well as the treatment and proper disposal of sewage wastewater.

There is a connection between family health and sanitation, nutrition, and drug and substance abuse. It is commonly said that a healthy family is a happy family. Good health is a precious possession. When you are healthy, you are happy. When you are sick, you are sad. Sanitation, nutrition, and drug and substance abuse affect family health in many ways.

About four centuries ago, people all over the world did not know what caused diseases. They had various kinds of superstitious ideas. Some thought that diseases were caused by evil spirits, while some thought that diseases were caused by bad air. In Nigeria, some people thought, and some still think, that diseases are caused by the anger of the gods; so they offer sacrifices to their gods to stop diseases. Gradually, scientists have been able to carry out investigations leading to the discovery of the causes of diseases.

Louis Pasteur (1822–1895), a French scientist, discovered that food spoilage was caused by very tiny living things (**microbes**) which could not be seen with the naked eyes, but with the aid of microscopes. Hence, they were and are still called **microorganisms**.

Robert Koch (1843–1910), a German physician discovered that each disease was caused by a specific kind of microorganism.

The next step in the growth of knowledge was to answer the question: 'Where do disease-causing microorganisms come from?' In due course, this question was answered. Just as young children come from their parents, microorganisms also come from their parents. Microorganisms are found almost everywhere, such as in the air, in water, in the soil, in decaying humus, in dirty places, on the surfaces of our bodies, and sometimes inside our bodies. Sanitation reduces sickness caused by microorganisms.

Fig. 3.1 A girl sweeping the floor

Meaning and importance of personal cleanliness and sanitation

Personal hygiene or personal cleanliness can be described as every practice that is aimed at improving the grooming and hygiene of a person. It involves keeping one's body, clothes and shoes in a clean and neat condition all the time.

Sanitation is the process of keeping places free from dirt, infection and diseases by removing waste materials, and by cleaning streets and our surroundings.

Personal cleanliness and sanitation are very important to humans because they help to make us healthy and happy. They are also very important for social reasons. In fact, people try to avoid or move away from those they think are smelly or unclean.
It is, therefore, very good to practise healthy hygiene habits daily.

Methods of keeping our body clean

The methods of keeping each part of the human body clean are as follows:

Body

The body is kept clean by washing with water, soap and sponge in the morning and night.

Nigeria is a tropical country and the atmospheric temperature is normally high

(room temperature may vary from about 25°C in the rainy season to about 31°C by midday in March). People sweat as they work, the sweat dries on the skin, and some microorganisms, which can cause diseases, live on the dried sweat. Dried sweat may also cause body odour or skin problems like acne.

For these reasons, it is necessary to wash the body twice daily. This also helps to reduce the bacteria that contribute to body odour, particularly in the armpits and on the feet.

Hair

Males should cut their hair short, and wash them daily. Females should wash their hair regularly or as soon as they feel uncomfortable, often through itching. Dirty hair may cause itching and growth of dandruff or lice.

Fingernails and toenails

Dirt usually accumulates under long fingernails and toenails. One should use a nail clipper or a razor blade to cut short the fingernails and toenails, and also wash the nails along with the fingers and toes.

Teeth

Proper oral hygiene is crucial in reducing and preventing problems of the mouth and gums like cavities and bad breath. The teeth should be cleaned with toothbrush and toothpaste twice a day, i.e. in the morning before breakfast and before going to bed at night.

Chewing sticks are also good for cleaning the teeth. In fact, chewing sticks made from certain plants are known to contain an antiseptic substance which kills harmful microorganisms that may be in the mouth. Your dentist can also help assess problem areas in your mouth and recommend special methods or products you may need.

Ears

Greasy and oily materials produced by the ear should be regularly cleaned out by using cotton buds.

Hands

The hands should be kept clean by washing them with clean running water. Apply soap, and then rinse thoroughly with water before drying with a fresh paper towel or an air drier especially before and after eating.

Washing of hands should also be done after attending a place or an event where there was a lot of handshaking; after manual labour; after handling animals; after going to the restroom; before and after changing a diaper or handling a small child; after handling garbage or dirty objects; before and after contact with a sick person, and after blowing your nose, especially when sneezing or coughing.

Clothes

Clothes should be kept clean by washing them as prescribed by the makers, ironing them (if necessary), and hanging them in an airy place to dry when necessary. Remove stains as soon as they occur.

Shoes

Shoes should be kept clean and neat by wiping off mud and other dirt on them with wet cloth, and polishing them where necessary.

Feet

The feet should be washed with clean water and soap along with the body, each time the body is washed.

Methods of keeping our homes clean

Keeping your home clean reduces bacteria and insects, and contributes to the overall wellbeing of the home. Every part of the home has a special way of cleaning it as now described.

1 **The kitchen**
Ceramic or metal sinks in the kitchen may be washed with scouring powder and plastic sponge or foam, and then flushed with clean water.

Cement, terrazzo, or tiled floors, should be mopped with soapy water and then dried with a dry mop or cloth. Always wash dirty dishes in the kitchen.

2 **Living rooms and bedrooms**
The floors of living rooms and bedrooms should be mopped with soap and water, and then dried with a mop. Always wash sheets and beddings at least twice a month.

3 **Wooden furniture**
Wooden furniture should be regularly dusted (with a duster) so as to remove all the dust.

4 **Window glasses**
Window glasses should be wiped clean with a slightly wet duster. The duster should be washed in clean water and wrung (drained of water) from time to time, while the window glasses are being cleaned.

5 **Walls**
If the internal surfaces of the walls are painted with oil paint, they may be cleaned by wiping them with a duster soaked in soapy water.

6 **Ceilings**
Cobwebs on the ceilings, at the corners of the walls and on burglary proof devices may be removed with long brooms.

7 **Window curtains**
Window curtains should be taken down, washed and dried in the sun or in a laundry drier from time to time.

8 **Toilets**
Toilets should be flushed after every use. The toilet bowls should be regularly cleaned with a toilet brush and detergents. The bathtub, and the sink in the bathroom also should be cleaned regularly with detergents and scouring powder.

Fig. 3.2 A clean modern toilet with a toilet paper in place

9 **The compound around the home**
It is advised that three dustbins should be provided in the premises. One dustbin should be for materials that can decay, such as leftover vegetables, fruits and food. The second dustbin should be for materials that can burn, such as paper, plastic, and wood. The third dustbin should be for pieces of metal and glass which do not burn or decay.

Materials that can decay may be emptied into a flower garden or vegetable farm. The materials that can

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Materials that can decay may be emptied into a flower garden or vegetable farm. The materials that can

burn should be burnt, while glass and metal pieces can be packaged and carried to a designated rubbish dump in the town. Waste materials should not be allowed to litter the premises. They should instead be put in the appropriate dustbin.

Again, weeds should not be allowed to grow around the home. If there is a lawn in the compound, it should be trimmed and kept neat and clean.

Activity 3.1 Proper handwashing techniques

Materials required

Your science notebook, soap, warm water/ running water, paper towel, biro

Procedure

1 Your teacher will organise your class into groups, with five students in each group.
2 Wet your hands with water.
3 Apply soap, and let it lather for at least 20 seconds.
4 Rub your palms and the back of your hands for at least 20 seconds, making sure to clean fingers, fingernails, cuticles, palms and wrists.
5 Rinse your hands under running water from your wrists to the top of your fingers.
6 Dry your hands with paper towels and use a towel to turn the faucet off, because sometimes, dirty hands were used to open the faucet.
7 Present your group report to your teacher for class discussion.

Activity 3.2 Cleaning agents and their uses

Materials required

Your science notebook, biro

Procedure

1 Your teacher will organise your class into groups, with five students in each group.
2 List the cleaning agents that you use in your home for personal cleanliness.
3 List the cleaning agents that you use in your home for home cleaning in your science notebook.
4 Write each cleaning agent you use in your home, and what it is used for in a table like the one below.

	Cleaning agent	Uses
1		
2		
3		
4		
5		
6		
7		

Advantages of personal hygiene and clean homes

The advantages of personal hygiene and clean homes include the following:

1 We look neat, fit and fine.
2 We reduce the number of disease-causing microorganisms that come in contact with us.
3 We are seldom sick, and are, therefore, usually healthy.
4 We are happy because we have good health.
5 We regularly go to school or to work as a result of good health.
6 We reduce our medical expenses because we are often well.

Consequences of poor hygiene

The consequences of poor personal hygiene or poor hygiene in our homes include the following:

1 We look untidy, and so do our home.
2 We tend to become frequently sick.
3 We may miss going to work or school regularly due to frequent illness.
4 We would tend to spend more on medical treatment than if we were usually healthy.
5 Poor hygiene would make us less happy than we should be.
6 We develop body odour, and bad breath which may prevent us from socialising with other people.

Summary

1 Personal cleanliness can be described as every practice that is aimed at improving the grooming and hygiene of a person. It involves keeping one's body, clothes and shoes clean and neat at all times.
2 There are specific ways to keep every part of the body or home clean.
3 Personal cleanliness entails proper hand-washing behaviour.
4 Personal cleanliness promotes good health, prevents diseases, makes us productive, saves us medical bills and keeps us happy and neat.
5 Some consequences of poor hygiene include suffering from various diseases, and having bad odour and bad breath at all times.

Revision questions 3

1 Sanitation means _____.
   A gravitation
   B cleanliness
   C sacrificing
   D wastes
   E going out
2 The body could be kept clean by _____.
   A washing with soap and water
   B wearing clean clothes
   C cutting nails
   D keeping hair tidy
   E all of the above
3 To ensure proper cleanliness, the body should be washed _____.
   A once in a few days
   B once a week
   C twice daily
   D twice a week
   E thrice a week
4 Keeping the home clean reduces _____.
   A bacteria
   B noise
   C sound
   D food
   E money
5 _____ is one of the consequences of poor hygiene.
   A Healthy bones
   B Mental stability
   C Frequent sickness
   D Looking neat
   E Low medical expenses
6 What is sanitation?
7 List six (6) ways of keeping our body clean.
8 List six (6) means of keeping our homes clean.
9 Describe the proper handwashing techniques.
10 State five (5) consequences of poor hygiene.

Chapter 4 Nutrition (Family health)

Introduction

Nutrition is the process of getting the right kind of food, eating, digesting, absorbing, and using it for growth, for the replacement of worn-out parts of the body, and for good health.

There is a saying that 'Your health depends on what you eat'. This means that the quality of your food affects your state of health. Please remember that food is not the only thing that determines how healthy you are. In addition to microorganisms and food, exercise and rest are other factors that affect your health.

Objectives

By the end of this chapter, you will be able to:

1 identify food types;
2 group food into classes based on nutrient;
3 explain the meaning of adequate diet; and
4 plan an adequate diet for a home.

Food

Food is any nutritious substance which, when eaten and digested, can be used by the body to provide energy, help in body-building and repair, and in preservation of health.

Nutrient

A **nutrient** is a source of nourishment for the body. It is a substance (or food) that provides what is needed by the body for healthy living and growth. The six essential nutrients (or classes of food) needed by the body are carbohydrates, proteins, fats and oils(or lipid), vitamins, mineral salts and water. However, in the particular case of mineral salts, sometimes each of them is regarded as a nutrient.

Nutrients can be classified as micro-nutrients and macronutrients.Macronutrients are nutrients we need in relatively large quantities while micronutrients are nutrients we need in relatively small quantities, e.g. vitamins and minerals.

Types of food

Scientists have studied various types of food, and it is now known that each class of food substances has a chemical structure of its own, and performs a particular function in the human body. It is important to know what each class of food substances does in the human body, and how different classes of food substances may be combined to provide a **balanced** diet.

There is a classification of foods, which is not scientific but just a convenient way of grouping foods. Hence, foods may be grouped into the following types:

1 Liquid and solid foods.

2 Foods eaten raw and foods eaten when cooked.
3 Cereals, vegetables and fruits.
4 Imported and local foods.

Table 4.1 Liquid and solid foods

Liquid foods	Solid foods
Cocoa drinks (such as *Bournvita*, and *Ovaltine*) Orange juice, Milk	Rice Yam Beans Garri

Table 4.2 Foods eaten raw and foods eaten when cooked

Foods eaten raw	Foods eaten when cooked
Lettuce Watermelon Pawpaw Carrot	Yam Rice Potato Meat

Table 4.3 Local and imported foods

Local foods	Imported foods
Yam Rice Beans Garri	Milk Butter, Stockfish Cheese Pasta (such as Spaghetti)

Table 4.4 Cereals, vegetables and fruits

Cereals	Vegetables	Fruits
Rice Wheat Millet Corn	Lettuce Cabbage Bitter leaf Waterleaf	Orange Mango Watermelon Avocado pear

Classes of food

This is a scientific classification of foods based on the:

1 chemical composition of the food; and
2 nutrients present in the food.

In this classification, foods are grouped into six classes, namely carbohydrates, proteins, fats and oils (or lipids), vitamins, mineral salts, and water.

The chemical composition or properties of each class of food, their functions in the body, and examples of each class of food are now discussed.

Carbohydrates

Carbohydrates are made up of carbon, hydrogen and oxygen atoms. The ratio of hydrogen to oxygen atoms in each molecule of carbohydrates is 2:1. Carbohydrates provide energy in the human body.

Foods that contain carbohydrates include garri, rice, millet, guinea corn, yam, bread, potato, wheat, maize and sugar.

Proteins

Proteins are made up of carbon, hydrogen, oxygen and nitrogen atoms. Sulphur and phosphorus may also be present in them.

Proteins are used for body building, growth, and for repair or replacement of worn-out cells. Enzymes which help in food digestion are proteins.

Foods that contain proteins include meat, milk, fish, beans, peas, egg, butter, cheese, and yoghurt.

Fats and oils (or lipids)

Fats and oils (or lipids) are made up of carbon, hydrogen and oxygen atoms in each molecule, but the ratio of hydrogen to oxygen in lipids is higher than that in

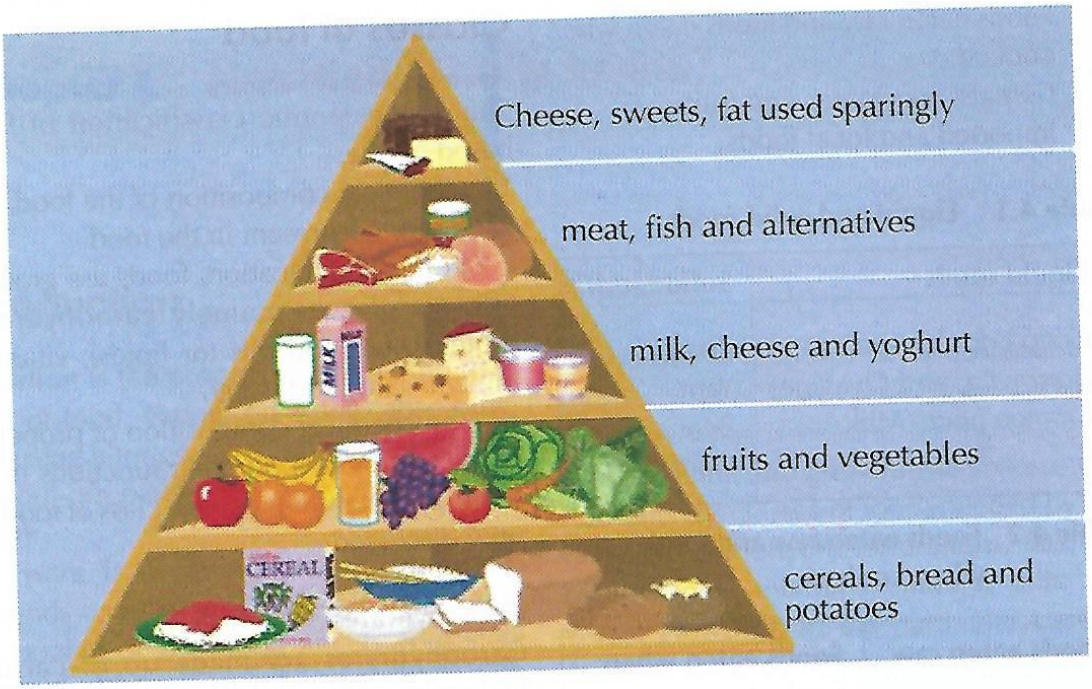


Fig. 4.1 Pyramid of classes of food

carbohydrates. Fats and oils are similar in chemical structure, but fats are solid, while oils are liquid at room temperature. Lipids are energy-giving foods.

Fats and oils (or lipids) include animal fat, palm oil, groundnut oil, olive oil, fish oil, melon oil, and vegetable oil.

Vitamins

Vitamins have no common chemical structure. Their chemical compositions also vary. What is common to them, however, is that each of them is made by the living thing in which it occurs.

Vitamins promote good health. There are several kinds of vitamins which are named Vitamins A, B, C, D, E and K. These vitamins are grouped into two: water-soluble vitamins (B and C) and fat-soluble vitamins (A, D, E and K). Their sources, properties and functions are shown in Table 4.5.

When a particular vitamin is deficient in one's diet, the body of that person suffers from a vitamin-deficiency disease specific to that vitamin.

Mineral salts

These are essential nutritional elements which when taken in, helps the body to perform its metabolic and others functions such as:

1 balancing of body fluids;
2 development of enzymes and hormones;
3 compositon of bones and teeth;
4 transmission of nerve impulse; and
5 contraction of the muscle.

These essential nutritional elements comprise the salts of the trace elements found in animals and macronutrients found in plants.

The deficiency of any of these nutrients can lead to deficiency diseases shown in Table 4.6.

Table 4.5 Sources and functions of the main vitamins required in the human diet and deficiency diseases caused by a lack of them

Name of vitamin and its designed letter	Principal sources	Function	Deficiency diseases and symptoms
Vitamin A (Retinol)	Fish–liver oil milk, carrots, spinach	Aids night vision.	Poor night vision; serious deficiency results in complete blindness.
Vitamin B_1 (Thiamine)	Wheat or rice, jam, yeast extract, liver, kidney	Helps during respiration.	Beri-beri; muscles may become weak and painful; children's growth is reduced.
Vitamin B_2 (Riboflavin)	Yeast extract, liver, egg, milk, cheese	Helps during respiration.	Tongue sores; sores at the corners of the mouth.
Vitamin B_3 (Niacin)	Meat, yeast extract, liver, whole meal bread	Helps growth.	Pellagra – skin lesions; rashes; diarrhoea.
Vitamin B_5	In most foods	Helps during respiratory and nervous coordination.	Poor nerve and muscle coordination; fatigue and muscle cramp.
Vitamin B_6	Egg, liver, kidney, whole grains, fish	Helps amino acid metabolism and fatty acid metabolism.	Anaemia; diarrhoea
Vitamin B_{12}	Meat, milk, egg, fish, cheese	Helps during formation of red blood cells.	Anaemia, particularly in women during pregnancy.
Vitamin C (Ascorbic acid)	Citrus fruit, green vegetables, potato, tomato	Concerned with the metabolism of connective tissues and the production of strong skin.	Scurvy – skin of gums becomes weak and bleeds; wounds fail to heal.

Vitamin D (Calciferol)	Fish – liver oil, egg yolk, dairy products, margarine	Important in bone and tooth formation; aids absorption of phosphorus by the action of sunlight on the skin	Rickets – failure of growing bones to calcify; bow legs are common features in young children and knock knees in older ones. Deformation of the pelvic bones in adolescent girls can occur which may lead to complications when giving birth.
Vitamin E	Brown flour, liver, green vegetables	Allows the reproductive system to function well.	Can cause sterility in male and infertility in female.
Vitamin K	Spinach, cabbage	It is necessary for blood clotting mechanism in the body.	Mild deficiency leads to a prolonged blood clotting time.

Table 4.6 Some mineral elements and their uses in living organisms

Element and symbol	Common food source	General importance	Deficiency disease
Nitrogen (N)	Lean meat, fish and milk	Synthesis of proteins and many other organic components; necessary for formation of protoplasm for repair of cells and tissues.	Kwashiorkor due to lack of protein.
Phosphorus (P)	Milk, fruits and seeds	Synthesis of protein; constituent of bone and teeth; necessary for respiration, assimilation of food and functioning of muscles.	Rickets; dental decay

Sodium (Na)	Table salt (sodium chloride) and bacon	Proper functioning of muscles and nerves.	Muscular cramps
Magnesium (Mg)	Vegetables and most other foods	Proper functioning of muscles and nerves.	Nerve disorder in children
Calcium (Ca)	Milk, hard water seafood, green vegetables, bones, grains, fruits	Constituent of bone, enamel and shells; necessary for blood clotting.	Poor skeletal growth, possibly leading to rickets and clotting of blood.
Manganese (Mn)	Vegetables and	Bone development. most other foods	Poor bone development
Iron (Fe)	Liver and red meat, some vegetables, e.g. spinach; in various foods, e.g. plantain	Formation of red blood cells and enzymes.	Anaemia
Magnesium (Mg)	Vegetables and most other foods	Proper functioning of muscles and nerves.	Nerve disorder in children
Calcium (Ca)	Milk, hard water seafood, green vegetables, bones, grains, fruits	Constituent of bone, enamel and shells; necessary for blood clotting.	Poor skeletal growth, possibly leading to rickets and clotting of blood.
Manganese (Mn)	Vegetables and most other foods	Bone development.	Poor bone development
Iron (Fe)	Liver and red meat, some vegetables, e.g. spinach; in various foods, e.g. plantain	Formation of red blood cells and enzymes.	Anaemia
Cobalt (Co)	Liver, red meat, most foods	Red blood cell development.	Anaemia

Fluorine (F)	Milk, drinking water in some areas.	Component of tooth enamel and bone.	Dental decay is more rapid.
Iodine	Seafood, salt	Proper functioning of the thyroid gland.	Goitre; cretinism in children
Potassium (K)	General diet	Helps in conduction of impulses by nerves.	Nerve disorder
Sulphur (S)	General diet	Necessary for formation of hair, nails.	Hair loss; poor formation of nails
Chlorine (Cl)	Added to food as sodium chloride	Maintains osmotic pressure of blood.	Low osmotic pressure of blood

Water

Water is made up of hydrogen and oxygen atoms only.

Water is regarded as a food substance because, while it does not by itself produce energy, it is a body-building material, and many physiological and biochemical processes in the body cannot go on without it. Lack of water will cause death sooner than lack of the other things we normally call food. The functions of water in the human body are as follows:

1 Water is a component of the blood, and makes up about 90% of the blood. Therefore, without water, blood will not exist.

2 Water is a component of all secretions in the body, such as saliva, enzymes, tears, and sweat.

3 Water is necessary for digestion because the enzymes that make digestion possible are secreted in aqueous (water) solution. Also, water is taken with solid food to make digestion easier.

4 Water is necessary for the absorption of food.

5 Water is essential for growth because it is necessary for the manufacture of the body material called **protoplasm**. If water is not available, the body cannot manufacture new protoplasm, and there will be no growth and life.

6 Chemical reactions in the body take place when certain substances are dissolved in water. So, without water, essential reactions will not occur.

Adequate (balanced) diet

An adequate or **balanced diet** is one that is sufficient in quantity and in food nutrients for good health. You have learnt that each food nutrient has a specific function in the body. Therefore, an adequate or balanced diet should contain all the food nutrients.

However, all food nutrients are not required by the human body in the same

Fig.4.2 Different types of food

amounts. Of all the nutrients, carbohydrates are required by the human body in the largest amount, followed by proteins, lipids, vitamins and minerals.

Balanced diet is one that contains adequate amount of all the six classes of food in their right proportion.

Activity **Planning an adequate or balanced diet for your family**

Materials required

Your science notebook, biro

Procedure

1 Your teacher will arrange the class into groups so that each group has five members.

2 Each group should plan a balanced diet for a family for one week.

3 Each group should use, as much as possible, foods available in the area where your school is situated.

4 Compare your plan with Table 4.8 to see if all the classes of food have been adequately included.

Table 4.7 Functions of different classes of food

Class of food	Function
1 Carbohydrate	Energy giving
2 Protein	Body building/repair of worn-out body tissues
3 Fat and oil (lipids)	Energy giving
4 Vitamins	Health promoting
5 Mineral salts	Involved in essential reactions for health
6 Water	Helps in body building and in essential reactions

Table 4.8 A sample balanced diet chart

Day	Breakfast	Lunch	Supper
Monday	Pap, akara	Garri, vegetable soup, meat	Yam, vegetable stew, fish
Tuesday	Fried or boiled plantain, stew	Moi moi, fruit	Rice, vegetable stew, fish
Wednesday	Pap, akara	Garri, vegetable soup, meat	Salad, bread, meat
Thursday	Yam, vegetable stew, fish	Plantain, vegetable stew, fish	Rice, vegetable stew, fish
Friday	Pap, akara	Garri, vegetable soup, meat, fruit	Beans, fried or boiled plantain
Saturday	Yam, vegetable stew, fish	Beans, fried plantain, fruit	Rice, vegetable soup, fish
Sunday	Bread, margarine,	Rice, vegetable stew	Moi moi, fruit

Summary

1 Food is any nutritious substance which when eaten, digested and absorbed, can be used by the body to produce energy, build the body and preserve health.

2 There are six classes of food, namely carbohydrate, protein, lipids, vitamins, minerals and water. Each class has its characteristics and functions.

3 There are different ways of grouping foods.

4 An adequate or balanced diet is that meal which contains adequate amount of all the six classes of food in their right proportion.

5 Every home needs an adequate diet.

6 Diseases that result from the lack of vitamins are called vitamin-deficiency diseases.

Revision questions 4

1 Which of the following is *not* a food item? _____.

A Milk
B Spinach
C Rice
D Orange
E Alcohol

2 A disease that results from the lack of a vitamin is called _____.

A a protein-deficiency disease

B a vitamin-deficiency disease
C a poverty illness
D a hunger disease
E kwashiorkor disease

3 Which of the following is the function of vitamins in the human body?

_____

A For providing energy
B For body building
C For preserving health
D None of the above
E All of the above

4 How many classes of food are contained in an adequate diet?

A 1
B 2
C 3
D 4
E 6

5 List three (3) food types.
6 Classify foods based on nutrient content.
7 Define an adequate or balanced diet.
8 Prepare an adequate diet chart for a week.
9 List five (5) functions of water in the human body.
10 List five (5) mineral elements and their deficiency diseases.

Chapter 5 Drug and substance abuse 1 (Family health)

Introduction

Wherever you live, you may have observed persons who roam about and appear to be mentally unstable. People who live close to them say that some of them became unstable by smoking Indian hemp, or by drinking too much alcohol.

When a chemical is called a drug, the chemical may not be bad in itself. It may have some useful applications in a hospital when prescribed by trained medical doctors. However, when individuals use drugs, such as cocaine or marijuana by themselves, the situation known as **drug abuse** may arise, with serious adverse effects.

When a substance, usually a drug, is taken by people in amounts or with methods which are harmful to them or others, there is also said to be drug or substance abuse. Substance abuse and addiction are known to run in some families and there is a theory that there is a genetic factor which influences certain individuals.

The use of certain drugs can lead to criminal penalty in addition to possible physical, social and psychological harm.

In this chapter, you will learn about causes of drug abuse, examples of drugs abused and their possible effects.

Objectives

By the end of this chapter, you will be able to:

1 define drug and substance abuse;
2 list the causes of drug abuse;
3 explain the meaning of drug addiction;
4 give examples of drugs usually abused; and
5 list symptoms common to drug addicts.

Drug and substance abuse

A **drug** is a substance usually taken for the treatment of ill health. It should be used as prescribed by a physician (medical doctor). If you have ever been sick and had to take medicine, then you already know about drugs.

When a drug is used properly, it means that it is used:

1 as prescribed by a medical doctor.
2 in the right amount.
3 for the right purpose.
4 in the right number of times.
5 in the right way.

You may probably have heard that drugs are bad for you! But what does that mean and why are they bad? Drugs become bad when people use them anyhow they want or buy them from people who are selling them illegally. This is also known as **drug abuse**.

Drug abuse means that a drug is used:

1 without doctor's prescription.
2 in the wrong amount.
3 for the wrong purpose.
4 in the wrong number of times.
5 in the wrong way.

Substance abuse is a wider term than drug abuse. It means the wrong use or consumption of any substance, whether it is a drug or not. For example, a person may habitually take too much sugar or soft drinks. This is an example of substance abuse.

Causes of drug abuse

Some causes of drug abuse have been identified as follows:

1 **Curiosity**
When some young people see some adults or their own mates smoking, drinking or using other drugs, they become curious, and ask themselves 'how does it feel?' In order to satisfy their curiosity, they may also begin to use such drugs and they may become addicted.

2 **Lack of self confidence**
A young man may decide to take alcohol to increase his confidence each time he plans to visit a girl he wants to be close to. The alcohol makes him feel more confident than being without it. With time, he may form the habit of drinking alcohol.

Actors and actresses sometimes suffer from what is called **stage fright**, i.e. they become nervous or afraid, owing to the awareness that a large number of people are watching them. They may forget some passages they have memorised. An actor or actress may then decide to take a drug that makes him or her feel comfortable before a large audience, and may form the habit of doing so.

3 **Trying to fit into a peer group**
Young persons are often tempted to smoke marijuana, or take other drugs, in order to feel accepted by members of their age group also doing so.

4 **Trying to have a grown-up feeling**
Some young people like to feel they are grown-up and mature. To demonstrate this, they try to smoke or drink as some adults do.

5 **Source of excitement**
A person may take a drug which makes him or her feel excited and good.

6 **Reduction of stress and frustration**
Persons facing some life problems, e.g. marriage break-up, business failure, academic failure and loss of a loved one, sometimes take a drug that seems to make them forget their sorrow temporarily. With time, such persons may find it difficult to stop taking the drug.

Examples of drugs abused

The sources, properties and effects of some drugs on users are now described.

1 **Opium**
Opium is obtained from the poppy plant, an annual plant (one that germinates, grows and dies within one year, such as maize), which is probably native to Asia Minor, but grows in many other countries.

Afghanistan produces a major part of the opium in the illegal world drug market.

As the fruits form, they are scratched with sharp knives at sunset. A white gummy liquid flows out. By the next morning, the dried liquid is scrapped off by hand. The dried liquid is kneaded into balls of opium which drug traffickers sell.

When inhaled in smoke, opium causes drowsiness (sleepiness) and

temporary loss of the senses. The user enjoys pleasant feelings called **hallucinations**. (Hallucination is defined as the experience of seeing or feeling something that is not really there.) Later, the user becomes helpless for many hours.

2 **Cocaine**

Cocaine is obtained from the *coca* plant which grows wild in the Andes area of South America. The plant is cultivated in South America and in Java. The commercial drug is extracted from the dried leaves of the plant with alcohol.

Cocaine is a strong stimulant, that is, it excites the user beyond the natural. Local people in South America who chew the leaves use the stimulating effect to increase their ability to work. The drug reduces fatigue, but raises blood pressure, makes the user very excited and talkative. It also dilates (widens) the pupils in the eyes, and increases heart beat. An overdose may cause the users' death.

3 **Valium**

Valium is manufactured in form of tablets. In hospitals, it has a proper use in treating conditions, such as anxiety (too much worry) and tension when prescribed by a doctor.

Drug abusers use it without doctor's prescription to treat themselves when suffering from sleeplessness. An overdose of valium may cause death.

4 **Alcohol**

Alcohol is classified as a drug because it has some properties in common with other drugs. These include the facts that alcohol:

a) affects the senses of the user;
b) is a stimulant;
c) makes one feel like sleeping;
d) creates an illusion (that is, a wrong opinion of oneself) in an abuser; makes you have a high feeling. For instance, a man that is drunk, thinks he is strong, whereas, in fact, he is weak;
e) is habit-forming (that is, when you form the habit of taking alcohol, it is difficult for you to stop);
f) when abused for a long time, gradually damages the brain, liver and other organs; and
g) abuse may lead to premature death.

5 **Tobacco and cigarettes**

Tobacco plants are grown in commercial quantities in Nigeria, Zimbabwe, some other countries in Africa and elsewhere in the world. The tobacco leaves are dried and then processed (made) into cigars, cigarettes, tobacco for pipes and ground tobacco for snuff.

All forms of tobacco smoking have been found to be injurious to human health. The Federal Government of Nigeria has passed a law that requires cigarette manufacturers to place a warning on each packet stating that smoking is injurious to health.

Tobacco or cigarette smoke contains several compounds which are harmful to human health. Both the smoker and those who happen to be around the smoker are at risk as they inhale the cigarette smoke, hence, there are signs in public buildings that say, 'No Smoking'.

Smokers are more likely to suffer from lung and respiratory tract disorders (such as cough) than non-smokers.

Fig. 5.1 A mentally ill man smoking

6 **Marijuana or Indian hemp**

Marijuana or Indian hemp grows in many parts of the world, including India, Arabia, Southern Europe and Africa, including Nigeria. The leaves and flowers may be eaten, taken as a drink, inhaled or smoked.

Marijuana affects the brain. The abuse of marijuana, either alone, or in combination with alcohol abuse, is suspected to be the major cause of the mental ill health of several Nigerian youth today.

Effects of drug abuse

The effects of drug abuse are summarised in the table below.

Effects of drug abuse

	Effects	Drug responsible
1	Mental illness	Marijuana
2	Feeling 'high'	Alcohol, cocaine
3	Having wrong opinion of oneself	Alcohol
4	Addiction (habit forming)	All drugs
5	Waste of money on something useless	All drugs
6	Premature death	Opium, valium, alcohol
7	Lung and respiratory track diseases	Tobacco/ cigarettes

Activity **Investigating causes of drug abuse**

Materials required

Your science notebook, biro

Procedure

1 Each student in the class should interview at least one person known to him or her, who is involved in taking a drug.
2 Find out the reason(s) why the person started taking the drug.
3 Find out if the drug abuser wants to stop the drug abuse and how he or she is trying to do so.
4 Find out if the drug abuser is succeeding in stopping the drug abuse or not.
5 Find out how the drug abuser gets supplies of the drug.
6 Try to know about how much the person spends on the drug weekly.
7 Record all your findings in your science notebook.
8 Submit the report of your findings to your teacher for class discussion.

Drug addiction

One of the properties of drugs is that a person who uses a drug tends to use it again. As the person continues to use the drug again and again, a time comes when the person is not able to stop the use or abuse of that drug. In fact, the person does not feel comfortable or normal until he or she uses the drug. Medical doctors prefer to describe this condition by saying the individual is **dependent** on the drug.

Those in the States' Houses of Assembly, the House of Representatives and the Senate, who make laws, prefer the terms addiction or habituation. All three terms; dependence, habituation and addiction, mean the same thing, which is that a drug user has formed the habit of using the drug, and finds it very difficult to withdraw from it. There are experts who help addicts to stop taking drugs. Some addicts have succeeded in stopping drug abuse by strong determination and with the help of experts.

Drug addiction is a dependence on an illegal drug or a medication. A person addicted to drug may not be able to control the drug use and may continue using the drug despite the harm it causes. Drug addiction can cause an intense craving for the drug. People addicted to drugs often want to quit, but they find out they cannot do it on their own.

For many people, what starts as casual use, leads to drug addiction. Drug addiction can cause serious long-term consequences, including problems with physical and mental health, relationships, employment and the law. To overcome addiction and stay drug free, the addict needs the help of the doctor, family, friends, support groups or an organised treatment programme.

Drug addiction mostly starts with a casual or social use of a drug. For some people, using the drug becomes a habit and its use becomes more frequent. As time passes, larger doses of the drug are needed to get high, just to feel good. As the drug use increases, it becomes increasingly difficult to go without the drug. Stopping may cause intense cravings and feeling of physical illness (withdrawal symptoms).

Helping an addict

If you think someone is using drugs, the best thing to do is to tell an adult that you trust. This could be a parent, other relatives, teacher, coach or school counsellor.

The person might need professional help to stop using drugs. A grown-up person can help the addict find the treatment needed to stop using drugs.

Another way young persons like you can help is by choosing not to use drugs without prescription or close monitoring.

Symptoms common to drug addicts

1 Loss of interest in school.
2 Changing of friends (to hang out with persons who use drugs).
3 Moody, negative, cranky or worried all the time.
4 Desire to be left alone a lot.
5 Lack of concentration.
6 Sleeping a lot (may be even in class)
7 Being violent and getting into fights.
8 Red or puffy eyes.
9 Loss or gain of weight.
10 Severe coughs.
11 Runny nose all the time.
12 Sweating and shaking (tremor) all the time.
13 Spending money on expensive drugs.

Summary

1 Drug use is taking a drug for its medically intended purpose.
2 Drug is misused if a medically–prescribed drug is taken inappropriately.
3 Drug addiction is a dependence on an illegal drug or a medication.
4 Drug is abused if a person:
   a) takes the prescribed drug for a purpose other than that for which it was intended;
   b) takes a dosage other than that recommended;
   c) takes drugs to gain confidence or boldness;
4 The consequences of drug abuse include:
   a) accidents;
   b) suicide;
   c) HIV infection;
   d) arrest by the police for drug possession;
   e) feelings of rejection, hostility, aggression, anxiety and depression; and
   f) death.

Revision questions 5

1 Write the sources of the underlisted drugs.

Drug	Source
Opium	
Marijuana	
Cocaine	
Morphine	
Heroin	

2 Causes of drug abuse include _____.
   A experimenting
   B curiosity
   C doing what others do
   D the desire to feel like a grown up
   E all of the above
3 Which of the following is not a group of drugs? _____.
   A Narcotics
   B Sedatives
   C Stimulants
   D Tranquilisers
   E None of the above
4 Why do young people become involved in drug abuse?
5 Describe the harmful effects of alcohol and tobacco on human health.
6 Describe the (a) sources (b) medical uses and (c) effects when abused, of two, named drugs.
7 Give three (3) reasons why drug abuse and drug trafficking should be controlled by governments.
8 Explain the meaning of drug abuse.
9 State two (2) sources of drugs.
10 Give two (2) examples of drug and substance abuse.
11 Mention two (2) effects of drug abuse.

Chapter 6 Drug and substance abuse 2 (Family health)

Introduction

Drug can be defined as a chemical substance used to treat a sickness, relieve a symptom or modify a chemical process in the body for a specific purpose.

A drug is abused when there is excessive or persistent use of such drug without regard to accepted medical practice.

Some examples of drugs that can be abused include: paracetamol, cocaine, caffeine, Indian hemp, valium, tobacco, barbiturates, cannabis, methaqualone.

