ADULT EDUCATION

book 3

NATIONAL TECHNICAL COMMISSION

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English Language

UNIT 1

VITAMINS FROM YOUR OWN BACKYARD

We are lucky to live in a part of the world where we can grow a great variety of fruits and vegetables all year round. A backyard garden can provide a household with highly nutritious vegetables at low cost.

Vegetables add necessary vitamins and minerals as well as flavour and variety to family meals. Many vegetables are low or very moderate in calories. This is increasingly important because so many people in the Caribbean suffer from overweight and disease such as diabetes which go along with it.

Dark green leafy and deep yellow vegetables are dependable and cheap sources of vitamin A , which is needed for eyesight. Although fully formed vitamin A is only found in foods from animals, the body can make its own vitamin A from a substance called *carotene* which is found in both dark green leafy vegetables or in yellow or orange ones. Carrots, pumpkins and the dark outer leaves of most commonly used greens are all good sources of carotene.

As a bonus, many of these same vegetables supply vitamin C. This vitamin helps the body to grow and to repair tissues, including the healing of wounds. Some of these vegetables also contain minerals like calcium and phosphorus which help in forming teeth and bones. We usually think of fruits such as orange, limes and West Indian cherry as being important for their vitamin C but cassava leaves, callaloo, cabbage, peppers and tomatoes also provide large amounts of this nutrient.

The dark green leafy vegetables also provide some sodium and iron but the body gets most of its iron and sodium from liver, meat, pear, beans and cereals. When it comes to protein, dried peas and beans are the vegetable champions. They provide higher quality protein which helps the body to grow and repair. So we don't necessarily have eat meat with our rice and peas or cook-up rice.

Vegetables are a good source of *dietary fibre,* the indigestable carbohydrates that makes up the cell walls of plants. Fibre was once thought of only as important to add bulk or roughage to the diet and stimulate normal digestion bowel movements. Recent research suggests that fibre play other more important roles in the body.

Eating plenty fresh vegetables can help those who need to cut down their energy intake. It makes our belly feel full without adding a lot of extra calories to be stored as fat.

Raw crisp vegetables such as carrots, cucumber and green peppers are nature's natural toothbrushes. Eating these instead of snack foods like chips, sweet, etc., will help remove food particles which may stick between the teeth and cause painful decay.

By Caribbean Food and Nutrition Institute
Jamaica

VOCABULARY

variety	-	many different kinds of something
flavour	-	good taste
dependable	-	sure
tissue	-	muscles and flesh
indigestable	-	cannot be digested
carbohydrate	-	energy giving foods, mainly sugar and starch

COMPREHENSION

1. Why are vegetables an important part of our diet?
2. Which vegetables provide vitamin A and what is the value of this vitamin?
3. Which vegetables provide vitamin C and what is its value?
4. How can vegetables help to prevent tooth decay?
5. List all of the valuable vegetables which you can grow in your backyard garden.

DISCUSSION

Invite someone from the Food and Nutrition Council (Ministry of Health) to speak to the class on vitamins and nutrition.

Members of the class who have backyard gardens should also give short talks on the setting up of backyard gardens.

GRAMMATICAL PRINCIPLE

Review of nouns

Remember that

A noun is a *naming word.*

Nouns may be *singular* or *plural.*

Nouns have *gender.*

Our fishing *fleet* sailed out to *sea* under captain *Paul.*

In the sentence above the word *fleet* is a *collective noun* because it is the name of *a group* of boats. It refers to a collection of boats.

The word *sea* is a *common noun* because it is the name of *something general.* There are many seas but *it does not refer to any one in particular.*

The word *Paul* is a *proper noun* because it is *the name of a particular person.* There are many captains but Paul is the name of a particular captain.

EXERCISES

1. Fill in the blanks with the correct *collective* noun from the list below:

swarm	library	catch	army	choir
car	side	fleet		

a _____ of fish

an _____ of soldiers

a _____ of singers

a _____ of bees

a _____ of books

2. Write two common nouns and make sentences using them.
3. Write two proper nouns and make sentences using them.
4. Place these nouns in their correct place under two columns: singular and plural.

woman	potatoes	shoe	box	supplies
calf	factory	keys	bluggo	ships

Nouns ending in *-er.*

- Some nouns are made by adding *-er* to the verb, for example: driver, boxer.
- When *er* is added to a verb to form a noun, the noun means somebody who does what the verb says.
  dancer - someone who dances.
  boxer - someone who boxes.
- Some other nouns are made by adding *-or* to the verb, for example: inspector, creator.
- Sometimes nouns are also made by adding *-ist* to a word, for example: dent/ist.

EXERCISES

1. Name three ways of forming nouns from words.
2. Add *-er* to these verbs to form nouns:

climb	wash	work	build	bank
teach	walk	play	sing	plant

3. Form nouns from these words:

sail	dance	visit	motor	act
collect	conduct	art	violin	guitar

4. From which verbs or words have these nouns been made:

liar	digger	agriculturist	debtor	relator
planter	specialist	photographer		

ALLEN BATTERED THE CARIBBEAN

With high winds raging at above 185 miles per hour, Hurricane Allen hit the Caribbean. Allen was the fiercest hurricane to hit the Caribbean in one hundred years. On the night of August 2, 1980 Allen passed over the Caribbean leaving a trail of distruction. It was the second hurricane to hit the region during that season and it was the worst.

The sister islands of St. Lucia and St. Vincent were the worst hit, because the "eye" or centre of the hurricane passed directly over them. Dominica, Grenada, St. Kitts, Jamaica, Haiti, Cuba and Mexico all felt Allens' destructive wrath.

In St. Lucia 16 people died, over 6,000 were left homeless and 15 schools were destroyed. The banana industry was devastated, water and electricity supplies were put out of order, the tourist industry was severely affected, factories were severely damaged and the economy was destroyed.

In St. Vincent severe damage was done to agriculture. The major banana growing areas were destroyed especially in Mesopotamia Valley and surrounding areas. Seventy-five percent of the nutmeg production was destroyed as well as the mango, avocado and breadfruit crop. The propagating station and arrowroot factory at Wallibou on the north-windward coast were also badly damaged. Roads were cut off and many families made homeless.

Throughout the Caribbean dozens of people died from the effects of Allen and millions of dollars damage was done to agriculture, roads, homes and services. Some parts of Grenada experienced high winds and rain during the hurricane. In Gouyave seven rooftops were blown off but repairs were speedily done by members of the Community. Great damage was done to agriculture crops in some areas and also to the roads. $16,2 million worth of damage was done to our crops.

The determination and unity of Caribbean people is most strongly felt in such moments of crisis. All over the region, messages of sympathy and concern flashed. Disaster-solidarity committees were formed in many islands to assist our more badly hit sister islands. In Grenada our people responding to the call of the National Relief Committee worked hard to raise what they could. We must be prepared to help any people at any time they call on us.

VOCABULARY

raging - blowing madly

wrath - anger

devastated - totally destroyed

COMPREHENSION

1. Why was hurricane Allen the most destructive in 100 years?
2. Which islands were the worst hit and why?
3. List some of the damages done by Allen.
4. What were some of the positive effects of the hurricane in the Caribbean?
5. Why should we always help those in need?

DISCUSSION

Any members of the class with experiences of hurricanes which they would like to recount should do so to the class.

All members of the class should be familiar with the preparations and precautions for hurricanes.

GRAMMATICAL PRINCIPLE

Interrogative forms of the verbs or how to ask questions

(a) He is a fisherman.

(b) Is he a fisherman?

Sentence (b) is a question. It asks or enquires about something.

- *To form a question the verb is placed before the subject.*

  In sentence (b) the verb *is* is placed before the subject *he.* Read the column carefully:

Statement	Question
He *is* a sportsman.	*Is* he a sportsman?
You *have* a fork.	*Have* you a fork?
She *will* donate the medicine.	*Will* she donate the medicine?
They *can* speak Spanish?	*Can* they speak Spanish?
We *are* working hard.	*Are* we working hard?
You *can't* be wrong and get right.	*Can't* you be wrong and get right?
He *musn't* run through the rain.	*Mustn't* he run through the rain?

- These verbs *(is, have, will, can, are, can't, musn't)* are the only verbs which form questions by only changing around the subject and the verb. These verbs are called *peculiars.*

- All the other verbs form the present interrogative by using do and the verb. To ask a question about what is happening now we use do + the verb.

  e.g. *Do* you known that hurricane winds are dangerous?

EXERCISES

1. Change the following statements into questions:

   Children are the flowers of the Revolution.

   You will make preparation for the hurricane season.

   Hurricane winds can do great damage.

   We must help all people who need it.

   The Caribbean islands have problems with hurricanes.

   We musn't disobey the hurricane precautions.

   You like to plant vegetables.

2. Can you say what is wrong with these questions?

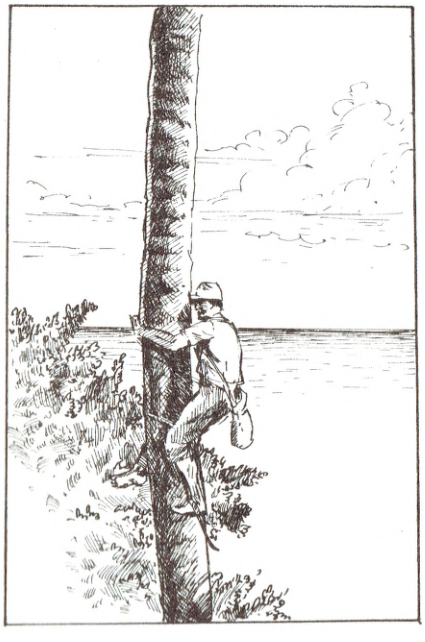
   Does you like the new radio programmes?

   Does she has the book?

   Doesn't they give hurricane relief?

UNIT 3

SILVERSPOON - THE ISLAND CLIMBER



From a top of a 50-foot coconut tree came a loud warning "About Coming". Quickly dozens of excited on-lookers underneath the tree began to distance themselvers. Immediately afterwards, with a loud thud, part of the coconut tree crashed to the ground. James "Silverspoon" Charles, the popular and one of the last professional tree climber was at work.

Silverspoon, who came from Moyah in St. Andrew's, used an old and interesting local method of climbing and cutting tall trees. When climbing Silverspoon spanned the tree trunk above his head with a large rope and held on to the free ends. Next, he firmly clasped his legs around the tree. By moving first the rope and then his legs he was abl to climb the tallest coconut and palmiste trees with speed.

Once at the top Silverspoon fastened the rope to the tree trunk, and inserted his feet into the loops at the free ends of the rope. With one hand holding on tightly, he began work cutting and trimming off the branches.

For twenty-seven years Silverspoon was involved in this kind of work. During these years, Silverspoon "the

Island Climber" cut innumerable trees all over Grenada in every parish. Even when he reached the ripe age of 68 the Island Climber was in the best health. With a bag containing his essentials strapped over his shoulder, he walked for miles, often barefooted to do his tasks.

Silverspoon the Island Climber represents a tradition which is dying away, but his skill and the mastery of his craft remains a shining example. The old-time crafts are being replaced with the use of machines, but the dedication, attention and mastery of the old craftmen remain a permanent example of what each of us achieve in our own area of work.

By Keith Jeremiah
Free West Indian

VOCABULARY

onlookers - spectators, people observing
spanned - embraced, encircled
clasped - fastened or gripped
inserted - fitted
innumerable - countless, "endless"

COMPREHENSION

1. Who was Silverspoon and what was he noted for?
2. For how long was he involved in this kind of work?
3. Why is Silverspoon important to us?
4. What do we have to learn from him?

GRAMMATICAL PRINCIPLE

Review of Pronouns

- *Pronouns are words that stand instead of or replace nouns.*

Personal pronouns replace the names of persons.

John went away and *he* came back yesterday.

He - personal pronoun.

Relative pronouns are words which are used instead of nouns and may also join two sentences together.

He lived in the house *which* was painted by Tom.

Which - relative pronoun.

Pronouns are either *singular number* of *plural number.*

Singular - he plural - they

Pronouns can be *masculine, feminine* or *neuter gender* or *common gender.*

he - masculine she - feminine
it - neuter them - common

EXERCISES

1. Fill in the blanks with the appropriate personal pronoun from the list:

I	she	they	her	us
he	it	him	we	his

After the footballer kicked the ball _____ ran off the field.

The women's group elected _____ to be chairperson.

The workers showed _____ around the airport site.

_____ walked to Freedom Hill in the march.

Silverspoon climbed the tree and _____ trimmed _____ .

2. Underline the pronouns in these sentences:

They are brothers and sisters.

He spanned the tree trunk with rope and held on to is.

Once it was tight he began to trim them.

I read that book. It was interesting.

He walked for miles, barefooted, to do his tasks.

3. Join these sentences using the appropriate relative pronoun.

e.g. This is the house. Tom built it.
This is the house that Tom built.

who	which	whose	whom	that	what

Gordon Hamilton painted that design. He works at the Art School.

I gave him something. He needed it.

They stayed with the man. His house is on the hill.

She is an old person. Everybody loves her.

Read these carefully:

Singular	I	my	me	mine	he
Plural	we	ours	us	ours	they
Singular	his	her	hers	him	
Plural	them	theirs	theirs	them	

Singular	she	this	that
Plural	they	these	those

THE MATERNITY LEAVE LAW 1980

Under the maternity leave law of 1980 all pregnant women employees are entitled to three months maternity leave and the right to return to work at the end of that leave.

An employee who has worked for the same employer for at least 18 months is entitled to receive full salary for two of her months maternity leave. The exact amount of maternity pay is: two months for monthly paid workers, eight weeks for fortnightly paid workers and one-sixth of the previous year's pay for daily-paid workers.

The worker can claim her maternity pay either as a lump sum to be paid on the first day of her leave or as wages in the usual way. It is the worker's right to choose the dates of her maternity leave. She must give her employer at least two weeks notice of her intention to take her maternity leave *and* of her intention to return to work afterwards. She must also notify her employer two weeks before she returns to work. She has the right to choose to return to work before the three months are up, but her employer does not have the right to order her to do so.

Maternity leave must be granted in addition to any vacation leave due to the worker. An extention of maternity leave for two extra (unpaid) months must be given if the worker produces a medical certificate post-poning her return on grounds of her health or that of her baby.

After the first maternity pay claim, a worker is only entitled to claim maternity pay after two years passed and not for more than three births in all. However ALL women workers must, no matter what, be given three months unpaid leave.

Any employer who does not give the maternity leave or the maternity pay can be brought to court and can be fined up to $1,000 or six months imprisonment. An employer who fires a worker simply because she is pregnant can be fined up to $2,000 or one year imprisonment. It will be the responsibility of *the employer* to prove that the worker was not fired because of pregnancy.

Any employer who is ordered by the court to reinstate an employee and refuses to do so will be fined up to $50 for each day during which the worker remained out of work. In the two previous cases, the worker will be entitled to receive all salary owed to her for the period during which she was not working.

This law does not apply to casual workers (those working less than two days a week on average). This law applies to ALL TYPES OF WORKERS - agricultural workers, factory workers, teachers, civil servants, police, prison and army employees, store and supermarket workers, nurses and nursing students, road workers manual and domestic servants. The maternity leave law was passed on October 10, 1980. Any women who have been denied the rights laid out by this law should contact the Womens Desk, the Labour Commissioner or the Ministry of Legal Affairs for advice.

KNOW THE MATERNITY LEAVE LAW;

RESPECT THE MATERNITY LEAVE LAW;

RESPECT WOMENS RIGHTS.

Prepared by the Womens Desk, Ministry of Education & Social Affairs

VOCABULARY

employee - someone who is working for somebody else

employer - someone who hires people to work for him

notify - inform

due - owed

to reinstate - to take back in the former position

COMPREHENSION

1. What is the main benefit of the maternity leave law of 1980?
2. If a woman has been working for someone for over 18 months what is she entitled to:

   (a) If she is a monthly paid worked?

   (b) If she is a fortnightly paid worker?

   (c) If she is a daily paid worker?
3. Who decides when a pregnant worker should take her maternity leave?
4. How does a pregnant worker make sure that she gets back her job?
5. Can maternity leave be substracted from normal vacation?
6. What can happen if an employer fires a worker simply because she is pregnant?
7. What happens if an employer refuses to give maternity leave or pay?
8. Who does the law apply to?
9. Which workers are not covered by this law?
10. If a woman has problems over her maternity rights where can she go for help?

DISCUSSION

Invite someone from Women's Desk or the Ministry of Legal Affairs to talk to the class on women's rights and the New Peoples' Laws.

GRAMMATICAL PRINCIPLE

Interrogative pronouns

What did he say?

Who came home?

Which do you prefer?

Whom did you send?

The words *what, who, which,* and *whom* are pronouns.

In the sentences above *they are used to ask a question.*

They are *interrogative pronouns.*

- *When pronouns are used to ask a question they are called interrogative pronouns.*

EXERCISES

1. Underline the interrogative pronouns in these sentences:

   Whom did you see?

   The boy who came home left yesterday.

   Whose house did the wind blow down?

   Who brought you along?

   What is the maternity law about?

   The holidays which you get are separate from maternity leave.
2. Make two sentences using each of these interrogative pronouns.

   who what which whom

UNIT 5

BETTER HOUSES

One of the problems faced by many of our people, especially in the rural areas, is the need for better houses. In the first year of our Revolution, the PRG established a $7.5 million housing programme. This aimed at benefiting the poorest sections of our society. As a result of the high cost of building materials, the programme was organized in a way which would bring immediate benefit to those who needed it most.

There are two schemes in the housing programme for those whose houses are in urgent need of repair. Under both schemes up to $1 000 dollars can be borrowed for house repair. Scheme one enables the borrower to repay only $660. The remaining $340 is considered a grant from the PRG. In scheme two, the borrower is required to repay the entire $1 000. The time allowed for repayment in both schemes is very favourable. In scheme one the borrower pays back $5 every month over a ten year period. In scheme two the borrower pays back $17 every month over a five year period.

Over one million dollars have been made available for house repair loans. This money forms what is called a *revolving fund.* This means that as soon as those who borrow money begin to repay, their repayments will be loaned to others. This requires co-operation because when all the money has been loaned, new loans cannot be made until those who have borrowed begin to pay back.

Another aspect of the housing programme is the construction of new houses. In the first phase 300 houses were built in Grand Anse and Telescope. The rental of these houses is fixed at the lowest possible rate. To qualify for one of these a family's total income must be at least four times the rent. After twenty years the house becomes the property of the family.

The National Housing Programme is another serious effort to solve some of the basic and most pressing problems of our people. Jobs, food and shelter are the material demands of our freedom loving people. The right to these is a basic human right and the basis of individual dignity.

VOCABULARY

rural areas - country side

borrower - the person who has borrowed money from someone else

income - money which is made regularly

COMPREHENSION

1. Why was a $\$7\frac{1}{2}$ million housing programme started?
2. How does the housing repair programme operate?
3. Why does my getting a loan depend on your paying back?
4. Besides house repair, what is the other major aspect of the programme?
5. How does one qualify for a house?

DISCUSSION

Does the class know who is the housing co-ordinator for the area?

Invite him/her to speak on housing and how to make use of the programme.

As a practical activity, the class should identify the house of someone in the community which is most in need of repair.

Elect a member of the class to assist that person in getting materials for repair, and the class should help repair the house.

GRAMMATICAL PRINCIPLE

Distributive pronouns

Either of the schemes are helpful to workers.

Each of the borrowers can get up to $1 000.

Neither of them did the right thing.

The words *either, each* and *neither* are *distributive pronouns.*

- *A distributive pronoun is one which indicates that the person or things referred to are taken separately.*

e.g. *Either* of the schemes is helpful.

The distributive pronoun *either* refers to scheme 1 and to scheme 2 separately.

Note:

Each, either and *neither* are always followed by singular verbs.

Each of the boats *is* on the beach.

These pronouns can NEVER take a plural verb.

EXERCISES

1. Make two sentences using each of these distributive pronouns:

each either neither

2. Underline the distributive pronouns in these sentences:
Either of schemes one or two can help to repair your house.

Each of the families will own the house after twenty years.

Neither of us is ready to leave.

Either of these houses will suit you.

Demonstrative pronouns:

This is my country.

That is her basket.

These are the people's laws.

Those who disrespect women's rights will be brought to court.

The words *this, that, these* and *those* point to particular places, persons or things. They are called *demonstrative pronouns.*

- *A demonstrative pronoun is one which points out the person, place or thing to which it is referring.*

Note:

This and *that* refer to single things. They are *singular* demonstrative pronouns.

This is my country. *(one* country)

That is her basket. *(one* basket)

These and *those* refer to more that one or several things.

They are *plural* demonstrative *pronouns.*

These are the people's laws. *(many* laws)

Those who disrespect woman's rights. *(some* people)

This and *these* refer *to* persons or things which are nearly, while *that* and *those* refer to persons or things at a distance —things which are far away.

EXERCISES

1. There are two chairs in a room. The green chair is near to your friend and the brown one is further away by the door. If you ask your friend to take "that chair" for you, which chair should he give you?
2. Underline the interrogative pronouns and circle the demonstrative pronouns:

   Which law is better? This one or that one?

   Those who disrespect womans rights will pay either this penalty or that.

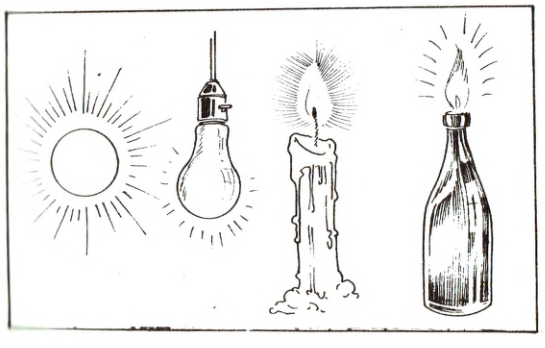
   Who is that cute child?

   What new situation has caused these laws to be passed?

   Whom did you send to collect those bags of mace?

UNIT 6

LIGHT-A FORM OF ENERGY



Light is a form of radiant energy. Its manifestation is governed by natural laws and the rays of light travel in straight lines from their source. A series of very interesting things have been discovered about light. These interesting facts which have been discovered have been applied and put to general use.

The greater part of the light which we receive is of natural origin and comes from the sun, which is the most powerful and nearest source of light to the earth. There are other natural sources of light from the firefly to the stars. Some stars produce more light than the sun but their light comes to us very weak because of the great distance over which it travels. Other sources of light in the sky are comets, meteors, and the North Star.

Man produces artificial light by converting one form of energy into another. When you rub two flints together it causes sparks to fly —mechanical energy is converted into light energy. When a wire is heated until it glows brightly, heat energy is being used to produce light. When an object is burning it gives off light because some of the chemical energy produced by combustion is converted into light.

As interesting as the ways in which light is formed is its speed. Light travels at a speed of 300,000 kilometers per second and always in straight lines. When passing through air, water or glass it travels at a lesser speed. When light rays hit an obstacle, one of three things happens: it passes through the object, it is reflected or it is absorbed by the object. If it passes through an object of a different density, the light rays change their direction. For example light passing through very thick glass. This change of direction is called *refraction.*

According to what happens to them when light hits them, objects are said to be *transparent, translucent* or *opaque.* Transparent objects like clear glass, allow light to pass right through them. Translucent objects only allow some light to pass through and refracts the remaining light. Painted and frosted glass are examples of translucent objects. Opaque objects prevent any light from passing through for example wood and rocks.

Understanding the nature of light energy and the laws which govern it, has enabled man to develop many useful instruments to better the quality of his life.

VOCABULARY

radiant - glowing, shining

manifestation - appearance

meteors - burning pieces of matter which sometimes fall to the earth.

combustion - burning

density - thickness

COMPREHENSION

1. What is light?
2. Name our sources of natural light?
3. In what ways can artificial light be produced?
4. What happens when light rays hit an object?
5. What are the differences between *transparent, translucent* and *opaque* objects?

DISCUSSION

What are some of the ways in which we produce light in our everyday life? And what kind of energy is converted into light?

The *masanto* for example uses chemical energy to create light (by burning kerosene).

How do we use light to improve our everyday life?

Discuss the uses of natural and artificial light (for example we use the sunlight to dry mace).

GRAMMATICAL PRINCIPLE

Alphabetical order and using the dictionary

The dictionary is a book containing hundreds of words in *alphabetical order.* We use the dictionary for several reasons:

—To find out the meaning of a word.

—To check the correct spelling of the word.

—To check the pronunciation of words.

To make full use of the dictionary and to save time in looking for a word, we should know the alphabet well and in its correct order:

A B C D E F G H I J K L M N O

P Q R S T U V W X Y Z

In the dictionary all the words beginning with A come before those beginning with D.

Words beginning with D come after those beginning with C but before those beginning with E.

Ant Donkey Energy

- When words begin with the same letter we look at the other letter to put them in alphabetical order.

*r*adiant *re*fraction

Both words begin with *r* but *a* comes before *e.*

trans*p*arent trans*l*ucent

Both words begin with *trans* but *l* comes before *p.*

EXERCISES

1. Put these words in alphabetical order:

light	governed	manifestation
firefly	sun	stars
water	air	glass

2. Find the meaning of these words in your dictionary:

combustion	refraction
radiant	reflection

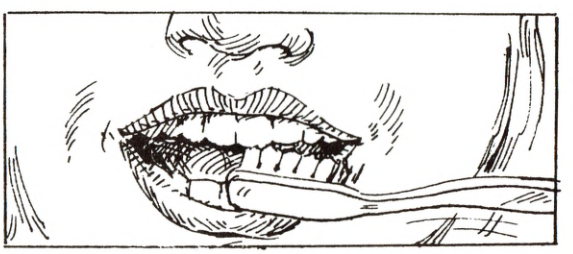
3. What are the first five words in your dictionary under these letters:

T V O B G R

UNIT 7

CARE YOUR TEETH

The most important structure in the mouth is the teeth, they play a key role in digestion of our food. The state of our teeth indirectly determines the state of our health. Bad, rotten teeth are not only unpleasant to look at but they also cause bad breath and cause us to get stomach problems because our food is not properly chewed.



The teeth are protected with a hard white substance called enamel. Enamel is the toughest, hardest substance in the body, resistant to most of the chemicals normally found in food except acids. Everyone has two sets of teeth. After birth a set of teeth called *milk teeth* are formed. These are replaced as the person approaches adulthood by *permanent teeth.* After these are formed, the cells which produce enamel disappear. It means that there can be no natural replacement for permanent teeth which may decay.

The main function of the teeth is to grind our food into tiny particles so that it can be easily digested by the stomach. Can you imagine how much chewing is done by your teeth in your life-time? If you consider this for a minute you will realize how much work is done by our teeth and how many different substances —sweet, sour, hot and cold— pass through our mouths. No wonder the teeth are covered by the hardest substance in the body.

We take care of our tools and machines but often neglect some of the most valuable and irreplaceable tools that we have —our teeth. We should avoid eating plenty of starchy or sugary foods especially between meals. Tiny bits of sweet or starchy foods left between the teeth form acids which will gradually eat away the enamel and cause our teeth to rot. We should brush our teeth with a tooth brush so that the bits of food stuck between the teeth can be removed. When brushing make sure you brush the teeth on all sides especially near the gum. Brush the inside, the outside and the flat surface many times. We should never use pins or other sharp metal objects to pick our teeth as this could damage the enamel. Use a tooth pick made of wood.

Drinking plenty of milk and eating vegetables, especially the leafy green ones, also helps to keep our teeth in good condition. A visit to the dentist every three months will save us much pain and keep our teeth in top form.

It is because the care of the teeth is so important to our health that the Revolution has opened many new dental clinics in every parish including Carriacou.

VOCABULARY

structure - parts
determines - decides
resistant - able to stand against
permanent - lasting
irreplaceable - cannot be replaced

COMPREHENSION

1. How do bad teeth affect us?
2. Which substance affects the teeth most and where does it come from?
3. What is the main function of the teeth?
4. How can we care for our teeth?
5. Which foods help prevent tooth decay?

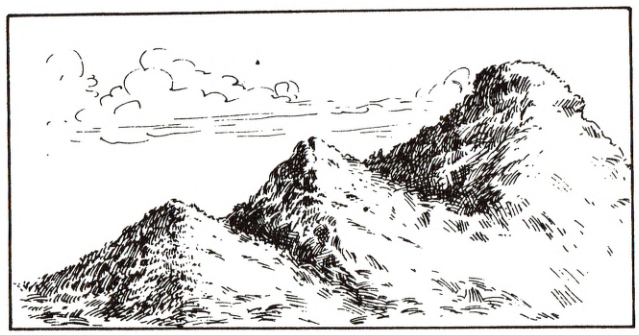
DISCUSSION

Invite a dentist or dental assistant to speak to the class on care of the teeth. If possible the dentist should give everyone a dental check.

If it is not possible, a member of the class should check with the nearest dental clinic to arrange for all the members of the class to check their teeth during this week.

GRAMMATICAL PRINCIPLE

Review of the comparison of adjectives



In this mountain range mountain B is high, mountain B is higher and mountain C is the highest.

high	*higher*	*highest*

High is a positive adjective. It simply tells us something about the mountain's height.

Higher is a comparative adjective. It tells us that between two things one is higher.

Highest is a superlative adjective. It tells us that among many things, one is the highest of all.

The finger nails are hard, the bones are harder, the teeth enamel is the hardest.

In Grenadian English we also have ways of expressing comparisons.

Dat man *hard.*

The positive adjective *hard* tells us that the man is highly skilled in his work or very talented in some field.

The NYO Sport Day in St. David's was the *hardest hard. Hardest hard* is a superlative. It tells us that among all of the Sport Day activities held in each parish by the NYO, St. David's was the best.

EXERCISES

1. Compare these adjectives by filling in the blanks:

cold	_____	_____
_____	older	_____
_____	_____	youngest
heavy	_____	_____

2. Form the comparative of these adjectives:

fat	big	fine
thin	hot	free

3. Form the superlative of these adjectives:

bold	bad	starchy
white	milky	cold

4. Rewrite these sentences choosing the correct adjective from the bracket:

Enamel is the (tough, toughest) substance in the body.

The (fast, fastest) of the boats won the race.

The permanent teeth are (strongest, stronger) than the milk teeth.

It is (better, best) to eat vegetables than sugary foods.

Prevention is (good, better, best) than cure.

Adjectives formed from the names of countries

Adjectives can be formed from the names of countries. People from Grenada are called *Grenadians.* Things from Grenada are *Grenadian.*

Name of Country	Adjective
Grenada	Grenadian
West Indies	West Indian
Dominica	Dominican
Haiti	Haitian
St. Vincent	Vincentian

- Adjectives formed from the names of countries must be written beginning with a capital letter.

EXERCISES

1. Form adjectives from these proper nouns:

Trinidad	Carriacou	Nicaragua
Jamaica	Cuba	St. Lucia
France	Nigeria	Canada

2. Fill in the blanks with the correct adjective:

Goods made in Britain are _____ goods.

Cocoa grown in Grenada is _____ cocoa.

Arrowroot exported from St. Vincent is _____ arrowroot.

People born in Guyana are called _____ .

Someone born in New York is an _____ citizen

The people of Puerto Rico are _____ _____

3. Make adjectives from these names and write sentences using them.

Spain	Carriacou
Italy	Japan
Germany	Vietnam

UNIT 8

ATTITUDES TO WORK

Have you ever asked yourself the question "Why work?" "We work to make money", some of us might say. "We work to live" others might reply.

To work to live means much more than working just to make money. To work to live is to produce and create. Without work society would be nowhere. If no one worked then none of our needs could be fulfilled. If nobody worked then there would be no food, clothing or shelter because it is by working that all of the many things that we need are produced. Work is therefore the foundation of every society. Without it there can be no development. So we can see that work means much more than money. Work is part of the essence of life and from the earliest times man has recognized this to be true. The Bible says "by the sweat of thy brow, thou shall eat bread" indicating to us that work is a *necessity.*

Since work is a necessary activity, then our attitude to work is of great importance. If we work only to make money then our attitude to work should be one that understands that we can only take out what we put in. If v understand that work is also necessary to develop our country then our attitude to work should be even more demanding. A correct attitude to work not only helps to increase production but also makes work easier. Think of the time and money that could be saved if we do a job in a disciplined and complete way. Some of us do our work in

careless "anyhow" way which wastes material, wastes time, wastes our own efforts because we often have to do the same work all over again.

A correct attitude to work means many simple but important things:

a) *Be disciplined.* Work requires discipline. We should a always be on time because this is the basis of the principle "a fair day's work for a fair day's pay". Discipline means doing our work in a serious way - without wasting time or too much turning and twisting.

b) *Respect and consideration for others.* Is another important aspect of a correct attitude to work. We hardly work alone. No matter what kind of work we do we are always in contact with other people. Respect and consideration for our fellow workers makes life at work pleasant and enables us to enjoy good relations with others.

c) *Obeying the rules and regulations of our jobs and knowing our rights and duties.* Every job has its rules and regulations which tell us *how* things should be done. In some jobs, especially those with dangerous machines, it is important to stick to these because they are important for personnal safety. In all jobs these rules and regulations are important because they help every-one to play their part in getting things done. Knowing our rights is important because it prevents us from being abused. Above all if we understand our rights then we also understand what our responsibilities are because they must go together.

We all dislike those who depend on others like parasites, because, it is easy to see through their attitude. A lazy, "don't care" or indisciplined attitude to work is not only dishonest but also makes work more difficult for those who work with us. On the other hand, a disciplined and thoughtful approach to our work gains us the respect of everyone. With this attitude, we work not just to live but to make living better.

VOCABULARY

essence - the most important or essential thing

discipline - firm behaviour

demanding - calling for more

COMPREHENSION

1. Why do we work?
2. What is the connection between work and society?
3. Why is our attitude to work important?
4. What is a correct attitude to work?

DISCUSSION

Discuss the passage paying attention to examples from the experience of the class of both positive and negative attitudes to work.

GRAMMATICAL PRINCIPLE

Comparison of adjectives

Sports is a *more necessary* activity than liming.

The adjective *more necessary* is the comparative. It tells that sports is more important than liming. Notice that comparative is made up of two words *more* and *necessary.* This is because the adjective has more than one syllable or parts.

Work is the *most necessary* activity.

The adjective *most necessary* is the superlative. It tells us that among all the different kinds of activity that exist, work is the *most necessary.* Again the superlative is made up of two words *most* and *necessary.*

- *When the adjective has more than one syllable (or is a long word) the comparative, superlative is formed by adding "more" and "most" to the positive degree.*

Note:

We never have forms like:

more bad nor badder

most bad nor baddest

He has a *bad* attitude to work.

Lazy people have a *worse* attitude to work.

Parasites have the *worst* attitude to work.

In those three sentences. The comparative and superlative of bad is *worse* and *worst.* Some adjectives, like *bad,* cannot be compared in the ways in which we have done.

These adjectives are said to be *irregular.*

- *Irregular adjective form the comparative and superlative by a complete change in the word.* e. g. *bad, worse, worst.*

Here are some irregular adjectives:

Positive	*Comparative*	*Superlative*
good	better	best
ill	worse	worst
little	less	least
much	more	most
many	more	most
sick	worse	worst

EXERCISES

1. From the list of irregular adjectives write sentences using the positive, comparative and superlative of each.
2. Choose the correct adjective from these in the brackets to complete the sentence:

   Honest people work _____ than indisciplined people. (hard, harder)

   Revolutionaries must be the _____ workers of all. (harder, hardest)

Sparrow is the _____ calypsonian in the world. (more famous, most famous)

A patriotic worker is _____ than an unpatriotic one. (hard working, more hard working)

I feel _____ than yesterday. (good, better.)

My youngest child is the _____ (troublesomest, most troublesome)

UNIT 9

RIVER WASHING-A TRADITION

Besides their importance for bathing and as a source of drinking water, rivers in Grenada are also laundries where hundreds of Grenadians do their washing every day.

River washing dates back to the time man invented clothing. The Ciboney and Caribs - the earliest inhabitants of this country, used the river to wash their clothing and hammocks. They knew no other means of doing their laundry.

Today, almost 500 years after the Ciboney and the Caribs, another race of people continue the practice and it has grown with the increase in the amount of clothes worn by a more advanced society.

A map of Grenada printed in 1966 names six rivers in the island. The largest river is the Great River which has its source in the Grand Etang lake and flows through a number of villages in St. Andrews. This map also showed hundreds of other unnamed streams meandering all over the island.

Whichever village they pass through, their crystal water is crucial to the villagers' life. Saturday is the big river washing day. Walking along the Great River on a Saturday one can see scores of women and girls in constant motion. With buckets of clothes balanced on their heads they move to and from the river.

Among the dirty clothes are their soaps, corn stalks and scrubbing brushes. Some women have a favourite stone to wash on, usually shaped in a particular way. These stones are easily identified by the white stain left by the soap. On either side of the river, stones are substituted for clothes lines. The clothes drying on the stones form a colourful display.

Children often accompany their mothers to the river and they swim and frolic while their mothers wash. Some boys catch crayfish with their hands or home-made hooks. Often the catch is roasted on a bonfire between stones in the dry valley of the river and eaten right away.

River - washing has traditionally been a woman's activity. Men are rarely seen washing in the river. This was because washing, like so much of the house work, was unmistakably seen as women's work.

Some people wash in the river because they have no pipe borne water in their homes, but others do it because they say it is faster or because it is a kind of social activity.

In many ways river washing could be and has been a dangerous practice. After periods of heavy rain, washers have sometimes been swept away by flash floods. People have contracted skin and other diseases from river washing. The most important danger is that river washing, especially when some of the latest detergents are used, pollutes our rivers. The soap kills many of the living things in the river and makes it unfit for drinking.

Since the Revolution the Central Water Commission has started a programme to bring pure, piped water to every home. Now large water treatment plants have being built in places like Mardigras and Peggy's Whim. Let us preserve our rivers for a better water supply.

By Vivan Philbert
Free West Indian

VOCABULARY

inhabitants	- people who live in a particular place
meandering	- winding
accompany	- go with
frolic	- play
contracted	- caught
pollutes	- poisons

COMPREHENSION

1. Who were the first people to use the rivers as laundering?
2. How many rivers are there in Grenada and which is the largest?
3. What do people use to wash in the river?
4. Does this affect the river and how?
5. What is being done to bring pipe water to all the villages?

DISCUSSION

"River washing is also a kind of social activity."

What does this statement mean?

The class can discuss its experience of river washing.

In what respect is it a social activity?

What are the good and the bad sides to it? etc.

GRAMMATICAL PRINCIPLE

Review of Adverbs

Do you remember:

- *An adverb is a word which modifies or adds to the meaning of a verb to tell when, how or where an action takes place.*

The women were *busily* washing in the river.

The adverb busily is an *adverb of manner* — it tells us *how* the women washed.

Men *seldom* wash in the rivers.

The adverb *seldom* is an *adverb of time* — it tells us *when* or how often men wash clothes in the river.

The children swim and frolic *everywhere.*

The adverb *everywhere* is an *adverb of place* — it tells us *where* the children swim and play.

The main types of adverbs of manner, time and place. But there are other types are adverbs:

(1) *Adverbs of degree* — tell us to *what extent* or at what rate an action happened.

The old man walked *quite* slowly.

Quite says at what rate the man walked. It is an adverb of *degree.*

(2) *Adverb of number* — tell us how many times an action happened.

I bathed in the Great River *twice.*

Twice says how many times I bathed in the Great River.

It is an adverb of *number.*

(3) *Adverbs of question* — asks questions how? where?

When is the big river washing day?

When is an adverb of *question.*

(4) *Adverbs of affirmation* — says yes to an action.

I *certainly* enjoy river — bathing.

Certainly says "Yes I definitely enjoy river bathing."

It is and adverb of *affirmation.*

(5) Adverbs of negation — denies an action.

We do not wash in the river.

Not denies that we wash in the river. It is an adverb of *negation.*

EXERCISES

1. Underline the adverbs and say what type of adverb it is:

Slowly but surely he climbed the hill.

It rained heavily on Monday.

The children swam twice round the rock.

He immediately called the doctor.

2. Form adverbs with these words:

brave equal lucky quiet lazy three

3. Make sentences using these adverbs:

before	today	since	once	where
now	easily	soon	certainly	only

UNIT 10

ILLITERACY IN OUR CARIBBEAN

Without language man would have remained in the dark ages. Language is one of the important factors of progress. Most of us fortunately have a full claim to language — we can read it, write it and understand it. In the midst of all of this, there are places where many people have only a limited claim to a language.

The world has hundreds of languages, yet there are as many as 800 million people walking on the face of the

earth who can neither read nor write a single language. In Our Caribbean alone over a hundred and fifty-thousand people cannot read or write. In Haiti nine of every ten people; in St. Lucia three out of every ten persons are unable to read or write.

In many cases it is not because of lack of motivation why these millions of human beings remain in ignorance, but simply because of lack of opportunities. If they had a choice all of them would become educated, once they are able to overcome the personal discomfort.

We who are literate can only guess at the horrors of the world of the illiterate. So much is shut off from them. Warning signs have no meaning. "Poisoned water, do *not* drink!" placed near a spring will not prevent an illiterate from drinking from the poisoned spring. Labels mean nothing, newspapers mean nothing. Books have no place in their world. There is no privacy in letters since all of their mail must be read to them and written for them by others. The illiterate person lives in a dark world full of limitations, easy to exploit and dependent on those who can read and write.

To teach the illiterate to read and write is to equip him or her to live a meaningful life. With the ability to read and write one is no longer dependent on hearsay and rumour for information. With literacy, the world of books and the written word is opened, and with it the possibilities of learning from the infinite treasure of human knowledge. With education, a man or woman understands fully his or her role in their society and can thus make a positive contribution towards its development.

VOCABULARY

factors - influence

motivation - the desire to do something

literate - able to read and write

infinite - endless

COMPREHENSION

1. Why do you think that language helps progress?
2. How many illiterates are there in the world?
3. Which country in our Caribbean has the highest rate of illiteracy?
4. Why are so many people illiterate?
5. What difference does it make to become literate?

DISCUSSION

Why is education so important to us and to our country?

Why should working people always upgrade their education?

What are some of the major problems in education in Grenada?

What are the main educational programmes and why are they set up?

What move can be made to improve education and how?

The class should collect all the good ideas and suggestions which come out of this discussion. A member of the class should be responsible for posting it to the C.P.E. National Office in St. George's.

GRAMMATICAL PRINCIPLE

Comparison of Adverbs

Do you remember > An adverb is a word which _____

_____.

This boat travels *fast.*

Alister travells *faster* than "Agatha K".

Speed boats travel *fastest.*

The words *fast, faster* and *fastest* are adverbs.

Like adjectives, adverbs can also be compared. In these sentences, the adverbs *fast, faster* and *fastest* compare the boats, they tell us how fast the boats sail in comparison with other boats.

Fast is an adverb of the *positive* degree.

Faster is an adverb of the *comparative* degree.

Fastest is an adverb of the superlative degree.

- Most adverbs form the comparative and superlative by adding *more* and *most.* This is because most adverbs are words with more than one syllable.

loudly _____ more loudly _____ most loudly

carefully _____ more carefully _____ most carefully

Children who go to scholl *most regularly* will not be illiterates.

- Most regularly describes how often those children who learn to read go to school. *Most regularly* is the *superlative.*

Here are some comparisons of adverbs:

Positive	*Comparative*	*Superlative*
clearly	more clearly	most clearly
happy	more happy	most happy
quickly	more quickly	most quickly
fast	faster	fastest
long	longer	longest

Sometimes the same word may be used as an adjective or as an adverb.

e.g. (a) The boat travelled *fast.*

(b) The boat was *fast.*

In sentence (a) the word *fast* is an adverb — it tells us *how the boat travelled* — it answers the question how did the boat travel? It describes the verb *travelling.*

In sentence (b) the word *fast* is an adjective. It answers the question *what kind of boat.* It tells us something about the boat.

- *Adverbs go with verbs to tell us how, when or where an action happens; adjectives go with nouns to describe them.*

EXERCISES

1. Say which adverbs are positive, comparative and superlative.

soon	seldom	easily
happily	freely	latest
long	softly	most clearly

2. Complete these sentences with a suitable adverb:

The girl sang _____

The young man learned _____

Gordon Hamilton paints _____

3. Form adverbs from these words:

faith	happy	sweet	wide
heavy	joy	one	simple

4. Underline the adverbs in these sentences:

Where did you find that knife?

We drove slowly around the airport site.

I did not go to the concert.

5. Say whether the underlined words are adverbs or adjectives.

Diamond is a *hard* substances.

Our farmers work *hard.*

Not *just* another society, but a *just* society.

The doctor is *more* hopeful today.

The Revolution brings *more* benefits to our people.

The iron got *red* hot.

You wore a *red* T-shirt at the rally.

I *still* visit the old lady.

Still waters run deep.

UNIT 11

IN NOBODY'S BACKYARD

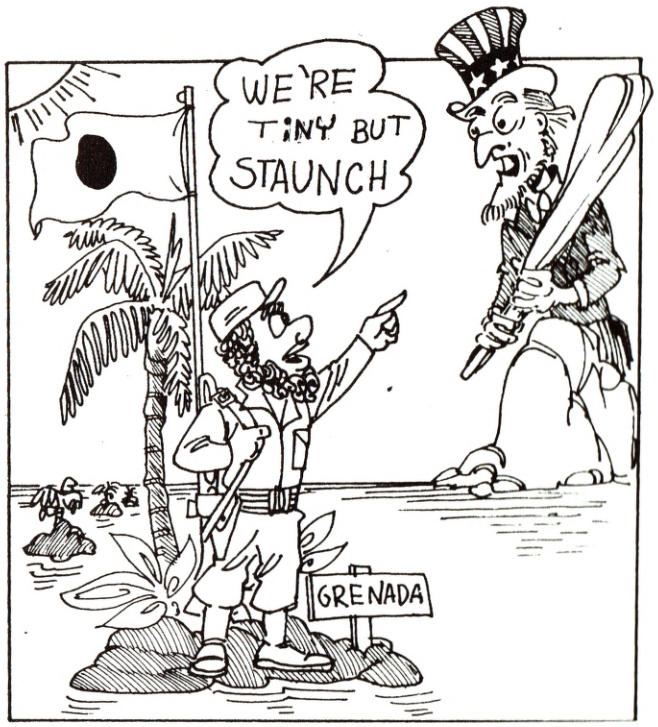
"We are a small country, we are a poor country with a population of largely African descent. We are a part of the exploited Third World and we definitely have a stake in seeking the creation of a New International Economic Order. This would assist in ensuring economic justice for the oppressed and exploited of the world and is ensuring that the resources of the sea are used for the benefit of all the people of the world and not for a tiny minority of profiteers. Our aim therefore is to join all organizations and work with all countries that will help us to become more independent and *more* in control of our own resources. In this regard nobody who understands present day realities can seriously challenge our right to develop working relations with a variety of countries.

Grenada is a sovereign and independent country — although a tiny speck on the world map. We expect all countries to strictly respect our independence just as we will respect theirs. No country has the right to tell us what to do or how to run our country or who to be friendly with. We certainly would not attempt to tell any other country what to do. We are not in anybody's backyard and we are definitely not for sale. Anybody who thinks they can bully us or threaten us, clearly has no understanding, idea or clue as to what material we are made of. They clearly have no idea of the tremendous struggles which our people have fought over the past seven years.

Though small and poor, we are proud and determined. We would sooner give up our lives before we compromise,

sell out or betray our sovereignty, our independence, our integrity, our manhood and the right of our people to national self-determination and social progress."

Comrade Prime Minister Maurice Bishop 13 April, 1979



VOCABULARY

descent - origin

a stake - an interest, something to gain

resources - wealth, riches

profiteers - those whose main interest is to make profits

sovereign - free

COMPREHENSION

1. What do we have to gain from a new International Economic Order?

2. What is our aim?

3. What does our independence mean?

DISCUSSION

This passage from a speech by our Comrade Prime Minister was made one month after the March 13 Revolution. Do you recall the incidents which led to this speech?

Since then many attempts have been made to dictate to Grenada what its policies should be.

GRAMMATICAL PRINCIPLE

Present and Past Continuous Tenses

We *are working* for social progress and economic independence.

I *am joining* in that effort.

In these sentences, the verb is formed by using two words *are* + *working, am* + *joining.* These verbs tells us about an action that is going on (continuous) at this very moment (present).

They are in the *present continuous tense.*

- *The present continuous tense tells us about an action that is going on.*

The people *were fixing* the road.

I *was listening* to the Police Band at the Park.

The verbs *were fixing* and *was listening* tell us about actions which were going on in the past time. They are in the *past continuous tense.*

- *The past continuous tense is used to show that an action was going on (or continuing) at some time in the past.*

To form the past continuous tense we use the past tense of the verb *to be* with the present participle of the verb describing the action.

e.g. were + fixing

was + listening

EXERCISES

1. Change the tense of the verb in these sentences to the present continuous:

We seek the creation of a New International Economic Order.

Harris climbs the tree.

Our people fight great struggles to build a New Grenada.

Many people work at the New International Airport site.

Imperialism tries to turn us back.

2. Change the tense of the verb in these sentences to the past continuous:

They are helping their neighbour to repair her house.

James learns to use modern machines.

The woman are making straw mats and preserves.

The children sang their favourite song at the camp.

The considerate husband helps his wife to do housework.

3. Something is wrong with the verbs in these sentences. Correct them:

We was cleaning the garden.

I making ice-cream for the harvest.

John were looking for you.

They trying to fix the pipe that were leaking.

4. Complete the columns:

Present Tense	Present Continuous	Past Continuous
I give		
You eat		
He saves		
They learn		
She fights		
We build		

UNIT 12

A FRIEND IN NEED

One time a poor hungry man visited two friends Sam and Dell for help. His house was broken down and needed repair, his children needed medical attention and education, himself and his wife needed work.

"All our friends know that things are hard with us", he told his wife "let us ask them to help us so that we can help ourselves". If they only agree to help us then we can buy some tools to plant our garden. With the money that we make we can educate our children so that they can take over the garden and get better crops. We can grow our own food, make fancy dishes with the extra food and sell it to buy what we cannot make for ourselves. As more of our children are able to work the garden, we will be able to gradually build a new house with room for all of us. The more our family works together and produces, the better we can make our life. But to do this we must be able to make a start. We have no money, our house is broken down, our children are hungry and sick.

So he went to the house of the first friend, Sam. He explained the situation to Sam and asked him for help.

"Well", said Sam "although I have a lot of money I will not be able to give you enough right now. I can only lend you some money to-buy galvanise to fix the roof. Maybe later I will be able to lend you money to buy some food from me – my wife makes the best lambie in the village. I could give you credit to buy provisions from my grocery and I could give your children jobs to work my land. But that might be early next year – not now and I cannot sell you the tools that you need. You know I really think that buying those tools will be a waste of money because your land is not very big so it might be better to work for me. I could buy some of your land and pay you a decent salary to work. Maybe I could help you but you must first have nothing to do with Dell. Dell is a waste".

The man returned home empty handed. His wife was disappointed and angry when she heard what had happened.

"I find that Sam well fast to tell us who to friend with. We ask the man for help because he have more money than anybody else and he want to use he money to tell us what to do."

The next morning the man woke up early and went to visit Dell. Once again he explained the situation that he was faced with.

"One thing I can tell you" said Dell "is that it is not going to be so easy to build a new house and to make things better for your family. It is not easy but it is possible. It can only work out if your wife and all your children help because there are many pests in the village that will destroy your crop and things like woodants that will eat away the posts of the house. I don't have much money so I cannot give you money but I can give you some of my tools and send some of my children one or two weekends to help you to clear up your land to plant your garden. Two of my children have studied Agriculture at school so they can help you to plant better. Although I don't have money I can help you to plant better. Although I do what you want to do. I cannot carry your brother, because my legs are not strong enough but I can help you to stand up straight".

"De story doe end and the wire won't bend."

By Didacus Jules

COMPREHENSION

1. What did the poor man want for his family?
2. What kind of help did Sam give him?
3. How did Dell offer to help?
4. Which of the two was a real friend and why?

DISCUSSION

One of the oldest traditions of our people is that of story-telling. We told stories as a means of recreation (ole talk) and also to teach a lesson.

What is the moral of this story? Apply and discuss it.

GRAMMATICAL PRINCIPLE

The Future – continuous tense

Soon, we *shall be exporting* fish.

The verb in this sentence is *shall be exporting.* It tells us what *will be happening* in the future in a continuous way.

"We *will be working* for ourselves and *we will be building* a new life for ourselves", said the poor man.

The verbs *will be working* and *will be building* tell us what will be going on in the future. These verbs are in the *future continuous tense.*

**The future continuous tense is formed by using the simple future tense (shall and will) with be' and a present participle (working and building).*

will + be + working

will + be + building

**The future continuous tense is used to express an action which will happen and continue to happen in the future.*

To ask a question about what will be happening we change around the parts of the verb.

We will be defending this land to the last.

Will we be defending this land to the last?

EXERCISES

1. Give the future continuous tense of these verbs and make sentences using them.

think	work	buy
write	grow	lend

2. Rewrite the following sentences in the future continuous tense:

I will write a letter.

We grow our own food.

He is going to a meeting.

We build a new house with room for all of us.

The rain fell yesterday.

3. Make these sentences asked questions:

I shall be working tomorrow.

You will be walking to town.

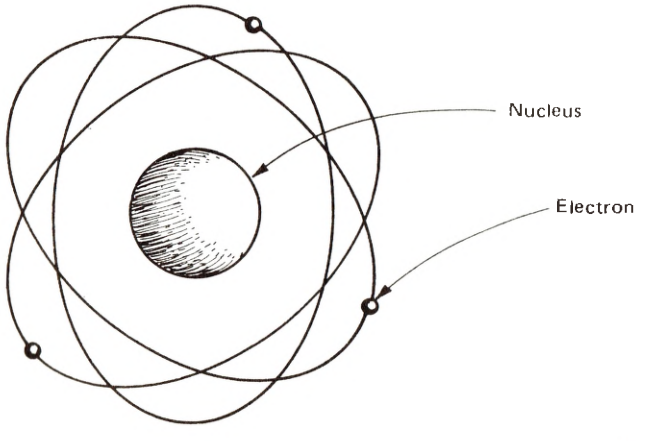
He will be feeling excited.

We will be doing the exam today.

Sam will be helping the poor man.

UNIT 13

ATOMS AND MOLECULES



If you look closely at a block you will notice that it is composed of tiny grains of sand and stone. All of these thousands and thousands of grains of sand are stuck together in the shape of a block.Just as the block is made up of tiny grains of sand, all substances are made up of tiny particles called atoms.

For a long time scientists thought that the *atom* was the smallest particle of matter that could exist. Now they know that the atom itself has many parts. Every atom has a *nucleus* which is like its center. Travelling around the nucleus are smaller particles called *electrons.* An atom with electrons circling its nucleus resembles our solar system with the planets circling the sun.

Atoms form part of the basic units of matter. These basic units which are generally made up of two or more atoms are called *molecules.* Although they are very small, some molecules are big enough to be seen by powerful electronic microscopes.

When we look at a brick it seems solid. If we examine it closer we will see that there are tiny spaces between the grains of sand that it is made of. If we had a powerful enough magnifier we would see that the grains of sand,

like the brick, are made up of even smaller particles with spaces between them, and all molecules are made up of atoms with even smaller spaces between them.

More difficult to believe is the fact that molecules are always in motion. Some kinds of molecules move more rapidly than others. It is possible to speed up the movement of molecules by doing certain things. For example, when water is heated, the activity of the molecules is increased, and as the water reaches boiling point the molecules move rapidly; some of them escape in the air as water vapour. If water vapour is cooled, the movement of the molecules is decreased and the vapour becomes water. The molecules in cold water move very slowly and still slower as water becomes ice.

In cooling we make use of molecular activity when we boil water with sugar to make syrup. If sugar is mixed with cold water only a little sugar will dissolve. The hotter the water becomes the more sugar will be dissolved until it becomes syrup. This happens because heat widens the spaces between water molecules and allows the sugar molecules to fit into them.

When there is a gas leak in a kitchen we are quickly able to detect it because the molecules of gas are very active and spread very rapidly in the air. Cooking gas has no smell, but for safety reasons other substances whose molecules mix easily with it are added to give it an identifiable smell.

It is very important for us to understand what atoms and molecules are, because they are the building blocks of matter. All substances in the universe are constructed from them. Understanding their structure and the laws that govern them, helps us to understand many things that happen around us.

VOCABULARY

atom - the smallest particle of matter

molecule - a larger particle of matter made up of two or more atoms

particle - a tiny piece of something

nucleus - the center or core of the atom

electron - the part of the atom that circles around the nucleus

electronic microscope - a powerful instrument which magnifies things

decreased - slowed down

COMPREHENSION

1. What is an atom and what is it made up of?
2. What is a molecule?
3. Give two important features of molecules.
4. How do these two features explain how water changes from solid to liquid to air?
5. Why should we understand what atoms and molecules are?

GRAMMATICAL PRINCIPLE

The present perfect tense

We have *worked* all day.

We *have read* about atoms and molecules.