In addition to what you have learnt in chapter 5, this Chapter will explain substance abuse and drug misuse.

Objectives

By the end of this chapter, you will be able to:

1 define drug;
2 mention some drugs and substances that can be abused;
3 explain substance abuse and drug misuse; and
4 explain instances of drug misuse.

Substance abuse

Substance abuse occurs when substances are used in excess or frequently used than expected. Substances like sugar, water, soft drinks, gum, salt and so on can be abused.

Whenever substances are abused, it can result into weakness, tiredness, boredom, inconveniencies in the body structure, especially the stomach; in form of pains, aches or upset.

Drug misuse

This can be referred to as taking drugs for a medical purpose but not in the appropriate amount/dosage, frequency, strength or way.

Instances of drug misuse include the following:

a) Taking drugs for the purpose for which it is not prescribed.
b) Not taking the drug at stipulated times, periods or intervals.
c) Misuse of drugs to induce sleep.
d) Misuse of drugs for confidence to commit crime such as rape, suicide, assault, etc.
e) Underdosage of an antibiotic can cause resistance by the causal micro-organisms while an overdosage of drugs such as chloroquine through self medication can cause blindness or heart failure.

Misuse of herbal medicine

A herb is a plant or part of plants that is used for its scent, flavour or nutritional value. Herbal medicines are a type of dietary supplement that can be prepared and sold in form of powders, teas, capsules, fresh or dried plants, e.g. neem plant, kola plant and lemon grass.

Herbal medicines can be misused when there is no scientific rationale in the content, that is, the right proportion of each constituent in the content. Also, the mechanism of action or dosage taken is not determined.

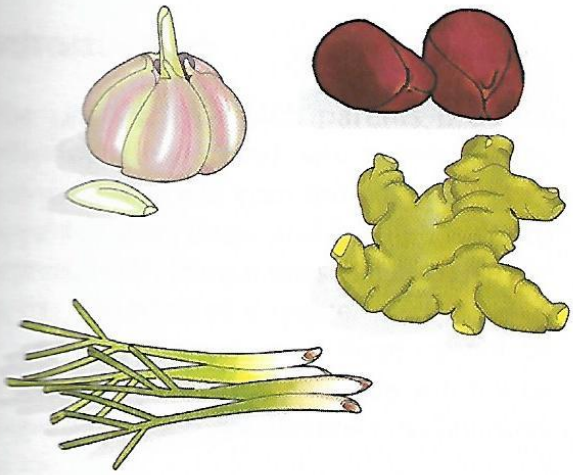


Fig. 6.1 Herbs including kolanut, ginger, garlic, spinach, lettuce, lemon grass

Fig. 6.2 Chemical drugs, e.g. tablet, caplet, capsule, syrup

Activity **Identifying some chemical drugs and herbal medicines**

Materials required

Different forms of drug like capsule, caplet, tablet, syrup, powder and suspension, neem leaf, kolanut, ginger, lemon grass, your science notebook, biro

Procedure (Group activity)

1 Your teachers will divide the class into two groups.
2 *One group will work on chemical drugs* while the other group will work on herbal medicines.
3 Your teacher will make samples of drugs in form of caplet, capsule, tablet, syrup and some herbal medicines available to the groups.
4 In each group, study, identify and make some observations about the drugs or herbs given to you.
5 Lastly, classify the drugs into their forms; and the herbs as either liquid or solid (for herbs only).

Summary

1 Drug is a chemical substance used to treat sickness, relieve a symptom or modify a chemical process in the body for a specific purpose.
2 Drug abuse is the excessive use of drug without regard to accepted medical practice.
3 Substances like salt, water, soft drinks, biscuits and sweet, can be abused when used in excess or more frequently than expected.
4 Substance abuse can lead to: weakness, tiredness and inconveniences in the body.
5 Drugs are misused when they are taken for medical purpose but not in appropriate amount or dosage. Instances of drug misuse include:
   a) taking drugs for the purpose for which it is not prescribed.
   b) misuse of drugs to induce sleep.

Revision questions 6

1 A chemical substance used to treat a sickness, relieve a symptom or modify a chemical process in the body is called _____.
   A food
   B water
   C drug
   D none of the above

2 The following are examples of drugs that can be abused except _____.
   A tobacco
   B cannabis
   C water
   D cocaine

3 The following are the result of substance abuse except _____.
   A tiredness
   B anger
   C weakness
   D inconveniences

4 _____ is taking drugs for a medical purpose but not in the appropriate dosage, frequency, strength or way.
   A Drug abuse
   B Drug usage
   C Drug misuse
   D Drug addiction

5 Drug abuse can be defined as _____.

6 _____ is a plant or part of a plants that is used for its scent, flavour or nutritional value.

7 _____, _____ and _____ are examples of herbal medicines.

8 _____ can be misused when there is no scientific rationale in the content.

9 Misuse of drugs can cause _____.

Chapter 7 Reproductive system

Introduction

The process in which parents produce offspring of their kind, which involves the union of gametes from the parents of two opposite sexes (male and female), is called reproduction. The gametes that fuse give rise to the formation of a zygote.

Without reproduction there cannot be increase in population, and life will not be interesting. Reproduction ensures continuity of life.

Objectives

By the end of this chapter, you will be able to:

1. identify parts of male and female reproductive organs;
2. state the functions of each part; and
3. explain how to care for the male and female reproductive organs.

Human reproductive organs and their functions

The human reproductive organs are made up of many parts that function together in producing new ones. The male reproductive organs are a pair of testes, penis and sperm ducts while the female reproductive organs are a pair of ovaries, the oviduct, uterus, cervix and vagina.

Male reproductive organs

Testes: The testes are the primary organs of reproduction in the male. These are the organs where sperm (spermatozoa) and hormone (testosterone) are produced. The testes are found in-between the leg. They are also responsible for sexual urge. They are located in the scrotum, which is a skin sac.

Scrotum: This helps to regulate the temperature of the testes which need to be kept cooler than the body temperature to produce sperm.

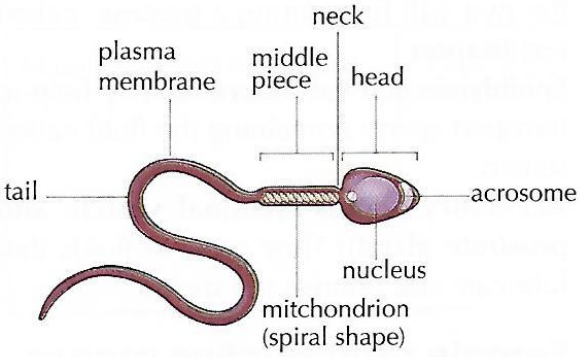


Fig. 7.1 Human male sperm

Penis: The penis lies between the legs and is attached to a bag of skin sac called scrotum, which contains the testes. It is the continuation of the urethra and a passage for semen and urine.

The penis lies flat at rest. It is erect when excited and enlarges in shape and size as blood rushes into it which makes it to easily penetrate into the vagina during sexual intercourse.

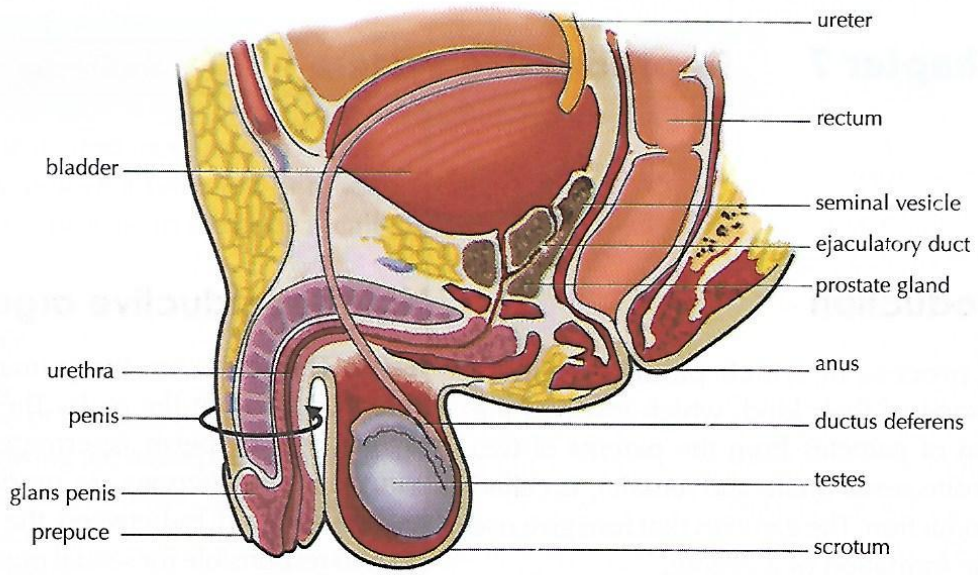


Fig. 7.2 Male reproductive organs

The sperm is released through the penis into the vagina and swims to meet the egg cell waiting at the fallopian tube in the female organ. If the sperm meets the egg, the two will fuse during a process called **fertilisation**.

Epididymis and vas deferens: They help to transport sperm containing the fluid called semen.

Accessory glands (seminal vesicle and prostrate gland): They provide fluids that lubricate and nourish the sperm.

Female reproductive organs

The female reproductive system consists of a pair of ovaries, the oviduct, uterus, cervix and vagina.

Ovary: It is the primary organ of reproduction in the female. It has two functions:

1 Production of egg or ovum, i.e. female sex cell.
2 Production of hormone; the hormones are called oestrogen and progesterone.

Oviduct (Fallopian tube): It is the connecting tube between the ovary and the uterus. If fertilisation occurs, the egg is directed to the uterus by the fallopian tube or oviduct to form the zygote, but if there is no fertilisation, the egg shrinks within 3 – 4 days and blood flows out through the vagina.

Uterus (Womb): The functions of the uterus are to:

1 house the zygote, i.e. the fertilised egg.
2 provide shelter for the zygote till it matures.
3 house the foetus till it is mature to be pushed out through the vagina.

Cervix: It closes the uterus to intruders to prevent infections but permits the sperm to enter the uterus.

Vagina: It is an external muscular organ that leads the uterus outside. The functions of the vagina are:

1 to connect the vulva and cervix;
2 for sexual intercourse;
3 as a passage for menstruation when there is no fertilisation;
4 as a passage for the baby from the uterus; and
5 as a passage or channel for sexually transmitted diseases.

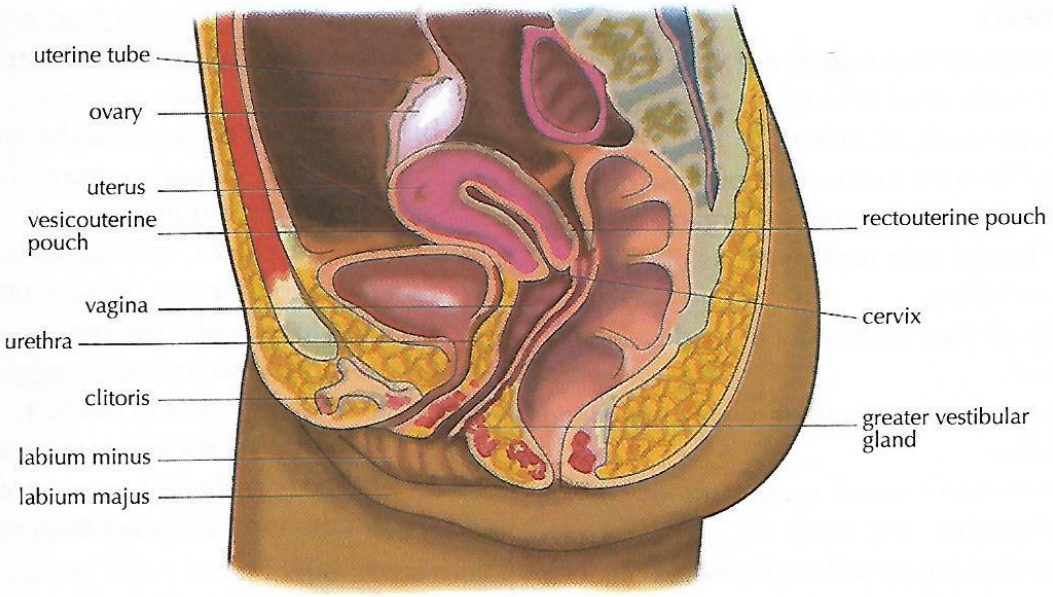


Fig. 7.3 Female reproductive organs

Activity 7.1 Identifying the male and female reproductive organs and their functions

Materials required

A chart showing the female and male reproductive organs, your science notebook, pencil, biro, eraser

Procedure

1. Study the chart presented to you.
2. Draw and label the male and female reproductive organs.
3. In a tabular form as shown in Table 7.1 and Table 7.2 respectively, write the male and female reproductive organs and their functions.
4. Submit your work to your teacher.

Table 7.1 Male reproductive organs and their functions.

Male reproductive organs	Functions

Table 7.2 Female reproductive organs and their functions.

Female reproductive organs	Functions

Care of the reproductive system

The reproductive organs are very sensitive, and as such, need to be taken care of to avoid different kinds of infection. The following should be done to take care of these organs:

1 Clean your external sex organ everyday.
2 Change your underwear as often as is necessary.
3 Wash your underwear immediately after use.
4 Keep your clean underwears in a clean place.
5 Whenever some symptoms of sexual diseases are noticed, rather than embarking on self medication, contact a medical doctor.
6 Abstain from sex before marriage.
7 Do not engage in any abortion of pregnancy.

Activity 7.2 Importance of reproduction

Materials required

Your science notebook, biro

Procedure

1 Your teacher will divide the class into groups.
2 Discuss the importance of reproduction in your group.
3 Write the result of your discussion in your science notebook.
4 Submit it to your teacher.

Summary

1 The type of reproduction in human beings is called sexual reproduction. It occurs between the parents (father and mother).
2 The male reproductive organs are:
   a) Testes, which are for production of spermatozoa and also the release of sperm.
   b) Penis, which releases the sperms into the female organ during sexual intercourse.
   c) Sperm ducts, which allow the passage of sperm into the penis.
3 The female reproductive organs are:
   a) Ovaries which produce eggs and release eggs to the oviduct.
   b) Uterus (Womb) which releases fertilised eggs, holds foetus, nourishes foetus and pushes out the foetus as a baby.
   c) Vagina, which allows blood to flow out during menstruation in the absence of fertilisation.
   d) Vulva, which is the opening end of the vagina.
4 The male sex cell (gamete) is the sperm cell or spermatozoa.
5 The female sex cell (gamete) is the egg cell or ovum.

Revision questions 7

1 The male sex cell/gamete is called _____.
   A scrotum
   B sperm cell
   C ppenis
   D ovum
   E none of the above
2 A female reproductive organ is the _____.
   A sperm
   B ovary
   C penis
   D testes
   E scrotum

3 Human male reproductive organs include all except _____.
   A ovum
   B penis
   C scrotum
   D testes
   E sperm
4 The male testes are found in the _____.
   A bladder
   B liver
   C kidney
   D scrotum
   E sperm duct
5 Which of these is not found in the male reproductive system? _____
   A Penis
   B Scrotum
   C Ovum
   D Testes
   E Sperm duct
6 List the main
   a) male reproductive organs
   b) female reproductive organs
7 Write the functions of the listed reproductive organs of each sex in Question 6.
8 Define reproduction and write two (2) benefits of reproduction.
9 Draw a well-labelled diagram of the female reproductive system.
10 List five (5) ways to care for the reproductive system.

Chapter 8 Human reproduction 1

Introduction

Reproduction in humans is known as sexual reproduction. Reproduction is the process in which parents produce offspring. In Chapter 2 (Human development) you were introduced to how to maintain good hygiene during menstruation.

In this chapter, you will further learn about menstruation, menstrual hygiene, ovulation and its signs, fertilisation and conception.

Objectives

By the end of this chapter, you will be able to:

1 define terms like menstruation, menstrual hygiene, cleanliness during menstruation, ovulation, fertilisation and conception;
2 explain the following: ovulation, signs of ovulation and the difficulty in predicting the ovulation period; and
3 state ways of maintaining hygiene and cleanliness during menstruation period.

Definition of terms

1 **Menstruation:** Menstruation is the flow or regular release of bloody waste known as unfertilised egg from the inner layer of the uterus through the vagina; or the shedding of an unfertilised egg through the uterine wall.

2 **Menstrual hygiene:** This is the necessary personal cleanliness being carried out during menstruation.

Cleanliness during menstruation

It is important to observe the following personal hygiene routine during menstruation as this will prevent infections caused by disease-causing organisms:

1 Change of sanitary pad as and when due.
2 Washing of hands after each change of pad.
3 Disposal of pad neatly by wrapping it in a newspaper; if a toilet roll is used, it should be disposed flushed away in the water closet.
4 Regular bath to prevent offensive odour and discomfort.
5 Use of warm water to wash the vagina during menstrual period.

Ovulation

Ovulation occurs when a mature egg is released from the ovary, pushed down the fallopian tube, and is made available to be fertilised. Ovulation can occur at various times during a cycle and may occur on a different day each month.

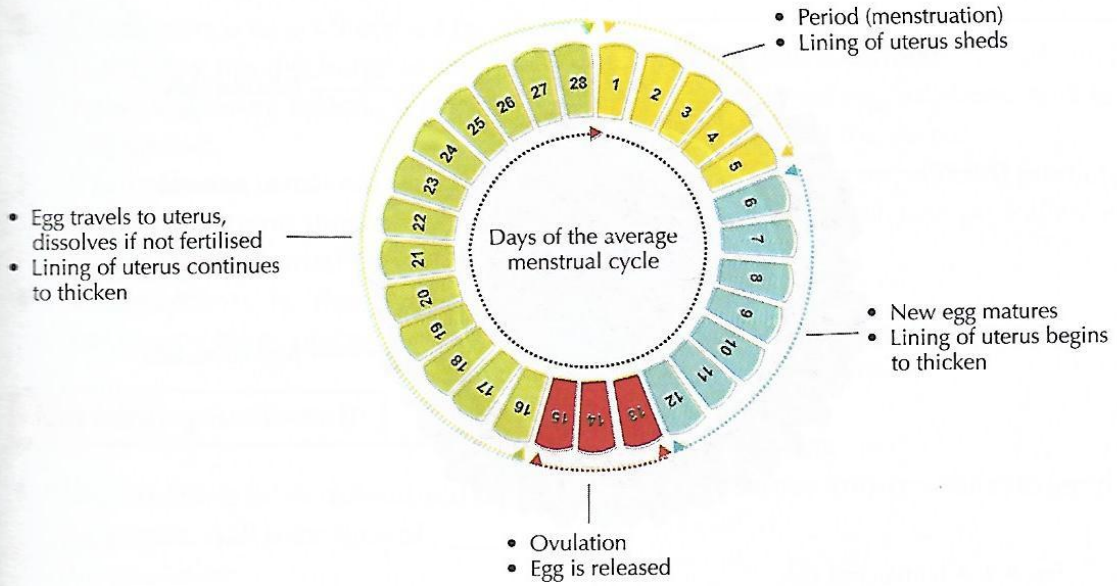


Fig. 8.1 Diagram showing the days of the average menstrual cycle and pointing to days of menstruation and when ovulation occurs

If there is no sperm to fertilise the egg, the egg decays and the uterine lining as well as blood will be shed during menstruation.

Signs of ovulation

Predicting ovulation is based on the concept of keeping track of when the ovary releases the egg. Here are some signs to predict ovulation:

1 Some girls/women experience cramp.
2 Some have pain on one side of the pelvis.
3 Breast tenderness.
4 Mild nausea in some girls women.
5 Increased sex drive.
6 Heightened sense of smell, taste or vision.
7 Abnormal bloating.
8 Light spotting.
9 The cervix is light, soft and open.

Causes of difficulty in predicting the ovulation period

1 Stress: This may cause a disorder and thereby affect ovulation.
2 Irregular menstrual cycle.
3 Luteal hormone (L – H) which is used to predict ovulation may not be regular.

Fertilisation

Fertilisation is the union or joining of the egg and sperm, resulting in a fertilised egg known as zygote. The egg is capable of fertilisation for only 12 to 24 hours.

The process

The egg will sit waiting for one sperm out of up to 150 million that begin the race, and it will merge with that sperm to create human life. While the egg waits, the sperms race and compete to be the first to penetrate the egg. Fertilisation takes place inside the fallopian tube.

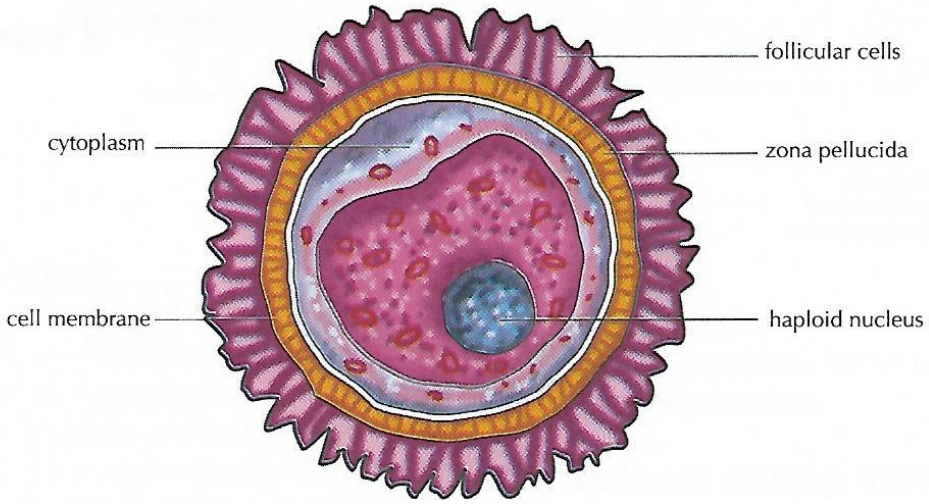


Fig. 8.2 A human egg cell

Conception

This is the journey from ovulation to fertilisation. Conception is the implantation of the fertilised egg to the lining or wall of the uterus.

This is how conception works:

1 The sperm – The sperm must transport be deposited and transported to the site of fertilisation.

2 Egg transport – Ovulation must occur and egg must be 'picked up' by the tube.

3 Fertilisation – Union between the sperm and egg results in this embryo development.

4 Implantation – The embryo must implant and begin to grow in the uterus.

Activity **Identifying signs of ovulation and causes of difficulty in predicting ovulation**

Materials required

Your science notebook, biro

Procedure (Group work)

1 The class will be divided into groups of five students in each group.

2 Each group should state signs of ovulation and causes of difficulty in predicting ovulation in form of a table.

3 Submit your report to your teacher for discussion.

Summary

1 Menstruation is the flow or regular release of bloody waste known as unfertilised egg from the inner layer of the uterus through the vagina.

2 Cleanliness is an act that must be carried out during the discharge of the bloody waste to prevent infections and forestall discomfort.

3 Cleanliness and maintenance of personal hygiene should be carried out during the menstrual cycle.

4 Conception is the period when pregnancy takes place.

Revision questions 8

1 The shedding of an unfertilised egg and the uterine wall is the time of _____.
   A ovulation
   B menstruation
   C hygiene
   D cycle
   E fertilisation

2 Conception occurs in the _____.
   A fallopian tube
   B oviduct
   C vagina
   D uterus
   E cervix

3 Conception occurs when _____.
   A sperm meets with the egg.
   B egg remains in the fallopian tube
   C egg is unfertilised
   D zygote is formed
   E fertilised egg implants itself to the lining of the uterus

4 The following are ways of predicting difficulty in ovulation period except _____.
   A stress
   B irregular menstrual cycle
   C luteal hormone
   D nausea
   E vomiting

5 The journey from ovulation to fertilisation is called _____.
   A conception
   B menstruation
   C uterus
   D personal hygiene
   E none of the above

6 Define the following terms:
   a) Menstruation
   b) Conception
   c) Ovulation
   d) Fertilisation

7 a) List five (5) signs of ovulation
   b) What are the difficulties in predicting ovulation period.

8 State five (5) ways of maintaining menstrual hygiene.

Chapter 9 Human reproduction 2

Introduction

All living things replicate by giving birth to young ones alive. The fusion of sperm with the egg brings about a gamete called zygote which develops to an embryo and finally to a foetus.

There are stages in pregnancy. The pregnancy period has three stages or trimesters. In this chapter, you will learn more on human reproduction (pregnancy).

Objectives

By the end of this chapter, you will be able to:

1 explain how pregnancy occurs;
2 describe symptoms of pregnancy and when to get help;
3 explain the growth of foetus (stage by stage till birth).

Pregnancy

Pregnancy is the time during which one or more offspring develop inside a woman. It is also the period between implantation of the embryo and the birth of the foetus. The time of pregnancy is also known as gestation period.

Pregnancy in humans occur through sexual intercourse, and the baby stays in the uterus for about 40 weeks. An embryo is the developing offspring in the first eight weeks in the uterine (womb) which is surrounded by a fluid called the amniotic fluid (watery liquid). The embryo obtains the food and oxygen it needs from blood vessels in the uterus.

After a few weeks, the placenta and umbilical cord develop. After the eighth week, the embryo develops to the foetus (i.e. a more recognisable being) until birth, when the fully grown foetus separates from its mother at the completion of pregnancy. The baby is pushed (normally head first) out from the vagina, still joined by the umbilical cord with the placenta. This is cut, and the stump forms the baby's navel.

Time of labour is the contraction of the strong muscles of the uterus to push the baby out. As it passes into the cervix (which is the neck of the uterus at the inner end of the vagina) the amniotic fluid (watery liquid) bursts and the fluid escapes.

The placenta comes out shortly after the birth of the baby.

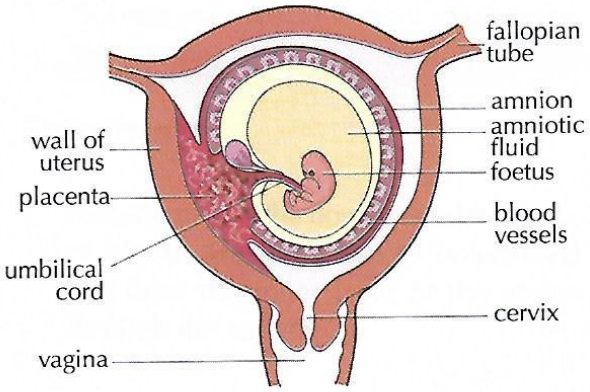


Fig. 9.1 Side view of a developing foetus

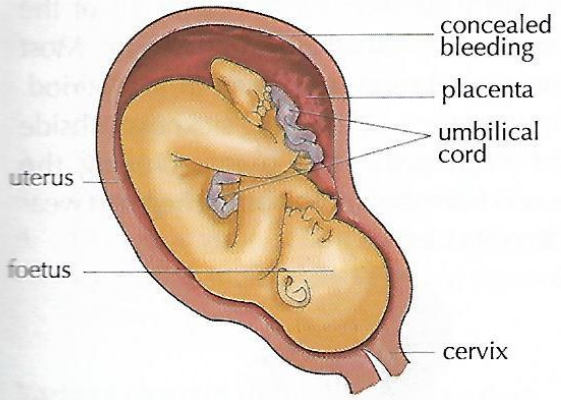


Fig. 9.2 The foetus coming out at the cervix area to the vagina

Activity 9.1 Identifying the developing foetus

Materials required

A chart showing a developing foetus, your science notebook, biro

Procedure (Group work)

1. The classs will be divided into groups of five students in each group.
2. Students in each group should observe the model of a developing foetus.
3. Discuss in your group.
4. Write your observations in your science notebook.
5. Submit your report to your teacher.

Symptoms of pregnancy

1. There is the need for a home pregnancy test or blood test. The best time to conduct the test is when the period is missed or it is late.
2. Shortness of breath: The growing foetus needs oxygen, leaving the pregnant woman a little short of breath and it may continue as the baby starts to put pressure on the lungs and diaphragm.
3. Fatigue: A pregnant person feels easily tired and this can continue throughout the first trimester, i.e 1 – 3 months.
4. Nausea: Some experience morning sickness (which can occur in the morning, noon and night). At this moment, food that will settle the stomach, such as crackers or ginger ale should be taken.
5. Frequent urination: At this moment, the body produces extra fluid, which makes the bladder work more.
6. Headaches: This is an early sign of pregnancy; a result of changes in hormones.
7. Backache: It could mean the ligaments are loosening and this might continue throughout the pregnancy as the weight is gained.
8. Cramps: It may be the uterus stretching to get ready for the baby.
9. Constipation and bloating: It is caused by the slowing down of the digestive system.
10. Mood swings: This occurs as a result of the body trying to adjust to new hormones.
11. Super smell: This means an increased sensitivity to odours.
12. Dizziness or fainting: It can be caused by low blood sugar or low blood pressure. A pregnant woman should stay well hydrated and eat enough food.
13. Late period: If the cycle was fairly regular before, it will now be late.
14. Positive pregnancy test.

Where to get help during pregnancy

1. Doctors and midwives
   The family doctor or a midwife should

be seen once pregnancy is suspected. The family doctor can advise on how to take care of the pregnant woman and the baby; and refer her to an obstetrician, i.e., a doctor who specialises in pregnancy and childbirth. This stage is called pre-natal care.

2 Community health centres: They give counsel on how to take care of the pregnant woman and the baby. Counselling on food to eat, body carriage, dress sense, the right exercise and other care is given to pregnant women.

3 Pregnant women are given less work to do; they enjoy the attention of every co-worker. They then have maternity leave.

Growth of foetus stage by stage till birth

Pregnancy is mainly broken into three periods or trimesters which make nine months. The first three months make one-third of the nine months.

First trimester: The uterus changes in size over the duration of the trimester. Many symptoms and discomfort of pregnancy like nausea and tender breasts appear.

Fig. 9.3 The embryo at first trimester

Second trimester: Weeks 13 to 28 of the pregnancy is called second trimester. Most women feel more energised in this period. The symptoms of morning sickness subside and eventually fade away. During the second trimester, most women begin to wear maternity clothes.

Fig. 9.4 The foetus at second trimester

Third trimester: The uterus expands, making up a larger portion of the woman's abdomen. This is the final stage of the pregnancy. Babies born between 39 and 41 weeks gestation have better outcome than either before or after this period.

Fig. 9.5 The foetus at third trimester

Activity 9.2 Identifying physical changes in pregnancy at the three trimesters

Materials required

A chart on various stages of pregnancy, your science notebook, biro

Procedure

1 Teacher should present to the class achart showing a lady in the 1st trimester, 2nd trimester, and 3rd trimester of pregnancy.
2 Students should study the chart.
3 Discuss the various changes observed.
4 Write in your science notebook, the various changes observed as in the table below.

Various changes in the three trimesters

1st trimester	2nd trimester	3rd trimester

Summary

1 Pregnancy in humans occur through sexual intercourse.
2 Childbirth typically occurs around 42 weeks from the last menstrual period.
3 An embryo is the developing offspring during the first eight weeks following conception.
4 Pregnancy is divided into three trimesters.
5 Some of the symptoms in pregnancy are tiredness, constipation, nausea (morning sickness), vomiting and heart burn.
6 The fusion of sperm and egg is called fertilisation.
7 The uterus is known as the womb.

Revision questions 9

1 Another name for uterus is _____.
A oviduct
B cervix
C womb
D egg
E vagina

2 The pregnancy stage in humans can be called _____.
A gestation
B incubation
C maturity
D puberty
E adolescence

3 The fusion of the nuclei of male and female sex cells forms the _____.
A zygote
B ovulation
C reproduction
D gestation
E conception

4 One of the following serves as a reproductive organ in a male: _____.
A cervix
B oviduct
C penis
D fallopian tube
E uterus

5 Conception occurs in the _____.
A fallopian tube
B oviduct
C cervix
D vagina
E uterus

6 Define reproduction.
7 Write six symptoms of pregnancy.
8 Where can a pregnant woman get help? (Give 2 points)
9 What happens at the second trimester of a growing foetus?

Chapter 10 Consequences of teenage pregnancy

Introduction

In many developing countries of the world and even some developed ones, teenage pregnancy is on the rise, such that it is becoming almost a normal thing in society. Many of these teenage pregnancies are factors of many things like waywardness, early marriage, peer pressure, poverty, parents neglect, economic situation, and drug abuse.

However, when a young woman marries or gets pregnant before the age of twenty, it attracts the attention of society because she is still a teenager. Also, teens may not have acquired the necessary positive parenting skills and life skills to cope with the stress and joy of having and raising a child, even if they are biologically mature.

Hence, consequences and implications of teenage pregnancy, self medication during pregnancy, drug abuse during pregnancy, and facts and myths about teenage pregnancy will be treated in this chapter.

Objectives

By the end of this chapter, you will be able to:

1 explain the consequences and implications of teenage pregnancy;
2 mention some effects of drug and self-medication during pregnancy;
3 list the effects of drug abuse on pregnancy; and
4 state some facts and myths about teenage pregnancy.

Meaning of teenage pregnancy

Teenage pregnancy occurs when a female adolescent between the ages of thirteen and nineteen becomes pregnant. This results in consequences that could stand against the teen in achieving her set objectives.

Consequences and implications of teenage pregnancy

The effects of teenage pregnancy can be very serious on the victims. It can result into many negative things in their lives, future and career. All these consequences can be considered under emotional, physical and social consequences.

Emotional consequences

1 The moment a teenager misses her period and is confirmed pregnant, fear and confusion will set in, followed by resentment and frustration.
2 In a situation where her partner refuses to accept responsibility for the pregnancy, she may get frustrated to the extent of considering suicide as an option for her.

3 An afterbirth mood disorder called 'post partum depression' may be experienced by the teenage mother. It can manifest in form of anxiety, sleeplessness, sadness, intolerance and impatience.
4 The pregnant teenager may have to drop out of school as a result of her disposition and emotions which can affect her school work.

Physical consequences

1 Teenagers are at high risk of giving birth prematurely. The effects can be long or short term and may cause development problems.
2 Anaemia is related to iron deficiency, and this condition may affect the baby's development before birth. It may increase the risk of premature birth and even pose challenges for both mother and baby during delivery.
3 It was discovered that pregnant teenagers' babies are likely to have low-birth weights (<2.5 kg) compared to those of adult mothers. This is due to the fact that teenage mothers do have poor eating habits. Also, it is more likely that they may not take their daily pre-natal vitamin supplements that can help them maintain adequate nutrition during pregnancy.
4 Lack of proper or adequate knowledge of the teenage mothers on how to take care of themselves as well as the baby in the womb, can lead to foetal death or stillbirth. For instance, smoking, fighting, uncontrolled use of drugs, drinking alcohol, not observing personal hygiene can all lead to foetal death or stillbirth.

Social consequences

Society has a way of influencing teenage mothers such that they do take some irrational steps which can lead to any of the following:

1 Drug abuse: Due to rejection from society (family and friends), teenage mothers may result into smoking and drinking, which can cause health problems for both the baby and mother.
2 Ridicule and discrimination: Schoolmates, teachers, peers, family members and even religious groups may begin to ridicule and discriminate by separating themselves from her or yelling, blaming, and despising her.
3 Isolation: The parents of the concerned pregnant teenage mother may abandon or reject her at this crucial time of her life that she needs them most. This may lead to loneliness and depression thereby making her isolate herself from parents, friends and families.
4 Dropping out of school: Due to shame, fear, ridicule and discrimination in the school environment, pregnant teenager may decide to stop going to school. Also, handling pregnancy or care for a new born can prevent a teenager from completing school, hence, giving her low level education attainment.

Effects of self medication and drug abuse during pregnancy

Due to cultural beliefs, ignorance, poverty, lack of understanding and exposure, many people take drugs that are not prescribed by a qualified medical doctor. All these also affect teenage mothers, hence they take to self medication during pregnancy.

The following are effects of such self medication on pregnant mothers:

1 Defects in the development of the reproductive organs.
2 Respiratory diseases in baby.
3 Foetal retarded growth or malformation.

Fig. 10.1 A pregnant teenager

Fig. 10.2 A pregnant adult

4 There may be complications like intra - uterine foetal death and mental retardation.
5 Genital diseases like urinary retention.

Whenever drugs are abused during pregnancy especially for new mothers, it can result into the following:

1 Foetal death.
2 Miscarriage.
3 Low birth weight (baby born with weight less than 2.5 kg).
4 Low blood sugar.
5 Premature labour and birth.
6 Breathing difficulties of the unborn baby.
7 Developmental delays.

Facts and myths about teenage pregnancy

These are truths (facts) and false beliefs (myths) surrounding teenage pregnancy and pregnancy in general. Some of them are shown in Table 10.1 and Table 10.2 respectively.

Table 10.1 Myths and facts of teenage pregnancy

S/N	Myths	Facts
1	A teenager cannot become pregnant the first time she has sex.	She can get pregnant, if her first time falls within her ovulation period.
2	When a pregnant woman eats, she is eating double portion, i.e. for her and the baby.	The food is only for the pregnant woman. After the food is digested, the unborn baby now gets its own.
3	If a pregnant woman moves or walks in the sun, an evil spirit will chase out the baby and take its position.	This is just to prevent pregnant women from stressing themselves, hence they are told some stories that make them panic.

Table 10.2 Myths and facts about pregnancy in general

S/N	Myths	Facts
1	The shape of the belly determines the sex of the baby.	The sex of the baby can only be detected through ultra sound scan.
2	It is impossible for a teenager to become pregnant during her period.	Sometimes, the menstrual cycle may be irregular, hence she can become pregnant.

Tips for pregnant teenagers

Teenage pregnancy is not advisale, and we oppose it strongly. But, just in case you discover you are pregnant;

1 Do not make any move to abort it.
2 Always try to seek counselling, when needed.
3 Avoid smoking, drinking of alcohol or using illicit drugs.
4 Eat nutritious and balanced diet to promote growth and good health for both mother and foetus.
5 It is advisable to get your pre-natal care earlier, as a pregnant teenager.

Activity Recording of ante-natal programme attended by a pregnant teenager

Materials required

Video clips, laptop/video player with flat screen, hospital environment (if need be)

Procedure (Group work)

1 The class is divided into two groups, depending on the number of students in the class.
2 As co-ordinated by the teacher, let each group visit a maternity home, clinic or hospital where ante-natal programme is held and a pregnant teenager is involved.
3 Alternatively, where this is not possible, teacher should make effort to go andrecord some activities of ante-natal programme in the hospital. Then, bring the video clips to the class and play them for students to watch.
4 Make your observations from the video and give some suggestions about teenage pregnancy.

Summary

1 Teenage pregnancy is a pregnancy that occurs in a female whose age is thirteen and nineteen years .
2 Giving birth to a baby as a teenager may have emotional, physical and social consequences on the teenage mother.
3 Drug abuse and self-medication during pregnancy can have some adverse effects on the baby and even the mother.
4 'A teenager cannot become pregnant the first time she has sex.': This is a myth but the fact remains that she can get pregnant if her first time falls within her ovulation period.
5 Some tips are helpful for pregnant teenagers, for example, do not abort in case you discover you are pregnant as a teenager.

Revision questions 10

1 Teenage pregnancy occurs in a female between the ages of _____.
   A thirteen and nineteen
   B ten and twenty
   C twelve and nineteen
   D eleven and twenty
2 Teenage mothers are _____.
   A emotionally fit
   B capable of raising children
   C not capable of raising children emotionally and socially
   D mothers indeed
3 The consequences of teenage pregnancy can be _____.
   A physical
   B emotional
   C social
   D all of the above

4 The following are physical consequences of teenage pregnancy except _____.

A obesity
B kwashiorkor
C confusion
D low birth weight

5 Myths about teenage pregnancy are _____.

A not common in our society
B scientifically true
C cultural beliefs that are baseless
D none of the above

6 Define teenage pregnancy and mention three (3) consequences of such pregnancy.

7 Mention five (5) effects of self medication during pregnancy.

8 State three (3) adverse effects of drugabuse on teenage pregnancy.

9 Write two (2) myths and facts about teenage pregnancy.

10 Mention three (3) helpful tips for pregnant teenagers.

Chapter 11 Environmental pollution

Introduction

In Chapter 3, you learnt that the environment is the total surroundings of an organism. Wherever you live, your environment will include the things surrounding you, such as the houses, the plants, the animals, the human beings, the soil, the atmosphere and all other things. Sanitation is very important to the environment. When your environment is clean, you have a better chance of being healthy and happy than when your environment is dirty.

There are always interactions between an organism and its environment. One of these interactions is the **exchange of material.** This means that an organism exchanges materials with its environment. For example, a human being inhales (breathes in) fresh air from the atmosphere, and exhales (breathes out) expired air into the atmosphere. A human being takes from the environment into his or her body, water and food materials. He or she gives out to the environment, urine, sweat and faeces.

Human beings eat bananas and oranges and throw away the peels. We drink sachet water and bottled water and throw away the sachets or empty water bottles anyhow. Humans also throw away several kinds of waste materials, such as plastic, glass, old dresses, damaged pots, plates and pans. Unused ripe tomatoes and mangoes, with time become bad, and we need to throw them away.

If you make a list of the things human beings throw away into the environment, you will find out that they are very many. An important way in which human beings affect their environment is by throwing away our waste products into our environment. The waste products we throw away affect the environment and us.

Objectives

By the end of this chapter, you will be able to:

1. define air, water and soil pollution;
2. identify various pollutants and their effects on the environment;
3. list various causes of pollution;
4. mention ways of reducing the risk of pollution; and
5. describe pollution control.

Pollution

Pollution is the discharge of waste products of human activities into the environment, **in quantities** and **for a length of time** that are harmful to human beings, animals and plants (crops).

Classification of pollution

Pollution may be classified into various types in the following ways:

1 Using the basis of the part of the environment that is polluted, pollution is classified into air, water and soil pollution.

2 Using the basis of the substance that is polluting the environment, pollution may be classified into chemical substance pollution, e.g. oil pollution, smoke pollution, carbon monoxide pollution; or energy pollution, e.g. noise pollution and heat pollution.

3 Using the basis of the source of the substance that is polluting, pollution may be classified into domestic pollution and industrial pollution.

4 Using the basis of the location or where the pollutant is originating from, pollution may be classified as point source pollution and non-point source pollution.

The substance that is polluting the environment is called a **pollutant**. Pollutants are classified in various ways, such as those that:

1 can decay (biodegradable; or

2 cannot decay (non-biodegradable).

Air pollution

Air is an important part of the environment, and most organisms need it. Air contains gases like oxygen, hydrogen and carbon dioxide. Animals obtain oxygen from the atmosphere and give out carbon dioxide into the atmosphere. Plants absorb carbon dioxide from the atmosphere for photosynthesis and give out oxygen to the atmosphere. Fresh air is healthy for animals and plants, but when air is polluted, human beings, animals and plants become uncomfortable.

Air pollution has always accompanied civilisation and industrial revolution. Air pollution is the discharge of waste substances of human activities into the atmosphere, in quantities, and for a length of time that are harmful to human beings, animals and plants. The waste substances that pollute the atmosphere are called **air pollutants.** Some of these pollutants are in the form of solid particles, and are called **solid air pollutants** while some others are in the form of gases, and are called **gaseous air pollutants**.

The emergence of great factories and consumption of large quantities of coal and other fossil fuels gave rise to unprecedented air pollution.

Air pollution comes from both natural and human-made sources. However, globally, human-made pollutants which come from combustion, construction, mining, agriculture and warfare are increasingly contributing more to air pollution.

The names of the solid air pollutants, their sources, their effects and their control are shown in Table 11.1, while those of gaseous air pollutants are shown in Table 11.2.

Table 11.1 Solid air pollutants

Solid air pollutant	Sources	Effects	Control
1 Wood particles	a) Sawmills b) Paper industries c) Carpenters' workshops d) Furniture manufacturing industries	a) Irritate the respiratory tract b) Cause respiratory tract disorders, such as cough c) Can start a crisis in an asthmatic patient	a) Wear nose mask to avoid inhaling wood particles when working in an industry that produces such particles. b) Shield the industry or workshop to prevent the escape of wood particles into the atmosphere.
2 Dust particles	a) Sweeping the floor inside a home and the grounds surrounding the home b) Movement of heavy trucks along untarred roads c) Cultivation of farmlands with tractors d) Road construction	a) Can block the view of vehicle drivers or pedestrians b) Can irritate the respiratory tract c) Can cause suffocation d) When dust settles on green leaves of plants, it reduces sunlight available to leaves and, therefore, the rate of photosynthesis	a) Wear nose mask while working in an environment where the atmosphere contains much dust b) Wet the ground during road construction. c) If possible, cultivate the farm when there is no wind.
3 Rock particles	Quarries that crush stones used for building or road construction	Accumulate in the respiratory system, and in time, cause health problems	a) Wear nose mask while in, around or near the quarry. b) Shield quarries to prevent the escape of rock particles into the atmosphere.

4 Asbestos particles	Asbestos factories during production of ceiling boards, roofing sheets and asbestos pipes	a) Accumulate in the respiratory system and cause respiratory diseases b) Can start a crisis for an asthma patient	a) Wear nose mask. b) Shield the factory to prevent escape of asbestos particles into the atmosphere.
5 Cement particles	a) Cement industries during packaging of cement bags b) Cement shops during loading and off-loading c) Building sites	a) Irritate the respiratory system b) Cause cough	a) Wear nose mask, preferably one that covers the head also. b) Wear an overall.
6 Lead particles	Exhaust gases from cars that use lead-containing petrol. (A lead compound is added to some brands of petrol. to make cars run more smoothly.)	a) Lead accumulates in the human body b) Lead is toxic; it is dangerous or poisonous to the human body c) Lead is toxic to crops	Service vehicle engines as and when due.
7 Unburnt carbon particles in smoke	a) Burning of firewood, coal and plastic b) Cooking with faulty stoves c) Bush burning d) Exhaust fumes from faulty cars, trucks and engines	a) Irritate the eyes b) Irritate the respiratory system c) Cause cough d) May cause respiratory disorders	Service stoves, cars, trucks and engines regularly.

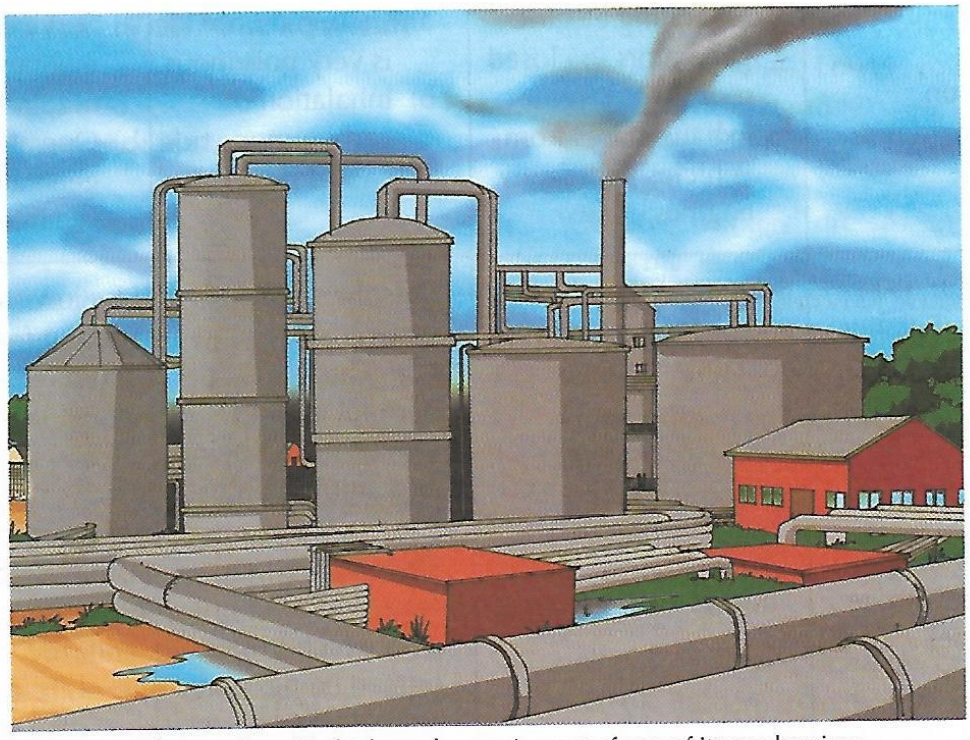


Fig. 11.1 A factory site with thick smoke coming out of one of its smoke pipes

Table 11.2 Gaseous air pollutants

Gaseous air pollutant	Sources	Effects	Control
1 Ammonia	a) Decaying organic materials b) Dirty gutters c) Stagnant water	Ammonia is poisonous to human beings and animals	Good sanitation
2 Carbon(IV) oxide (Carbon dioxide)	a) Burning of wood, coal and kerosene in domestic cooking b) Bush burning c) Gas flaring	a) Accumulates in the atmosphere b) Reduces oxygen in the blood c) Reduces passage of heat from the earth into the atmosphere	Plant trees in your compound which use carbon dioxide for photosynthesis.

3 Carbon(II) oxide (Carbon monoxide)	a) Operating electric generators in closed rooms b) Exhaust gases from vehicles with faulty engines	a) Carbon monoxide is very poisonous. b) Inhalation of carbon monoxide causes death	a) Service vehicle engines regularly. b) Operate electric generators in ventilated places.
4 Sulphur (IV) oxide (Sulphur dioxide)	Burning of wood, coal, and petrol or diesel oil containing sulphur	Dissolves in rain water to form acid rain which is harmful to farm crops, human beings and animals	Use low sulphur or sulphur-free petrol and diesel oil.
5 Nitrogen (IV) oxide (Nitrogen dioxide)	Burning of wood or humus	Dissolves in rain water to form nitric acid which irritates human beings and animals, and harms plants	Minimise bush burning.
6 Hydrogen sulphide	Decaying organic matter	Poisonous to human beings and animals	Do not accumulate refuse.
7 Insecticide	a) Sprayed in homes to kill houseflies, mosquitoes, cock-roaches and ants b) May be sprayed by health officials in gutters to kill harm-ful insects	a) Irritates the eyes b) May cause cough c) Harmful to human beings if inhaled in large dose	a) Spray minimum insecticide needed to kill the insects in the rooms b) Leave the room immediately after spraying until the fumes have cleared.

- Other air pollutants are smog, haze, chlorofluorocarbons (CFCs) and nitrogen oxides.

Activity 11.1 Visit to a sawmill

Materials required

Your science notebook, glass slide, Vaseline, biro

Procedure

1. Your teacher will make all arrangements for you to visit a nearby sawmill. The arrangements will include transportation.
2. When you are about 20 m away from the sawmill, stop and look at the atmosphere in the sawmill and in the surrounding environment. Record your observations.
3. Rub Vaseline on one face of your glass slide and hold up your glass slide with your left hand as you enter the sawmill. Hold the glass slide up for two minutes. Lower your glass slide and hold it safely.
4. Observe what the workers do in the factory.
5. Observe workers' dresses, including caps, masks and shoes.
6. When you return to your school, look carefully at the side of the glass slide where you rubbed Vaseline.
7. Rub your finger over the glass slide.
8. Record all your observations in your science notebook.

Soil pollution

Soil pollution is the discharge of waste products of human activity on soils in amounts that are harmful to human beings, animals and plants. Classes and examples of soil pollutants are shown in Table 11.3.

Table 11.3 Classes and examples of soil pollutants

	Class of pollutants	Examples
1	Solid wastes	Metal scraps, plastics, paper, glass, textiles, vegetable matter, wood, leather
2	Farm wastes	Chicken droppings, rice husks
3	Heavy metals	Found in batteries
4	Chemical wastes	Used engine oil, paint, grease, carbide
5	Asbestos	Pieces of asbestos
6	Rubber	Tyres, rubber parts of cars
7	Radioactive elements	Uranium, thorium, potassium
8	Bones	Bones of animals
9	Ceramics	Old water closets (WC) sinks
10	Insecticide	Herbicides, pesticides and chlorinated hydrocarbons

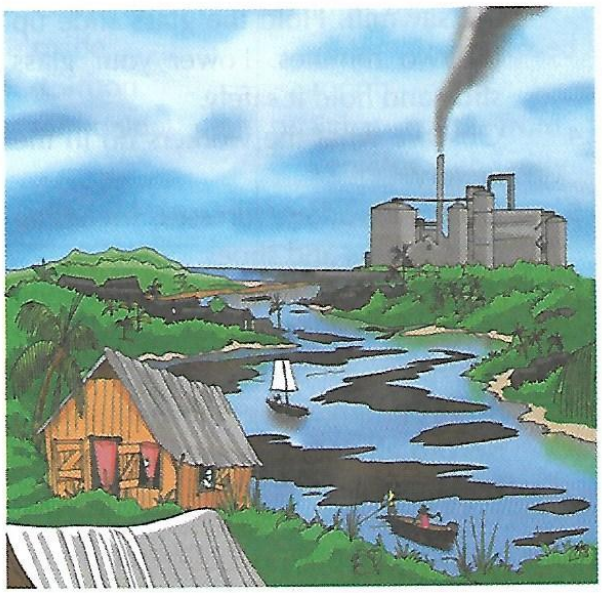


Fig. 11.2 Soil pollution from oil

Fig. 11.3 Solid soil pollutants

Activity 11.2 Visit to a motor mechanic workshop

Materials required

Your science notebook, biro

Procedure

1. Your teacher will arrange for members of your class to visit a motor mechanic workshop nearby. Your objective is to observe soil pollution in a motor mechanic workshop.
2. Your teacher will organise you to work in pairs.
3. List all cases of soil pollution that you observe in the workshop and in a nearby panel beating workshop.
4. Record your observations in your science notebook, and when you get back to the class, participate well in the class discussion of all observations.

Activity 11.3 Soil pollutants in your school compound

Materials required

Your science notebook, biro

Procedure

1. Your teacher will organise the students in your class to work in pairs.
2. Walk round all parts of your school compound.
3. Record all the soil pollutants you observed, and where they were found.
4. From your observation, write a report on the quality of cleanliness of your school premises.
5. Bring your report to your teacher for class discussion.
6. Write down three things that can be done to get rid of these pollutants and maintain a high standard of cleanliness in the school premises.

Fig. 11.4 A newly cleared and burnt refuse dump, showing broken glasses, plastic, rags, paper, metal scraps on the ground, and some half buried things in the soil

Table 11.4 Soil pollutants

	Soil pollutant	Sources	Harmful effects	Control
1	Refuse, such as paper, plastic, organic matter	Homes, offices, markets and factories	a) Occupies space needed for better uses b) May look dirty c) Some items smell. d) Some items may interfere with soil micro-organisms and reduce crop yield.	a) Sort refuse into different kinds. b) Recycle those that can be recycled. c) Send refuse that can decompose to farmlands for use as manure. d) Burn combustible items (that burn easily) in incinerators.

2	Metal scraps and old vehicle bodies	Old vehicles, metal craps and disused machines from building sites	a) Can cut human body, b) Can prevent farming c) Block air flow	Collect the items for recycling.
3	Glass	Industries that manufacture glass or use glass bottles	a) Can cut human body b) Does not decay; remains in the soil until removed c) Renders soil risky and loose for a long time	Collect the pieces of glass for recycling.
4	Plastic	Plastic industries, homes, markets	a) Occupies space without decaying b) May collect water where mosquitoes breed c) Smoke from burning plastic may contain poisonous chemicals harmful to human beings, animals and crops.	Collect them for recycling.
5	Pesticides	Pesticides sprayed on crops	a) May kill useful insects b) May be washed by rain into surface floods that carry them into rivers or streams, causing pollution	Use only required amounts.

Water pollution

The discharge of waste products of human activity into water in amounts harmful to human beings, animals and plants is known as **water pollution**.

Clean water is colourless, odourless and tasteless. As a result of the entry of impurities into water, water may become coloured, have taste and smell.

Dirty or polluted water may be purified by boiling it.

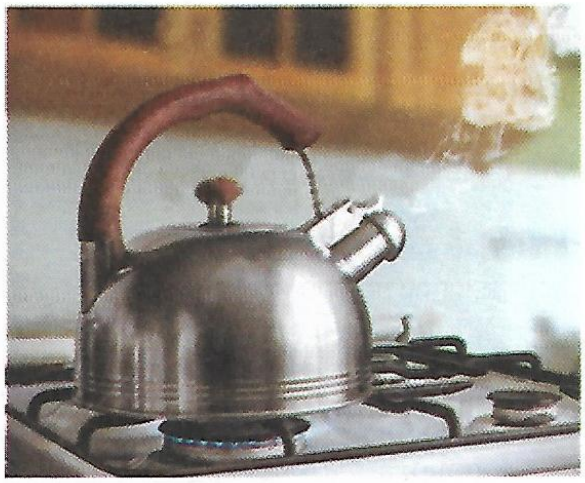


Fig. 11.5(a) Water purification by boiling

Purification of dirty or polluted water

Activity 11.4 Water purification by boiling

Materials required

Rain or stream water, kettle, bucket, clean white cloth, stove, funnel

Procedure

1. Wash the kettle thoroughly.
2. Fill the kettle with rain or stream water.
3. Heat the kettle of water on the stove till the water boils.
4. Allow the hot water to cool to room temperature.
5. Tie a piece of clean white cloth to cover the mouth of the bucket as shown in Fig. 11.5(b).
6. Gradually pour the water from the kettle into the bucket covered tightly with white cloth.
7. Observe the top of the white cloth. What do you see?

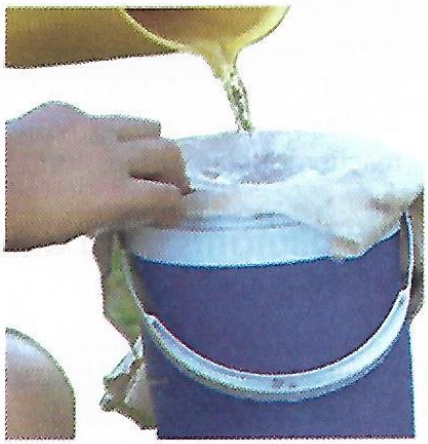


Fig. 11.5(b) Filteration of water

Discussion

When the water is boiled, some of the harmful organisms in the water are killed. When the boiled water is allowed to cool down, some suspended particles sink to the bottom of the kettle.

When the water is filtered, particles in the boiled water are filtered out on the white cloth. By boiling and filtering, polluted water may be made fit for human drinking.

Causes of water pollution

Activity 11.5 Discussion of domestic waste products that pollute water

Materials required
Your science notebook, biro

Procedure

1 Your teacher will divide the class into groups with five students in each group.
2 Each group should identify domestic waste products that pollute water.
3 Each group should identify how each domestic waste product gets into a stream, river, lake, pond or ocean.
4 Write your reports and submit to your teacher for class discussion.

Water pollutants from domestic sources

1 **Palm oil and vegetable oil** may spill from cans in the home, or may be washed from plates, pots and frying pans. The water used for washing may flow into a gutter and then into a stream or river.
2 **Kerosene or engine oil** may be washed out of a container and the water may later flow into a stream.
3 **Soap and detergents** used in washing plates, pots, sinks, clothes, cups, and other things in a home may eventually flow into a stream.
4 **Refuse** dumped beside a river may be carried by rain flood into the river.
5 **The dung of cattle, sheep, goats, and chicken** may be left on land to decay. Rainwater may wash the dung into a river or stream.
6 **Human beings** may excrete in a bush. When it rains, rain flood may carry the *feaces* into a stream. If the faeces contain microorganisms that cause diseases, they will remain alive and later cause harm.
7 **Sand, silts** and **sediments** may be washed off into a river or stream anytime it rains or there is serious erosion.
8 **Hot liquid used as coolant** in a power plant may be discharged into water bodies.

Water pollutants produced from industrial processes

1 **Hydrocyanic acid from cassava:** In order to make garri, cassava tubers are peeled, washed, and then taken to an engine that crushes them. After crushing, the cassava (in form of a pulp) is put in a bag, and the open end of the bag is tied up. The bag of crushed cassava is placed under a press that squeezes out most of the liquid in the crushed cassava. This liquid contains hydrocyanic acid which is very poisonous to human beings.

The liquid that is squeezed out is usually allowed to flow and enter a pit.

Fig. 11.6 Garri processing

If allowed to flow into a stream, it will make the stream water polluted and poisonous. (The crushed, squeezed cassava is fried to produce garri).

2 **Soaps and detergents** are used to wash some industrial equipment. If the dirty water is allowed to flow into a stream, it will constitute water pollution.

3 **Alcohol** may be washed out from an alcohol-making factory, and the water allowed to flow into a nearby body of water.

4 **Crude oil** is a serious pollutant of water in the Niger Delta area. The crude oil that pollutes water comes from oil spills, from ships while loading or offloading oil, from leaks out of oil pipes, from oil rigs or from boats that transport oil.

The crude oil covers the surface of the water, reducing the amount of oxygen that can dissolve in the water. Then the fish in the water die. Pollution, therefore, does not allow fishing occupation to do well in the area.

5 **Vegetable oil, engine oil and other oils** may spill from industries and eventually flow into a stream or river. The effect will be as in (4) above.

6 **Chemical compounds** used or produced by industries may flow into bodies of water and cause pollution. These chemicals include:

a) Zinc sulphide (used in paint industry).

b) Sulphuric acid (tetraoxosulphate (VI acid) used in filling car batteries.

c) Lead sulphate from manufacture of vehicle batteries.

7 **Fertilisers and herbicides** (weed killers) applied on farms may be washed by rain water into bodies of water, causing water pollution that is poisonous to living things.

Fig. 11.7 A site in the Niger Delta where crude oil has polluted the river/sea

Activity 11.6 Making a chart of water pollutants

Materials required

Cardboard sheet, biro, coloured marker, ruler

Procedure

1 Study again the section on causes of water pollution in this chapter.

2 Prepare a chart of water pollutants, showing their sources and effects.

3 Display your chart in your classroom.

Effects of water pollution

Activity 11.7 Observing the effects of water pollution

Materials required

Your science notebook, biro

Procedure

1 Your teacher will arrange for your clas to visit a water pollution site, e.g. a stream or river with waste from an industry channelled to it.
2 Your teacher will arrange students in your class into groups with five students in each group.
3 When you arrive at the water pollution site, carefully observe the following:
   a) Causes of the pollution
   b) Effects of pollution on the colour and smell of the water
   c) Effects of pollution on the organisms in the polluted water
   d) Are there actions taken to the control the pollution, and if so, are such actions successful or not?
4 Discuss your observations within your group.
5 Prepare your report and submit to your teacher for class discussion.

The effects of water pollution are:

1 **Death of organisms**
Many pollutants are poisonous to organisms. When water becomes polluted, many types of organisms that formerly lived in it die, leaving only a few types that can cope with the polluted water.
2 **Prevention of sporting activities**
When water is polluted, such as by crude oil, sporting activities in the water become impossible. For example, those that enjoy swimming will not swim in such water because their bodies will be covered by crude oil.
3 **Health hazards**
There are various health hazards that exist in polluted water. For example, if water is polluted by human faeces, persons who drink or use the water may be infected by typhoid fever, dysentery, cholera, skin diseases and other diseases.
4 **Adverse effects on economic activities**
Pollution of water by crude oil in the Niger Delta area has deprived the people of their traditional occupation of fishing. Oil pollution has killed many of the fishes in the Niger Delta waters, and fishing is no longer a rewarding occupation. Thus, those who enjoy fishing will no longer fish because most of the fishes are dead, due to lack of oxygen in oil-covered water.
5 **Increase in vegetation**
Increased vegetation as a result of water pollution may impede waterflow and navigation.
6 **Increase in sedimentation**
Rate of sedimentation increases, shortening the life span of the water body, e.g. rivers, and lakes.
7 **Odour**
Even after treating such water, (treatment is expensive), it may still have an unacceptable odour.

Activity 11.8 Demonstrating the effects of water pollution on living things

Materials required

River water, stream water, or pond water containing living things, such as mosquito larvae or tadpoles, your science notebook, biro

Procedure

1 Your teacher will provide three beakers for each group of ten students.
2 Label the three beakers *A*, *B* and *C* respectively.
3 To each beaker, add pond water to make the beaker half-full.
4 To beaker *A*, add a table spoonful of kerosene.
5 To beaker *B*, add 10 cm^3 of detergent solution made by dissolving one table spoonful of the detergent in 50 cm^3 of clean water.
6 Do not add anything to beaker *C*.
7 Shake each beaker thoroughly in the same way and allow them to stand for 15 minutes.
8 Observe the organisms in each beaker and record your observations in your science notebook.

You may have observed that the organisms in beaker *A* and beaker *B* died within 15 minutes, while in beaker *C*, the organisms did not die. The explanation is that in beaker *A*, the kerosene prevented atmospheric oxygen from dissolving in the water in the beaker. So the organisms in beaker *A* lacked oxygen and died. In beaker *B*, the detergent poisoned the organisms and they died.

Control of water pollution

The increase in pollution all over the world has become a disturbing issue and has increased the importance of finding ways to control pollution of air, soil and water.

Activity 11.9 Discussion on control of water pollution

Materials required

Your science notebook, biro

Procedure

1 In Activity 11.8, you observed that the addition of one table spoonful of kerosene and one table spoonful of detergent solution to half-beakerful of pond water killed the organisms in the pond water.
2 Suggest measures to reduce or remove the kerosene and detergent that pollute our waters.
3 Suggest a way to control each of the pollutants in Activity 11.8.
4 Write these measures in your science notebook.

Industries are asking these kinds of questions now:

1 How can the quantity of alcohol washed out from bottles, or spilled in the process of bottling be removed from or reduced in the wastewater for washing the factory so that the quantity of alcohol that enters the streams and rivers will be reduced to the minimum?
2 How can the tetraoxosulphate (VI) acid in wastewater in a factory that makes lead batteries for vehicles be removed or reduced to a minimum before the wastewater enters a stream, river or sea?

In this case, the factory collects the wastewater in tanks, adds a chemical that converts the tetraoxosulphate(VI) acid into a harmless substance before the wastewater is released into the environment.

You will read about other control measures in Table 11.5.

Table 11.5 Water pollutants, sources, effects and control

	Pollutant	Sources	Effects	Control
1	Detergent	Homes and industries	Poisonous to fish, other aquatic organisms and human beings	Use only minimum amounts.
2	Acids such as hydrocyanic acid, sulphuric acid (tetra-oxosulphate(VI) acid)	Industries	Poisonous to living things	Collect acid water in a container, convert acid into a harmless form before discharging the wastewater.
3	Vegetable oil	Homes and industries	a) Floats on surface of water b) Prevents oxygen from dissolving in water c) Lack of oxygen makes aquatic organisms die.	a) Dispose of oil from homes in septic tank. b) Avoid leaks in oil factories.
4	Petroleum products, such as petrol, kerosene, and engine oil	a) Homes b) Spillage in industries c) Petrol stations d) Tankers during loading	a) Poisonous b) Cover surface of water c) Reduce amount of oxygen dissolved in water.	Repair leakages that occur in loading and offloading of tankers.
5	Fertiliser	Farms and industries	Increases the population of water plants which may block the free flow of water, e.g. water lettuce	Use only the recommended amount of fertiliser.
6	Refuse and sewage	Homes	a) Produce foul smell b) Make the environment dirty c) Help harmful microorganisms grow	Burn or bury refuse properly.

7	Human faeces and urine	a) Homes b) Markets c) Offices d) Schools	a) Produce poisonous substances b) Give rise to water-borne diseases, such as typhoid fever	a) Make cesspits for disposal of faeces. b) Boil and filter water for drinking.
8	Alcohol	Homes and manufacturing industries.	Poisonous to organisms to a minimum level	Reduce amount of alcohol in waste-water.

Noise pollution

Noise pollution is the disturbing level of noise that may harm the activity or balance of human or animal life.

Noise pollution encompasses roadway noise, aircraft noise, noise from religious places of worship (churches and mosques), industrial noise as well as high intensity sonar. The dominant source of noise pollution is the motor vehicle, producing about 90% of all unwanted noise worldwide.

Noise pollution induces hearing loss, high blood pressure, stress and sleep disturbance.

Summary

1 Pollution is the discharge of waste products into the environment as a result of human activities, in quantities and for such duration that are harmful to human beings, animals and plants.

2 Anything that pollutes the environment is called a pollutant.

3 On the basis of the area of the environment polluted, pollution is classified into air, soil and water pollution.

4 Pollution may also be classified according to the name of the pollutant, such as oil pollution and carbon monoxide pollution.

5 Pollutants may be classified in various other ways. Based on the source, pollutants may be classified into those from domestic or industrial sources. Based on the states of matter, pollutants may be classified into solid, liquid and gases.

6 Air pollution is caused by tiny solid particles (such as wood, asbestos, rock) or by gaseous pollutants.

7 Soil pollution is caused by solid wastes, including scrap metals, plastic, paper, vegetable matter and textile materials. Other pollutants include agricultural wastes, chemical wastes and petroleum products.

8 Water pollution is caused by pollutants from domestic and industrial sources, including petroleum products, human faeces, hydrocyanic acid from garri processing, and chemicals from industries.

9 Pollutants have harmful effects on the environment, on human beings, (farm) animals, crops and other plants.

10 Using appropriate methods, pollution can be controlled.

11 Pollution control means the control of emissions, discharges and effluents into air, water or soil.

12 Without pollution control, the waste products from consumption, agriculture, mining, manufacturing, transportation and other human activities, whether they accumulate or disperse, will degrade the environment.

Revision questions 11

1 Which of the following soil pollutants can be recycled? _____

A Paper
B Plastic
C Metal scraps
D Glass
E All of the above

2 The best protective wear against air pollutants in a sawmill is _____.

A rubber sole shoes
B leather belt
C dark eye glasses
D nose mask
E blue shirt

3 Which of the following pollutants of water may be produced from both domestic and industrial sources? _____

A Kerosene
B Detergent
C Soap
D Alcohol
E All of the above

4 Effects of water pollution does not include _____.

A death of water organisms
B prevention of sporting activities
C smoke that causes injury to the eyes
D depriving people from economic activities
E health hazards

5 On the basis of the part of the environment polluted, pollution is classified into air, soil and _____ pollution.

6 State two (2) examples of pollution which can be controlled by using the pollutants in minimum amounts.

7 State three (3) major causes of each of the following:

a) air pollution
b) soil pollution
c) water pollution

8 Describe the consequences of

a) carbon monoxide pollution of air in a home.
b) solid refuse pollution of soil.
c) crude oil pollution of water.

9 Describe three (3) consequences of throwing solid refuse anywhere in the environment.

10 Describe

a) two (2) ways of controlling soil pollution.
b) two (2)ways of controlling water pollution.

Chapter 12 Living and non-living things

Introduction

If you look at the different things in your environment, you will observe that all of them occupy space. Some objects may occupy so little a space that you can hardly see them with the ordinary eyes. You will need instruments like lenses and the microscope to see such objects in enlarged form. Some other objects may occupy large spaces and you can easily see them as big objects. Indeed everything on earth occupies space and everything on earth has weight.

The weights of different objects can be measured, using appropriate instruments. Because all the objects in the environment occupy space and have weight, they are grouped together as **matter**. Anything that occupies space and has weight is called matter.

There are three forms of matter: solid, liquid and gas. These forms are called the three states of matter. Using certain characteristics, matter can be put into two major groups: living and non-living things.

In this chapter, you will identify the meaning of matter, examples of matter, the states of matter and the classification of matter into living and non-living things, using specific characteristics, as well as identify the characteristics, examples, importance and uses of living and non-living things in your environment.

Objectives

By the end of this chapter, you will be able to:

1. recognise that all living and non-living things are made up of matter;
2. identify things in your environment as matter;
3. identify the three states of matter;
4. collect and identify samples of living and non-living things in your environment and explain their uses;
5. list the characteristics of living and non-living things; and
6. state the importance of plants and animals.

Matter

Scientists define matter as anything that occupies space and has weight. Matter can be found anywhere in our environment.

Activity 12.1 Investigating the meaning of matter (Space)

Materials required

Your science notebook, biro

Procedure

1. Your teacher will organise your class into groups of five students each.
2. Each member of a group should pick up any object from your environment.

3 Place each object on a surface.
4 Observe all the objects picked closely.
5 Find out if the objects occupy space.
6 Find out if there is any difference in the amount of space occupied by different objects.
7 Write your observations in your science notebook for discussion in class.

Activity 12.2 Investigating the meaning of matter (Weight)

Materials required
Your science notebook, biro

Procedure
1 Use the objects picked up in Activity 12.1.
2 Place each object on your palm one after the other.
3 Feel the weight of each object.
4 Find out if all the objects have the same weight.
5 Write your observations in your science notebook.

You would have observed in Activities 12.1 and 12.2 that all the objects occupy space and have weight. In fact, every object (thing) in your environment occupies space and has weight.

Identification of matter

Matter is anything that occupies space and has weight. What are those things that occupy space and have weight in your environment?

Activity 12.3 Identfying matter

Materials required
Your science notebook, biro

Procedure
1 Your teacher will organise you into groups of five students each.
2 Take a walk round your environment.
3 Let each group make a list of the objects in your environment that occupy space and have weight.

Does your list include stones, paper, table, water and air?
Do you wonder if air is matter? Find out.

Activity 12.4 Finding out if air occupies space

Materials required
Five balloons, your science notebook, biro

Procedure
1 Work in your groups of 5 students each.
2 Each member of the group should blow up a balloon.
3 Note what happens to the balloons. (The increase in size of the balloon is called expansion.)
4 Write your answers and observations in your science notebook.

Activity 12.5 Finding out if air has weight

Materials required
Strings (thread), broom sticks, pins, big balloons, your science notebook, biro

Procedure

1 Work in your groups of five students.
2 Have a piece of 30 cm long broom stick.
3 Tie a string (40 cm long) at the middle of the broom stick.
4 A member of the group should hold the string such that the broom stick is suspended and balanced as in Fig. 12.1(a).
5 Blow two balloons to full size and tie each with 2 cm long strings.
6 Suspend one balloon on each side of the broom stick 10 cm away from the mid point such that the broom stick remains stable and balanced as in Fig. 12.1(b).
7 Use a sharp pin to puncture the balloon on the left side of the broom and allow the air to escape gradually.
8 Observe the direction the broom stick tilts as the air escapes from one balloon as in Fig. 12.1(c).
9 Write down your observations.
10 Explain your observations in class.

From Activities 12.4 and 12.5, you would have observed that air occupies space and has weight. You have thus identified air as an example of matter. Air is part of your environment.

States of matter

It is commonly known that matter exists in three states. These are **solid**, **liquid** and **gas**. Everything on earth exists either as a solid, liquid or gas. Objects that exist in these different states have different qualities.