In these sentences the verb is made up of two parts: have + a past tense form.

have + worked

have + read

Both verbs tell us about an action that has just finished. *Have worked* and *have read* are in the *present perfect tense.*

- *The present perfect tense tells us about an action that has just finished. We use it when we are thinking more about the present result than about the past action.*
- *The present perfect tense is formed by using has or have and the past participle.*

EXERCISES

1. Underline the verbs in the past perfect tense.

   Scientists have discovered many parts to the atom.

   They thought that the atom was the smallest particle of matter.

   Knowledge of the atom has helped Man.

   One molecule has many atoms.

   The trees have fallen across the road.

2. Add *—ed* to these present participles to form the past participle e.g. laugh-laughed.

climb	call	repeat
jump	move	talk
walk	borrow	compose

3. Study this list. It shows irregular forms of the past participle.

Present	*Past*	*Past Participle*
sink	sank	sunk
become	became	become
give	gave	given
know	knew	known
write	wrote	written
took	take	taken
buy	bought	bought
drink	drank	drunk

4. Make sentences using these verbs in the past perfect tense.

sink	give	discover
become	buy	know
heat	seen	carry

5. Correct the incorrect sentences.

You have wrote to the bank.

He have taken some tickets from me.

Spannertoe has drank a quart of rum at one go.

We has seen the truth.

UNIT 14

SPEECH AND LANGUAGE

Any system of signs by which one is able to communicate is a language. For example, drivers understand the traffic signs which have definite meanings, the hand signals of the traffic police and the signals of other drivers. For seamen, the positioning of ship's flags, and certain flashes of light all convey messages.

But generally when we speak of language we refer to that which human beings use to communicate thought. Human language is a system of material means: sounds, patterns of behaviour, words and regular combinations of these through which men relate and exchange ideas. Because of this, language is a social happening born out of man's need to communicate ideas in the course of his work. Without language, social production and society itself would be impossible.

Language, inseparably tied to thought, registers and puts into words the results of mental work, the advances in knowledge made by man and makes possible the exchange of ideas in human society.

Without language, human thought could neither exist nor develop because it is the substance of thought. It is not possible to separate thought from its expression - language.

In addition to being a social happening, the creation of language is conventional. In other words, language follows regular patterns and rules. A word means something because it is generally agreed that this set of sounds should mean this. For example the word *Grenada* means the island where we live. If it was generally agreed that the word Grenada should refer to a writing instrument, then Grenada would mean "pencil". What makes language acceptable therefore is usage. As more and more people use the word *fret* to mean *annoy*, and as they use it more often, *fret* becomes a conventional part of our language.

Every country or region has its own form of speech; what we call its language or idiom which plays a key role in writing its people. Although there are many different languages, some have a common origin and because of this they share certain similarities. This is the case with Spanish, French, Portuguese, Italian and English which all come from Latin.

Languages which have a common origin form a family of languages. English belongs to the romance language family but this does not mean that all English words are of latin origin. It has many words which come from other languages but is also has many local words and expressions. Everywhere a language is spoken there are words which are peculiar to that area. In our case these words are called Grenadianisms. Some are peculiar to us alone and others are shared with other Caribbean islands.

Here are some Grenadianisms

bashie - a cheap fete
brango - hot news
doundan - a social misfit
drogue - to carry
dudoy - a fool
impute - to give someone a scornful look
locho - a miserly person
masanto - a home made torch
planass - to hit with the flat of a cutlass
saraca - a religious sacrifice
tabanca - a womans hold over a man
tabay - gossip
zagada - ground lizard

VOCABULARY

Communicate - to bring across a message
Social production - the production of goods to meet society's needs
Inseparably - unable to be separated or divided
Conventional - according to customs and rules
Grenadianisms - words used by Grenadians alone

COMPREHENSION

1. What is language?
2. Is there only one type of language?
3. Why is language so important to man?
4. What is a language family?
5. What are Grenadianisms and how do you think they come about?

GRAMMATICAL PRINCIPLE

The past perfect tense

When we *arrived* at the farm, John *had completed* his work already.

In this sentence there are two verbs, *arrived* and *had completed.* The verb *arrived* is the single past tense. The verb *had completed* tells us about *something which happened before* arrival at the farms. This verb is in the *past perfect tense.*

- *The past perfect tense tells us that action took place before another action in the past.*

The past perfect tense is formed just like the *present perfect tense* except that the past tense of the verb *(had)* is used instead of *have* and *has.*

Do you remember?

Present perfect tense = have or has + past participle.

Past perfect tense = had + past participle

had + completed.

EXERCISES

1. Read this short passage and underline the verbs which are in the past perfect:

   The wood cutters went to the forest on Tuesday. Joseph had cleared the path so it was easy for them to find their way. John had cut down the big tree and Peter and Jim had carried the log to the truck. By the time the wood cutters arrived, they had already finished the work.

2. Rewrite these sentences putting the verb in brackets in the past perfect tense:

   He *(gave)* the man the car before he worked on it.

   Andrew (pressed) the button to start the engine.

   The farmer (finished) digging the garden when he planted the seeds.

   I (forgot) about the meeting.

3. Explain the difference between the present perfect tense and the past perfect tense.

4. Give five examples of the past perfect tense and write sentences using them.

UNIT 15

FORWARD MARCH

Rupert marched to Otway House,
Forward march!
Alister marched against oppression,
Forward march!
(Chorus) And now Grenadians caught their vision
End of misery and oppression
so we fill Grenada full with our song
Forward march, forward march
Forward march against Imperialism
Forward march, forward march
Forward march against Imperialism
Marryshow fought for federation
Forward march!
He fought it to the end
Forward march!

We have fought colonialism
Forward march!
We will fight it to the end
Forward march!
Now we the workers fight for justice
Forward march!
In the struggle we are united
Forward march!
And now that we have caught our vision
We'll end corruption and oppression
And we'll build Grenada with these very hands
Forward march, forward march
Forward march against Imperialism

FORWARD!

REVISION EXERCISES

1. Rewrite these sentences choosing the correct pronoun from the brackets.

   (He, him) and (I, me) live together.

   My son is younger than (he, him).

   Was it (she, her) who ran away?

2. Put these words into the right columns:

Verb	Nouns	Pronouns	Adjective	Adverb

ran	seat	sweet	carelessly	whose
cow	stand	who	wet	Pearls
roof	easily	untidy	climb	catch
him	peas	use	happy	smallest

3. Complete these sentences:

   A noun is _____

   A verb is _____

   An adjective _____

   While an adverb _____

   The past perfect tense _____

   The present perfect tense _____

4. Fill in the blanks:

Masculine	*Feminine*
boar	_____
_____	landlady
_____	heroine
Policeman	_____
brother	_____

5. Make all nouns and pronouns plural:

   He gave the mango to the child.

   The woman drove the tractor.

   The worker is building a new house in the parish.

   The Mosquito carries disease.

6. Write sentences using these adjectives:

wooden	heavy	bright
fertile	several	longest
most beautiful	firm	best

7. Give the comparative and superlative of these adjectives.

Positive	*Comparative*	*Superlative*
big		
long		
good		
wise		
calm		
bad		

8. Underline the pronouns in these sentences. From among the pronouns which you have identified say which are interrogative and which are demonstrative.

   This land is our land.

   To whom did he speak?

   What did you receive for it?

   Those mangoes on that tree are green.

   Which do you prefer?

   Marryshow said "it is coming" and this is really it.

9. Fill in the blanks with an adjective or an adverb where necessary and say which are adjectives or adverbs.

   He painted the most _____ pictures.

   The Alister sailed _____.

   The woman stirred the pot with a _____ spoon.

   Rain fell _____ in August.

   Hurricane Allen was the _____ in years.

10. Change these sentences from the present continuous to the past continuous tense.

    People are saying come and see for yourself.

    We are struggling for a cause.

    It is raining so they stayed at home.

    Some people are confused by rumours.

11. Correct these sentences:

    They is playing in the field.

    We was planting corn.

    Our children was running in the rain.

    I is learning in the CPE Adult Education Programme.

    Plenty fish was swimming in the river.

12. With these verbs: sweep, build, bake.

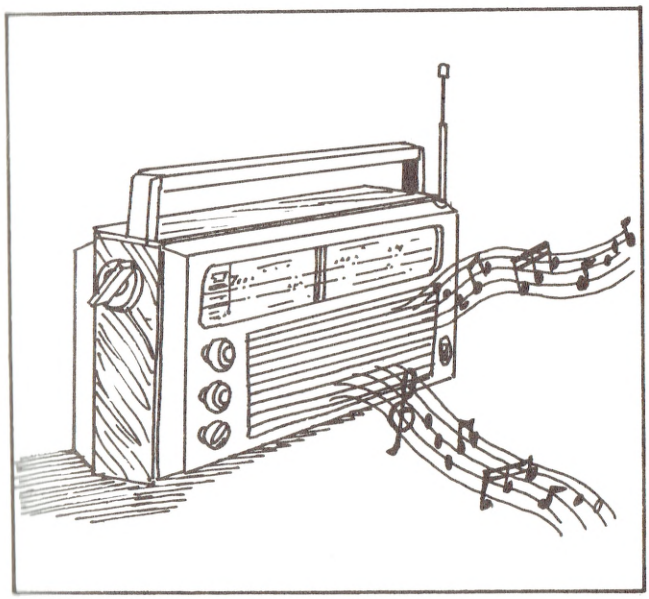
    a) Write three sentences in the future continuous tense.

    b) Write three sentences in the present perfect tense.

    c) Write three sentences in the past perfect tense.

UNIT 16

MUSIC



"Music is a type of feeling, you just can't explain"... Thousands of people throughout the Caribbean were quite hooked on these words of a song by the Gaylords called "Hit me with music." This song expressed the mysterious power of music in our lives. All of us have at some time felt that life would be utterly tasteless without music. People of all cultures and ages have also felt so. In African culture music played an important role. African peoples used the drum in all of their major activities: they worshipped, sang, danced, and worked to the music of the drum. The ancient Greeks believed that their god of music, Apollo, was also the god of cures. This indicates their belief in the curative power of music.

"Music is a type of feeling you just can't explain"... Why has music been such a difficult thing to explain? Why do we need music so badly?

Music has been with man from the earliest times. In recent years radio, television and tape recorders (especially cassette players) have made sounds a background to human life. They have helped to spread music and make it even more popular. Through these modern means the world of music has opened up.

Even though man is unaware of it, his need to listen to music is related to a need for mental relaxation. Feelings of deep upset and anger can be soothed by music. Harsh emotional experiences can be dampened by a favourite song. Sometimes when we are sad, a sad song can have the effect of helping us to overcome that feeling. Such is the magic of music.

Over the last few years, doctors and scientists have been experimenting with the curative power of music and have developed a method of using music, called musical therapy, to help cure certain diseases. It is used to help the mentally disturbed to overcome emotional instability. During a musical therapy session, the patient is played music which sounds like a voice of compassion for his troubles and emotional experiences. This is followed by calm contemplative music to evoke feelings of comfort and peace. The session ends with gentle, lively music.

In everybody's life music has a healthy and stimulating effect on us. It stirs our feelings and changes the complexion of our world. In the words of the poet:

"To an angry man music
could be a tranquilliser
To a man in sorrow music
could be a heart uplifter..."

VOCABULARY

mysterious - unknown

utterly - totally

curative - having the ability to cure or heal

soothed - calmed down

musical therapy - method of using music to cure illness

instability - unsettled

contemplative - reflective

COMPREHENSION

1. How has man considered music?
2. What has helped to spread and popularize music?
3. Why do we need to listen to music?
4. How has music been used to cure illness?

DISCUSSION

Members of the class should give their own opinions on the importance of music in our lives and discuss these:

What is your favourite music?

Why is it your favourite?

GRAMMATICAL PRINCIPLE

Simple and compound sentences

Do you remember

- *A simple sentence makes a single statement. Gives a command or asks a question.*

Music influences our lives - statement

Why do we need music? - question

Hit me with music! - command

} simple sentences

The diver caught the sea eggs *and* his son sold them.

This sentence above is made up of two simple sentences.

The diver caught the sea eggs + his son sold them.

This sentence is a good example of a *compound sentence.*

These two simple sentences are joined together by a conjunction *and.*

- *A compound sentence is one which is made up of two simple sentences or main clauses. They are sometimes joined by a conjunction.*

When we heard the music we began to dance.

This sentence has two parts or clauses.

(1) When we heard the music.

(2) We began to dance.

The first clause *(when we heard the music)* does not make sense by itself. It is a *subordinate clause.* The second or *main clause* does make sense by itself. This sentence is a *complex sentence.*

A *complex sentence* can be converted into a *simple sentence* by changing a subordinate clause into a word or phrase.

e.g. Musical therapy uses music *which* is *gentle and lively.* (complex sentence)

Musical therapy uses gentle and lively music. (simple sentence)

The work brigade stopped work *when the sun set.* (complex sentence)

The work brigade stopped work at sunset. (simple sentence)

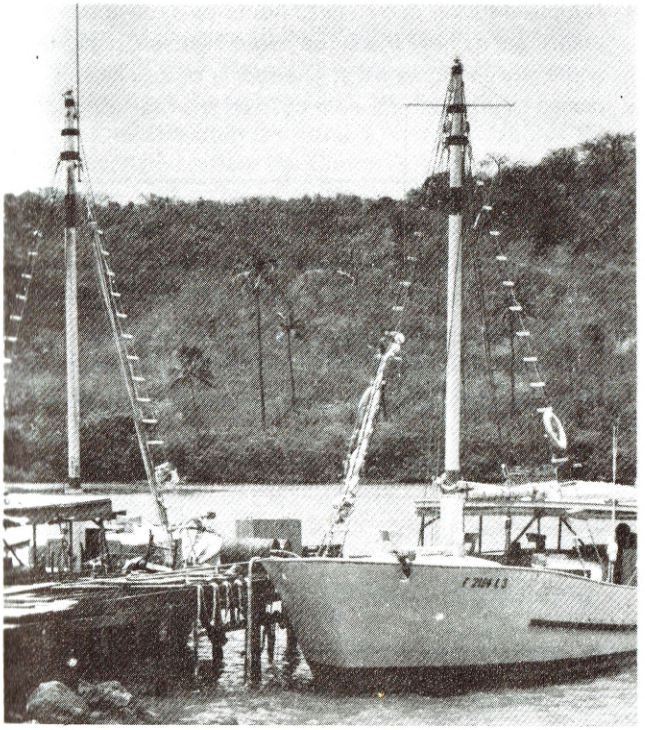
EXERCISES

1. Which of these sentences are simple or compound?
   The influence of music is great.
   Music has been at the heart of every culture.
   We went to the garden but we could not work.
   The Greek god of music was also their god of cures.
   He was an honest man so he brought the bag to the police.

2. Make compound sentences using these conjunctions:
   although but and if because
   as until or

3. Change these complex sentences into simple sentences:
   Musical therapy uses music which is gentle and lively.
   He is a man who is honest.
   Andrew denied that he had seen me.
   I left the farm as the clock struck five.
   We work so that we may live.
   She could not say how old he was.
   The farmer gets out of bed when the sun rises.

SCIENTIFIC FISHING TO BRING MILLIONS



Fisheries has been identified as one of the four main pillars of the economy, and since the revolution of March 13, 1979 increasing attention has been focused on this industry.

At present the country's recorded annual fish catch stands in the region of three million pounds. However, research has shown that the fish catch can be increased by as much as five times. With this abundance of fish in our waters, Grenada still imports over three and a half million dollars worth of fish products every years. The expansion of the fishing industry would therefore mean that less foreign exchange would be leaving the country. In addition, it would help create jobs for thousands of people. This clearly shows that scientific fishing would mean that much more money would remain in the country.

The first step that was taken in the re-organization of the fishing industry was made in the area of training. The students are trained in techniques of modern fishing, captaincy and engineering.

The boats which are used by students who have already graduated can hold about four to five tons of fish and can stay at sea for up to a week.

The fish caught on the boats are used by the fish processing plant. Salt-fish was one of the first products to be produced at the plant. The locally produced salt-fish has proven to be highly successful on the market. The plant also produces a local smoked fish very similar in taste to smoked herring.

Some of the fish is also filletted or cut into blocks and frozen. The filletted fish has proved to be very successful with the hotel industry and restaurants.

In addition to fish, Grenada has been discovered to have a unique and very expensive variety of shrimps. This could bring thousands of dollars to the fishing industry. Sea eggs lambie and lobsters also abound.

Fisheries officals are, however, looking ahead to the future and are already laying down plans for the establishment of a multi-million dollar fishing complex. The complex is expected to consist of a canning factory, ice plant and an animal feed plant. Fisheries officals are confident that in a short while the country will be millions richer from the fishing industry.

VOCABULARY

identified	- spotted, selected
focused	- fixed
foreign exchange	- foreign money
unique	- only of its kind, unusual
expansion	- making larger
techniques	- ways of doing things
abound	- plentiful

COMPREHENSION

1. Name one of the four main pillars of the economy.
2. Name the other three main pillars of the economy.
3. Why should efforts be made to increase the amount of fish being caught?
4. In what areas are students of the fishing school trained?
5. What is done at the processing plant with the fish caught?
6. What can the establishment of a fishing complex do for the economy?

GRAMMATICAL PRINCIPLE

Review -sequencing of paragraphs

Do you remember?

- A paragraph must have a main idea or topic sentence, supporting sentences and a concluding sentence.

In the lesson SCIENTIFIC FISHING TO BRING MILLIONS paragraph one tells of fishing being one of the main pillars of the economy. Paragraph two however tells of the amount of fish caught annually and by how much that catch can be increased. The main idea of paragraph three deals with the first step taken in the re-organization of the fishing industry.

Each paragraph of the reading lesson deals with one main idea. Let us examine the construction of paragraph two: *main idea:* The capacity of fishing in Grenada.

Supporting sentences:
- Our present annual catch of fish.
- Our potential to increase the amount of fish being caught by five times the present catch.
- The amount of money spent on importing fish products every year.
- What we can sabed by expanding our fishing industry.

Concluding sentences:
- This clearly shows that millions of of dollars would remain in the country.

EXERCISES

1. Write a paragraph on a topic of your choice.
2. Read this passage carefully and suggest a title for it.

   A banana sucker or bull head has to be cleaned before planting. The hole should be about eighteen inches deep and eighteen inches wide. The sucker or bull head is placed in the hole and then covered with earth.

Remember: The title tells about the main idea of the passage

3. Write out the supporting sentences of the above paragraph. Can you write a concluding sentence for the above paragraph?

UNIT 18

FOOD PRESERVATION FOR HOME USE

Food must be carefully preserved in order to prevent spoilage. Different types of foods are stored away in different ways.

Foods like cereals, rice, flour, sugar, dry peas, salt and powdered milk are called *dry foods.* Have you ever noticed how salt, for example, becomes soggy if left exposed to the air? Dry foods absorb water from the air, clog and become lumpy. To keep them from getting spoilt, they should be kept in air tight containers. All dry foods should be stored in clean, dry containers with tight-fitting covers. Empty milk tins, jars or biscuit tins are good for this purpose.

Storing food in these containers has another advantage. It prevents flies, cockroaches and mice from interfering with them. These pests often carry disease and it is important to safeguard our food against them.

Fresh fruit and vegetables are *perishable foods.* As the name suggests, they spoil very easily. Some of them can only be stored for a few days. Perishable foods, unlike dry foods, should be stored in cool places where they can receive fresh air. Most fruits and vegetables spoil very quickly when kept for long periods in dark, damp places. Vegetables like lettuce and water cress will last longer if they are placed with their stems in a shallow of water.

Tinned stuff, for example condensed milk, should not be left in the tin-can after opening. It should be emptied into a clean jar covered tightly. Fresh milk lasts longer if it is boiled and cooled before storage. Butter and cheese can be properly stored by placing their container to stand in a shallow dish of cool water or by covering them with a damp cloth (if one end of the cloth is placed in the water, it helps the cloth to remain damp and keeps the cheese or butter cooler). Cheese should not be kept for long periods in sealed plastic bags as it tends to become mouldy. Bread is best stored in an air tight tin or container.

We should always have a reasonable supply of the foods which we use everyday. It is more economical to buy weekly quantities of things like flour, rice, sugar, cooking oil and butter. On the other hand things like salt, baking powder and baking soda should be bought in smaller quantities.

In packing away food stuffs in our cupboard, it is wiser to pack unused food stuff in front of newly bought ones. In this way we make use of older food stuffs first.

Storing and preserving food is an important aspect of saving. The better we are able to preserve food, the more we save and the better we manage our household budget.

VOCABULARY

perishable - easily spoilt
mouldy - covered with mould
economical - cheaper

COMPREHENSION

1. Why should food be carefully preserved?
2. What foods are listed as *dry* foods and why?
3. How do we store dry food?

4. How do we store perishable food? Tinned food?

5. How does our knowledge of dry and perishable food influence our shopping?

DISCUSSION

Members of the class should discuss the idea of food preservation and share their own experiences. How have you been able to make certain foods last longer?

Invite someone from the Food & Nutrition Unit of the Ministry of Health or from the Domestic Arts Institute to run a two day seminar on "food preservation for home use". Invite all interested members of your community.

GRAMMATICAL PRINCIPLE

Composition or essay writing

An essay or composition needs more than a single paragraph.
The essay deals with one main idea and each paragraph deals with some aspect of the main idea.
For an example let us work with this main idea or topic and find sub-ideas for the topic.

Banana day

Main idea: BANANA DAY

Sub ideas:

(1) What happens in the field.

(2) What takes place at the boxing plant.

(3) Unloading bananas and loading the Geest boat.

- It is important before writing the composition to make a plan.

The plan consists of:

(1) Main topic.

(2) The sub topics.

- The sub topics or sub ideas come from the main topic and are expanded to paragraphs.

- Each of the new ideas should be in a new paragraph.

Study the composition below and notice how the sub ideas are linked to the main ideas.

Topic: BANANA DAY

Today is banana day. The ship is awaiting its cargo on the dock. Farmers and workers rise early and set off for the fields.

- The first activity is usually the cutting of dry banana leaves. These are placed on the ground to form a sort of padding on which the bunches of bananas are placed. Then journeying through the fields, the workers examine and cut the stems of banana which are ready for harvesting. Both men and women carry these bunches on their heads or shoulders. They use sponge to prevent the fingers of fruit from being damaged. In some areas trucks are used to transport the bunches to the central spot. At this central spot some farmers dehand their fruits before taking them to the boxing plant. Others transport their stems on carefully padded trucks to the boxing plant.

- At the boxing plant the bananas are dehanded and graded by specialist workers. They are weighed and washed. The head of the hand is sprayed to prevent rotting. Thirty-four to thirty-seven pounds of bananas are placed in each box for shipment. The book-keepers, who work with the plant, keep careful tally of the amount of fruit the farmers deliver.

- The boxes of fruits are loaded on trucks which transport them to the pier. At the pier, the truck-loads of fruit are weighed so that a note can be kept of the number of tons of banana exported. The boxes of fruit are then loaded on the boat.

EXERCISES

(1) (a) Members of the class should suggest topics for writing brief essays.

(b) The class should together choose one topic.

(c) The class should collectively write an essay on the topic which was chosen.

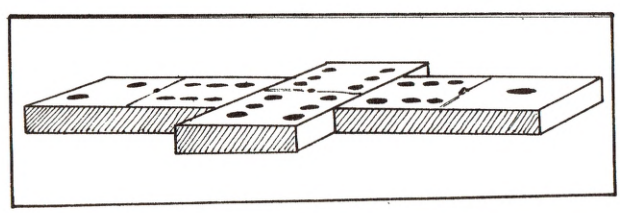
(2) Each member of the class should write an essay on the topic of his or her choice.

UNIT 19

DOMINOES

Everyone finds some way or the other to spend their leisure time. Some people engage in out door sports, others enjoy themselves by playing indoor games.

One indoor game which is widely played and which is becoming very popular locally and regionally, and is even reaching the competitive level, is Dominoes.



The game of Dominoes probably originated in the eighteenth century in Italy. It was then played by two or more people. Today the game is best played with four persons.

The Domino set is made up of twenty-eight pieces. These pieces are rectangle in shape. They are usually painted black, with white dots to denote the value of the Domino. Sometimes it is a white rectangular with black dots. The face of each piece is divided into two squares each of which may have a value ranging anywhere from zero to six. In addition to these pieces with many combinations of value, there are doubles which have the same value on both halves of the face. These are called double two, double five, double six, depending on the dots which appear on each half of the face.

Before the game begins, the Dominoes are placed face down on a table or a flat surface and shuffled. If played with four persons, each player draws seven pieces. The player having double six-the highest piece-poses or plays first in the centre of the table. The next player then attempts to match either end of the Domino which has been placed face up on the table with one of the pieces which he has in his hand.

If the first player plays double six, the next player to the right will have to play a domino with a six. This he places against the six on the table. If the player is unable to match with a domino from his set, he then says the word "pass". Then the next player plays. The game continues in this manner, and a column of Dominoes is extended across the playing table. However when a double is played, it is placed crosswise to the column.

The game is won by the player who has played all of his dominoes first. If the game is blocked, the player with the lowest count value on the dominoes in his hand wins the game. If the player who blocked the game was not aware of it, he loses the game even if he has the lowest count. This is said to be an unconscious block.

To begin a new game, with the same player, the winner of the last game has the opportunity of posing first. He can pose with a double or any other piece. If the game is played with partners, the winner may allow his partner to pose first.

In other countries the game is played differently. For example in some countries the player who finishes first scores the total number of points that appears on the Dominoes which remain in each of his opponents hands. This is repeated until one of the players scores five hundred points. This is usually considered as a game.

In some patois-speaking countries in the Caribbean, as in St. Lucia, a game of Dominoes consists of seven games. Any player who does not win one of the seven games is said to have received a *sapat.*

VOCABULARY

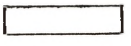
leisure time - spare time

originated - begun

rectangle - a figure with two equal long sides and two equal short sides

combination - unity

unconscious - unaware

 rectangle  square  circle

COMPREHENSION

1. How can one spend his or her leisure time?
2. What do you do with your leisure time?
3. Where did the Domino game originate?
4. What makes up a domino set?
5. How many persons usually play the game?
6. Do you think it's a game which needs lots of concentration? Why?
7. What can happen if one loses his concentration during a game?
8. What is a sapat?

GRAMMATICAL PRINCIPLE

Letter Writing-Review

Grand Roy,
St. John's,
Grenada.
2nd June 1981.

Dear Harry,

We all miss you and we hope that you enjoyed your flight to Trinidad. The weather here has been fairly good even though we are now in the rainy season. How is the weather in Trinidad?

I'm still in the third level of the C.P.E. Adult Education course. I like the mathematics because it makes it easier for me to work out my business. The English is OK. I learn a lot from the reading lessons but I prefer the parts on letter writing and filling in forms.

Things are moving at the factory. We have had some problems but we are struggling to overcome them. We hope to get some new machinery soon.

Gregory is going to America next week to see his aunt Bertie, Selwyn, Merle and Lennox are fine. Then men on the block are planning to start a domino club and the work brigade is having a community block-o next week. Boy you missing all the action!

Everybody says to tell you hello. Love to your family and don't do what I wouldn't do!

Forward Ever,
George.

What kind of letter has George written to Harry?

Observe how George wrote his address. Everytime you

write someone remember to put your address in the top right hand corner. George has also divided his letter into several parts. Each part deals generally with a particular point.

We always end our letters with some form of greeting. In this letter George ends with "Forward Ever"

When writing personal letters we can end with whatever greeting we wish. For example:

Forward Ever	Fraternally
Yours truly	Your friend
Much love	peace
Always	Your loving friend

Other Kinds of letters

Besides the *personal* letter, there are other kinds of letters:

a) *Business or Official letters*

These are letters concerning business of offical matters. They do not contain personal sentiments. These letters are always *formal.* That ia, they deal strictly with the business matter and do not address people personally.

b) *Social note*

This type of letter is slightly different from a personnal letter. It is the kind of letter which is sent to someone who has done us a personnal favour.

c) Other kinds of letters include letters of invitation and thanks, in which we extended an invitation to someone or thank them for something.

Remember

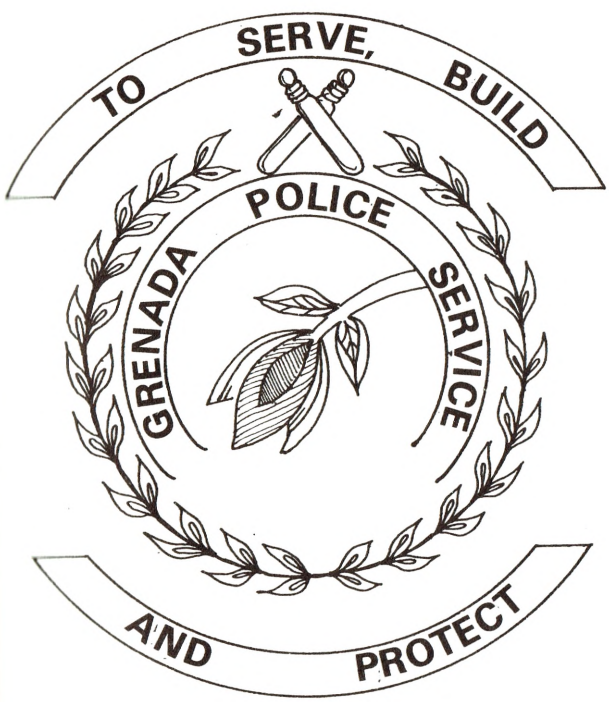
- In a friendly or personal letter, we write as if we are speaking face to face with a friend.

EXERCISES

1. Write three personnal letters to friends of yours.

UNIT 20

A NEW POLICE SERVICE



Centuries of colonialism followed by harsh and dictatorial rule left with the entirely wrong concept of the role of the police in our country. It was a deliberate policy of these sinister forces to keep our policemen and women in a completely ignorant and backward state of mind in which they saw themselves as tough and even brutal protectors of privilege.

Under the old system, it was not surprising to see landowners, businessmen or government officials publicly commit offenses in full view of policemen. They turned deaf ears and blind eyes to these offenses. All such lawbreakers got off completely free. All kinds of injustices were suffered by the people at the hands of a few. The masses therefore saw the police as sectarian, serving the narrow interests of a few.

In the days of the dictatorship, the police played a big part in suppressing the struggle for justice by our workers. All efforts of the people to free themselves of oppression were met with strong opposition by the so called upholders of law and order. Whenever our people demonstrated against oppression, corruption and exploitation, they were brutalized by the police. In the old system the police put cheap promotion ahead of truly serving the people. The people began to see them as enemies. Resentment turned to hate. "Babylon" the police were called with scorn.

In our new, free and revolutionary society, the police are becoming one with the people and the people must see the police service as their own. We must show ourselves

truly as a police *service* and not a force. We must see our role as *To Serve, Build and Protect.* We must understand the great changes taking place in our country and be part of it. We must educate ourselves in the struggle against all types of injustice, backwardness and disease.

The importance of regular and close contact with our people cannot be over emphasized. The masses alone can decide our destiny. We as policemen and women must unite among ourselves so as to inspire unity among all our people.

The economy of our country is very important. We could help the economic position of our country by working very hard ourselves. We must also encourage others to work hard. The more we produce, the more the success of our Revolution would be guaranteed.

We must be ready to march with our patriotic brothers and sisters in defence of our homeland. We must always be ready to safeguard the lives of our leaders. Together with our people, we will build a free and just society. We must create a Grenada which we and all of our children would be proud of.

This essay won a prize in the First Festival of the Revolution national essay competition. It was written by a policeman Comrade Fitzroy Charles of St. Andrew's. What you have read is a shorter version

VOCABULARY

deliberate	- purposeful
sinister	- evil
demonstrated	- marched in protest
corruption	- dishonesty
exploitation	- the act of using people for selfish purposes
brutalized	- ill treated
colonialism	- control of one country by another foreign country
dictatorial	- bossy and overbearing
sectarian	- separate, apart from the people

COMPREHENSION

1. Whose interest did the police protect before the Revolution?

2. What role did the police play in the days of the dictatorship?

3. What is the difference between 'police force' and 'Police Service'?

4. What do you see as the role of the police service in our country?

DISCUSSION

Invite the officer in charge of the nearest police station to speak to the class on the role of the Police Service. The talk should highlight the practical work of the police in the community.

GRAMMATICAL PRINCIPLE

Letter of Application

A letter of application is a form of business letter. It is an official letter that is written when applying for a job, a loan or any other forms of business.

- A business letter contains six parts. They are:

(1) A heading (2) address (3) saluatation
(4) body (5) closing and (6) signature

(HEADING)

Paradise,
St. Andrew's,
July 4th, 1981.

(ADDRESS)

The Manager,
Grenada Development Bank,
St. George's.

Dear Sir, (SALUTATION)

(BODY)

(CLOSING) Yours faithfully

(SIGNATURE) Stephen Francis

Read this letter:

Paradise,
St. Andrew's,
July 4th, 1981.

The Manager,
Grenada Development Bank,
St. George's.

Dear Sir,

I am a small farmer owning three acres of land in St. Andrew's. Over the last two years I was able to bring two acres under cultivation. My output for last year was two thousand pounds of egg plant, one thousand pounds of plantains and one thousand five

hundred pounds of cabbage. In order to expand production I would like to do some investment; I need two cows, some farm implements such as fork, hoe, spade, hose and a small pick-up for transportation of my produce to the marketing board. I would therefore like to apply for loan of $15,000 over the next year for that purpose.

I am prepared to mortage the land as well as half an acre situated behind my house. I will come to St. George's at your convenience in order to discuss the matter in greater detail.

I am looking forward to your co-operation and assistance.

Yours faithfully,
Stephen Francis.

When writing an application:

- The first sentence is important. It should arouse interest and create a good impression on the reader.
- The letter must stick to the subject. Simple and direct language must be used.
- Separate paragraph must be used for each idea.
- The last sentence occupies an important position. It should be clear cut and complete.
- The letter must give the reader a clear idea of who the person applying is, what precisely he wants, and what qualification he has or what he is prepared to do.

EXERCISES

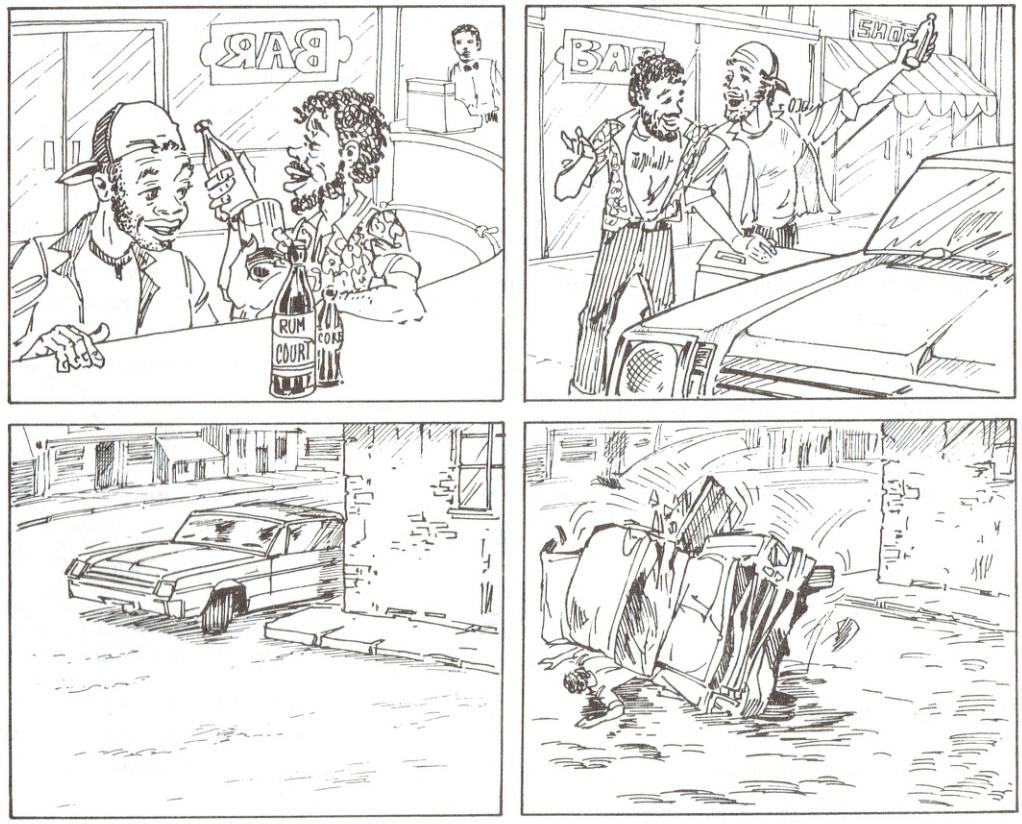
1. Write an application for a housing loan. The letter should be addressed to:

   The Co-ordinator,
   Housing Repair Programme,
   Ministry of Housing,
   St. George's.

2. Write an application to the Grenada Electricity Company asking that electricity be installed in your home.

UNIT 21

THE HABIT OF DRINKING



Although rum drinking usually helps to enliven festive and social occasions, excessive drinking can be harmful both to the individual who overdrinks and to those closely associated with him.

The habit of overdrinking does not begin just like that. It develops over a period of time. Persons who normally fall into this habit usually have no control over the amount of liquor which they consume. According to Sparrow "they never teach them rum control, so put as long dey glass could hold".

Can you think of some of the reasons why so many people become alcoholics?

Sometimes people claim that rum helps them to forget problems which are bothering them. Hence they overdrink in the hope that their problems will be solved or will at least go away. Experience has shown that drunkness does not solve problems but definitely adds new ones.

Have you ever considered the damage caused by habitual overdrinking? Sometimes people who drink excessively suffer from defective organs. The heart and liver are the ones most commonly affected. Most alcoholics eventually suffer from a disease of the liver called sclerosis of the liver. The nervous system is also weakened. Over-drinking affects the physcial appearance of alcoholics. Their skin assume an unhealthy colour and their stomachs become extended. Besides its damage to the body, alcoholism exposes us to serious physcial dangers. Road accidents, walking into objects, and falling in the streets are the common lots of alcoholics.

Overdrinking also has its social effects. The Mighty Sparrow in one of his famous calypsoes, "Drunk and Disorderly" shows us how alcoholism leads to anti-social behaviour.

"Drunk and disorderly,
Always in custody
Me friends and me family
All man fed-up with me."

Excessive rum drinking does not solve any of our problems. It only makes our lives more difficult.

VOCABULARY

enliven	- to make more lively
festive	- time of fete/celebration
alcoholic	- a drunkard, one who cannot stop rum drinking
habitual	- regular
excessively	- more than is necessary
defective	- faulty

COMPREHENSION

1. How does the habit of overdrinking develop?
2. Why do people become alcoholics?
3. What damage does excessive drinking cause?
4. How do you think we can overcome the habit of drinking?

DISCUSSION

Invite a senior nurse, doctor or an officer of Alcoholics Anonymous to speak to the class on "The Habit of Drinking". Every member of the class should bring along members of the community.

The talk should be followed by questions and discussion of the problems which lead to alcoholism.

GRAMMATICAL PRINCIPLE

The Apostrophe: Showing Possession or Ownership

(a) The hat of the man flew across the road.

(b) The man's hat flew across the road.

- *The apostrophe* can be used:

(a) To shorten the form of the sentence.

(b) To show ownership or possession.

In sentence 'b' above the Apostrophe shows possession as well as shortens the sentence.

Here is another example of the use of the Apostrophe:

A drunkard's life is always in danger.

- Nouns which show possession could be written both as singular and plural. For example: The animal's foot was broken. Here the word *animal's* is a singular noun which tells of ownership.

  Here is another example:

  The lady's house was repaired.

  The noun lady's shows possession and it is written in the singular number — it refers to *one* lady.

  Study this sentence:

  The ladies' houses were repaired.

- Nouns which ends in y change the y into *ies,* the apostrophe is then added after the s'. For example:

Singular possessive	*Plural possessive*
lily's	lilies'
try this one: baby's	———

- When the plural does not end with an 's' apostrophe 's is added.

  For example: Woman

  Singular: woman's Plural: women's

  Note carefully where the apostrophe is placed.

- When the plural ends in 's' the apostrophe is added after the s'. In other words it is an s apostrophe. It is expressed like this s'. For example:

The boys' books.

EXERCISES

1. Write these the short way:

   The mast of the ship...
   The problems of the rum drinker.

   The families of the rum drinker.

   The ring which belongs to mother.

2. Change these from singular possessive to plural possessive.

   The drunkard's feet...

   The man's work ...

   The butterfly's wings...

   The cane-cutter's tools...

3. Put the apostrophe in these sentences:

   Have you seen Peters father?

   The fishermens nets were cut by a shark.

   The doctors talk on rum drinking was very interesting.

   Fresh cows milk is good for growing children.

   High winds blew down the farmers crops.

4. Write six sentences of your own using the apostrophe.

UNIT 22

THE WILD PINE

One way in which the problem of unemployment can be eased is by more people trying to become self employed. For this, many areas of work can be gotten into. One of these areas is that of straw craft, which, if developed properly can be very rewarding.

The wild pine is grown in tropical countries. In our country it grows mainly on the eastern coastal areas, while few trees are found in the interior. Besides being used in the straw industry, it is planted in areas where soil erosion takes place. When it is tall enough it could be used as a wind break.

Wild pine is used for making many different things; bags, hats and mats are made from it. This is done in many villages throughout Grenada. It is most commonly done in the villages of Marquis and Soubise in the parish of St. Andrew's. They also export some of their plaited straw to Trinidad.

The preparation of wild pine for use is not a very easy job. The straw has to be cut, boiled, then spread in the sun to be bleached and dried. The prickles are then removed from the length of the pine leaf. The straw is stretched with a knife and rolled around the finger. The cleaned pieces of straw that were rolled are placed in the sun again before they are stripped for plaiting.

Although this industry has been existing in Grenada for a very long time, it took quite a while to develop to what it is today. Presently, there is still plenty of room to improve the industry. Most people who work the straw lack the skill of doing fine and neat products, and as a result they get little reward for their work.

VOCABULARY

extensively	- widely
export	- send to another country
reward	- that which you get for doing something
minimum	- the least amount
existing	- present

COMPREHENSION

1. Where does the Wild Pine grow?

2. What are the main uses of the Wild Pine?

3. Which parts of Grenada are well known for their straw work?

4. Describe the preparation of straw from the Wild Pine.

GRAMMATICAL PRINCIPLE

Possessive Pronouns

Those parcels are *yours: mine* has not yet arrived.

This country of *ours* is very beautiful.

The words *yours, mine* and *ours* in these sentences show possession.

In sentence one the word *yours* shows that the parcel belongs to you.

In the second sentence the word *ours* tells us that the country belongs to us. Those words show ownership.

They are called *Possessive Pronouns.*

Possessive pronouns are words which show ownership. They are the possessive form of Personal Pronouns.

Here is the list of Possessive Pronouns:

Singular	*Plural*
mine	ours
yours	ours
his	theirs
hers	theirs

EXERCISES

1. Underline the Possessive Pronouns in the sentences:

   The straw hats are theirs.

   His mother sells straw hats in the market.

   This umbrella is hers.

   These hats are yours. Ours are sold out.

   Those straw mats are his.

2. Change the singular form of the Possessive Pronouns in each sentence into plural:

   These books are mine.

   Those straw baskets are yours.

   His father helps in community work.

   The paper and pens are all hers.

3. Use these Possessive Pronouns in sentences of your own:

   theirs hers yours his

UNIT 23

SUGAR CANE

Sugar cane belongs to the "grass family"; it is really a big grass. It grows on the flat lands. In Grenada this crop is grown chiefly in the parishes of St. George's and St. Andrew's.

The stem of the sugar cane is jointed and it contains a pith which is full of sweet, sticky juice. The stem of the sugar cane resembles that of the maize or corn.

To get maximum results from the sugar cane the plants must be grown from cuttings. These cuttings are lengths of cane stems with one or more buds and must be strong and healthy looking. They are laid in furrows and covered with earth. As they grow, they form roots and send up more shoots.

Sugar cane usually takes twelve to fourteen months to become ripe. One can tell when the cane is ready for cutting. The stem becomes quite heavy and the skin dry and smooth.

It is important for farmers to watch out for insects and harmful diseases which would attack the sugar cane. The moth borer and weevil borer are especially dangerous. They eat their way into the stems. Other insects suck the juice from the cane and cause black fungus to grow or turn the stem brown and dry. Ants nests near the stool retard the growth of the plant. To protect the crop, farmers should check their plants quite often so that insect pest can be detected early.

The first crop of canes reaped from the nearby plantec cuttings is called "plant canes". They take between twelve to fourteen months to mature. After cutting, the roots are

left in the ground. They are called *stools* and from them new canes will grow. These new cane shoots are called *ratoons.* Ratoons may be reaped up to the end of the fifth year. After this, the crop does not give a good yield so it should be dug and new canes planted.

The sugar cane is bought to the sugar factory where it is crushed and the juice extracted. The cane juice is processed and used to make sugar and rum. The *bagasse* or trash left from the crushed cane can be used as *mulch* for other crops. It also serves as a good cover for the floor of fowl-coops.

Although sugar cane is such an important crop, sugar cane farmers were exploited in the past. Today, with the reorganization of the sugar industry, the interest of cane farmers and workers is better served. Our objective is to improve the sugar industry so that it can easily satisfy the local demand for sugar.

VOCABULARY

furrows - a narrow trench cut with a spade or plough

retard - hold back

detected - to find out, discover

yield - return, profit

harvested - reaped

mulch - half rotten waste used to enrich the soil

COMPREHENSION

1. On what kind of land does sugar cane grow best?
2. To which plant family does sugar can belong?
3. How long does it take for the cane to ripen?
4. What products are made from sugar cane?
5. Which two insects are particularly dangerous to the cane?

GRAMMATICAL PRINCIPLE

Interrogative and demonstrated adjectives

Whose medicine is this?

Which insect eats into the cane stalk?

What business has she?

When the words *whose, which* and *what* preceed a noun, they are called *interrogative adjectives.* They ask us to describe the kind of insect, the type of business and the owner of the medicine.

- *Interrogative adjectives ask questions about the noun.*

e.g. *Whose* banana was it?

Note:

If *what, which* and *whose* are used alone, they are.

Interrogative pronouns:

Whose banana is it? (Interrogative *adjective)*

Whose is it? (Interrogative *pronoun)*

Each ton of cane was crushed at the factory.

Every man pulled his weight.

Either girl was brave enough.

Neither grinder could work.

When the words *each, every, either* and *neither* are followed by a noun, they are called *distributive adjectives.* They point separately to people or things: *each* ton, *every* man, etc.

This cane plant is diseased.

That truck holds five tons of cane.

These people are friendly.

Those children are very active.

The words *this, that, these* and *those* when followed by a noun, are called *demonstrative adjectives.* They point to particular people or things.

Note:

This (singular) and *these* (plural) refer to persons or things which are near.

That (singular) and *those* (plural) refer to persons or things which are some distance away.

EXERCISES

1. Fill in the blanks with an interrogative adjective:

   _____ man won the prize?

   _____ cane farmer grows the most sugar cane?

   _____ building is that?

   _____ reason did she give?

2. Put in an appropriate noun after the interrogative:

   Whose _____ are these?

   Which _____ do you need?

   What _____ did he leave with?

   Which _____ did you help build?

3. Put in the correct *distributive adjective* to complete the sentence:

   _____ athlete must be successful in the race.

   _____ bag contained one pound of milk.

   _____ square inch of land must be made to produce.

4. Write four sentences using interrogative adjectives, distributive and demonstrative adjectives.

LISTENING

Listening is one of the keys to understanding. Each one of us has to listen. Of the four skills, speaking, reading, listenings and writing, *listening* is the one which we use most frequently.

Listening is an art that we all should develop. It is important to listen carefully, thoughtfully and critically. Too often we misinterpret what is heard, especially news from the mass media. This is due to careless thoughtless listening.

Some people listen in a most carefree manner while others just wait for an opportunity to jump in and steal the conversation. Others sit and stare passively. Some try to listen but their attention is easily distracted by other things. On all these occassions the listener loses the trend of thought, catches up on some of the facts and ends up with distorted impressions. Such wrong impressions could be dangerous and vicious. This is because the listener may have lost the key points and so loses the essence of what was said. Careless, carefree listening wastes time as the listener has to make up by always asking the speaker to repeat what was already said.

Have you ever heard some of the backward rumours that circulate in your community? On most occassions they are the result of careless and inattentive listening habits. Just as a traveller can get lost by not listening carefully and following directions so we can also be misled by not listening. We can lose our way, just like the careless traveller and reach the wrong conclusions.

Thoughtful listerners pay careful attention to whatever is said to them. They follow the trend of the speaker and most times paint mental pictures in their mind. This helps them to better understand what is said; it also aids in remembering. They weigh the news to discern facts from fiction. Thoughtful listerners listen with critical ears. Not all that is said is worth believing and remembering but only critical listening will determine that.

Listening to whatever others have to say is also a sign of respect for them. Even if we disagree with what others say we can still learn by listening. Sometimes we find just what we were in search of by listening to the other person's opinion. We should avoid quarrels and quick fights when our opinions differ. Instead we should solve the problem by reasoning carefully. Listening is not only a sign of courtesy but is also a profitable tool and one of the gateways to knowledge.

VOCABULARY

misinterpret	- misunderstand
distorted	- twisted
vicious	- bad, cruel
circulate	- go around
discern	- to make out
fiction	- false story
courtesy	- considerate behaviour

COMPREHENSION

1. What are two disadvantages of not listening carefully?
2. Name two characteristics of careful listening.
3. What is listening?
4. Why should we listen carefully?
5. Why do you think we should listen to each other?

GRAMMATICAL PRINCIPLE

Simple Analysis

The careful listener is a wise person.

In the sentence above, we are speaking about *the careful listener. The careful listener* is called *the subject.*

Is a wise person tells us about the subject. It is called the *predicate.*

In every sentence the subject must agree with the verb.

- A *singular subject* goes with a *singular verb.*

  e.g. The *fisherman catches* lobsters.

- A *plural subject* requires a *plural verb.*

  e.g. People listen attentively at rallies.

Note:

We always use a *singular verb* with *each, anybody, nobody, everybody, everyone, no one, neither, either.*

e.g. *Everyone knows* that a united people cannot be defeated.

EXERCISES

1. Divide these sentences into subject and predicate:

   Listening is an art of concentration.

   We should listen to others.

Rumour and gossip are the enemies of unity and understanding.

Asphalt is used to repair roads.

Fish is a very good source of protein.

2. Add an appropriate predicate to these subjects:

The old man _____.

Listening _____.

A wise man _____.

We _____.

3. Add a subject to these predicates:

_____ got lost on the way.

_____ are grown in the garden.

_____ ran off the slippery road.

_____ pay careful attention to whatever is said to them.

4. Divide these verbs into two columns: Singular and Plural verbs:

does	make	were	are	say
have	sells	was	has	buys

5. Use one of the verbs in brackets to complete the sentence:

Listening to others _____ a sign consideration. (is, are)

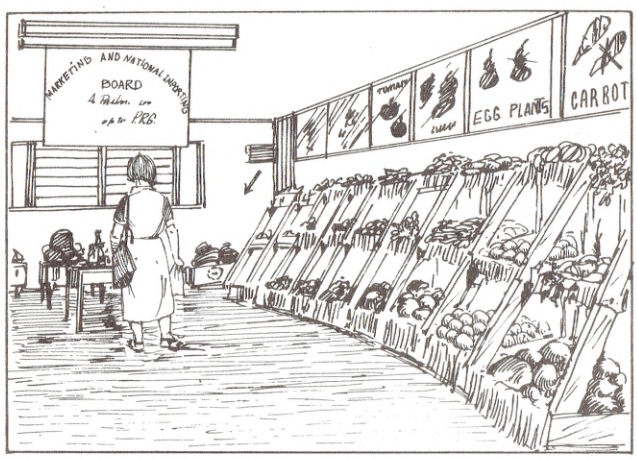
Deaf people _____ not hear at all. (do, does)

My aunt _____ fruits to Trinidad. (sell, sells)

Every child _____ the right to free and full education. (has, have)

UNIT 25

FRUITS AND THEIR USES



In every part of the country there are numerous species of fruits which ripen at different times. Most of these fruits can be used to make juices and preserves. All of them are highly nutritious.

The majority of these fruits are wasted because our people do not make enough use of them. Some people still hold on to the mistaken view that imported foods are better that our local fresh foods.

Let us now a look at some of these fruits with a view to seeing how we can take full use of them.

One of the fruits which is not widely used is the damson. Damson can be made into delicious perserves like stews and jams. Candied damson, like cashew, plums and paw-paw, can be used to replace currants and raisins in cake-making. This greatly reduces the cost of making a fruit cake.

The sticky acid pulp of the tamarind can be used for making jellies. It can also be used to make a refreshing drink. Tamarind balls are made by extracting the pulp and mixing it with sugar and a pinch of ground pepper. Tamarind pulp is also used for making chutney.

The white cottony pulp of the sour-sop can be used to make a tasty sour-sop drink. The juice has to be extracted from the pulp. Pouring hot water over the sour-sop pulp makes the extraction of the juice easier. Sugar and milk can then be added. Sour-sop juice makes a delicious ice cream. Flavours like lime peel or vanilla can be added if so desired.

Guavas which are allowed to rot can be used to make a very delicious drink. Guavas also make delicious and appetising wine, nectars and cheese. It is a very good source of iron.

Red cherries are rich in vitamin A. They can be used to prepare a refreshing cherry drink. Cherry wine and jam can also be made from cherries. Like cherries, citrus fruits make vitamin rich drinks. The skin of the citrus can be made into marmalade and candied peel.

Other fruits like mangoes, golden-apples, bananas and cashew are all useful. Ripe banana makes a delicious fruit salad. It can be used for making ice cream and banana cakes. All these fruits can be used in the preparation of drinks, stews and jams.

It is important that we use fruits in our daily diet. We have them in our backyard, let us make use of our fresh fruits.

VOCABULARY

numerous - several, many
species - different kinds
extracting - drawing out
imported - bought from overseas
delicious - tasty
pulp - fleshy inside of a fruit

COMPREHENSION

1. Why should we use local fruits instead of imported ones?
2. Which fruits can replace currants, raising and prunes in cake-making?
3. What important nutrients do we get from fruits?
4. Can you list other fruits and their uses?

DISCUSSION

Invite a home economics teacher, an officer of the Domestic Arts Institute or someone from the community who knows how to preserve local fruits to give a demonstration or a talk.

GRAMMATICAL PRINCIPLE

Contractions

- *Contractions are shorter ways of writing or saving things.*

We tend to use many contractions in our everyday speech.

The short way of writing *has not* is *hasn't.*

The short way of writing *you will* is *you'll.*
The apostrophe (') shows that a word has been shortened.
Common Contractions

I am I'm	You are You're	He is He's	We are We're	They are They're
I have I've	You have You've	We have We've	They have They've	

We also use contractions for negatives:

do not - don't
does not - doesn't
have not - haven't
has not - hasn't

EXERCISES

1. Rewrite these sentences using the shorter forms (Contractions) of *do not* or *does not.*

   She does not like to drive in heavy traffic.

   We do not make enough use of local fruits.

   Anna does not like to waste time.

   They do not want to see us live united.

2. Write the contractions for the following:

they are	he has	cannot
you have	they will	have not
he is	do not	she has
I will	was not	does not

3. Write sentences using the contractions from Exercises 2.

UNIT 26

LANDSLIDES & EROSION

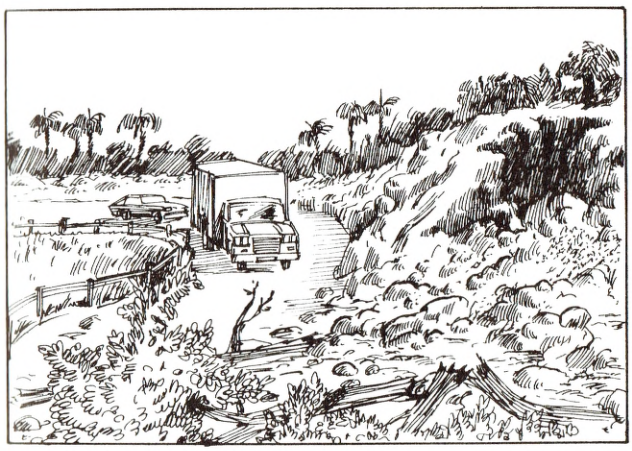
A *landslide* is the shifting of lands from one area to another. These take place especially on mountain sides and on hillslopes. A landslide is caused by rain and running water. The amount of water in the soil increases the weight of the soil or the rock which holds the water. The soil becomes saturated and over-weight. Because of this, huge mass of top soil slides down the slope.

Landslides are most prevalent where there is an underlying layer of clay, which when moist, provides a smooth surface over which the mass of surface soil can move easily.

In the Grand Etang, St. Andrew's, and in the Mabouyah in St. John's there are typical areas of severe landslides. In the former, where the soil is clayey, areas of cultivated lands move to lower regions, mainly the public roads. In the latter, tons of rocks collapse from higher slopes and tumble to the lower grounds, often blocking the roadside.

Landslides cause much damage to the farmer's crops and so help to weaken the economy. Sometimes high areas of cultivated lands let loose, carrying with them fallen trees and cultivated crops like banana, cocoa,

nutmeg, dasheen, tannias and fruit trees. This of course is a total loss to the farmers and to Grenada generally.



Landslides affect other areas of the economy. Blocked roads have to be cleared. Telephone and electrical poles which are damaged by fallen trees and moving soil have to be replaced. Roads which are broken or washed away have to be rebuilt. Damaged buildings including homes have to be relocated. Lives lost cannot be replaced. Money spent to replace some of these areas could have been used for further economic development of the country.

Erosion is the washing away of top soil by the agents of weathering. The chief agents of erosion are the sun, the wind, rain, frost, running water, moving ice and the sea. In the West Indies and in Grenada in particular, the two which are not present are frost and moving ice. The three which are most destructive are rain, running water and the sea.

Heavy rains have a powerful action in loosening and carrying away top soil. Flood water which flows through cultivated areas washes away fertile top soil, fertilizers and crops. The rough sea which pounds on our costal areas hurls a great mass of water against the shore and washes away the soft parts. The harder parts are left bare as headlands, capes, or caves in the rocks.

Some forms of erosion could be checked. In some, terraces could be built. In other areas drains could be dug across the slopes to carry away the running water. Hill grass like bamboo could also be planted.

VOCABULARY

prevalent - common
saturated - full
severe - terrible
relocated - replaced in other areas
costal areas - land near to the sea
capes - lands which jut out into the sea
terraces - steps made from soil

COMPREHENSION

1. What is landslides?
2. Name two agents which cause landslides.
3. Why are landslides common in areas of clayey soil?
4. List an area in your village where landslides occur?
5. Can you trace the reason for landslides in your area?
6. How can landslides and erosion affect the economy?
7. Which two agents of erosion are most common in Grenada?
8. Can you suggest other means which can be used to check erosion?

DISCUSSION

Discuss other areas where landslides and erosion occur. Try to find out the causes. An officer from the Soil Preservation Unit of the Ministry of Agriculture should be contacted to discuss the topic further. The class should arrange for a member to check out the officer.

GRAMMATICAL PRINCIPLE

Formation of opposite by

(a) Adding a prefix.

(b) Substituting *less* for *full.*

Study these sets of opposites:

Set A	Set B	Set C	Set D
correct	healthy	possible	comfort
*in*correct	*un*healthy	*im*possible	*dis*comfort

Some words form their opposite by adding a syllable to the root word, for example - true - *un*true.

- The syllable *un* is called a prefix.
- A prefix is a syllable which comes before the root word.

It gives the opposite meaning of the root word. For example: agree - disagree.

Other prefixes are il, ir, non.

For example:

regular	legal	sense
*ir*regular	*il*legal	*non*sense

EXERCISES

Write the opposite of: visible

true

pure

advise

literate

advantage

relevant

Study this set of opposites:

careful	fruitful
careless	fruitless

Some words form their opposite by a change of the suffix. For example: care*ful* care*less.*

Ful and *less* are opposite suffixes.

- A suffix is a syllable at the end of the root word. For example: hope*ful* and hope*less.*

EXERCISES

1. Write the opposite of:

   useful, thankful, powerful, pitiful, harmful, restful, doubtful.

2. Write the root words from these words:

   untidy, insufficient, immovable, irresponsible dishonest, skilled.

3. Write the opposite of these words:

   cultivate, polite, pure, wise, secure

4. Change the underlined words in the sentences to the opposite:

   (a) Severe toothache caused Richard to have a *restful* night.

   (b) Heavy rains have a *powerless* action in loosening and carrying away top soil.

   (c) Farmers are *satisfied* with the price they receive for their bananas.

   (d) Many forms of erosion are *checked.*

   (e) We produce *sufficient* amount of sugar.

UNIT 27

FREEDOM MARCH

From early dawn they gathered in hundreds at Leapers Hill in Sauteurs, the site from where the Caribs leapt to their death over the cliffs. These early inhabitants chose death instead of slavery under the French colonists. At 5 a.m. on the morning of February 7th 1980 the hundreds of Grenadians gathered at Leapers Hill divided into two groups and began the first Freedom March in the history of Grenada.

They marched on both sides of the island - on the east and on the west all heading for the same spot. Their destination was Freedom Hill the historic place 30 miles away from which the attack against the forces of oppression was launched. As they walked from village to village, town to town more sisters and brothers joined in. They were thousands strong. Some were chanting and singing, others were clapping. The old as well as young were determined to reach Freedom Hill. All along the route, people lined the road. Those who did not march shouted encouragement, some provided cold drinks and fruits.

By two in the afternoon, the Freedom walkers approached True Blue in South St. George's and began to climb Freedom Hill. Even though tired from the long walk the vast majority made the climb. On the hill top, the Freedom flag (the red circle on a white background) was hoisted. Six shots rang out among the silent hills: One shot for each year of independence. Then the leadership of our country addressed the thousands of marchers.

History, they said, was the long, brave and difficult road from Leapers Hill to Freedom Hill. This hard road was more than 30 miles long. Between Leapers Hill and Freedom Hill lay hundreds of years of pain and struggle. From 1651 to March 13, 1979 was a long struggle for freedom. From Leapers Hill to Freedom Hill was a march which everyone made. A few got tired on the way, one or two dropped out but the great majority made it to the top of Freedom Hill. The road was long and hard, some travelled by the East, some travelled by the West but the destination was the same. Whichever the road, there are no short cuts to freedom.

VOCABULARY

inhabitants - residents, occupiers

destination - objective, the end of the journey

route - way, the road travelled

addressed - spoke to

COMPREHENSION

1. Where is Leapers Hill?
2. Why was the march arranged?
3. On what date did the march take place?
4. Where did the march end?
5. What did those people who do not march do?

6. Did everybody who begin the walk get to Freedom Hill?

7. Can you suggest another way of celebrating our victory over the oppressor?

GRAMMATICAL PRINCIPLE

Word Usage: (prepositions and adverbs)

Do you remember? ➤ • A preposition is ___

_____.

An adverb is _____.

A. Come *over* and help us to clean up the drains.

B. The ball went *over* the wall.

Note in both sentences the word *over* is used.

- In sentence A the word *over* is an *adverb.* It suggests a place.
- In sentence B the word *over* is a *preposition.* It shows the relation between the noun *ball* and the *noun* wall.

Some prepositions are commonly misused. Here is a list of some of them:

agree to (something)
agree with (somebody)
different from
disappointed in (something)
disappointed with (somebody)
divide among (many persons)
divide between (two persons)
tired of (something)
tired from (doing something)
vexed at (something)
vexed with (somebody)

EXERCISES

1. Use each of these words in a sentence as:

   (a) Preposition (b) Adverb

   around up off far immediately over

2. State whether the words underlined in the sentences are Prepositions or Adverbs:

   They came here *before.*

   They stood *before* the building.

   The cricketers ran *around* the wickets.

   Why are you running *around?*

   Look *down:*

   The carpenter climbed *down* the ladder.

   Why did they start so *near?*

   The "Edith M" sailed *near* the rocks.

3. Fill in the blank with an appropriate preposition:

   People walked _____ the coast on the Freedom March.

   The Caribs leapt _____ Leapers Hill.

   Many years of history lie _____ Leapers Hill and Freedom Hill.

   He rested the hoe _____ the wall.

   All patriotic Grenadians are proud _____ their country.

4. Write five sentences using prepositions which are commonly misused.

UNIT 28

ALWAYS ON THE ROAD

Grenada, Grenada you will shine,
Because your sons and daughters willingly toil,
With spades and tramp, shovels and brooms,
Your infrastructure we'll improve.

On every street and corner, highway and byway,
We display our ability day after day,
Sweeping and burning, trimming and digging,
Free Grenada your roads are improving.

Potholes and bridges we repair,
Landslides we remove and they soon disappear,
Rainy or sunny, stormy or windy,
We ensure that the culverts are free.

There is dignity in labour which can't be suppressed,
Grenada must never be kept in a mess,
Together we will work, we'll use every means,
To ensure that Grenada always remain clean.

Road workers are important to our economy,
Good roads help to develop our country,
At all times do your duties responsibly,
Remember workers are open to public scrutiny.

By Alice Mitchell

VOCABULARY

infrastructure - system of roads, bridges, etc.

culvert - a concrete drain used in road construction

scrutiny - examination

Poetry is something which comes from deep feeling and experience. To fully understand a poem we must share the experience from which it comes

Join the work brigade in your community and participate in the repair of bad roads in your community

GRAMMATICAL PRINCIPLE

Rhyming words

- day, way
- repair, disappear
- mean, clean
- mess, suppressed

The pairs of words above sound alike - they rhyme.

Day sounds like *way*.

Repair sounds like *disappear*.

We are very familiar with rhyming words and rhymes from our childhood. Rhyming words helps to give poetry its beat. Read this section of a poem called TAKEOVER written by Renalph Gebon.

Bun jay,
All you doh hear,
Revolution on the air
True blue gone,
Guana on de run,
Not a shot,
De radio station gone,
They hold big shot
They take ah lot...

Which are the rhyming words? They help to add life to the poem and give the poem its beat.

EXERCISES

1. Fit these rhyming words in their correct places in the poem below:

house	see	stupidee	spade	chores
mouse	be	me	trade	indoors

Looking at me you go say I _____ .

But doe blame me is so me husband have _____.

He keep me in the _____.

Ah turn real church _____ .

Scrubbing, baking, cooking, doing all house _____ .

He say is better if I stay _____ .

Women, open you eyes wide enough to _____ .

Inside the house is not the only place to _____ .

Take up you fork, you hammer, you _____ .

Is not man alone dat could work _____ .

Drive you tractor bus and truck.

Show them you could do what they call hard work.

From: A WOMANS STRUGGLE
By Merle Clarke

2. Write three words which rhyme with each of these words words:

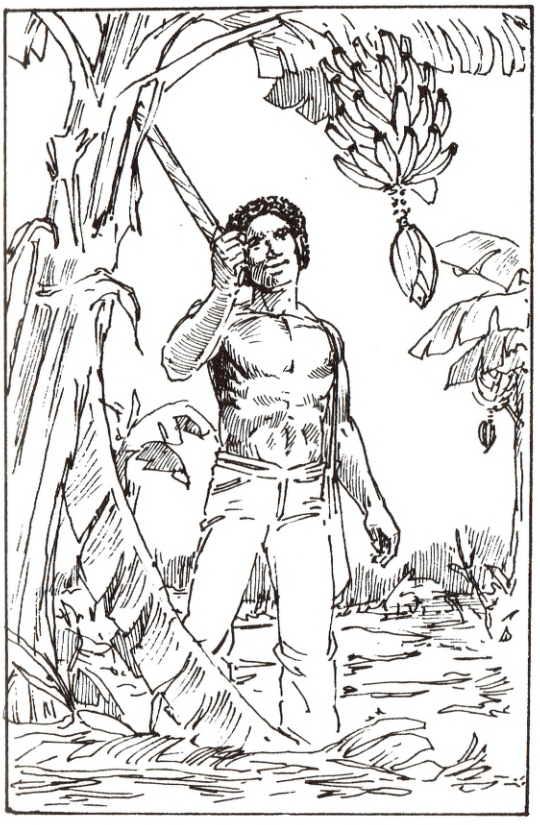
LATE	F _____	CR _____	_____
RAIN	P _____	CH _____	_____
SEE	B _____	FR _____	_____
MAN	V _____	P _____	_____
ROAD	L _____	B _____	_____

Note:

Rhyming words are NOT always spelt alike. They sound alike.

3. Try writing a poem on a topic of your choice.

AGRICULTURAL WORKERS: KEY TO MORE PRODUCTION



Every year since March 13, emphasis has been placed on greater production. 1980 was called the "Year of Education and Production". 1981 was called "Year of Agriculture and Agro-Industries". Every year, one of our main tasks must always be to increase production because it is only by producing more that our country can earn the money it needs to build itself.

Since Agriculture is the main pillar of the economy, an increase in agricultural production would benefit the whole country. The greater part of the money which we use to buy things that we need from abroad comes from the sale of our agricultural products. In 1979 for example Grenada's three main export crops, cocoa, bananas and nutmegs brought in fiftyseven million dollars.

The success of the drive to increase agricultural production depends largely on the farmers and agricultural workers. "Grow more food, build the Revolution" would mean nothing without the Co-operative effort of the farmers and agricultural workers. While we have always known that agriculture forms the backbone of our economy, we have not always recognised agricultural workers to be the salt of our earth. Historically agricultural workers have been treated with contempt, even though they have made such a vital contribution to the economy.

After the Revolution several efforts have been made to better the conditions of agricultural workers. The Agricultural and General Workers Union (AGWU) was formed, full trade union rights were restored and equal pay for equal work was established. The right of equal pay for equal work was especially important since the majority of agricultural workers are women. A farm-training school - Mirabeau Agricultural School - was re-established to train youths in the principles of scientific farming. Together with the efforts of NACDA, more young people are getting involved in agricultural production. This is important for the future of agriculture because in 1979, the average age of farmers was 62 years.

In addition to the work of their union AGWU, new programmes have been started to bring benefits to agricultural workers. Direct benefits for their labour comes from the profit sharing scheme *on Government farms.* In this scheme workers receive a third of the profits made by the farm during the year. They also benefit from the house repair programme, the milk distribution programme, the CPE Adult Education and free medical attention. As part of the effort to gain greater respect for the contribution of agricultural workers, "Worker of the month" awards are given to the most outstanding workers on each estate. Every year one of the best workers is given the Worker of the Year Award.

Agricultural workers are the key to greater production and the builders of the pillars of our economy.

VOCABULARY

emphasis - stress, importance

contempt - scorn

co-operative - joint

COMPREHENSION

1. Why is "greater production" a main task of the Revolution?
2. What is the main pillar of the economy?
3. Who determines the success of the drive for increased production?
4. Do you think that agricultural workers should share in the profits made by the farms? Why?
5. How can trade unions benefit workers?
6. What benefits do agricultural workers get?

DISCUSSION

Any member of the class who is an agricultural worker or small farmer should give a talk to the class on *The role of agricultural workers and farmers in building production.*

An officer of AGMU (Agricultural and General Workers Union) or PFU (Productive Farmers Union) should be invited to speak also on *The role of agricultural workers and farmers in society.*

A third activity is for the class to organize a social evening with a group of farmers or agricultural workers from the community and to discuss their conditions of work, role in the society, etc.

GRAMMATICAL PRINCIPLES

Punctuation - Colon (:) - Semi Colon (;)

- The colon (:) is used after the salutation of a business letter.

  Example: Dear Mr. Noel:

- The colon is used to introduce a long list of items or a long or formal quotation or statement.

  Example (i): Garden tools must consist of the following: spade, cutlass, hoe and fork.

  Example (ii): This is the most important sentence of a speech made by the Prime Minister at a rally: 'A conscious, organised, vigilant and united people can never be defeated'.

- The *semi-colon* (;) is used between two parts of a sentence which can stand on their own but are not joined by a conjunction.

  Example: There are many historical sites in Grenada; they are in different parts of the country.

  The *semi-colon* is used to separate parts of a sentence when they have comas within themselves.

  Example: In the harbour there are many types of boats; yachts, schooners, motor vessels, steamships and cruise ships.

EXERCISES

1. The colon is used to _____

   _____

2. The semi-colon is used to _____

   _____

3. Punctuate these sentences, using the colon or semicolon where necessary:

   Viv Richard hit the ball through the covers it was lost in the mango trees.

   Brother Lou grows several cash crops on his land egg plant, tomatoes, lettuce, passion-fruit and tamarind.

   Do not delay buy airport bonds today.

   Concentration is important if you don't concentrate, you don't learn easily.

   Grenada has six parishes St. George's, St. Andrew's, St. David's, St. Mark's, St. Patrick's, St. John's.

   If you know teach if you don't learn.

   Every worker a student every student a worker.

UNIT 30

MALNUTRITION

When a child does not get enough of the right food to eat the child may become malnourished. There are two types of malnourishment. One is known as *Marasmus* and the other as *Kwashiorkor.*

The child who suffers from *Marasmus* does not get enough to eat. He gets extremely thin and loses Weight. After some time there is very little flesh left on the body and the skin becomes shrivelled and dry.

The child who suffers from *Kwashiorkor* gets enough food to fill his stomach *but the kind of food which he eats is not* nourishing. Children suffering from *Kwashiorkor* gets enough food to eat but this food is the wrong kind. These children appear to be fat and plump but in reality, their limbs are puffy. In some cases, the childs' hair turns red and may drop off. Lips get red and blistered, the stomach is swollen. The eyes get puffy and the child catches other diseases easily because of the weakened condition of its body.

Grown ups can also suffer from malnutrition. In the case of children, malnutrition can cause more permanent damage since it affects the childs' growth and development.

It is important not only to eat enough but to also eat the right foods. We need a *balanced diet* which provides us with enough protein and vitamins. We get proteins from fish, beans, peas, nuts, milk, and eggs. Fresh fruits and vegetables such as callaloo, spinach, carrots and pumpkin provide vitamins and minerals. Our daily meals should have a balanced proportion of these foods - this is the best safeguard against malnutrition and ill-health.

VOCABULARY

extremely - very

shrivelled - wrinkled

permanent - lasting

proportion - share

COMPREHENSION

1. What are the two types of malnutrition?
2. What are the signs of each type of malnutrition?
3. What should be done to prevent malnutrition?

DISCUSSION

Invite the community nurse or someone from the Food and Nutrition Council to speak on malnutrition.

CONSOLIDATORY EXERCISES

1. Punctuate the following sentences:

   do you know why im here

   we get proteins from meat fish peas and eggs

   join the militia defend this country

   woy watch fish

   please come to check us next week said joseph

2. Give complete answers to these questions:

   What is your name?

   Where do you live?

   How old are you and what is your date of birth?

   Where do you work?

   What is your occupation?

3. Fill in the blanks with the appropriate word:

   sewing their here

   sowing there hair

   The farmer is on the land _____ tomatoes seeds.

   The tailor was _____ a new shirt jac.

   I heard about the Agro-industrial factory so I went _____ .

   The people of Grenada are ready to defend _____ dignity and country.

   The rastas have uncut _____ .

   We always tell tourists to come _____ and see for themselves.

4. Read and discuss the front page article in the latest issue of the Free West Indian.

5. From that same article extract all the nouns, verbs and pronouns. Place them in columns like this

NOUNS	VERBS	PRONOUNS

6. From the column of verbs, say what are the tenses of the verbs.
7. Use a dictionary to find the meaning of strange words.
8. Write a personal letter to another member of the class.
9. Write a letter to the C.P.E. giving your opinions, criticisms and suggestions for improving the adult education programme.

   Address your letter to:

   C.P.E.
   Ministry of Education
   St. George's.

10. What are your three main interests?

    Write a one page essay on the main interest.

Mathematics

UNIT 1

MORE ON LONG DIVISION AND NUMBERS

INTRODUCTION

By now we should be able to handle natural numbers and the four basic operations of addition, multiplication, subtraction and division easily. We still have a little more work to do on long division. We are going to do that in this section. Most of the work we are going to do here in Book 3 # would be just developing and deepening the ideas and knowledge we gained in Book 2 #.

REVIEW

It is important that we revise some of the important things we learned in Books 1 and 2 before moving on.

The number 4 672 can be written as sums:

$$4\,672 = 4\,000 + 600 + 70 + 2$$

It can also be written as sums of products:

$$4\,672 = (4 \times 1\,000) + (6 \times 100) + (7 \times 10) + (2 \times 1)$$

We can use powers of 10 instead of 1 000, 100 and 10.

so $4\,672 = (4 \times 10^3) + (6 \times 10^2) + (7 \times 10) + (2 \times 1)$.

EXERCISE-A-REVIEW

1. Let us write these numbers as sums:

   (a) 67 341 (b) 5 201

2. Let us write these numbers as sums of products:

   (a) 7 743 (b) 2 991

3. Let us write these numbers as sums of products using powers:

   (a) 16 080 (b) 24,834 721 (c) 2 734 200

4. Let us continue this exercise by filling in the correct values in the blank spaces:

$10^5 = 10 \times 10 \times 10 \times 10 \times 10 = 100\,000$

$10^4 =$ _____ = _____

$10^3 =$ _____ = _____

$10^2 =$ _____ = _____

$10^6 =$ _____ = _____

$10^7 =$ _____ = _____

$10^8 =$ _____ = _____

$10^9 =$ _____ = _____

- We learned a little about multiples and factors:

$$a \times b = c$$

Here a and b are factors and c is the multiple. c is a multiple of a as well it is a multiple of b.

5. Let us write down 5 multiples of the following:

(a) 10^3 (b) 100 (c) 10^4

In Book 2 we looked at each operation and examined each one for commutativity, associativity and distributivity.

The chart is a reminder of how these laws apply to each operation. Study the chart again and then do the exercise below:

Operations	Commutative	Associative	Distributive	Identity
Addition	Yes $a + b = b + a$	Yes $(a + b) + c =$ $= a + (b + c)$	NO $a + (b + c) \neq (a + b)$ $+ (a + c)$	0
Multiplication	Yes $axb = bxa$	Yes $(axb)xc =$ $= ax(bxc)$	Yes $ax(b + c) =$ $= (axb) + (axc)$ $ax(b - c) =$ $= (axb) - (axc)$	1
Subtraction	NO $a - b \neq b - a$	NO $(a - b) - c \neq$ $\neq a - (b - c)$	NO $a - (b - c) \neq$ $\neq (a - b) - (a - c)$	0
Division	NO $a \div b \neq b \div a$	NO $(a \div b) \div c \neq$ $\neq a \div (b \div c)$	Yes (over its dividend) $(a + b) \div c =$ $= (a \div c) + (b \div c)$	1

6. Let us say which of these statements are true and which are false, by writing T or F in the spaces:

(a) $6 + 4 = 4 + 6$ _____

(b) $(3 + 2) + 1 \neq 3 + (2 + 1)$ _____

(c) $7 - 1 = 1 - 7$ _____

(d) $7 - (3 - 1) \neq (7 - 3) - 1$ _____

(e) $14 \times 2 = 2 \times 14$ _____

(f) $(12 \times 3) \times 2 \neq 12 \times (3 \times 2)$ _____

(g) $16 \div 4 = 4 \div 16$ _____

(h) $3 \times (2 + 4) \neq (3 \times 2) + (3 \times 4)$ _____

7. Let us do these calculations:

(a) 116 x 24 (b) 1 824 + 3 468 + 2 400

(c) 34 672 x 431 (d) 70 704 x 29 (e) 4 827 ÷ 48

(f) 3 401 ÷ 27 (g) 9 438 ÷ 38

MORE LONG DIVISION

In Book 2 # we learned to handle divisions with 2 digit divisors e.g. 6 432 ÷ 64. We followed some definite steps in our calculation. Let us go through these steps again to ensure that we understand them.

Steps:

(1) Mark off the first 2 digits of the dividend.

```
      100
64 ) 6432
     -64
      032
```

(2) Looking at the first digit of the dividend and divisor we divide: 6 ÷ 6 = 1.

(3) Use 1 in the quotient and subtract.

(4) Carry down the 3 tens.

(5) We cannot divide so we put 0 in the quotient and carry down 2 units. We still cannot divide, so we put another 0 in the quotient. Our answer is then 100 R 32.

These same steps are followed when dividing by 3 digit divisors. For example: 64 233 ÷ 321

Steps:

(1) This time we mark off 3 digits of the dividend at first, because we have 3 digits in the divisors (642,33).

```
      200
321 ) 642,33
     -642
      000 33
```

(2) We then proceed with our division as before by considering the first digit of the divisor and dividend: 6 ÷ 3 = 2, trying 2, we multiply 321 by 2 and then subtract.

(3) Carrying down 3 tens we cannot divide, after putting 0 in the quotient we carry down the 3 units. Again we cannot divide so we put another 0 in the quotient.

Our answer is 200 R 33

Four digit divisors and larger divisors are all handled in exactly the same way. We must only make sure to start by marking off the correct number of digits in the divisor.

Here are two examples: Example 1 uses a divisor with 4 digits, and examples 2 uses a divisor with 5 digits.

e.g. 1: 67 345 ÷ 2 241

```
       30
2 241 ) 67345
        6723
        ----
         115
```

Answer is 30 R 125

e.g. 2: 8 725 131 ÷ 42 121

$$
\begin{array}{r}
207 \\
42\,121\overline{)8725131} \\
\underline{84242} \\
300931 \\
\underline{294847} \\
006084
\end{array}
$$

Answer is 207 R 6 084

In examples like these; 6 000 ÷ 100, 40 000 ÷ 10 000, 5 000 ÷ 100, etc., the answer can be obtained by a short cut method.

e.g.: 6 000 ÷ 100 = 60. The divisor 100, has 2 noughts.

We simply knock off 2 noughts from the 6 000 to give us our answer 60. We are going to use this short cut much more when we come to division of decimal. You should note that the divisors are all power of 10.

Let us prectice:

EXERCISE-B

1) 32 598 ÷ 308 2) 6 472 ÷ 105 3) 32 146 ÷ 1 872 4) 8 076 ÷ 1 442

5) Let us read off the answers for these without actually working the divisions:
(a) 60 000 ÷ 1 000 (b) 16 000 ÷ 100 (c) 43 000 000 ÷ 100 00

MORE PROOFS OF DIVISIBILITY

We already know how to detect when numbers can be divided evenly by 2, 4, 5 and 10. Let us just double check.

- Which if these numbers are divisible evenly by 2?

  6, 68, 40, 24 378, 5, 3

- Which of these are exactly divisible by 10?

  70, 85 430, 32, 700, 213

- Which are exactly divisible by 5?

  54, 55, 6 700, 7 272

We are now going to learn how to detect numbers that can be divided evenly by 3, 6 and 9.

- If the *sum* of all the digits of a number is divisible by 3, then the number is divisible by 3.

  e.g. 1: 162 ÷ 3

  The sum of the digits ..... 1 + 6 + 2 = 9

  9 can be divided by 3 evenly (9 ÷ 3 = 3)

  162 can therefore be divided by 3 evenly.

$$
\begin{array}{r}
54 \\
3\overline{)162}
\end{array}
\qquad 162 \div 3 = 54
$$

e.g. 2: 161 ÷ 3

The sum of the digits – – – 1 + 6 + 1 = 8

8 cannot be divided evenly by 3 so 161 cannot be divided evenly by 3.

$$
\begin{array}{r}
53\,R\,2 \\
3\overline{)161}
\end{array}
\qquad 161 \div 3 = 53\,R2
$$

- If a number can be divided by 2 evenly and also by 3 evenly, then it can be divided evenly by 6. Let us prove this;

e.g. 1: $66 \div 6$ can it work out evenly?

— First 66 is divisible by 2, because it ends with a 6 . . . $66 \div 2 = 33$

— Then 66 is divisible by 3, because the sum of the digits is 12 . . . $66 \div 3 = 22$

— 66 should then be divisible by 6.

$$6\overline{)66}\quad 11 \qquad 66 \div 6 = 11$$

Example 2: $69 \div 6$ . . . can it work evenly?

— First 69 is not divisible by 2.

— Then, 69 is divisible by 3.

— 69 cannot be divided by 6.

$$6\overline{)69}\quad 11\ R\ 3 \qquad 69 \div 6 = 11\ R\ 3$$

Only if the number is divisible by both 2 and 3, then it is divisible by 6.

- If the sum of the digits of a number is divisible by 9, then the number itself is divisible by 9.

e.g. 1: $135 \div 9$

The sum of the digits $1 + 3 + 5 = 9$

9 is divisible by 9 of course. So 135 should be divisible by 9.

$$9\overline{)135}\quad 15$$

e.g. 2: $134 \div 9$. . . . can it work out evenly?

The sum of the digits is $1 + 3 + 4 = 8$ . . . .

. . . 8 is not divisible by 9 so 134 is not divisible by 9.

$$9\overline{)134}\quad 14\ R\ 8$$

EXERCISE-C

1. Which of these numbers can be divided evenly by 3? Underline them.

   (a) 171 (b) 153 (c) 205 (d) 213 (e) 315

2. Which of these numbers can be divided evenly by 9?

   (a) 3 081 (b) 4 375 (c) 3 798 (d) 5 731

3. Which numbers here are *not* divisible by 6?

   (a) 72 (b) 486 (c) 314 (d) 7 188

POWERS OF NUMBERS

Already we know that powers of 10 are developed when 10 is multiplied by itself a number of times.

e.g.: $10 \times 10 = 10^2$. Here we called 10 the base and 2 the index.

This happens with all other natural numbers as well so that $2 \times 2 = 2^2$ we say two squared, or two to the second power. Also $2 \times 2 \times 2 = 2^3$ we say 2 cubed, or two to the third power.

- Here is a list of some powers of two up to 2^9. You can complete the list by filling in the correct values:

$2^2 = 2 \times 2 = 4$

$2^3 = 2 \times 2 \times 2 = 8$

$2^4 = 2 \times 2 \times 2 \times 2 = 16$

$2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

$2^6 =$ ——————————

$2^7 =$ ——————————

$2^8 =$ ——————————

$2^9 =$ ——————————

In those above we used 2 as the base but any number can be used as the base, including decimal fractions and common fractions:

$3^2 = 3 \times 3 \quad = 9$

$3^3 =$ _____ $=$ ____

$3^4 =$ _____ $=$ ____

$3^5 =$ _____ $=$ ____

$3^6 =$ _____ $=$ ____

Remember that the base tells us the number that we are repeating and the index tells us how many times we are repeating it.

- Let us fill in the correct values for these:

$3^5 =$ _____ $\quad 4^2 =$ _____ $\quad 5^3 =$ _____

$10^2 =$ _____ $\quad (\frac{1}{2})^2 =$ _____ $\quad 25^2 =$ _____

If we have to *add* or *subtract* powers we simply work out the value of each power and then calculate the answer.

e.g. 1: $2^2 + 3^2 = 4 + 9 = 13$

e.g. 2: $3^2 - 2^2 = 9 - 4 = 5$

This is very straightforward. To multiply powers we also work out the value of each power and then multiply. However, if the bases are the same, we can use a short cut.

e.g. 1: $3^2 \times 2^3$ ..... $9 \times 8 = 72$

e.g. 2: $2^2 \times 2^2$ = The bases are the same, 2, we can simply add the indices, and use the sum as our new index, and keep the same base. So that:

$$2^2 \times 2^2 = 2^4 = 16$$

We can prove this by actually working out the value of each and then multiplying:

$$2^2 \times 2^2 = 4 \times 4 = 16$$

• What is the value of: $3^3 \times 3^2$?, $4^2 \times 2^3$?

To divide powers we again need to work out the values of the powers before dividing. However if the bases are the same we simply subtract the indices.

e.g. 1: $4^2 \div 2^3 = 16 \div 8 = 2$

e.g. 2: $2^2 \div 2^2 = 4 - 2 = 2 \blacksquare 2^2 = 4$ to prove it, $2^4 \div 2^2 = 16 \div 4 = 4$

• What is the value of $4^2 \div 4^2$?, $5^2 \div 5'$?

Lastly let us look at some special indices. If we worked out the value of 6^1 we would get the same 6. The same thing happens for any other number, $7^1 = 7, 2^1 = 2, 3^1 = 3$.

We can safely say then that any number expressed to the first power is equal to the number itself. Or any number which has 1 as its index is equal to the number itself.

$$a^1 = a$$

Working out the values of $6^0, 7^0, 8^0$, we would all get 0 for our answer, because the index 0 is telling us the number or base does not occur at all far less to be repeated. We can say then that any number which has 0 as its index, is equal to 0.

$$a^0 = 0$$

EXERCISE-D

1. Let us work out the values of the following:

   (a) 6^2 (b) 7^3 (c) 3^4 (d) 6^1

2. Let us write the powers for these:

   (a) $2 \times 2 \times 2 =$ ———— (b) $7 \times 7 \times 7 =$ ————

   (b) $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} =$ ———— (d) $14 \times 14 =$ ————

3. What is the value of $4\ 678^0$?

4. What is the value of $1\ 341^1$?

5. Let us calculate the following:

   (a) $2^2 + 3^4 + 23$

   (b) $7^2 + 3^2$

   (c) $5^3 \times 5^2$

   (d) $4^4 \div 4^2$

   (e) $15^3 \div 15^2$

FACTORS MULTIPLES AND PRIME NUMBERS

To understand what a prime number is we must better understand factors and multiples.

$$3 \times 4 = 12$$

In this statement we see that 12 is a multiple of 3 and also a multiple of 4. 3 and 4 are factors of 12 because 3 can divide into 12 evenly, and also 4 can divide into 12 evenly:

$$12 \div 3 = 4 \text{ and } 12 \div 4 = 3$$

3 and 4 are not the only factors of 12. $12 = 6 \times 2$ so 2 and 6 are also factors of 12. Then $12 = 12 \times 1$, so here 12 is a factor of itself, and 1 is a factor of 12.

If we were to write down all the factors for 12 we would get 1, 2, 3, 4, 6, 12.
1 is a factor of all numbers, because it can divide evenly into all numbers.

- Let us write down all the possible factors for these numbers: 18, 24, 15, 3, 5, 7.

You would notice that for the last 3 numbers, 3, 5, and 7 we were only able to get 2 factors for each one. In each case one of the factors was the number itself, and the other was 1.

3 : 3, 1

7 : 7, 1

5 : 5, 1

Numbers that behave like these, 3, 5 and 7, are usually called *prime numbers.*

- What would you say a prime number is?

A *Prime Number* has no more than two factors. The number 1 and the number itself. It is divisible only by 1 and itself.

The number 1 is a prime number with only one factor itself.

EXERCISE-E

1. Let us write down all the prime numbers between 1 and 20, beginning with 1.
2. Let us write down 5 multiples for each of the following numbers. The first one is done as an example:

(a) 2: 2, 4, 6, 8, 10.

(b) 3: – – – – – – – – – – .

(c) 4: – – – – – – – – – – .

(d) 5: – – – – – – – – – – .

Your multiplication tables would help you with these.

PRIME FACTORS

Let us write down all the possible factors of 28.

28: 1, 2, 4, 7, 14, 28

From these, let us choose out those that are prime numbers:

1, 2, 7. We can call these *prime factors* because they are factors of 28 and at the same time they are prime numbers.

We would now learn how to reduce numbers into their prime factors.

If we were to write 28 as the product of 2 numbers we may write $28 = 2 \times 14$. Of these two factors, we see that 2 is a prime factor but 14 is not. However it is possible to express 14 as two other factors; $14 = 2 \times 7$ and here both 2 and 7 are prime factors: $28 = 2 \times 14$ can now be written as:

$28 = 2 \times 2 \times 7$ ——————— (2×7) takes the place of 14. Using our knowledge of powers we can write instead:

$28 = 2^2 \times 7$

What we have just done is to reduce 28 into its prime factors. We ended up with a chain multiplication in which all the factors were prime factors.

Let us try to reduce 48 into its prime factors.

$48 = 2 \times 24$

But $24 = 2 \times 12$ so $48 = 2 \times 2 \times 12$

Then $12 = 2 \times 6$ so $48 = 2 \times 2 \times 2 \times 6$

Again $6 = 2 \times 3$ so $48 = 2 \times 2 \times 2 \times 2 \times 3$

3 is already a prime number so we need not break it further. 48 reduced to its prime factors then gives us.

$$48 = 2 \times 2 \times 2 \times 2 \times 3$$

or $$48 = 2^4 \times 3$$

There is a shorter way to do this. We simply do a chain division, using the smallest possible prime number each time as the divisor. To do this we can arrange the division by putting the quotients below.

2) 48
2) 24
2) 12
2) 6
3) 3
1

all the divisors we used are our prime factors... $48 = 2^4 \times 3$, we ignore the 1 because even though we put it in the value of the answer remains the same.

For a last example let us reduce 27 into its prime factors.

3) 27
3) 9
3) 3
1

In this example 3 was the smallest possible prime number we could have started with.

$$27 = 3 \times 3 \times 3 \text{ or } 27 = 3^3$$

EXERCISE-F

1. Let us reduce the following numbers into their prime factors:
   (a) 16 (b) 21 (c) 18 (d) 54.
2. Let us write down all the factors of 84.
3. Let us write down all the factors of: (a) 16 and (b) 24
   (a) 16: ----------.
   (b) 24: ----------.
   (c) Are there any factors common to both 16 and 24?
   (d) What are they? Draw lines connecting the common factors.
   (e) Which common factor is the highest?

Note:

The highest factor that is common to both numbers is usually called the *highest common factor* of the two numbers. We write it shortly like H.C.F.

4. Let us write down all the factors of 20 and 25 and find the H.C.F.
5. Let us do the same for 16 and 20.

COMMON MULTIPLES

We have looked at factors, prime factors and a bit of common factors. We are now going to look at common multiples. These would prove to be very important when we come to the addition and subtraction of fractions with different denominators, in Unit 3. They are also useful for solving some special problems.

Let us write down some multiples of 3 and some multiples of 4, beginning from the smallest up.

3: 6, 9, 12, 15, 18, 21, 24

4: 8, 12, 16, 20, 24, 28, 32

- What multiples are common to both 3 and 4? ——————————.
- Which common multiple is the lowest? ——————————.
  We usually say that is the *lowest common multiple,* written shortly as: L.C.M. The L.C.M. of 3 and 4 is 12. 12 is the smallest number that can be divided by 3 and 4 at the same time, without leaving a remainder.
- Let us write down 9 multiples of 4 and 5 from the smallest up and find the L.C.M., by looking at the multiples.
- Let us now write down 6 multiples each for the factors 2, 3 and 4 and then identify the L.C.M.

The method we have been using so far to find the L.C.M. is a long method, especially when we have alot of numbers as the factors. To find the L.C.M. of 6, 2, 5, 4 and 8 for instance, would mean that we have to make a list of a set of multiples for each number and then identify the L.C.M. Sometimes such lists can be very long. We would therefore learn to use a quicker and shorter method.

Let us find the L.C.M. of 4, 6 and 3.

We can set down the numbers as a kind of division and follow the steps given. Actually we are reducing each number into its prime factors.

Steps:

(1) We reduce the numbers beginning with the lowest prime factor that can work for any one, or more numbers. In this case we begin with 2.

2	4	6	3
2	2	3	3
3	1	3	3
	1	1	1

(2) We divide through. In this case 2 cannot divide evenly into 3^5 so we simply bring the 3^5 down continue.

(3) Again we can divide by 2, and have to carry down both 3^5.

(4) Lastly we can no longer use 2 so we use the prime number 3. We now end with 1 for each number. Our L.C.M. is the product of all the divisors that we used. L.C.M. of 4, 6 and $3 = 2 \times 2 \times 3 = 12$.

You can prove it by using the old method.

Let us use another example: Let us find the L.C.M. of 6, 8, and 9.

Steps:

(1) Using 2.

(2) Using 2.

(3) Using 2 again.

(4) We can no longer use 2.

(5) Using 3 again.

2	6	8	9
2	3	1	9
2	3	2	9
3	3	1	9
3	1	1	3
	1	1	1

L.C.M. of 6, 8 and $9 = 2^3 \times 3^2 = 8 \times 9 = 72$.

In the next unit we are going to see how finding the L.C.M. of denominators can help us in adding or subtracting fractions.

For now let us learn to find the L.C.M. of numbers quickly and accurately.

EXERCISE-G

1. Let us find the L.C.M. of these sets of numbers:

   (a) 2, 6 (b) 6, 8 (c) 15, 25 (d) 6, 12, 18 (e) 3, 5, 7.

SUMMARY

We learned in this unit, how to handle divisions where the divisor has 3 or more digits. We saw that these can be handled in basically the same way as those we met earlier with 2 digit divisors.

We then learned to detect when numbers can be divided evenly by 3, 6 and 9.

We then looked at powers of numbers. We expressed numbers in different powers. We saw that to multiply powers with the same bases we could simply add the indices, and to divide them we subtract the indices.

In looking at prime numbers we discovered that these special numbers can only be divided by 1 and themselves evenly. We learned to reduce numbers to their prime factors and to identify the highest common factor (H.C.F). Lastly we looked at common multiples, and learned to calculate the lowest common multiples (L.C.M.) of numbers. These are especially important for calculating fractions of different denominators.

CONSOLIDATORY EXERCISES

1. Let us do these divisions:

   (a) 74 398 ÷ 234 (b) 624 002 ÷ 3 142

2. Which of these numbers are divisible by 3?

   (a) 168 (b) 343 (c) 222 (d) 471

3. Choose out the numbers that are divisible by 9.

   (a) 72 (b) 2 522 (c) 432 (d) 333 (e) 102 (f) 212

4. Let us reduce these numbers into their prime factors:

   (a) 234 (b) 18 (c) 4 728

5. Let us find the L.C.M. of these numbers:

   (a) 14, 28, 12 (b) 6, 9, 15 (c) 8, 2, 7 (d) 12, 10, 21

6. Let us find the values of these:

   (a) 6^3 (b) 21^2 (c) 432^2

Solution of long division problems related to students daily activities

UNIT 2

MORE ON COMMON FRACTIONS

REVIEW

You would remember that in Book 2 we learned a great deal about fractions. We learned about fractions of the same size, increasing and decreasing commons, division with fractions as the quotient, multiplying, addition of common fractions, subtraction of fractions, division of fractions and so on.

EXERCISE-A-REVIEW

1. Now let us write fractions that are equivalent, or fractions that are of the same size to these: $\frac{1}{2} =$ ———; $\frac{1}{4} =$ ———, $\frac{2}{7} =$ ———

2. Let us try adding these: $\frac{1}{2} + \frac{1}{4} =$ ———————

3. Together let us practice some multiplication of fractions:

$\frac{3}{4} \times \frac{1}{2} =$ ——————— $\frac{5}{6} \times \frac{2}{3} =$ ——————— $\frac{4}{5} \times \frac{3}{8} =$ ———————

4. We also did subtraction of fractions. Now let us try these:

$\frac{3}{4} - \frac{1}{4} =$ ——————— $\frac{7}{8} - \frac{3}{8} =$ ——————— $\frac{5}{6} - \frac{2}{3} =$ ———————

5. Now, let us practice some division:

$\frac{3}{4} \div \frac{1}{4} =$ ——————— $\frac{1}{2} \div \frac{1}{8} =$ ——————— $\frac{4}{5} \div \frac{3}{15} =$ ———————

6. To complete this exercise let us practice these:

(a) What fraction is 7 of 21?

(b) What fraction is 8 of 16?

(c) What fraction is 3 of 15?

(d) What fraction is 6 of 24?

(e) What fraction is 3 of 9?

IMPROPER FRACTIONS AND MIXED NUMBERS

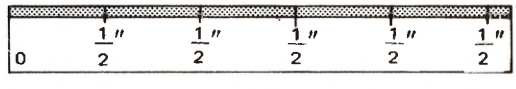
Very early you learned that a fraction is part of a whole thing or number. We read the symbol $\frac{2}{3}$ as two thirds. Fractions like these have a value less than 1. Its numerator is smaller than its denominator.

Now we are going to learn about another type of fraction.

Let us look at this fraction: $\frac{3}{2}$. Is it the same as the other fractions we did? Such fractions are called improper fractions. The symbol $\frac{3}{2}$ mean three halves.

- This ruler has five $\frac{1}{2}$ inches marked off on it. Let us add them.

(See fig. 2.1)



- Now let us write it: $\frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} + \frac{1}{2} = \frac{5}{2}$ ins.

We have just learnt that five halves can be written as $\frac{5}{2}$.

- Now let us add them again to see how many wholes we can get. Let us add together. $\frac{1}{2} + \frac{1}{2} = 1$ in., $\frac{1}{2} + \frac{1}{2} = 1$ in. = two wholes and a $\frac{1}{2}$ ins. This can also be written as $2\frac{1}{2}$ ins. We call these, mixed numbers.

What we have seen so far is that an improper fraction is a fraction which has its numerator bigger than its denominator, or a fraction greater than 1, and that a mixed number is a whole number and a fraction together.

EXERCISE-B

1. Let us write these as improper fractions:

(a) write 7 halves

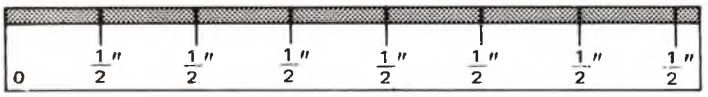
(b) write 5 quarters

(c) write 4 thirds

2. Now let us write these mixed numbers:

(a) Write the length of the ruler in inches.

(See fig. 2.2)



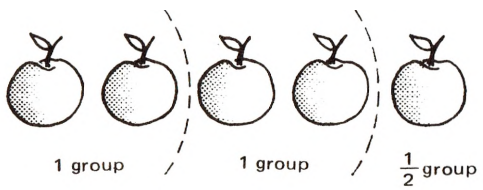
(b) Write four and a half pounds of rice.

CHANGING MIXED NUMBERS TO IMPROPER FRACTIONS AND VICE VERSA

We learned that five halves can be written as $\frac{5}{2}$ as an improper fraction, or $2\frac{1}{2}$ as a mixed number.

- You would also notice that if 5 is divided by 2 the numbers obtained are 2 R 1.

(See fig. 2.3)



It means then that $\frac{5}{2} = 2\frac{1}{2}$ and $2\frac{1}{2} = \frac{5}{2}$

- Now let us try to change these fractions to mixed numbers.

$$\frac{12}{5} = \text{-------} \qquad \frac{23}{7} = \text{-------}$$

As we have seen above we can use division to change any improper fraction to a mixed number.

Now we can change a mixed number to an improper fraction in this way:

$$3\frac{1}{4} = \frac{(3 \times 4) + 1}{4} = \frac{12 + 1}{4} = \frac{13}{4}$$

In this example the whole number is broken up into quarters because the fraction is in quarters. This we did by multiplying by 4, the denominator of the fraction. After bringing the 3 wholes to quarters (12), we then add the 1 quarter to give us 13 quarters or $\frac{13}{4}$.

Here is another example: $5\frac{2}{3}$ to an improper fraction,

$$= \frac{(5 \times 3) + 2}{3} \text{ bringing the wholes to thirds}$$

$$= \frac{15 + 2}{3} = \frac{17}{3}$$

Now let us practice changing these mixed numbers to improper fractions:

$$1\frac{1}{3} = \text{-------} \qquad 4\frac{1}{4} = \text{-------} \qquad 2\frac{2}{3} = \text{-------}$$

EXERCISE-C

1. Let us do these for practice:

   (a) Write a mixed number equal to $\frac{5}{2}$

   (b) Write a mixed number equal to $\frac{8}{5}$.

   (c) Write a mixed number equal to $\frac{14}{3}$.

2. Now let us write improper fractions for these mixed numbers.

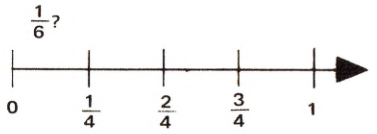
   (a) Write an improper fraction for $1\frac{1}{2}$.

   (b) Write an improper fraction for $3\frac{1}{6}$.

LOWEST COMMON DENOMINATOR

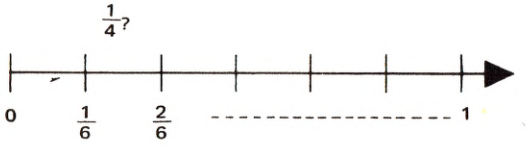
If we try to show $\frac{1}{4}$ and $\frac{1}{6}$ using the same diagram and we begin by dividing the line into fourths, we can show a quarter but not $\frac{1}{6}$.

(See fig. 2.4)



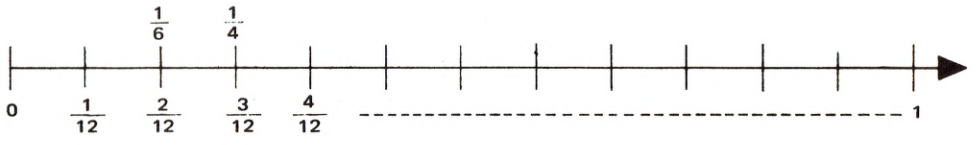
If we try dividing it into sixths, we would find no division point for fourths.

(See fig. 2.5)



But you would remember that the fraction $\frac{1}{4}$ has other names, such as $\frac{2}{8}$, $\frac{3}{12}$, and $\frac{1}{6}$ has other names such as $\frac{2}{12}$, $\frac{3}{18}$ and $\frac{4}{24}$. Notice that each fraction could be named by a fraction with 12 as a denominator. Let us look at how the line is divided into twelfths and how $\frac{1}{4}$ and $\frac{1}{6}$ are shown.

(See fig. 2.6)



- Now let us see if we can divide a unit segment on a number line so that there is a division point for the given pair of fractions. $\frac{1}{4}$ $\frac{1}{6}$

When we replace $\frac{1}{4}$, by $\frac{3}{12}$ and $\frac{1}{6}$ by $\frac{2}{12}$, we had expressed $\frac{1}{4}$ and $\frac{1}{6}$ as fractions with the common denominator 12. We can express $\frac{1}{4}$ and $\frac{1}{6}$ as fractions with other common denominators, but the lowest common denominator (L.C.D.) makes it simpler.

Therefore the lowest common denominator (L.C.D.) of $\frac{1}{4}$ and $\frac{1}{6}$ is 12.

In general we can find the lowest common denominator of two or more fractions by finding (L.C.M.) of the denominators.

- Now let us try these:

(a) Find the L.C.D. of $\frac{1}{2}$ and $\frac{1}{3}$ = L.C.M. (2, 3) = ...

(b) Find the L.C.D. of $\frac{1}{2}$ and $\frac{1}{4}$ = L.C.M. (2, 4) = ...

Now let us look at this one: L.C.D. of $\frac{5}{6}$, $\frac{7}{15}$ L.C.M. (6, 15) = 30.

It is important that we know how to find the lowest common denominator of two or more fractions by finding their L.C.M. Because it is very important for us to know how to find L.C.D. when we come to do addition of fractions.

Example: $\frac{1}{6} + \frac{1}{4}$

First we find the L.C.D.

	6	4
2	3	2
3	3	1
	1	1

$$\frac{2+3}{12} = \frac{5}{12}$$

Here we see that 12 is a denominator of $\frac{1}{6}$ and $\frac{1}{4}$ and $\frac{1}{6} = \frac{2}{12}$ and $\frac{1}{4}$ and $\frac{3}{12}$.

EXERCISE-D

Let us practice these:

1. Name the lowest common denominator of $\frac{1}{4}$, $\frac{1}{2}$.

2. Name the lowest common denominator of $\frac{1}{3}$, $\frac{2}{5}$.

3. Divide the line to show $\frac{1}{6}$ and $\frac{2}{3}$.

(See fig. 2.7)

4. Name the L.C.D. of $\frac{3}{4}$ and $\frac{2}{3}$

ADDITIONS INVOLVING MIXED NUMBERS

In Book 2 we began addition of fractions. But the fractions we added were common fractions. Now we are going to learn to add mixed numbers.

Now, John has $5\frac{1}{2}$ oranges and Jimmy has $6\frac{1}{2}$. Let us try to find out how many oranges they have together?

The number of oranges together is *12.* The process here is to add the whole numbers 6 and 5, then the fractions and put them together.

Example: John's $5\frac{1}{2}$ oranges and Jimmy's $6\frac{1}{2}$ oranges together can be represented this way:

$$6\tfrac{1}{2} + 5\tfrac{1}{2} = (6 + \tfrac{1}{2}) + (5 + \tfrac{1}{2})$$

$$= (6 + 5) + (\tfrac{1}{2} + \tfrac{1}{2})$$

$$= 11 + 1$$

Therefore $6\frac{1}{2} + 5\frac{1}{2} = 12$ oranges.

Here is another example:

$$11\frac{2}{5} + 4\frac{1}{10} = (11 + \frac{2}{5}) + (4 + \frac{1}{10})$$

$$= (11 + 4) + (\frac{2}{5} + \frac{1}{10})$$

$$= 15 + (\frac{2}{5} + \frac{1}{10})$$

But $\frac{2}{5}$ is the same as $\frac{4}{10}$; then $\frac{2}{5} + \frac{1}{10} = \frac{4}{10} + \frac{1}{10} = \frac{5}{10}$ or $\frac{1}{2}$.

Therefore $11\frac{2}{5} + 4\frac{1}{10} = 15\frac{1}{2}$.

What we have just learnt is that to add mixed numbers, we first add the whole numbers then find a common denominator of the fractions and add them.

There is another way we can set down the addition:

Here is an example: $3\frac{1}{6} + 4\frac{1}{4}$

$(3 + 4) = 7$

$(\frac{1}{6} + \frac{1}{4})$ $\qquad 7\frac{2+3}{12} = 7\frac{5}{12}$

2	6	4
2	3	2
3	3	1
	1	1

We add the whole numbers first, then to add the fractions find the L.C.D. From the L.C.D. we see that $\frac{1}{6}$ is equivalent to $\frac{2}{12}$ and $\frac{1}{4}$ to $\frac{3}{12}$. When we add them we get $\frac{5}{12}$.

Therefore $3\frac{1}{6} + 4\frac{1}{4} = 7\frac{5}{12}$.

EXERCISE-E

1. Let us practice what we have just learnt:

   (a) $2\frac{1}{4} + 3\frac{3}{4}$ $\qquad$ (b) $1\frac{1}{2} + 1\frac{1}{33}$

   (c) $1\frac{1}{2} + 3\frac{3}{4}$

2. $1\frac{1}{2}$ Inches of rain fell on Monday, $2\frac{1}{4}$ on Tuesday, how many inches of rain fell?

MULTIPLICATION INVOLVING MIXED NUMBERS

We have learnt how to add mixed numbers. Now let us try multiplying mixed numbers.

You would remember also that we changed mixed numbers to improper fractions. Now to multiply mixed numbers, we must first change the mixed number to an improper fraction.

e.g. 1: $2\frac{1}{2} \times 2\frac{2}{5}$

$$= \frac{5}{2} \times \frac{12}{5}$$

After changing the mixed numbers to improper fractions we would then multiply the numerators. Then, the denominators.

Therefore $\frac{5}{2} \times \frac{12}{5}$ becomes $\frac{60}{10}$.

Now let us try another one. Multiply $1\frac{1}{2}$ by $1\frac{1}{4}$. Let us do it together. Write $1\frac{1}{2}$ as an improper fraction, then $1\frac{1}{4}$, multiply their numerators, then their denominators.

EXERCISE-F

1. For more practice let us work these:

(a) $3\frac{1}{2} \times 2\frac{1}{4}$ (b) $2\frac{2}{3} \times 1\frac{1}{3}$ (c) $3\frac{1}{2} \times 1\frac{2}{3}$

2. Find the cost of $3\frac{1}{2}$ yards of cloth at $2\frac{1}{2}$ dollars a yard.

SKILL OF CANCELLING

When we multiply mixed numbers, what we did was to multiply the numerators and denominators after changing them to improper fractions.

There is another way we can do that. We can make the fractions simpler or reduce it before multiplying. The process whereby we make the fraction simpler is called cancelling.

We can say then that cancelling is reducing by factors any numerator or denominator to their lowest terms before multiplying.

e.g. 1: $1\frac{1}{3} \times 3\frac{3}{4} = \frac{\overset{1}{\cancel{4}}}{3} \times \frac{15}{\underset{1}{\cancel{4}}}$

Here we divide a numerator and a denominator both by 4.

$= \frac{1}{3} \times \frac{15}{1}$

Learning the skill of cancelling is very important when multiplying fractions. It is also very important in division of mixed numbers as we would discover later.

Let us do another example before we practice:

e.g. 2: $2\frac{2}{3} \times 2\frac{1}{4}$

Here we divide a numerator and a denominator by 3, and by 4.

$\frac{\overset{2}{\cancel{8}}}{\underset{1}{\cancel{3}}} \times \frac{\cancel{9}^{3}}{\underset{1}{\cancel{4}}} = \frac{2}{1} \times \frac{3}{1}$

EXERCISE-G

1. Now let us try these. Practice cancelling.

(a) $\frac{9}{13} \times \frac{13}{8}$ (b) $\frac{5}{2} \times \frac{2}{5}$ (c) $\frac{3}{2} \times \frac{16}{9}$

SUBTRACTION OF MIXED NUMBERS

In Book 2 we did subtraction of common fractions and now we are going to look at subtraction of mixed numbers.

When subtracting mixed numbers we can follow the same steps as addition, although we are reducing. We can give the fractions common denominators.

e.g. 1: $5\frac{2}{3} - 2\frac{1}{4} = 5\frac{8}{12} - 2\frac{3}{12}$

$= 3\frac{8}{12} - \frac{3}{12}$ Subtracting whole numbers first.

$= 3 + \frac{8}{12} - \frac{3}{12}$ Then subtract the fractions.

$= 3 + \frac{5}{12}$

$= 3\frac{5}{12}$

But here is another way we can do this same example.

$5\frac{2}{3} - 2\frac{1}{4}$

$3 \quad \frac{8 \quad -3}{12} \quad = 3\frac{5}{12}$

In this case the whole numbers were subtracted first, then to subtract the fractions find the L.C.D. From the L.C.D. we see that $\frac{2}{3}$ is equivalent to $\frac{8}{12}$ and $\frac{1}{4}$ to $\frac{3}{12}$. When we subtract them we get $\frac{5}{12}$ ..