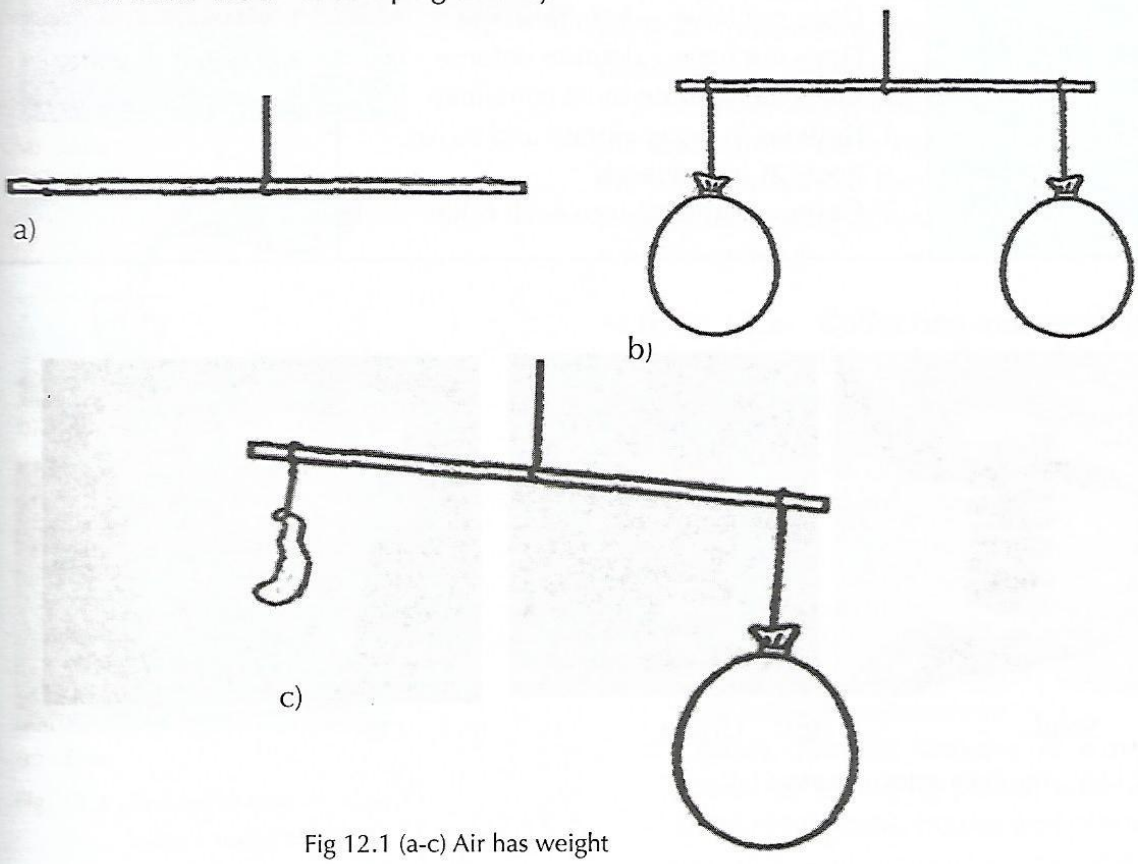
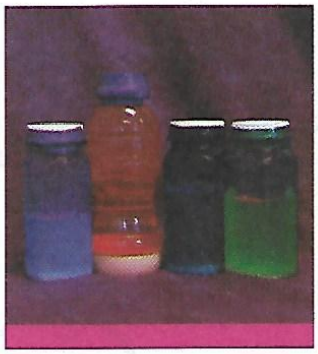


Fig 12.1 (a-c) Air has weight

Table 12.1 States of matter

State of matter	Qualities	Examples
Solid	1 Has a definite volume 2 Has a definite shape 3 Not compressible 4 Has a rigid structure 5 Particles in a solid vibrate (jiggle) but generally do not move from place to place	1 Metals 2 Crystals 3 Trees 4 Stones
Liquid	1 Has a definite volume 2 Does not have a definite shape 3 Take the shape of its containers 4 Has a different boiling point. 5 Particles in a liquid vibrate, move about and slide past each other. Liquid flows from a higher lever to a lower level	1 Water. 2 Wine. 3 Kerosene.
Gas	1 Does not have a definite shape 2 Does not have a definite volume 3 Takes the volume of its container 4 Particles in a gas vibrate and move freely at high speeds 5 Gases can diffuse into each other	1 Oxygen 2 Carbon dioxide 3 Hydrogen

(a) Solid



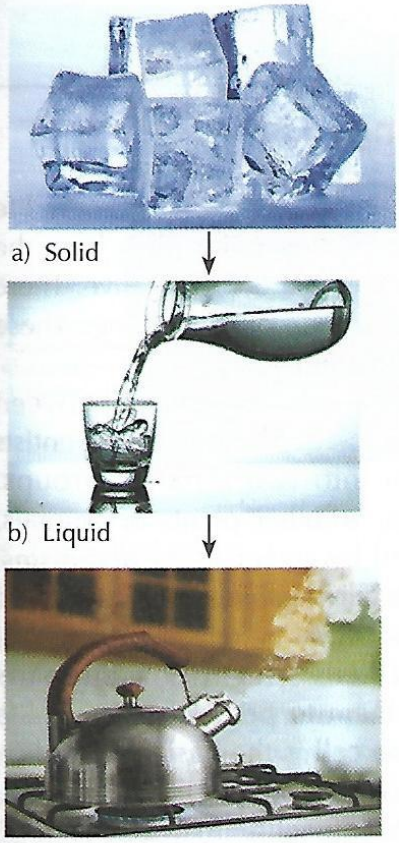
(b) Liquid

(c) Gas

Fig. 12.2 The three states of matter

Recent studies in science have added another state of matter called **plasma**. Plasma is a refined form of gas and therefore, it is still part of the state of gas. You will learn more about plasma as you continue your study of science.

It has also been observed that some objects have the ability to change from one state to another. Example is water. Under very low temperature, water freezes and becomes solid, which is called **ice**. When removed from the freezer, after some time, ice melts into liquid (water). When the liquid is boiled over a burner or fire, it gives out gas in form of steam (vapour). Water undergoes changes in state: ice (solid) → water (liquid) → steam (gas).



a) Solid

b) Liquid

(c) Gas

Fig. 12.3 Change of state of water: solid → liquid → gas

Classification of matter

Your environment contains millions of objects such that it is difficult to identify all of them. By sorting them out or putting them into groups, they may be identified with greater ease. We can group objects, using specific characteristics, including their physical appearance, e.g. size, colour, shape; and behavioural patterns, e.g. methods of feeling, movement or reproduction.

The act of grouping or sorting a collection of objects using observable characteristics is called **classification**. Classification helps to identify particular objects from a collection of objects. All objects in the environment can be classified into two major groups: living things and non-living things. Living things possess life, show the characteristics of life and can carry out life activities, such as movement, growth, feeding and reproduction. An example of a living thing is a rat. Non-living things do not possess life and cannot carry out any life activity. They remain where they are placed until something else removes them. Stone is a non-living thing.

Activity 12.6 Collecting and sorting things in the environment

Materials required

Your science notebook, biro, plastic bags, bottles

Procedure

1. Follow the instructions of your teacher and go on nature walk in your school environment.
2. Collect different samples of matter available, including plants, animals, sand, stone, cans, bottles and plastic.

3 Be careful with the animal samples and put them in the collection bottle while you put the plant samples in plastic bags.
4 Go back to the classroom and work in your group to sort your collection into two groups.
5 Place all the objects that possess life in one group and those that do not possess life in another group.

Write the list of objects in each group as in Table 12.2.

Table 12.2 Things in the environment

Living things	Non-living things
1	1
2	2
3	3
4	4
5	5

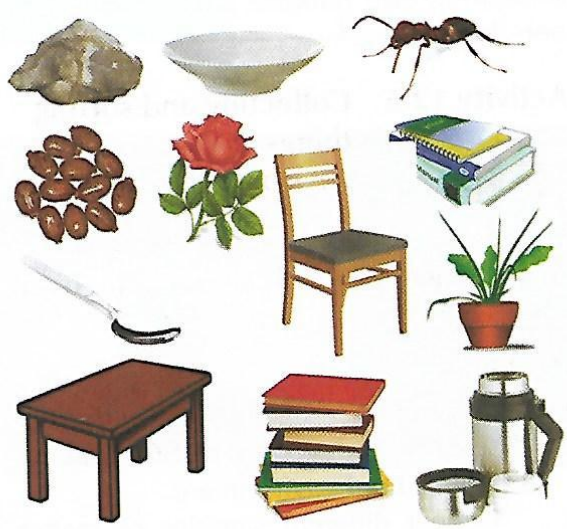


Fig. 12.4 Matter in the environment

Activity 12.7 Classifying of matter

Materials required

Objects in Fig.12.4, your science notebook, biro

Procedure

1 Look at Fig. 12.4.
2 Identify the objects in the pictures.
3 Sort the objects under living or non-living things, using Table 12.3.

Table 12.3 Classification of matter

Living things	Non-living things
1	1
2	2
3	3
4	4
5	5

Living things

Living things are objects that possess life or show that they have life. They have the characteristics of life or being alive. There are two major groups of living things. These are **plants** and **animals**.

There are some differences between plants and animals. These made scientists to put them into two separate groups. Living things, whether plants or animals, are described by scientists as **organisms**. This is because living things have organised structure and body parts. Organisms are made up of cells which form the parts and enable them to perform different life functions. The cell is the basic unit of life. Examples of living things include bacteria, protozoa, plants, fungi, animals and humans.

Some plants and animals are very tiny and are made up of only one (single) cell. They are called **unicellular organisms**. An

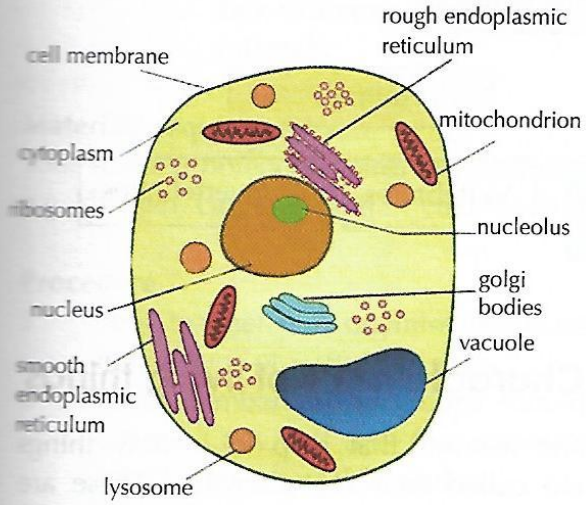


Fig. 12.5 An animal cell

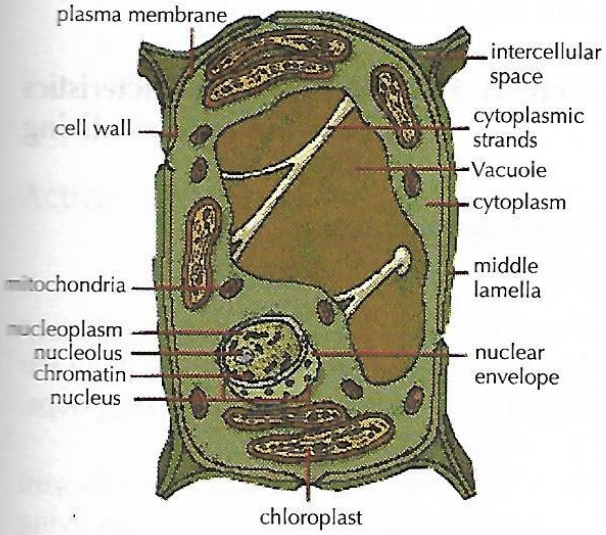


Fig. 12.6 A plant cell

example of unicellular plants is diatoms. An example of unicellular animals is amoeba. The single cell possessed by unicellular organisms enables them to perform all life functions, such as movement and feeding.

Some other plants and animals are large and are made up of millions of cells. They are called **multicellular organisms.** Examples of multicellular plants are mango trees, okro and bean plants. Examples of multicellular

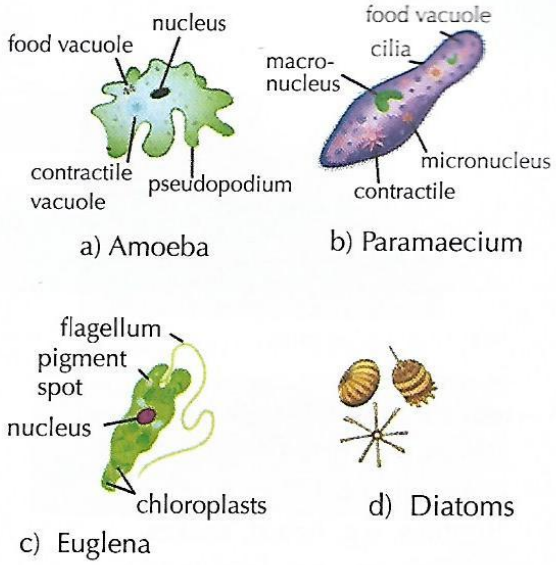


Fig. 12.7 Unicellular organisms

animals are human beings, elephants, rats and mosquitoes. The many cells possessed by multicellular organisms are in different groups, each group used to perform specific life functions. Some are responsible for such functions as movement, while some others are responsible for feeding or excretion.

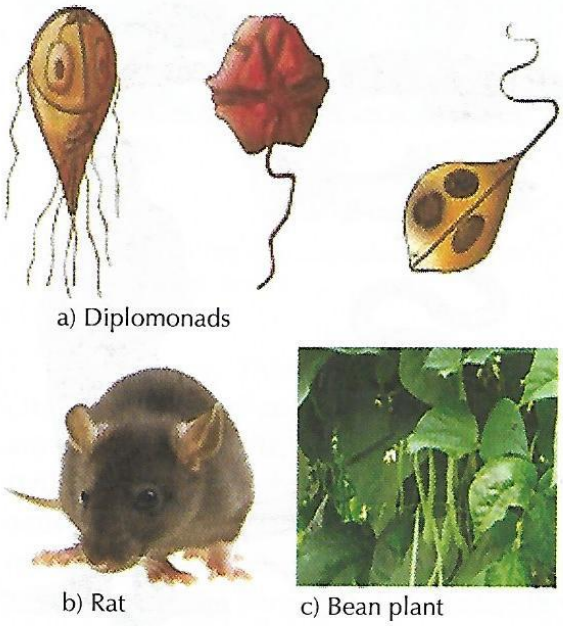


Fig. 12.8 Multicellular organisms

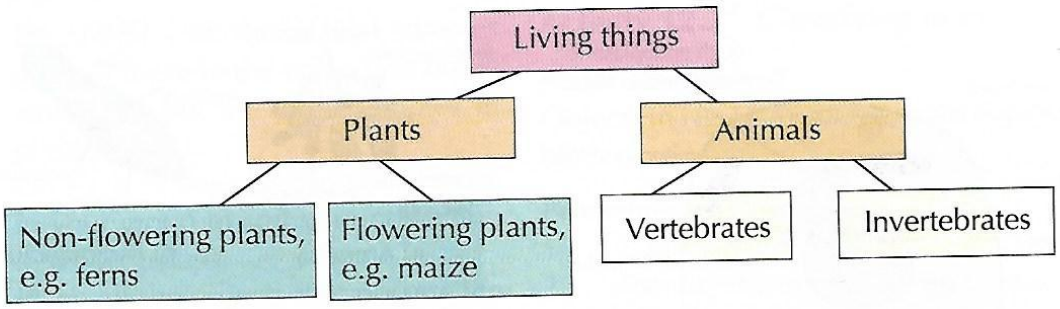


Fig. 12.8 Living things

Vertebrate (Animals with backbone)

1 Pisces, e.g. fish
2 Aves, e.g. birds
3 Reptiles, e.g. lizard, snakes
4 Amphibians, e.g. frog, toad
5 Mammals, e.g. monkeys, lions, man

Invertebrates (Animals without backbone)

1 Platyhelminthes, e.g liver fluke
2 Nematodes, e.g. tapeworm
3 Molluscs, e.g. snails
4 Annelids, e.g. earth worm
5 Echinoderms, e.g. starfish

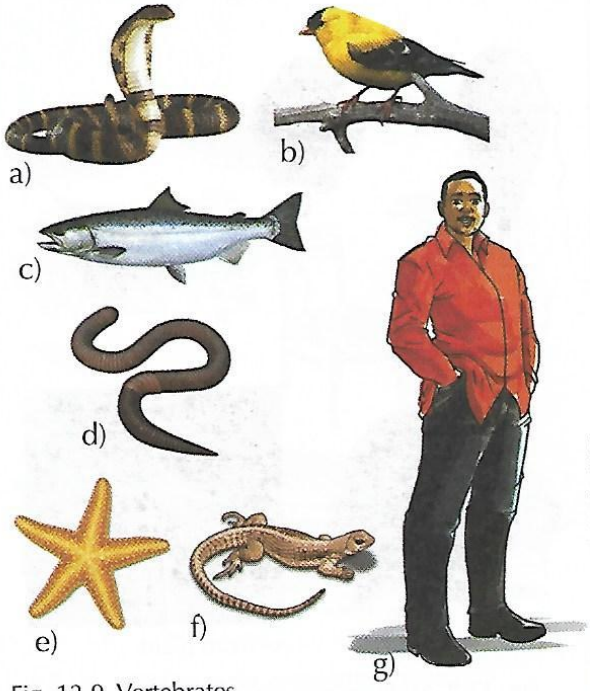


Fig. 12.9 Vertebrates

Characteristics of living things

The features that help to identify things are called their characteristics. These are features that some things have which others do not have. Things with similar features are put in the same group or class and are said to have similar characteristics.

Activity 12.8 Identifying characteristics of living and non-living things

Materials required

Your science notebook, biro

Procedure

In Activities 12.6 and 12.7, you put all the objects in the environment into two groups.

1 Name these two groups.
2 List the characteristics which you used to group the objects into living and non-living things in Table 12.4

Table 12.4 Characteristics of living and non-living things

Living things	Non-living things

Activity 12.9 Identifying the characteristics of living things in animals

Materials required

Your science notebook, biro, any animals, e.g. chicken, cat, dog, goat or cockroach

Procedure

1. Your teacher will organise the class into groups of 5 students each.
2. Each member of the groups should observe any of the five animals selected for about 10 minutes.
3. Write down a list of activities done by the animal within the 10 minutes.
4. Compare your list with the characteristics of living things you listed in Table 12.4.
5. Tell whether or not there are any similarities.

Activity 12.10 Identifying characteristics of living things in plants

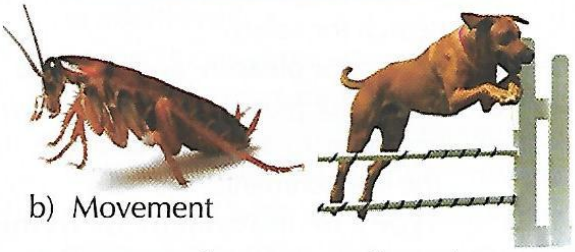
Materials required

Your science notebook, biro, bean seeds, humus soil, bowl

Procedure

1. Work in groups as in Activity 12.9.
2. Fill a bowl with humus soil.
3. Wet the soil.
4. Put some (about 5) bean seeds in the soil.
5. Place the bowl by the window.
6. Observe the potted plant (plant in a bowl) for 14 days and record what happens.
7. Compare your record with Table 12.3.

a) Nutrition



b) Movement

Fig. 12.11 Some characteristics of living things (animals)

Fig. 12.12 One of the characteristics of living things (plants): growth

All living things have certain characteristics in common: living things are made up of cells, have organised body structures and require energy for their activities. Whether they are unicellular or multicellular, and whether they are plants or animals, all living things have characteristics which non-living things do not have.

There are ten key characteristics of living things which cannot be found in non-living things.

1 **Movement** (change in position or posture) Movement may involve change in position or location of the organism, or adjustment (bending) of body parts to different directions.

Animals have the ability to move from one location to another. Most plants can only adjust their body parts to the desired direction.

Reasons for movement include

a) search for food.
b) search for safety.
c) search for pleasure and comfort.
d) search for partners or company.
e) response to stimuli and touch in the environment.

Types of movement in living things include walking, running, flying, swimming, crawling, rolling, sliding, jumping and bending.

Movement may be **internal** or **external**. All living things have internal movement by which they move substances from one part of the body to another, e.g. movement of food from the mouth to the stomach. Some living things also have external movement by which means they move their body from one place to another.

2 **Nutrition** (intake of food substances) Living things take different substances from their environment for food. Such substances include plants and animals (other living things). Different animals feed on different substances. Some feed on plant and animal substances. Such animals that feed on both plants and animals are called **omnivores**. An example is a human being. Some animals feed only on plant substances and are called **herbivores**, e.g. grasshopper, cow and goat. Some other animals feed only on animal substances. They are called **carnivores**, e.g. lion.

Animals depend on other living things for food. They do not manufacture their own food. They move in search of the food substance. Plants do not have the ability to move from one place to another in search of food. They manufacture their own food. using chemical substances in their environment in the presence of sunlight. The process by which plants manufacture their food is called **photosynthesis.**

Reasons for feeding are:

a) to obtain energy for their activities; and
b) to obtain nutrients for growth and good health.

3 **Excretion** (removal of waste from the body)

When living things feed, the food substances taken in undergo chemical processes called **metabolism.** During metabolism, energy and other nutrients needed by the body are extracted from the food substances. The materials which are not needed by the body are called **waste products** of metabolism.

If the waste products are not removed from the body, they may become poisonous. So, they must be removed. The process by which waste products of metabolism are removed from the body is called **excretion.** Waste products can be in form of liquid, e.g. urine, or gas, e.g. carbon (IV) oxide (CO_2) which animals breathe out during respiration. Other waste products from the body

include ammonia, excess water and salt. The main reason for excretion is to remove poisonous substances from the body.

4 **Respiration** (exchange of gases)
Animals breathe in oxygen and breathe out carbon (IV) oxide (CO_2) as waste product. Plants take in carbon (IV) oxide (CO_2) and release oxygen into the environment. During respiration, living things take in the gas needed for metabolism and release the gas produced as waste.

5 **Reproduction** (producing young ones)
The ability of living things to produce young ones that look like the parents is called **reproduction**. The purpose of reproduction is to ensure continuity of life and survival.

Reproduction occurs in two forms:

a) ***Sexual reproduction*** involves the coming together of two individuals (male and female) for the purpose of **fertilisation.** For example, in human beings, reproduction takes place by the sexual relationship between a man and a woman.

b) ***Asexual reproduction*** is reproduction that does not involve male and female individuals. This can also be described as **vegetative** reproduction. Any part of the living organism can regenerate and grow into adulthood. This is a common feature in plants.

6 **Irritability** (response to stimulus or touch) sensitivity
Living things feel their environment and react to changes in the environment. These changes in the environment are called **stimuli** (stimulus, singular). Stimuli may be brought about by temperature (heat or cold), touch, pain, light, sweet and foul smell, sound or taste. Living things are able to feel these stimuli, using their sense organs, such as the skin, eyes, ears, mouth and nose.

The ability to respond to stimuli is referred to as irritability or sensitivity. Irritability is used to assess the health and how well the sense organs of living things function. In human beings, for example, good condition of the ear can be assessed by making a sound by the side of the ear.

7 **Growth** (change in size, from birth to adulthood)
Living things grow as a result of the irreversible increase in the number of their body cells. As living things feed, they obtain necessary nutrients that enable their body cells to multiply and increase in number. This increase in the number of cells is observed as increase in the body size of the organism. This irreversible increase in size is called **growth**. Growth involves changes in behaviours.

8 **Death**
All living things must die because they have a definite and limited period of existence. All living things must pass through these five stages of life namely.
Birth → Growth → Maturity → Decline (old age) → Death

9 **Adaptation**
This can be said to be the way living organisms get used to their various environments in such a way that they will be comfortable. This is done in order to survive. Those features of organisms, including modifications of structure, functioning and behaviour which fit them for life in their particular

habitats and improve their changes of survival, are called adaptations.

10 **Competition**

This is the ability of living things to struggle for all the necessities of life in order to survive in their various environments.

Living things compete for food, light, space, water and mates in order to survive and be in continuous existence.

Differences between plants and animals

Though plants and animals have some common characteristics as living things, there are other characteristics which distinguish them from each other. The major differences between plants and animals are shown in Table 12.5.

Importance of plants

1 **Protection:** Plants serve as source of shelter or habitat for animals. Some animals hide behind or climb big trees to protect themselves from danger.

2 **Food:** Animals depend on plants for food. Some animals feed directly on plants, such as vegetables, fruits, tubers and roots. Human beings use plant products by first washing or cooking.

3 **Health:** Most medicines are formulated

Table 12.5 Differences between plants and animals

	Plants	Animals
1	Most plants are green in colour due to the presence of chlorophyll, and this colour enables them to manufacture their food in the presence of sunlight.	Animals have various body colours.
2	Plants manufacture their own food.	Animals depend on plants and other animals for food.
3	Most plants are static, i.e. they remain in one location. Only parts of the plants carry out some form of bending movement.	Animals have organs for movement and are able to move from one place to another.
4	Plants have rigid body structure.	Animals have flexible and jointed body structure.
5	The body cells of plants have definite shape.	The body cells of animals have various shapes.
6	Plants have no fixed number of parts and branching is continuous.	Animals have fixed number of parts which are usually compact.
7	Plants show slow response to external stimuli.	Animals show fast response to external stimuli.
8	Food is stored mainly as starch except in fungi.	Food is stored mainly as glycogen and fat.

from plant materials. These medicines are needed for the maintenance of our health. These can be got from the roots, leaves and barks of the plants.

4 **Wealth:** Plants are economic resources. Plants are used in various economic activities of human beings. Farmers make money through the sales of crops like rice, groundnut, beans, corn and palm oil. Most of the timber used in making furniture and in building houses are plant products. Plants can be used to create wealth.

Activity 12.11 Identifying the uses of plants

Materials required

Your science notebook, biro

Procedure

1 Your teacher will organise you into groups of five students each.

2 Discuss and mention the common plants in your environment.

3 List the uses of the common plants as in Table 12.6.

Importance of animals

1 **Food:** Some animals (carnivores and omnivores) depend on other animals for food. e.g. lions depend on other animals. Human beings take the meat of other animals to remain healthy.

2 **Wealth:** Animals are important resources for wealth creation, e.g. poultry farming. Recently, fish and snail farming have become sources of economy in different parts of Nigeria.

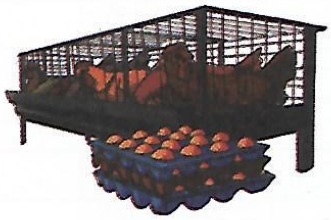


Fig. 12.13(a) Poultry farming

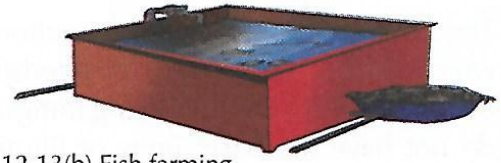


Fig. 12.13(b) Fish farming

Activity 12.12 Identifying the uses of animals in the community

Materials required

Your science notebook, biro

Procedure

1 As in Activity 12.11.

2 Mention the common animals in your community and their uses.

3 Record your findings as in Table 12.7.

Table 12.6 Uses of plants

Plants	Uses
Palm fronds	Basket making for hampers and broom making
Wood	Furniture making and roof making
Herbs	For making medicine
Cotton	For making weaving thread and cloth
Dry grass	For making thatched houses
Grass	As animal feed

Table 12.7 Common animals in the community and their uses

Animals in the community	Uses of the animals

Non-living things

The millions of objects in the environment which do not show any characteristics of living things are the non-living things. They do not have the basic units of life (cells). They include sand, wood, stone, water and gas.

Non-living things can easily be grouped into two based on their relationship with life.

1 **Once a living thing, e.g.**
   a) Ball manufactured, using rubber from plants.
   b) Fruit juice from plants.
   c) Hand bags made using leather from the skin of animals.
   d) Paper manufactured from trees.
   e) Furniture made with wood from trees.
   f) Coal and petroleum formed from trees that died long ago.

2 **Never a living thing, e.g.**
   gold, diamond, silver, stone, gravel, metal, iron, hydrogen.

Non-living things can also be grouped, using their physical and chemical properties, such as whether they are **metals or non-metals**.

1 **Metals:** At room temperature, all metals are hard solids except mercury. Metals have high densities, and different melting and boiling points. Metals are good conductors of heat and electricity. Metals can be drawn into wires, (they are ductile). They can also be beaten into different shapes, (they are malleable). They shine when polished (they are lustrous). They are also sonorous and can produce sound when struck.

2 **Non-metals:** At room temperature, non-metals can be solid, liquid or gas. Non-metals are soft except diamond. Non-metals do not conduct heat or electricity. They are insulators, e.g. helium and sulphur.

Uses of non-living things

Non-living things are important components of the environment and are very useful for the survival of living things in several ways.

1 **Respiration:** Gases like oxygen and carbon (IV) oxide are used in respiration by animals and plants respectively. Without respiration, animals and plants will not survive.

2 **Health:** Non-living materials are used in the production of drugs which serve in the maintenance of human health. For instance, pain-relieving tablets are made from a combination of chemicals.

3 **Technological advancement:** Non-living materials are used in the development of technology, e.g. electric cables made from silicon are good conductors of electricity.

4 **Wealth:** Precious elements like gold and diamond are money earners. Crude oil is the main economic stay of Nigeria.
5 **Comfort:** Uranium is used for the production of nuclear energy which generates electricity and heat for comfortable life. There are many ways electricity provides good services in the community.
6 **Communication:** The noble gases are used for the exciting communication signals, e.g. road traffic lights and decoration lights.

Activity 12.13 Identifying the uses of non-living things

Materials required
Cardboards, biro, pencil

Procedure
1 Your teacher will divide the class into groups of five students each.
2 Make a chart of non-living things in your community and their uses.
3 Discuss this chart in your group and in the whole class, under the supervision of your teacher.

Activity 12.14 Classification of non-living things into metals and non-metals

Materials required
Charts from Activity 12.13

Procedure
1 Identify some non-living materials.
2 State their properties and state whether they are metals or non-metals.
3 Record your findings as in Table 12.8.

Table 12.8 Classification of non-living things into metals and non-metals

Non-living element	Properties	Class (metal or non-metal)
Wood	Solid; does not conduct heat or electricity	Non-metal
Zinc	Solid; conducts heat, malleable, sonorous	Metal

Summary

1 Matter is anything that occupies space and has weight.
2 Mass of an object is measured as weight while its volume is measured as the space it occupies.
3 There are three states of matter: solid, liquid and gas.
4 Classification helps in a meaningful identification of objects.
5 Classification may be done, using specific characteristics, including physical appearance and behaviour.
6 Living things are objects that possess and show the characteristics of life or being alive and have the basic unit of life (cell).
7 Living things may be unicellular or multicellular and they may be plants or animals.
8 Living things can be recognised by ten major characteristics which are movement, nutrition, excretion,

respiration, reproduction, irritability, growth, death, adaptation, and competition.

9 Though plants and animals have some common characteristics of living things, there are other characteristics which distinguish them from one another.

10 The importance and uses of plants include serving as source of protection, food, health and wealth.

11 The importance and uses of animals include serving as source of food and wealth.

12 Non-living things are the objects in the environment which do not show any characteristics of life and do not possess the basic unit of life (cell).

13 Non-living things can be described, in relationship with life, as
   a) once a living thing, e.g. paper manufactured from trees, or
   b) never a living thing, e.g. stone.

14 Non-living things can be classified into two major groups as metals and non-metals, using their physical properties.

15 Non-living things are important components of the environment, and are very useful for the survival of living things in several ways, such as respiration, health, technological advancement and wealth creation.

Revision questions 12

1 Which of these is a unicellular plant?
   A Apple
   B Tridax
   C Spirogyra
   D Amoeba
   E Palm

2 Which of these statements is true of plants as living things?
   A Plants and animals have some common characteristics as living things.
   B Plants do not have common characteristics with animals.
   C Plants depend on animals for food.
   D Plants lack the basic unit of life.
   E Plants do not respire.

3 Respiration means _____.
   A movement from place to place
   B ability to swallow food
   C exchange of gases
   D breathing out of a gas
   E taking in of oxygen

4 Matter is any object on earth that occupies _____ and has _____.
   A space and weight
   B space and time
   C space and length
   D breadth and length
   E space and volume

5 Which of these animals is not a carnivore?
   A Eagle
   B Cat
   C Dog
   D Lion
   E Cow

6 Non-living things could be classified as metals or _____.

7 Write down three (3) uses of living things.

8 List five (5) characteristics of animals.

9 List five (5) differences between living and non-living things.

10 Explain the term classification.

Chapter 13 Sexually transmitted infections (STIs)

Introduction

Sexually transmitted infections (STIs) are (venereal) illnesses that have a significant probability of transmission between humans by means of sexual behaviour. STIs have been well known for years. It means a person may be infected and may infect others.

Sexually transmitted infections are passed on through sexual contact or the exchange of body fluids. Many people who have an STI may not have any obvious symptoms or signs. So it is important you get the facts about how they are spread.

Objectives

By the end of this chapter, you will be able to:

1 define the term STIs
2 list the causes of some STIs;
3 describe the symproms of some STIs; and
4 explain the various methods of preventing STIs.

Meaning of sexually transmitted infections (STIs)

These are infections passed from person to person through sexual intimacy.

One can get infected by having intimate sexual contact with someone who already has the infection. You cannot tell if a person is infected because many STIs have no symptoms. But STIs can still be passed from person to person even if there are no symptoms.

Each STI causes different health problems, but overall, untreated STIs can cause cancer, infertility, pregnancy problems, widespread infection to other parts of the body, organ damage and even death.

Having an STI can also put you at greater risk of getting HIV. Risky sexual behaviour can also make a person contract other STIs, including HIV. Contracting some STIs makes it easier to contract HIV if you are exposed.

Symptoms of STIs

Many STIs have only mild or no symptoms at all. When symptoms do develop, they are often mistaken for something else, such as urinary tract infection or yeast infection. This is why screening for STIs is so important. The STIs listed in the table are some of the most common or harmful.

STIs: causes, symptoms and prevention

	STI	Causative organism	Symptoms	Prevention
1	Bacterial vaginosis	Bacterium	a) Vaginal itching b) Pain when urinating c) Discharge with a fishy odour	a) Use of a condom during sexual intercourse b) Medical consultation when suspected
2	Chlamydia	Bacterium (*Chlamydia trachomatis)*	a) Abnormal vaginal discharge b) Burning feeling when urinating c) Bleeding between periods d) Low back pain e) Nausea f) Fever g) Pain during sex	a) Use of condoms b) Abstinence c) Staying with only one trusted partner d) Medical consultation when suspected
3	Genital herpes	Virus	a) Small red bumps, blisters or open sores where the virus entered the body, such as on the penis, vagina or mouth b) Vaginal discharge c) Fever d) Headache e) Muscle ache f) Pain when urinating g) Itching, burning or swollen glands in genital area h) Pain in legs, buttocks or genital area	a) Medical consultation when suspected b) Right use of condom
4	Gonorrhoea	Bacterium (*Neiseria gonorrhoea)*	a) Pain or burning feeling when urinating b) Yellowish and sometimes bloody vaginal discharge	a) Right condom use b) Abstinence c) Seeking medical help when suspected

			c) Bleeding between periods d) Heavy bleeding during period e) Pain during sex	
5	Hepatitis B	Virus	a) Low grade fever b) Headache and muscle ache c) Tiredness d) Loss of appetite e) Stomach upset or vomiting f) Diarrhoea g) Dark coloured urine h) Stomach pain i) Skin and white of eyes turning yellow	a) Use of condom during sexual intercourse b) Seeking prompt medical help when suspected c) Abstaining from sexual contact
6	HIV/AIDS	Virus	a) Fevers and night sweats b) Feeling very tired c) Skin rash or flaky skin d) Quick weight loss e) Headache f) Enlarged lymph nodes g) Diarrhoea, vomiting and stomach upset h) Mouth, genital or anal sores i) Dry cough	a) Right and consistent condom use b) Abstinence c) Seeking prompt medical help when suspected
7	Human papilloma virus	Virus	a) Visible warts in the genital area, including the thighs b) Growths on the cervix and vagina	a) Right condom use b) Abstinence c) Seeking prompt medical help when suspected
8	Syphilis	Bacterium (*Treponema pallidum*)	a) A singe, painless sore appearing 10-90 days after infection. It can appear in the genital area, mouth or other parts of the body	a) Right condom use b) Abstinence c) Seeking prompt medical help when suspected.

			b) Skin rash with rough red or reddish-brown spots on the hands and feet c) Fever d) Sore throat and swollen glands e) Patchy hair loss f) Weight loss and tiredness g) Damage of internal organs, e.g. brain.	

Summary

1 A sexually transmitted infection is majorly transmitted through sexual intercourse.
2 Common STIs include chlamydia, syphilis and HIV/AIDS.
3 Each sexually transmitted infection is caused by a particular microorganism, and has its symptoms.
4 STIs can be prevented by abstinence from unprotected sex, health education, correct and consistent condom use and avoiding multiple sexual partners.

Revision questions 13

1 Which of the following is a sexually transmitted infection? _____
   A Malaria
   B Syphilis
   C Cholera
   D Guinea worm
   E River blindness
2 Which of the following statements is false? _____
   A Some diseases are transmitted through sexual intercourse.
   B Syphilis is caused by a bacterium.
   C A virus is an animal.
   D Staphylococcus causes boils.
   E Victims of sexually transmitted infections are ashamed to tell anyone about it.
3 Sexually transmitted infections can be reduced by _____.
   A health education
   B not having many sexual partners
   C use of the condom
   D proper treatment of patients of sexually transmitted infections
   E all of the above
4 Describe fully, one named method of preventing sexually transmitted infections.
5 Explain the effects of the following on the spread of sexually transmitted infections:
   a) Lack of knowledge of sexually transmitted infections;
   b) Having sexual intercourse with many partners;
   c) Failure to disclose a sexually transmitted infection to a sexual partner.
6 State the meaning of STI.

Chapter 14 HIV/AIDS

Introduction

HIV is the human immuno-deficiency virus Acquired immune deficiency syndrome (AIDS) is a disorder which damages the human body's immune system. It is caused by the human immuno-deficiency virus (HIV). It breaks down the body's immune system and leaves the victim exposed to a variety of diseases.

It is important to know that infection with HIV does not necessarily result in AIDS. As with other diseases, some people may remain without symptoms and are, therefore, termed **carriers**.

Objectives

By the end of this chapter, you will be able to:

1 explain the meaning of HIV/AIDS;
2 decribe how HIV/AIDS can be transmitted;
3 list the precautions against HIV/AIDS;
4 describe the cure for HIV/AIDS;
5 list places to go for counselling on HIV/AIDS;
6 mention some advantages of post-test professional counselling;
7 explain the need for community care and support for people living with HIV/AIDS; and
8 mention some myths and facts about HIV/AIDS.

Meaning of HIV/AIDS

HIV (human immunodeficiency virus) is the name given to the virus that usually destroys the immune system of human beings thereby making them susceptible to diseases. Hence, HIV is a virus that destroys the body's immune system (i.e. the antibodies that fight diseases in the body) over a period of time. From its name, HIV; human means it affects human beings; *Immuno-deficiency* means it is a condition in which the immune system, consisting of white blood cells, is not working and the body cannot fight the disease-causing germs; and virus is the organism that causes the infection.

AIDS (acquired immune deficiency syndrome) is a disease caused by HIV which is usually transmitted through the exchange of body fluids. The body becomes vulnerable to infection, especially pneumonia, brain infections, severe diarrhoea, persistent fever, rapid loss of weight, loss of hair and an unusual type of skin cancer called Karposi's sarcoma. From its name, AIDS; *acquired* means it can be gotten from someone else; *immune* means it affects the immune system especially the white blood cells of the body that fight disease; *deficiency* means the immune system no longer works well; and *syndrome* means it is just a single illness, but with many different symptoms. Infections develop because the immune system cannot fight off other diseases.