Here is another example like the one we just did:

$3\frac{3}{4} - 1\frac{1}{2}$

$2 \quad \frac{3 \quad - 2}{4}$ $\qquad 2\frac{1}{4}$

2	2	4
2	1	2
		1

Let us do one more example before we practice.

e.g. 2: $5\frac{1}{4} - 2\frac{1}{2}$

$2\ \frac{3-2}{4}$

What we see now is that we have to subtract $\frac{8}{12}$ from $\frac{3}{12}$. But remember we said earlier that they are all twelfths so what we can do is to take 1 from the 5 and break it up into twelfths and add it with the $\frac{3}{12}$ because they are all twelfths.

Therefore $5\frac{3}{12} - 2\frac{8}{12}$ would become $4\frac{15}{12} - 2\frac{8}{12}$

$2\frac{15-8}{12} = 2\frac{7}{12}$

What we have just learnt is that in subtracting mixed numbers, we subtract the whole numbers first, then we find a common denominator of the fractions and subtract them.

EXERCISE-H

1. Now let us practice these:

(a) $5\frac{3}{4} - 1\frac{1}{4}$ (b) $5\frac{5}{6} - 3\frac{1}{2}$ (c) $3\frac{1}{5} - 1\frac{1}{2}$

2. From a piece of cloth $4\frac{3}{4}$ feet long, one length $2\frac{1}{2}$ was cut. How much of the cloth was left?

DIVISION OF MIXED NUMBERS

In studying operations with whole numbers we learned that division is the opposite of multiplication. e.g. $6 \div 3 = 2$ because $2 \times 3 = 6$.

Just as $6 \div 3$ asks the question 'How many threes are there in 6? " So $6 \div \frac{1}{3}$ asks the question "How many thirds are there in 6? "

e.g.: If we had to find out how many lengths of wood, $1\frac{3}{4}$ feet long can be cut from $5\frac{1}{2}$ feet length? Let us use this method: $5\frac{1}{2} \div 1\frac{3}{4}$. The first step in dividing fractions is to change the mixed numbers to improper fractions. $5\frac{1}{2} = \frac{11}{2}$ and $1\frac{3}{4} = \frac{7}{4}$. We now have $\frac{11}{2} \div \frac{7}{4}$.

The next step is to change the division sign to multiplication and capsize the divisor $\frac{11}{2} \times \frac{4}{7}$. Before multiplying reduce the fractions to their lowest terms if necessary $\frac{11}{\cancel{2}_1} \times \frac{\cancel{4}^2}{7} = \frac{11}{1} \times \frac{2}{7}$.

After reducing the fractions we would then multiply. That is instead of multiplying $\frac{11}{2} \times \frac{4}{7}$. We would multiply $\frac{11}{1} \times \frac{2}{7} = \frac{22}{7}$.

Let us change this improper fraction $\frac{22}{7}$ to a mixed number.

$$\text{Answer } \frac{22}{7} = 3\frac{1}{7}$$

Here is another example: $3\frac{1}{2} \div 2\frac{1}{4}$

$$= \frac{7}{2} \div \frac{9}{4}$$

$$= \frac{7}{\cancel{2}_1} \times \frac{\cancel{4}^2}{9} = \frac{7}{1} \times \frac{2}{9} = \frac{14}{9}$$

$$\text{Answer } = 1\frac{5}{9}$$

EXERCISE-J

1. Let us practice now:

(a) $1\frac{3}{4} \div 1\frac{1}{2}$ (b) $3\frac{3}{8} \div 1\frac{1}{2}$ (c) $5\frac{1}{3} \div 3\frac{1}{3}$ (d) $4\frac{1}{6} \div 3\frac{1}{5}$

2. How many lengths of cloth each $2\frac{1}{3}$ feet long can we get from a piece $12\frac{3}{4}$ feet long?

EXPRESSING REMAINDERS OF ORDINARY DIVISIONS AS FRACTIONS

In Book 2 we learned division, and we also learned about fractions. We are now going to do some ordinary divisions and express their remainder as fractions.

Now let us try to find out how many weeks are in 15 days. We would now divide 15 by 7 — 15 ÷ 7, because 7 days = 1 week.

$$15 \div 7 = 2\ R\ 1$$

This shows that in 15 days there are 2 weeks and 1 day remaining, but we need weeks for the answer, therefore we would express the 1 remaining day as a fraction of one week.

We then would have $\frac{1}{7}$ week remaining.

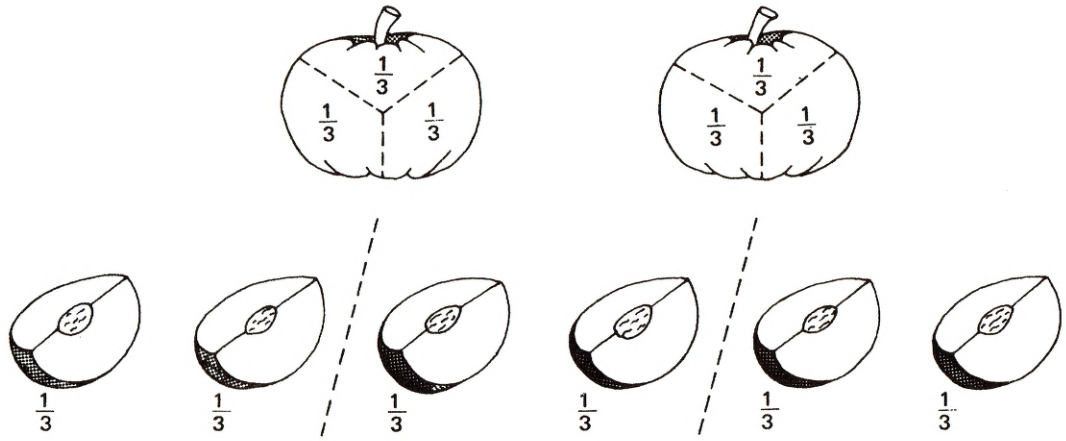
Our answer is $2\frac{1}{7}$ weeks in 15 days.

Or, suppose we had to share 38 breadfruits, equally among 3 men. 38 ÷ 3 = 12 and 2 remaining.

The 2 remaining would have to be divided among 3. Thus each would get $\frac{2}{3}$.

Our answer therefore is $12\frac{2}{3}$ breadfruits' a man'.

(See fig. 2.8)



EXERCISE J

Let us try these:

1. Divide these numbers and express their remainders as fractions:

   (a) Divide 37 by 5

   (b) 321 ÷ 11

   (c) 89 ÷ 12

2. Share 316 dollars equally among 12 men.

3. Share 513 banana plants equally among 11 farmers.

SUMMARY

In this unit we learned what are improper fractions and mixed numbers. In one case we used a ruler to show how we arrived at an improper fraction.

We also saw how we can change an improper fraction to a mixed number and a mixed number to an improper fraction. We did that by dividing the numerator by the denominator and by multiplying denominators with whole numbers and adding numerators.

We learned how to add mixed numbers by adding the whole numbers first then fractions and also by finding the L.C.D. We also did multiplication involving mixed numbers. This we did by changing them to improper fractions and cancelling.

In this unit we also tackled subtraction and division of mixed numbers. These were done by a similar method used in addition and multiplication.

Finally, we did some ordinary divisions and expressed their remainders as fractions. We used examples like the days of the week, a sum of mohey and vegetables to help in the explanation.

There were not many illustrations because a basic look on fractions was done in Book 2. However, the unit is very important because we have covered a much wider area on fractions which may be important in our daily lives.

If there is anything which you do not understand, or would like to get some more practice we can go over them before we go to the final exercise.

CONSOLIDATORY EXERCISES

1. Change these improper fractions to mixed numbers:

   (a) $\frac{8}{3}$ (b) $\frac{7}{4}$.

2. Change these mixed numbers to improper fractions:

   (a) $3\frac{1}{2}$ (b) $6\frac{3}{4}$

3. Find the L.C.D. of: (a) $(\frac{3}{4}; \frac{7}{8})$ (b) $(\frac{5}{6}; \frac{2}{9})$

4. (a) $3\frac{1}{4} + 1\frac{1}{2}$ (b) $1\frac{1}{2} + 4\frac{1}{8} + 2\frac{1}{4}$

5. $1\frac{1}{2} - 1\frac{1}{4}$

6. $3\frac{3}{4} \div 1\frac{1}{3}$

7. Share 16 oranges equally among 3 women.

   Now let us try some problems.

8. (a) What is the improper fraction for $4\frac{2}{9}$?

   (b) The fraction $\frac{52}{7}$ names the same number as the mixed number _____.

   Which is the simpler form?

9. Find the sum of $1\frac{1}{2}$ and $2\frac{3}{8}$.

10. From $9\frac{1}{4}$ inches take $3\frac{3}{4}$ inches.

Solution of problems related to students daily activities

UNIT 3

MORE ON DECIMAL FRACTIONS

REVIEW

In Book 2 we started working on decimal fractions. You would recall that we saw how common fractions are related to decimal fractions, we looked at nought in decimal fractions, and did some addition and subtraction of decimals.

In this unit we are going to cover much more work on decimal fractions. But before we go into new work on this unit, let us review some of what was done in Book 2.

EXERCISE-A-REVIEW

1. Let us change these common fractions to decimal fractions:

   (a) $\frac{16}{100}$ (b) $\frac{5}{10}$ (c) $\frac{200}{1\,000}$

2. Now let us add these:

   (a) 0.3 + 0.6 (b) 0.4 + 0.32 (c) 0.131 + 0.221

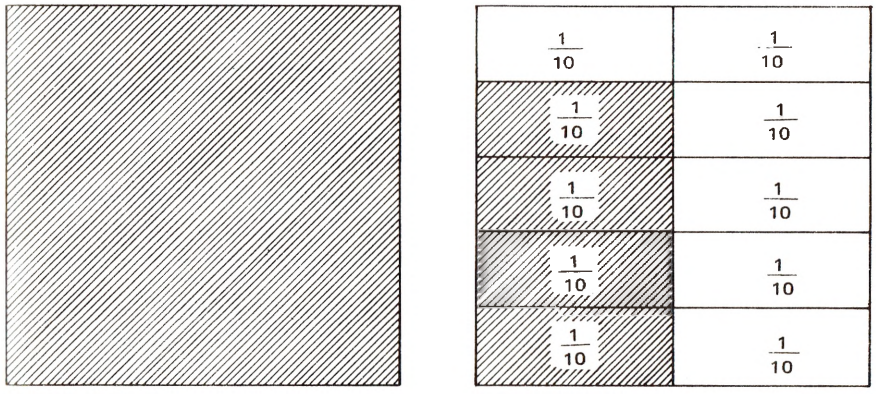
3. Now let us subtract:

   (a) 0.68 — 0.42 (b) 0.29 — 0.24 (c) 0.92 — 0.8

MIXED NUMBERS IN DECIMALS

In the same way that we have mixed numbers in common fractions, we also have mixed numbers in decimal fractions. There are also made up of whole numbers and fractions.

(See fig. 3.1)



In the figure we have shaded 1 complete square and $\frac{4}{10}$ or 0.4 of the other. The size of the shaded portions together is therefore $1\frac{4}{10}$ using common fractions or 1.4 using decimals. Notice that the whole number comes before the point and the decimal fraction after the point. A mixed number like 2.3 would be read — — — — two point three.

These few examples show us how mixed numbers of common fractions are related to mixed numbers of decimals.

(a) $3\frac{7}{10} = 3.7$ (b) $17\frac{21}{100} = 17.21$

(c) $3\frac{3}{10} = 3.3$ (d) $6\frac{3}{100} = 6.03$

The chart below shows the place value of each digit of the decimal mixed numbers. Notice again that the numbers before the point are whole or natural numbers whereas those after the point are representing parts or fractions.

	← whole numbers →				← fractions →		
	100	10	1	.	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1\,000}$
6.03 =			6	.	0	3	
13.12 =		1	3	.	1	2	
116.021 =	1	1	6	.	0	2	1
24.34 =	—	—	—	—	—	—	—
30.001 =	—	—	—	—	—	—	—

• Let us fill in the digits of the last two into their correct places.

Later on in the unit we are going to do some more of these, when we learn to change any common fractions to decimal fractions and vice versa.

EXERCISE-B

1. Let us write these mixed numbers using decimals:

(a) $6\frac{1}{10}$ (b) $1\frac{2}{100}$ (c) $103\frac{15}{100}$

2. Fill in the chart with the digits of these decimal mixed numbers to show their correct place value:

	1 000	100	10	1	.	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1\,000}$	$\frac{1}{10\,000}$
743.001									
3.1									
2.011									
11.03									
1 491.672									

DECIMAL PLACES

The number of digits after the point in a decimal fraction or number is usually called the number of decimal places. The decimal mixed number 6.341 has 3 digits after the point. It therefore has 3 decimal places.

• How many decimal places do these decimal numbers have?

(a) 6.421 (b) 0.0001 (c) 17.2 (d) 17.01

Sometimes we would meet decimal numbers with many decimal places e.g. 6.34341219. In such cases we are not usually required to write out all the places, but rather to cut the number of places short, so that we only get a close idea as to the exact size of the decimal. We might therefore write 6.34341219 to two decimal places, arriving at 6.34, and stopping.

This seems fairly straightforward. However there is one technique we need to learn in doing this.

Let us write 7.346 so that it has 2 decimal places instead of 3. We can follow these steps:

(1) The decimal, written first with its 3 places. 7.346.

(2) Now we examine the third place to find out if it is 5 or more than 5, or if it is less than 5.

(3) If that third decimal place is less than 5, then we simply write 7.34 and are finished. If the third decimal is 5 or more however, we add 1 to the second decimal place. We now write 7.35 and stop.

(4) We see that the third place, 6, is greater than 5, so our result would be 7.35.

Let us use another example. Let us write 6.71356 to 3 decimal places.

(1) First consider the fourth decimal place (the decimal place just after the one we are asked for). Is it 5 or more, or is it less?

(2) It is 5 so we add 1 to the 3 making it 4.

(3) The result is then 6.714.

16.213 to 2 decimal places gives 16.21 because the third place is less than 5.

In Book 4 we are going to see why this happens. For now let us just learn to use it properly.

EXERCISE-C

1. Write 7.273156 correct to:

(a) 5 decimal places (b) 4 decimal places (c) 3 decimal places

2. Write 23.91 correct to 1 decimal place.

3. Give 14.4475 correct to 2 decimal places.

ADDITIONS

We do this just the same as with whole numbers. We have to put the numbers in such a way that the decimal points are in the same vertical line, one under the other, so that corresponding digits are beneath each other.

Example 1. Add together 14.144, 2.897, and 0.768

	10	1		$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
	1	4	.	1	4	4
		2	.	8	9	7
+		0	.	7	6	8
	1	7	.	8	0	9

Start with the right hand digit and add as whole numbers. The point in the answer must be in line with the other points.

On adding the right hand column (thousandths) column, the result is 19 thousandths = 1 hundredth + 9 thousandths, therefore we put the 9 in the thousandths place and carry the 1 to hundredths. Adding the hundredths column we get 20 hundredths = 2 tenths, 0 hundredths we write down the 0 under hundredths and carry the two to tenths. When we add the tenths we get 18, in this case the 8 goes under tenths and the one to units.

e.g. 1: 6.47 + 40.1 + 3.423

$$\begin{array}{r} 6.47 \\ 40.1 \\ +\ 3.423 \\ \hline 49.993 \\ \hline \end{array}$$

EXERCISE-D

1. Now let us try these:

(a) 43.148 + 2.14 + 1.3 (b) 75.061 + 3.211

(c) 12.3 + 1.026 (d) 2.21 + 12.319 + 0.9

MULTIPLICATION

When multiplying a decimal by a single digit we multiply the same way as a whole number, but we must always keep the point in the answer under the point in the number to be multiplied. Here are some examples:

Multiply: 4.397 by 8

$$\begin{array}{r} 4.398 \\ \times\ 8 \\ \hline 35.176 \end{array}$$

The decimal point in the product falls under that of the multiplicand.

Now we are going to consider multiplying by two digits. In this case we follow the same pattern as that of long multiplication. We must always remember that in setting down the number, digits in the product and multiplicand of same value must be under each other.

Here is an example: 0.0945×27.

$$\begin{array}{r} 0.0945 \\ \times\ 27 \\ \hline 0.6915 \\ 1.8900 \\ \hline 2.5815 \end{array}$$

Notice that the units digit of the multiplier is under the last digit of the multiplicand.

When multiplying a decimal number by another decimal we use a slightly different method.

Let us multiply: 25.15 by 6.5

Steps:

(1) First multiply the numbers as thouhg they were ordinary natural numbers. (2 515 × 65)

$$\begin{array}{r} 25.15 \\ \times\ 6.5 \\ \hline 125\ 75 \\ 1509\ 00 \\ \hline 1\ 634\ 75 \end{array}$$

(2) To arrive at our answer we count the number of digits that came after the point, in both the multiplicand and the multiplier – in the multiplicand there are 2 decimal places, and in the multiplier there is 1 decimal place. We have 3 decimal places in all.

(3) Our answer therefore should have 3 decimal places. Counting 3 from the last digit, we realize that our decimal point must fall between the 3 and the 4 in our answer.

1 6 3 . 4 7 5

Our answer is then: 163.475

Here is another example: 34.72 x 2.31

(1) Multiplying as usual we get 802032.

$$\begin{array}{r} 34.72 \\ \times 2.31 \\ \hline 3472 \\ 104160 \\ 694400 \\ \hline 802032 \end{array}$$

(2) Counting the total number of decimal places we get 4.

(3) Our answer then must have 4 decimal places which gives 80.2032.

- Try working these on your own. 17.411 x 2.85, 3.001 x 4.2.

Multiplying decimals by 10 or powers of 10 are special cases that we can work using a short cut method. Let us see how this works. Let us work these:

4.397 x 10;	6.24 x 10;	0.8 x 10
4.397	6.24	0.8
x10	x10	x10
43.970	62.4	8.0

Let us now compare our answers with the multiplicands.

4.397 gave 43.970 when multiplied by 10.

6.24 gave 62.4 when multiplied by 10.

0.8 gave 8.0 when multiplied by 10.

Notice that it is just as though we moved the decimal point one place to the right in each case. e.g. 4.397 - - - 43.97, 0.8 - - - 8.0. When multiplying decimals by 10 we can just simply move the point one place to the right.

Let us see what happens when multiplying the same numbers by 100.

4.397 x 100	6.24 x 100	0.8 x 10
x100	x100	x100
439.700 or 439.7	624.00	80.0

Here we see that: 4.397 became 439.700 which is really 439.7.

6.24 became 624.00, and 0.8 became 80.0. It is just as though we moved the point two places to the right.

When multiplying decimals by 100 we can simply move the point 2 places to the right. Notice that moving the point of 0.8 caused us to have to add on noughts when we ram out of digits so 0.80 became 80.0.

The same pattern continues for other powers of 10. Multiplying by 1 000 we move the point 3 places, putting in noughts where needed. Multiplying by 10 000 we move the point 4 places and so on.

EXERCISE-E

(1) 6.32 x 9 (2) 7.8 x 14 (3) Multiply 3.32 by 10

(b) 3.32 x 100 (c) 3.32 x 1 000

(4) Multiply: 17.482 by 29

(5) Multiply: 67.342 by 2.8

SUBTRACTION

We already have an idea of subtraction of decimals. Here we are going to look at some examples that are not so easy.

Let us subtract 0.37 from 1.21:

	1	.	$\frac{1}{100}$	$\frac{1}{100}$
	1_0	.	2_1	$_1 1$
−	0	.	3	7
	0	.	8	4

The subtraction is done in the same way as for natural numbers.

(1) Beginning from the right we say 1-7 cannot. We must break up one of the 2 tenths from the number on top. If we break up $\frac{1}{10}$ we are actually breaking up $\frac{10}{100}$ ($\frac{1}{10} = \frac{10}{100}$) so we add 10 hundredths to the first 1 hundredth getting 11 now $11 - 7 = 4$.

(2) Now we have only $\frac{1}{10}$ because we broke up one already $1 - 3$ cannot. We must break up 1 unit which is really $\frac{10}{10}$ we add $\frac{10}{10}$ to $\frac{1}{10}$ getting $\frac{11}{10}$ $11 - 3 = 8$.

(3) We carry down the point.

(4) Now we have no units because we used it up so $0 - 0 = 0$ units.

$$1.21 - 0.37 = 0.84$$

The process is very much the same as with ordinary subtraction. Each time we cannot subtract, we must break up one from the number above.

Here is another example: $0.25 - 0.031$

	1		$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{100}$
	0	.	2	5	0
−	0	.	0	3	1
	0		2	1	9

Here we must put in nought to fill in the empty space in the number above.

Answer is 0.219

EXERCISE-F

1) $7.9 - 4.2$ 2) $5.2 - 0.007$ 3) $1.7 - 0.89$

4) $3.814 - 2.09$

CHANGING COMMON FRACTIONS TO DECIMALS AND VICE VERSA

We can already change some common fractions to decimals.

e.g.: $\frac{3}{10} = 0.3$; $\frac{2}{100} = 0.02$; etc.

To change fractions with other denominators we have to do some more calculations. Let us try to change $\frac{3}{4}$ into a decimal fraction. Remember that the fraction line really means ÷ so we simply obey the fraction line by trying to divide 3 by 4. We set this down as an ordinary division and follow the given steps.

Steps:

(1) Since we cannot divide 3 by 4, we change the 3 units into 30 tenths ($1 = \frac{10}{10}$ so $3 = \frac{30}{10}$)

(2) Dividing 30 tenths by 4 we try 7 but this would really be 7 thenths or 0.7

$$\begin{array}{r} 0.75 \\ 4\overline{)\,30} \\ 28 \\ \hline 20 \\ -\,20 \\ \hline 00 \\ \hline \end{array}$$

(3) After subtracting 28 we got 2 tenths over. We cannot divide so we change 2 tenths to 20 hundredths ($\frac{2}{10} = \frac{20}{100}$). We now divide 20 hundredths by 4 and get 5 hundredths. Subtracting we get 20 — 20 = 00

Our answer is .75 or 0.75

$$\frac{3}{4} = 0.75$$

Here is another example: Change $\frac{1}{4}$ into a decimal fraction. Since we know that our answer is going to be a decimal and that we must change units to tenths, we can begin by putting 0 after the 1 and a point in the quotient.

(1) Dividing as usual we get 2 and 2 tenths remaining, changing 2 tenths to hundredth we get 20 (simply add 0).

(2) Dividing again we get 5 hundredths. $\frac{1}{4} = 0.25$.

Notice that as long as we have a remainder we can add a nought and continue dividing.

```
0.25
4) 10
    8
    20
    20
    00
```

- Let us change $\frac{2}{5}$ to a decimal fraction.
- Let us change $\frac{1}{3}$ to a decimal fraction.

Notice that in the last case, changing $\frac{1}{3}$, we got a long chain of 3^5. This would continue as long as we continue working we usually say that the three is *recurring.* In such cases we can stop at two or three decimal places. The answer then can be written as $\frac{1}{3} = 0.33$ recurring, or $\frac{1}{3} = 0.33$ the dot there is saying that 3 is recurring.

In converting a decimal into a common fraction, we can follow these examples.

e.g.: Let us find fractions equivalent to:

(a) 0.2 (b) 14.63 (c) 1.237

(a) $0.2 = \frac{2}{10}$

(b) $14.63 = 14 + \frac{6}{10} + \frac{3}{100} = 14\frac{63}{100}$

(c) $1.237 = 1 + \frac{2}{10} + \frac{3}{100} + \frac{7}{1\,000} = 1\frac{237}{1\,000}$

In each case the numerator is the number formed by the figures of the given decimal, and the denominator is that power of ten which correspond to the number of decimal figures. We should then reduce the fraction to its lowest term if that is possible.

EXERCISE-G

Now we are going to practice what we have just learnt about transferring from common fractions to decimals and vice versa.

1. Express the following decimals as fractions in their lowest terms:

(a) 0.65 (b) .36 (c) 5.38

2. Change the following to decimals:

(a) $\frac{7}{40}$ (b) $\frac{7}{8}$

3. Change as decimals correct to the third decimal place:

(a) $\frac{11}{19}$ (b) $\frac{14}{23}$

APPLICATION OF DECIMALS IN METRIC AND MONEY

The structure of the metric system is actually based on decimals.

$10\ mm = 1\ cm$ This means that $1\ mm = \frac{1}{10}$ or $0.1\ cm$

$10\ cm = 1\ dm$ again $1\ cm = \frac{1}{10}$ or $0.1\ dm$

$10\ dm = 1\ m$ so $1\ dm = \frac{1}{10}$ or $0.1\ dm$

This happens for all the other units here and also for the measures of weight.

$10\ mg = 1\ cg$ so that $1\ mg = \frac{1}{10}$, $0.1\ cg$

From the above we can see that $6\ mm = 0.6\ cm$ $7\ mm = 0.7\ cm$

A length of $4\ m$, $3\ dm$, $2\ cm$, $4\ mm$ would actually be $4.324\ m$

Likewise a weight of $6\ g$, $2\ dg$, $3\ cg$, $1\ mg = 6.231\ g$. It is very easy to work with the metric system because of this.

	1 000 *m*	100 *m*	10 *m*	1 *m*	0.1 *m*	0.01 *m*	0.001 *mm*
	km	*Hm*	*Dm*	*m*	*dm*	*cm*	*mm*
(a)		4	0	6	0	5	0
(b)	7	0	3	0	8	1	0

Looking at the numbers in the length (a) in the chart we can read off the number in millimetres as 406 050 *mm*, in centimetres as 40605.0 *cm*, in decimetres as 4060.5 *dm*, in metres as 406.05 *m*, and so on. So to change the unit name we just move the point to the left as we change from smaller units to larger ones. The numbers for the length in (b) can be read in kilometres as 7.030810 *km*, in Hectometres as 70.30810 *Hm*, in Decametres as 703.0810 *dm* in metres as 7030.810 *m* in decimetres as 70308.10 and so on. Here as we are moving from larger units to smaller ones we simply move the point to the right. If we move one step the point moves one place. If we move two steps the point moves two places and so on.

- Let us change 6.734 *m* to *dm* by moving the point.
- Let us change 34.00 12 *m* to *mm* by moving the point.

Another common use of decimals is in money. 1 dollar is equal to 100 cents. 1 cent therefore is $\frac{1}{100}$ of a dollar or 0.01 of a dollar. 6 cents would be \$0.06. 78 cents would be \$0.78. This is the reason why we write \$14.00 for 14 dollars. Again \$75.48 multiplied by 100 can be handled just as decimals so \$75.48 × 100 = \$7548.00 ——— the point moves 2 places to the right side.

EXERCISE-H

1. Write the following as decimals in metres:

   (a) 7 *Dm* 4 *m* 3 *dm* (b) 7 *dm* 4 *cm* 3 *mm* (c) 6 *m* 4 *cm* 2 *mm*

2. Let us change (a) 30701.0 *mm* to metres by moving the point. (b) 16.2 *m* to *cm* by moving the point. (c) 1002 *m* to *km* by moving the point.

3. Write the following as decimal numbers in dollars and cents:

(a) 3 dollars and 17 cents (b) 26 dollars and 4 cents
(c) 118 dollars and 30 cents (d) 7842 cents

4. Calculate the following by moving the point:

(a) \$679.00 × 10 (b) \$234.80 × 100
(c) \$23.84 × 10 (d) \$1342.67 × 1 000

SUMMARY

In this unit we covered much more on decimal fractions than we did in Book 2. Besides doing mixed numbers in decimals we also learned how to write numerals to given decimal places. We also touched on multiplication with decimal fractions and much more on addition and subtraction. These included carrying over.

Transferring from common fractions to decimals and vice versa was also dealt with in some detail. And to conclude the unit we applied decimals in metric and money.

In Book 4 we are going to learn some more on decimals, concentrating then on division.

CONSOLIDATORY EXERCISES

Now let us practice what we have learnt about mixed numbers in decimals.

1. Write these mixed numbers in decimal notation:

(a) $.2\frac{1}{10}$ (b) $4\frac{11}{100}$ (c) $11\frac{1}{100}$

2. Let us practice writing numerals to a given number of decimal places:

(a) write 9.637 inches correct to 2 decimal places.

(b) what is the equivalent of 3.136 correct to 2 decimal places.

3. Let us try some addition and subtraction:

(a) 31.213 + 2.19 + 1.7 (b) 13.2 + 5.102
(c) 8.9 − 5.6 (d) from 3.6 take 1.72

4. Now let us multiply:

(a) 1.8 × 4 (b) 3.12 × 10
(c) 2.41×10^2 (d) 17.801 × 14.32

5. Express the following decimals as fractions in their lowest terms:

(a) 0.35 (b) .15 (c) 6.48

6. Change the following to decimals:

(a) $\frac{7}{40}$ (b) $\frac{5}{8}$ (c) $\frac{1}{9}$ (d) $\frac{2}{3}$

7. Write the following as decimals of one metre:

(a) 1 *km* 2 *Hm* 3 *m* 1 *cm* (b) 7 *m* 1 *cm* 2 *dm*

8. Write these as decimals of one dollars:

(a) 2 dollars and 5 cents (b) 11 dollars and 50 cents.

9. 0.3 of a pole is painted red. 0.4 is painted black and the remainder in green. What fraction is painted green?

10. From a stick 28.3 *m* long, 17.8 *m* was cut off, what is the length of the stick now?

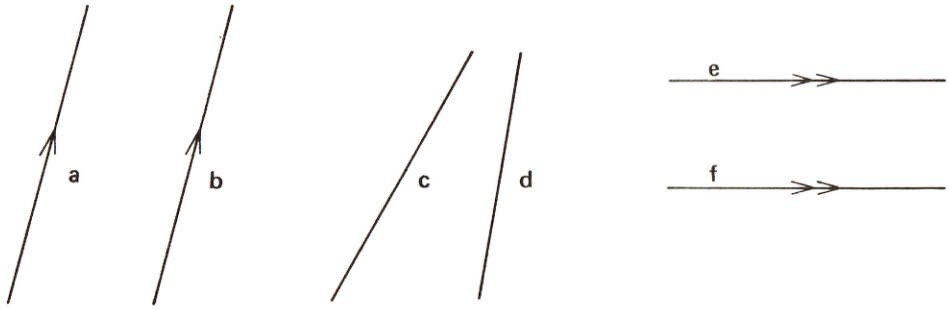
GEOMETRY

We have been studying quite alot about lines, angles, shapes and forms. All of these make up the subject of *Geometry.* In this unit we are going to go deeper into this subject of Geometry. Let us just review a bit before we go ahead.

EXERCISE-A-REVIEW

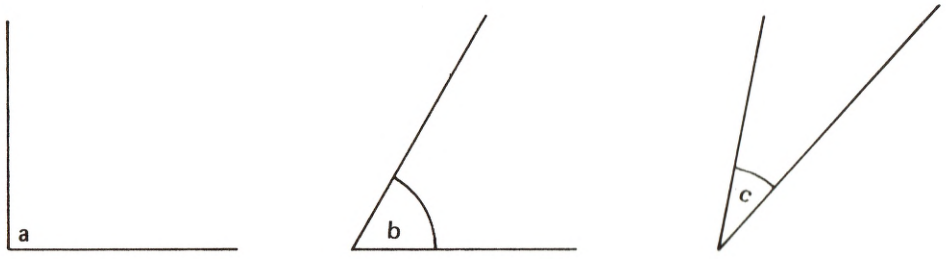
1. Let us name the line segments shown in the figure below:

(See fig. 4.1)



2. Which of these pairs of lines are parallel?

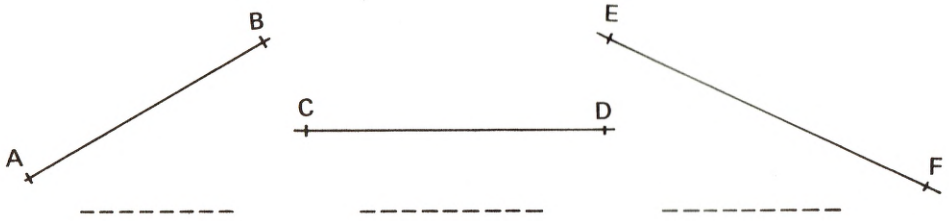
(See fig. 4.2)



a b c

3. Let us measure the value of these angles using our set squares.

(See fig. 4.3)

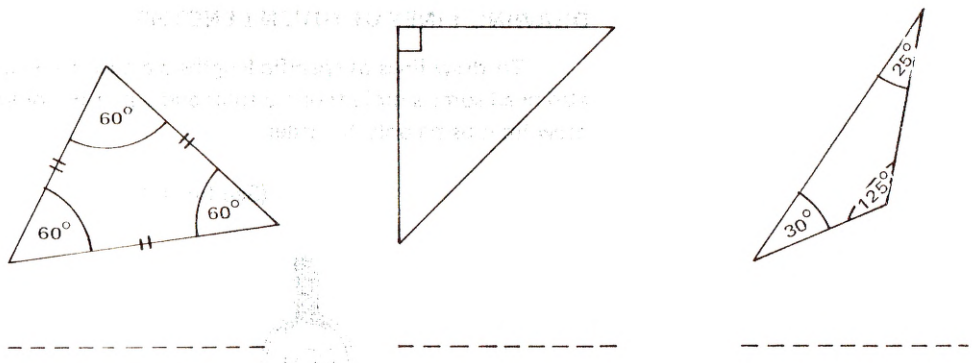


4. What king of angle is $< a$?

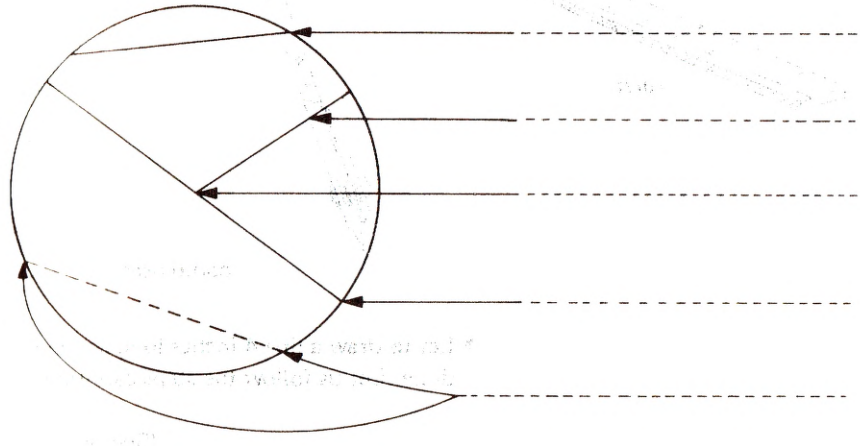
   (a) What is a quadrilateral!?

   (b) Draw any two quadrilaterals and name them.

5. Here are some triangles. Let us write down the correct word for the type, underneath theme e.g. isoceles, right triangles scalene, or equilateral.

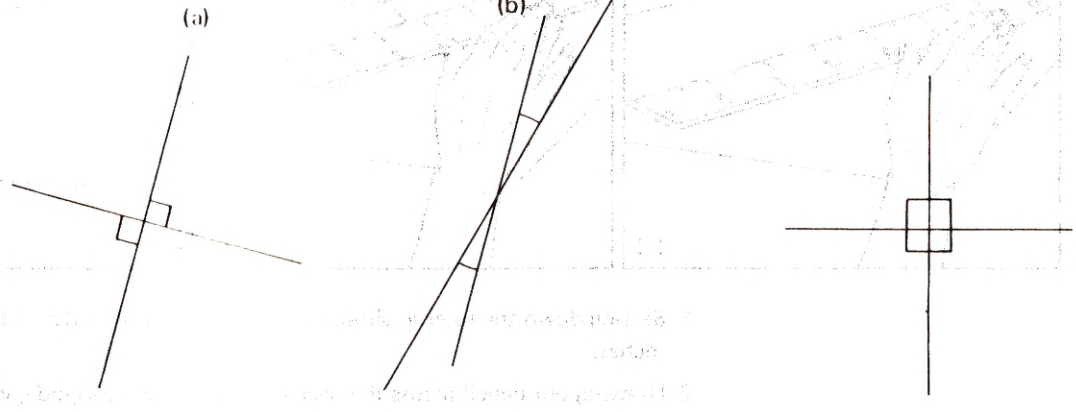


(See fig. 4.4)



6. Let us name these parts of the circle.

(See fig. 4.5)



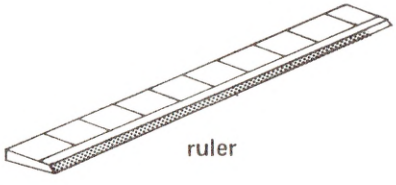
7. Which of these pairs of lines are perpendicular to each other?

(See fig. 4.6)

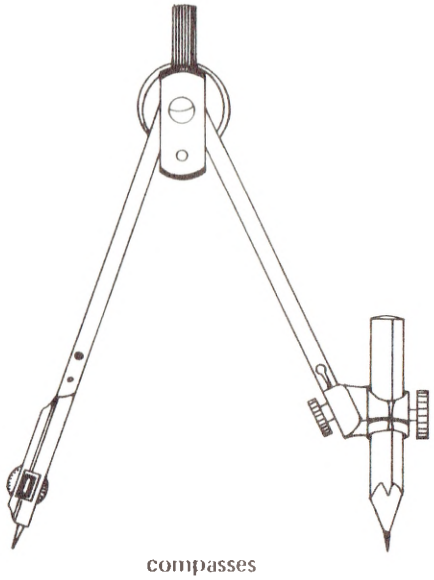
DRAWING LINES OF GIVEN LENGTHS

To draw lines of specific lengths we need to be able to measure accurately. We also need some simple tools: a ruler and a pair of compasses. First we are going to draw lines using only the ruler.

(See fig. 4.7)



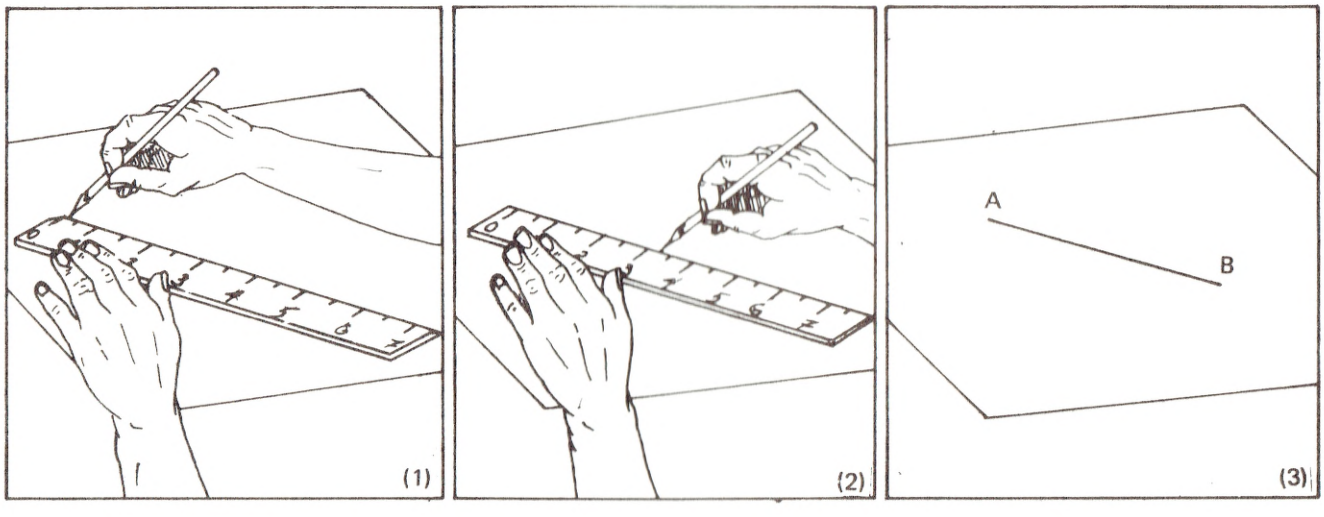
ruler



compasses

- Let us draw a line 4 inches long across our page. The diagram shows how this is done. Let us follow the steps carefully.

(See fig. 4.8)



1. Setting down the ruler as shown, we start our line exactly on the mark of nought inches.
2. Drawing our pencil across the page using the ruler as a guide, we stop exactly at the 4 inches mark. We have drawn a line 4 inches long.

- Let us draw some lines for these lengths. Draw some vertically, some horizontally, and some sloping:

5 inches, 6 inches, 7 inches, $8\frac{1}{2}$ inches.

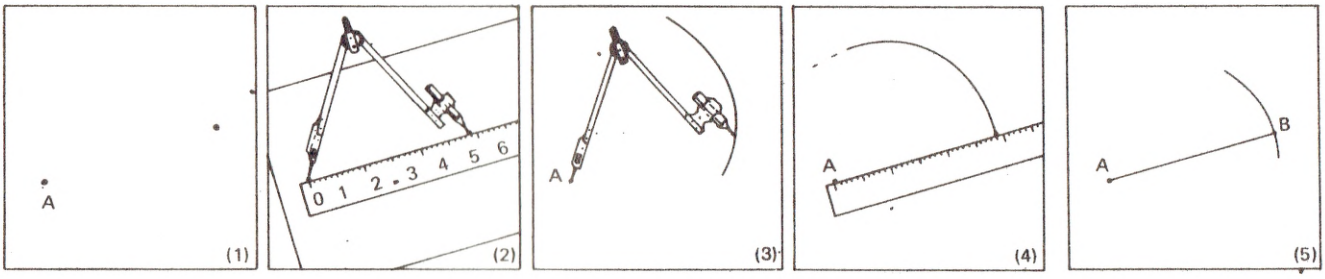
Name each line.

The method we have been using is a very quick method, but sometimes is not very accurate.

We would now use our compasses and ruler to draw more accurate lengths. Let us draw a line $4\frac{1}{2}$ inches long using our compasses and ruler.

The diagrams again show the steps to be followed.

(See fig. 4.9)



1. We mark our starting point. In this case we call it A.
2. Using the compasses, we open it till the point and the pencil point are spread exactly $4\frac{1}{2}$ " apart, using the ruler for this as shown in the diagram.
3. Then, placing the compass point on A we draw an arc very lightly, by spinning the compass, letting it pivot on its point as shown.
4. Now we place pur ruler touching point A and any desired point on the arc as shown, and draw a line with our pencil, connecting the point on the arc B with point A. We have now drawn the line A B exactly $4\frac{1}{2}$" long.

We can use the same method to draw our lines in this and future exercises and generally in drawing lines of given lengths.

Let us practice.

EXERCISE-B

1. Let us draw these lines:

   (a) AB = 6" (b) CD = $5\frac{1}{4}$" (c) EF = $3\frac{1}{2}$" (d) GH = 14 *cm*

2. Let us draw a line AC passing through point B on this page. AC must be 3" long.

B.

A.

3. Let us draw a line CD that is equal in length to this line xy but going vertically.

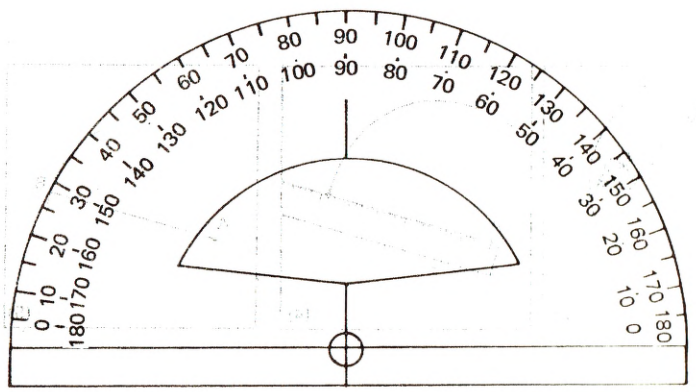
4. Let us draw a line LM that is parallel to CD on this page. Line LM must be $2\frac{1}{2}$" long.

   Hint: Draw the parallel line first using the method in Book 2 and then use the compass to mark off $2\frac{1}{2}$".

ESTIMATION AND MEASUREMENT OF ANY ANGLE

We have already learned to measure angles using our set squares. The angles we could measure with them are few; e.g. 90°, 45°, 30°, and 60°. Here we are going to learn to measure angles using the protractor.

(See fig. 4.10)

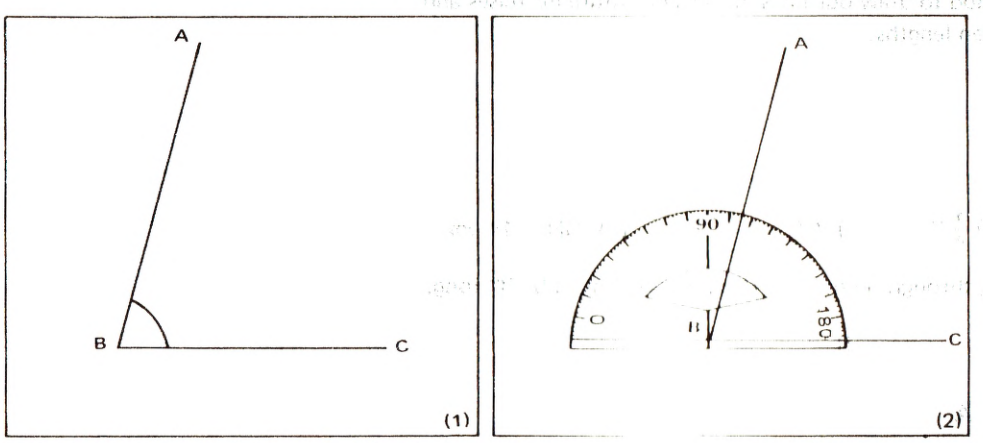


Protractor

We would also do some practice in estimating the sizes of angles — that is, using only our eyes and 'averaging' the size.

Let us measure the size of the angle shown in this figure.

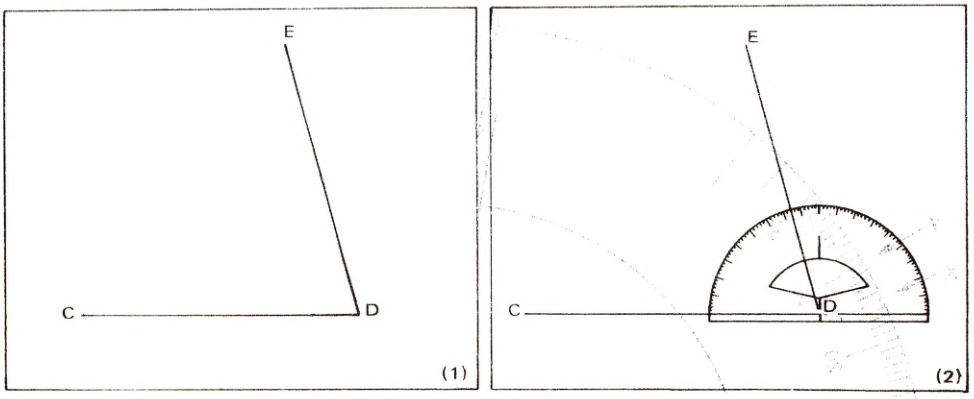
(See fig. 4.11)



To do this, we place the protractor on the angle as shown. The centre point on the protractor must be on the vertex of the angle, and the bottom line must run directly along the side of the angle — in this case side BC. Next we look at the point on the protractor where the other side BA cuts. On the protractor there are two sets of numbers. We use the set which has its 0 on line BC, and now are actually counting from 0 up, until we meet the point on the protractor where line BA cuts. The protractor is marked of in tens. We therefore arrive at 70° as the size of $< ABC$ $< ABC = 70°$.

The angle we just measured was on the right hand side of the protractor. Let us now measure an angle on the left hand side of the protractor; $<$ CDE.

(See fig. 4.12)

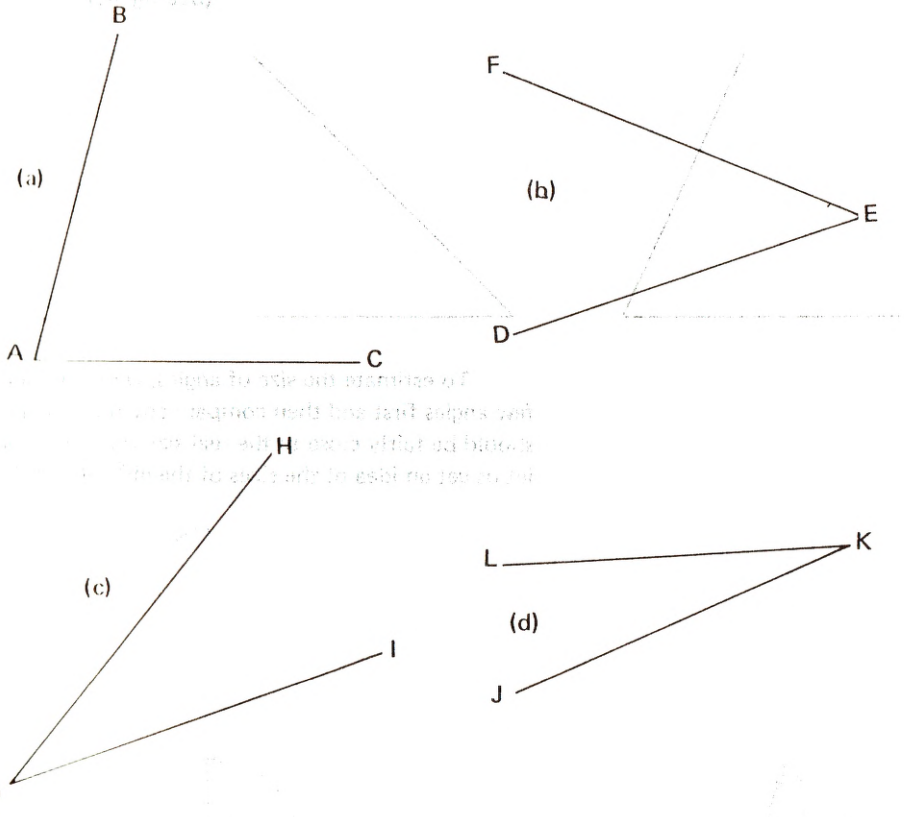


We set down the protractor again as shown in the diagram. The centre point of the protractor rests on the vertex, D and line CD runs directly along the bottom line of the protractor. Notice now that the nought that this line CD cuts; belongs to the other set of numbers. We then count the number of degrees up to the point cut by line DE, at a glance we read it off as 50°.

$\angle CDE = 50°$

- Let us practice by measuring the angles shown here:

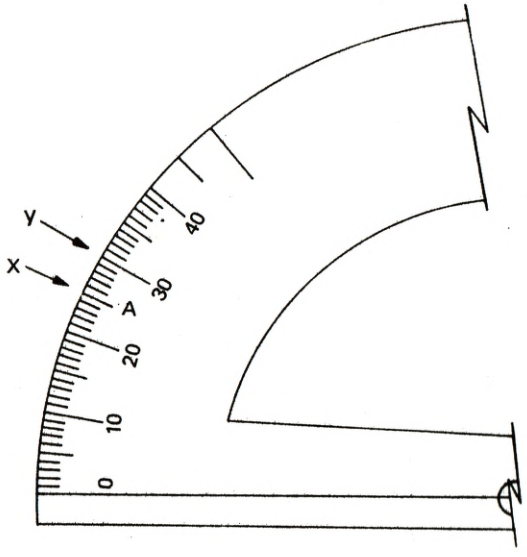
(See fig. 4.13)



All these angles are exact multiples of 10. Sometimes we find angles that are between these numbers, for instance 23° or 44°. Let us see how we measure them.

Taking a close look at the measurements on the protractor we see the markings as they are shown here.

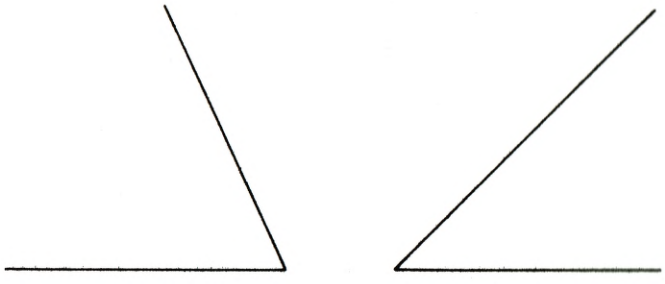
(See fig. 4.14)



Each tiny mark represents 1° so starting from 20° and counting to meet point X we get 24°. Counting to point Y, we get 29°. Notice that there is a longer mark at point A. This mark is the half-way mark between 20° and 30°. It is therefore 25° The half-way mark between 10° and 20° would of course be 15°, etc.

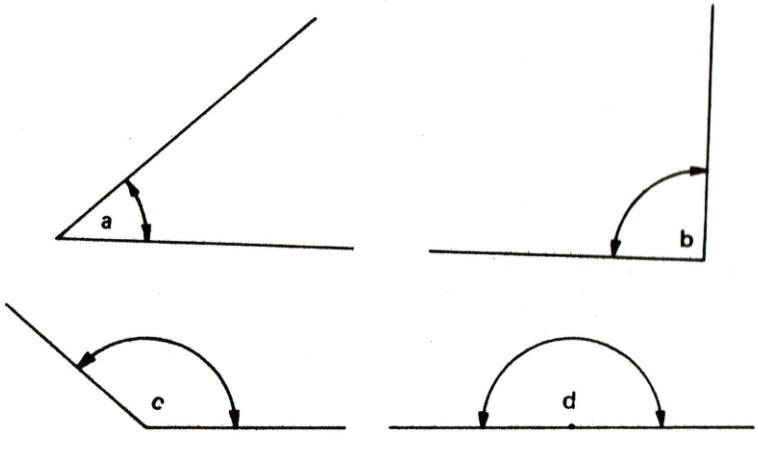
- Let us now measure the sizes of these angles.

(See fig. 4.15)



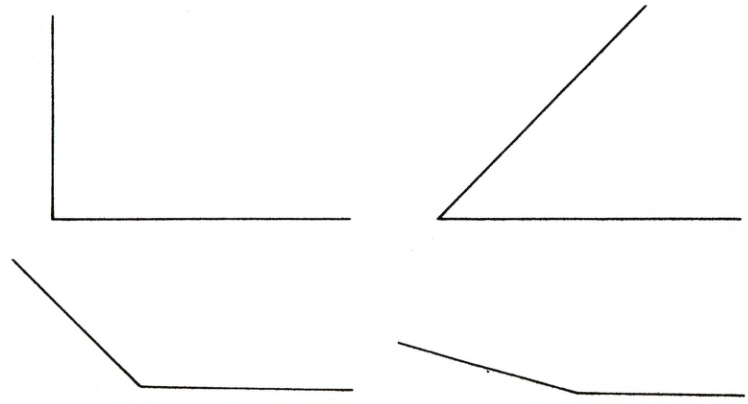
To estimate the size of angles, we try to get an idea in our mind of the size of a few angles first and then compare any other angle with these. The size that we 'average' should be fairly close to the real size then, and sometimes would be the true size. First let us get an idea of the sizes of the 45°, 90°, 135°, and 180° angles.

(See fig. 4.16)



$< a$ is a 45° angle, $< b$ is 90°, $< c$ is 135° and $< d$ is 180°. After looking at the size of each one carefully, let us try to 'average' the sizes of these below. Then after estimating each one, let us actually measure it with the protractor, to see how close we came to the real answer.

(See fig. 4.17)



You might ask yourself the question, is the angle greater or less than 90°, or 45°, as the case might be.

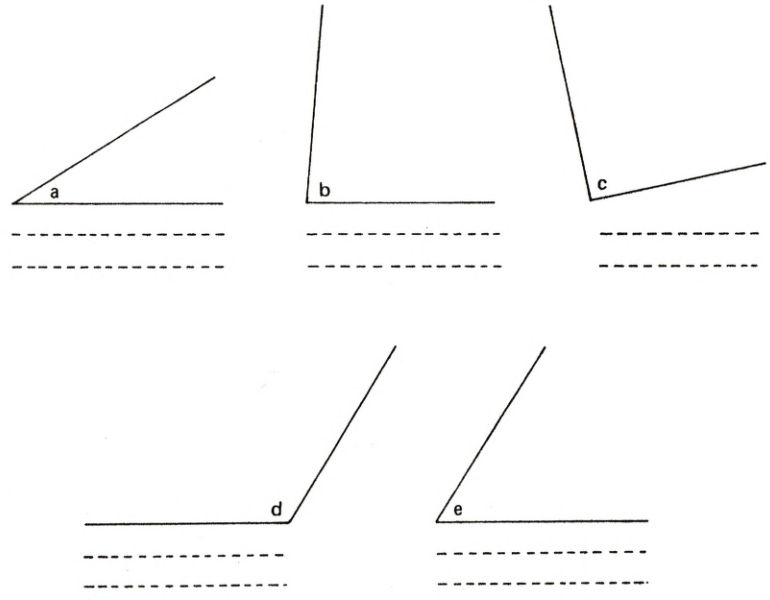
Let us fill in the spaces with what we estimated and the real size.

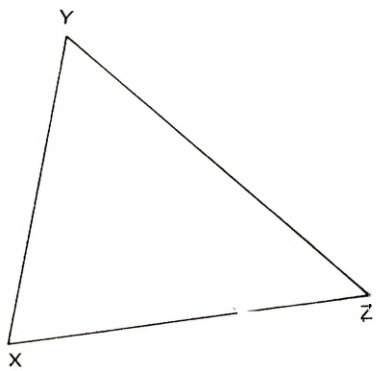
	Estimation	*Actual size*
$<$ ABC	------	------
$<$ DEF	------	------
$<$ GHI	------	------
$<$ JKL	------	------

EXERCISE-C

1. Let us estimate these angles and then measure them, filling in our answer in the blank spaces below:

(See fig, 4.18)





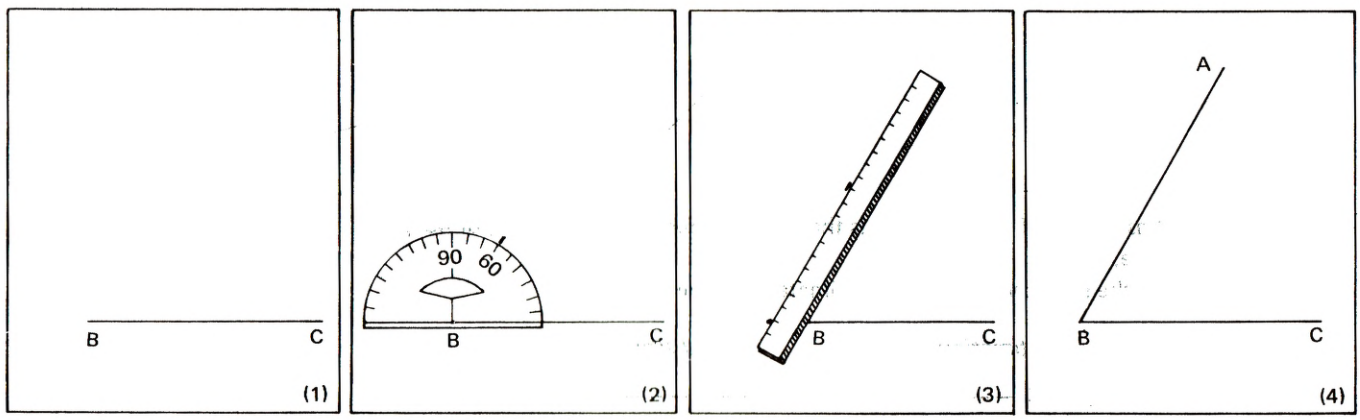
2. Let us measure all the angles of these triangles.

(See fig. 4.19)

DRAWING ANGLES OF GIVEN SIZES

Drawing angles of given sizes is actually the opposite of measuring given angles. We only need our ruler, protractor and pencil to do this. Let us draw an angle ABC measuring 60°, with side BC horizontal to our page. We can follow the steps in the diagram to do this.

(See fig. 4.20)



(1) First draw line BC horizontal to the page. We are not told what length that line should be so we simply use a suitable length. Note that point B is the vertex of the angle. Also you should write the letter names underneath the points.
(2) Next, position the protractor with the centre point on the point B, and line BC along the bottom line of the protractor. We look for the 60° mark, remembering to use the right set of numbers, and put a point on the paper next to the 60° mark.
(3) Using the ruler as shown draw a line from point B, passing through the mark you made and stopping at any suitable length, at point A.

We have now drawn angle ABC = 60°. Most times we would be told what lengths the sides of the angle should be. We already know how to draw lines of specific lengths so we simply use that method to draw line BC then measure our angle, put our mark, and then draw line BA to its given length, again using the compasses to measure the correct length.

Let us practice.

EXERCISE-D

1. Let us draw $\angle$ABC so that it is equal to 55°.
2. Let us draw $\angle$ CDE so that $\angle D = 40°$, side DE = 2" and side CD = $2\frac{1}{2}$".
3. Draw Δ FGH so that side GH = 3", FG = $2\frac{1}{4}$" and $\angle G = 35°$.
4. Draw a right angle Δ JKL so that KL = $1\frac{1}{2}$", and JK = 2".

PLANES: NAMING AND RELATIONS TO EACH OTHER

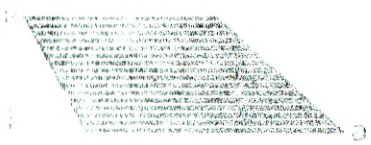
We already know that a plane is a surface, and we have worked with surfaces before. The plane surfaces we met already are, polygons and circles. Here we are only going to look at the method of naming these planes and how planes are related to each other.

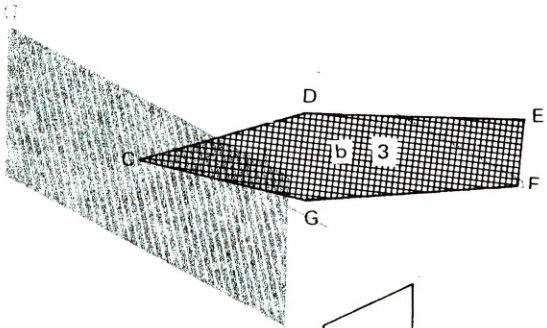
(See fig. 4.21)

In the figure we have shown a rectangular plane. This plane can be named by using the small letter 'a'. It can also be named using the number '2', in this case. Also the plane can be named using the two letters at the opposite corners of the plane.

In the case of planes with more than four corners we can name the plane by a small letter, a number, or naming each corner.

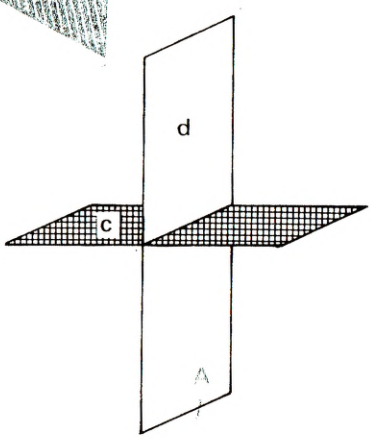
(See fig. 4.22)





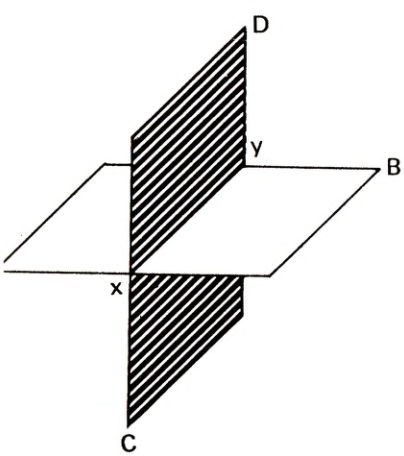
This plane can be called (b) (3) or CDEFG.

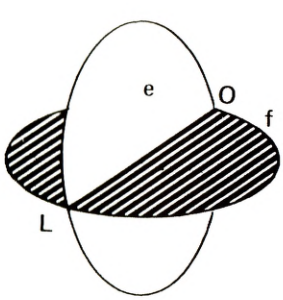
(See fig. 4.23)

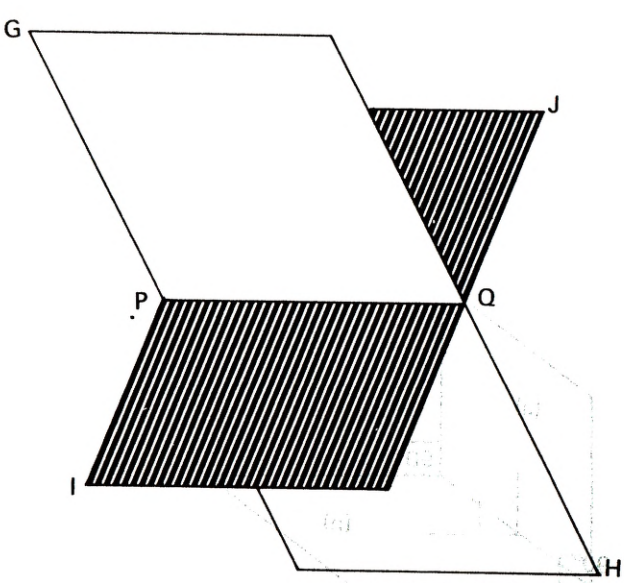


This figure shows two rectangular planes c and d meeting each other. Where they meet they form a line. What is the name of the line formed? Look at the walls of the room, notice that they form straight lines where they meet. Whenever two planes meet or intersect each other they form a straight line. Figure 4.24 shows pairs of planes intersecting each other.

(See fig. 4.24)

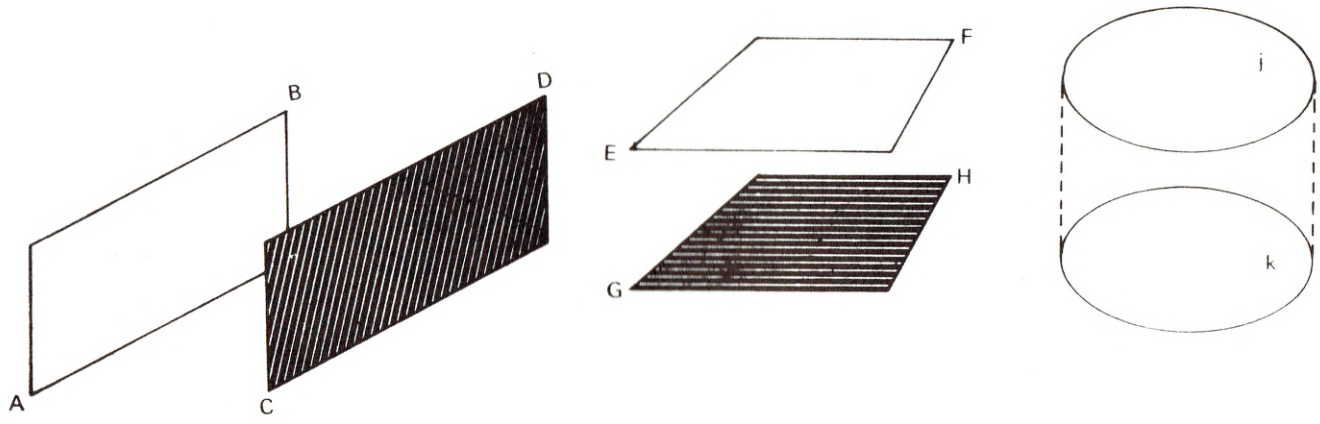






Name the straight lines formed by the planes intersections.
In figure 4.25 we see a line intersecting a plane.

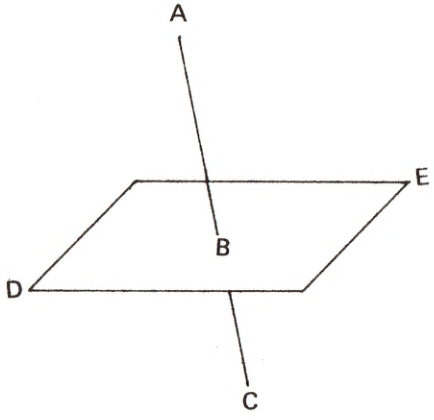
(See fig. 4.25)



Here we see that a point, b, is formed where they intersect.

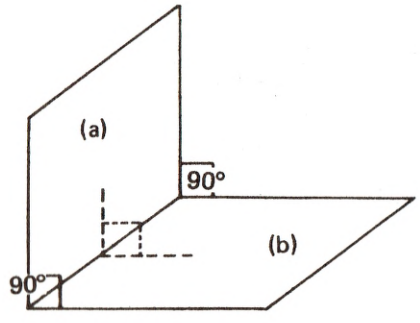
In the same way that we have parallel and perpendicular lines we have planes. The figure shows planes that are parallel to each other. The ceiling and floor of the room are most likely parallel planes.

(See fig. 4.26)



How would you describe parallel planes?
Some perpendicular pairs of planes are shown in the figure.

(See fig. 4.27)



In the first pair, plane a is vertical and plane b is horizontal. Why would we say that in all the pairs the planes are perpendicular to each other?

EXERCISE-E

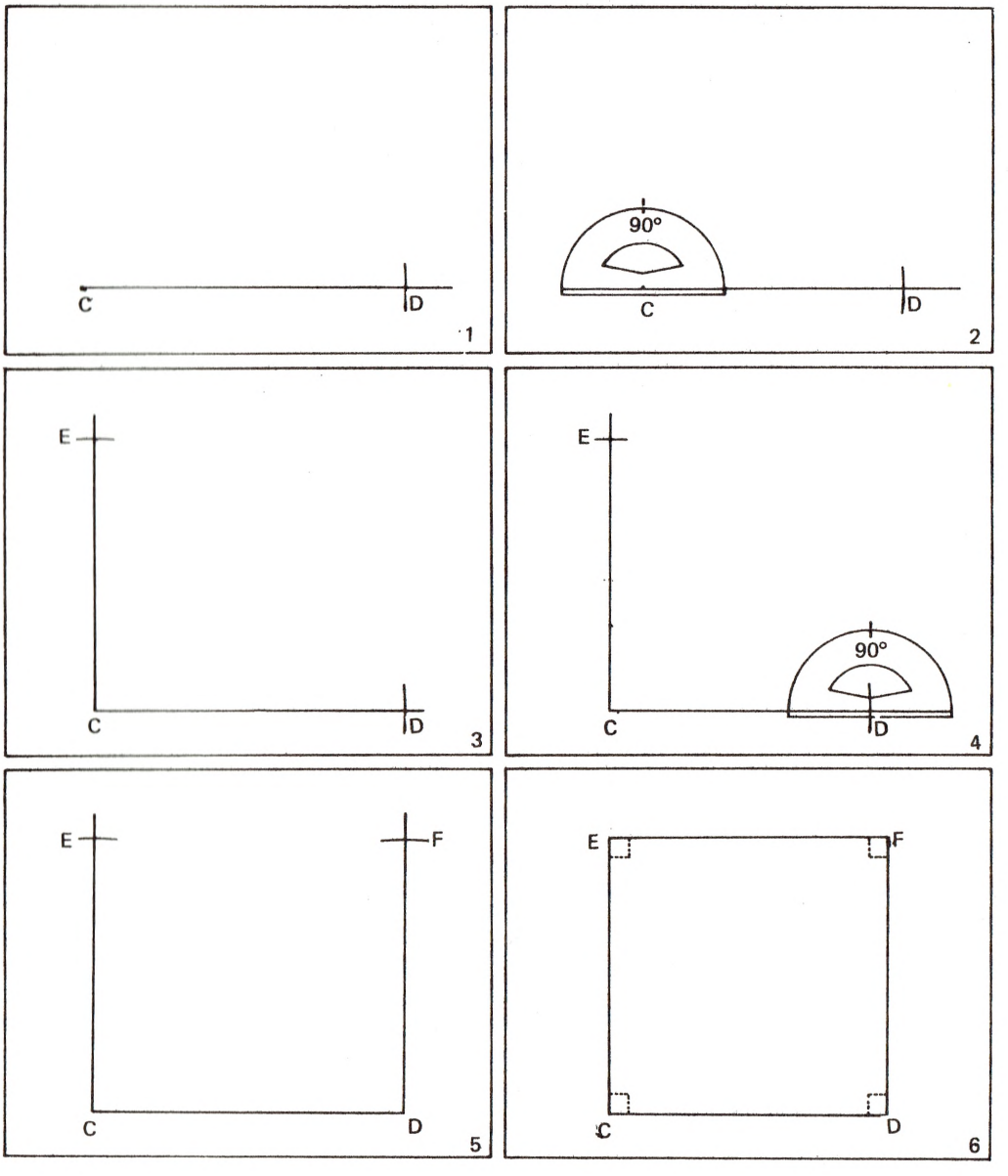
Look about you; see if you can identify intersecting or meeting planes, perpendicular planes, vertical planes and horizontal planes.

DRAWING PLANES AND FIGURES OF GIVEN DIMENSIONS

We have learned to draw lines and angles of specific measurements. We would now learn to draw planes. This would involve the drawing of lines of specific lengths and the drawing of angles of specific sizes. First let us draw a square CDEF with each side measuring 4". Although we are not told the sizes of the angles we know that all the angles of a square are 90° or right angles.

The diagrams and steps show us how to go about drawing the square, we need a ruler, protractor and compasses.

(See fig. 4.28)



(1) Draw line C D across the page exactly 4″.

(2) Position the protractor as shown on point C and measure off 90°, putting a mark next to it.

(3) Next we draw the line CE exactly 4″ long, using the compasses to measure off the exact length.

(4) We then measure off 90° at point D and mark it off as before.

(5) Draw line D F exactly 4″.

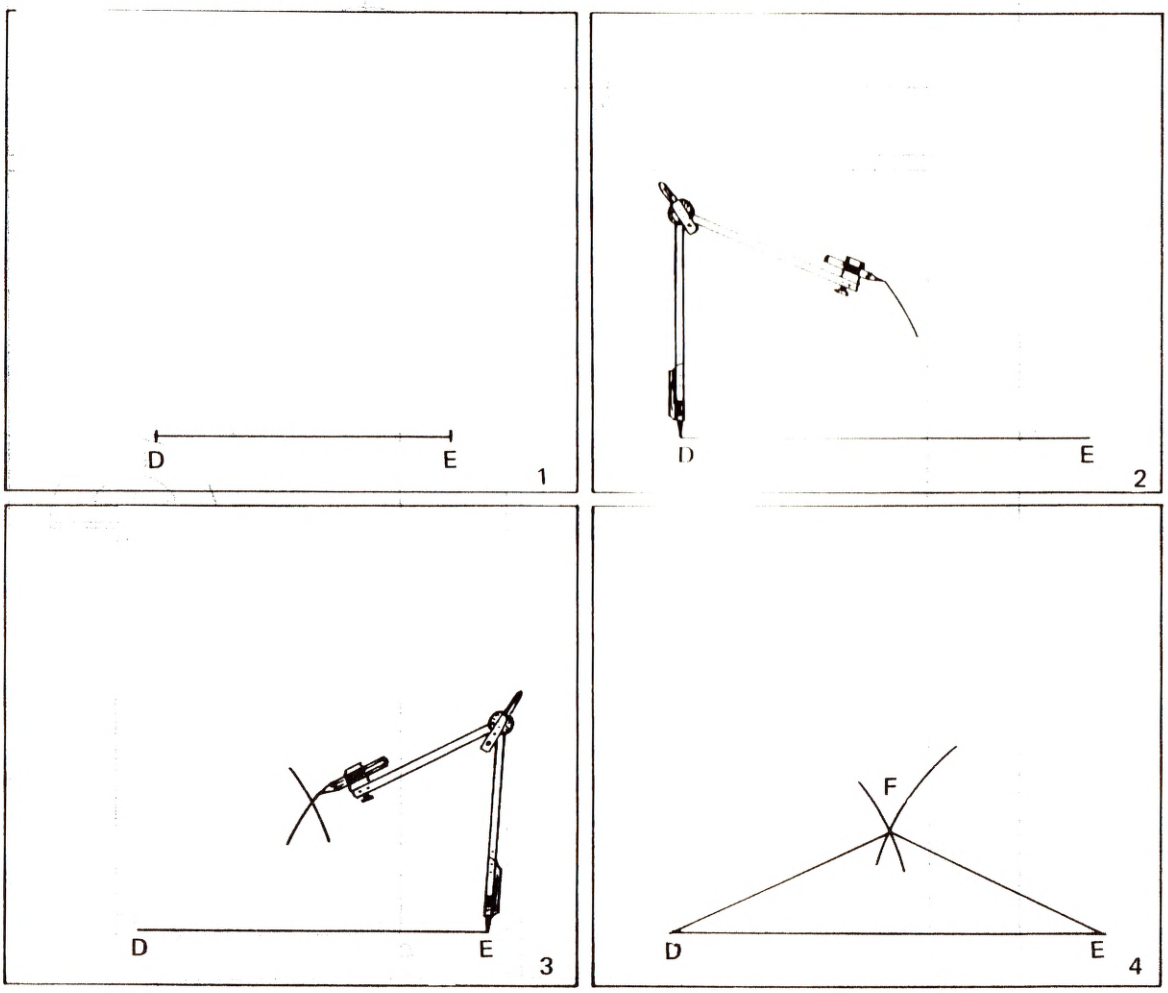
(6) Finally we connect points E and F. We now have a square CDEF with each side measuring 4″. There was no need for us to measure off angles E and F. They would automatically work out to be 90°. This usually happens with squares and rectangles You can prove it by measuring them.

To draw rectangles we use the same procedure as above, only remembering that this time we have two long sides of same length, and two shorter sides of same length. Here again all the angles are 90°.

- Let us draw rectangle GHIJ so that GH = 10 *cm*, HI = 5 *cm*, IJ = 10 *cm* and GI = 5 *cm*.

To draw triangles the procedure is almost the same. Let us draw triangle DEF so that the base DE = 7 *cm*, side EF = 4 *cm* and side DF = 5 *cm*. Here we only have the lengths of the sides to work with. Let us follow the diagrams and the steps.

(See fig. 4.29)

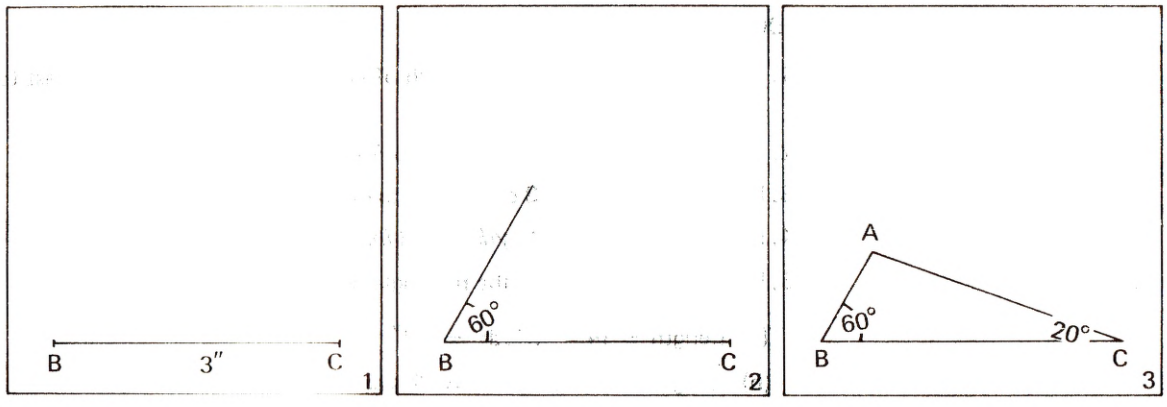


(1) First draw the base of the triangle DE 7 *cms* long. Use the compasses and ruler to measure the length accurately.
(2) Now set the compasses to measure 5 *cm* and with the point at D draw an arc as shown. Point F would be somewhere on this arc.
(3) Then setting the compasses to measure 4 *cms*, and putting the compass point at E we draw a second arc so that it cuts the first one. The point of intersection is our point F because it is exactly 4 *cm* from E, and 5 *cm* from D.

Let us practice one where we are given the length of one side and the size of the two angles on the ends of that side.

We are going to draw triangle ABC so that the base BC = 3" $<$B= 60° and $<$C = 20°.

(See fig. 4.30)



(1) Draw the base BC, 3" long.

(2) Measure $<$ B, 60° and draw a line from point B as shown, be careful not to draw the line too short.

(3) Measure $<$ C, 20° and draw the line from point C.

(4) Wherever the two lines intersect is point A. We now have triangle ABC with BC = 3", $<$ B = 60° and $<$ C = 20°.

- Let us practice this by drawing triangles MNO so that MN is 4", $<$ N = 40° and $<$ M = 40°.

SUMMARY

We have begun to draw lines and angles of accurate sizes, and to use these skills to draw plane figures; the square, rectangle and triangle of given measurements. This kind of work is very important for draughtsmen, architects and builders; as all constructions are made up of shapes and forms in different combinations.

CONSOLIDATORY EXERCISES

1. Let us say which of these pairs of planes are parallel.

2. Let us draw a square ABCD, in which all the sides are $2\frac{1}{2}$".

3. Let us draw a rectangle DEFG so that, side DE = $3\frac{1}{2}$", EF = 2", FG = $3\frac{1}{2}$" and DG = 2".

4. Draw a triangle ABC in which BC = $4\frac{1}{2}$" $<$ B = 45°, and $<$ C = 45°.

5. Draw a triangle DEF in which side DE = $1\frac{1}{2}$" side EF = 1" and side DE = 2".

MEASUREMENTS

REVIEW

In Book 2 we learned the different units of lengths and weights, both the British System and the Metric System. We learned to change the lengths and weights from 1 unit to another, e.g. changing 6 feet to inches. We learned to apply the operations of addition, multiplication, subtraction and division to measurements. We also learned to find the areas of squares, rectangles and triangles.

Let us review a little of what we learned before we move on.

EXERCISE-A-REVIEW

1. If you have to measure the length of your page which unit is the best to use? *Yds, ft, ins.*
2. Let us change 2 *yds*, 2 *ft*, 3 *ins* to *ins.*
3. Let us change 6 *dm*, 3 *cm*, 2 *mm* to *mm.*
4. Let us change 58 *ins* to *yds ft* and *ins.*
5. Let us find the areas of the rectangles with these measurements.
   (a) Length = 14″ width = 12″
   (b) Length = 3 *yds* width = 2 *yds.*
   (c) Length = 3 *m* width = 2 *m.*
6. The base of a triangle measures 14″ and its altitude is 6″. What is the area of the triangle?
7. Which is longer 1 *m* or 1 *yd.*
8. The weight of a quantity of fish was 5 *lbs.* How many *ozs* is that?

PERIMETER AND CIRCUMFERENCE

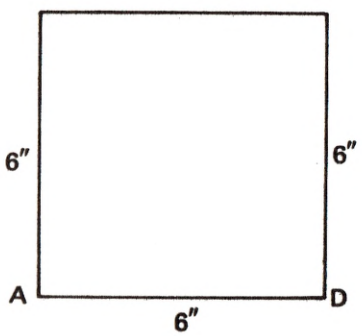
The distance right around a square, rectangle or other polygon is called the *Perimeter* of that figure.

- Let us read and write: Perimeter ——————, ——————, ——————.

The distance right around a circle is called its *circumference.* Let us read and write the word: Circumference: ——————, ——————, ——————.

First we would learn to calculate the perimeter of squares and rectangles.

(See fig. 5.1)



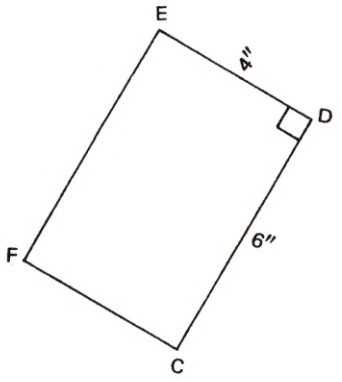
In the figure the square ABCD has each of its sides measuring 6″. To find the distance right around we can start at point A. Now moving from A to B we get 6″, then from B to C another 6″, then from C to D gives a further 6″ and back to A gives still another 6″. The perimeter then is 6″ + 6″ + 6″ + 6″ or 4 × 6″ = 24″. 6″ was the length of each side of the square so we can say simply that the perimeter is equal to 4 L. We can write a formula for finding perimeters of squares:

P = 4L ..... here P = perimeter, and L = length.

- Let us find the perimeter of a square garden whose length is 14 *yds.*

To find the perimeter of a rectangle we use a similar method.

(See fig. 5.2)



In this rectangle the length is 6" and the breadth is 4". Starting from point C and D we get 6", then from D to F we get 4", from E to F is another 6" and finally from F to C is 4". The perimeter then was: $6 + 4 + 6 + 4$.

We really have $(6 + 4) + (6 + 4)$ or $6 + 4$ coming up twice. This is the same as $2 \times (6 + 4)$. Since 6 is the length and 4 is the breadth we can use the letters L and B and write a formula for finding the perimeters of rectangles.

$$P = 2 (L + B)$$

Here p = perimeter of a rectangle. e.g. Let us find the perimeter of a rectangle whose length is 7′ and breadth is 5′.

$$P = 2 (L + B)$$

so $$P = 2 (7 + 5)$$

$$P = 2 \times 12'$$

$$P = 24'$$

The perimeter is 24′.

Notice how we started off with the formula and moved towards the answer by substituting the correct values for L and B in the formula. Would this formula work also for squares? Try it and see. Try to find the perimeter of a square whose length and breadth is 5" using the two formulas $P = 4L$ for squares and $P = 2 (L + B)$ for rectangles. What do you notice?

This happens because the length and breadth of the squares is the same measurements.

To find the circumference of a circle we must know the diameter of the circle and then we use this formula:

$$\pi D = C$$

In this formula; C is the circumference of the circle, D is the diameter and the symbol π which is called 'pie' represents a fraction; $\frac{22}{7}$, or a decimal fraction of 3.14. Once we know the diameter of the circle, we simply multiply it by 3.14 or $\frac{22}{7}$ whichever is more convenient to use, and we would have our circumference. E.g. Let us find the circumference of a circle whose diameter is 7".

formula: $\pi D = C$

substituting we get $\frac{22}{7} \times 7 = C$ remember 7 is the same as $\frac{7}{1}$

so cancelling we get $\frac{22}{\cancel{7}_1} \times \frac{\cancel{7}^1}{1} = \frac{22}{1} = C$

$$22" = C$$

Here is a very rough way to find the circumference of the rim of a tin.

(See fig. 5.3)

- Let us calculate the circumference of the circles with the following diameters.
- 6", 5", 3". Do you think it is possible to find the circumference of a circle if only the radius is known? Why?

- If the radius of a circle is 4″ then the diameter is $2 \times 4 = 8$″, so we can find the circumference by multiplying 3.14×8. Here we see that we had to multiply the radius by 2 before we found the circumference. We can include that step in the formula using r for radius.

  So $\pi 2 r = C$. This formula is normally written as $2 \pi r = C$. This is the same thing because of the commutativity of multiplication.

  We have therefore developed two formulas for finding the circumference of a circle.

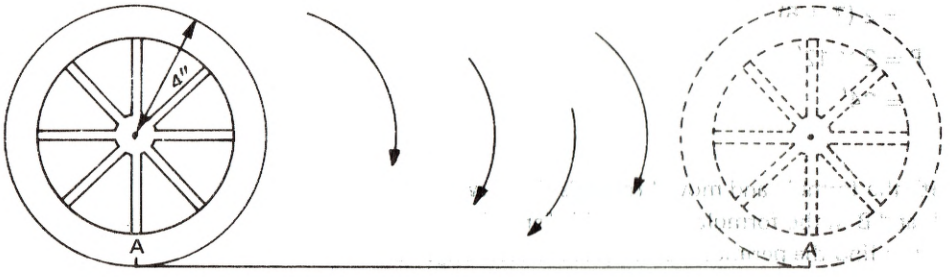
$$\pi D = C$$

$$2 \pi r = C$$

  We can use the most suitable one.

- Let us find the circumferences of the circles whose radii are: 2″, 3″, 6″.

(See fig. 5.4)



If we were to roll the wheel shown in fig. 5.4 so that it made 1 complete turn, it would have travelled a distance that is equal to its circumference. What would that distance be in inches?

EXERCISE-B

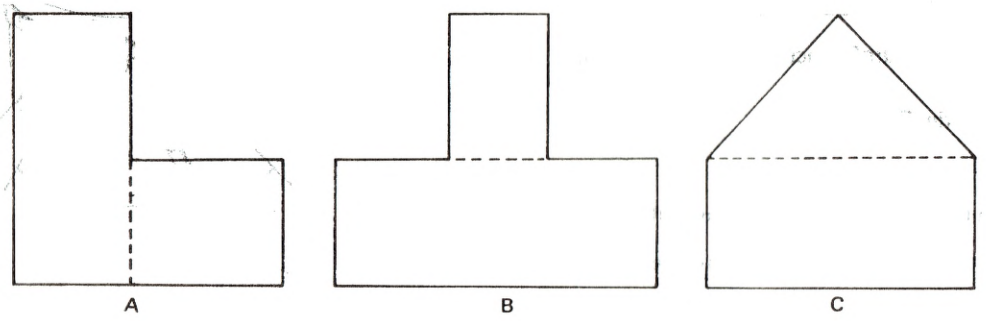
1. Let us find the perimeter of a floor whose length is 14′ and breadth is 12′.
2. A farmer wants to put a paling fence around his rectangular garden. If the length of the garden is 24 *yds* and the width is 20 *yds*. At least how many *yds* of paling he needs to buy?
3. Find the perimeter of a square whose length and breadth is 3 *m*.
4. The diameter of the top of a cylinder is 8 *cm*. What is the circumference of the top?

A wheel has a radius of 12′. What distance would the wheel travel if it is rolled for (a) 1 complete turn; (b) 6 complete turns. Give your answers in *yds*, feet and inches.

AREAS OF IRREGULAR FIGURES

Sometimes we need to find the areas of shapes that are irregular that is, they are combinations of other shapes.

(See fig. 5.5)



These shapes are all combination of other shapes:

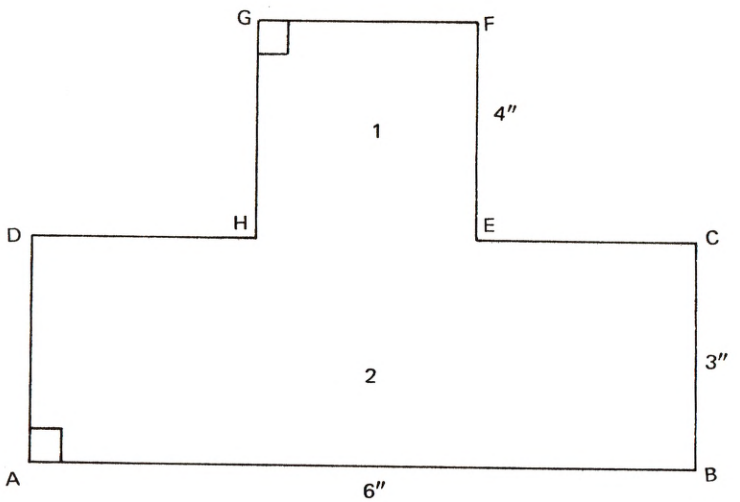
(a) Is really made up of two rectangles.

(b) Is made up again of two rectangles.

(c) Is made up of a rectangle and a triangle. This makes it easy for us to find the areas of such figures.

Let us find the area of the figure shown below.

(See fig. 5.6)



- First let us draw a dotted line joining points H and E. We now have a rectangle (2), and a square (1). We can now find the area of the square (1) $A = L \times B$, $A = 4 \times 4 = 16$ *sq ins.*

Then we can find the area of the rectangle (2).

(2) $A = L \times B \quad A = 6 \times 3 = 18$ *sq ins*

Then adding the two areas together, we would get the entire area of the figure.

Area of the figure $= (16 + 18)$ *sq ins* $= 34$ *sq ins*

We could have done this a shorter way by saying: Area of the figure = area of square (1) + area of rect. (2) and working it out: Area of the figure

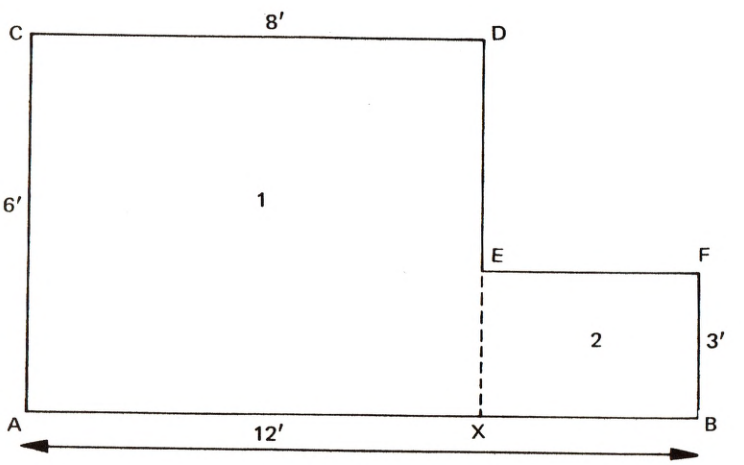
$= (4'' \times 4') + (6'' \times 3'')$

$= 34$ *sq ins*

Notice that drawing the dotted line was very important as it allowed us to see the shape as 2 regular figures that we handled before. Also notice that after finding the area of the separate sections we must add in order to get the total area of the figure.

Here is an example where we have to calculate the length of a side before finding the area.

(See fig. 5.7)



In this case the dotted line is drawn from point E to X. We therefore have 2 rectangles named (1) and (2). Looking at rectangle (1) we see that the $L = 8''$ and $B = 6$ but looking at rect. (2) we realize that the length is not known, and the breadth is 3. How can we find the length of rect. (2)?

First notice that the length of side AB is 12. Then the length of $AX = 8$ then it is easy to see that the length of BX is $12 - 8$, which is 4.

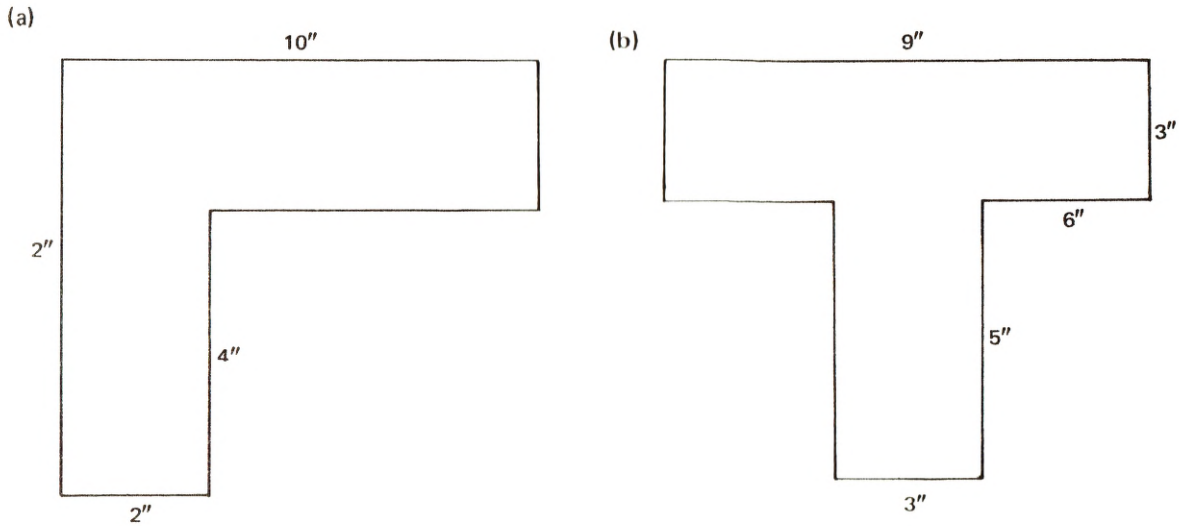
So for rect. (2) $L = 4$ and $B = 3$

We can now find the area as before.

$$\begin{aligned}\text{Area of figure} &= \text{area of rect. (1)} + \text{area of rect. (2)} \\ &= (8 \times 6) + (4 \times 3) \\ &= 48 + 12 \\ &= 60 \ sq\ ft\end{aligned}$$

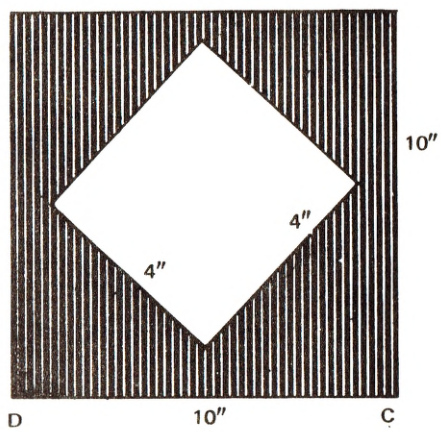
- For practice let us find the areas of the figures shown here.

(See fig. 5.8)



Here is an interesting example. Let us try to find the area of the shaded portion of the figure shown in fig. 5.9.

(See fig. 5.9)



Could you think of a way to tackle it? First let us think of ABCD as a large complete square area (10 X 10) *sq ins.* Then think of cutting out of it a smaller square area of (4 X 4) *sq ins.* What is left would be the area of the shaded part. We therefore have to subtract the area of the small square from the area of the larger one. Thus:

$$(10 \times 10) - (4 \times 4)$$

The area of the shaded part $= (10 \times 10) - (4 \times 4)$

$= 100 - 16$

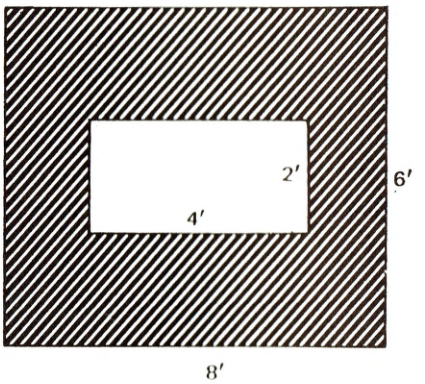
$= 84$ *sq ins*

Here we see that we subtracted one area from the other in order to find the required answer.

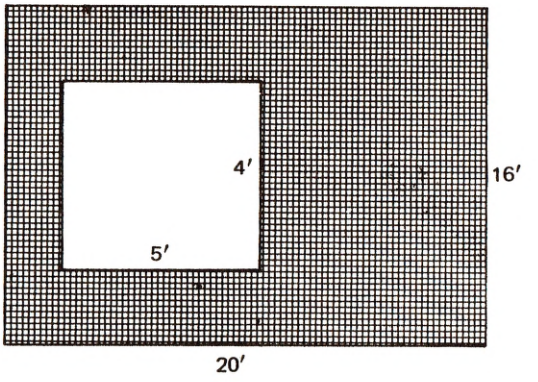
- Let us practice by finding the area of the shaded parts of these figures.

(See fig. 5.10)

(a)



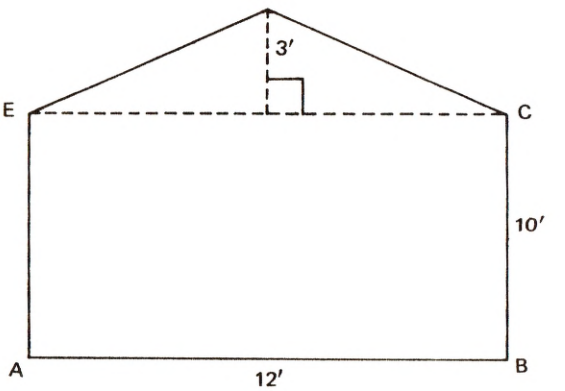
(b)



Those we have looked at so far were made up of squares or rectangles. In all the cases we were able to divide the whole figure into 2 regular shapes. Sometimes we would need to divide the figure into more than two shapes. In these cases we simply find the area of each one and then add or subtract them, whichever is required.

We are now going to look at figures made up of triangles, squares and rectangles. Let us find the area of the figure shown here.

(See fig. 5.11)



If we draw a dotted line from point E to point F we would end up with a rectangle ABCD measuring 12′ by 10′ and a triangle CDE with its base CE being 12′ (CE = AB), and its altitude given as 3′. The total area of the figure then would be:

Area of the triangle plus the area of the rectangle.

$$\text{The area of the figure} = (L \times B) + \frac{1}{2}(B \times H)$$

$$= (12 \times 10) + (6 \times 3)$$

$$= 120 + 18$$

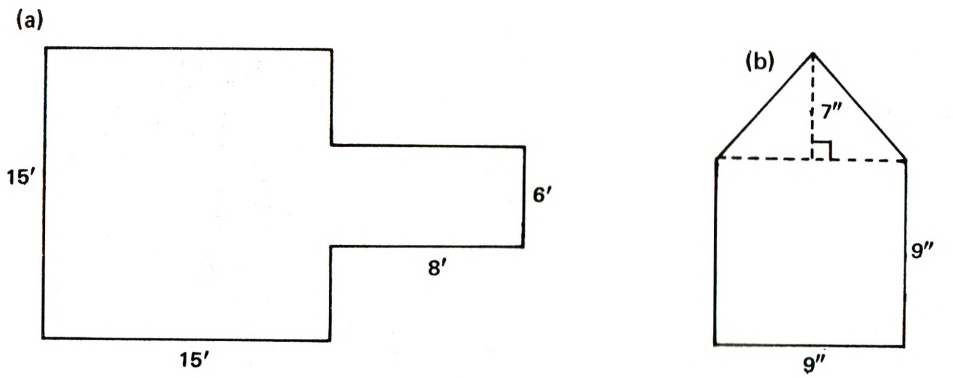
$$= 138 \text{ } sq \text{ } ft$$

Remember that the altitude is always perpendicular to the base. So DC is not the altitude.

EXERCISE-C

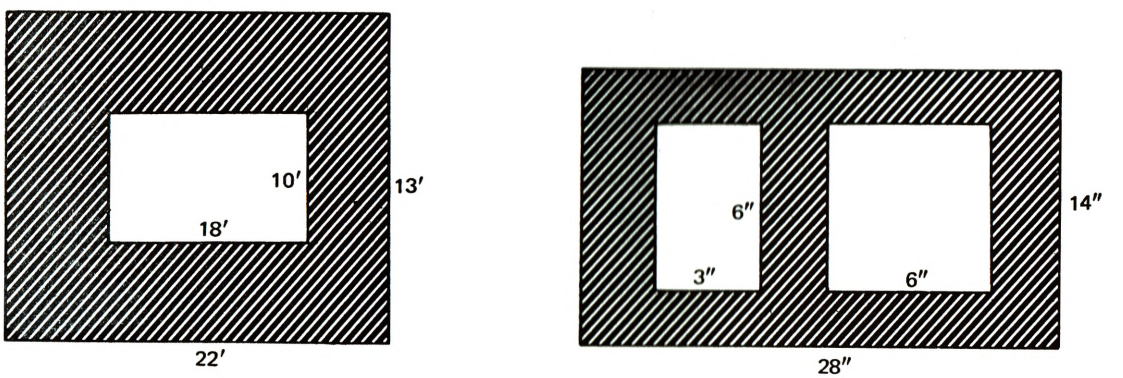
1. Let us find the areas of these figures:

(See fig. 5.12)



2. Let us find the areas of the shaded parts of these figures:

(See fig. 5.13)



3. A rectangular wall measuring 16′ by 10′ had 2 windows in it, 1 window measured 3′ by 3′ and the other measured 4′ by 3′. Find the area of the wall itself. (It may help to draw a diagram of the wall putting in the windows.)

SQUARE MEASURES

Here we are going to look at the units of square measures that are used in both the British System and the Metric System and see how they compare with each other.

The British table of square measure		
144 *sq ins* (in^2)	=	1 *sq ft* (ft^2) a *sq ft* = 12" X 12" = 144 *sq"*
9 *sq ft*	=	1 *sq yd* (yd^2) a *sq ft* = 3' X 3' = 9 *sqft*
4 840 *sq yds*	=	1 acre
640 acres	=	1 *sq mile*

In Book 2 we learned how to change from one unit to another using the tables. To change acres to *sq yds* in this case we multiply by 4 840.

$$2 \text{ acres} = 4\,840 \times 2 \text{ sq yds}$$
$$= 9\,680 \text{ sq yds}$$

Then to change from a small unit to a higher one we divide. To change from *sq ft* to *sq yds* we divide by 9. 18 *sq ft* = 18 ÷ 9 = 2 *sq yds.*

- Let us practice by changing 16 *sq ft* to *sq ins* and 36 *sq ft* to *sq yds.*
- How many *sq yds* are in 3 *acres?* How many *sq ft* would that be?

The metric table is much easier to handle. Let us look at it.

The metric table of square measure		
100 *sq mm* (mm^2)	=	1 *sq cm* (cm^2) because 1 *sq cm* = 10 *mm* X 10 *mm*
100 *sq cm*	=	1 *sq dm* (dm^2) • 1 *sq dm* = 10 *cm* X 10 *cm*
100 *sq dm*	=	1 *sq m* (m^2) • 1 *sq m* = 10 *dm* X 10 *dm*
100 *sq m*	=	1 are *(a)*
100 ares	=	1 hectare *(ha)*
100 hectares	=	1 *sq km* (km^2)

The hectare is about $2\frac{1}{2}$ acres in size.

From this table we can see how easy it is to change from one unit to another we simply multiply or divide by 100 or some other power of 10 depending on what unit we are changing to.

For example: Let us change;
3 *sq m* to *sq dm* each *sq m* = 100 *sq dm* so the answer is 300 *sq dm.* Now let us change 200 *sq cm* to *sq dm* — 200 + 100 = 2. Answer is 2 *sq dm.*

We would now compare some of the metric units with the British units.

Metric		British
1 *sq cm*	=	0.155 *sq ins*
1 *sq dm*	=	15.5 *sq ins*
1 *sq m*	=	1.9599 *sq yd*
1 are	=	119.599 *sq yd*
1 hectare *(ha)*	=	2.47105 acres
1 *sq km*	=	247.105 acres

Generally we can say that when changing from the metric units to the British units we multiply, and when changing the British units to the metric units we divide, when using this particular table. So that $2\ sq\ dm = 15.5 \times 2\ sq\ in$

$= 31\ sq\ in$

- Let us change 15 *sq m* to *sq yds.*
- Let us change 3 *sq km* to acres.

EXERCISE-D

1. Let us change the following to *sq ft.*
   (a) 4 *sq yds* (b) $4\frac{1}{2}$ *sq yds* (c) 12 *sq yd*
2. Let us change the following to square *yds.*
   (a) 3 acres (b) 4 acres (c) $\frac{1}{2}$ acre
3. How many *sq yds* are there in 5 *sq m.*
4. How many *sq yds* are there in 2.5 *sq m.*
5. Which is greater an acre or an hectare.

BOARD FEET

Many times we need to buy board to do repair work, build cupboards, ledges or even 'chicken runs'. At the lumber yard the board is usually sold in units called board *ft (bd ft)* a *bd ft* is not the same as the regular foot that we have been working with. If you need a length of board 3′ long and 6″ wide for instance, you actually would pay for $1\frac{1}{2}$ *bd ft* and not 3 *bd ft* of course the length would still be the 3′ that you wanted. Let us see how we work out the amount of *bd ft.* The actual size of a *bd ft* is represented by a piece of board 1 *ft* long, 1 *ft* wide and 1 *in* thick, or 1 *ft* X 12″ X 1″.

Let us find how many *bd ft* would be equal to a piece of board 2 *ft* long 12″ wide and 1″ thick? We can use this formula.

$$bd\ ft = \frac{L \times B \times T''}{12}$$

Here the length L is in feet, the breadth or width B, is in inches and the thickness, T, is in inches.

We multiply the number of feet by the breadth by the thickness and then divide by 12.

So putting in the numbers above into the formula we get:

$$\frac{2' \times 12'' \times 1''}{12}$$

We get $\frac{24}{12} = 24 \div 12$ or 2 *bd ft*

Let us find how many board feet this size of board would be equal to: L = 4′ B = 6″, T = 1″

$$bd\ ft = \frac{L' \times B'' \times T''}{12} \quad \frac{4' \times 6'' \times 1''}{12} = 2\ bd\ ft$$

Here we see that although the actual length that we need is 4′ we are only required to buy 2 *bd ft* the length 4′ is usually referred to as the length in *running feet.*

Most times the salesman would make this calculation for himself after you tell him the length in running feet and the width and thickness of the board. However it is good for us to be able to work it our as it would help us to be able to find the cost of our bill before we make the purchase. Board is priced in *bd ft.*

EXERCISE-E

1. Let us change these lengths of board into *bd ft:*

   (a) L = 14′, B = 4″, T = 2″ (this is usually called 2 by 4)

   (b) L = 14′, B = 4″, T = 1″ (1 by 4)

   (c) L = 10′, B = 2″, T = 2″ (2 by 2)

   (d) A plank, L = 8′, B = 12″, T = 2″ (2 by 12)

TIME

Apart from understanding the measurement of weight and lengths, it is important for us to understand the measurement of time. Whereas we spoke of units of weight and length before, now we are going to speak of periods of time.

First we are going to learn the different periods of time and how they compare with each other and then we are going to learn how to read off time properly from a clock.

We are familiar with all the names so we would just go right into the table of time.

Table of time

60 seconds *(s)*	=	1 minute *(min)*
60 minutes	=	1 hour *(hr)*
24 hours	=	1 day *(dy)*
7 days	=	1 week *(wk)*
2 weeks	=	1 fortnight
4 weeks	=	1 month
365 days	=	1 common year
366 days	=	1 leap year
12 calendar months	=	1 year
10 years	=	1 decade
100 years	=	1 century *(c)*
1000 years	=	1 milenium

When we speak of a day we usually mean the period of time when there is light. However in actual measurement of time a day also includes hours of darkness. Another thing to note is that a month has 4 weeks which is supposed to be equal to 28 days. In reality, only the month of February has 28 days in common year. While some months have 30 days and others have 31.

Here are the 12 calendar months together with the number of days each one has.

(1) January	31	(2) February	28
(3) March	31	(4) April	30
(5) May	31	(6) June	30
(7) July	31	(8) August	31
(9) September	30	(10) October	31
(11) November	30	(12) December	31

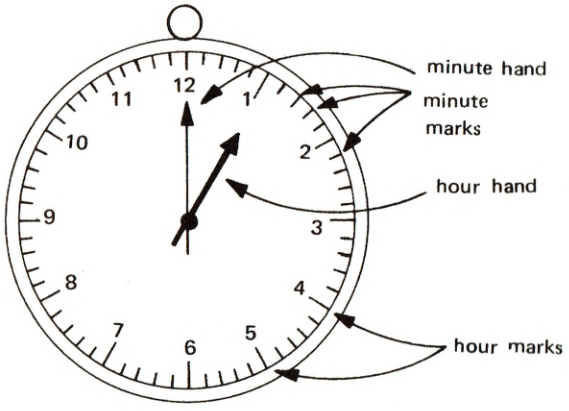
A leap year occurs every 4 years. Any year's number which is divisible by 4 is a leap year. Is 1982 a leap year? When would be our next leap year?

Looking back at the table, we can change from one period of time to another, using the same method that we used for the tables of length and weight. So 3 days would be 3 X 24 or 72 hours *(hrs).*

- How many hours are there in a week?
- We have just begun the decade of the'80^{s}. This decade begun with the year 1980 when would this decade end?

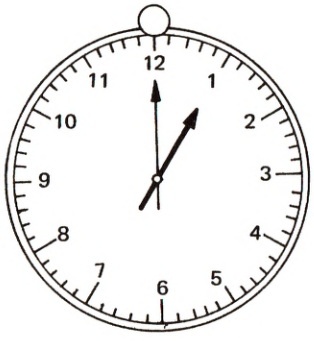
We would now learn to read time using a clock. Although each day has 24 hours, on the clock only 12 hours are shown. The highest hour we can read then is 12.0 'clock.

(See fig. 5.14)



The numbers represent hours, and the tiny marks represent minutes. If you were to count the number of tiny marks, beginning from 12 going right around the circle, you would get 60. Each time the minute hand does this it causes the hour hand to move the next hour.

(See fig. 5.15)



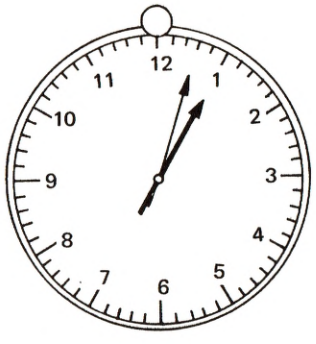
1 0' clock- 1.00

The time shown on this clock is 1. o'clock. Notice that the hour hand is directly on 1 and the minute hand is on 12.

(See fig. 5.16)

Here the minute hand is no longer on 12. It has moved down three tiny marks, which means 3 minutes has passed since 1. o'clock. This time is read: 3 minutes past one, and written 1.03.

(See fig. 5.17)



3 minutes past 1 - 1.03

In (a) the minute hand has moved 15 minutes. It is therefore showing 15 minutes past 1 or quarter past one, because 15 *mins* $= \frac{1}{4}$ hour. This time is written as 1.15. Notice the hour hand is slightly past 1.

In (b) again the minute hand has moved to 20 *mins*. The time is 20 *mins* past 1 or 1.20.

(c) Now it is showing 25 *mins* past 1 or 1.25.

(d) Here it is showing half past 1 or 1.30 we say half past because it is half an hour past 1. 30 *mins* $= \frac{1}{2}$ hour.

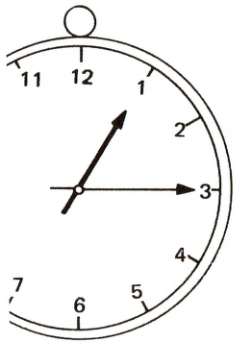
(e) Now once we past the half-way mark we now think of 2. o'clock instead of 1. o'clock in reading off the time. However in writing it we still use 1. o'clock in this case therefore the time is 1.35 but we read it; 25 *mins* to 2, because there are 25 *mins* to go before 2. o'clock.

(f) Here we read 20 *mins* to 2, but write 1.40.

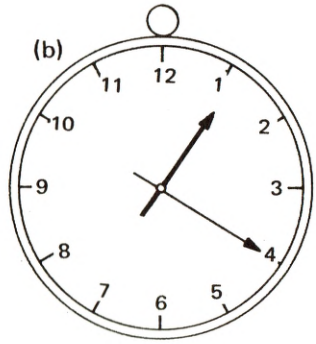
(g) Here we have only 15 *mins* or quarter hour before 2, so we read quarter to two but write 1.45.

(h) Finally we arrive at 2. o'clock. Notice that here the hour hand is on 2 and the minute hand on 12. From here the whole cycle is started again.