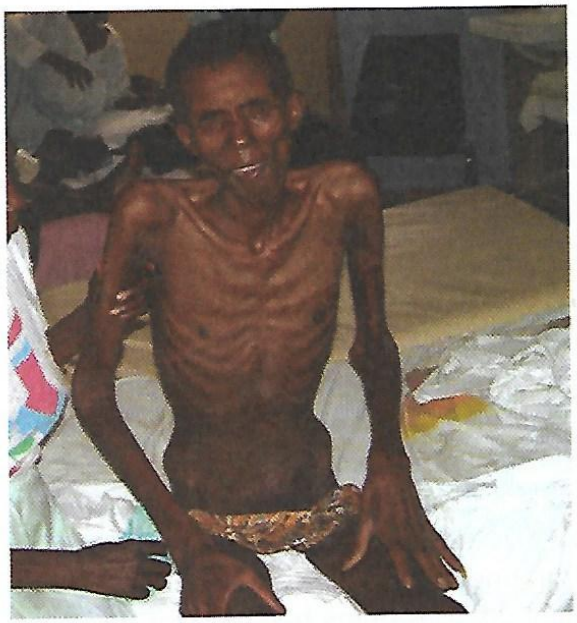


Fig. 14.1 An HIV/AIDS patient

AIDS usually shows up in its patient within the period of 5 – 10 years of diagnosing HIV.

Transmission of HIV/AIDS

The human immuno-deficiency virus can only survive in body fluids and is transmitted by blood or semen. In 90% of cases, the transmission is achieved by sexual contact. People can contract the disease in the following ways:

1 **Intimate sexual contact**: It is passed from an infected person to his/her partner through sex. The risk becomes proportionately greater amongst those who have multiple sexual partners.

2 **Infected blood entering the blood stream**: AIDS can be contracted by intravenous drug users practising self injection by means of unsterilised needles and syringes that are contaminated with HIV.

Once in the bloodstream of the drug addict, HIV can then be passed on through sexual activity. Unfortunately, the disease can also be contracted after being given blood or blood products already infected with HIV.

Close contact between an infected and non-infected persons through cuts and open wounds has also been known to pass on the virus.

Drawing tattoos, tribal marks, circumcision and blood oaths, using contaminated and unsterilised objects have also been known to pass on the virus into the bloodstream.

3 **From mother to baby**: An infected pregnant woman can pass on the virus to her baby through the placenta, at birth or through breast milk during suckling. The chances of the infection being transmitted from the mother to her baby are currently estimated to be 25-50%.

Precautions against HIV/AIDS

1 The use of a barrier during sexual intercourse can prevent the virus from infecting through blood or semen, e.g. correct and consistent use of condom during sex.

2 Keeping to only one faithful sexual partner and the absence of promiscuity will also clearly reduce the risk of infection. Partners who wish to marry must conduct an HIV/AIDS screening blood test before marriage.

3 The use of clean sterilised needles and syringes in our health facilities will bring about a reduction in the spread of HIV.

4 Screening all blood received from donors before transfusing patients who need it will help to check the spread of HIV.

5 Education about the disease has an important part to play, particularly in reassuring the public about the real risks.

There is no evidence that HIV/AIDS can be transmitted by droplets through the nose or mouth, or by casual contact, such as in shaking hands or hugging. Health care staff who attend to AIDS patients have never contracted the disease this way. Also, mosquito bites have not been known to transmit the HIV.
Sharing things, such as clothes, dishes and toilet seats does not transmit this virus.

Cure for HIV/AIDS

Researchers all over the world are striving to produce an effective vaccine that can cure the disease, but as yet, no product has been made ready for human trials.
So for now, there is no known cure for HIV/AIDS.

Counselling and testing for HIV/AIDS

Counselling for HIV/AIDS is a private conversation with a specially trained person aimed at helping the HIV/AIDS patient to help himself/herself. This exercise is expected to be free and confidential. That is, the counsellor is not permitted/allowed by his profession to tell anyone about the situation of the patient without the permission of the HIV/AIDS patient.

There are two kinds of counselling that should be considered important: pre-test and post-test counselling. Pre-test counselling is the kind of face-to-face counselling that a person receives from professionals (i.e. counsellors) before conducting HIV/AIDS test. Post-test counselling is the kind of counselling and instructions a person receives from counsellors after the result of the test is given. This is very important, especially when the test is confirmed positive so that the HIV/AIDS patient can be helped with coping skills.

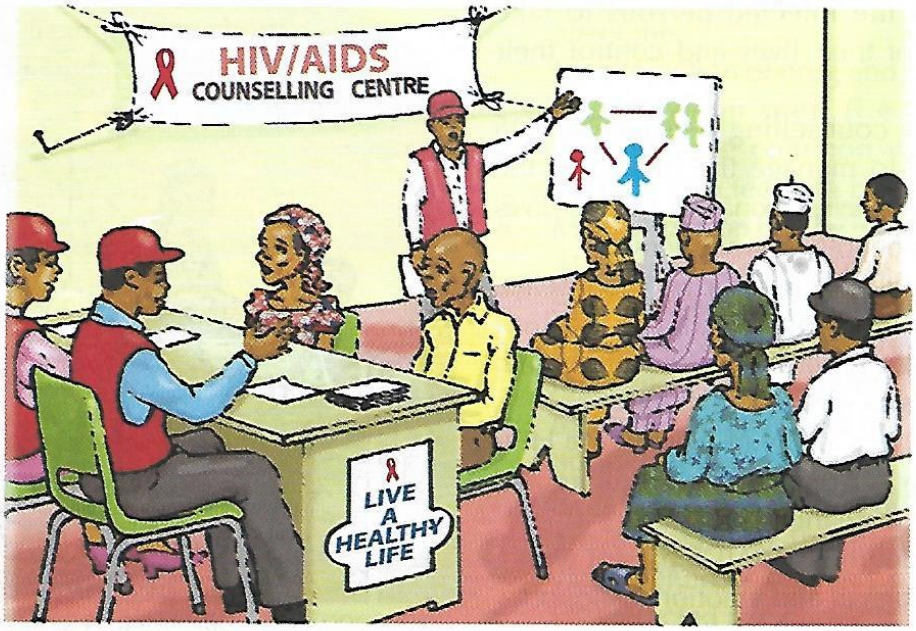


Fig. 14.2 HIV/AIDS counselling centre

Places of counselling on HIV/AIDS

Considering the importance and sensitivity of people towards HIV/AIDS, counselling about it should not be done just anywhere or every place. Some places that are suggested for HIV/AIDS counselling to take place include the following:

1 General hospitals
2 Health centres
3 HIV/AIDS centres/clinical counselling centres
4 Maternity homes
5 Sexual health clinics
6 Teaching hospitals

Advantages of post-test professional counselling on HIV/AIDS

Counselling on HIV has a lot of benefits; some of them are mentioned below:

1 It helps the infected persons to take charge of their lives and control their health.
2 Post-test counselling helps HIV/AIDS patients to manage the impact of the disease on their personal lives and the lives of other people around them.
3 It makes the counsellor and counsellee come to a point that the patient accepts the result and lives positively with the virus as well as the disease.
4 Post-test has a way of helping the HIV/AIDS patient to plan for the future and still live a meaningful life.
5 It provides the HIV/AIDS patient with psychological and emotional support.

Community care and support for people living with HIV/AIDS

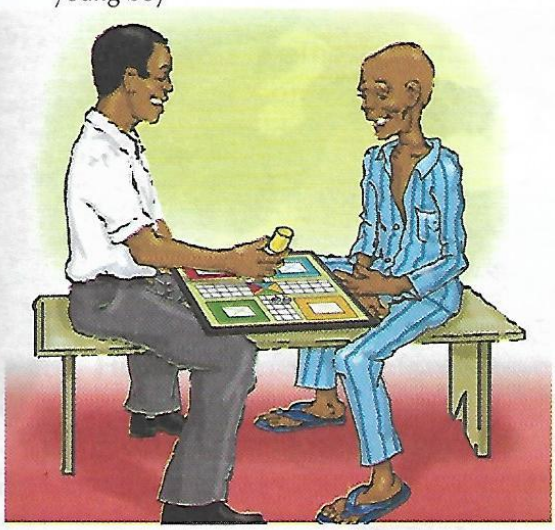
Proper care and support system is expected from friends and relatives of the HIV/AIDS infected person, especially when they are ill or indisposed. Friends, families and even the community need to help and support them because this act will bring back hope, acceptance and sense of belonging to the HIV/AIDS patient.

Community care and support can be carried out through the following:

1 Always encouraging the HIV/AIDS patient to get treatment especially when they are sick.
2 As friends and families, show love, support and respect to the infected people.
3 Bring alive hope to them by talking much about a brighter future for them.
4 Help them to reduce stress or stressful situations, e.g. by playing games with them.
5 Balanced and nutritious meals should be made available to the patient by friends and families.

a) A woman feeding an HIV/AIDS patient with family members around

b) An HIV/AIDS patient taking drugs from a young boy



c) A young man playing Ludo with an HIV/AIDS patient

Figs 14.3 a) - c) Care and support given to HIV/AIDS patient by friends and relatives

Myths and facts about HIV/AIDS

Myth can be referred to as a commonly held but false belief or a common misconception about something or somebody. Fact is a fundamental reality that has been agreed upon by a substantial number of people. There are many false stories as well as facts about HIV/AIDS. Some of the myths and facts about HIV/AIDS include:

1 Myth: Relatives and friends caring for the HIV/AIDS-infected person will contract the disease by supporting them.
Fact: HIV/AIDS cannot be passed on by coughing, touching or sharing eating utensils.

2 Myth: HIV/AIDS is a death sentence.
Fact: In the 1980s, there was a very high death rate from AIDS. But nowadays,there are many antiretroviral drugs that have improved the health and quality of life of people living with the disease.

3 Myth: HIV is the same as AIDS.
Fact: HIV and AIDS are two different things. HIV is the virus that causes AIDS. Hence, not all HIV-infected people develop AIDS.

4 Myth: I am straight, faithful and not a drug user. Hence, HIV/AIDS cannot affect me.
Fact: Injection of drug and unprotected sex between men (i.e. exchange of fluids) are common ways people become infected with HIV.

5 Myth: A person can be infected by HIV/AIDS from mosquito bites.
Fact: Although HIV/AIDS can be spread through blood, there is no evidence that mosquito bites can transmit HIV/AIDS.

6 Myth: It is dangerous to live around HIV positive people.
Fact: HIV can only be contracted if you are exposed to the blood, semen, vaginal fluid or mother's milk from an HIV-infected person.

7 Myth: Pregnant women that are infected with HIV/AIDS always pass it on to their babies.
Fact: When mother and baby receive proper treatment and care before, during and after birth, there is just about 1 to 12% chance that an infected mother will pass HIV/AIDS to her baby in the womb.

Activity **Acting a playlet or drama on prevention of HIV/AIDS in our society**

Materials required
Intelligent students, teacher, classroom environment

Procedure

1 Select some intelligent students in the class that can also face their classmates and display.
2 Explain the concept of prevention ofHIV/AIDS to the class.
3 Allow the students to brainstorm on a playlet or drama to show the concept.
4 After that, the selected students should come out before their classmates and act the play.
5 Contributions should be allowed from the rest of the students over what they gained or learnt from the drama.

Spread of HIV/AIDS in Africa

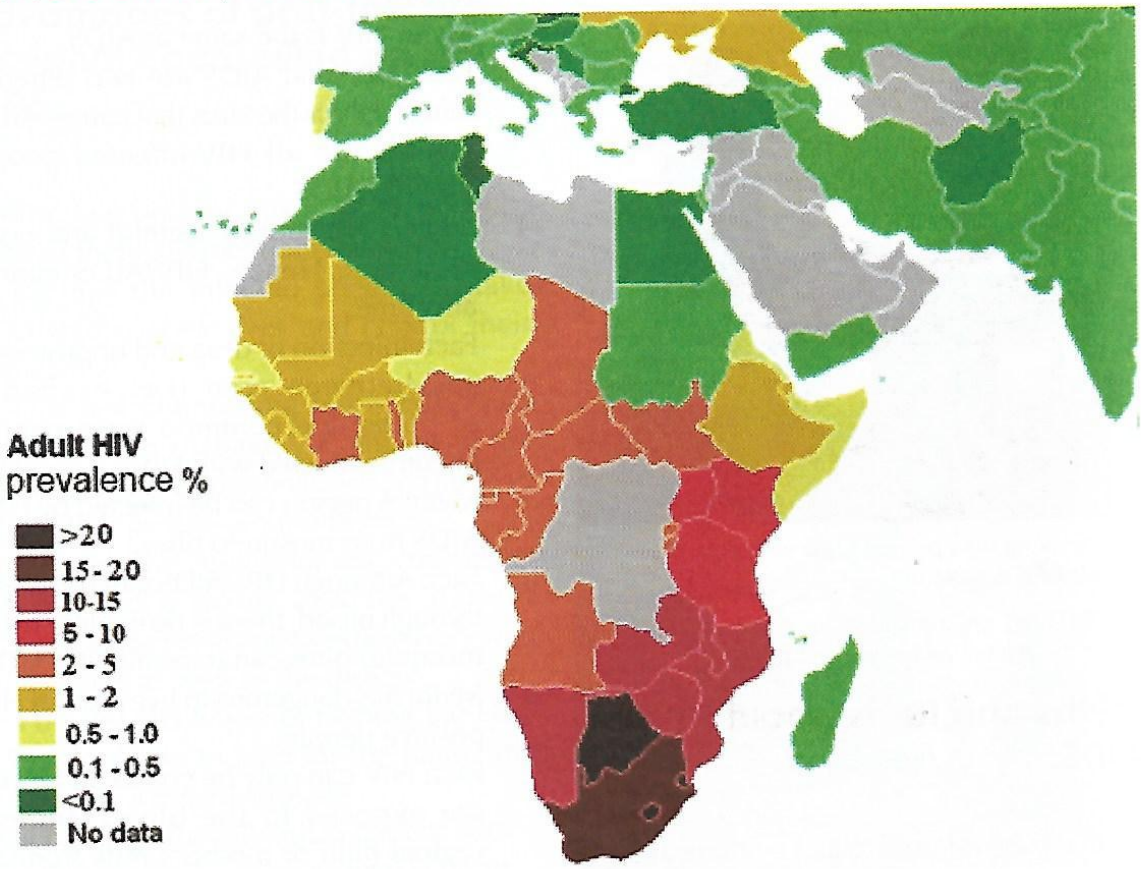


Fig. 14.4 Map of Africa showing the statistics on the distribution of HIV/AIDS

Summary

1 HIV is a virus that destroys the immune system of the body.
2 HIV is human immune-deficiency virus which causes AIDS (acquired Immune deficiency syndrome).
3 AIDS is a deadly disease that attacks the body after HIV has entered the body.
4 There is need for pre-test and post-test counselling for infected people in places like general hospital, sexual health clinics and teaching hospitals.
5 Relatives, friends and people in the community need to show love, care and support for the HIV/AIDS infected people.
6 There are different myths and facts about HIV/AIDS. For instance, eating or sharing towel with infected person will make one to have the disease. The fact remains that HIV/AIDS can only be transferred through body fluids.

Revision questions 14

1 HIV simply means _____.
   A Human Immune Virus
   B Human Infected Virus
   C Hormone Immunodeficiency Virus
   D Human Immunodeficiency Virus
2 One of the following is not a place of counselling for HIV/AIDS _____.
   A Teaching hospital
   B Rest room
   C Health centre
   D General hospital
3 _____ counselling is the type a person receives from a counsellor after the result of the test has been given.
   A Post-test
   B Pro-test
   C Pre-test
   D Pot-test
4 One of the following is not the reason to support an HIV/AIDS infected person.
   A To bring back hope
   B To give them sense of belonging
   C To encourage them to be having unprotected sex
   D To give them acceptance
5 Eating together with an HIV/AIDS patient can make us contract the disease.
   A True
   B False
   C Not sure
   D All of the above
6 Differentiate between HIV and AIDS.
7 List five (5) places to go to for both pre - and post-test counselling on HIV/AIDS?
8 Mention three (3) advantages of post-test professional counselling on HIV/AIDS.
9 Mention some ways community care and support can be carried out for an HIV/AIDS person.
10 State five (5) myths and facts about HIV/AIDS.
11 Give reasons why all teenagers should learn about HIV/AIDS.
12 State the meaning of the following terms: HIV, AIDS.
13 List three (3) methods that can protect you against HIV/AIDS infection.
14 Develop a poster to be used in a class campaign against HIV/AIDS.

Chapter 15 Disease vectors

Introduction

Many human diseases are caused by tiny living things. A sick person carries in his or her body many of these tiny living things commonly called **germs**. A healthy person becomes sick if germs are passed from a sick person to him or her, and they grow inside him or her.

In this chapter, you will study one important method by which germs are passed from one person to another, by small living organisms. These small living things that pass germs from one person to another are called **vectors**.

Objectives

By the end of this chapter, you will be able to:

1 identify disease vectors and the diseases they transmit;
2 describe the life cycle of anopheles mosquito and use the knowledge to control the breeding of mosquitoes and spread of malaria;
3 describe the life cycles of other vectors; and
4 explain how malaria, river blindness and sleeping sickness are transmitted.

Transmission of disease-causing organisms

Disease-causing organisms are transmitted or passed from one person to another through:

1 direct contact;
2 air, water, food or objects; and
3 other living things.

Transmission of germs by direct contact

The germs that cause certain diseases such as leprosy, are passed from a sick person to another person by direct body contact. These germs are on the surface of the body of a sick person.

A healthy person, who has body contact with a sick person, such as by a handshake, hugging, brushing, or sleeping on the same bed may pick up the germs from the sick person.

Diseases passed on by body contact are said to be **contagious**. Examples are ringworm, leprosy, small pox and measles.

Transmission of germs through air, water, food or objects

A person that is sick of the common cold (or catarrh) breathes out the germs every time he or she breathes out, and the germs remain alive in the air for some time. If a healthy person, standing or sitting close to the sick person breathes in the germs, the healthy person may become infected with the common cold.

A person sick with cholera passes out cholera-causing germs in the stool. If such a person passes stool in a bush, the stool

may dry up and break up into dust in the area. Ripe fruits may fall on the soil in the area and pick up the cholera germs now mixed with the soil. These fruits will become contaminated. Again, rain water may wash the stool into a nearby stream which the people of that area may be using for drinking and washing. The water will become contaminated. A healthy person who uses this water for drinking or for washing hands before eating may suffer from cholera.

Diseases which are passed on through the air, water, food or objects are said to be **infectious**.

Transmission of germs through living things

Almost every time people talk about malaria, they also talk about mosquitoes. There is a close link between the two. This link will be described in detail later in this chapter. When a mosquito bites a person sick with malaria, it will, in that process, suck up the blood with germs that cause malaria. When that mosquito bites a healthy person, it will inject the malaria germs into the healthy person. This person may then suffer from malaria.

An organism which passes germs from one person to another is called a **vector**. Some vectors and the diseases they transmit are shown in Table 15.1.

Characteristics of a vector

A vector has **four** characteristics:

1 It is a small animal, sometimes an insect.
2 It passes germs from one person to another.
3 The germs grow and develop inside the vector to a stage that they can infect another person when introduced into the person's body.
4 The vector is not made sick by the fact that it has the disease-causing germs in its body.

Malaria and anopheles mosquito

Malaria is a very serious disease in the tropical and sub-tropical areas of Africa and other continents.

Economic effects of malaria

1 Malaria disease makes people under-productive or unproductive.
2 About 70% of all hospital patients in Nigeria are treated for malaria. This means that individuals and families are spending much money to keep themselves free of this disease.

Table 15.1 Disease vectors, causal organisms and the diseases they transmit

Disease	Vector	Causal organism	Parts of the world where they are found
1 Malaria	Female anopheles mosquito	Plasmodium	The tropics and sub-tropics
2 River blindness	Black fly	Filarial worm	Africa
3 Filariasis	Anopheles and culex mosquitoes	Filarial worm	The tropics and sub-tropics

4 Yellow fever	Aedes mosquito	Yellow fever virus	The tropics and sub-tropics
5 Sleeping sickness	Tsetse fly	Trypanosoma	The tropics

3 The Nigerin Government is spending billions of naira per year on efforts to control malaria, with programmes such as 'Roll-back-malaria'.
4 Malaria disease shortens people's lives, especially the poor.

Life cycle of female anopheles mosquito

The female anopheles mosquito has a life cycle of four stages: egg, larva, pupa and young adult (Imago). It is, therefore, said to have complete **metamorphosis**.

Egg

The adult female anopheles mosquito lays her eggs singly in stagnant water, such as ponds; puddles; and water collected in dirty gutters, cans, abandoned containers, leaf axils of cocoyams and bananas, damaged septic tanks and standing water tanks. Each egg has a boat shape, with two air floats to make it float on the water. In two days, it hatches into a larva.

Larva

The larva is long, and lies parallel to the water surface, just under the water surface. It breathes atmospheric air through a breathing tube that projects above the water. It feeds on water plants, and after ten days, it changes into a pupa.

Pupa

The pupa is comma-shaped. It stays just below the water level, and breathes atmospheric air directly through two breathing tubes. It does not feed. In about seven days, it changes into the young adult or imago.

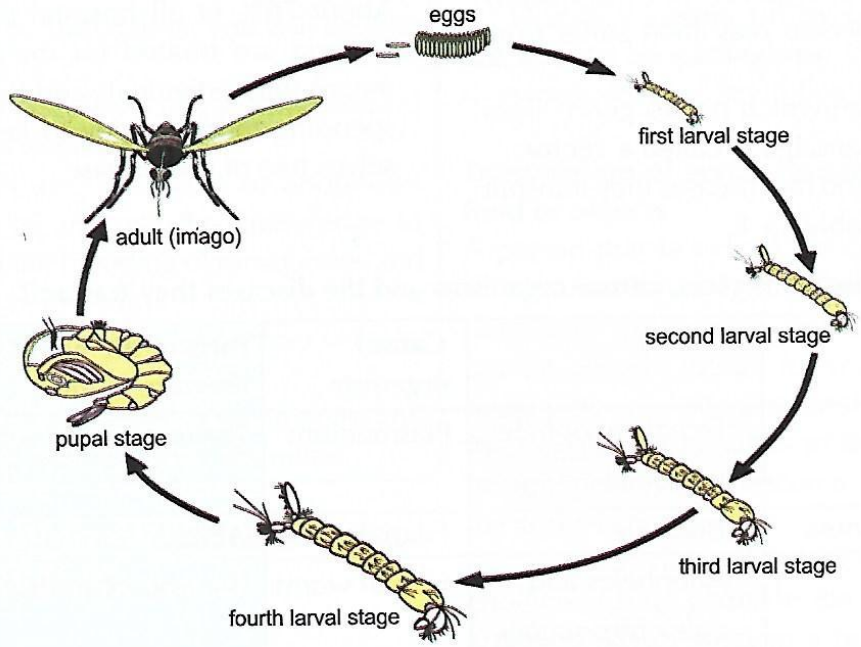


Fig. 15.1 Life cycle of the female anopheles mosquito

Imago

The imago is like the adult, but small. Metamorphosis in mosquitoes takes about 21 days, but this varies with temperature. It is faster in hot weather than in cold weather.

Activity Observing the life cycle of mosquito

Materials required

Four open milk cans, water, your science notebook, stool, magnifying lens, biro

Procedure

1 Put 20 cm^3 of clean water into each of the four open milk cans.
2 Place the milk cans outside on a stool.
3 Observe the water in the cans everyday to know when mosquitoes have laid eggs in them. Write down the date.
4 Use the magnifying lens to observe the eggs.
5 Make a drawing of a collection of eggs, and one egg in your science notebook.
6 Observe the eggs daily till they hatch. Write down the date.
7 Use the hand lens to observe the larvae. Make a large drawing of one larva in your science notebook.
8 Continue to observe the larvae daily until they change into pupae. Make a large drawing of one pupa. Write down the date.
9 Continue to observe the pupae until they change into young adults. Before this happens, cover the cans with plastic wire netting, to prevent the mosquitoes from flying away. Draw one imago.
10 Count the number of days taken by each stage of the life cycle. Add together the total time for metamorphosis.

How many days were required for the development of the mosquitoes from eggs to young adults?

Feeding habit of the anopheles mosquito

The male anopheles mosquito feeds on nectar. Only the female feeds on human blood. The mouth parts of the female anopheles mosquito are made for piercing the human skin and for sucking blood from a blood vessel in the human body.

When a mosquito settles on the skin of a person, and pierces the skin, it first injects its saliva into the blood of the person. The mosquito's saliva prevents the human blood from clotting while the mosquito is sucking.

The mosquito sucks the blood and flies away. If the blood contains malaria parasites, the parasites are not digested in the mosquito's digestive system, but rather develop inside the mosquito to a form that can again cause malaria in human beings. The parasites then move inside the mosquito into the salivary glands. When this mosquito bites a healthy person, it will inject the malaria parasites already inside the salivary glands into the healthy person. This way, the healthy person may become sick.

Control of mosquitoes and malaria

Mosquitoes and malaria can be controlled as follows:

1 **Reduction of mosquito breeding sites**

The living places where mosquitoes breed can be reduced by:

a) clearing gutters, so that they do not collect stagnant water;
b) clearing empty cans in the environment;
c) drying stagnant pools and ponds; and
d) clearing tall grass around homes.

2 **Destruction of mosquitoes in the young stages**

This can be done by:

a) spraying insecticides on stagnant water; and

b) covering stagnant water with kerosene or oil so that the mosquito larvae and pupae die because they cannot breathe.

3 **Killing of adult mosquitoes**
Adult mosquitoes can be killed:
a) directly with brooms, etc; and
b) by using insecticides.

4 **Preventing mosquito bites**
This can be done by:
a) using mosquito-proof nets to cover windows;
b) sleeping under mosquito nets; and
c) using insect repellants.

5 **Preventing mosquitoes from reproducing**
Female anopheles mosquitoes produce a chemical substance which attracts male mosquitoes to mate with them. This substances called **pheromone**, have been identified by scientists. It is now manufactured artificially. When pheromone is placed in a trap, male mosquitoes stream into the trap. They are then killed in the trap with insecticides.

6 **Treatment of patients**
Treatment of malaria patients with drugs reduces the available infective malaria germs to be passed from one person to another.

7 **Taking drugs that prevent malaria**
Daraprim is an example of drugs which, when taken as prescribed by a medical doctor, prevents malaria. A person who takes Daraprim may not pass on the germs. Malaria parasites in the person's body also die.

Black fly and river blindness

The black fly, *Simulium damnosum*, is the vector of the human parasite that causes river blindness. The parasite is a *filarial* worm.

Geographical distribution

The black fly is found in Africa, South America and Central America.

Economic effects

The *filarial* worms transmitted by the black fly tend to move into the eyes of the victim. They may become trapped and die in the small blood vessels in the eyes, and hence, cause blindness. In West African savannah region, severe attacks of river blindness once caused inhabitants to desert some parts of Chad.

Life cycle of blackfly

Adult female black flies lay their eggs in fast-flowing waters which contain more oxygen than slow-flowing waters. The larvae of black

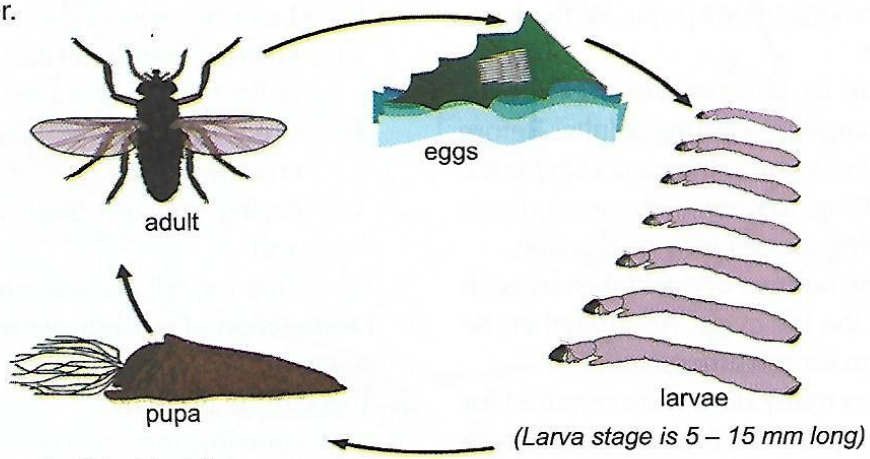


Fig. 15.2 Life cycle of the black fly

flies require streams or rivers containing much oxygen in order to grow and develop.

The life cycle has all the four stages of metamorphosis namely, egg, larva, pupa and adult.

The larvae mature into adult black flies within 8 to 12 days.

Feeding habit of the black fly

The adult female black fly sucks human blood. When a female black fly bites a victim of river blindness, it sucks the parasites into its stomach. The parasites develop inside its body to an infective stage. When a black fly containing infective parasites bites a healthy person, it passes the infective parasites into that person.

Control of black flies

1 Chemicals that kill the eggs, larvae and pupae are sprayed on streams where the black flies breed. This kills the young stages of black flies.
2 Adults are active fliers. They can fly over many kilometres from their starting point. However, in the heat of the day, they rest in bushes. These adults can be killed with insecticides. Large areas are sprayed with insecticides from helicopters.
3 Drugs are used to treat patients and so reduce the number of parasites.
4 There are now drugs that prevent the attack of river blindness.

Tsetse fly and sleeping sickness

Sleeping sickness is a disease of human beings, horses and cattle. The tsetse fly (*Glosinna sp*) is the vector of the parasite (*Trypanosoma*) that causes sleeping sickness in man, and *nagana* in cattle and horses.

Geographical distribution of the tsetse fly

Tsetse flies are found in Africa, South of the Sahara, especially in the savannah regions. Recently, tsetse flies were found in South America. They are also found in two localities of the Arabian Peninsula.

Economic effects of the tsetse fly

Cattle attacked by *nagana* become lean, and eventually die.

Human beings who suffer from sleeping sickness are tired, weak, and lean. In advanced cases, they sleep most of the time. The disease may lead to death.

Life cycle of the tsetse fly

The life cycle of the tsetse fly has all the four stages of egg, larva, pupa and young adult.

The eggs hatch inside the mother's uterus. After some days, the larvae are deposited in soft, sandy soil. The larva grows in the soil and changes to pupa. After about four or five weeks, the pupa changes into the young adult. Young adults wait for some days for their wings to be expanded and for them to become strong enough to fly.

Feeding habit of the tsetse fly

Tsetse flies feed on the blood of human beings, cattle and horses. When a tsetse fly sucks the blood of a victim of sleeping sickness, it also sucks the parasites that cause the disease with it. When it bites another person, cattle or horse, it injects the parasites into their blood. This way the parasites are spread.

Tsetse flies feed every two or three days. They start feeding a few days after they have become adults.

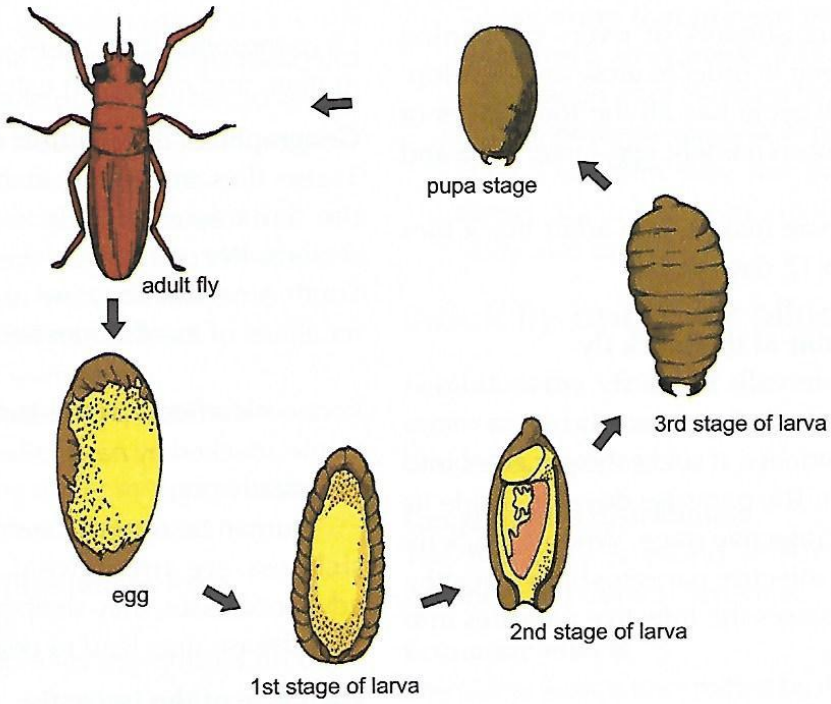


Fig. 15.3 Life cycle of the tsetse fly

Control of the tsetse fly

1 Insecticides are used to spray the adults in their resting places in bushes. Large areas are sprayed from helicopters.
2 Drugs that cure sleeping sickness are used to kill the parasites in patients.
3 Drugs that prevent sleeping sickness are used to keep healthy people free from the disease.
4 Sex pheromones are used to attract male tsetse flies into traps where they are killed with insecticides.

Summary

1 A vector is a small animal, such as an insect, that passes disease-causing organisms from one person to another.
2 Different vectors pass on different disease-causing organisms.
3 A vector does not suffer from the disease it transmits.
4 The female anopheles mosquito is the vector for malaria.
5 The black fly is the vector for river blindness.
6 The tsetse fly is the vector for sleeping sickness.
7 Knowledge of the life cycle of the vector is useful in controlling the vector.
8 Vectors can be controlled in the young and adult stages.

Revision questions 15

1 Disease-causing organisms can be passed from one person to another through _____.
   A water
   B food
   C body contact
   D vectors
   E all of the above

2 Small living things that pass germs from one person to another are called _____.
   A vectors
   B organisms
   C parasites
   D host
   E mosquitoes

3 Which one of the following is not a vector? _____.
   A The black fly
   B The tsetse fly
   C Water
   D Anopheles mosquito
   E · Culex mosquito

4 The male anopheles mosquito feeds on _____.
   A blood
   B nectar
   C water
   D food particles
   E none of the above

5 List the methods of controlling mosquitoes.

6 Use diagrams to illustrate the life cycle of a named vector.

7 Describe three (3) ways of controlling vectors.

8 Describe how malaria is transmitted from one person to another.

9 List three (3) types of diseases and the vector that causes each.

10 Explain the transmission process of any one of the following:
   a) river blindness.
   b) sleeping sickness.

Chapter 16 Prevention of diseases 1 (Water-borne)

Introduction

In developing countries, four-fifths of all the illnesses are caused by water-borne diseases, with diarrhoea being the leading cause of childhood death.

Recent statistics shows that billions of people still have no access to improved drinking water sources and adequate sanitation. Today, we have strong evidence that water, sanitation and hygiene-related diseases account for so many deaths annually.

Objectives

By the end of this chapter, you will be able to:

1 list water-borne diseases;
2 explain and identify the necessity for boiling water taken from streams, ponds, or untreated sources; and
3 list the advantages of pipe-borne water.

Water-borne diseases

Water-borne diseases are diseases that are mainly caused by drinking or using contaminated water. Water-borne diseases are spread by contamination of drinking water systems, especially with the urine and faeces of infected animals or people.

This is likely to occur where public and private drinking water systems get their water from surface water (rain, creeks, rivers, lakes, etc), which can be contaminated by infected animals or people. Run-off from landfills, septic fields, sewer pipe and residential or industrial developments can also sometimes contaminate surface water.

This has been the cause of many dramatic outbreaks of faecal-oral diseases, such as cholera and typhoid. However, there are many other ways in which faecal material can reach the mouth, for example, from the hands or from contaminated food. In general, contaminated food is the single most common way in which people become infected.

The germs in the faeces can cause the diseases by even a slight contact. This contamination may occur due to flood waters, and water run-off from landfills, septic fields and sewer pipes.

One way to break the continued transmission is for people to improve their hygiene. Another way is to provide them with certain basic needs: drinking water, washing and bathing facilities, and sanitation.

Examples of water-borne diseases are:

1 Typhoid
2 Cholera
3 Shigellosis
4 Dengue fever
5 Diarrhoea
6 Guinea worm
7 Dysentery

Cholera

Cholera is a good example of water-borne diseases. It is caused by a bacterium called *Vibrio cholerae*. The main source of infection is water contaminated by faeces from a sufferer of the disease or a **carrier**. A carrier is an individual infected with *vibrios* who does not develop the typical symptoms of cholera. Drinking contaminated water, and washing food or utensils in it are the most common means of transmission.

Direct contamination of food with faeces as a result of poor hygiene is also possible. *Vibrio cholerae* multiplies in the intestine, releasing a powerful toxin which results in violent inflammation of the intestine and production of a watery diarrhoea. The organisms can only multiply and flourish in the human intestine, although they can survive outside the body.

The main sign of the disease is severe diarrhoea due to irritation of the bowel by toxins from the microorganisms. The liquid of the faeces is so profuse and cloudy that it is called *rice water*. Abdominal pain and vomiting are also common.

Fever is absent; in fact, the skin feels *deathly* cold and often damp. Dehydration is rapid and quickly results in death unless rehydration treatment is given.

If the faeces is not collected or disposed of hygienically, then one victim can infect a wide area of a community. This is because each cubic centimetre of diarrhoea will contain up to a thousand million cholera-causing microorganisms. Thus, a mild case of cholera or a carrier may create a great hazard.

Treatment and prevention of cholera

The prime cause of death from cholera is loss of water with its mineral salts. Replacement of these mineral salts is, therefore, the first task.

1. Where cholera is endemic, for example in refugee camps, cheap and immediate therapy is by oral rehydration, that is by giving packs of water containing balanced mineral salts and sugar through the mouth.
2. Also, various antibiotics, such as tetracyclines and chloramphenicol, are effective at destroying the *vibrios* and stopping the diarrhoea.
3. Improved basic human hygiene, including better garbage and waste disposal should be put in place.
4. In-house toilets with appropriate water flushing system should be put in our homes.
5. Control of flies which act as vectors intransferring faecal material to food.
6. Isolation of patients and hygienic disposal of faeces and vomit from patients.
7. Identifying carriers and preventing them from working in the food industry or cooking food at all.
8. Proper health education, such as washing of hands after defecation.
9. Provision of clean drinking water.
10. Vaccination: Recommended for people visiting areas where cholera is endemic and for those living in such areas.