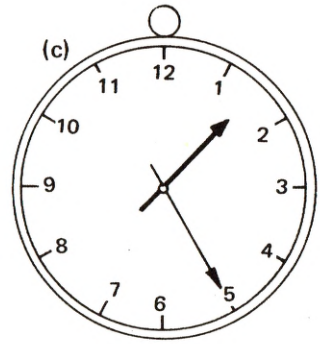
Because only 12 hours are shown on the clock here we must think of the day as two half days; each having 12 hours. The morning hours and evening hours. Morning hours are usually written in a shortened form as a.m. and evening hours as p.m. From midnight to midday we use a.m., and from midday or noon, to to midnight we use p.m. 8. o'clock in the morning is therefore 8.00 a.m., and 8. o'clock in the evening is 8.00 p.m.



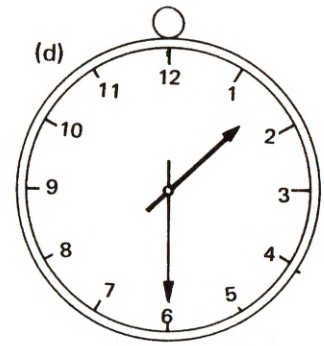
1.15



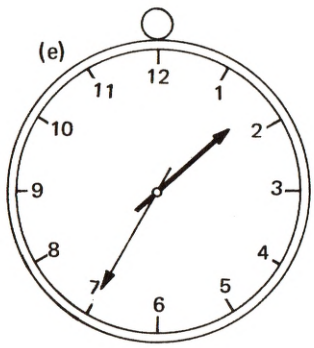
1.20



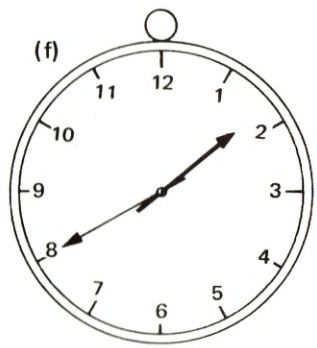
1.25



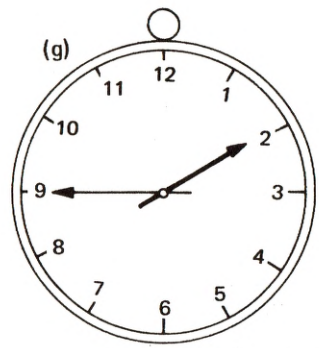
1.30



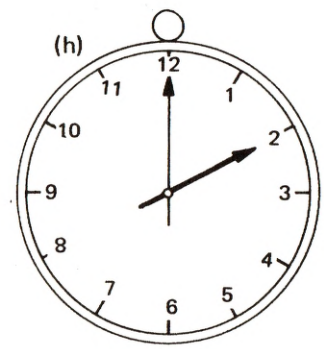
1.35



1.40



1.45

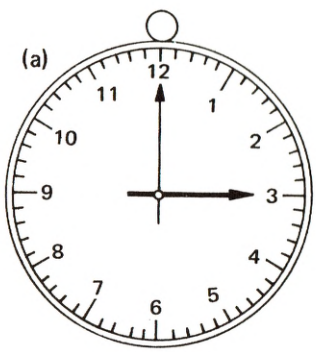


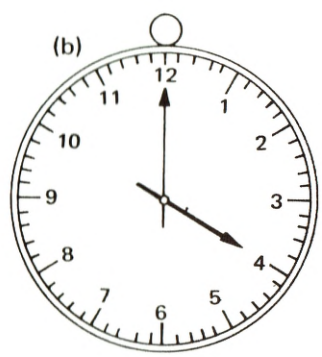
2.00

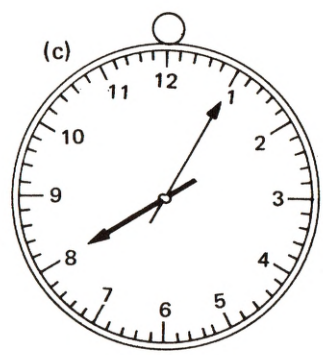
EXERCISE-F

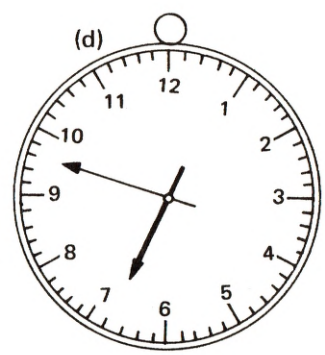
1. Let us read the times shown by these clocks and write them using words and numbers the plain clocks are showing times in the morning and the shaded ones are showing times in the evening.

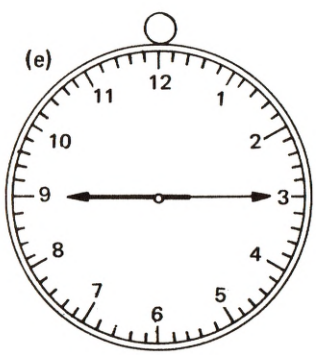
(See fig. 5.18)

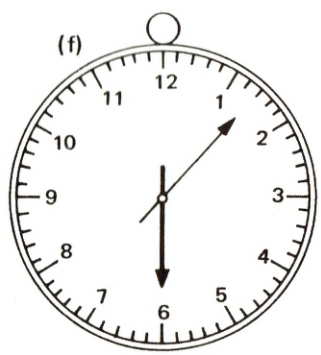


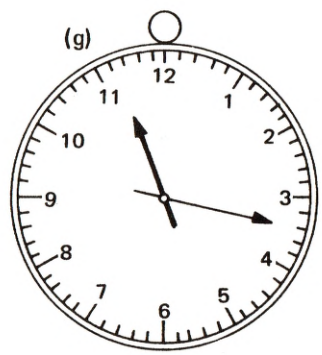


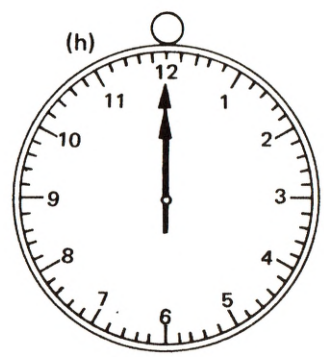










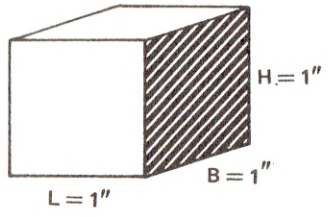


2. How many days are there in the months of January and February together?
3. A bus takes one hour to travel from Sauteurs to St. George's.
   (a) If it left Sauteurs at 6.15 a.m. at what time should it arrive in St. George's?
   (b) If it left at 12.30, at what hour should it arrive?

INTRODUCING VOLUMES

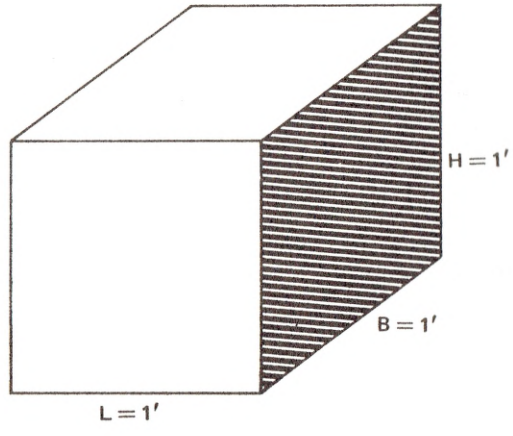
Here we are going to learn just a little about how the space taken up by forms or objects with 3 dimensions are measured.

(See fig. 5.19)



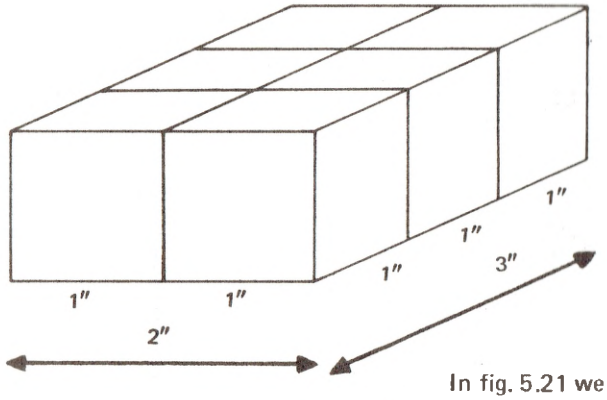
In the figure we have a cube. The length of that cube is 1 inch, the breadth is 1 inch and the height is also 1 inch. This cube takes up a space in the atmosphere, which is called 1 cubic inch. 1 cu". Notice that we have considered three dimensions the length L, the breadth, B and the height H. All of these measurements were 1 inch. If we multiply 1 X 1 X 1 we get 1^3 which is still the same as 1.

(See fig. 5.20)



In the same way the cube shown in fig. 5.18 would take up a space called 1 cubic *ft* in its actual size-its length, breadth and height or thickness are all 1 *ft* long.

(See fig. 5.21)



In fig. 5.21 we have a large rectangular solid but this large cube is divided into smaller cubes each measuring 1 cubic inch. There are 6 such cubes so the space taken up by the entire large solid is 6 cubic inches, or 6cu". Notice that the length of the large solid is 3cu", the breadth is 2" and the height or thickness is 1", if we multiply them together, we get 3 X 2 X 1 = 6cu" we call this the *volume* of the cube and express it in

cubic inches, because the measurements were given in inches. We can therefore write a formula for finding the volumes of cubes or rectangular solids;

V = L X B X H. When V is the volume of a cube or rectangular solid, L is the length, B is the breadth, and H is the height or thickness. Looking at that formula we see that L X B is the same as the area of the bottom or top of the cubes. (A = L X B) we can therefore say that V = A X H meaning that the volume of a cube or a rectangular solid is equal to the area of the bottom or the top, multiplied by the height or thickness.

EXERCISE-G

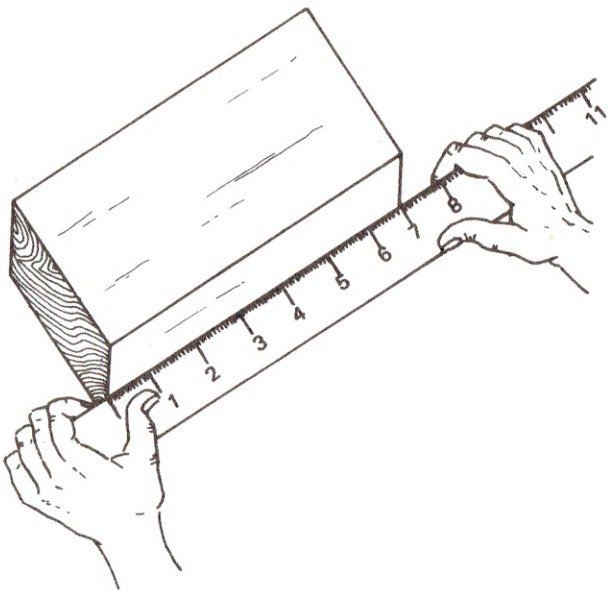
1. Let us find the volume of these boxes:
   (a) L = 2′, B = 1′, H = 1′
   (b) L = 3′, B = 2′, H = 2′
   (c) L = 4′, B = 3′, H = 2′
   (d) L = 16 *cm*, B = 12 *cm*, H = 10 *cm*

SOME HINTS ON ACCURATE MEASURING

When using a ruler or tape to measure lengths we need to observe certain guidelines in order to get accurate readings. Here are some guidelines:

(1) Most rulers have chipped edges. This could lead to errors in our readings. To avoid these errors we can take our measurements from a mark on the inside of the ruler rather than from the ends of the ruler. The picture shows which way is correct.

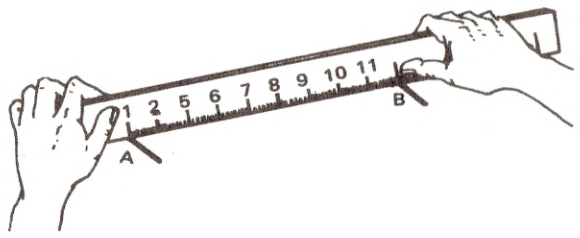
(See fig. 5.22)



We should take a note of where we are starting from and subtract this from the reading.

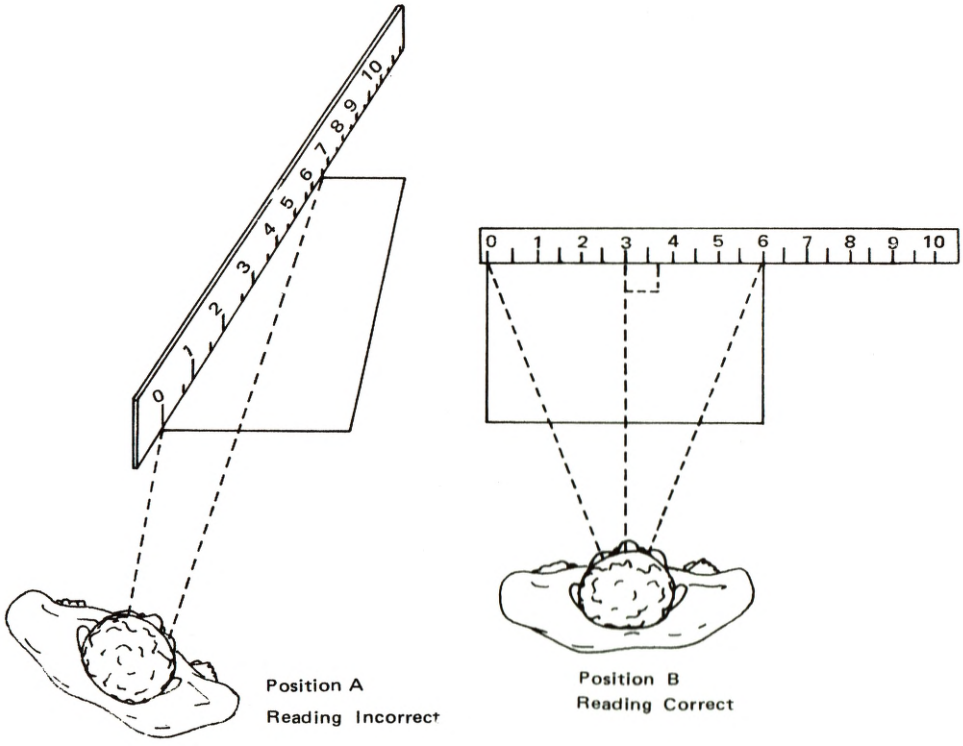
(2) Sometimes because of the shape of the edge of the ruler it is not easy to see when the points you are measuring line up with the marks on the ruler. To avoid error in this case we can hold the ruler on its edge as shown in the picture.

(See fig. 5.23)



(3) The position of our eyes makes alot of difference as to the reading we get and the actual length. We should try always to view the marks with our line of vision perpendicular to the marks. The effect of this is shown in the picture.

(See fig. 5.24)



SUMMARY

Quite alot was covered in this unit. We learned to find the perimeters of squares and rectangles and the circumferences of circles, using the formula $P = 2(L + B)$ for rectangles, $P = 4L$ for squares and $C = \pi D$ or $2\pi r$ for the circumference of circles.

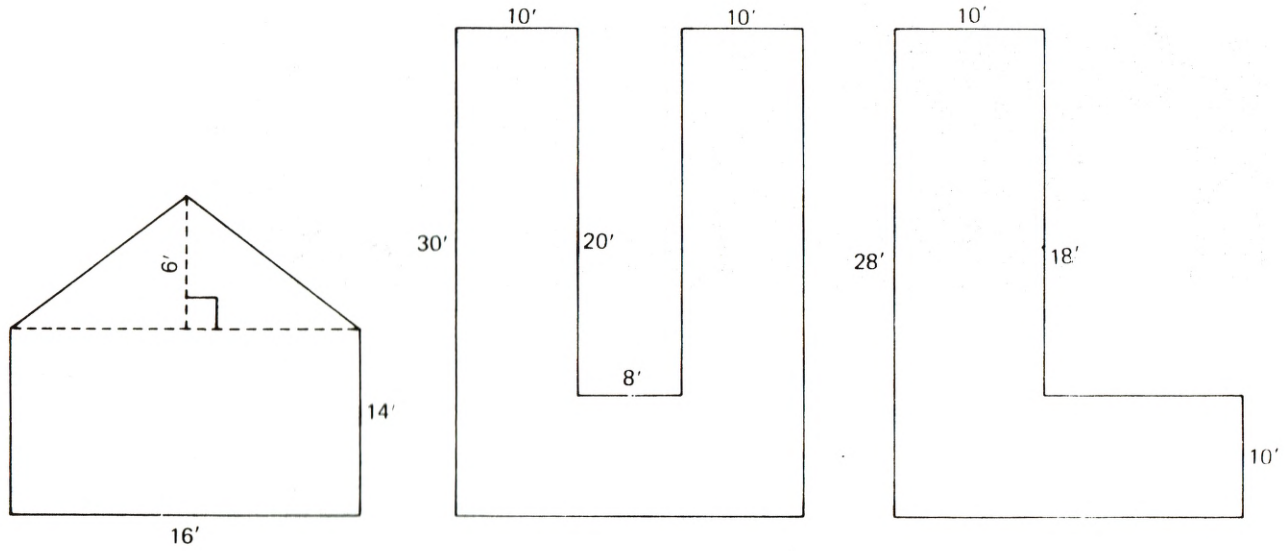
We then learned to calculate the areas of irregular figures, and to use the technique of dividing the irregular figure into regular shapes. We also learned to use the tables of square measure for both British and Metric Systems and also how to compare the metric units with the British units. This particular skill would prove to be very important to us whenever we begin to use the metric system nationally. It would be a good idea to learn the tables of square measure by heart.

We then learned to calculate board feet using the formula $\frac{L' \times B'' \times T''}{12}$ where L was the length in feet, B the breadth in inches and T the thickness in inches. We then looked at the tables of time and learned to read off time from the clock. Lastly, we got a slight idea of how the volumes of cubes or rectangular solids are calculated, using the formula; $L \times B \times H = V$ or $A \times H = V$. We would do alot more of this in Book 4.

CONSOLIDATORY EXERCISES

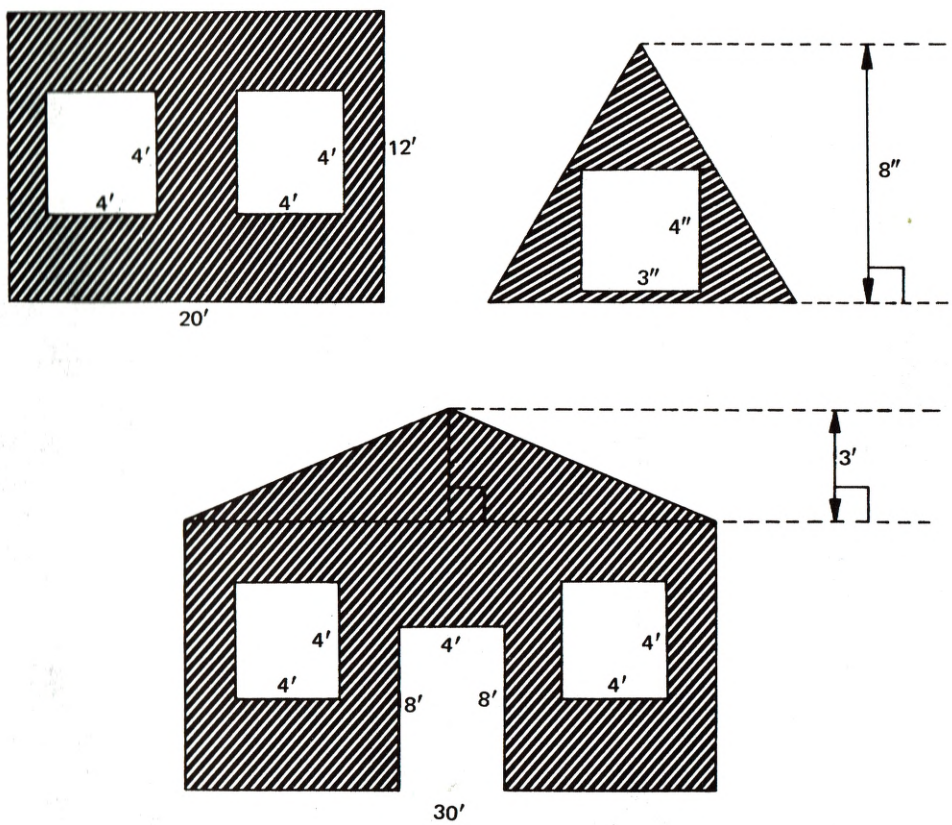
1. What is the perimeter of a square garden whose length is 18 *yds.*
2. If you had to put up a paling fencing around your rectangular garden which had a length of 124′ and a width of 114′. How many feet of paling do you need to buy?
3. The wheel of a car had a radius of 10″. How far would the wheel travel if it made 24 complete turns?
4. Let us find the area of these figures.

(See fig. 5.25)



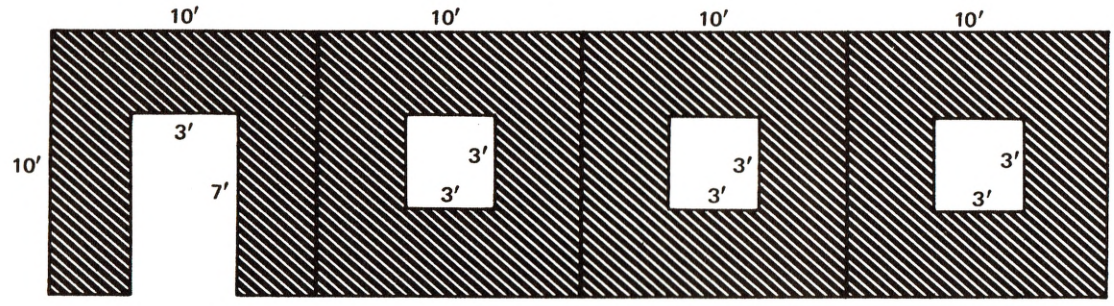
5. Let us find the areas of the shaded portions of these.

(See fig. 5.26)



6. You are planning to add on a small room to your house. The room is to be square with a length of 12′, and a height of 10′. On 3 of the walls you plan to put a small window measuring 3′ by 3′ and in the remaining wall a door measuring 3′ by 7′. What would be the total surface area of all the walls of your room?

(See fig. 5.27)



Hint: Take the total length of the walls, and regard the height as its width, then use the same method used for finding the shaded areas in the examples we met before.

7. If you wish to use concrete blocks for the room project and these blocks have an area of 124 *sq in* on their broad side, at least how many blocks you should buy to put up the four walls?

Hint: Change the total area of the walls into *sq ins* and divide by 124 *sq ins.*

8. What times are shown on these clocks?

(See fig. 5.28)

The shaded ones show p.m. and the plain ones show a.m. Use words and numbers.

9. a) Make a list of all the months that have 31 days.
   b) Make a list of all those that have 30 days.
10. A bus travelling from Grenville to St. George's through St. David's takes approximately $1\frac{1}{2}$ hours to make the trip. If the bus leaves Grenville at 11.30 a.m. when should it arrive at St. George's?

UNIT - 6

ALGEBRA

REVIEW

So far we have done just a little algebra in Book 1 and 2. We have done a little on substitution and on signs. At this stage we are going to deepen our ideas in Algebra.

Before we enter into any new work in algebra, let us just review a little of what was done.

EXERCISE-A-REVIEW

1. $2 + a = b$
   (a) What would be the value of b if a was 7?
   (b) Find what b would be if a was 13?
2. Say what these statements mean:
   (a) $11 > 9$ (b) $3 + 2 + 1 = 3 + 3$ (c) $1 + 4 \neq 4 - 1$ (d) $7 < 14$

EQUALITY IN EQUATIONS

An equation is a statement that shows equality between two expressions. In other words we are saying that the expressions on either side of the equal sign are equal in value.. The parts of an equation separated by the equal sign can also be called the right hand and left hand sides of the equation.

e.g.: $2 + 1 + 4 = 3 + 4$

The important thing to remember even while working equations, is the two sides are equal and must be kept equal. Here are some examples:

(a) $2 + 2 = 3 + 1$ Both sides are equal because they add up to 4.

$2 + 2\ (+2) = 3 + 1$ This is untrue because another 2 is added to the left hand side so they are no longer equal.

$2 + 2\ (+2) = 3 + 1\ (+2)$ Now it is correct because the same quantity is added to each side. Therefore if you add a quantity to one side, you must add the same quantity to the other side.

(b) $2 + 4 = 3 + 3$

$2 + 4\ (+1) = 3 + 3$ ---- untrue

$2 + 4\ (+1) = 3 + 3\ (+1)$

$7 \quad = \quad 7$

(c) $2 + a = 3 + 1$

$2 + a\ (+2) = 3 + 1$ ---- untrue

$2 + a\ (+2) = 3 + 1\ (+2)$

$4 + a = \quad 6$

As in addition, when doing multiplication you treat both sides alike:

Here are some examples: (a) $2 \times 2 = 3 + 1$

$2 \times 2 (\times 2) \neq 3 + 1$ This is not a balanced statement because one side is greater.

Now $2 \times 2 (\times 2) = 3 + 1 (\times 2)$

$8 = 8$ There is a balance because each side is multiplied by 2. Here again we see that if you multiply one side of the equation by a quantity you must also multiply the other by the same quantity.

(b) $3X = 6 \times 2$

$3X (\times 3) = 6 \times 2$ ---- untrue

$3X (\times 3) = 6 \times 2 (\times 3)$

$9X = 36$

So far we have seen that in equations if you add or multiply a quantity to one side you must also do the same to the other side.

Now let us look at subtraction:

$2 \times 3 = 3 + 3$

$2 \times 3 (-2) = 3 + 3$ ---- untrue

$2 \times 3 (-2) = 3 + 3 (-2)$

$4 = 4$

In the subtraction the steps taken are similar to that of addition, but in this case we subtract.

Here is another example:

$8 + 6 = 7 + 7$

$8 + 6 (-4) = 7 + 7$ When the four is subtracted from

$8 + 6 (-4) = 7 + 7 (-4)$ one side it causes a difference;

therefore it must be subtracted from the other side of the equation also to keep the quantities equal.

This does not apply only to addition, multiplication and subtraction but also to division.

e.g.: $4 \times 4 = 8 + 8$

$4 \times 4 (\div 4) = 8 + 8$ ---- untrue

$4 \times 4 (\div 4) = 8 + 8 (\div 4)$

$4 = 4$

Looking at the example, when one side of the equation is divided by 4 the statement is no longer equal; but when both sides were divided by 4 there was equality.

Here is another way of working the division:

$$\frac{4 \times 4}{4} = \frac{8 + 8}{4}$$

$$4 = \frac{8 + 8}{4}$$

$$4 \qquad 4$$

From the examples that we have done we can see that an equation is like a balance; if you add a quantity to one side you must add the same to the other side. If you multiply one, multiply the other. Also if you subtract a quantity from one side you must subtract the same quantity from the other side; and if you divide one side of the equation by a quantity you must also divide the other side by the same quantity.

EXERCISE-B

1. Now let us try to balance these equations:

   (a) $6 + 2 + 1 = 5 + 3$ (b) $14 + 2 - 6 = 8 + 8$

   (c) $3 + 1 \times 3 = 2 + 2$ (d) $3 \times 3 \div 3 = 6 + 3$

2. Say whether these equations are balanced:

   (a) $5 + 3 = 3 + 1 + 4$ (b) $2 - 1 = 3 + 1 - 2$

LETTERS AND THE BASIC OPERATIONS

The symbols $+, -, \times, \div$ have the same meaning in algebra as in arithmetic, but it is not always necessary to write the $\times$ sign. We can write ab instead of $a \times b$.

Similarly, the product of a number and a letter, $3 \times a$, may be written 3a.

Here are some examples:

(i) $a + a + a = 3a$

(ii) $a \times a = a^2$

(iii) $3a \times 3 = 9a$

(iv) $3a \times a = 3a^2$

(v) $7a - 5a = 2a$

$$6x^3 \div 2x^2 = \frac{6 \times x \times x \times x \times x}{2 \times x \times x} = 3x$$

EXERCISE-C

Now let us try these:

1. Write down the values of the following:

   (a) $a + a + a + a =$ ..... (b) $x + x + x + x + x - x + x =$ .....

   (c) $4a + 8a1 =$ ..... (d) $13x - x =$ .....

   (e) $x + 2 =$ ..... (f) $a \times 2a =$ .....

   (g) $10x^5 + 5x =$ .....

FINDING THE UNKNOWN QUANTITIES

So far we have done some work on the equality of equations. Now we are going to work out the equations to find the 'unknown' quantities.

Let us look at this example: $4 + a = 20$

Maybe you can just look at it and say that the 'unknown' quantity represented by a is 16. But in order to work more difficult equations, we must fully understand the steps or method in working the simple ones.

Therefore $4 + a = 20$ can be worked as:

$$4 + a = 20$$

Subtract 4 from each side, $4 + a - 4 = 20 - 4$

then we get $a = 16$

Like we have said before, both sides of the equation must be treated alike. In this case 4 was subtracted from each side and the unknown quantity represented by a is 16.

Here is another example: $5 + b = 7$

$$5 + b - 5 = 7 - 5$$

$$b = 2$$

In other words, to find the unknown quantity in the equation, we work the opposite way. That is, when it is addition (examples above). We subtract to find the unknown quantity.

We can also use this method to find the unknown quantity when doing equations with multiplication.

e.g.: $4 \times b = 24$ or, $4b = 24$

$$4b = 24$$

Divide each side by the same quantity; that is 4. $4b \div 4 = R4 \div 4$

$$b = 6$$

or, $$\frac{4b}{4} = \frac{24}{4}$$

$$b = \frac{24}{4}$$

$$b = 6$$

Here again we see that we work opposite to the sign used in the equation. Multiplication was the sign used, to find the unknown quantity we divided.

We can use another example where only letters form the equation and use the same method of working.

Example: The formula for finding the area of a rectangle:

$A = L \times B$, find L

$$A = 1 \times B$$

Divide both sides by B $$\frac{A}{B} = \frac{L \times B}{B}$$

$$\frac{a}{B} = 1$$

In this example $A = L \times B$; in order to find 1 we divide A by B.

Here is another example: Using the formula to find the area of a triangle:

$A = \frac{1}{2} B \times H$ find H

$$A = \frac{1}{2} B \times H$$

First we divide both sides by $\frac{1}{2}B$ $$\frac{A}{\frac{1}{2}B} = \frac{\frac{1}{2}A \times B}{\frac{1}{2}B}$$

$$\frac{A}{\frac{1}{2}B} = H$$

Now let us do an example with subtraction:

$a - 3 = 9$ $a - 3 = 9$

We add 3 to each side $a - 3 + 3 = 9 + 3$

$a = 12$

This example is worked similar to that of addition. Again we work the opposite way. To find the unknown quantity in the subtraction we add.

Here is an example of division:

$a \div 3 = 11$ $a \div 3 = 11$

We multiply each side by 3 $\frac{a}{3} \times 3 = 11 \times 3$

$a = 33$

In this case of division we multiply to find the unknown quantity in the equation.

What we have noticed in all cases is that we first try to get the unknown quantity on one side. Then if the original was addition. We subtract and vice versa to get the unknown: or, when it is multiplication we divide and vice versa to find the unknown.

But there are some more difficult cases which we are going to look at now.

e.g.: $3x + 7 = 19$ $\qquad 3x + 7 = 19$

- First we take 7 from both sides ..... $3x + 7 - 7 = 19 - 7$

$\qquad 3x = 12$

- Then we divide both sides by 3 to find the unknown quantity ..... $\frac{3x}{3} = \frac{12}{3}$

$\qquad x = \frac{12}{3}$

The unknown quantity represented by x is 4 ..... $x = 4$

Here is another example: ..... $6x - 8 - 3x = 2x + 12 - x$

- Gathering all the x's together ..... $(6x - 3x) - 8 = (2x - x) + 12$
- Working out the x we get ..... $3x - 8 = x + 12$
- Subtracting x from each side ..... $3x - x - 8 = x + 12$
- Adding 8 to both side ..... $2x = 12 + 8$

..... $2x = 20$

- Dividing both sides by 2 ..... $\frac{2x}{2} = \frac{20}{2}$

..... $X = 10$

Then by 3 $\qquad 6a \times 3 = 18b \times 2$

We can work this another way:

We multiply each numerator by the opposite denominator ..... $\frac{6a}{2} = \frac{18b}{3}$

..... $18a = 36b$

Whenever we work an example in this way we can say we cross multiply.

EXERCISE-D

Let us practice finding the unknown quantities in these equation:

(1) $7x - 4 = 7$ $\qquad$ (2) $2x + 15 = 23$ $\qquad$ (3) $5x - 9 = 21$

(4) $a = L \times B$, find b $\qquad$ (5) $4x - 3 = 3x + 4$ $\qquad$ (6) $\frac{3x}{8} \quad \frac{5}{9}$

(7) $\frac{x}{3} = \frac{5}{6}$ $\qquad$ (8) $\frac{x}{5} = \frac{4}{3}$

COMPOSING EQUATIONS TO MATCH PROBLEMS

We have all been asked questions of this type. 'I am thinking of a number. When I add 2 to it, the result is 6. Find the number.'

We know that the answer is 4 and that we find the answer by subtracting 2 from 6.

This question can be put more simply in the language of algebra by supposing that the unknown number is x. When we add 2 to x the result is 6. Therefore $x + 2 = 6$.

When we do this, it is called an equation.

e.g. = There are 206 boys in a school and g girls. The total is 400. This can be written as $b + g = 400$. This is an equation.

Here is another example: I have x dollars. If I spent 7, I should have 18.

Equation: $x - 7 = 4$

EXERCISE-E

Now let us practice forming equations from these: and solving them to find the unknown:

1. I have 10 dollars. I spend s, and have 20 left.
2. A bus has 8 seats and each seat holds 6 people. When the bus is full it holds 2 people.

3. Three times a number is equal to 42.
4. The length of a floor is metres, its breadth is 14 *m.* the area is 280 *sq m.* What is its length (1).

SUMMARY

In this unit we have done quite a lot in Algebra. We have done equality in equations where we use a variety of examples to show equality or how to balance an equation. We also learnt the methods of finding the unknown quantities in equations. In finding the unknown quantity we use examples like areas of rectangle and triangle. And the final section we composedor made equations to match problems.

I am sure that you understand everything we did in this unit and is ready to practice now.

CONSOLIDATORY EXERCISES

1. Say if these statements are equations:

   (a) $2x = 14$ (b) $1 + 16 = 20$ (c) $2a + 3 \neq 5$ (d) $3a + 6$ 7

2. I am thinking of a number, when I subtract 9 from it, the result is 7. Find the number.
3. From equations from the following statements:

   (a) I have x dollars. If I had twice as many, I should have 16.

   (b) I have $6.00, I spend x and have y left.

4. $7x = 21$ (5) $\frac{x}{5} = \frac{1}{6}$ (6) $15x - 12x = 6$ (7) $3x - 5 = 10$

   (8) $5x + 2 = 6x - 1$

Solution of problems related to students activities

LOOKING FORWARD

In this book we have learnt quite alot of new things. At this level all the operations should be clearly understood and your understanding of mathematics and its usage in everyday life should be fairly deep. You should pay very close attention to the handling of decimal fractions, and also common fractions.

It is important that all the work at this level be thoroughly understood. If there are any sections you find difficult to grasp, study them over with the help of your teacher.

The next important thing you are going to do is your level 3 evaluation. All the questions in that evaluation will be based on work that we did during this book. You should rework some of the exercises in the book especially those on areas, decimal and common fractions and long division. It is also a good idea to try to make some exercises on your own. Finally, always keep practicing what you have learnt daily, as you find situations in your different activities, transactions, etc., that call for mathematics.

In Book 4 we are going to put the finishing touches to our course, by learning just a few more aspects, and doing review work, polishing' up the weak areas, etc.

"It is only when we use our minutes wisely that we would succeed."

UNIT 1

ELECTRICITY - A FORM OF ENERGY

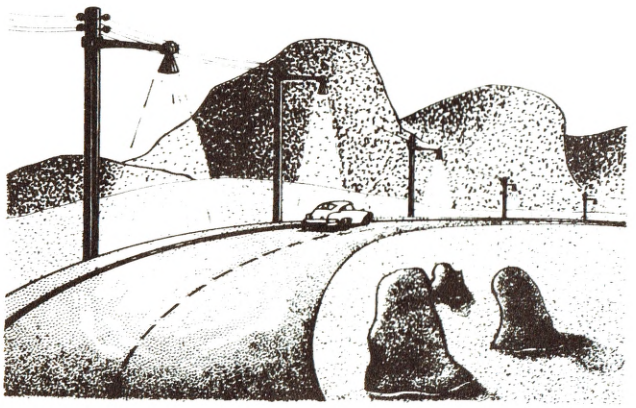
• WHAT IS ELECTRICITY?

Very little was known about electricity until the nineteenth century. Since then knowledge of this great force has developed rapidly, to the extent that it is now widely used in modern day science and technology.

An outstanding scholar once said that knowledge of electricity can be considered to be reasonably good, only when man discovers how to utilise it.

Without electricity, radio, television, radar, the developments in transport, communications and industry would have been impossible. The use of this great force plays a vital role in the economy of any country. Numerous branches of science related to the use of electricity have been created e.g. electrical engineering, radiology, etc.

Electricity is another form of energy. We have already discussed light and heat as two forms of energy, and have pointed out that there are other forms of energy, one of which is electricity.



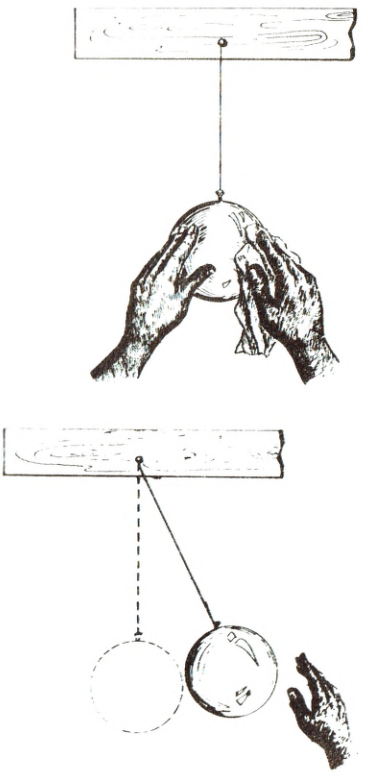
Electricity used to light street lamps.

• TYPES OF ELECTRICITY: STATIC AND CURRENT

(a) *Static Electricity:*

The first type of electricity observed by man is called STATIC electricity. It was observed that certain bodies when rubbed developed the ability to attract light objects. This happened because the bodies developed electric charges as a result of the friction. This can be tested by doing the following simple experiments:

1. On a dry day walk across a rug, dragging your shoes on it. Then touch a radiator or large metal object. What happens?
2. Rub a pen with a woolen cloth, the sleeve of a man's suit will do. Place the pen near some bits of paper. What happens?
3. Rub a balloon with a woolen cloth. Then hang the balloon by a string from the ceiling. Hold your hand near the balloon. Because the balloon is charged with electricity it can move. The electrical charge gives it energy. Look at the following picture which would show you how it should work.



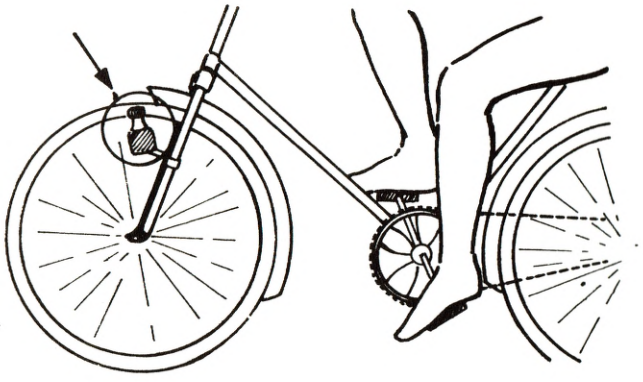
Experiment with balloons to showstatic electricity.

The kind of electricity we get by rubbing is called *STATIC electricity.* It can stay still on the object for a while.

(b) *Electric Current:*

The power that comes through a wire to light a bulb is another kind of electricity.

In the picture fig. 3.3, the rider has to pedal hard for the wheels to turn the generator.



Bicycle showing generator.

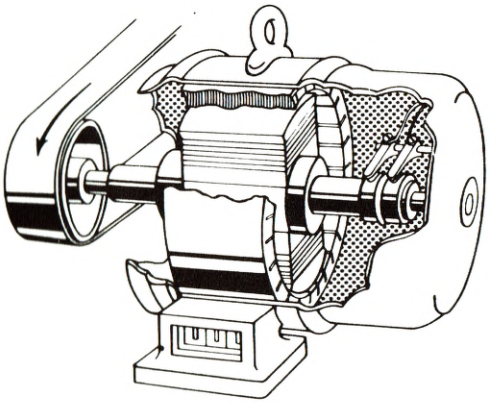
His generator makes *CURRENT electricity* instead of static electricity. The current electricity flows along the wires and lights the headlight. Another pair of wires carries some of the current electricity to the taillight.

The electricity that is used in most of our homes is made by very large generators. In Grenada, these large generators are presently located at the Grenada Electricity Services Plant in Queen's Park, St. George's.

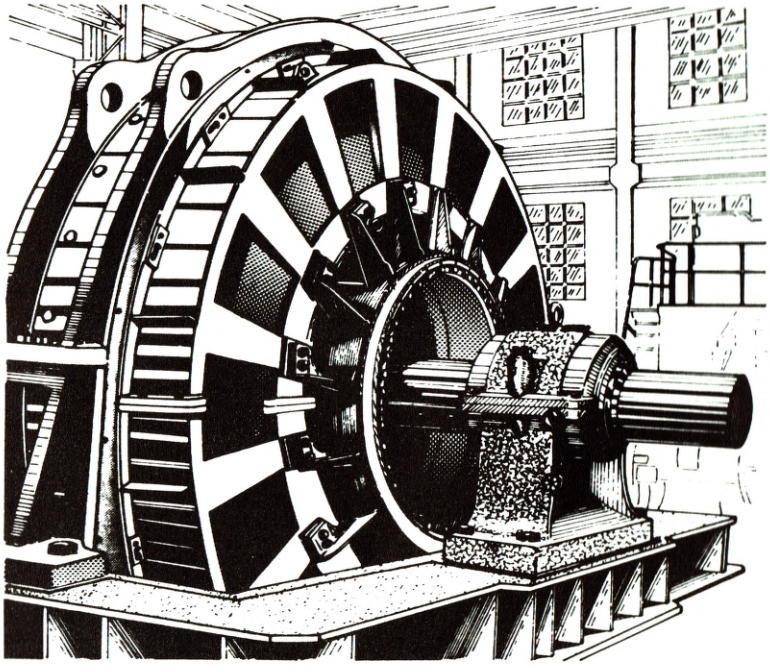
Oil is used to provide the energy to run the generators. The chemical energy in oil is converted to electrical energy in the process. The electricity thus formed flows along wires to supply the whole country, and is made to do useful work in our homes, in workplaces, street lights, etc.

Sometimes large generators get their energy from falling water. In countries where there are large enough rivers or waterfalls, they are used as the source of energy to produce electricity. The electricity thus formed is called *HYDRO-electricity.* Investigations are being carried out into some of the rivers here to see whether they can be used to provide hydro-electricity. Already there are indications that this may be possible in the future.

In areas where there is no electricity, or where there is a power failure from the plant, some people own small generators that supply them with electricity for a small area.



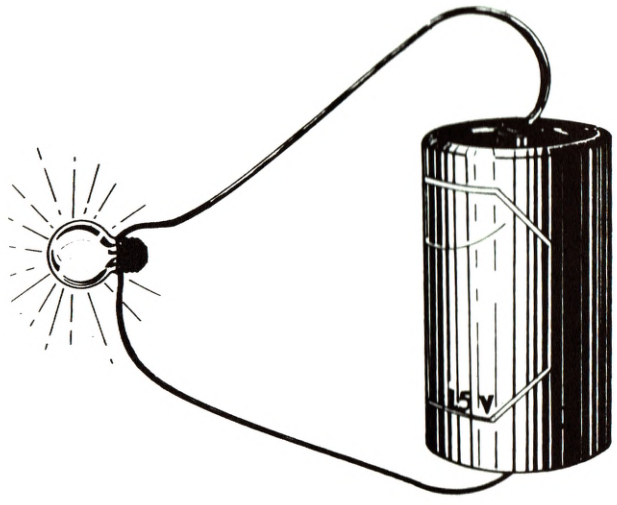
Small generator.



Example of a large generator use to produce electricity in a plant.

Another source of current electricity is a *DRY CELL* (found in a battery). There are chemicals in a dry cell that can change energy into electrical energy. Dry cells are used to produce electricity in flashlights, cars, etc.
Experiment: To see a dry cell produce electricity. All you need to do this experiment is a bulb, a dry cell (battery), and two pieces of wire.

Touch or hold two wires to the dry cell, one at the top, and one at the bottom. Touch the other end of one wire to the bulb. (You may need someone to help you do this.) Does the bulb light? Now, still keeping the one wire touching the bottom of the bulb, touch the other wire to the side of the metal part of the bulb. Does the bulb light now?

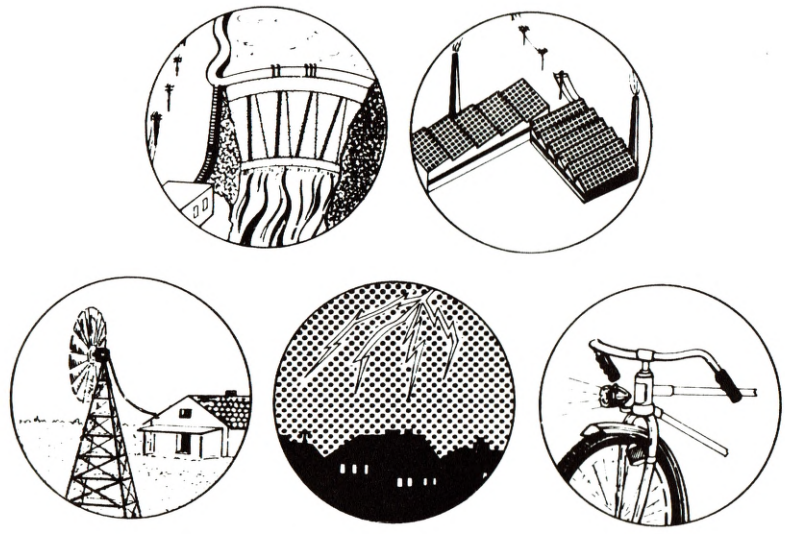


Simple experiment to show haw an electric current is produced.

A dry cell produces *current electricity* as a generator does, rather than like static electricity produced by rubbing a pen.

This type of electricity that is produced by generators and dry cells, is the type that has to run along wires or other conductors to do useful work for us. Hence the name current electricity.

It takes other kinds of energy to make electrical energy. For example it takes more energy to pedal a bicycle when there is a generator on it making electricity for the bicycle's lights. This energy is provided by the person riding. A dry cell uses chemical energy to make electricity. Rubbing a glass bottle with a silk handkerchief requires energy in order to put an electric charge on the glass, that can make bits of paper move.



Can you tell haw electricity is produced in each of these examples.

• ELECTRICITY IN THE ATMOSPHERE

There is a vast amount of energy in a storm as the winds break up raindrops and swirl them around and around. This violent movement creates an electrical charge in the clouds a form of static electricity. The process keeps on and on until the charge built up in the cloud is so great that a long spark jumps between the cloud and the earth, just as a spark can jump from your hand to the metal object in the experiment given before. This great electrical spark can be seen as it travels from the clouds to earth and is called LIGHTNING.

The lightning is accompanied by a loud noise. As the flash of electricity or lightning travels through the air, heat is produced. This heat causes the air to expand suddenly. This sudden expansion of heat causes the loud noise or thunder. Although they occur together, we see the lightning before hearing the thunder. This is because light travels faster than sound.

Picture of lightning in the sky.

• ELECTRIC CIRCUITS

Electricity travels in a path. These paths are usually wires. If the wire is broken, the electricity cannot go along that path. When electricity can travel all of the way around a path back to the starting point, we say that we have a *CIRCUIT* for the electricity.

In the experiment shown in fig. 3.6 we used a dry cell to make electricity. Instead of a dry cell we might have taken the electricity from a bicycle generator, or a storage battery.

When you touch the bottom of the bulb with the free end of the wire, the bulb becomes lighted. This shows that electricity flows through the bulb. This is an example of an electrical circuit. When the whole circuit is completed by touching the bottom of the bulb, an electric current flows.

In order to make current flow in a circuit, there must be a source of supply or driving force of the current. In our experiment, the torchlight battery provides this force. Our electricity supply in our homes is driven by generators in the power station. Batteries provide electricity in cars and buses.

• CONDUCTORS AND INSULATORS

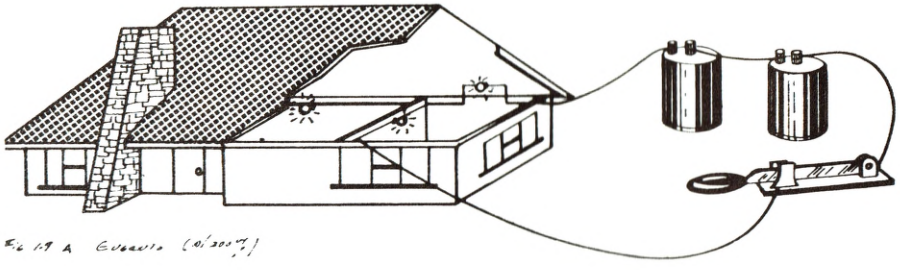
Not all materials conduct electricity to the same extent. Some materials conduct electricity very easily, others to a lesser extent, and there are some that do not conduct electric currents at all. According to this fact materials are grouped as CONDUCTORS or INSULATORS.

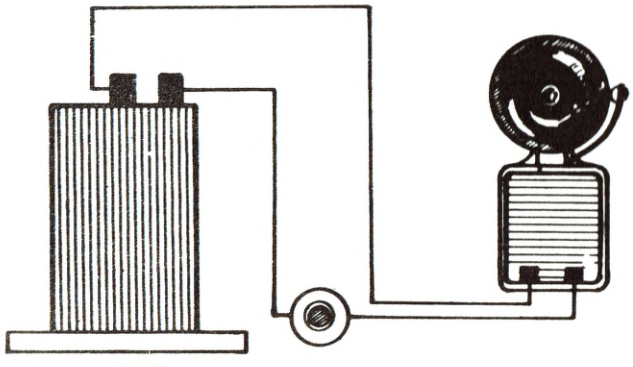
If an electric current can flow through a substance, that substance is called a CONDUCTOR of electricity. But some conductors are better than others. Most metals are conductors of electricity, copper and silver are two of the best. A substance which allows little current to pass through is a bad conductor.

Some materials do not allow any current to pass through. They are therefore NON-CONDUCTORS of electricity, better known as INSULATORS. Most non-metals like wood, plastic, glass, etc. are non-conductors. But there are exceptions e.g. Carbon is a non-metal but is a good conductor.

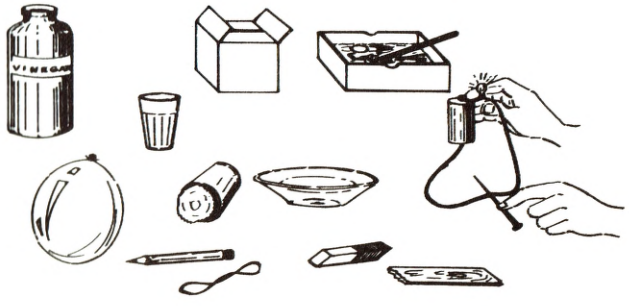
Experiment:

Make a tester to test different materials to see whether they are good conductors of electricity or poor conductors. All you need is a dry cell (small battery) as a source of electrical energy, a small flashlight bulb and two pieces of wire.





(a) (b) Two examples of circuits used in real life.



Experiment to test different materials to see whether they conduct electricity or not.

Touch the tip of the bulb and two pieces of wire cell. Touch one wire to the bottom of the dry cell and the other wire to the base of the bulb. Now have someone take the ends of the two wires and touch them to the object you wish to test in order to see whether it is a conductor of electricity. If the bulb lights, the object is a good conductor, if the bulb is very dim, the object is a poor conductor of electricity, if the bulb does not light at all, the object is a non-conductor of electricity or an insulator.

Here are some materials you can test to see whether they are good conductors, poor conductors or non-conductors of electricity:

silver (25c. piece)	nickel (5c. piece)
copper (1c. piece)	tin (unpainted part of
plastic (plastic cup)	toothpaste tube)
water (glass of)	wood
salt water	leather
vinegar	iron
mercury	glass
rubber	aluminium (foil)
brass	graphite (lead in a soft
paper	pencil)

Make three headings called: good conductors, poor conductors and insulators. Write the name of the material you have tested under the proper heading. Study your list and think of articles you know that are made of each of these. It is important for you to be familiar with each of the three types so that in time of an emergency when dealing with electricity, you can recall which types of materials should or should not be used.

CONDUCTORS	INSULATORS
metals	rubber
graphite (black lead)	porcelain (china ware)
humid air	dry air
salt water	pure water
acid water	wood
water with potash	glass
human body	plastic

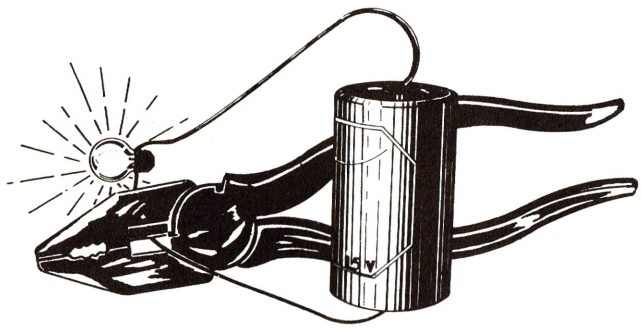
Conductors, usually wires, are used in electric circuits to carry electricity from one place to another. Insulators are used to keep one conductor from touching another conductor, and thus letting the electricity go where we want it to go.

Observe the cord in an electric iron carefully. There are two conductors inside the cord. These conductors have to be kept from touching each other, so they are covered with an insulator. Rubber, cloth and plastic are often used as insulators around wire or other conductors.

• OTHER TYPES OF CIRCUITS AND SWITCHES

Remember we described circuits earlier, as the complete path along which electricity travels. We also pointed out that electricity flows when the circuit is COMPLETE or CLOSED. Now try this experiment.

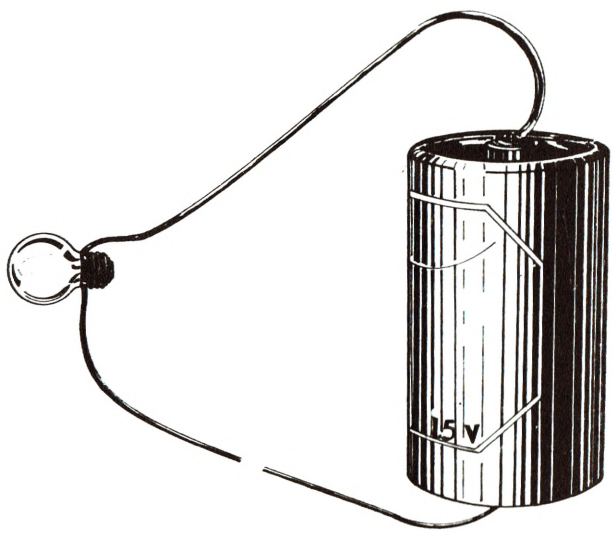
You begin the experiment just as you did in the one shown in fig. 3.9, but you will need a pair of pliers or old scissors for this one.



Experiment to show what happins when the conductors in a circuit are ent.

Make sure that the people who are holding the wires against the dry cell and the bulb hold them still. While the bulb is shining have someone cut one of the wires in two, what happens to the light?

If there is any place in a circuit where electricity cannot travel along a good conductor, the electricity cannot do any work. Its path is then called an OPEN CIRCUIT.



This is on open circuit. Electricity counot fluw from the dry cell along the broken conductor to the bulb. The bulb does not light.

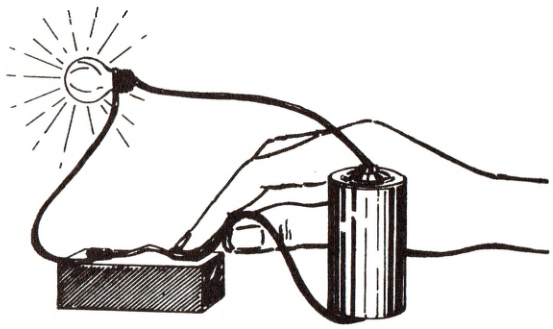
Experiment continued:

Now take the two ends of the wire that have just been cut and put them back together. What happens? What is one way to make the bulb go on and off?

Here's an even better way to make the bulb go on and off.

Apart from the circuit, you will also need a small block of wood, two thumb tacks, and a paper clip.

Set the block of wood under the place where you cut the wire in the last experiment. Fasten one end of one wire to the block with a thumb tack. Fasten the end of the other wire together with the paper clip, on the other side of the block. You will have to bend the paper clip up a little so that it will not touch the first thumb tack.



After the circuit has been, broken, the electricity will not flow. You must join the broken inds by a conductor. A switch can do this. The switch in this experiment is made fron Two Thumb tacks and a paper clip.

Now press down the paper clip to make it touch the first thumb tack. What happens to the light bulb?

A SWITCH acts like a bridge on these wire paths. With a switch you can open or close a pathway for electricity. We say that a switch can complete or break a circuit.

Switches are used in many ways to open and close circuits. They are used in homes, schools, factories and in any place where we want electricity to work some of the time, but not all the time. Switches may seem different, but they all do the same kind of job. How many of these switches have you seen or used?

Sometimes a conductor such as a knife or nail, is pushed very hard against a covered wire or two insulated wires, cutting through the insulation, and touching the two conductors inside.

Then instead of electricity going all the way along the wire to the bulb, it will take a short cut and travel across the nail. When electricity can follow a shorter path than was planned for it to follow, we say there has been a SHORT CIRCUIT.

Can you remember the term short circuit? In what connection was it used?

Exercise:

Take your pencil and trace along the path that the electricity follows (a) in the experiment; (b) in the classroom. Always begin with the source of the electricity.

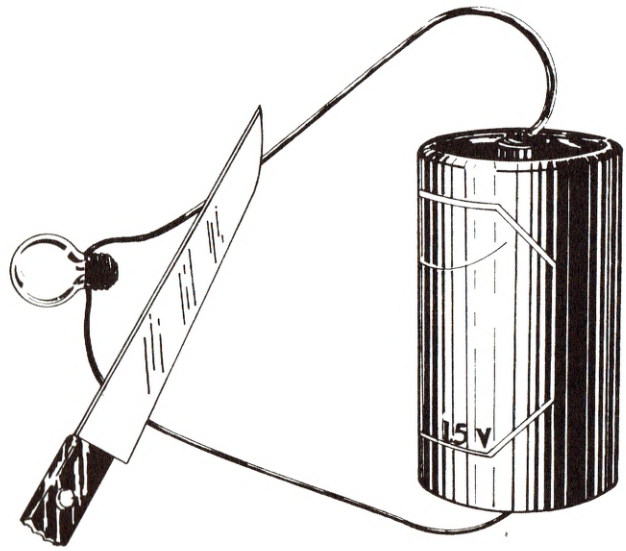


Illustration of a short circuit.

• RESISTANCE

Water can only flow through a pipe if there is a force applied at one end. Without this force, water will not flow through. This force is usually supplied by a pump. A narrow pipe requires a larger force to make the water flow. We say that the pipe *resists* the flow of the water. The force of the pump overcome this resistance and makes the water flow through the pipe. Do you think that a pipe with a large diameter has a greater resistance than one with a small diameter?

Just as water flows through a pipe, electricity flows through a conductor. The conductor resists this flow of electricity, but the dry cell, battery or generator supplies the force for the current to flow.

The RESISTANCE of a conductor depends on the material it is made of, its length, and its area of cross-section (that is, its thickness). Connect a circuit with four flashlight batteries, a bulb and some connecting wires as shown in the diagram.

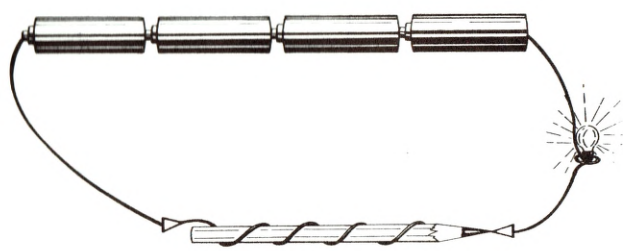


Illustration of circuit with more than one dry cell.

Cut out equal lengths of copper iron and lead wire. The wires should be of the same thickness. Coil up each wire on a pencil. Connect the ends of the copper wire to the paper clips. What happens? Remove the copper wire and replace it with the iron wire. Is the bulb as bright as before? Is iron a better conductor than copper? Remove

the iron wire and replace it with the lead wire. Is the bulb very bright now? Which of the wires give the brightest light? Which is the best conductor? Which is the worst conductor?

A good conductor has a small resistance to electricity and a large electric current can flow easily through it. In this case the bulb is brightly lighted. The wire which is the worst conductor has the greatest resistance to electricity. It allows only a small current to flow through giving a dim light in the bulb.

This experiment shows us that for equal lengths of conductors, their resistances depend on the material they are made of.

Obtain three pieces of copper wires of equal length but different thickness. Take the thinnest wire and connect its end to the paper clips in your circuit. Observe carefully the brightness of the bulb. Next replace this wire with a thicker wire and note the brightness of the bulb. Is it brighter than previously? Is the resistance of this thicker wire greater or lesser than the first? Repeat the experiment with the thickest wire. Is the bulb brighter than the previous two cases? Can you explain why?

From your experiment you should have found out that a thicker wire has a lower resistance. If the experiment is repeated with different lengths of the same kind of wire, you will find that the longer the length, the higher is the resistance.

Connect a copper wire, coiled round a pencil to the circuit as you have done before. Feel the wire. Does it become very hot? Do the same thing with the iron and lead wires. Do they become very hot? Which one becomes the hottest? Which wire gives off the most heat? Does a low resistance wire give off more heat than a high resistance wire?

Copper is a very good conductor of electricity and copper wires have low resistances. Iron and lead are not good conductors compared to copper. Wires made of iron and lead have higher resistances than copper wires.

• MAKING USE OF HEAT GIVEN OFF BY ELECTRICITY

When a current flows through a wire, heat is given off. The amount of heat that is given off depends on the resistance of the wire. When electricity passes through a good conductor, very little heat is produced. When a strong electric current is forced through a poor conductor, a great amount of heat is produced, because the resistance is greater.

In electric heaters, thin wires made of material with high resistance are used. In this way, when a current flows through the wires, a very large amount of heat is produced. The heat given off can even make the wires glow and become red hot.

Electric bread toasters, irons, electric cookers and other household appliances make use of this same feature.

• FUSES

Sometimes electricity produces heat where it is not wanted. Even a good conductor like the copper wire that carries electricity within the walls of a house can get very hot if it is made to carry too much electricity. They must be protected because sometimes people attach too many appliances to one electric outlet.

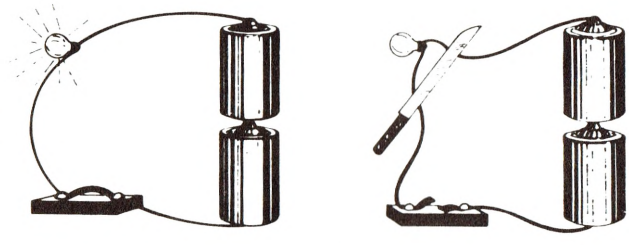
Some way had to be found to protect the conductors (wires) in the walls of a building from overheating. If there is some fault in the circuit, the heat given off may be so great as to cause a fire.

To prevent this, FUSES are used.

Experiment:

To show how wiring can be protected from too heavy a load on one circuit.

Connect two or three dry cells to a light bulb as shown in fig. 1.16.



Experiment to show how fuses function.

Cut a strip of thin foil, or a piece of tin from the side of an old toothpaste tube. With thumb tacks fasten the two ends of the block of wood.

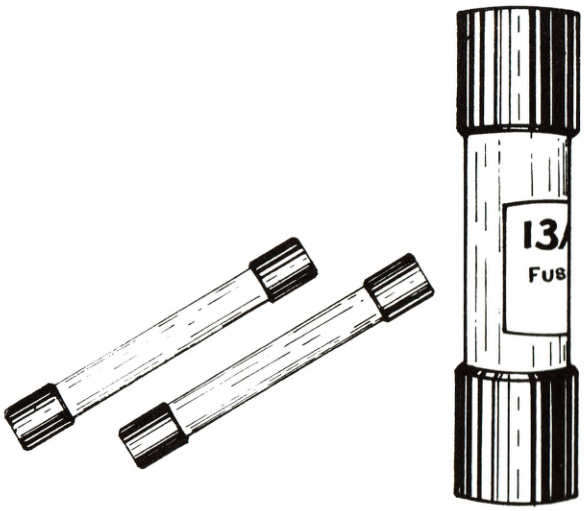
When the circuit is completed, electricity should travel from the dry cells along the top conductor to the bulb and return to the dry cell through the bottom conductor and the thin piece of foil or tin. The bulb should be lighted. Now make a short circuit by placing a nail across the two conductors at x and y.

It is much easier for the electricity to travel through the nail than through the bulb. A strong electric current will travel through the foil. What happens to the foil?

The piece of foil in the demonstration was really a fuse. A FUSE is a short conductor (usually wire) made of a kind of metal that will melt easily. If everything is alright, the heat given off in the circuit is not sufficient to melt the fuse. On the other hand, when the circuit is faulty, that is, too much electricity flows in it, a large amount of heat is produced. The fuse wire will become very hot and melt. This causes the fuse to break and the circuit is not complete. No current will flow in the circuit - we say that the fuse is blown.

All electric circuits in homes, factories, offices, etc., contain fuses. They protect the wires inside the walls of a building. When a fuse blows, all lights and electrical appliances connected to the circuit will not work. There may be many fuses in one house. Each fuse is for one

circuit. When a fuse blows, only those lights connected to that fuse will go off. Have you ever experienced this in your house? A fuse blows and lights go out in only one part of the house. All you have to do is replace the blown fuse to get the lights going again. You may also have to lessen the load on that circuit.



Fuses are used to protect conductors so that they do not carry roo great an electric current and become hot. The cartridge fuse on the right is used to protect the wiring going to electric stones. The fuses in the lower portion of the picture is used to protect the circuit in cars.

Numbers are usually stamped on the backs of plug fuses. They may be marked 10, 15, 20, 25 or 30. The numbers tell how many amperes *(AMPS)* of electric current the fuse will carry before it melts. *An ampere* indicates the amount of current flowing in the circuit. Fuses must be matched in amperage to the needs of a particular circuit.

• USES OF ELECTRICITY

Electricity or electrical energy can be transformed to many other forms to energy: –heat, light, sound, mechanical, energy, etc. Electricity is transformed to all these different forms in its application for modern day use. Can you name some electrical appliances that produce heat?

Electrical energy can be easily transformed to mechanical energy that runs the motors of various industrial machines, transport, etc. There are also many small motors that make electrical domestic appliances work e.g. fans, shaving machines, mixers, etc.

Electricity is also greatly used in communication by telephones, telegraphs, television, etc.

• SAFETY MEASURES WHEN USING ELECTRICITY

–Some electricity is safe for experiments, but some is very dangerous. Electricity supplied by the power station is usually 220 volts. This is extremely dangerous for experiments though it is quite safe to use for lamps and appliances. This is because the conductors are properly insulated. Electricity with more than 12 volts (e. g. flashlight batteries, etc.) should not be used for experiments.

–Our bodies can carry electricity. If a large amount of it flows through a person it can do very serious harm. This picture shows how a person might become part of a short circuit for a strong electrical current.

The human body can conduct electricity. It can there fore provide a short circuit for an electric current from a broken conductor causing the person to get shoked.

Learn to handle all electrical appliances safely. Observe all the regulations.

–Always secure and mend exposed wires immediately.

–Never handle electrical appliances or fittings with wet hands.

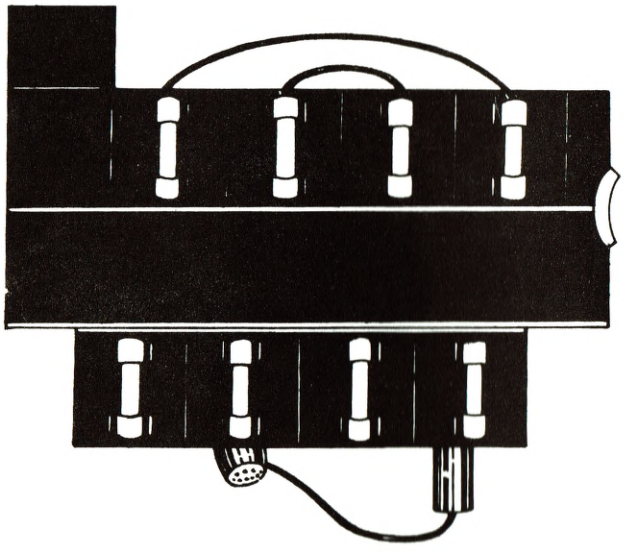
–Teach small children not to play with outlets.

EXERCISES

1. Make a simple electric circuit as shown in the lesson and make it work.
   (a) Explain how the current flows in the circuit.
   (b) Point out all the parts that make up a circuit.
2. (i) Write the name of a piece of equipment or machine that uses electrical energy that has been transformed to the following:
   (a) light energy
   (b) heat energy
   (c) sound energy
   (d) mechanical energy

(ii) Do you use electricity to do any aspect of your work? What form of energy is the electricity changed to in the process?

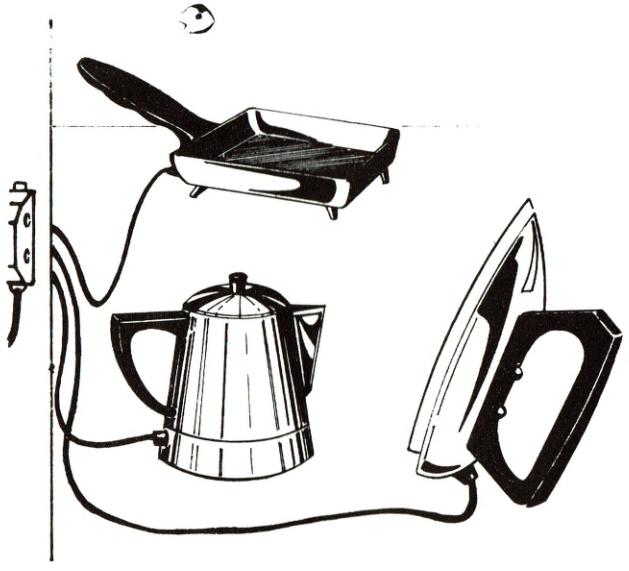
3. A car jack shifted in the trunk of a car and cut through the insulation in the conductors going to the right taillight. The jack finally touched both conductors and caused a short circuit. What do you think happened to the taillight? What happened to the fuse? What would have happened if there were no fuse in the circuit? What must the driver do before he can drive home?



4. The circuits which supply electricity to the headlights, taillights, horn and radio in a car are all brought to one fuse panel. Fuses must be inserted to protect all of these circuits.

   Look at the picture. Can you tell how many separate circuits there are?

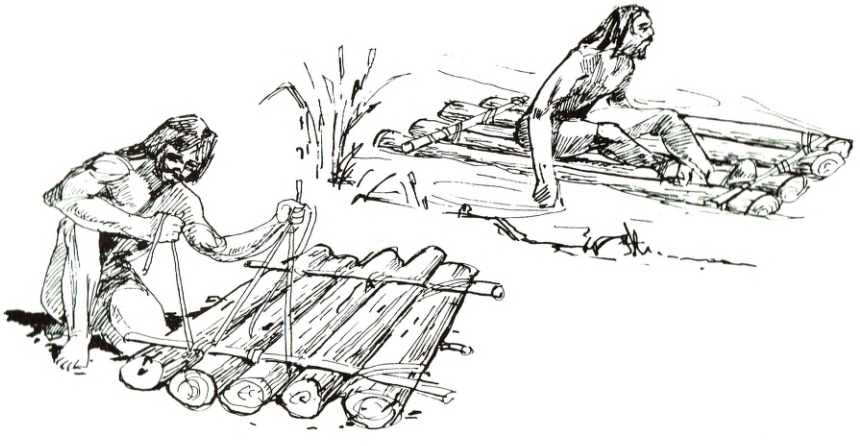
5. Look at the picture, why do you think the 15 ampere fuse blew? What should have been done instead of connecting the toaster, the iron and the kettle to one circuit?



UNIT 2

MECHANISATION – MACHINES

• MECHANISATION OF WORK



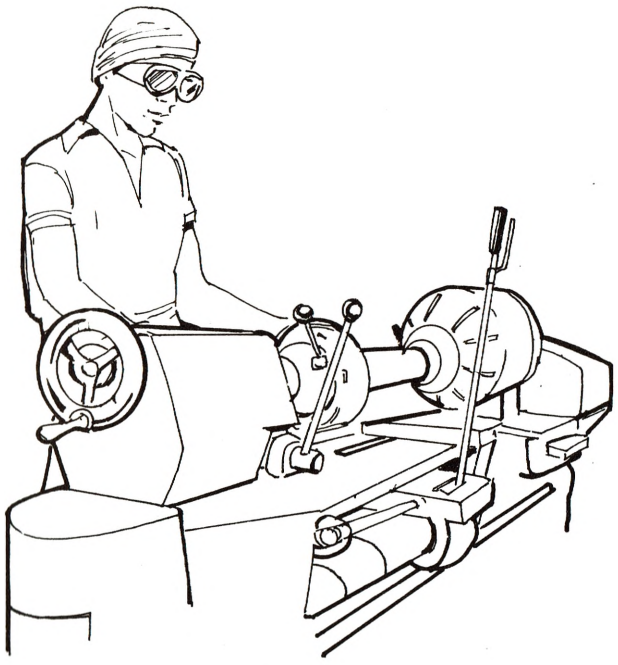
Primitive did this work without tools.

Primitive man only made use of his muscles and whatever little means provided by nature to do all his work.

In his struggle to control nature, he had to work in communities (collectively). The tools of labour and produce obtained belonged to everyone in the community and was shared equally among the members of the community.

In the course of time, man improved the tools with which he raised the quality of his work. With the improvements of tools gradually emerged private owners of these tools, who loaned them in exchange for part of the produce obtained. At the same time too, individual ownership of land and livestock emerged and this was accompanied by the exploitation of man by man, along with the greater exploitation of nature by man.

For centuries the tools or instruments of production were continuously improved, and man himself developed in the process. Life was much more difficult for man before he learned to make those tools. He could only raise those things that were not too heavy for his strength to raise. He could not pull things that were very much heavier than himself. He could not carry heavy objects for long distances. Through experimenting, man learned to make machines which would make work easier for him.



Modern machines with present day technology.

Primitive man using very simple tools.

Every step forward led to another. After the wheel moved by wind and by water, came the steam engine. These steam engines moved the locomotives and industrial machines. Later the internal combustion motors, the electric motors, turbine engines, and reactors replaced the steam engine and became the driving force of ships, tractors, air planes, electric tools, space ships, etc. Each generation of men improved upon the work of those before them, until we now have the machines which do most of the hard work for us.

Today man uses powerful technology to change nature. This has permitted the MECHANISATION of labour, that is the substitution of machines for muscular force in production. Every step that we make in replacing muscular work by machines in certain processes of production, assists the development of mechanisation or automation as it is sometimes called.

Mechanisation increases the productivity of work. In some societies it signifies the lightening of work, lessening of the number of hours of work and increases the material well being of the workers. In other countries, on the other hand it is used to increase the exploitation of workers and unemployment. Without the use of powerful excavators,

tractors, dredges and other machinery, it would be impossible to do a great amount of work in a short time.

With the mechanisation of labour, new techniques that require specialized knowledge have emerged. This knowledge is necessary in order to direct and operate the machines. It is for this reason that all working people must have the necessary knowledge and skill to control and use technology, so as to contribute to building the economy of a country.

University trained (or high level) engineers, middlelevel technicians and trained workers who would contribute to the planning of our economy are needed.

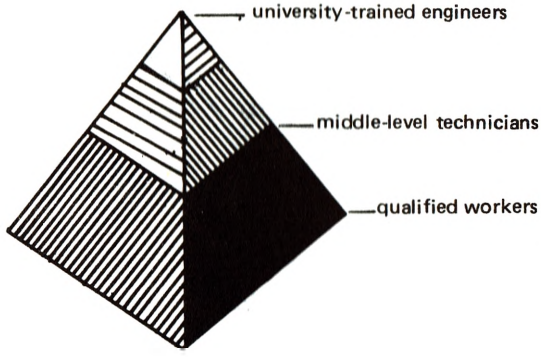


Figure 2.4 represents the proportion that exists between the number of university trained technicians, medium level and trained workers, who determine the development of science and technology in our age. The base of the pyramid represents the number of trained workers, the middle part represents middle level technicians and the top part, the university graduates.

In Grenada, if we are to raise production and build our economy, more opportunities will be provided for further education and skills training in the form of night schools, etc., to meet the needs for our working people to become trained to use modern methods of science and technology.

• MACHINES

Any mechanism used to transform energy to do useful work is called a MACHINE. When we talk about machines, we usually think of big machines in factories or some other complicated machines. Actually, all big complicated machines are made up of many simple machines.

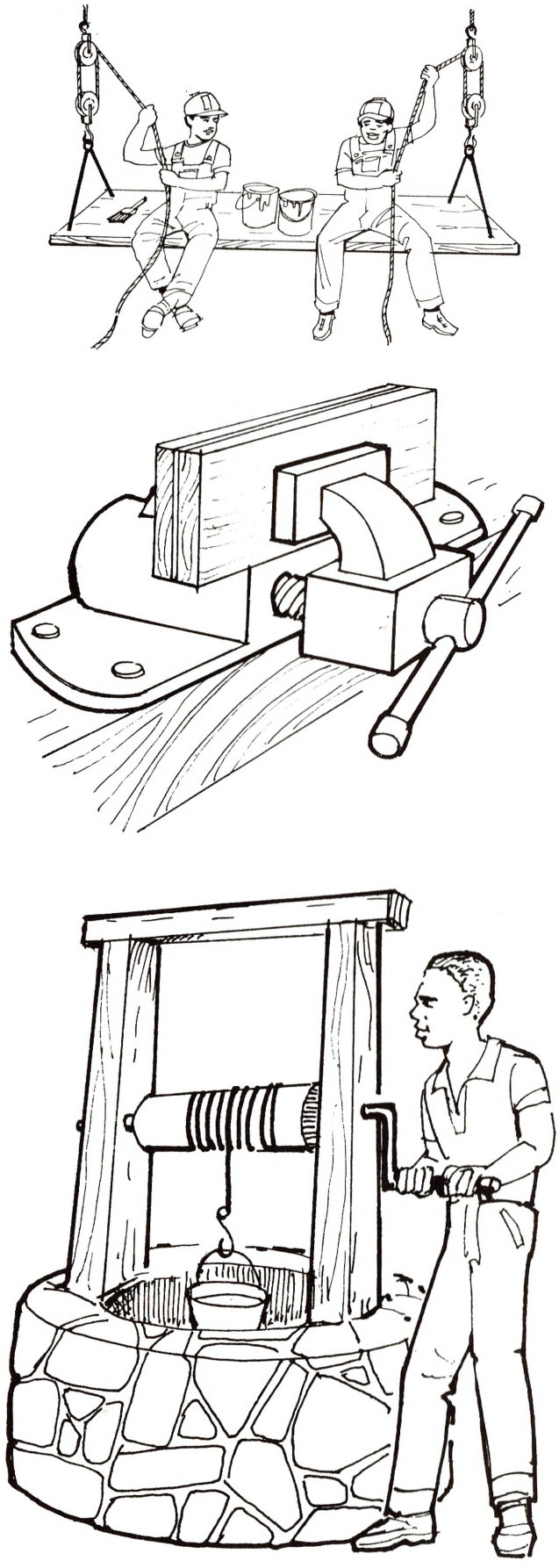
The utilisation of any machine must have two main aims:

(a) increasing productivity

(b) lessening man's work

Machines are classified according to their complexity as either (a) SIMPLE or (b) COMPLEX or COMPLICATED.

SIMPLE machines are those that cannot be separated or broken down into smaller machines and cannot do work on their own.



Examples of some machines. Do you recognise them?

Among the simple machines we have levers, wedges, inclined planes, pulleys, wheel and axle (winches), the screw.

COMPLEX machines are those which are made up of combinations of two or more simple machines. Examples are cranes, trucks, sewing machines, etc.

• SIMPLE MACHINES

1. *Levers:*

Levers are the most simple of all the simple machines and were the first to be used by man. It served to do work with greater ease and less effort.

When you find it difficult to open the lid of a tin, you can use the handle of a metal spoon to prise the lid open.

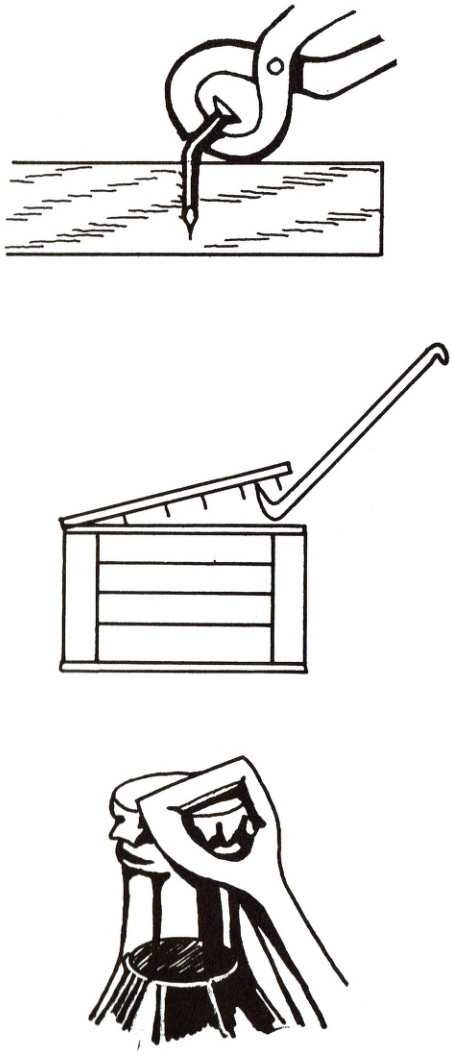
Spoon being used to remove the lid of a tin.

In this case the spoon is a simple machihe. If you need to move a big rock, you may look for a small stone and a long stick to help you do the work.

Example of a simple lever being used-man raising rock with a long stick and a small stone.

The stick or a crowbar helps you in the same way as the handle of the spoon and both of them act as levers.

There are numerous instruments that act as levers, some of which are shown in the illustration.



Different levers.

All levers have the following three basic parts:

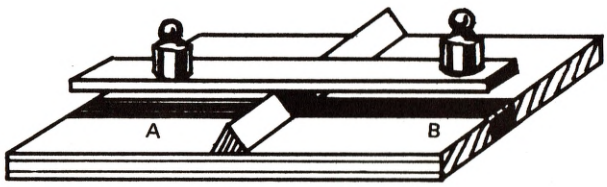
(a) Effort - the force that is used on the lever.

(b) Load - the weight that has to be raised or moved.

(c) Fulcrum or Support - the point of the lever that supports the work, and does not move.

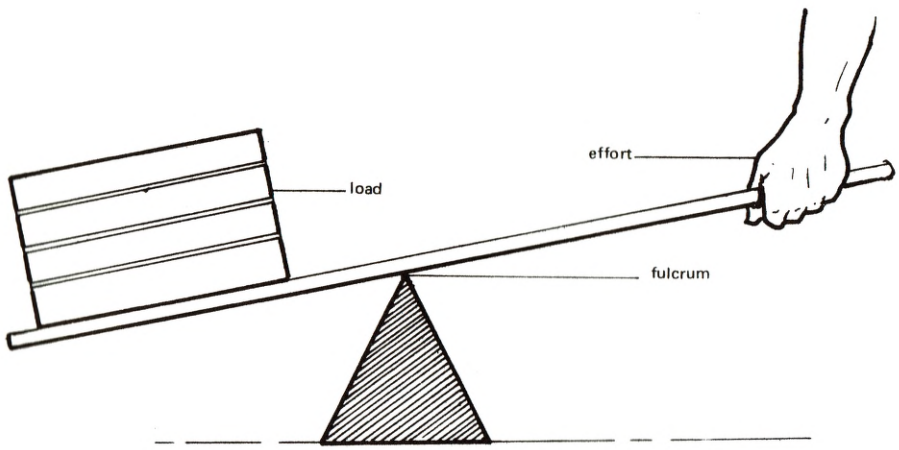
Can you tell what the effort, load and fulcrum were in each of the first two examples.

Archimedes, the Greek Scientist, found out why the lever is so useful. Two weights A and B balance on a plank on a support or fulcrum. The weight of A multiplied by its distance from the fulcrum is always equal to the weight of B by the distance of B from the fulcrum.



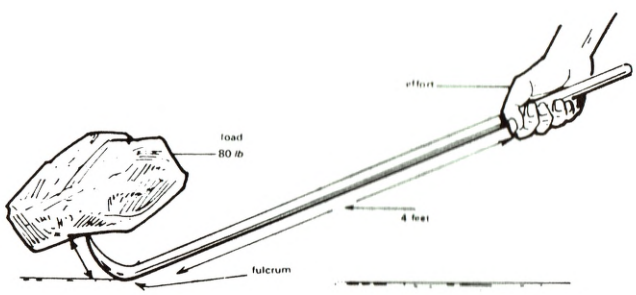
Two weightk A and B being balanced on a piece of wood.

load. How is an oar used to make a boat move? The free end of the oar is the effort, the oar-lock is the load and the end of the oar in the water is the fulcrum. In this case, you would see that the load is between the effort and the fulcrum. This is a second class lever, examples of which are a bottle opener, a can opener and a wheel barrow. Where are the load, effort and fulcrum in each of these?



First class lever.

This is true for all levers, as Archimedes found out and is called the Law of Levers. The effort multiplied by its distance from the fulcrum is always equal to the load multiplied by its distance from the fulcrum.



EXERCISE

In the above picture the length of the piece of wood is 5 feet. The rock is 1 foot from the fulcrum and weighs 80 *lbs.* What weight must the man exert in order to lift the rock, 20 or 320 *lbs?*

• TYPES OF LEVERS

There are three classes of levers. The class a lever belongs to depends on the relative positions of the effort, load and fulcrum between its load and effort.

Examples of this first class of lever are a crowbar, 'pigtoe', hammer and a pair of scissors. Can you name any others that you know?

We have seen that by putting a small force or effort on the long end of a crowbar, we are able to lift a heavy

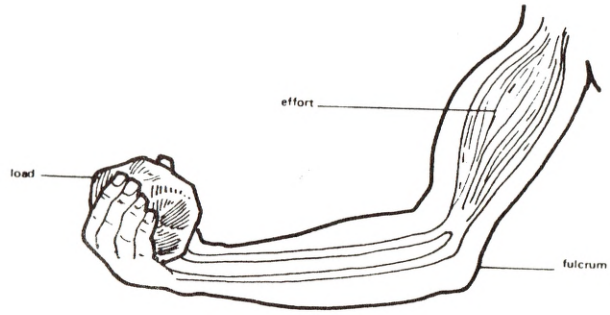
If you look carefully at the simple machines that are first and second class levers, you would observe that the effort always moves through a greater distance than the load is moved. Look at the law of levers again, it will help you to understand this.

Third class levers are those in which a large effort is used to move a small load. It may seem as a disadvantage to have to use a large effort to move a small load, but in this lever the effort moves a shorter distance than the load. Our arm and using a fishing rod are examples of this third class of levers.

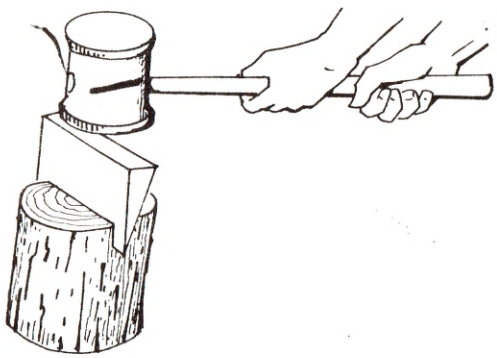
Second class lever. Can you identify the thall parts?

2. *Wedges:*

Wedges are very simple but useful machines. It consists of a body with a sharp edge on one end and a flat plane on the opposite end.



Third class lever.

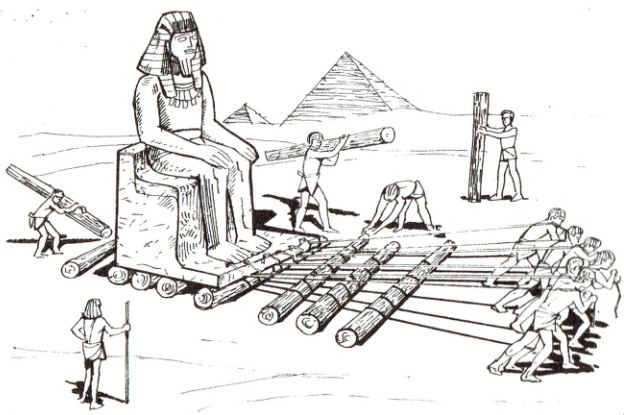


Simple wedge being used to split wood.

The force applied on top of the flat end is transmitted through the flat sides leading to the sharp edge. This causes the object on which the wedge is used to separate into two parts. Examples of these are the chisel, nails, large crocus bag ("cocoa") needles, kitchen knife or chopper, plough blades.

3. *Wheel and Axle:*

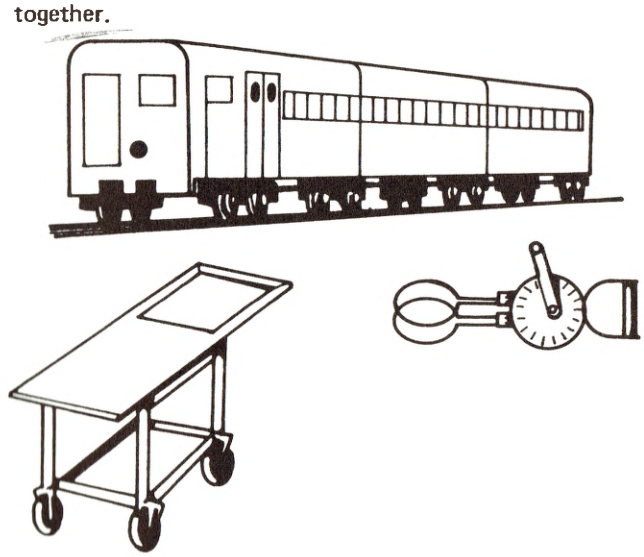
Thousands of years ago, people found that wheels made it easier to move heavy loads. The first wheels were developed from rollers. Perhaps the first rollers were the trunk of almost round trees and were used to move heavy blocks of stone. The rollers made the work much easier, but rollers had one disadvantage. It was necessary to move the rollers from the back of the load and carry them to the front as the load moves forward.



Primitive man used rollers to move heary objects. This may have given him the first ideas about making the wheel and axle.

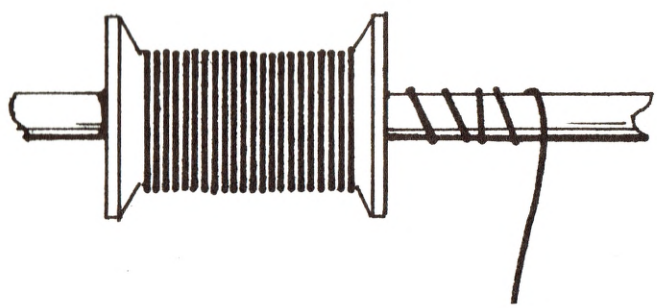
Soon, through experimenting man found that if the middle or central part of each roller were made smaller, it would not be necessary to change rollers so often. This thin part in the middle was to become an axle, while the large parts at the ends were to become wheels. Instead of rolling out behind the load, the axle turned or rotated underneath. This was an advance of the use of rollers because then it was not necessary to move the axle along as the load moved forward as was done with the rollers.

Wheels are one of man's most important inventions. Think what life would be like if we did not have wheels. The wheel itself is not a machine, but it becomes one when you combine it with an axle. The axle is really like a second smaller wheel fixed tightly to the first so that they turn together.



All these machines use wheels and axles.

To find out how useful a wheel and axle is, make a simple wheel and axle. Get an empty cotton reel. Fix a long pencil tightly into the hole of the reel. Tie a loop of wire to each end of the pencil. Suspend the cotton reel and pencil by these loops of wire. The pencil should lie horizontally. This is a simple wheel and axle, the cotton reel forming the wheel and the pencil, the axle.



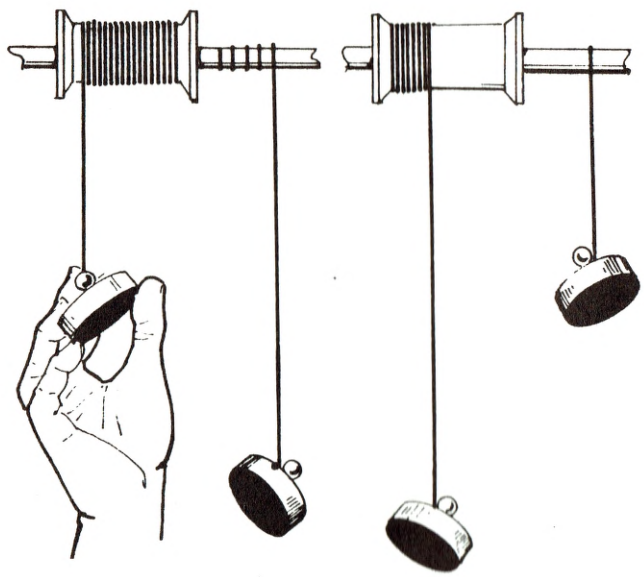
A pencil and Reel forms a wheel and axle in this illustration.

Fix a piece of string to the wheel and another to the axle. Wind a few turns of the string on the wheel and a few turns on the axle. You would observe that the string on the axle is wound in the opposite direction to the string on

the wheel. Now tie a piece of weight to the axle string and a slightly lighter weight to the string of the wheel.

See which one moves down and explain what happens.

Suppose the circumference of the wheel (cotton reel) is three times the size of the axle (pencil). One complete turn of the wheel turns the axle once, as they are fixed together. If the circumference of the wheel is three inches, you have to pull three inches of string to make the wheel turn once. This will also wind one inch of string on the axle.



This illustration shows what happens when the string with a weight is wound round the wheel and axle.

How heavy a load the effort can lift depends on how many times the wheel is larger than the axle. If the diameter of the wheel is 3 inches and that of the axle is 1 inch, then the wheel is three times as large as the axle. Then the effort can lift a load three times as heavy.

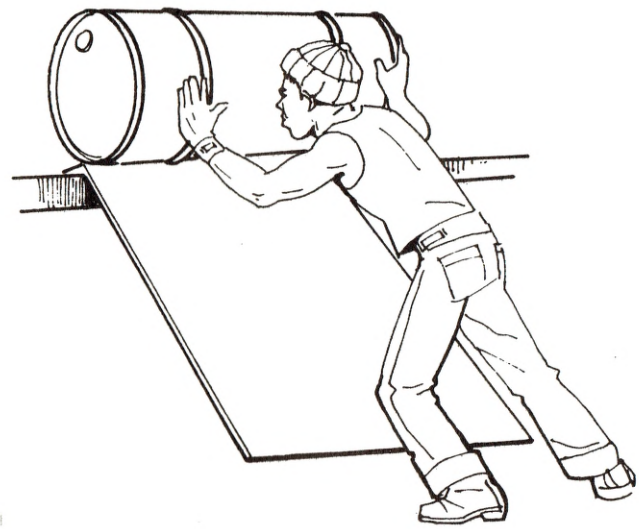
It was soon discovered that when an axle turned, it rubbed against the material that was carrying the load or axle. This was because the two parts had to slide over each other making the wheel hard to turn. Bearings were made to hold that part of the axle that rubbed against the wheel. When balls (ball bearings) or rollers (roller bearings) are placed between the wheel and the axle, the wheel turns more easily. This is because the bearings reduce the friction.

Not every wheel and axle machines has a complete wheel fixed to an axle. Instead, in most modern machines, the wheel is replaced by a handle attached to an axle called a crank. It works in the same way as the wheel.

In places where there are wells, the wheel and axle idea is used in the windlass to raise water from the wells. The bicycle is another example of where the wheel and axle is used, another example is the sterring wheel of a car, can you think of others?

4. *Inclined Planes:*

As the name indicates the INCLINED PLANE consists of a flat surface leaned in an inclined position that makes it possible to lift an object to a certain height, by moving it along the plane without much force.

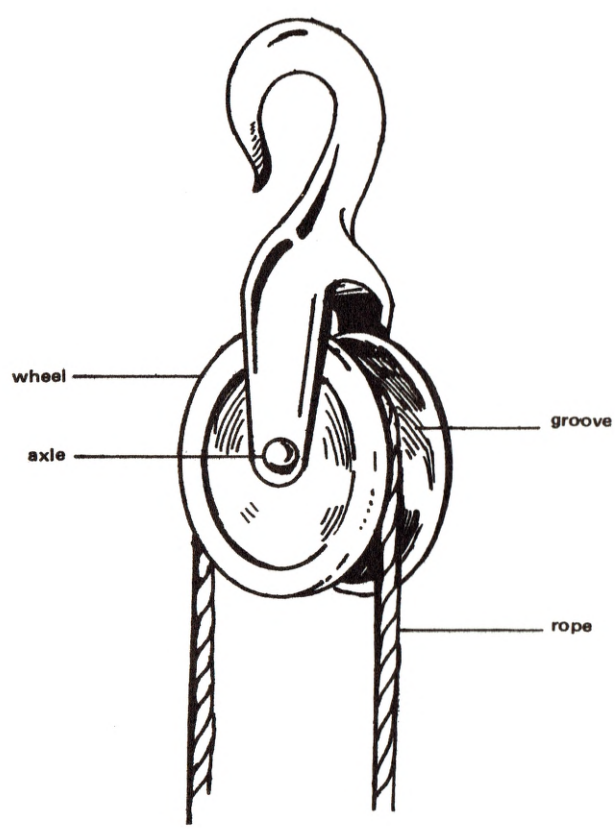


An inclined plane.

Examples of this machines are the ramps of garages, slides that children play on, sheets of board used to roll barrels unto a truck.

5. *Pulleys:*

The pulley is another type of simple machine made from a wooden or metal wheel that spins on an axis. The outer side of the wheel has a groove through which a cable either rope or chain passes.



Parts of a simple pulley.

Pulleys can either be FIXED or MOVABLE and are used to lift heavy weights or change the direction of a force.

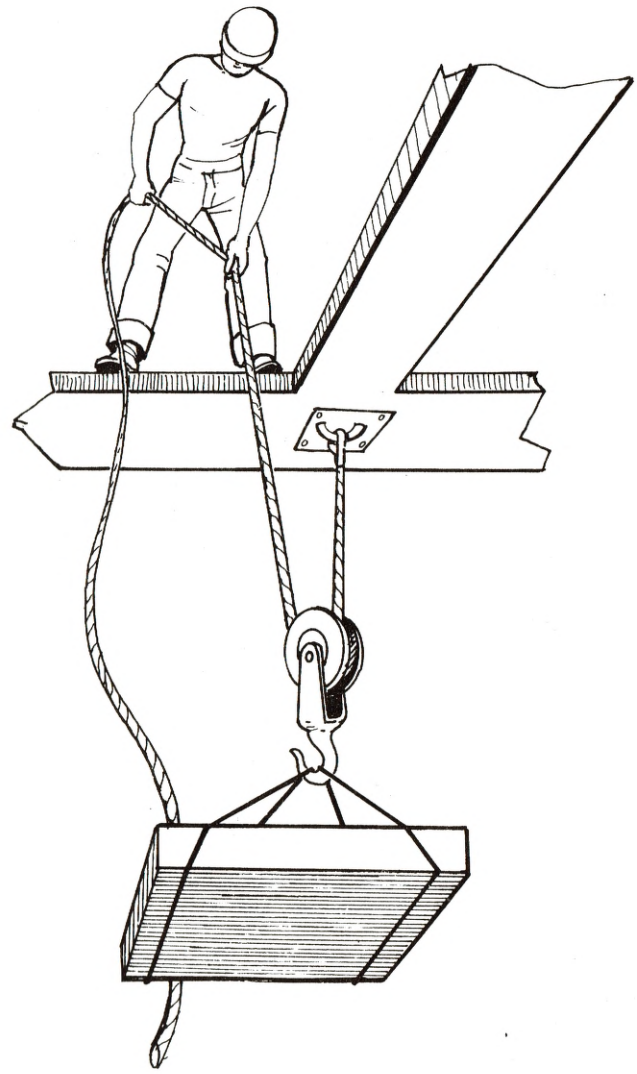
FIXED pulleys as the name suggests are those that are fastened to a fixed point so that the axis does not move up or down as the weight is lifted.

In order to lift a weight by means of a single fixed pulley one must apply a force on the rope or chain that is equivalent to the weight of the object. For this reason, the work done is not lessened, but it allows a change in direction of the force applied, which is important. Look at the man in the picture. By pulling the rope down, the bucket is lifted upwards.

Man using a single fixed pulley.

A flag is raised in the same way. Can you explain what happens. Are there any other examples showing the use of a single fixed pulley that you can think of?

A movable pulley is not attached to a fixed point, but is allowed to slide along the free end of a rope or chain, while the other end of the rope is fixed to a point.

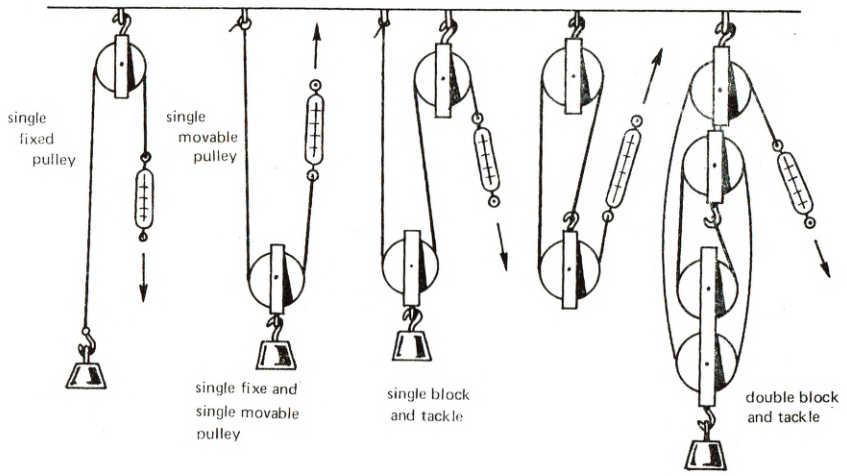


Single movable pulley being used to lift weight.

In a single movable pulley, the weight to be lifted is hung on the pulley itself, and the effort is applied on the free end of the rope as is shown in the picture. With this type of pulley, the effort needed to raise the object is equivalent to half of the weight of the object. In a single fixed pulley the load is supported by one section of rope, whereas in a single movable pulley the load is supported by two sections of the rope. Since the load is supported by more sections of the rope, the effort needed to raise it is less.

In many cases a combination of fixed and movable pulleys are used, with which less effort is required and the work is accomplished with greater comfort. Here are some examples of combinations of pulleys that are used. Can you determine how many sections of rope support the load in each case? (See Fig. 2.25.)

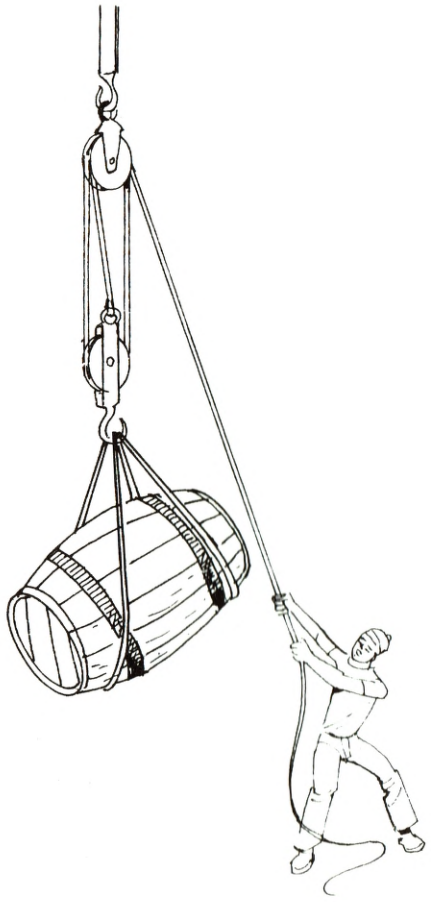
Let two persons hold a broomstick each. Tie a rope to one of the sticks and wrap it several times around both sticks as shown in the picture. Ask the two persons to hold



Some common types of pulleys.

their sticks firmly while another person pulls the free end of the rope. Can the sticks be pulled closer together even if the first two persons are trying to keep them apart?

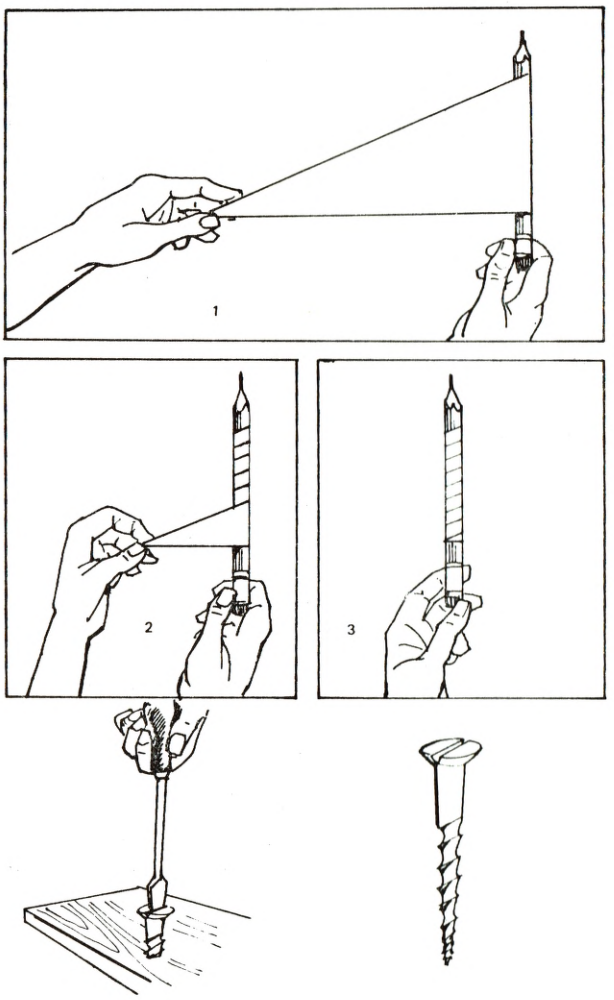
This simple activity makes use of a combination (fixed and movable) of pulleys, called the block and tackle. It is commonly used for raising heavy loads e.g. in off loading ships, etc. Can you think of other examples.



Block and tackle pulley being used to raise heavy load.

6. *Screws:*

Screws are commonly used to hold things together, but larger screws can be used to lift cars and other very heavy objects.



Why do we sometimes screws instead of nails to hold two pieces of wood together?

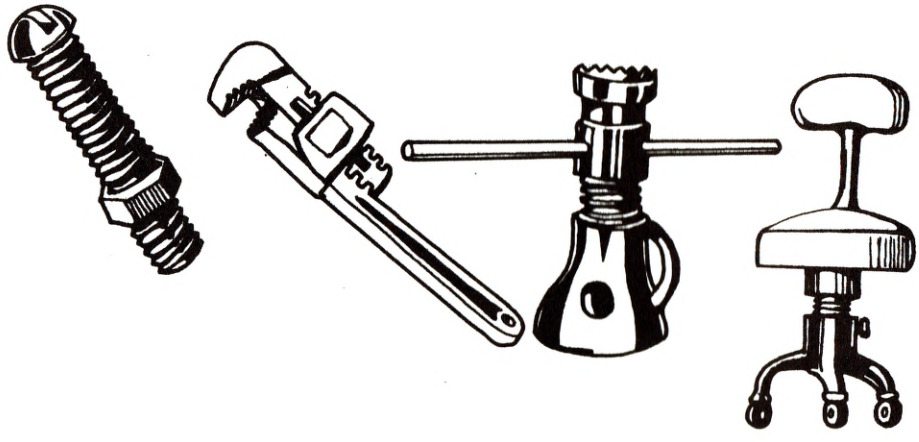
This simple activity will help you understand what a screw is.

Take a square piece of paper and cut it so that you have two equal triangles. Colour the long edge of one of the triangles and wrap it around a pencil as shown in the illustration. Notice how the coloured edge appears on the paper, what have you made? (See Fig. 2.25.)

A screw can be described as an inclined plane wrapped around a cylindrical object such as a pole.

When a screw is turned around once, it advances a distance equal to the space between two neighbouring threads. This distance is called the pitch of the screw. It is more difficult to get a screw with a big pitch into a piece of wood than one with a smaller pitch. Why do you think this is so?

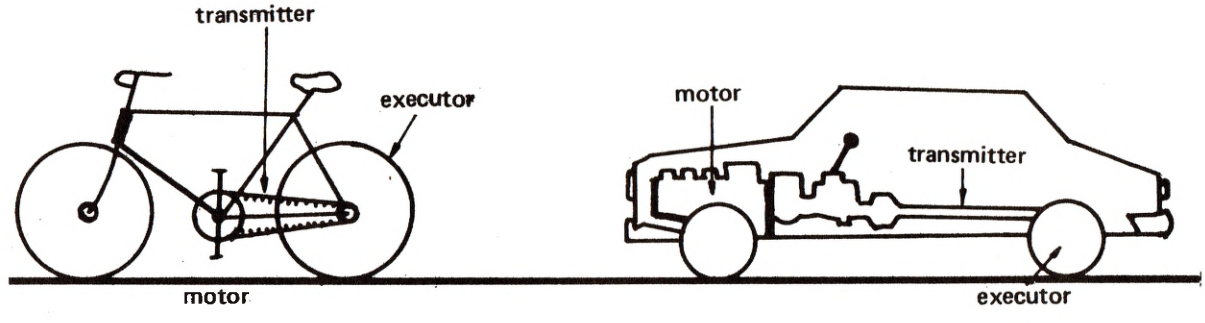
Look at the examples of screws shown in the picture. What uses are made of screws?



Uses of the screws.

• COMPLEX MACHINES

All complex machines contain the following mechanisms: a motor mechanism; a mechanism of transmission; and a mechanism of execution.



Three essentiol parts of any complex machine.

—Motor Mechanism

This serves to put the machine in motion. It is the source of energy to do the work required, or the driving force of the machine. For example, in a vehicle it is the internal combustion motor; in a bicycle it is the pedal and cogged wheel.

—Mechanism of Transmission

This serves to transmit the movement of the motor to the mechanism of execution. In vehicles it is made up of the gears, the gear box and the differential, in a bicycle it is the chain, in a manual sewing machine, it is the machine strap.

—Mechanism of Execution

This part puts the organ of work of the machine in motion, doing the work for which the machine was made. The wheel is the mechanism of execution in a vehicle or bicycle.

Complex machines are classified into motors and machinery.

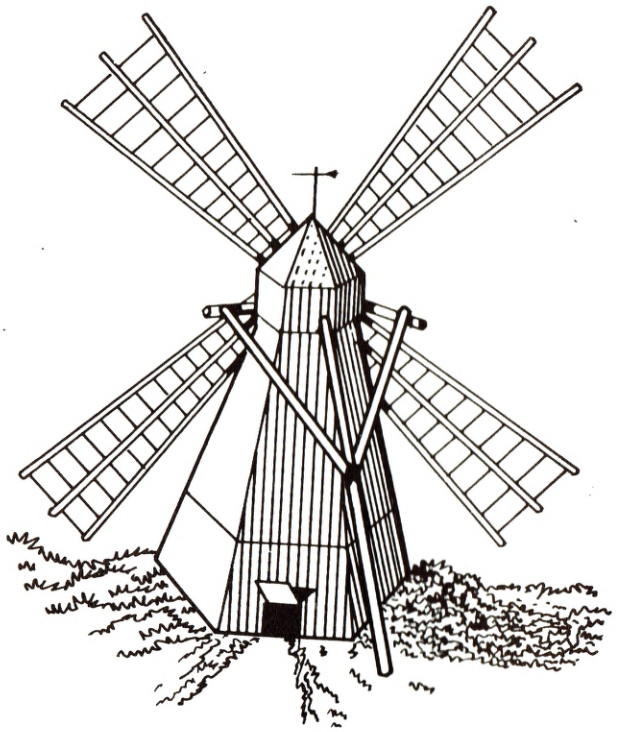
• MOTORS: THEIR CLASSIFICATION

Motors are machines that transform energy provided by air (wind), water, heat and electricity to mechanical energy for work.

These are classified into wind motors, hydraulic (water power) motors, combustion (heat) motors, electric motors.

—Wind Motors

These motors work with the energy provided by wind (moving air). Wind motors were known from very long ago. Figure 2.29 shows a windmill.



Picture of a wind mill.

The wind pushes against the inclined plane of the sails of the windmill making it turn. This spinning movement of the windmill sails is transmitted to other mechanisms within the windmill that does work such as pumping water or grinding corn.