Typhoid

Typhoid has been a great problem of humans. It has typically been a disease of overcrowded communities and is, therefore, associated with poverty, starvation and war.

Once there is an improvement in sanitation and water supply in a community,

the spread of the disease will be greatly reduced.

The bacteria (*Salmonella typhi*) are derived from the faeces of a sufferer from the disease or from a carrier. The disease is spread by water or from contaminated food.

Common sources of infection

1 Water supplies may be contaminated by human faeces through seeping of sewage into a reservoir, leakage from defective underground sewers or discharge of sewage into a river.

2 Serious epidemics have also been traced to food. Milk can be contaminated by a carrier or from equipment washed with contaminated water.

When the infecting microorganisms have been swallowed, they migrate to the blood stream, and the victim develops headache and muscular pains. A fever develops, reaching its peak after about one week. A faint rash may appear. In the second week, diarrhoea develops and the victim deteriorates and may even die.

Prevention

Any typhoid patient requires the highest standards of nursing together with isolation and hygienic disposal of faeces. The two most important preventive measures are:

1 proper sewage treatment; and
2 purification of water supplies.

Contamination of food can be reduced by personal hygiene, hygienic measures in the food trade and at home, and control of flies, which can transfer faecal material to food.

Prevention of water-borne diseases

Clean water is a pre-requisite for reducing the spread of water-borne diseases. It is well known that the prevalence of water-borne diseases can be greatly reduced by:

1 provision of clean drinking water;
2 provision of safe place for disposal of faeces, i.e. stopping indiscriminate faecal disposal; and
3 disinfecting water to kill pathogens that may be present in the water supply to prevent them from growing again in the distribution system.

Sources of clean water

Water is so vital in our lives. Not only is it essential to our health, we also use it for numerous household tasks. Every day we use water for cooking, bathing, cleaning and drinking; but how often do we think about its source, i.e. where does our water come from, and how do we know it is safe to drink?

To answer these questions, it is important to go back to the basics. There are two main sources of water: **surface water** and **ground water**.

Surface water is found in lakes, rivers and reservoirs. Ground water lies under the surface of the land, where it travels through and fills openings in the rocks. The rocks that store and transmit ground water are called **aquifers**. Ground water can be pumped from aquifers to the earth's surface for use.

Consumers receive their water from one of two sources: a private well or a community water system. A household well pumps ground water for household use. The

source of a community water system may be either surface water or ground water.

Examples of sources of clean water

1 Pipe-borne water (provided the pipe is not leaking)
2 Spring water
3 Rain water (if collected directly from the sky)
4 Certified treated bottle water and sachet water

Necessity for boiling water taken from streams and ponds

In a drop of pond water, you observe under the microscope many tiny things. There are tiny single-celled plant-like living things. There are also tiny animal-like living things, some of which move from place to place. Bacteria and viruses are present in water from ponds, streams, rivers and untreated sources.

It is, therefore, necessary to boil water from any untreated source before drinking it. The purpose of boiling water for drinking is to kill the disease-causing tiny living things in the water. After boiling, drinking water should be filtered as well, to remove any suspended matter.

Activity 16.1 Boiling water collected from a river or stream

Materials required

Water collected from a river or stream, a stove, a crucible, your science notebook

Procedure

1 Put 10 cm^3 of river or stream water into a crucible.
2 Look closely to see whether the water is colourless or coloured, cloudy or clear, and if it has any suspended matter in it.
3 Heat the water strongly.
4 Observe the water as it dries.
5 Heat the water in the crucible to dryness.
6 Is there any residue at the bottom of the crucible?

Activity 16.2 Examining a drop of pond water with a microscope

Materials required

Microscope, pond water, a cup, a small pipette, microscope slide, cover slip, your science notebook, pencil

Procedure

1 Your teacher will collect some pond water in a cup, and mount a drop of it on a microscope slide, which the class will examine.
2 Students in the class will examine the microscope slide one after another.
3 Make a diagram in your science notebook of what you see.

Sources of unclean water

Several contaminants occur in nature that may present a health risk if they are found in drinking water. They include bacteria, viruses, uranium, radium, nitrate, arsenic and fluoride. Many of these contaminants are naturally present in rock formations, and consequently end up in the water supply.

Other sources of contamination are results of human activities, such as manufacturing, agriculture, and individual misuse.

The following activities may cause harmful chemicals to enter the water:

1 Leakage from waste disposal treatment or storage sites.

2 Discharges from factories, industrial sites and sewage treatment facilities.
3 Leakage from land. through application of pesticides and fertilisers on yards or fields.
4 Accidental chemical spills.
5 Leakage from underground storage tanks.
6 Improper disposal of household wastes, such as cleaning fluids, paint and motor oil.

Water treatment processes

Water treatment plants produce drinking water for public consumption, and industrial water for manufacturing and other business operations.

Water treatment plant

Treatment often involves some combination of:

1 Filtering out sediments and disease-causing organisms.
2 Chemical treatment to remove excess minerals and other contaminants.
3 Further settling or filtration.
4 Final disinfection and chemical adjustment to reduce scaling or corrosion within the delivery system.

Water treatment is, collectively, the industrial scale processes that make water more acceptable for use.

Water purification is the removal of contaminants from untreated water to produce drinking water that is pure enough for the most critical of its intended uses, i.e. for human consumption.

Substances that are removed during the treatment of water meant for drinking include suspended solids; bacteria; algae; viruses; fungi and minerals, such as iron, manganese and sulphur.

Measures are taken to ensure water quality is maintained after the treatment of the water, and also during distribution.

It is, therefore, common practice to have residual disinfectants in the treated water in order to kill any bacteriological contamination during distribution.

A combination selected from the following processes is used for municipal drinking water treatment worldwide:

1 **Pre-chlorination**: for algae control and arrest of any biological growth.
2 **Aeration**: along with pre-chlorination, for removal of dissolved iron and manganese.
3 **Coagulation**: chemicals are added to water to cause the clumping together of suspended particles like sand.
4 **Flocculation:** Chemicals are added and gently stirred or mixed to make particles increase in size for easy filtration of water.

5 **Sedimentation**: for the removal of suspended solids trapped in water.
6 ***Filtration***: *removing particles from* water.
7 **Disinfection**: for killing bacteria.

The clean water is now stored and ready to be distributed through pipes to different homes and industries.

Advantages of using pipe-borne water

1 It is clean, and most dissolved and suspended matter have been removed.
2 It has been treated to kill any disease-causing living things.
3 It is conveniently available in the home.

Activity 16.3 A visit to a water treatment station

Materials required

Your science notebook, biro

Procedure

1 Your teacher will arrange for your class to visit a water works in your area.
2 While there, observe the different units of the water works, and what is done to the water in each unit.
3 Also observe how the water is tested at the end of the treatment to confirm that it is safe for drinking and other human uses.
4 Write your observations in your science notebook.

Summary

1 Water-borne diseases include typhoid, cholera, diarrhoea and guinea worm.
2 Water-borne diseases are diseases that are mainly caused by drinking or using contaminated water.
3 Water-borne diseases can be controlled by improving people's hygienic be*haviour, providing good water, for* drinking washing and bathing, and sanitation.
4 Stream water, pond water and river water usually contain dissolved and suspended impurities as well as tiny living things, some of which may cause diseases.
5 Examples of clean water are pipe-borne water, spring water, rain water (if collected directly from the sky), and certified treated bottle water and sachet water.
6. Boiling of water for drinking kills harmful microorganisms in it.
7 Treatment of town water supply includes filtration, coagulation, sedimentation and disinfecting.

Revision questions 16

1 Which of the following is a water-borne disease? _____.
   A Tuberculosis
   B Tetanus
   C Cholera
   D Malaria
   E Cough
2 The reason for boiling water before drinking is that boiling _____.
   A removes suspended matter in the water
   B dissolves all salts in the water
   C removes all colour from the water
   D gives the water a normal taste
   E kills disease-causing organisms in the water

3 Typhoid is caused by the bacteria _____.

A *Samolina typhi*
B *Semolena typhi*
C *Salmonella typhi*
D *Selmonalla typhi*
E *Silmonela typhi*

4 Contamination of food can be reduced by _____.

A drinking water
B sleeping hygiene
C personal hygiene
D eating
E driving

5 Treatment of town water supply includes _____.

A filtration
B coagulation
C disinfecting
D sedimentation
E all of the above

6 Describe the methods of prevention of two (2) water-borne diseases.

7 Describe the process of treating river water to become potable water.

8 What are the advantages of using pipe-borne water in the home?

9 State the importance of boiling water for drinking.

10 Name two (2) water-borne diseases.

Chapter 17 Prevention of diseases 2 (Immunisation)

Introduction

At a simple level, another name for immunisation is **vaccination**. It is a common experience in developed countries, and it is one of the means which have helped to reduce the incidence of infectious diseases so dramatically in those countries.

Other means have been social and environmental improvement, such as treatment of water to make it clean for drinking, better nutrition and sewage treatment.

Objectives

By the end of this chapter, you will be able to:

1 give the meaning of immunisation;
2 list the schedule and routes of immunisation; and
3 state how human body defends itself against infection.

Immunisation

Immunisation is the process of introducing vaccines into the body to protect the body from certain deadly diseases and infections.

When you get sick, your body generates antibodies to fight the disease and help you get better. These antibodies stay in your body even after the disease has gone, and protect you from getting the same illness again. This is called **immunity**.

You do not have to get sick to develop immunity; you can be given a vaccine.

Activity 17.1 How can I help to stop the spread of diseases?

Materials required

Your science notebook, biro

Procedure

1 In your science notebook, make a list of the ways in which you can help to stop the spread of diseases.
2 Make your list under the heading 'Rules for staying healthy'.
Some causes of diseases are shown in Table 17.1.

How the human body defends itself against infection

The white blood cells in the human blood defend the body against infection in two ways:

1 Some white blood cells attack and engulf (swallow) germs, such as bacteria that enter the body.
2 Some white blood cells secrete chemical substances called **antibodies** which destroy microorganisms or their harmful products. There are different types of white blood cells which secrete different types of antibodies. They are:
   a) **lysine**; which dissolves the outer coats of bacteria, causing the bacteria to die.

b) **antitoxins**; which neutralise poisons produced by foreign microorganisms in the body.

c) **agglutinins;** which cause foreign microorganisms in the body to stick together and reduce their ability to attack the body.

d) **precipitins**; which cause soluble products of disease-causing micro-organisms to become insoluble, so that the white blood cells which swallow particles or micro-organisms can swallow them.

Table 17.1 Some causes of diseases

Causes of diseases	Some of the diseases caused
1 Food deficiency	
a) Lack of protein	Kwashiorkor.
b) Lack of vitamins	Bleeding of gums, night blindness, scurvy, pellagra.
c) Lack of iodine	Goitre
2 Microbes	Malaria, tuberculosis, leprosy, sleeping sickness, polio, cholera
3 Heredity	Diabetes, arthritis, sickle-cell anaemia, haemophilia, colour blindness
4 Smoking	Heart and respiratory diseases
5 Drug abuse	Mental and physiological illnesses
6 Stress, inadequate rest	High blood pressure

Immunity through immunisation

Immunisation (or vaccination) protects a person from diseases by introducing a vaccine into the body that triggers an antibody response as if that person had been exposed to a disease naturally.

The vaccine contains the same antigens or parts of antigens that cause the disease, but the antigens in vaccines are either killed or greatly weakened. Vaccines work because they trick your body so that it thinks it is being attacked by a disease.

Immunity through immunisation happens without the consequence of being ill and without the risk of potential life-threatening complications from the disease.

However, not all vaccines provide life-long immunity. Diseases, such as tetanus require booster doses every ten years for adults to maintain immunity.

At any age, vaccination (immunisation) provides the longest lasting and most effective protection against diseases, but childhood immunisation does not provide lifelong immunity against some diseases, such as tetanus and diphtheria. Therefore, immunisation is not for children only.

Immunisation for adults

Adults are immunised in health centres and hospitals against:

1 Cholera
2 Tetanus
3 Yellow fever
4 Small pox
5 Polio.

Various countries have various immunisation requirements for foreigners, before admission into their countries. For example, Brazil requires anyone flying

directly from Nigeria to Brazil, or anyone who visited Nigeria in the last six months before travelling to Brazil, to have immunisation against yellow fever.

Adults require helper or booster shots to maintain immunity. Also, adults who were not adequately immunised as children may be at risk of infection from other vaccine-preventable diseases. They can also infect others. For example, adults who contract measles or mumps can infect infants who may not yet be fully immunised.

The World Health Organisation (WHO) with support from various organisations like United Nations Children's Fund (UNICEF) and the World Bank has targeted some major diseases in the developing countries. Over 80% of children in developing countries now receive vaccination against those diseases.

In Nigeria, the diseases prioritised for inclusion in the national programme on immunisation are:

1 Poliomyelitis
2 Tuberculosis
3 Diphtheria
4 Pertusis
5 Tetanus
6 Measles
7 Yellow fever
8 Hepatitis
9 Cerebrospinal meningitis

A child being immunised by a health officer

Table17.2 Schedule for immunisation

Vaccine	Time (weeks/months)	Route of adminstration
1 BCG (to prevent tuberculosis)	At birth	Intradermal
2 Oral polio vaccine (OPV)	0, 6, 10, 14 weeks	Oral (mouth)

3 Diphtheria	0, 6, 10, 14 weeks	Intramuscular
4 Pertusis	0, 6, 10, 14 weeks	Intramuscular
5 Tetanus	0, 6, 10, 14 weeks	Intramuscular
6 Hepatitis B	Birth, 6, 14 weeks, 6 months	Intramuscular
7 Measles	9 months	Subcutaneous
8 Yellow fever	9 months	Subcutaneous
9 Tetanus	TT1: Early pregnancy TT2: 4 weeks TT3: 6 months TT4: 1 year after TT5: 4 years or subsequent pregnancy	Intramuscular

Improvement to some vaccines, such as the flu vaccine, is still needed and there is still no vaccine against some diseases, notably cancer, leprosy, malaria, AIDS and Ebola, despite intensive research.

The immunisation for all the vaccine-preventable diseases is to be administered by a qualified health practitioner in a reputable health facility.

Activity 17.2 Where is immunisation available in your area?

Materials required

Your science notebook, biro

Procedure

The whole class will discuss as a group.

1 Find out where immunisation is available in your community and the diseases that children and adults are immunised against.
2 Find out the percentage of students in your class that have been immunised against each disease.
3 Draw up tables in your science notebook to show your findings.

Summary

1 At a simple level, another name for vaccination is immunisation.
2 Immunisation is the process of introducing vaccines into the body to protect the body from certain deadly diseases and infections.
3 Some diseases are vaccine-preventable, such as polio, tuberculosis, tetanus, measles, yellow fever, diphtheria, hepatitis B and cerebrospinal meningitis.
4 At any age, vaccination provides the longest lasting and most effective protection against diseases.

Revision questions 17

1 Immunisation is very important because it helps to _____.
   A prevent diseases
   B cure diseases
   C stop drug abuse
   D improve environmental sanitation
   E provide nutrients

2 Which of the following diseases are children immunised against? _____.
   A Diphtheria
   B Tetanus
   C Polio
   D Tuberculosis
   E All of the above

3 For which of the following diseases is immunisation done through the mouth? _____.
   A Polio
   B Cholera
   C Tetanus
   D Tuberculosis
   E Whooping cough

4 Immunisation is effective in the control of _____.
   A inherited diseases
   B nutrient-deficiency diseases
   C diseases caused by microorganisms
   D diseases caused by stress and pressure of work
   E diseases caused by smoking and drug abuse

5 White blood cells attack _____.
   A food
   B blood
   C germs
   D water
   E organs

6 Adults can be immunised against _____.
   A cholera
   B tetanus
   C yellow fever
   D small pox
   E all of the above

7 Which diseases are pregnant mothers immunised against?

8 Name three (3) diseases against which adults may be immunised.

9 Name three (3) human diseases that can be prevented through immunisation.

10 List the different types of antibodies.

Chapter 18 Environmental conservation and safety 1 (Maintaining a balance)

Introduction

The earth is the home of many living things, including human beings. The part of the earth in which living things live is called the **biosphere**. Without the non-living part of the earth, the living part cannot survive. For example, plants absorb water and minerals from the soil, and carbon dioxide from the atmosphere. Human beings breathe in oxygen from the atmosphere and obtain water from the non-living environment. The living and the non-living parts of the earth constantly interact. When living things die and decay, they give back to the non-living part of the earth what they have taken from it.

The movement of materials or elements from the non-living part into the living part of the earth and back again creates material and chemical cycles, such as water, carbon and nitrogen cycles. Again, living things on the earth are interdependent, i.e. they depend on one another. There are delicate balances among them. What happens to one group affects another group. An understanding of the delicate relationships in nature makes us appreciate the need to protect our environment and conserve it, so that we will be safe, healthy and happy.

In this chapter, you will learn about conservation of energy, water and wildlife; water, carbon and nitrogen cycles; and the importance of maintaining a balance of resources in the environment.

Objectives

By the end of this chapter, you will be able to:

1. state the source of the earth's energy;
2. explain conservation of energy, water and wildlife;
3. discuss the importance of maintaining a balance of resources in the environment;
4. explain the following: water cycle, carbon cycle, and nitrogen cycle; and
5. list the importance of resources in the environment.

Energy from the sun

The earth has no energy of its own. The sun is the principal source of the energy that drives all life on earth. The earth is 108 million kilometres away from the sun. The sun gives out a large amount of energy known as **radiant energy** in all directions. This radiant energy includes visible light and heat.

Part of the energy given out by the sun reaches the earth. This energy of the sun keeps the earth warm enough to be inhabited by living things; it keeps living things warm and also provides the energy that drives all life on earth. How this happens is now described as follows:

1. Green parts of plants capture sunlight energy and use it to convert carbon dioxide and water into sugar. The process is very important in nature

because it converts the energy in sunlight into chemical energy which is stored in sugar. This sugar is used to make carbohydrates of various kinds, lipids, proteins and other body components of plants. The energy received from the sun is stored in these compounds.

2 Herbivores (animals that eat plants) eat various parts of plants in order to obtain the energy stored by the plants in their leaves, fruits, stems and other parts. This energy came initially from the sun. Herbivores use the energy in the plant materials they eat for their own life processes. They store some and lose some energy as heat.

3 Carnivores (animals that eat flesh) feed on the herbivores and in turn obtain energy from the flesh they eat. The energy in the flesh came initially from the sun. Carnivores use some of the energy obtained from the flesh they eat, store some, and lose some as heat.

4 Eventually, plants and animals die and decay.

5 As dead plants and animals decay, the chemicals in their bodies return to the earth. The mineral elements may be absorbed by plants again. As this happens, the chemicals are cycled from living things to the non-living environment and back to living things.

6 Some dead matter that was previously living, under special conditions of heat and pressure in the soil, is converted into coal or petroleum. Such dead or organic matter still contains a remnant of the energy initially received from the sun. This is why coal and petroleum products can burn and provide energy, which can be used for various purposes.

The water cycle

As the sun shines on both the land and the seas, the land is heated up faster than the seas. Hot air rises over the land. This creates a difference in air pressure between the land and the seas. A sea breeze results, blowing from the sea to the land, and carrying a lot of water vapour with it. As moisture-containing air rises on land, it cools; clouds form and condensation into water drops occurs. Other sources of water vapour which enter the clouds include:

1 water lost from the land by evaporation, and

2 water lost by plants through transpiration and excretion.

The water drops formed by condensation of water vapour in the upper part of the atmosphere fall as rain. As rain falls, a part of it soaks into the ground and infiltrates downwards to the water table. Some of it, called **run-off water**, flows along the surface

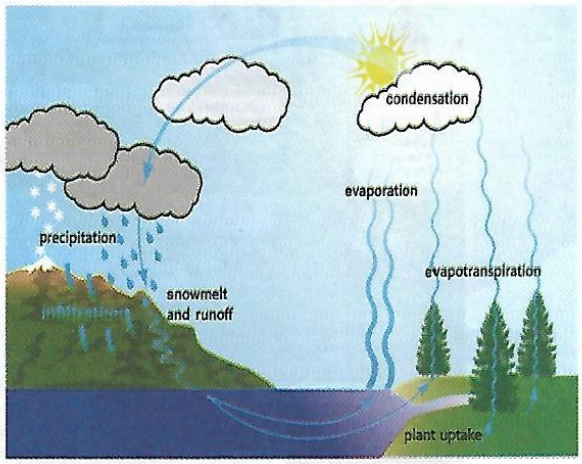


Fig. 18.1 The water cycle

of the ground into streams, rivers and soil, and eventually flows into the sea (ocean). The events just described take place all the time and constitute the water cycle.

The carbon cycle

The carbon cycle is the path along which carbon passes from living things to non-living things and back to living things in nature.

1 The atmosphere contains a reservoir of carbon dioxide, which makes up 0.03% of the air.
2 In sunlight, green parts of plants take in carbon dioxide from the atmosphere and use it to make sugar. This sugar is in turn converted to complex carbohydrates or used to make lipids, proteins and other substances in plants.
3 Animals feed on plants and take in plant materials that contain carbon compounds.
4 When animals respire (breathe), they give out carbon dioxide into the atmosphere.
5 As plants and animals decay, they give out carbon dioxide into the atmosphere.
6 When plant and animal materials burn, they give out carbon dioxide into the atmosphere.
7 Dead plant and animal materials may be compressed in the soil, under conditions of heat and pressure, to form coal or petroleum. When coal and petroleum products burn, they give carbon dioxide into the atmosphere. All these events make up the carbon cycle.

The nitrogen cycle

In nature, the element nitrogen passes from living things into the non-living environment

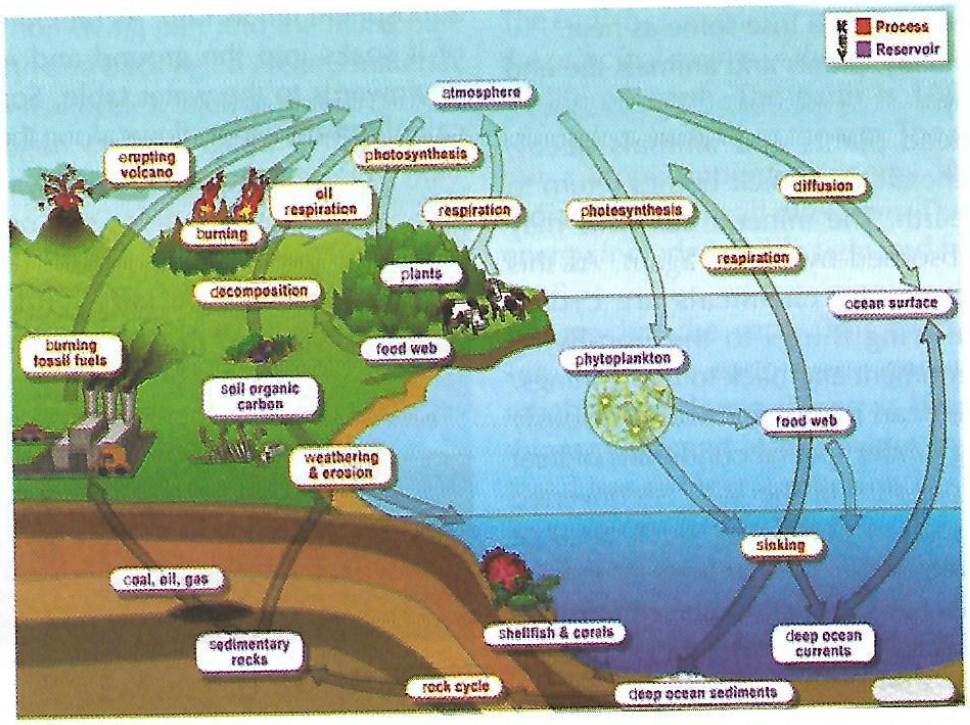


Fig.18.2 The carbon cycle

and back into living things along these paths:

1 In the atmosphere, there is a large reservoir of nitrogen, which makes up 79% of the atmosphere by volume.
2 Nitrogen-fixing bacteria in root nodules of leguminous plants convert atmospheric nitrogen into complex nitrogen compounds in the root nodules.
3 Free-living nitrogen-fixing bacteria in soil convert atmospheric nitrogen into nitrates in the soil.
4 Lightning (with electrical discharges) in the atmosphere converts atmospheric nitrogen in the air into nitrates, which are washed down by rain to the soil.
5 Dead plants and animals decay in the soil. As they decay, the proteins in the dead matter are converted into ammonia and ammonium compounds. The ammonium compounds are converted into nitrites by specific bacteria called **nitrosomonas**, and the nitrites are converted into nitrates by specific bacteria called **nitrobacter**.
6 The nitrates in the soil may be absorbed by plants again.
7 Some nitrates in the soil are converted into nitrogen by denitrifying bacteria; in other words, nitrogen returns to the atmosphere.

Conservation of energy

In nature, organisms feed on one another in an orderly way. For example, a grasshopper feeds on grass, a mouse eats a grasshopper,

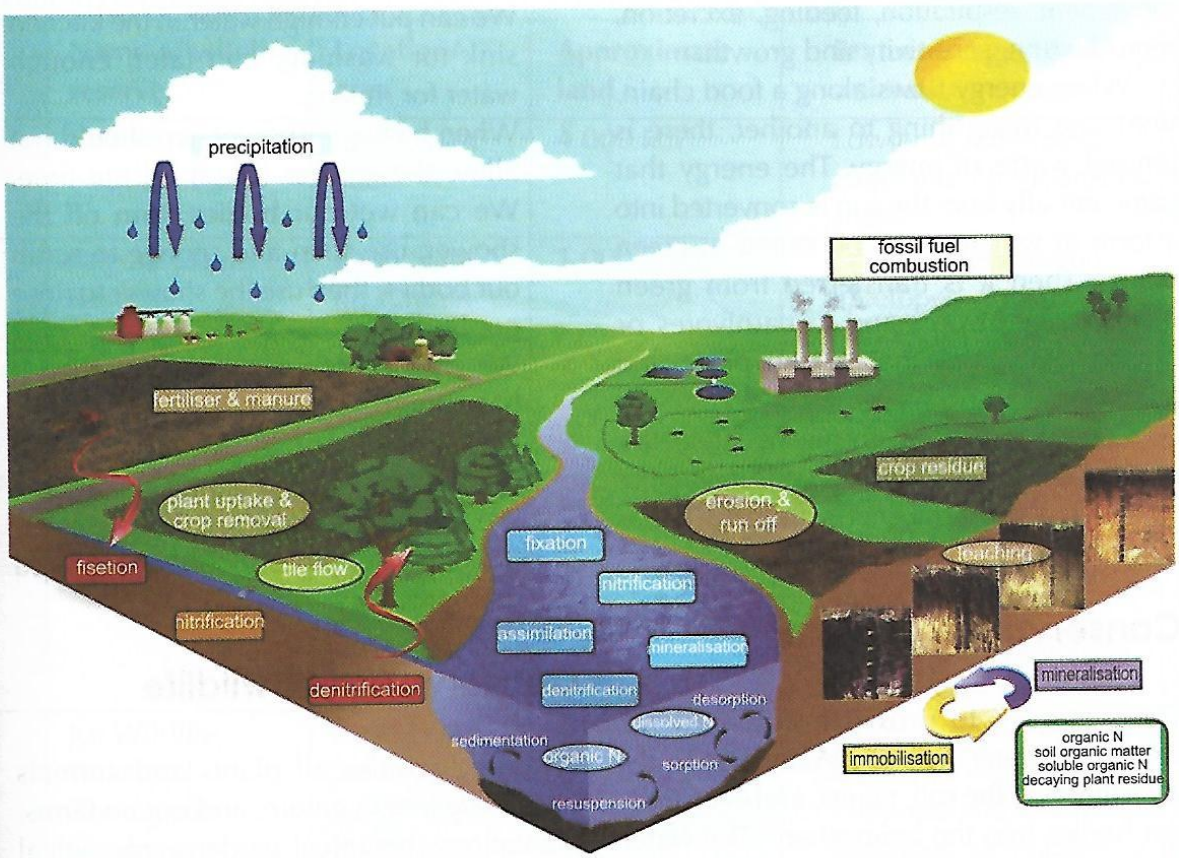


Fig. 18.3 The nitrogen cycle

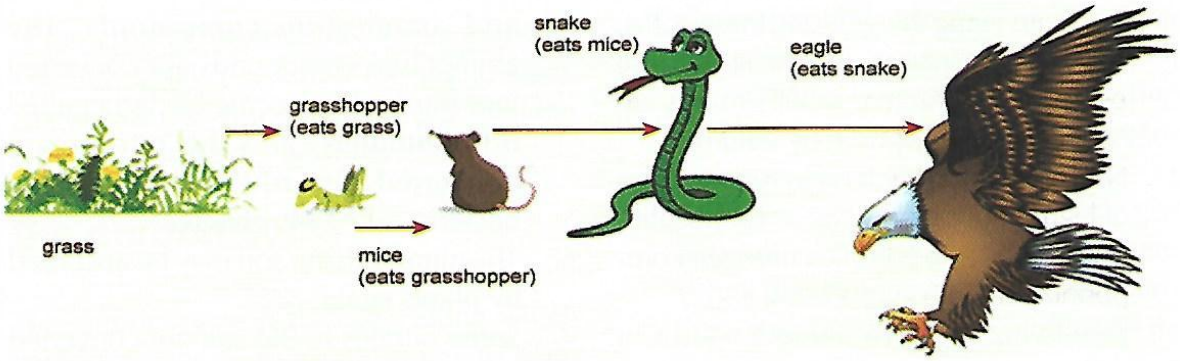


Fig. 18.4 The food chain

a snake eats a mouse, and a hawk (a carnivorous bird) eats a snake. When arranged in a line, these organisms are said to form **a food chain**.

Why does a grasshopper eat guinea grass, and why does a mouse eat a grasshopper? The sequence of eating occurs so that each organism will obtain the energy it needs for movement, respiration, feeding, excretion, reproduction, sensitivity and growth.

When energy flows along a food chain, from one living thing to another, there is limited waste of energy. The energy that came initially from the sun is converted into a form in which it can be stored in green plants. Then it is transferred from green plants to herbivores and to carnivores or omnivores (animals that eat both plants and animals).

Conservation of energy means careful use of energy. Therefore, there is conservation of energy in nature. The energy from the sun is carefully used to reduce waste.

Conservation of water

The water cycle provides a system for conserving water in nature. Water evaporates from the seas, the soil, plants, and even from our bodies into the atmosphere. The water vapour rises in the atmosphere to heights where it is cooled, then condenses and falls as rain.

By this water cycle, the same water is used over and over again. In our homes and other places, there are ways by which we can conserve water. Some examples are:

1 We can save water in washing plates by not allowing the tap to run all the time. We can put enough water in the kitchen sink for washing, and later, enough water for rinsing.
2 When having a shower, we should not allow the shower to run all the time. We can wet our bodies, turn off the shower, use soap and sponge to scrub our bodies, then use the shower to rinse our bodies.
3 We should not water gardens when it has rained.
4 We should not allow taps to run needlessly.
5 We should not wash cars needlessly.
6 Broken water pipes should be repaired promptly.

Conservation of wildlife

Wildlife includes all plants and animals which live free in nature, and not on farms, plantations, botanical gardens, zoological gardens, or near homes.

Some uses of wildlife to human beings are:

1 Wild plants shade the soil, and protect it from getting too hot.
2 *Wild plants break the force of rain drops* and prevent the rain drops from wearing away the soil.
3 The roots of wild plants help to check erosion.
4 Wild plants provide firewood.
5 Wild plants provide some edible fruits and vegetables.
6 Wild plants provide timber.
7 Wild plants provide some useful products, such as sponge, fibres and cane.
8 Wild plants provide homes and food for wild animals.
9 Some wild plants are used for producing useful medicines.
10 Wild animals provide meat for human beings.

There is active interest in wildlife conservation in all countries because:

1 when wild plants are cut down without re-planting, timber and other forest resources are lost; the soil is exposed to erosion and becomes rapidly degraded.
2 animals that previously lived in destroyed forests become endangered species and may die out altogether.

Nigeria has established several wildlife reserves shown in the table. In wildlife reserves, unauthorised shooting of animals is not permitted.

Wildlife reserves in Nigeria

	Name of wildlife reserve	Location/ area	Approximate land	Features/vegetation/ animals
1	Cross River National Park	Cross River State	4 000 km^2	Lowland; rain forest; elephants, chimpanzees, snakes
2	Falgore Game Reserve	Kano State (in Tundun Wada Local Govt Area)	1 000 km^2	Savannah vegetation; antelopes, duikers, baboons, cats, monkeys, lions, buffaloes, hyenas, porcupines, birds
3	Gashaka-Gumpi National Park	Partly in Adamawa State partly in Taraba State	6 402 km^2	Lowland; rain forest; antelopes, duikers, chimpanzees, monkeys, buffaloes, lions, leopards, hippopotami, birds, fishes
4	Jos Wildlife Parks and Zoological Gardens	4 km East of Jos city along Jos-Miaggo Road, Plateau State	8 km^2	Tropical savannah climate and vegetation; Hippopotami, ostriches, buffaloes, crocodiles, zebras, hyenas, elephants

	Name of wildlife reserve	Location/ area	Approximate land	Features/vegetation/ animals
5	Kainji Lake and National Game Park	Niger State	5 340.80 km^2	Savannah vegetation; aquatic and terrestrial habitats; hippopotami, buffaloes, terrapin, bush bucks, lions, leopards, monkeys, baboons.
6	Lekki Conservation Centre	Lagos at Km 19 along Maroko – Epe Expressway	98 hectares	Project of the Nigerian Conservation Foundation and Worldwide Fund for Nature. The complex was built and donated to the body by Chevron Oil Co.; squirrels, monkeys, chameleons, monitor lizards, crocodiles
7	Okomu National Park	Ovia South-West Local Government Area of Edo State	1 082 km^2	Forest vegetation; buffalo, elephant, chimpanzees, dwarf crocodiles, monkey, grasscutter
8	Sambisa Game Reserve	Gwaza Local Government Area, North-West Borno State	518 km^2	Savannah vegetation; antelopes, gazelles, duikers, red bucks, hyenas, porcupines, baboons
9	Samola Kyarimi Park	Maiduguri, Borno State	4.2 hectares	Wildlife sanctuary; savannah vegetation
10	Old Oyo National Park	Northern Oyo State and Southern Kwara State	2 512 km^2	Dense woodland, savannah woodland, grassland; lion, antelope, porcupine, baboon, buffalo, hyena

	Name of wildlife reserve	Location/ area	Approximate land	Features/vegetation/ animals
11	Yankari Game Reserve	Gombe State	224 km^2	Savannah vegetation; streams within the reserve; elephants, buffaloes, lions, antelopes, hippopotami, water bucks, duikers, baboons, monkeys, birds

Importance of a balance of resources in the environment

Earlier in this chapter, it was stated that the living and non-living components of the environment interact. The living things depend on the non-living environment. The living things are inter-dependent. A balance always exists between the living and non-living things, and among the living things.

The following examples serve as illustrations:.

1 If there are too many human beings living in one room, they will be uncomfortable. In this case, available space (non-living environment) is too small for the inmates.

2 If rain fails and drought occurs, lack of water (non-living factor) will reduce the growth of plants. Some herbivores which do not have enough food will die. Consequently, the population of carnivores will also be reduced by death.

3 If grass increases in quantity, initially herbivores will increase in number, and carnivores will also increase in number. In time, the herbivores will eat up the grass and some of them will die of hunger. As the herbivores reduce in number, some carnivores will also die so that a fresh balance is established between the grass and herbivores, and between herbivores and carnivores.

4 If human population increases beyond the food supply in a country, hunger will set in, and people will die and reduce the population to the level that can be supported by available food.

This is also true of a family, hence, countries advocate family planning. The living things in an environment must be in a balance with available resources.

Summary

1 The sun is the source of the energy used by living things on earth.

2 Water, carbon and nitrogen have cycles in nature.

3 Energy is conserved in nature through the food chain.

4 The water cycle conserves water in nature.

5 There is the need to conserve wildlife because of their numerous uses to human beings.

6 There is a balance between the number

of living things and the available resources in nature.

Revision questions 18

1 The source of the earth's energy is ___.
   A the sun
   B food
   C plants
   D animals
   E petroleum

2 The path along which water circulates in nature from living to non-living things, and back to living things is _____.
   A evaporation
   B the water cycle
   C precipitation
   D condensation
   E transpiration

3 Carbon dioxide is removed from the atmosphere by _____.
   A burning of firewood
   B breathing out
   C photosynthesis
   D feeding by animals
   E the sun

4 The part of the earth in which living things live is the _____.
   A monosphere
   B trobosphere
   C minosphere
   D biosphere
   E anosphere

5 The energy from the sun is _____ energy
   A kinetic
   B solar radiation
   C potential
   D pressure
   E electrical

6 Wildlife provides _____.
   A shade for the soil
   B firewood
   C edible fruits
   D vegetables
   E all of the above

7 Draw a labelled diagram of the nitrogen cycle.

8 Explain the significance of maintaining a balance of natural resources.

9 Name two (2) natural conservation centres in Nigeria.

10 Use two (2) examples in each case to show the importance of
   a) conservation of energy;
   b) conservation of water; and
   c) conservation of wildlife.

Chapter 19 Environmental conservation and safety 2 (Sanitation)

Introduction

Environmental sanitation is well known in Nigeria. Around 1985, the Federal Government of Nigeria declared the last Saturday of every month as environmental sanitation day, during which people were required to spend the time from 7 a.m. to 10 a.m. to clean the environment, including home surroundings, markets, workshops, factory premises, office premises, roadside gutters and open spaces in both urban and rural areas. This practice is still being observed in some states but the commitment of people to its implementation has varied from state to state and from one government to another.

In this chapter, various human activities that affect environmental balance will be identified. Ways in which communities and schools can dispose of refuse, the difference between biodegradable and non-biodegradable materials and the need for environmental sanitation will also be explained.

Objectives

By the end of this chapter, you will be able to:

1 identify various human activities that affect environmental balance;
2 list ways in which communities or schools can dispose of refuse;
3 distinguish between biodegradable and non-biodegradable materials; and
4 explain the need for environmental sanitation.

Human activities and environmental balance

There is a balance in nature. The plants that grow in an area are just those that can be supported by the available sunlight, rainfall, minerals and other resources in that area. Living things feed on one another along food chains. In each food chain, the herbivores are just as many as can be supported by the plants they feed on, and the carnivores are just as many as the herbivores can support.

Many human activities affect environmental balance. Specific human activities and the ways they affect environmental balance will now be described.

Farming

Farming is an important human activity. It is essential for production of food and various materials for industries. Farming affects environmental balance in the following ways:

1 Vegetation is cleared from the surface of the soil before cultivation is done.
2 Clearing of vegetation for cultivation of the soil exposes the soil to soil erosion by rain water.
3 Mechanised cultivation of the soil for crop planting promotes wind erosion of soil, and dust pollution of the atmosphere.

4 Some of the fertilisers applied to farms are washed out by surface floods into streams and rivers, thereby polluting the streams and rivers.

Commercial activities

1 Bushes are cleared in order to construct markets, leading to deforestation which affects environmental balance.
2 Markets generate much refuse.

Manufacturing

1 Vegetation is cleared in order to build manufacturing industries.
2 Each manufacturing industry produces refuse and materials that pollute the air, water or soil in the neighbouring area.
3 Industries produce noise and heat that disturb human beings or other living things in the environment.

Construction

1 Every construction project involves a certain amount of destruction of plants in site clearing.
2 Construction may soften or otherwise disturb the soil and often promotes erosion (unless special steps are taken to prevent this).
3 Construction may affect natural courses of streams and rivers.

Growth of towns

As towns expand, forests are cleared in order to build new houses.

Transportation

Transportation also affects the environment in the following ways.

1 Road transport requires roads. In order to construct roads, vegetation is cleared.
2 Motor vehicles, trains, ships and aeroplanes produce carbon dioxide which pollutes the air.

Mining

Each mining industry produces mining wastes that pollute the environment. If you visit a coal mine, iron ore mine or limestone mine, you will observe various types of mining wastes.

Household activities

Activity 19.1 Effects of household activities on the environment

Materials required

Your science notebook, biro

Procedure

1 Make a list of waste materials which are produced in your home and added to the environment in your science notebook. Compare your list with that shown below:
smoke, carbon dioxide, ash, paper, oil, water containing soap, water containing salt, plastic cans, metal cans, glass bottles, leftover food, waste parts of fruits and vegetables, yam peels, maize husks, etc.
2 How do you dispose of waste produced in your home? Write it in your science notebook.

School activities

Students write, eat and wash. Waste from these activities affect the environment. Students discard old shoes, clothes and other materials. Unless cleanliness is strictly maintained, a school compound may become littered with groundnut shells,

orange and banana peels, plastic cans and pieces of paper.

Ways in which a community or school disposes of refuse

Activity 19.2 Describing how refuse is disposed of in your community

Materials required

Your science notebook, biro

Procedure

1 In your science notebook, describe how your community disposes of refuse.
2 In your description, include the types of refuse produced, where each family throws away the refuse, and how the refuse is disposed of.

Proper disposal of refuse requires three actions: refuse collection, refuse sorting and refuse disposal.

Refuse collection

Refuse is most easily collected in dustbins in individual homes. The dustbins are carried to refuse collection centres and emptied there, either on a daily basis or when full.

Sorting of refuse

Refuse at a collecting centre should be sorted into different kinds:

1 remains of plants and animal materials;
2 plastic;
3 glass;
4 textile materials;
5 metals;
6 paper; and
7 others, e.g. rubber.

The purpose of sorting the refuse into kinds is to facilitate disposal.

Refuse disposal

Refuse disposal means getting rid of refuse. The following methods are usually adopted:

1 **Decomposable materials,** e.g. remains of plants and animals are thrown into farmlands to decay and form compost.

Fig. 19.1 A refuse heap

2 **Combustible materials** are burnt in incinerators. These materials include paper and textile materials. Plastic materials are burnt in high-temperature incinerators, with temperature of 1500°C.

3 **Metal scraps** are collected by their kinds, e.g. iron and aluminium, and where possible, sent back to factories to be used again.

4 **Glass materials** are collected, ground and used to make new glass containers.

5 **Land filling:** Materials which are not burnt or used again may be used in land fills, that is, to fill up valleys in the area.

6 **Recycling:** Recycling means using again what has been used before. In Nigeria, almost everybody is familiar with the use and reuse of bottles of drinks. In this way, the same bottles are washed after each use, and are used over and over again. This is an example of recycling. It prevents the throwing away of glass bottles all over the environment.

Another example of recycling is the recycling of paper. Newspapers which have been read, and other kinds of used paper are collected and sent back to the factory where they are reconverted into paper pulp and used to make recycled paper or toilet paper.

Recycled paper is often not as white as original paper, but it is cheaper than original paper. The recycling of paper also saves many trees that should have been cut to make original paper everytime.

Biodegradable and non-biodegradable materials

The decay of dead materials is brought about by very tiny living organisms, such as bacteria and fungi. The process of decay involves the breakdown of complex substances to simple ones.

A **biodegradable** material, such as vegetable, fruit and meat, is one which can decay, and be broken down by microorganisms that cause decay. A **non-biodegradable** material, however, is one which cannot be broken down by microorganisms. Examples of non-biodegradable materials are plastic, glass and steel.

The need for environmental sanitation

A clean environment gives pleasure to humans and promotes human health, because it does not encourage the growth of disease-causing organisms. Keeping the environment clean, therefore, keeps the human beings in that environment healthy. The harmful effects of refuse in the environment include the following

1 Refuse is unsightly, i.e. not pleasant to look at, and makes the environment untidy.

2 Refuse occupies land space, which could be used for other good purposes.

3 Refuse block roads, and may cause accidents.

4 Abandoned refrigerators may trap children who play in them, and cause their death. Scrap metal from old vehicles may inflict cuts and other injuries on people.

5 Heaps of refuse form breeding grounds for cockroaches, bacteria, rats, mosquitoes and houseflies that transmit disease germs.

6 Refuse blocks gutters, thereby obstructing the free flow of water, and

causing flooding of residential areas and possible collapse of residential buildings.

7 Burning of refuse heaps produces poisonous smoke which may be inhaled by residents in the area.

Activity 19.3 Collecting and classifying refuse

Materials required

Your science notebook, plastic bags, biro

Procedure

1 Your teacher will direct you to go to a part of your school compound where you can collect refuse.
2 Collect all kinds of refuse that you see there and put them in your plastic bag.
3 Return to your classroom.
4 In your classroom, classify the refuse into biodegradable and non-biodegradable refuse.
5 Write down in your science notebook a list of the biodegradable items, and a separate list of the non-biodegradable items.
6 At the end of this activity, put all the refuse into the dustbin.
7 Wash your hands properly.
8 Discuss your lists with your teacher.

Activity 19.4 Visiting a refuse dump site

Materials required

Your science notebook, biro

Procedure

1 Your teacher will guide you to visit a refuse dump site near your school.
2 Observe the refuse dump site closely.
3 The following questions will help you in your observation:
   a) Does the refuse dump still smell?
   b) Has a part of the refuse dump been set on fire?
   c) Do you see any rats, cockroaches, and flies on the refuse dump?
   d) Does the refuse dump block a part of a road?
   e) Find out, if possible, from people who live close by, when the refuse dump was last cleared.
4 Record all your observations in your science notebook for class discussion.

Compost

Compost is decayed plant and animal matter. It is used as manure (fertiliser) on farm crops. The importance of compost is that it makes soil that has lost its fertility, fertile again.

In a home, biodegradable refuse from the kitchen or elsewhere can be used to make compost, thereby putting this kind of refuse into good use.

Activity 19.5 Making compost

Materials required

Garden fork, spade, cutlass, water sprinkler

Procedure

1 All members of the class will work together in this class activity.
2 Your teacher will show you a suitable part of the school farm where you will make compost heaps.
3 Mark out four squares on the ground, each 1.5 m by 1.5 m, in a row, separated by 1 m space between two squares.

4 On the first day of this activity, gather as much biodegradable matter as you can, such as green leaves, flowers, overripe fruits, leftover food, and place in square *A*.

5 After two weeks, transfer the material

Fig. 19.2 A square for compost heaps

in square *A* into square *B*, and put fresh material in square *A*.

6 After another two weeks, transfer the material in square *B* into square *C*, material in square *A* into square *B*, and put fresh material in square *A*.

7 After another two weeks, transfer the material in square *C* into square *D*, material in square *B* into square *C*, material in square *A* into square *B*. Put fresh material into square *A*.

8 The material in square *D* is called compost. The whole process of turning material from square *A* to *B* to *C* to *D* is called **compost making**.

Sewage disposal

Sewage is waste water together with waste materials in the water. It includes waste water from the toilet, from the bathroom and from the kitchen. An efficient method of treating sewage is important because it helps to maintain a clean home environment and prevent the spread of diseases.

In a modern home, a water closet (WC) toilet is provided. From the water closet bowl, water flushes the faeces into the septic tank. There the faeces remains and is decomposed by microscopic living things called **bacteria**. After a long time, when the septic tank is filled, water overflows from the septic tank into the soakaway pit. From the soakaway pit, water soaks into the ground.

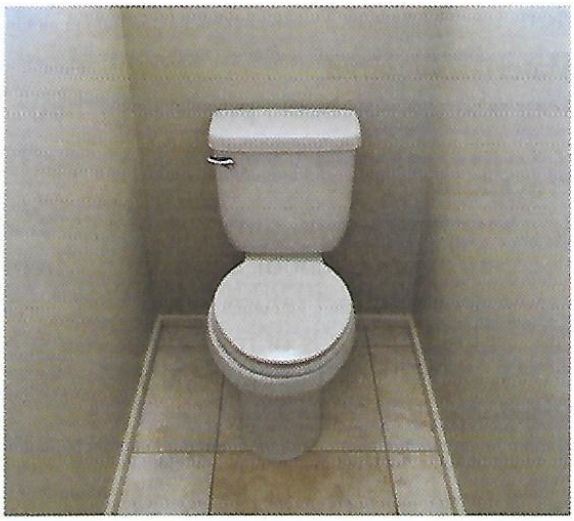


Fig. 19.3 A water closet toilet

Fig. 19.4 A soakaway

The whole system is clean and odourless. Waste water from the kitchen and bathroom is also channelled into soakaway pits. A good sewage system helps us to remain healthy by preventing the spread of disease germs.

Summary

1 There is a balance in nature. The living things are in a balance with the non-living things, and with one another.
2 Human activities which affect environmental balance include farming, commercial activities, construction, transportation, manufacturing, growth of towns and household activities.
3 Communities and schools can dispose of their refuse properly through a good system of collection, sorting and disposal.
4 Biodegradable materials are those which can be broken down by microorganisms which cause decay. Non-biodegradable materials are those which cannot be broken down.
5 Environmental sanitation promotes human health through reducing the number of disease-causing organisms.
6 Biodegradable materials may be used to make compost.
7 A good sewage system promotes good health.

Revision questions 19

1 The human activities that affect environmental balance include: _____.
   A agriculture
   B transportation
   C construction
   D growth of towns
   E all of the above
2 A community can dispose of refuse by _____.
   A leaving refuse in homes
   B collecting refuse at street corners
   C burning refuse in incinerators
   D dropping refuse in gutters
   E throwing all refuse into dustbins
3 Sorting of refuse means _____.
   A separating refuse into their various kinds
   B putting refuse into another dustbin when one is full
   C selecting the people to carry away dustbins when full
   D dumping all refuse into landfills
   E burning all refuse from time to time at collection centres
4 Describe one (1) modern way of refuse disposal in your community.
5 Give three (3) examples of biodegradable and four (4) examples of nonbiodegradable materials.
6 Explain how environmental sanitation promotes human health.
7 Describe the harmful effects of poor refuse disposal in a community.
8 List three (3) human activities that affect the environment.
9 Explain two (2) effects of human activities on the environment.
10 Discuss the importance of compost.

Theme 2

You and energy

Chapter 20 Energy

Introduction

The life of everybody, old or young, man or woman is affected by the use of energy. Everyone eats and thereby, gets energy to go about their daily activities. Science and technology have also brought about devices that make our daily activities easy for us. For example, we now have machines that wash clothes. Such appliances have to be operated, using electrical energy. The supply of electrical energy to the citizens of a country, thus becomes very important and necessary.

In this theme, you will learn many things on energy, its forms and the types of energy that can be renewed as well as those that cannot be renewed. You will also learn about forces.

In going about our daily activities, even simple ones, such as standing, sitting, and reading, we expend (use) energy. The energy expended must be replaced in order for us to be able to carry out these activities from time to time.

In this chapter, you will learn what energy means as well as its sources, forms and uses. You will also learn how energy can be transformed from one form to another.

Objectives

By the end of this chapter, you will be able to:

1. explain the meaning of energy;
2. state and describe the sources of energy;
3. name the forms of energy;
4. explain how energy is transformed from one form to another; and
5. state the uses of energy.

Meaning of energy

Energy is the ability or capacity to do work. This implies that energy must be possessed by a body to be able to do work. Vehicles like trucks are able to carry load from one place to another because they possess energy. Rainstorms use their energy to uproot big trees. Human beings are able to walk, jump, run and go to different places because they possess energy (Fig. 20.1).

We derive energy from the food we eat. The plant itself, used to cook the food, derived its energy from the sun. This is through the process of photosynthesis in which sunshine is converted to food by green plants. The food we eat is digested and converted to energy, with the aid of the oxygen we breathe in.

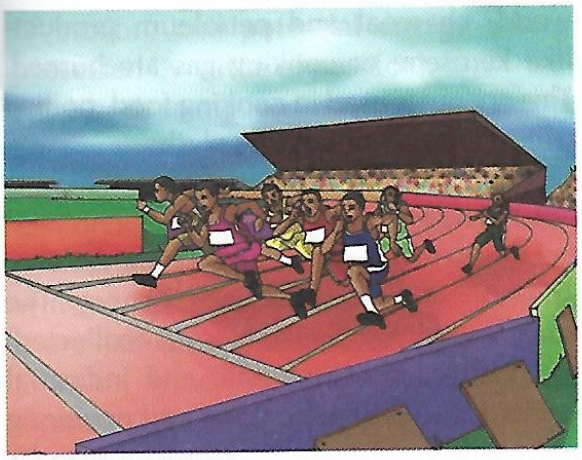


Fig. 20.1 Students running on sports tracks

Sources of energy

There are many sources of energy. Some are natural sources, that is, sources of energy that are not man-made. There are also sources of energy that are man-made. They are called artificial sources.

Natural sources

Natural sources of energy include the sun, the food we eat, coal, wind, natural gas and the water that is so abundant all around us.

The sun, seen in the sky, is responsible for the sunshine that:

1 helps to dry washed clothes.
2 makes plants to grow.
3 gives us warmth.
4 gives out light.

Food

When we eat food, its energy is released as it is broken down in the cells contained in our bodies. This energy is used in the various activities we carry out day by day.

Coal

Plants that are dead and buried under the ground over many years form coal. When coal is burnt, heat is released. The heat energy is used in cooking, baking and ironing clothes.

Wind

The movement of air around us is referred to as wind. Sometime, the movement is fast and at other times, it is slow. The wind is a source of useful energy in the production of electricity.

Natural gas

Natural gas, which occurs together with petroleum, is a useful source of energy when burned. It is used for cooking and for production of electricity.

Water

A flood of water is a great source of energy. It can cause the collapse of a weak building. The energy possessed by a flood of water is useful in turning the wheel of a hydroelectric generator to produce a large quantity of electricity. By placing a dam or a barrier across a river, a large quantity of water accumulates which can then be made to flow through an opening in the dam.

Artificial sources of energy

Artificial sources of energy include petroleum products, such as petrol, kerosene and diesel. The different components of petroleum, also known as crude oil, are obtained from refining the crude oil. A typical petroleum refinery (Fig. 20.2) works as follows: The various components of petroleum have different boiling points. The heat applied in the refinery is controlled in such a manner that each component is distilled at its boiling point. It is then collected separately.

Other artificial sources of energy are batteries and electric generators.

Fig. 20.2 A typical petroleum refinery

Forms of energy

Energy is in various forms. The forms of energy include electrical energy, heat energy, solar energy, light energy, sound energy, chemical energy, mechanical energy and nuclear energy.

Electrical energy

Electrical energy is the energy produced by electricity (flow of electric current). Many household utensils like the electric kettle, electric cooker, pressing iron, washing machine, refrigerators, radio, television and the vacuum cleaner are operated by electrical energy.

Electrical energy is supplied to various homes by the electrical distribution companies in Nigeria. The quantity of electrical energy used is measured by electric meters installed in homes and offices. Payment is then made depending on the quantity of electrical energy used.

Heat energy

Heat energy is the energy supplied when wood, charcoal and petroleum products like kerosene or cooking gas are burned. This energy is used in cooking food, boiling water, baking and ironing clothes.

Solar energy

Solar energy refers to energy from the sun. The sun is a source of abundant energy. The sun's energy can be harnessed (collected) to meet a lot of domestic and industrial needs like lighting, cooking and powering of machines. Nowadays, solar energy is used in the production of electricity.

Light energy

Light from any source has ability to do work. For example, light energy from the sun is used by plants to make their food through photosynthesis.

Sound energy

When a big bang is heard, sound is produced. The energy in the sound produced can be destructive or useful. It is capable of damaging the eardrum of human beings. On the other hand, sound produced through music could be melodious and used for different purposes.

Chemical energy

Energy from the food we eat is converted into chemical energy before we are able to use it for daily activities like walking, standing and sitting. Batteries also possess chemical energy.

Mechanical energy

Mechanical energy is the energy used in movement. It is also the energy possessed in readiness for movement by a body. Thus mechanical energy is of two types: **kinetic energy** (energy possessed by virtue

of motion) and **potential energy** (energy possessed by virtue of position).

A body in motion (moving) has a greater energy than a stationary one (not moving). Compare the damage a moving loaded truck can do when it collides with another body, to what a loaded stationary (unmoving) truck will do. Obviously the moving truck will do more damage that the stationary one.

Also, a body raised to a great height has a potential to cause danger (when it falls to the ground). An example is a coconut about to fall. Sitting under it can be dangerous because it possesses potential energy by virtue of its position.

Nuclear energy

A large quantity of energy is released when the nuclei (singular, nucleus) of some chemical elements, like uranium are made to fragment (break). This energy is used in warfare to make bombs against opposing nations.

Transformation of energy

(Law of conservation of energy)

The first law of conservation of energy states that energy can neither be created nor destroyed but can be transformed from one form to another. The various ways of transformation (conversion) of one form of energy to another form are.

1 **Conversion of electrical energy to light energy**

We are all familiar with electric bulbs. When electricity (electrical energy) is made to flow into an electric bulb by putting on the switch, the filament inside the bulb, made up of tungsten, glows and lightens the surroundings.

Activity 20.1 Demonstrating transformation of electrical energy to light energy

Materials required

Batteries, electric bulb, connecting wires, science notebook, biro

Procedure

1 Connect a piece of wire to the positive terminal (end) of the battery and another piece of wire to the negative terminal.

2 Connect the other ends of the two pieces of wire to the bulb.

3 Record your observations in your science notebook.

You must have observed that the electric bulb glows. In this way, the electrical energy is transformed or converted to light energy.

2 **Conversion of electrical energy to heat energy**

There is hardly any home that does not have an electric pressing iron. Electricity is made to flow into the pressing iron by plugging it to the mains (socket) which supplies electrical energy. The filament in the pressing iron is heated. The pressing iron is then ready to straighten rough clothes. The electric cooker follows the same process.

3 **Conversion of electrical energy to sound energy**

In some homes, an electric bell is placed at the door for visitors. The visitor presses the bell instead of knocking the door, sound energy is produced and someone comes to open the door for the visitor. In this way, electrical energy is converted to sound energy.

The electric bell works as follows: In Fig. 20.3, if the hammer hits the gong regularly, the bell will ring. By pressing the bell, current flows into the soft iron core through the coil round it. The soft iron core then becomes an electromagnet which attracts the armature to which the hammer is attached, enabling it to hit the gong.

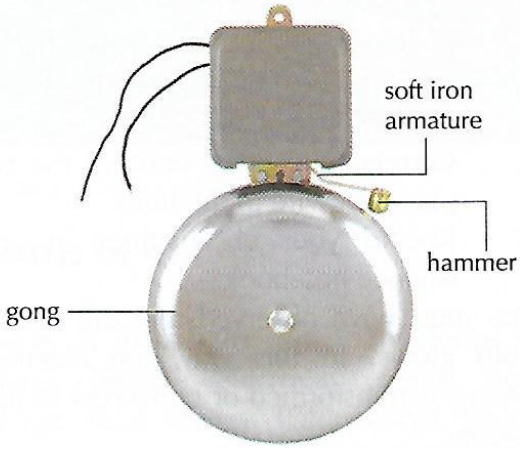


Fig. 20.3 The electric bell

4 **Conversion of electrical energy to mechanical energy**

In the pepper-grinding machine, electrical energy is converted to mechanical energy. The mechanical energy makes the coil in the machine, to which a rod is attached, to rotate. The rotation of the rod results in the grinding of the pepper.

5 **Conversion of electrical energy to magnetic energy and then to mechanical energy**

When electricity (electrical energy) flows in a coil, the coil becomes a magnet possessing magnetic energy. As a result, a motor device is introduced. A motor is capable of rotating when electric current (electricity) flows into it. The rotation is mechanical energy.

A refrigerator, an airconditioner and an electric fan are examples of electrical appliances that operate, using electric motors.

6 **Conversion of mechanical energy to electrical energy**

Mechanical energy is transformed to electrical energy in an electric generator. By kick-starting the engine of the electric generator or pulling its rope (mechanical energy), its coil is set in motion across the field of the magnet. A flow of electricity results. In this way, mechanical energy is transformed into electrical energy.

7 **Conversion of chemical energy to electrical energy**

A battery or cell consists of two electrodes and an electrolyte (a chemical solution). As positive ions or cations of the electrolyte move towards the negative electrode **(cathode)** and negative ions or anions move towards the positive electrode **(anode)**, electrical energy or electricity flows. In this way, chemical energy is transformed to electrical energy.

8 **Conversion of sound energy to electrical energy and then to sound energy**

In a telephone, sound energy in the voice of the caller or speaker is transformed into electrical energy in the mouthpiece of the phone. By the time the electrical energy gets to the earpiece of the receiver's phone, it is transformed to sound energy. In this way, the person receiving the call is able to hear the voice of the caller. Fig. 20.4 shows the mouthpiece and earpiece of a telephone.

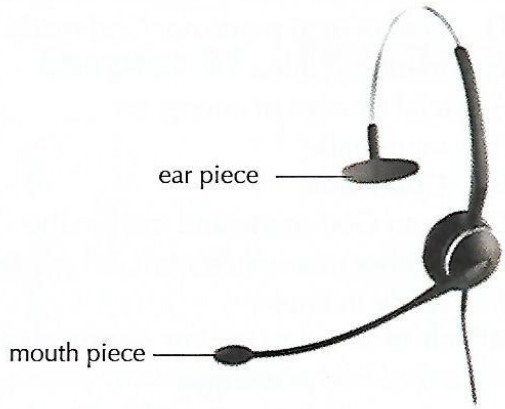


Fig. 20.4 Mouthpiece and earpiece of a telephone

9 **Conversion of mechanical energy to sound energy**

Activity 20.2 Demonstrating the conversion of mechanical energy to sound energy

Materials required

Tuning forks, iron rod, science notebook, biro

Procedure

1 Use the iron to strike the tuning fork.
2 Observe the reaction of the tuning fork.
3 Note what you hear.
4 Record your observation in your science notebook.

You would have observed that sound was produced when the tuning fork was struck by the iron rod. You would also have observed that the tuning fork vibrated when struck.

The production of sound by the vibrating tuning fork shows the conversion of mechanical energy to sound energy. The tuning fork is a metal bar bent into the shape of a U and mounted upon a stem at the base of the U.

10 **Conversion of chemical energy to heat energy**

Activity 20.3 Demonstrating the conversion of chemical energy to heat energy

Materials required

Matchbox, science notebook, biro

Procedure

1 Take one stick from the matchbox.
2 Strike it and observe what happens.
3 Record your observation in your science notebook.

You would have observed that fire was ignited when the matchstick was struck. What happened was that the chemical energy at the tip of the matchstick was converted to heat energy in the fire.

Uses of energy

You must have seen how useful energy is in your study of this chapter. Energy is used in almost every aspect of life and for virtually every activity of man. These activities include cooking; ironing; movement from place to place; cooling of air in homes, offices and cars; lighting and entertainment.

Summary

1 Energy is the ability or capacity to do work.
2 Natural sources of energy include
   a) the sun b) wood
   c) wind d) food
   e) coal f) natural gas
   g) water

3 Artificial sources of energy are
   a) petroleum products, such as petrol, kerosene, diesel.
   b) batteries (electric cells)
   c) electric generators
4 First law of conservation of energy states that energy can neither be created nor destroyed but can be transformed from one form to another.
5 Various forms of energy are:
   a) solar energy
   b) chemical energy
   c) electrical energy
   d) mechanical energy
   e) heat energy
   f) light energy
   g) magnetic energy
   h) sound energy
6 Energy is transformed from one form to another through devices, such as electric generator, electric motor, telephone, battery, electric door bell, water heater and torch
7 Energy is used for
   a) lighting b) driving
   c) grinding d) cooling
   e) ironing f) cooking
   g) running h) broadcasting

Revision questions 20

1 What is energy?
   A Ability to do work
   B Running
   C Sitting
   D Standing
   E Talking loudly
2 Natural sources of energy are_____.
   A man-made
   B not man-made
   C both God-made and man-made
   D neither man-made nor God-made.
   E made in China
3 Artificial sources of energy are _____.
   A man-made
   B God-made
   C both God-made and man-made
   D neither man-made nor God-made
   E made in England
4 Which of these is not an example of natural source of energy?
   A Sun B Wind
   C Water D Petrol
   E Coal
5 Which of these is not an example of artificial source of energy?
   A Electric generator
   B Kerosene
   C Battery
   D Coal
   E Petrol
6 Describe briefly how
   a) the sun; and
   b) the wind are sources of energy.
7 Complete this statement: Energy can neither be created nor destroyed, but can be_____.
8 Mention five (5) forms of energy.
9 Describe how chemical energy is transformed into electrical energy.
10 Describe how electrical energy is transformed into mechanical energy.
11 Explain the energy transfer involved in
   a) striking a matchstick.
   b) kicking a ball.
   c) pressing clothes with a pressing iron.
   d) kick-starting an electric generator.
   e) pressing an electric doorbell.
12 State four (4) uses of energy.

Chapter 21 Renewable and non-renewable energy

Introduction

Sometimes you find yourself in dire need of money because you had not been careful in spending the one you had. Also, you might have faced a situation in which you wanted to iron your school uniform and electrical energy was not available.

Just as money is useful, energy is also very useful, as you just learnt in Chapter 20. Some types of energy, mostly the artificial ones, are not renewable (not always available). Care must be taken so that they are not misused.

Objectives

By the end of this chapter, you will be able to:

1 explain the meaning of renewable and non-renewable energy;
2 give examples of renewable and non-renewable energy;
3 state the implications of the misuse of non-renewable energy; and
4 describe how energy generation affects quality of life.

Resources (renewable and non-renewable)

The word **renewable** means **restorable** or **replaceable**. In life, generally some things can be renewed or restored while some cannot. For example, a particular piece of cloth that you use cannot always be restored. A time comes that it fades and becomes tattered. This means that cloth is not renewable. On the other hand, the water we drink can always be recycled or restored. This means that it is renewable.

In the same way, some types of energy are renewable while other types are non-renewable. Resources, such as water, forest plants and animals from the natural environment are renewable as long as they are adequately monitored, protected and conserved. They are also referred to as **infinite resources.**

Examples of renewable energy are:

1 solar energy, because we have sunshine everyday.
2 energy from wind since wind is never exhausted.
3 water.
4 biomass, e.g. timber (when harvested sustainably, can be replenished and this replenishment can occur within time frame meaningful to humans).

Fig. 21.1 Example of solar energy, the sun also visible in the sky

A non-renewable resource is also called a **finite resource**. It is that resource that does not renew itself at a sufficient rate for sustainable economic extraction in meaningful human time frame, e.g. fossil fuels, such as coal, petroleum and natural gas.

Examples of non-renewable energy sources are:

1 petroleum products like petrol, kerosene and diesel because petroleum can be exhausted.
2 electrical energy.
3 coal.
4 natural gas.

Implications of misuse of non-renewable energy

As you observed in the last chapter, energy is very useful. Unfortunately, energy, especially non-renewable energy, can be misused. When non-renewable energy like electrical energy is wasted, it is misuse of energy. In Nigeria and many third-world countries, electric bulbs and switches are left on even when they are not being used. People hardly unplug the sockets after office hours despite the fact that the supply of electrical energy is not sufficient. Indiscriminate felling of trees from which we get wood is another misuse of energy.

When non-renewable energy is misused or wasted, it could reduce or finish. We will, therefore, not enjoy the services or benefits we enjoy from that energy again. The inadequate supply of electrical energy for example has made many welders, barbers and operators of other businesses and industries to pack up. A lot of man-hours is thus wasted and society loses. Also, the continual use of fossil fuels at the current rate is believed to increase global warming and cause more severe climate change.

Energy and society

How energy generation affects quality of life

Society has been greatly transformed (made better) through science and technology. This has brought about the use of household, office and industrial gadgets that have made life generally easier than in the days of our forefathers.

In agriculture for instance, the use of harvesters and tractors has replaced the use of hoe and cutlass on the farm. In the banking industry, Automated Teller Machines (ATM) are gradually replacing the manual dispensing of cash to customers. Electronic mail or e-mail is now used to send information all over the world through the Internet (International Network of Computers). This has almost replaced having to go to the post office to post letters.

For all these devices to function well, adequate supply of electrical energy is needed. The implication of this is that government should make it available to every citizen.

Fig. 21.2 Mechanical energy, making farming better

Summary

1 Renewable energy is energy that cannot be exhausted; energy that is always available. They can be replenished naturally and over relatively a short period of time.

2 Non-renewable energy is energy that can be exhausted; energy that may not always be available. They are available in limited supplies. This is usually due to the long time it takes for them to be replenished.

3 Examples of renewable energy are
   a) solar energy.
   b) energy from wind.
   b) water.
   c) biomass.

4 Examples of non-renewable energy are
   a) electrical energy.
   b) energy from petroleum products, coal and natural gas.

5 The implications of the misuse of non-renewable energy is that
   a) It can be exhausted (It must, therefore, not be wasted or misused).
   b) Alternative sources of energy should be found.

6 The quality of life of a country's citizens depends on the availability of energy because energy is required to operate household, office and industrial gadgets. Energy, therefore, enhances (improves) our quality of life.

Revision questions 21

1 Which of these words does not mean the same thing as the word renewable?
   A Inexhaustible
   B Restorable
   C Consumable
   D Replaceable

2 Which of these is not an example of renewable energy?
   A Wind
   B Sunshine
   C Petrol
   D Water

3 Which of these is not an example of non-renewable energy?
   A Wind
   B Kerosene
   C Petrol
   D Wood

4 One effect of misuse of non-renewable energy is that it will _____ one day.

5 State three (3) reasons for careful use of non-renewable energy sources like coal and petroleum products.

6 Mention three (3) types of trade that cannot operate without electrical energy.

7 State three (3) ways through which lack of energy supply affects societal development.

Chapter 22 Forces

Introduction

If you have ever pulled a door open or pushed someone, you have applied a force. At the entrance to some offices or organisations, you find pasted on the door words like, **pull** or **push**. In either case, you are expected to apply some force to gain entrance.

Objectives

By the end of this chapter, you will be able to:

1 explain the meaning of force;
2 identify contact and non-contact forces;
3 differentiate between magnetic and gravitational forces;
4 measure and calculate gravitational force (GF) and gravitational acceleration;
5 describe how to set up a balanced force; and
6 explain the meaning of friction, its uses, advantages and disadvantages.

Forces

A force is something that either causes the movement of an object or stops the movement of an object. Force also can change the direction or shape of an object.

Different types of force include:

1 Contact forces
2 Non-contact forces
3 Magnetic forces
4 Electric forces
5 Gravitational forces

Contact forces are forces in which the application of force has direct contact with the object. A vivid example is that of push or pull on a body.

Non-contact forces exercise a pull on a body without direct contact. Such forces are referred to as **force fields**. This is because an object or a body in the field (neighbourhood) of such a force experiences a pull or push. Gravitational force, electrical force and magnetic force are examples of force fields.

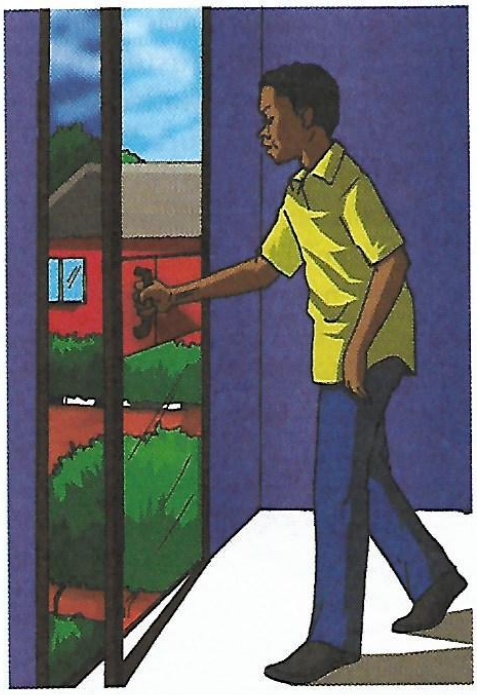


Fig. 22.1 The force of pull

Electrical force

Activity 22.1 Demonstrating electrical force on a piece of paper

Materials required

Tiny pieces of paper, a comb, science notebook, biro

Procedure

1 Place the pieces of paper on your desk.
2 Comb your hair when it is dry or use biro to rub your hair.
3 Bring the comb or biro near the pieces of paper.
4 Record your observation in your science notebook.

You would have observed that the pieces of paper are attracted to the comb. This is because the electrically charged comb exercises a pull on the pieces of paper. The electrically charged comb possesses electrical force.

Magnetic force

Most likely we have all played with magnets at one point of our lives. Magnets are known to have a pull on substances made of iron.

Activity 22.2 Demonstrating magnetic force

Materials required

A magnet, iron filings, a cardboard or paper, science notebook, biro

Procedure

1 Spread the iron filings on the cardboard or paper.
2 Place the cardboard or paper on your desk.
3 Put the magnet under your desk, close to the top of your desk.
4 Record your observation in your science notebook.

You must have observed that the magnet, though placed under your desk, has a pull on the iron filings. This is magnetic force in action.

Gravitational force

The earth also exerts a pull on bodies towards the centre of the earth. This pull or force is **gravitational**. As a result of gravitational force, a body thrown up falls back to the ground. The earth's gravitational force, GF, is the product of the mass, m, of a body and the acceleration of the gravitational force, g. i.e.

$$GF = mg$$

Note that gravitational force is equal to the weight of a body. Thus, the weight of a body is the product of the body's mass and gravitational acceleration. The mass of a body is defined as the quantity of matter it possesses.

Fig 22.2 A spring balance

Difference between mass and weight

Mass		Weight
1	Mass is the quantity of matter or material in a body.	Weight is the force with which a body Is attracted to the centre of the earth.
2	The mass of a body is usually constant.	Weight varies across the surface of the earth.
3	Mass is measured in kilogrammes (kg).	Weight is measured in Newtons (N).
4	The instrument used to measure the mass of a body is **beam** or **chemical balance**.	The instrument used to measure the weight of a body is the **spring balance**.

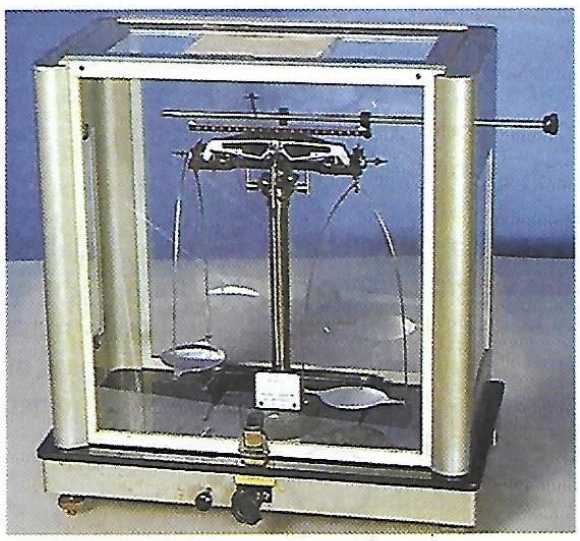


Fig. 22. 3 A chemical balance

Calculation of gravitational force

Example

Calculate the gravitational force of a man whose mass is 150 kg given that gravitational acceleration = 10 ms^{-2}

$$GF = 150 \text{ kg} \times 10 \text{ ms}^{-2} = 1\,500 \text{ N}$$

The unit of force is Newton, denoted by N. A body of mass 1 kg moving at an acceleration of 1 ms^{-2} has a force of 1N.

Balanced and unbalanced forces

Activity 22.3 Demonstrating balance and unbalanced forces

Materials required

Metre rule, weights, thread, pivot, science notebook, biro

Procedure

1. Balance the metre rule on the pivot by making sure the pivot is exactly under the 50 cm mark (i.e. middle point).
2. Tie weights of 10 g at 20 cm and 80 cm marks.
3. Note your observations.
4. Tie the same weights at 40 cm and 80 cm marks.

5 Observe carefully what happens.
6 Tie weights of masses 10 g and 20 g at 20 cm and 80 cm marks respectively.
7 Record your observations in your science notebook.

You would have observed that when equal weights were tied to 20 cm and 80 cm marks, each weight placed 30 cm away from the pivot, the metre rule was balanced. This is because equal forces were acting on the metre rule. Remember that *weight* equals *force*.

However, when the equal weights were tied at 40 cm and 80 cm marks i.e. 10 cm and 30 cm away from the pivot, the rule was not balanced and so it moved. This is because the product of the weight and distance to pivot were not equal in both cases.

Also when unequal weights were tied, the metre rule fell, showing that it was not balanced. We can say *equal forces* are *balanced forces*. When equal forces act on an object, they do not cause motion. Unequal (unbalanced) forces cause

1 motion.
2 change in speed of motion.
3 change in direction of motion.

Friction

Have you ever walked on a slippery place, e.g. bathroom? How easy was it? Compare walking on an oily tarred road on a wet day with that of a dry tarred road. It is easier to walk on the latter. The reason is that motion is opposed on the dry tarred road much more than on the oily slippery road. This means friction is experienced more on the dry tarred road than on the oily road. Thus the greatest advantage of friction is that by opposing motion, it aids walking, running or movement generally.

Advantages of friction

1 Friction helps in walking upright without slipping.
2 Friction helps us to climb up a ladder without falling.
3 It helps us to grind our pepper, using grinding stones and grinding machines.
4 It helps us to sharpen our knives and cutlasses.
5 It helps us to strike our matchsticks against our matchbox to produce light.
6 It helps us to write with our pen in our hands, i.e. it enables us to hold our pen perfectly.
7 It helps the ladder to stand vertically against the wall without slipping.
8 It helps to stop a moving body.
9 It helps to prevent vehicles from skidding off the road.
10 It is used to produce charges.
11 It makes a nail to hold two surfaces of wood together.

Disadvantages of friction

1 Friction causes wear and tear of moving parts in machines.
2 To overcome wear and tear, lubricants have to be used, leading to extra cost.
3 Moving machines have to do more work to overcome friction, leading to consumption of more fuel.
4 It opposes motion.
5 It wastes useful energy.

How to reduce friction

1 By lubrication.
2 By streamlining, i.e by re-shaping the body like that of a fish or an aeroplane.

3 By smoothening the surfaces concerned.
4 By polishing.
5 By using ball bearings.

Summary

1 A force is something that
   a) makes a body to move or that stops the movement of the body.
   b) changes the direction of a moving body.
   c) changes the shape of a body.
2 The different types of forces are contact and non-contact forces.
3 Examples of contact forces are pull and push.
4 Non-contact forces are also known as force fields.
5 Examples of non-contact forces or force fields are electrical force, magnetic force and gravitational force.
6 The gravitational force, *GF*, is the product of the mass, *m*, of a body and the acceleration due to gravity, *g*, of the gravitational force.
7 The gravitational force, *GF*, is equal to the weight of a body: $GF = mg$.
8 Friction is a force that opposes motion.
9 The major advantage of friction is that it prevents us from slipping while in motion. It, therefore, aids quick movement.
10 Friction causes wear and tear.
11 It makes machines do extra work.
12 We can use lubricants to overcome friction but at extra cost.

Revision questions 22

1 Which of these is not correct? A force _____.
   A causes movement of a body.
   B changes direction of a body.
   C changes the shape of a body.
   D is the ability to work.
2 Which of these is not an example of non-contact forces?
   A Light force
   B Gravitational force
   C Electrical force
   D Magnetic force
3 Which of these statements is correct?
   A Balanced forces are unequal forces.
   B Unbalanced forces are equal forces.
   C Balanced forces are equal forces.
   D Balanced forces cause the motion of a body.
4 Two types of forces are _____ and _____.
5 Two types of contact forces are _____ and _____.
6 Non-contact forces are also known as _____.
7 What is the difference between the mass of a body and its weight?
8 Whose gravitational force is greater: A man whose mass is 100 kg or a man whose mass is 150 kg?
9 Define friction.
10 Mention a major advantage of friction.
11 Mention three (3) disadvantages of friction.

Theme 3

Science and development

Chapter 23 Gravitation and space

Introduction

Only about 30 years ago in Nigeria, telephone communication was done only indoors, using landlines. The telephones were installed inside the house and calls were picked only when people were available in the house or office. Also, only major cities and towns had access to telephone network. Nowadays, telephone communication could be done anywhere, using mobile lines. People pick their calls from anywhere, even from the remote corners of the country.

Again in the past people used to spend very many hours in the bank trying to cash their money or do other banking transactions. All that has changed now. People can now draw their money directly within minutes any time of the day and any day of the week from ATMs (Automated Teller Machines) placed outside the banking halls and other public places.

The introduction of mobile phones or GSM (Global System of Mobile Telecommunications) and Internet services has brought about ease in communication and greater relationship among people, communities and nations with greater understanding. The use of telephone, facebook, twitter, television, videos, photographs, email, chatting and text messages, among others, appears to break distances and remove borders or boundaries such that people are now said to operate in a global village.

Scientific knowledge helps in the development of new ideas and products that affect people and nations. Science can be good or bad. Science has very many positive and negative effects on humanity. The way scientific knowledge is used can lead to development or destruction of communities. Science has led to the discovery of the causes of, and cure for, many diseases. Science has led to the discovery of better quality foods, better manufacturing processes, better communication and many other new things that make life more interesting and enjoyable.

On the negative note, science has given rise to great pollution, and the production of biological, chemical and nuclear weapons used for mass destruction of lives and properties during wars.

This theme discusses the effects of science on development. In this chapter, you will learn about gravitation and weightlessness, their effects on objects and their applications to scientific discoveries; the earth in space and components of the solar system; space travel and satellite and their uses, especially in our community.

Objectives

By the end of this chapter, you will be able to:

1 explain the terms gravitation and weightlessness;
2 state the effects of gravitation and weightlessness on objects;
3 explain the terms satellite and space travel;
4 identify the uses of satellite in your community;
5 identify the components of the solar system;
6 explain the terms earth in space, and rotation and revolution of the earth and moon respectively;
7 identify the seasons of the year; and
8 list the benefits of space travel.

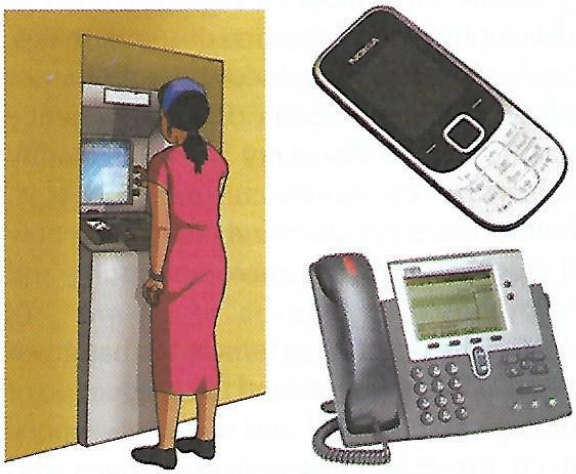


Fig. 23.1 Some applications of scientific knowledge

Gravitation and weightlessness

Gravitation

In Chapter 22, you learnt about forces. Gravitation is a type of force. It is the force of attraction between any two objects. It is natural. If an object is not supported at a height, it falls to the ground. The force of attraction can be a push or a pull. Gravitation can best be defined as a natural phenomenon by which physical bodies attract each other.

Activity 23.1 Investigating gravitation

Materials

Pieces of objects of different sizes (ball, book, pen, stone)

Procedure

1 Your teacher will organise your class into groups of five students each.
2 Pick an object.
3 Hold it up, and allow it drop from a height.
4 Record what happened.

The investigation of gravitation started centuries ago by a young English physicist and mathematician called Sir Isaac Newton. Born on 25 December 1642, Isaac Newton was brilliant, curious, and a deep thinker who always wanted to know more. He was widely recognised as one of the most influential scientists of all time and a key figure in the scientific revolution.

Fig. 23.2 Sir Isaac Newton (1642 - 1727)

It is a popular story in science discoveries that Isaac Newton, while in his garden, saw an apple fall from its tree to the ground. What he saw immediately made him think deeply. He wondered why fruits always fall straight to the ground. Why do they not veer off (shift) to the right or left? His earlier law of motion states that anything begins moving from a starting point A to B and undergoes acceleration C to D (and where there is acceleration, there must be a force) as shown in Fig. 23.3. The apple started from the tree and landed on the earth (ground) which made Newton reason that there must be a force of attraction between the apple and the earth.

He reasoned further that even if the tree was higher up in the air, the apple would still feel this force of attraction with the earth and fall. In fact, he thought the attraction should carry on way up into the sky where we have the moon and other planets. The question then came up in his mind: if everything around the earth should feel this force of attraction, why did the moon not fall and crash into the earth the same way the apple did? Newton concluded that the moon felt the same effect and that the moon was indeed falling towards the earth, but there was a good reason why it did not crash down.

Newton used experiments to explain this reason. If you throw an object horizontally from a height, the object will first fly in that horizontal direction before falling down to the earth. It falls when the flying force is reduced. This is what happens with the moon. The moon moves fast enough all the time so that the earth never catches it and cannot attract it downwards. This observation brought up the space age science. Newton's law and observations on gravitational force helped engineers to work out or calculate how much energy is needed to break the gravitational bounds of the earth. It was used to map the pathway of every astronaut (space traveller) and the orbit (path) of every satellite which serves for communication, earth observation, and research around the earth or planet.

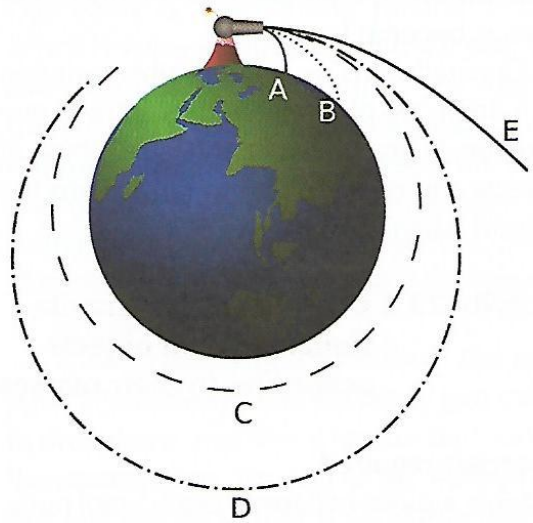


Fig. 23.3 Newton's orbital image

Isaac Newton's encounter with the falling apple ended up helping to send rockets into space. He explained the workings of the universe through mathematics. His principles are universally accepted. Objects fall to the ground if not supported because the earth exerts an attraction on them. This force of attraction to the earth is called **gravitational attraction** or **pull**. It is not only the earth that exerts gravitational attraction. The gravitational pull of the earth is called earth's gravitational pull.

As you learnt in Chapter 12, matter is made up of small particles. Every particle in matter has gravitational attraction for every other particle of the matter. The gravitational pull or force between two objects increases as the two objects approach each other. The

gravitational pull depends on the masses of both objects and the distance between them. As you sit in the classroom, you are gravitationally attracted to your deskmate, to your seat and even to your books on the desk. All objects attract according to their mass (weight). Most forces are too minimal to be noticed. Gravitational forces get more visible (clearly seen) as the masses of objects become large.

Gravitation is a natural phenomenon by which all physical bodies attract one another. It gives weight to these physical objects and causes them to fall toward the ground when dropped.

Activity 23.2 Comparing the gravitational pulls on objects according to their masses

Materials required

A stone, a piece of paper, cotton wool pods, a table, your science notebook, biro

Procedure

1 Stand on a table to create height.
2 Hold a piece of fairly large stone on one hand and a piece of paper on the other hand.
3 Drop both objects at the same time from the same height.
4 Observe the fall of the objects to the ground.
5 Record your observations in your science notebook
6 a) Did the two objects hit the ground at the same time?
   b) Write your answer and explanation(s) of why one hit the ground before the other.

The earth has a great gravitational pull because it has a great mass (size). At any point on the earth's surface, the gravitational pull is directed towards the centre of the earth. The nearer an object is to the centre of the earth, the greater the gravitational pull of the earth on the object.

Activity 23.3 Finding the centre of gravity of objects

Materials

Spring balance, different weights, your science notebook, biro

Procedure

1 Your teacher will organise you into groups of three students each.
2 Hang different weights on a spring balance one after the other.
3 Read the pointers of the spring balance.
4 Record your readings in your science notebook.

The extent to which the pointer moves downwards is the measurement of the earth's gravitational pull on the object. This is the same thing as the weight of the object. Recall that you learnt in Chapter 22 that the earth's gravitational pull on an object is the weight of that object.

Gravitational force is the only force acting on all particles with mass. It is always attractive and never repulsive. It cannot be absorbed, transformed or shielded against.

Effects of gravitational pull

1 Gravitational pull affects the weight of an object.
2 Gravitational pull affects the stability of human beings on the earth's surface such that human beings can stand well

rooted on the earth no matter their positions.

3 Gravitational pull keeps the planets of the solar system in their positions because all the planets exert pull on one another.

4 Gravitational pull enables the moon to stay revolving round the earth without veering off from the earth.

5 Gravitational pull is responsible for the formation of tides.

Weightlessness

Weightlessness: means having little or no weight. It is like floating, the feeling you get when a roller coaster suddenly goes down.

Fig. 23.4 Weightlessness in space

The force of attraction of one object to another depends on two factors:

1 The masses of both objects.

2 The distance between the objects.

Imagine an object of a certain mass located on the earth. The pull of attraction of that object to the earth will be quite high and so its weight appears highest when the object is on earth. As this same object moves away from the earth into space, the pull of attraction progressively reduces and the object may not have the same weight while in space. Here, the object experiences weightlessness.

In another space, objects and people do not have weight because the gravitational pull of the earth is not acting there. This is the same experience astronauts have during space travel. The knowledge of weightlessness outside the earth enables scientists to prepare for space travel.

The earth in space

The earth is one of the natural bodies which revolve in space around the sun. The earth, formed about 4.5 billion years ago is spherical in shape, and that is why, starting from any point on the surface of the earth and travelling in a straight line, one will eventually come back to the starting point. The earth has large mass and a diameter of 12 700 kilometres.

Three parts can be identified: the solid part called **lithosphere,** the liquid part called **hydrosphere** and the gaseous part called the **atmosphere**. The top of the lithosphere is a layer of rocks and is called the **earth's crust**. Below the earth's crust is the **mantle** which contains denser rock. About 71% of the earth's surface is covered by water (the lithosphere). The atmosphere is a blanket of gases around the earth.

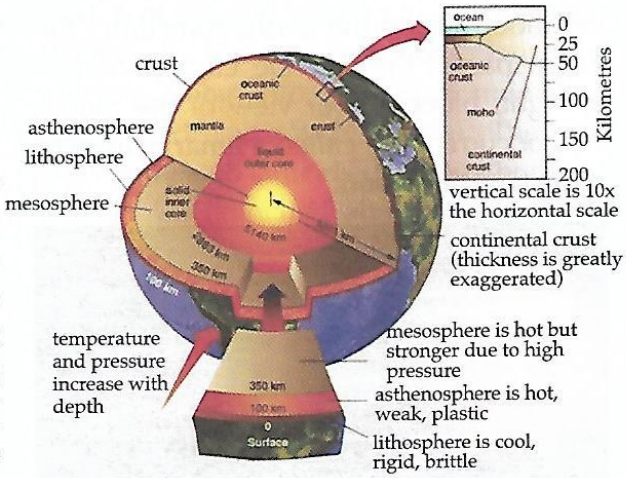


Fig. 23.5 The parts of the earth

Eclipses

The earth moves round the sun once in a year so that different parts of the earth face the sun at different times of the year. The moon moves round the earth once in about 30 days.

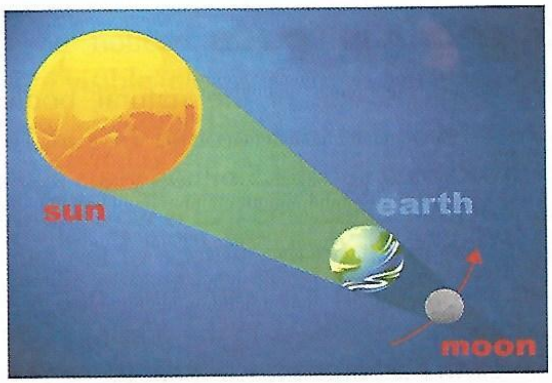


Fig. 23.6 (a) The sun, earth and moon

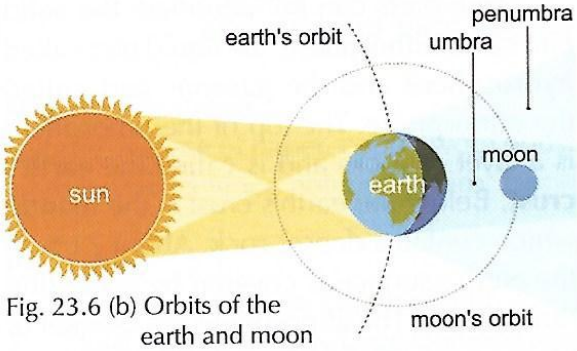


Fig. 23.6 (b) Orbits of the earth and moon

As the earth moves round the sun, and the moon round the earth, sometime, the moon passes through the earth's shadow at night, blocking our view of the moon. This occurrence is called a **lunar eclipse** or **eclipse of the moon**.

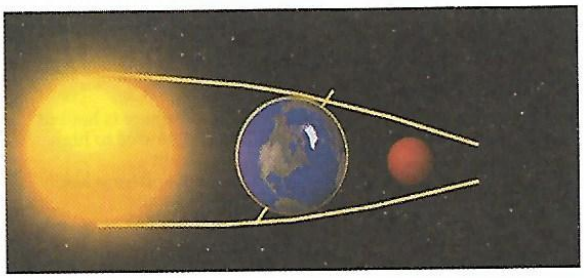


Fig. 23.7 Lunar eclipse

The moon can even come between the sun and the earth during the day, blocking our view of the sun. This occurrence is called **solar eclipse** or **eclipse of the sun**. The occurrence of eclipse is a consequence of the orbits of the earth and the moon with respect to the sun. Eclipses are predictable.

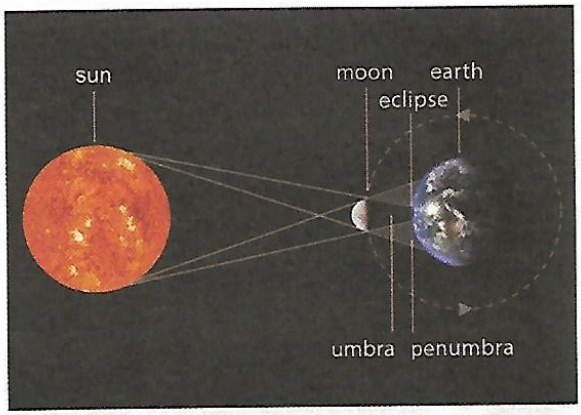


Fig. 23.8 Solar eclipse

From the earth, the sun and the moon appear as objects of the same size up in the sky. This is not so. The fact is that the sun is much larger than the moon and much farther away from the earth than the moon. So when a solar or lunar eclipse occurs, it is possible for one object to completely block the other object from view. This is called a **total eclipse**. It is more common that only a part of the object is blocked and this is called a **partial eclipse**.

Total eclipse is rare but when it occurs, it is very special and can last for about an hour. At any single location on earth, a total eclipse may occur once in about 300 years. Lunar eclipse is more common than solar eclipse.

Day and night

As the earth moves round the sun, it also rotates about its own axis once in 24 hours.

The shape of the earth is spherical; so

as it rotates on the axis, the parts facing the sun experiences bright light. This part is said to be in **daytime**. The part outside this daylight experiences darkness and is said to be in **nighttime**. The rotation of the earth about its own axis causes the day and night in different parts of the earth.

Seasons of the year

The movement of the earth round the sun causes the seasons of the year. The part of the earth directly opposite the sun experiences summer or dry season, while the side outside the heat of the sun experiences spring or rainy season.

Space travels and exploration

Beyond the sun, stars and planets, there is a space which is called outer space. The sun and all planets with their moons remain suspended in space, with each keeping its position because of their gravitational pull on one another.

Throughout human history, space has remained a mystery and a wonder. Scientists have been working towards new discoveries in space and what lies in space and the secrets of the universe.

Nature of the outer space

1 There is no gravitational pull in the outer space and objects have experienced weightlessness.
2 Light from the sun passes through space.
3 Outer space is large, empty and quiet as sound does not pass through.

Space travel means going to the moon or space outside the earth. It may also mean orbiting in a special spacecraft called **spaceship**. It is space exploration.

Interest in space travel or exploration started in the 1950s when American and Russian governments announced their plans to launch satellite into space. This announcement sparked the push for innovations and advances with increased funding for research and education. The result has been invention of many new and beneficial technology that has changed the world.

Some countries have had successful launch of satellites. They are Russia, US, France, China, Uk, India, Israel, Iran and North Korea.

The events of space exploration

The first major event is the launching of **Sputnik** 1 by Russia on 4 October 1957. Sputnik 1 was the world's first artificial satellite to orbit the earth. It orbited at a speed of 29 000 kilometres per hour and completed each orbit in 96.2 minutes. *Sputnik* 1 transmitted radio signals back to the earth during its orbit. It travelled about 70 million kilometres before it decayed and burnt while trying to re-enter the earth on 4 January 1958.

Sputnik 1 was quickly followed by the launch of *Sputnik* 2 on 3 November 1957. *Sputnik* 2, for the first time, launched a living thing into orbit, (an animal (a dog called Laika was inside). The dog got overheated and died within hours of takeoff. US launched another satellite on 31 January 1958.

The next major event in space exploration history was the launching of *Vistok* 1 manned by human beings, by Russia on 12 April 1961. A 27-year old Russian called Yuri A. Gagarin manned the *Vistok* 1 spacecraft which orbited the earth once. The flight lasted for 1 hour, 48 minutes. It

travelled 320 kilometres above the earth (in outer space). Gagarin made reports back to the ground station throughout the flight. After completing the orbit, *Vistok* 1 was set to re-enter the atmosphere (the earth) but its speed was not safe for landing. When it was noticed that its speed was not safe for landing, Gagarin was ejected (removed) from the spacecraft and he landed with a parachute from about 7 kilometres above the ground. *Vistok* 1 also landed about 280 kilometres away from the intended landing site. Gagarin was the first man to orbit the earth.

Russia again launched *Vistok* 2 on 18 March 1965 manned by Paul Belyayev and Alexey Leonov. While the spacecraft orbited (moved around) in space, Alexey Leonov exited (got out) and walked in space for 12 minutes, 9 seconds. Leonov wore a space suit and exited through an inflated airlock. He was successful in his space walk but the pressure made his suit too stiff to re-enter until he was able to recover. There were problems with resealing the airlock and some other delays, but Leonov succeeded as the first man to walk in space.

The next and the most famous event was the launching of **Apollo II** by the US that landed the first man on the moon. *Apollo* II had on board three Americans: Neil Armstrong, Buzz Aldrin and Michael Collins. *Apollo* II was launched on 16 July 1969 from Florida. It landed on the moon on 20 July 1969. Neil Armstrong stepped out onto the surface of the moon on 21 July 1969. This stepping out was described as 'one small step for man but one giant step for mankind'.

Activity 23.4 Man on the moon

Materials

Your science notebook, biro

Procedure

1. Discuss in your group, why this stepping out into the moon was described as 'one small step for man and one giant step for mankind'.
2. Imagine yourself landing on the moon. What will be your comment on the experience?
3. Write your answers in your science notebook.

Neil Armstrong of America was, therefore, the first man to step on the surface of the moon. He was followed shortly after by Buzz Aldrin. Michael Collins remained in the spacecraft, on command, for the duration of the flight. *Apollo* II stayed in the moon for 21 hours. Armstrong and Aldrin stayed outside the spacecraft for about 2.5 hours. They collected specimens from the moon for research. They also left behind a US national flag and a bag of things from earth, including a golden olive branch as a symbol of peace. *Apollo* II returned to the earth and landed on 24 July 1969 in the Pacific ocean. *Apollo* II was a landmark and the most amazing space exploration in history. It effectively carried peace even to the moon.

In 1975, US and Russia had a joint flight called *Apollo–Soyuz* Test Project. The two spacecrafts, *Apollo* of US and *Soyuz* of Russia, were launched together on 15 July 1975. They docked together on 17 July 1975. They separated in space. *Soyuz* returned on 21 July 1975 while *Apollo* returned on 24 July 1975.

On 25 April 1990, US launched a hubble space telescope equipped with radio and camera. It was the first space equipment to be repaired in space.

There was also the 'disintegrated space shuttle' of Columbia – US that took about 27 trips to space before it was destroyed on its last trip on 1 February 2003.

Once the orbit of the earth and moon had been achieved, the next was Mars. The first attempt was in 1971, using *Mars – Rovers* involving Russia, US, UK and India. Mars *Pathfinder* was launched in July 1997. Another one by UK called *Spirit* was launched in 2003 and it lost contact only in 2010. Another Rover called *Opportunity* was launched in 2004 and has been there to date. *Curiosity* was launched on 26 November 2011 and it landed on Mars on 16 August 2012. India launched *Mangalyaan* to orbit Mars on 5 November 2013. It was scheduled to reach the Mars orbit on 24 September 2014. It reached its halfway point on 11 April 2014.

One of the most exciting efforts in space exploration is private space travels. Space *X* of California is working towards colonising Mars with a focus on lowering the cost for making space trips and making it affordable to private parties.

Purpose of space travel

Technological advances have been made in the course of space travels particularly in the fields of radio, television and telephone communications. The shape of the earth is known. Its temperature and radiation can now be predicted.

Problems of space travel

The following problems need to be solved to improve space travel.

1 There is the need to overcome the force of gravity to enable the spacecraft to escape the earth's surface.
2 Basic needs of life are absent in space. So, these must be provided enough to last the period of each flight.
3 Loss of weight (weightlessness) in space needs special equipment, and training is needed for astronauts (or space travellers).
4 There should be clear understanding of complex computations to get accurate measurements.

Dangers of space travel

1 It is very risky. An example is the explosion of rockets at different stages.
2 It is very costly. Equipment fails and this may cause delay or destruction of whole project (purpose).

Benefits of space travel

Space travel technology has helped in the provision or improvement of the following:

1 Computers.
2 Data about the earth.
3 Telegraphic equipment.
4 Telecommunications.
5 Remote control.
6 Rocket.

Satellites

The sun and all the bodies that orbit (move) around it, make up the **solar system**. The bodies that orbit around the sun are called **planets**. There are nine planets in the solar system. The planets include Mercury, which is the nearest planet to the sun. It is followed by Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto, the farthest away from the sun. The first four planets nearest to the sun are referred to as the **inner planets**. The other five are the **outer planets.**

Table 23.1 The solar system (planets and moons)

Order of nearness to the sun	1st	2nd	3rd	4th	5th	6th	7th	8th	9th
Planet	Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus	Neptune	Pluto
Number of moons	0	0	1	2	12	9	5	2	0

The earth is the only planet in the solar system that supports living things.

Another body in the solar system which orbits round a planet is the moon. Moon is described as a natural satellite. A planet may have no moon while others may have one or more moons. The planet earth has only one moon. Table 23.1 shows the planets and the number of moons in the solar system.

The moons that orbit the planets in the solar system are the natural satellites. Scientists have made **artificial satellites** which are launched to orbit the planets.

These artificial satellites launched into the planets by different countries of the world have different sizes, functions, heights from earth; and shapes, speeds and angles of inclination. When a satellite is orbiting the earth at the same speed that the earth is orbiting (round) the sun, the satellite will appear to be stationary to an observer on earth. Communication satellites are of this kind. They enable telephone or radio signals to be sent to the satellite for easier transmission over a large area of the earth.

In 2003, Nigeria followed nine other countries of the world to launch a satellite called *SAT* 1.

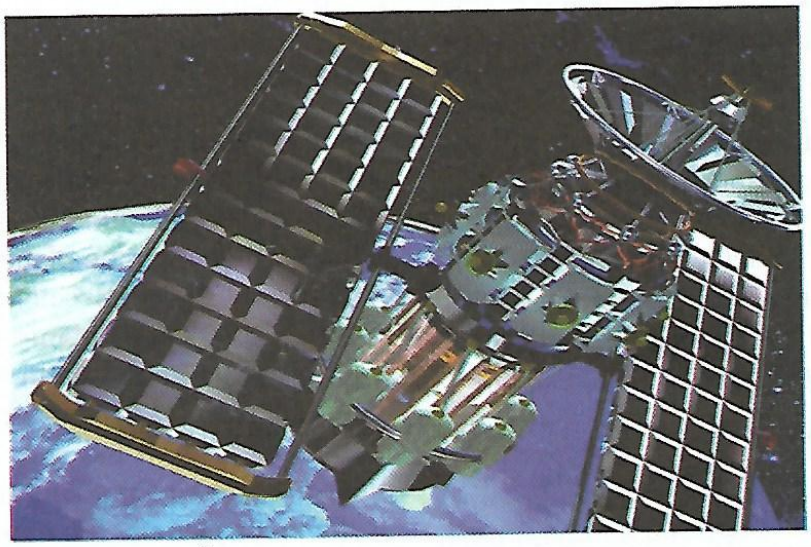


Fig. 23.9 A satellite

Table 23.2 Countries and satellites launched by them

	Country	Name of satellite	Year of launch
1	Russia	*Sputnik* 1	1957
2	US	*Explorer* 1	1958
3	Australia	*Blue streak*	1964
4	France	*Asterix*	1965
5	Japan	*Osumi*	1970
6	China	*Dong Fang Hong* 1	1970
7	UK	*Prospero* X-3	1971
8	India	*Rohini* 1	1979
9	Israel	*Ofeg* 1	1988
10	Nigeria	*SAT* 1	2003

Satellites are coded by their owners. The structure of each satellite is like a spaceship and when launched, each satellite remains in space for a planned period of time performing given functions. Satellites are launched into orbit by a system of rockets.

Types of satellites

Satellites can be classified by their functions. Every satellite is launched into space to do a specific job. The type of satellite that is launched to monitor cloud patterns for a weather station will be different from a satellite launched to send television signals across a country. The satellite must be designed specifically to fulfil its function.

Uses of satellites

The use of each satellite depends on its type and structure.

The following are nine different satellites, with different uses, as shown in their names.

1 Astronomy satellite e.g *hubble space telescope.*
2 Atmospheric studies satellite e.g *polar, alouette.*
3 Communication satellite, e.g. *navstar.*
5 Reconnaissance satellites, e.g *kennan, bigbird.*
6 Remote sensing satellite e.g *radar* Sat.
7 Search and rescue satellite e.g *cospas-*Sarsat.
8 Space exploration satellite, e.g *galileo.*
9 Weather satellite, e.g *meteo* Sat.

Table 23.3 Satellites and their uses

Satellites	Uses
1 Astronomy satellites	a) To make star maps. b) To study mysteriou phenomena, such as black holes in space. c) To take pictures of the planets in the solar system. d) To make maps of different planetary surfaces.
2 Atmospheric studies satellite	To study the earth's atmosphere.
3 Communication satellites	a) To send information quickly from one place to another. b) Telephone signals can be sent from source to the satellite. c) It allows radio, television and telephone transmissions to be sent live anywhere in the world. d) A receiver in the satellite receives the signals while a transmitter in the satellite transmits the signal to the earth where it is received from the satellite.
4 Navigation satellites	It helps ships to know exactly where they are at any given time. In the middle of the ocean or out of sight of land, you cannot find out your position accurately just by looking out of the window.
5 Astronomy satellite	a) To spy on other countries. b) To provide intelligence and information on the military activities of foreign countries. c) To detect missile launches or nuclear explosion in space. d) As an orbital weapon by placing war heads on a low orbit satellite to be launched at a ground target

6 Remote sensing satellite	a) In observing and measuring our environment from a distance. b) To monitor resources important for humans e.g remote sensing satellite might track animal migration, locate mineral deposits, watch agricultural crops for weather damage, or see how fast the forests are being cut down.
7 Search and rescue satellite	a) Designed to provide a way for vessels at sea and in the air to communicate from remote areas. b) It can detect and locate emergency beacons carried by ships, aircrafts, or individuals in remote or dangerous places.
8 Space exploration satellite	a) To detect information deep into the solar system. b) To send back detailed pictures and other data of a faraway planet. c) Responsible for many of astronomy's most important achievements, e.g. Jupiter's rings were discovered by space exploration satellites.
9 Weather satellite	a) For weather forecasts. b) To detect volcanic eruptions and the motion of ash clouds. c) Radiation measurements from the earth's surface and atmosphere give information on amounts of heat and energy being released from the earth and the earth's atmosphere. d) People who fish for a living can find out valuable information about the temperature of the sea from measurements that the satellite makes. e) To monitor the amount of snow in winter, the movement of ice fields in the Arctic and Antarctic, and the depth of the ocean.

Classification of satellites

Satellites can be classified by their functions. They are launched into space to do specific jobs. A satellite must be designed specifically to fulfil its functions.

Table 23.4 Types of satellites and their uses

Type of satellite	Uses
1 Communication satellite	a) Sending information quickly from one place to another. b) Telephone signals can be sent from source to the satellite. c) A receiver in the satellite receives the signals while a transmitter in the satellite transmits the signal to the earth where it is received from the satellite.
2 Weather satellite	a) Used for weather forecasts. b) Monitors the weather conditions in the atmosphere and sends information to ground stations.
3 Observation or surveillance satellite	a) Used for general observations of areas of the earth. b) It takes photographs of areas for map making in the study of geography.
4 Reconnaissance satellite	Used for military observation for monitoring troop movement and enemy camp.

Nigeria owns a surveillance satellite *SAT 1* launched with technical assistance from China for geographical mappings of boundaries between states.

Nigeria has further developed a communication satellite called *COMSAT* to improve the communication system in the country.

Summary

1 With science and development, the world has been turned into a global village.

2 Gravitation is a natural phenomenon by which physical bodies attract one another.

3 The investigation of gravitation started in the 17th century by an English physicist and mathematician called Sir Isaac Newton.

4 Sir Isaac Newton was attracted to the study of gravitation when he saw an apple fall from an apple tree in his garden.

5 The moon is not pulled down by the earth's gravitational force because the moon moves fast all the time such that the earth cannot equal its speed of movement.

6 Sir Isaac Newton's ideas led to the space age science.
7 Gravitational pull between two objects depends on two factors: the masses of both objects and the distance between them.
8 The earth's gravitational pull on an object is the weight of that object on earth.
9 Objects in the outer space (beyond the earth) do not experience gravitational pull but rather experience weightlessness.
10 The earth is one of the nine planets of the solar system.
11 The moons that orbit round the planets are the natural satellites.
12 The earth is the only planet in the solar system that supports living things.
13 As the planet earth orbits the sun and the moon orbits the earth, eclipses may occur.
14 Eclipse of the moon occurs when the moon passes through the shadow of the earth at night, blocking our view of the moon (The earth is between the sun and the moon.)
15 Eclipse of the sun occurs when the moon comes between the sun and the earth during the day, blocking our view of the sun.
16 The seasons of the year are formed by the orbiting of the earth round the sun.
17 Beyond the earth's atmosphere is the outer space which is large, empty and quiet, but has light.
18 Russia was the first country to launch artificial satellite called *Sputnik* 1 into the space in 1957.
19 Yuri Gagarin was the first man to orbit the earth in 1961 as he manned *Vistok* 1 spacecraft.
20 Alexey Leonov was the first man to walk in the space for 12 minutes, 9 seconds wearing a space suit in 1965.
21 Neil Armstrong, an American, was the first man to step on the surface of the moon, followed shortly after by Buzz Adarin while Michael Collins was commander in 1969 on board *Apollo* II.
22 The American flag was the first national flag to be on the moon, with a signal of peace.
23 Space travel extended to the planet called mars in 1977.
24 Future space travels may involve private travellers.
25 The major purpose of space travel is to make discoveries, and understand the nature of the earth and other planets.
26 The major challenges of space travel are the need for the spacecraft to overcome the gravitational pull of the earth while taking off, and how to cope with the weightlessness conditions while in space.
27 About ten countries of the world, including Nigeria have launched satellites into space.
28 Nigeria launched her satellite called *SAT* 1 in 2003 and launched *COMSAT* II about a decade later to improve communication.

Revision questions 23

1 It is wrong to say the earth _____.
   A is a planet
   B orbits round the sun
   C rotates on its axis
   D has only one natural satellite
   E has no gravitational pull
2 Gravitational force is a force of ____.

A carriage
B friction
C attraction
D repulsion
E opposition

3 Which of these is present in the outer space?
A Air
B Sound
C Life
D Gravity
E Light

4 The first man to walk in space is _____.
A Buzz Adarin
B Neil Armstrong
C Isaac Newton
D Alexey Leonov
E Michael Collins

5 The first man to step on the moon is _____.
A Neil Armstrong
B Alexey Leonov
C Buzz Adarin
D Michael Collins
E Yuri Gagarin

6 What attracted Newton to study gravity?

7 Explain the statement 'one small step for man and one giant step for mankind'.

8 What message did America pass by taking a golden olive branch to the moon?

9 Define the term satellite.

10 State two (2) benefits of space travel to your community.

Answers to objective revision questions

Chapter 1
1 A
2 E
3 E
4 D
5 A

Chapter 2
1 A
2 B
3 A
4 B
5 C

Chapter 3
1 B
2 A
3 C
4 A
5 C

Chapter 4
1 E
2 B
3 C
4 E

Chapter 5
1 Poppy plant
Cannabis plant
Coca plant
Poppy plant
Poppy plant
2 E
3 D

Chapter 6
1 C
2 C
3 D
4 c

Chapter 7
1 D
2 B
3 A
4 B
5 C

Chapter 8
1 B
2 D
3 E
4 A
5 A

Chapter 9
1 C
2 A
3 A
4 C
5 E

Chapter 10
1 C
2 C
3 D
4 C
5 D

Chapter 11
1 E
2 D
3 E
4 C
5 Water
6 Soil and water pollution

Chapter 12
1 C
2 A
3 C
4 A
5 E
6 Non-metals

Chapter 13
1 B
2 C
3 E

Chapter 14
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2 B
3 A
4 C
5 B

Chapter 15
1 E
2 A
3 C
4 B

Chapter 16
1 C
2 E
3 C
4 C
5 E

Chapter 17

1 A
2 E
3 C
4 C
5 C
6 E

Chapter 18

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3
4 D
5 B
6 E

Chapter 19

1 E
2 C
3 A

Chapter 20

1 A
2 B
3 A
4 A
5 D

Chapter 21

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2 C
3 A
4 Finish

Chapter 22

1 D
2 A
3 C
4 Contact forces and non-contact forces
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8 The man is 150 kg mass

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1 E
2 C
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