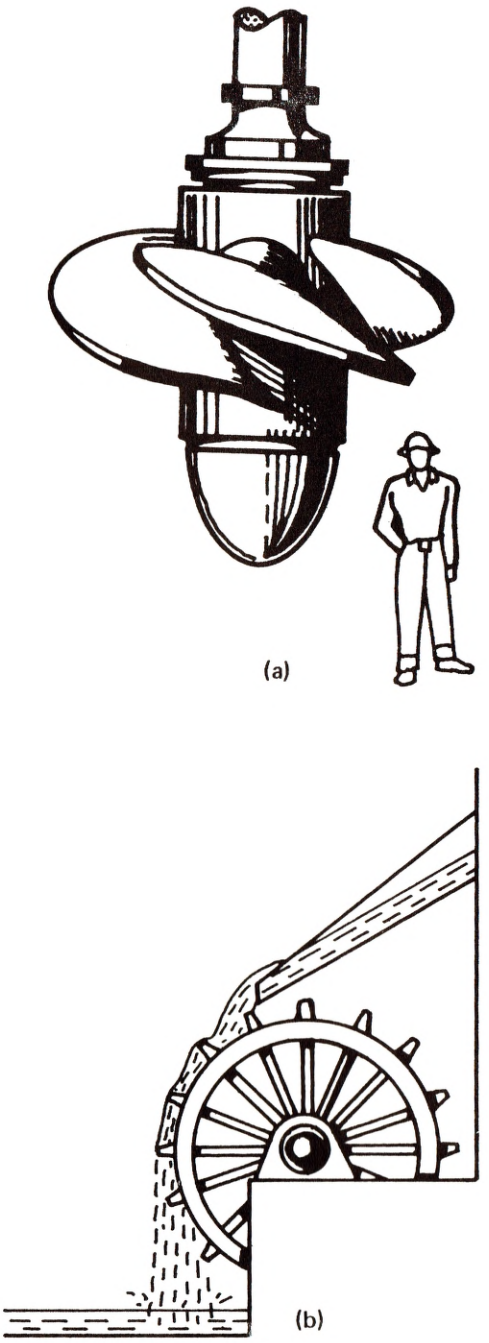
—Hydraulic Motors

Water in motion possesses energy and can do useful work. Very huge dams have been constructed to make use of the energy in flowing river water. The higher the dam, the higher the level of water is raised, and the greater the energy it possesses as it falls.

In hydro-electric plants the energy in water is used to set turbines in motion.

One of the most simple of hydraulic motors is the water-wheel. As water falls on the blades of the wheel, it causes the wheel to spin and this is used to do work. In some rum distilleries, this is used to grind the cane.

Modern technology uses hydraulic turbines to set hydro-electric plants in motion. These turbines are huge machines whose weight is sometimes 1,500 *tons*. The diameter of its wheel being up to 10 meters.



a) Huge turbine.

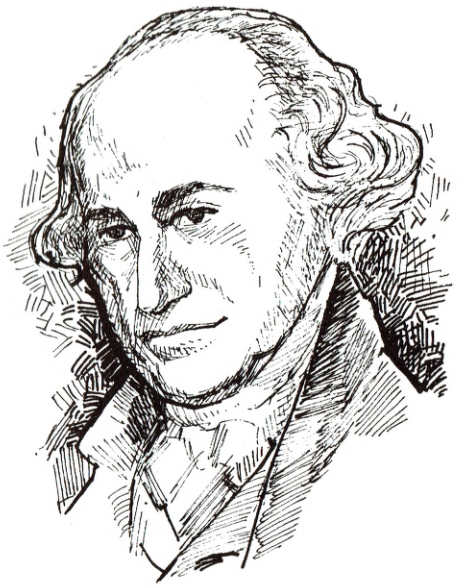
b) Water wheel.

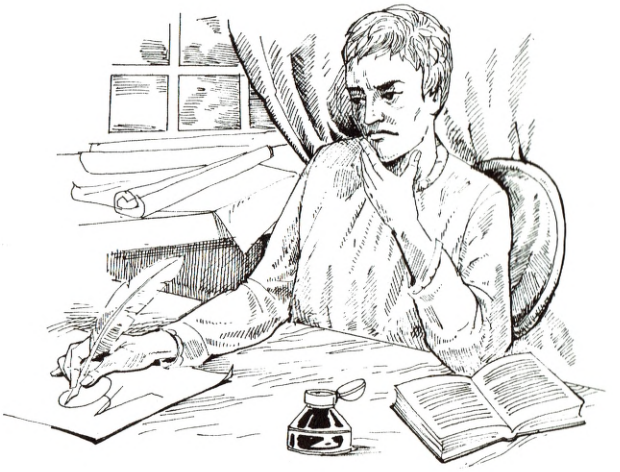
—Combustion Motors

These machines work with heat energy provided by water vapour or by the combustion of certain fuels e.g. gasoline and diesel oil.

Among this type of motors we have the steam engines and the internal combustion motors.

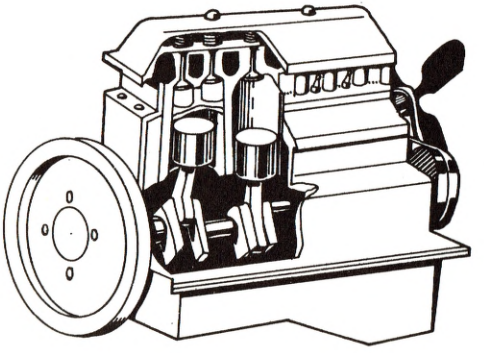
During the 18th. century the steam engine was invented by Polsunov of Russia and Watts of England.





James Watt (1733-1819)
I.I. Polsunov (1728-1816)

Steam engines are widely used in electrical power stations and in ships. In the internal combustion motors, a mixture of fuel and air is formed in the cylinder. It does not require a boiler, nor is it necessary to convert the fuel to a vapour. This type of motor is widely used in the field of transport: vehicles, planes, trucks, and fish trawlers.



Inter nol combustion motor of a vehicle.

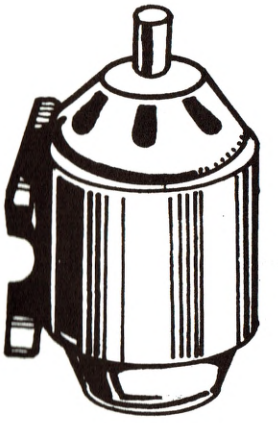
The mechanisation of agriculture requires many tractors and other haulage machines that work with this type of motors.

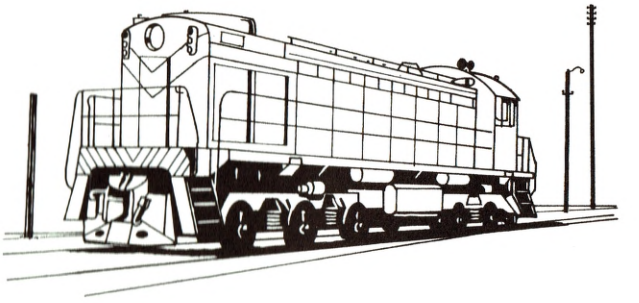
—Electric Motors

These motors work with electricity, which is transformed to mechanical energy.

Electric motors can be made with any capacity or power, that would depend on the purpose for which it would be used - from the very tiny motors that makes the dentist's drill work, to the very powerful motors used to drive the heavy rollers of a huge mill.

They are used in hydraulic pumps (the mechanism that lifts cars in a service station), milking machines - used to milk large numbers of cows in a dairy; railway stations, different workshops and factories, among other uses.





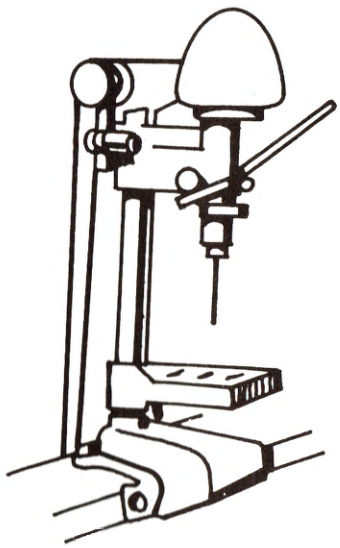
Electric motors used in transport.

• MACHINERY: CLASSIFICATION AND USE

Machines are classified as machine tools, transport facilities and agricultural machines.

—Machine Tools

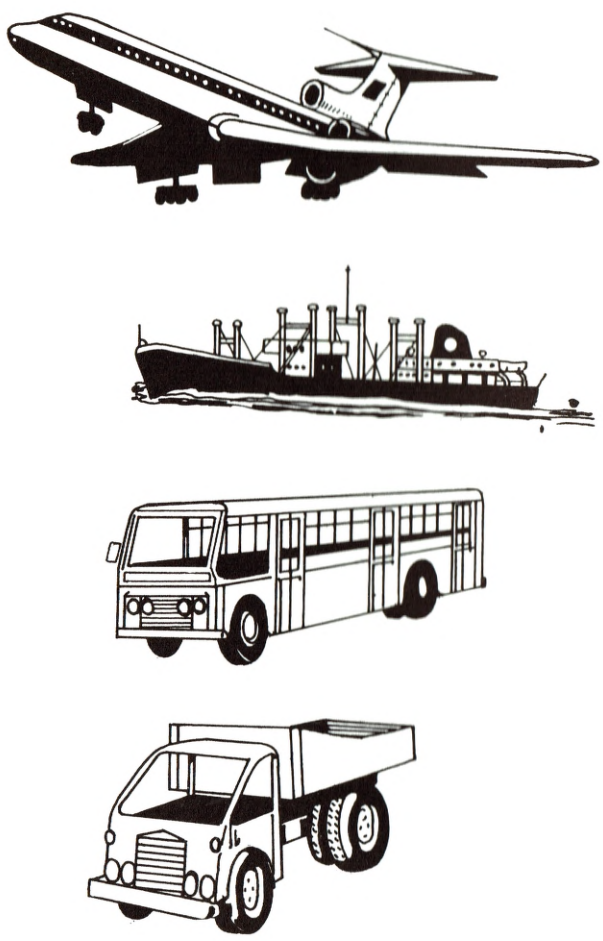
These are the machines that use mechanical energy from the motors to do useful work in the processes of manufacturing materials and parts for other machines. They do work such as: cutting, rolling or pressing, levelling, shaping, drilling, etc. Examples of these are ploughs, drills, lathes, circular saws, etc.



Picture of a power drill.

—Transportation

These machines are used to transport people, cargo, etc. They are constructed in many different ways to travel on land, in the air and on water. Examples of these are: cars, large buses, trucks, motor-cycles, planes and boats.

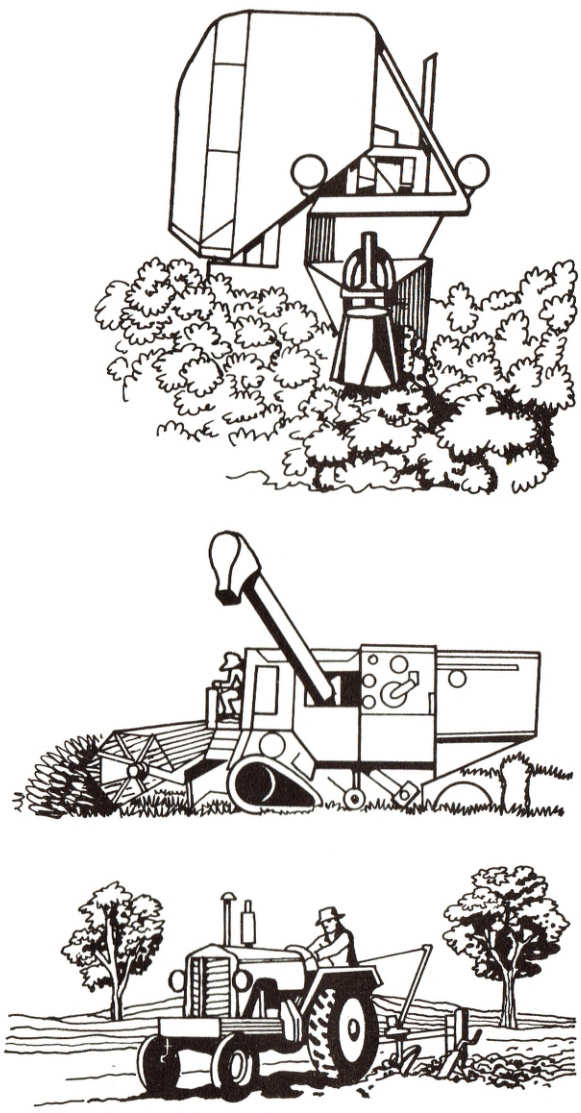


Some forms of transport.

—Agricultural Machines

The great developments in agriculture that are needed in order to build the economy of our country to a reasonable level of true independence would require a scientific revolution in the field of agriculture. Tractors and other such agricultural machines will have to be more widely used to bring about the mechanisation of the laborious tasks involved in cultivating the land. The sooner this process begins, the better it will be for our country.

Some examples of agricultural machines include: sowers or seed drills for sowing seeds on a large scale, cultivators, fertilizing machines, spraying machines, harvesters or reapers and packing machines.



Some agricultural machines.

Any advances made in science and technology in the area of agriculture will help raise agricultural production in the twentieth century and contribute to raising the standard of living of our people.

SUMMARY OF THE CLASSIFICATION OF MACHINES

Simple Machines

- Levers – Pliers, scissors, crowbars
- Wedges – Chisels, nails, kitchen knife
- Wheels & Axle – Egg whisk, bicycle wheel
- Inclined Planes – Garage ramps
- Pulleys – Fixed pulleys, movable pulleys
- Screws – Car jack, screw and nuts

Complex Machines

- Motors
  - Wind motors – wind mills
  - Hydralic motors – water wheels
  - Combustion motors – car motors
  - Electric motors – factory motor
- Machines
  - Machine Tools – drills, ploughs
  - Transportation – cars, planes
  - Agricultural harvester and machines – packing machines

EXERCISES

1. What is the main difference between simple and complex machines?
2. What simple machines have you studied? Briefly explain what each is.
3. Examine any machine that is used in your workplace and determine how it works.
4. Complete the following table:

Machine	Use	Tool
Levers	Lift or move objects	Crow-bar
Wheel & axle		
Wedge		
Inclined plane		
Screw		
Pulley		

5. For each of the following complex machines say which part is (a) motor, (b) mechanism of transmission, (c) mechanism of execution, (i) bicycle, (ii) car, (iii) sewing machine (hand).
6. (i) What are machine tools used for?
   (ii) Write the names of five examples.
7. Give the names of four (4) agricultural machines.

UNIT 3

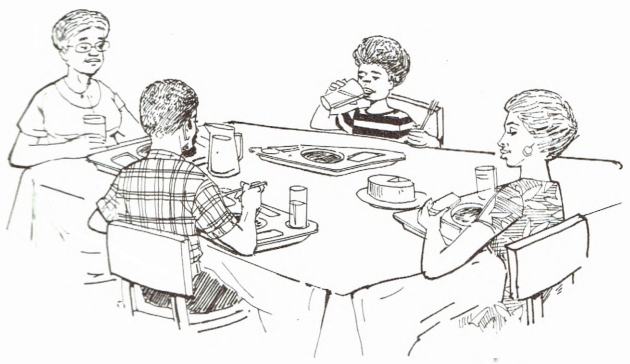
FOOD - MAN'S SOURCE OF CHEMICAL ENERGY

• IMPORTANCE OF FOOD

Food is necessary for life. It is very important to us because it provides us with the substances needed for growth and the energy required for work and play.

The amount and type of food a person eats in a day is called the daily diet. There are many different types of food that are eaten, that make up a person's diet. The main types of food that make up a diet are as follows:

(a) Proteins
(b) Fats
(c) Carbohydrates
(d) Vitamins
(e) Mineral Salts
(f) Water



Family having a meal-Food is a necessity of life.

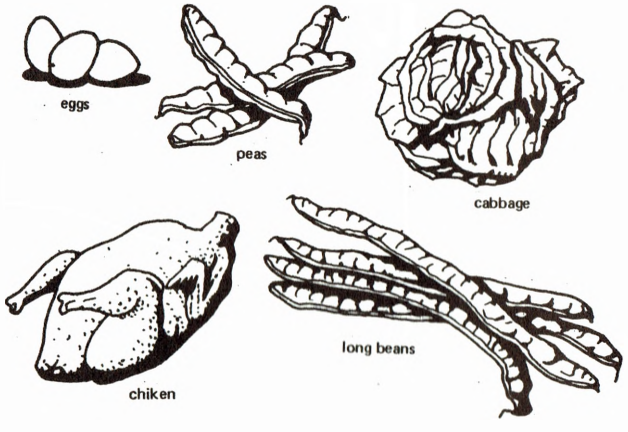
A balanced diet is one that contains all the different types of foods, but in varying amounts. If the correct quantity of each type of food is regularly eaten, it helps maintain a healthy body and avoids many different illnesses.

• TYPES OF FOOD

(a) *Proteins:*

Proteins can be found in almost all plants and animals. The muscles of animals are mostly made up of proteins. There is much protein in milk, cheese and in the white of eggs. Butter also contains some proteins. Beans, peas, and other common vegetables like cabbage, are rich in protein. Can you name some more of these vegetables?

Proteins are mainly body building foods. They provide the substances needed to repair worn out tissues in our bodies and for growth. Because of this fact babies and young children need a great deal of proteins to enable healthy growth. Proteins can also provide us with energy, but they are more important for repairing tissue and growth.



Some protein foods.

(b) *Carbohydrates:*

Starch, sugar and cellulose are carbohydrates. There are many types of sugars: grape sugar, fruit sugar, cane sugar, malt sugar and milk sugar are a few examples of these. Plants and animals contain two types of starch that are slightly different from each other. Foods like rice, potatoes and wheat contain much starch. Can you give other examples.

Cellulose is another type of starch, but is found only in plants. Animals do not contain the type of starch called cellulose. A good example of material rich in cellulose is the outer coat of citrus fruit segments ("pegs"). Cellulose helps cause easy bowel movements.

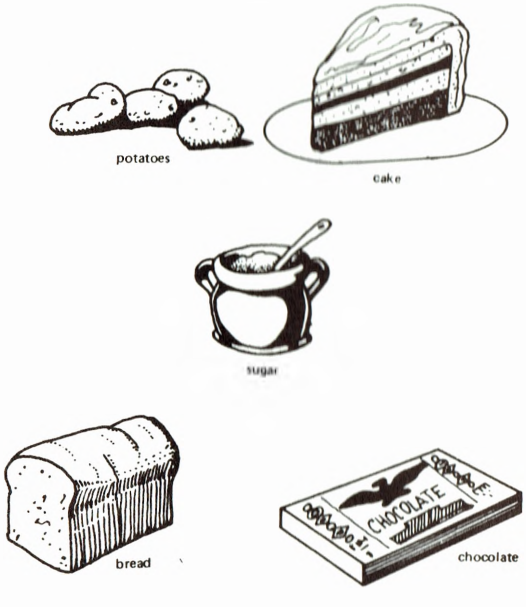
Carbohydrates give us energy. If we eat too little carbohydrates, we will get tired easily. On the other hand, if we eat too much and do not exercise, we will tend to get lazy and fat. This is because all the extra carbohydrates that are taken into our bodies are changed to fat and stored in the body. In which parts of the body do you think fats are usually stored?

These foods contain fats.

(c) *Fats:*

Fats can be found in both animals and plants. A fat is really an oil in a solid form. When fats are heated they become oils, and when oils are cooled, they become fats. Eggs (especially yolk), milk, fish, butter cheese and certain seeds like peanuts, cashew nuts and linseeds, gives us fats and oils. Can you think of other foods which also contain fats?

Like carbohydrates, fats give us energy. They keep us warm, especially when the temperature is low. Fats also contain certain vitamins which we shall study about later. Why is it that people in cold countries need to eat more fats?



Some carbohydrate foods.

(d) *Vitamins:*

The vitamins are a group of very important substances. They are found in very small amounts in certain foods, and are needed in very small quantities by our bodies. They keep us healthy and prevent diseases. Vitamins A, D and E can dissolve in fats, while Vitamins B and C can dissolve in water.

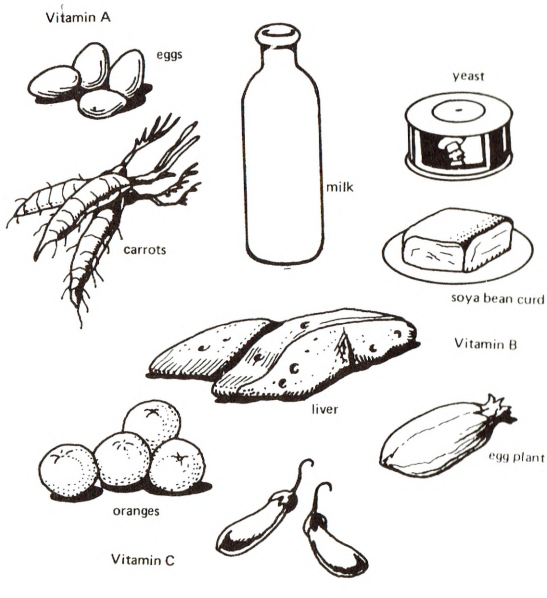
Vitamin A is needed for proper growth. If we do not have it in our diet, we will suffer from night blindness. This is a disease of the eyes. Milk, butter, cream, fish oils (e.g. cod liver oil) and egg yolk contains this vitamin.

There are many types of vitamin B. They are needed by the body to remain healthy. If vitamin B is absent, two diseases will arise. One is Beri-Beri, a disease of the nerves and the other is pellagra, a skin disease. Some vegetables, fruits, seeds, liver, eggs and yeast contain vitamin B.

We need vitamin C to help our bodies fight against colds and other common diseases. This vitamin is also used in the repair of skin tissue. If we do not take in enough vitamin C we may get the disease scurvy in which the mouth gets sores and the teeth start falling out. The skin also becomes infected. Do you know why sailors going on long voyages in the past used to suffer from scurvy?

Vitamin D is necessary for the proper growth of bones. If it is absent from the diet of young children, they will get rickets. This is a disease in which the bones become soft or grow in a bad shape. Too little vitamin D may also give rise to bad teeth. This vitamin is present in eggs, butter and fish oils. It is also made by our skin in the presence of sunlight.

Vitamins are therefore very important to us.



Foods containing vitamins.

(e) *Mineral Salts:*

Mineral salts are found in small amounts in different types of food, like certain meats and vegetables.

Sea foods also contain some mineral salts. Our bodies only need small amounts of mineral salt in order to remain strong and healthy, but without them we can develop serious diseases. We also need mineral salts to fight against diseases.

Common salt, or table is very important. The minerals, iron, iodine, calcium and phosphorus are also very important for different reasons that we shall discuss later on. This means that our diet should include all the mineral salts containing these minerals.

Common salt is present in all parts of our bodies. It must be present for our bodies to function well. Most meat and fish contain common salt. We also add it to our food when we cook. It makes the food more tasty and at the same time keeps us healthy.

Iron is important because blood is made from it. Blood which contains much iron is healthier than blood which contains only a little iron. Healthy blood is thick and bright red in colour. If the foods we eat do not contain enough iron, we become pale, weak and tired. Certain plants like spinach, and the liver of animals, contain much iron.

Iodine is also important for growth. It helps the body to function properly. Fish from the sea, and shell-fish are rich in iodine. When there is insufficient iodine in our diet, we suffer from a disease called Goitre. In this disease the neck swells and forms a soft lump.

Calcium and phosphorus are important because they help in the building of strong bones and teeth. They also help give us healthy skin. Babies and growing children need a lot of calcium and phosphorus to ensure good bone and teeth formation. If they do not have enough of these minerals, they will grow very slowly and will suffer from tooth decay and skin diseases. Milk, cheese and vegetables contain calcium and phosphorus. Sea foods are also rich in these minerals.

(f) *Water:*

All plants and animals contain three-quarters of their weight of water. This means that water is found in almost all parts of their bodies. We also need water. Our bodies cannot function well if we do not have enough water. When we need water, we feel thirsty and uncomfortable. How is water used up in the body?

• FOOD CONTAINS CHEMICAL ENERGY

You would have observed from what was said before that food is necessary for life. Food provides our bodies with chemical energy which is converted to mechanical energy in the numerous activities (or work) that the human body does. Here again we see energy being converted from one form (chemical) to another (mechanical) in order to do work.

It is also important to understand the relation between this and agriculture. How is our food, both plant and animal material produced. If we are to produce enough food so that all our people can eat a balanced diet on a regular basis, agriculture will have to be greatly increased. The alternative to this would be to import food from other countries. This is very costly, we cannot afford it, especially since there is very rich fertile soil in Grenada.

The various sources of energy that man uses to carry out all the processes of production are vital for development. Some of the world's greatest problems lie in this area, the search for energy - sometimes referred to as the energy crisis. One major step towards solving the problems is when each person, understanding this, does his or her little part to reduce it.

In Grenada we have some potential for easing the problems. With serious, united efforts by our people, the process of development can be brought about while overcoming these problems.

EXERCISES

1. What are the main types of foods?
   Give examples of foods we eat that contain each type.
2. Explain what is a balanced diet.
3. Name some diseases that are brought about by a lack of the vitamins? How can these be avoided?
4. Explain why food is necessary for life.
5. Is it true to say that the use of food in the human body is one example of the transformation of energy from one kind to another? Why?
6. In what ways can you help to relieve the problem of food shortage?

Geography

UNIT 1

THE NATURAL RESOURCES OF GRENADA AND ITS DEVELOPMENT

• IMPORTANCE OF NATURAL RESOURCES

In the process of man's development and the development of society, man used the resources found in nature.

> Natural Resources are the useful materials that man takes from nature and uses them directly or indirectly to satisfy his needs

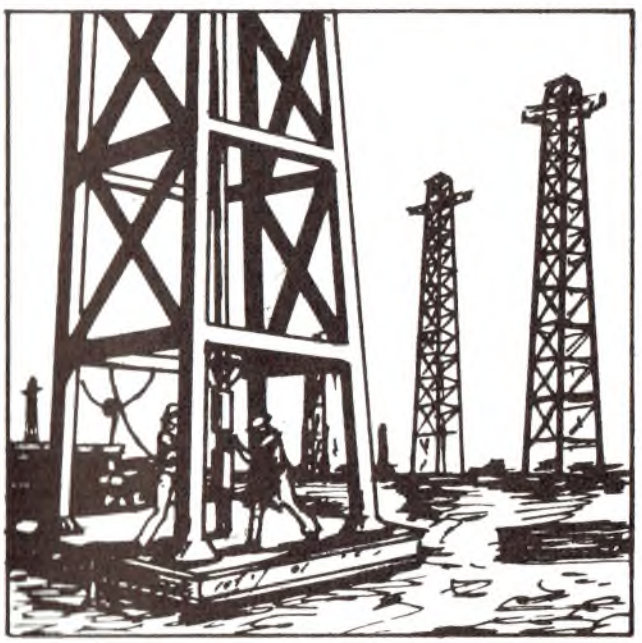
According to the period in history in which man lived, he has made use of the natural resources, obtaining some benefits.

> The main natural resources are the air, the soil, the vegetation, the animal life, the minerals, water, climate, etc.
> Man forms part of this wealth of natural resources as he is part of nature, but because of man's ability to *work*, he is able to *change* nature

From as early as thousands of years ago, man has been changing nature, in the struggle to control water, fertilize the desert, control erosion, etc.

Today, apart from using natural resources directly, man has the developments of science and technology at his service. Through these, new resources can be produced. The modern day instruments of labour (tools) allow him to make use of natural resources. But man has to do this in a conscious way, so that his actions will bring good benefits. (See Fig. 1.1.)

Man is considered the most important natural resource because ha alone is aware of the value of the different things in nature. He can therefore use them in his own interest. Man has opened a way of knowing and working in which each one of us as adults and as members of the society can play our part for the good of all.



Oil Persian Oil

Drilling mechanism to extract oil from the earth.

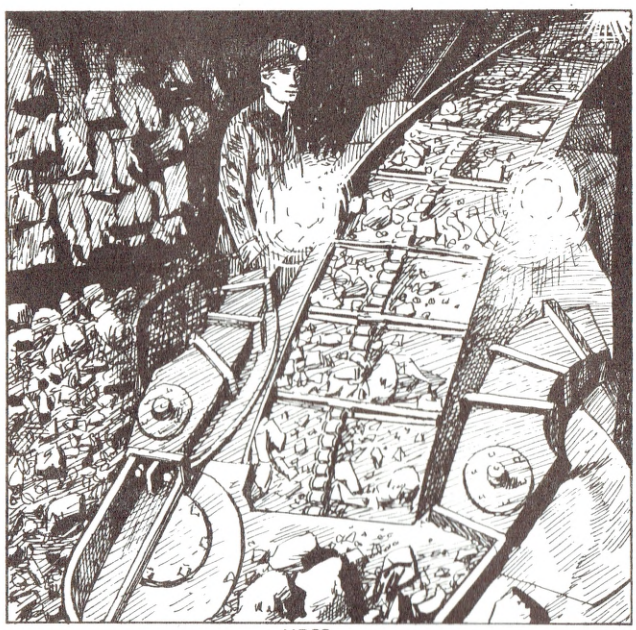
The value of the natural resources depends on how useful they are to society. The resources have a relative value. What does this mean? It means that a particular resource may have a high value today which it did not have in the past because its properties were not known. In the same way it can happen that a natural resource has great importance today, but does not have the same value in the future as a result of new developments in science, that we do not have today. (See Fig. 1.2.)

It is important for us to note that the understanding of the term natural resource changes with the development of society. Natural resources make up the basis of the existence and productive activity of man, without which there can be no agriculture or industries or subsistence for life.

With the explanation given before, it is easy for us to understand why it is necessary to protect our natural resources and use them in a sensible way.

In the past, many of our natural resources have been exploited and used without planning. It is therefore very

important for our people to plan and develop our natural resources for the benefit of all. At the same time, we can avoid the dangers of destroying, lessening and under-utilising the resources that we have in nature.



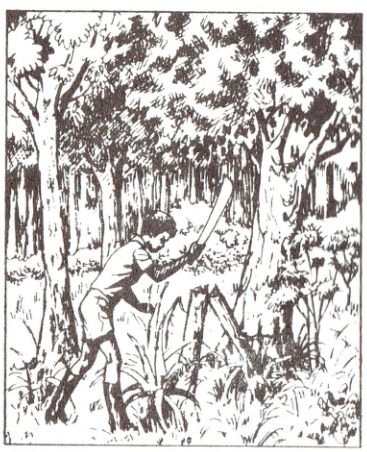
URSS

In the past, coal was the main fuel used for heatingin cold countries. Nowadays, with the developments of society electrical eating provided by the combustion of oil is more widely used.

• TWO MAIN TYPES OF RESOURCES

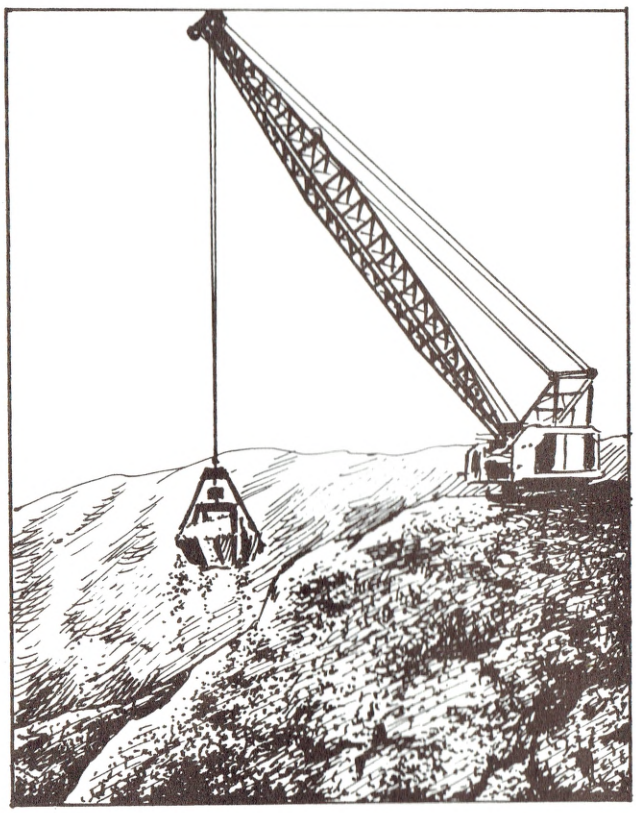
There are two main types of natural resources, RENEWABLE resources and EXTRACTS.

Renewable resources are those which can be used indefinitely, as long as man is careful to ensure its continuation by the normal principles of removal and conservation e.g. the forests. Forests can be maintained indefinitely provided that new plants are put in to replace those that have been cut down.



Work being done in the forest.

Extracts or non-renewable resources are those that can be finished by continuously removing from its source, over a long period e.g. oil. These cannot be replaced in the same way as the first type, but man is capable of using it over and over again by means of new methods of science and technology, e.g. minerals. Iron ore can be extracted from one source until all is used up. Man cannot replace the source of iron ore, but can re-use old iron to make new things.



Picture shows the mining of minerals.

Whether resources are renewable or not, care and attention is required to prevent their exhaustion.

• THE SOIL

The soil is one of the most valuable resources of nature. It is made up of very tiny particles and other materials from dead plant and animal remains. It supports plant life or vegetation and is a very important factor for the development of life on earth.

A scientific knowledge of the soil - its make up, di different types, and other features - is of vital importance to us as Grenada is an agricultural country. It is a well known fact that Grenada's soil is among the richest in this region.

Over the last few years, every effort has been made to use modern improved methods on our soils so as to get the greatest output from it. In the area of soil and water conservation, a project was started at Mardigras, in St. Paul's, which is aimed at bringing lands that have been

badly eroded under cultivation. It is also a centre for carrying out experimentation and demonstrations in soil and water conservation methods, to farmers and students.

Picture of Mardigras Soil Conservation Project.

The Ministry of Agriculture has also has been active in giving technical advice and in working along with sugar-cane farmers in an effort to get them to apply the correct treatment to their soils in order to receive the highest possible yield.

The following are the main soil types in Grenada, places where they are most commonly found, and the crops that are best grown on them.

(a) *Capital Clay Loam:*

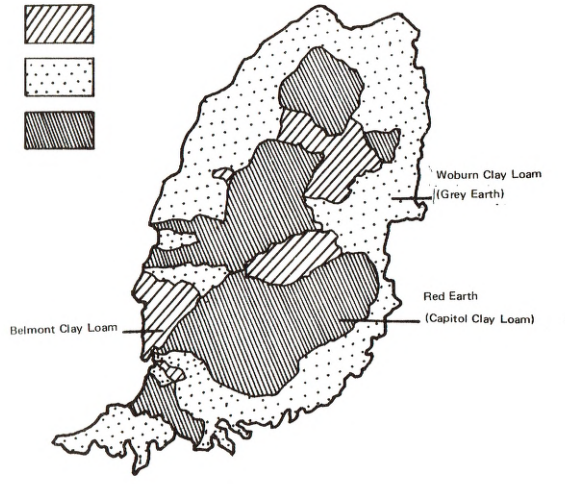
This type is found mainly in St. Andrew's and St. David's, but also in some parts of St. John's, St. Marks and St. Patrick's. It has a bright red colour and is sometimes called "Red Earth" or "Red Mud". Most of our cocoa, nutmegs and bananas are grown on it. Large amounts of coconuts, citrus fruits and food crops are also cultivated on this soil.

(b) *Woburn Clay Loam:*

This soil is dark brown to grey in colour. It is found along the sea coast in all the parishes. Mostly coconuts and food crops are grown on this soil.

(c) *Belmont Clay Loam:*

This soil is brown in colour and is found mainly in St. Patrick's and St. Mark's. It is the most fertile of the three groups mentioned. Cocoa, coffee, nutmeg and food crops are mainly grown in this soil.



Map showing the occurence of different soil types in Grenada.

The present land use in the state covering the islands of Grenada, Carriacou and Petite Martinique is as follows:-

	Acres
Land under tree crops	23,153
Arable land - temporary crops	6,994
- temporary pasture	2,540
- temporary fallow (undeveloped land)	1,398
- other arable land	1,833
Grassland	
Cultivated	391
Uncultivated	1,703
Forest/Woodland	7,635
Other agricultural lands	930
All other land	37,863
	84,420

• PROTECTION AND CONSERVATION OF SOIL

The protection and conservation of soil is of great importance for the development of agriculture.

The measures used for the protection of soil are aimed at preventing its destruction and contributing to the conservation of the food nutrients that it contains.

The most important measures for achieving this are as follows:

(a) Use adequate irrigation.

(b) Use proper drainage according to the terrain (slope) of the land.

(c) Put up *wind-breaks* in the areas where they are needed.

(d) Rotate the crops so as to avoid depletion of certain nutrients in he soil.

(e) Use adequate fertilizer to replenish (re-supply) important nutrients.

• VEGETATION

Another natural resource that must be taken into con consideration is the vegetation.

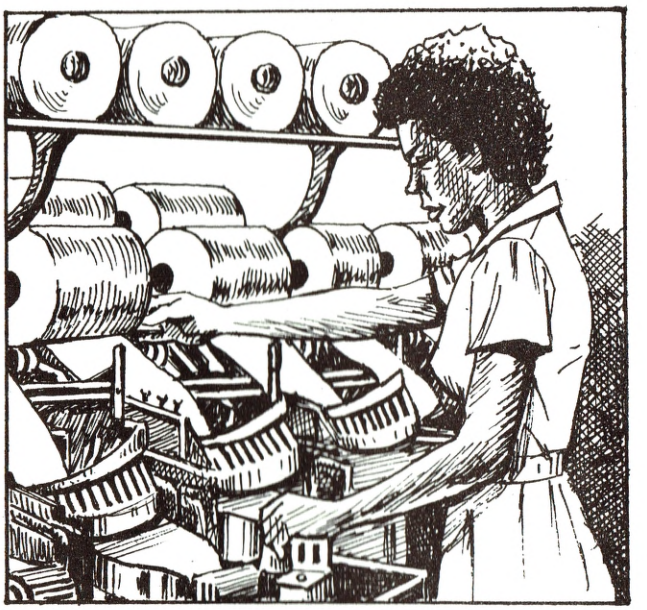
> The vegetation is made up of the plants that are grown in a country or region, according to the characteristics fo that area

Picture showing typical vegetation of Grenada.

Industries such as cloth, food, medicine, and many more, are supplied with raw materials from the vegetation. Apart from this, plants are used directly in other ways by man and animals e.g. man eats some plants as food. (See Fig. 1.8.)

The forests in any country make up a significant, economic aspect of the vegetation. In Grenada a great deal of work is being done by the Forestry Division of the Ministry of Agriculture to develop that industry. A special body has been set up to direct and guide the work of forestry within the Ministry. That body is called the Forestry Development Co-operation and its main task is to develop all the local forest resources.

There is a drive on to make the Grand Etang area into a productive centre, producing up to 1 000 000 board feet annually. In order to meet that target at least one hundred acres of land has to be planted every year. A network of 8.6 miles of road also has to be opened in the forest to make that goal possible.



Textiles - Great Britain

Use of plant fibres in textile cloth industry.

The Grand Etang forest is the largest expanse of forest in the country (3 816 acres) and it belongs to government. The only lumber that is being produced there is split fencing, fence posts and laths for housing. A survey carried out on the Grand Etang forests showed that there are at least 30 000 000 board feet in there.

We import about 3.5 million feet of board annually; it is therefore possible to supply one third of our needs in the very near future.

The main types of wood of some economic value that can be found in the forests of Grenada are:— Gommier, West Indian Mahogany, White Cedar, Balata, Saman, Tapana, Maruba, Blue Mahoe, Caribbean Pine, British Honduras Mahogany, Teak and Red Cedar.

Some areas of forest in Grenada.

• FAUNA

> FAUNA is the term used to describe the sum total of all animal life in a country or region, that can be found throughout that area, living in natural surroundings

In Grenada there is a great variety of animals, many of which did not originate here, but were brought from different continents. The armadillo (Tatoo), and iguana are examples of indigenous animals, whereas the horse and pig were brought here.

The birds are very numerous, there are many species. There is also a great variety of fishes.

There are many species of insects, some of these are dangerous to man, domestic animals and even useful plant life. Other types are very useful e.g. bees.

• CONSERVATION OF FAUNA

It is always necessary to take certain steps to protect and safeguard animals from destruction and possible extinction. In Grenada certain measures have been established by law to ensure this. For example, some months of the year are declared "Closed Season" for different animals that are hunted and eaten as food.

The closed season is usually the period of time during which the animal mates and reproduces. It is illegal to hunt an animal during its closed season. Do you know some of the animals that have a closed season, and what time of the year is declared as such for each type?

This step ensures that all the animals of a particular type are not killed or destroyed. They are given a chance to have young ones that will replace them in the future.

In the case of some animals that are in danger of becoming extinct, a permanent closed season is declared that forbids killing them, no matter what time of the year. This is maintained until the number of that species is so increased, that the danger no longer exists.

Can you think of any such animal either in the past or presently?

10th June, 1981.

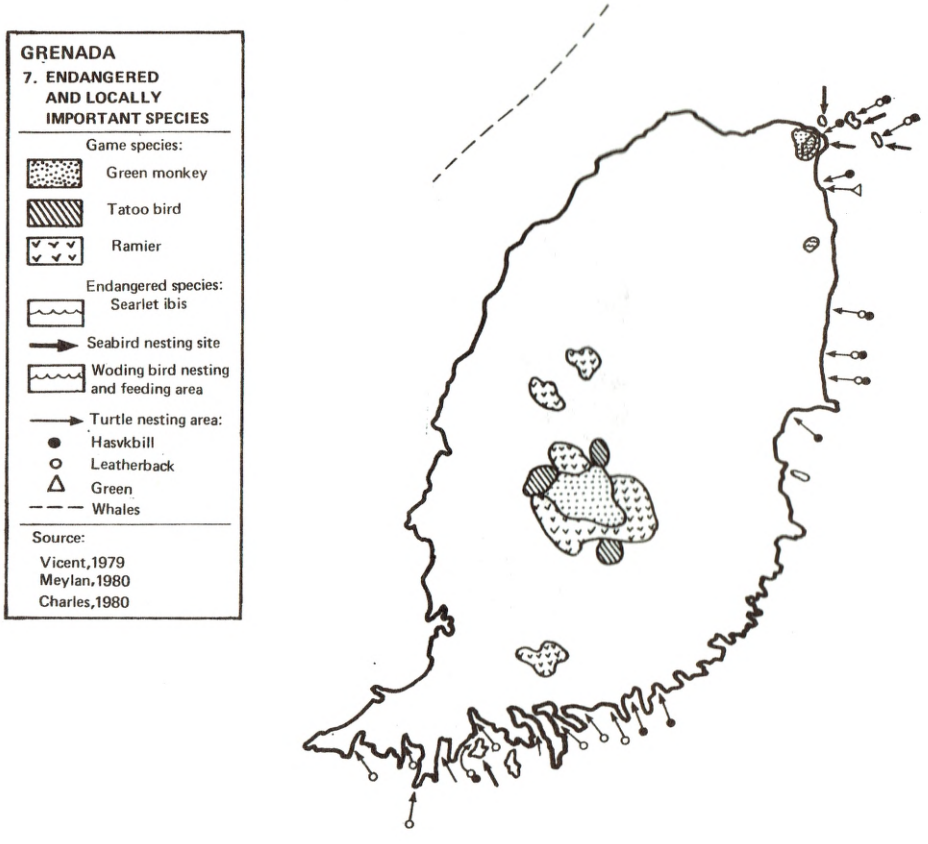
ANNOUNCEMENT

This is to remind the public that the Close Season for Lobsters, and Turtles began on May Ist, and will end on September 30th. It is against the law harvest these because Grenada has to conserve both the eggs and the live animals so that the already low stock will not get lower.

The public is asked to be on the look out for offenders and report them to the nearest Police Station.

By trying to increase our stock, we will be building our economy.

Sample of a closed Season Announcement.



• WATER AS A NATURAL RESOURCE

As a result of the rugged build of Grenada, there are a number of gulleys and valleys, which provide a natural medium of fresh water. This include many rivers, largest of which is the Great River. When the number of streams in relation to the size of the country is considered, one sees the great potential for development in that area.

At present, the only activity of any economic importance that is carried on is river fishing. Many Grenadians enjoy eating river fish and crayfish and ever so often, people mainly in the rural areas go to the many rivers to fish for personal use and sometimes for sale.

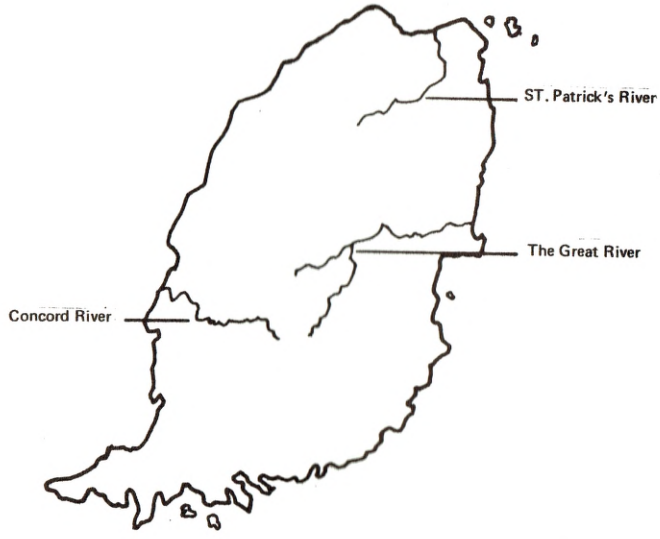
Apart from this, investigations are being made into the possibility of using our rivers to provide energy for the production of hydro-electricity. This electricity can be used to supply all the villages in the country and would mean that we would have to import less oil to run the present power station.

Government has just received assistance to conduct a survey for this purpose. The Great River in St. Andrew's is the place where the first part of the survey would be carried out.

Another possible economic use of rivers in Grenada can be in the area of irrigation. In many areas in the country where there is dry uncultivated land, these lands can irrigated to enable them to be properly cultivated. In other areas, during the dry season the crops are withered as the earth becomes parched. Water from some of these rivers can be used to irrigate those areas. There are machines that can be used in some of these rivers for irrigation of nearby lands.

Here is a list of some of the key rivers in Grenada:

NAME	PARISH
Great River	St. Andrew's
Antoine River	St. Patrick's/St. Mark's
Charlotte River	St. Mark's
Beausejour River	St. George's
Black Bay River	St. John's
Concord River	St. John's



(b) Some of the main rivers in Grenada.

(a) River washing a common practice in the rural areas.

• RESOURCES OF THE SEA IN GRENADA

Recently the United Nations passed a law, giving states the right to claim up to 12 miles of sea off their shores for their own use, and up to 200 miles to be involved in economic activity.

Grenada is very fortunate in this respect as this puts us in a position to obtain much needed resources from the sea, especially as the land mass of the island is so small.

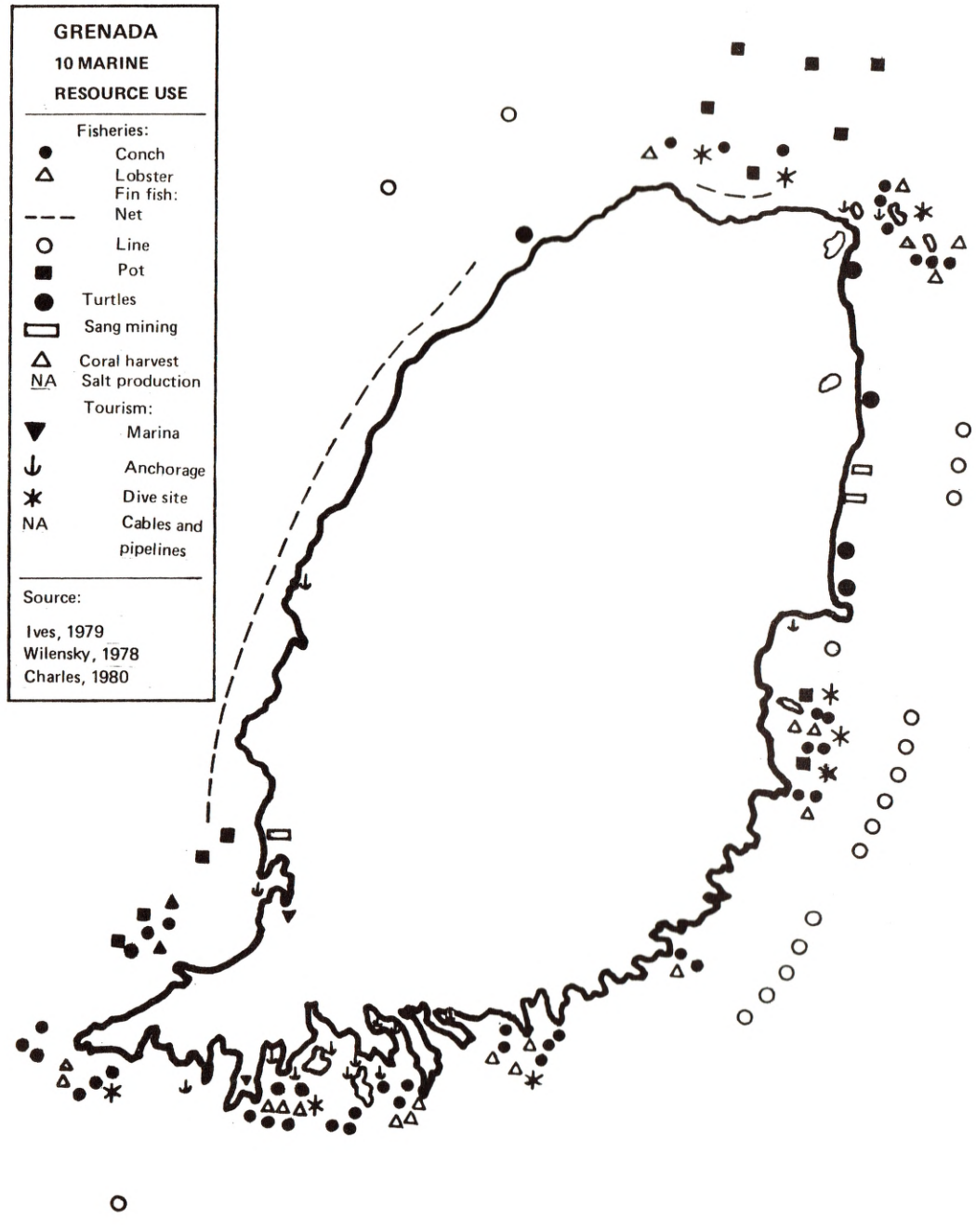
A lot more work needs to be done in order to determine the real economic value of the sea to our people. But from investigations done so far, Grenada's territorial waters contain a very large amount of fish, shellfish and other valuable resources.

Already, the beauty of our beaches attract thousands of tourists to our country each year, this in itself being a natural resource.

The present high cost of rich protein foods makes it necessary for Grenadians to find cheaper sources of protein foods. Fish provides a good answer to this problem as it is the cheapest source of high-protein foods. In other words it can be used to replace meat, to feed the many people who cannot afford to buy meat, and also for export.

It is for this reason that extensive work is being done to develop and expand Grenada's fishing industry. This includes the use of more modern techniques and machinery.

The resources of our seas have great potential for building the economy of Grenada.



• CLIMATE AS A NATURAL RESOURCE

The climate is another valuable natural resource that has influenced the economic activity of man to a great extent.

As discussed in an earlier lesson, Grenada's climate is favourable for the development of agriculture, tourism and forestry.

• POLLUTION

Grenada is fortunate in that, it does not have any major problems of pollution of the environment. This is mainly because it is not a highly industrialized country and industrialisation is one of the key factors that contribute to pollution, if it is not properly planned and controlled.

On the other hand, it is important for all citizens to maintain good public health practices as one of the safest measures to avoid pollution in the future. Proper garbage disposal, handling of food, pest e.g. mosquitoes cockroaches, etc., control and proper faeces disposal are very important aspects of this process.

As we do not have a major pollution problem, we should try by all means to keep it this way or even improve it.

EXERCISES

1. Explain what natural resources are, giving examples.
2. Explain what is meant when we say that man is the most important natural resource.
3. Show the difference between renewable resources and extracts, giving examples.
4. Why is soil such a valuable natural resource?
5. State three uses of the forest.
6. Explain what measures government has taken to protect animal life in Grenada.
7. Show briefly how important it is for man to protect and conserve natural resources.

UNIT 2

POPULATION OF GRENADA

• POPULATION, DENSITY AND DISTRIBUTION

The total population of Grenada according to Ministry of Planning estimates (1980) is 110 390. The population is mainly concentrated in the parishes of St. Andrew's and St. George's, which have the major towns. Apart from the towns, most of the people live in small villages nearer the coast, and on the gentler sloping hillsides, rather than in the central mountainous parts of Grenada. The same is true of Carriacou, but there are a few, very sparse "pocket communities" in the mountainous area on the mainland.

The following table taken from the 1970 census results gives an idea of the distribution of the population in the parishes. Bear in mind that this has increased a great deal.

The total land area of the state of Grenada is as follows:

	Square Miles	Acres
Grenada	120	75 379 (approx)
Carriacou	12 (approx)	8 550 (approx)
Petit Martinique	1 (approx)	500 (approx)
TOTAL	133	84 420

N.B. 133 square miles is equivalent to 344 square kilometres. The population density (overall average number of persons per unit of land surface) is 291 persons per square kilometre. This does not mean that on every single square kilometre of land, one will find 291 people, because of course some areas are more densely populated than others.

Towns/Parish	Male	Female	Total
St. George's Town	2910	3403	6313
Rest St. George's Parish	11228	12319	23547
Total	11438	15922	29860
Gouyave	1166	1332	2498
St. John's Parish	2921	3191	6112
Total	4087	4523	8610

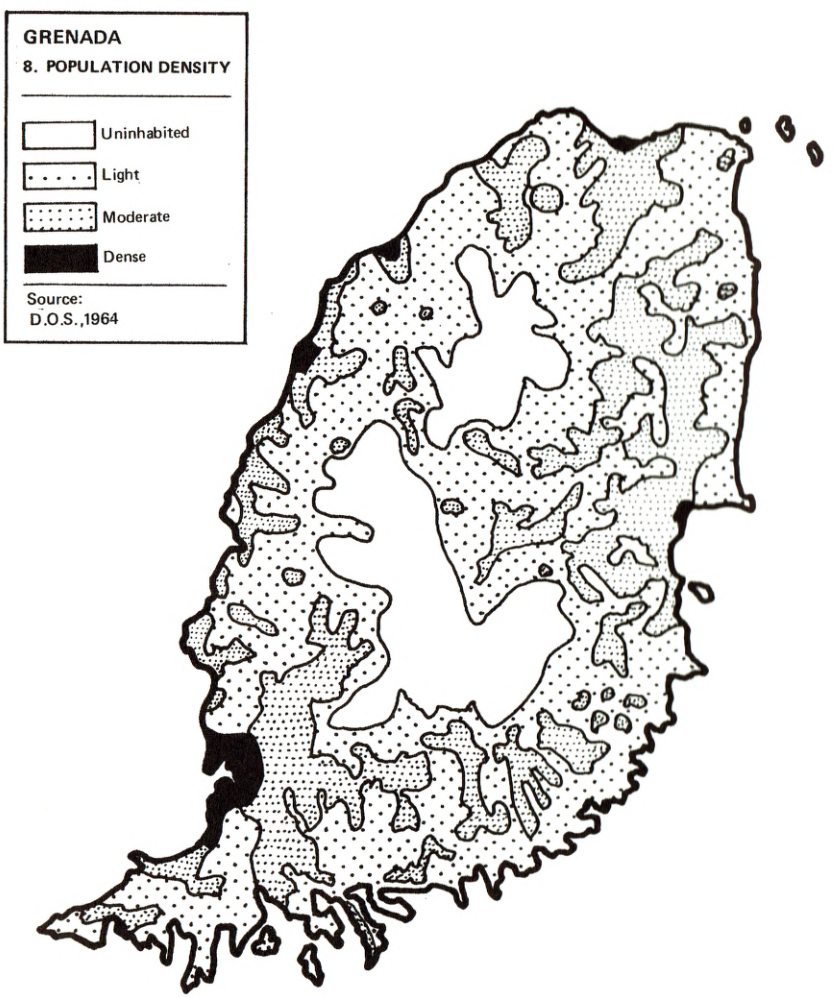
Towns/Parish	Male	Female	Total
Victoria	794	897	1673
St. Mark's Parish	1037	1232	2269
Total	1831	2111	3942
Sauteurs	243	362	605
St. Patrick's Parish	5002	5649	10651
Total	5245	6011	11256
Hillsborough	259	325	584
Carriacou & Petit Martinique	2286	3080	5366
Total	2545	3405	5950
St. David's	5193	5425	10618
Grenville	777	946	1723
St. Andrew's Parish	9876	10973	20818
Total	10653	11883	22536

• ETHNIC RACES

There is now very little trace of the indigenous people (those who orignated here) of Grenada, the Amerindians - Caribs. As late as 1960, the census noted nine Caribs, of which six were males. The bulk of the present population are descendants of the Africans, imported during the slave trade years, and to a lesser degree, indentured labourers from the East Indies.

According to the "Facts and Figures" on Grenada produced by the Central Statistical Office - August 1980, 84% of the population are Negro/Black, 11% Mixed, 3%East Indian and less than 1% White.

In 1979 the rate of growth of the population was 17.9 for every thousand of the population. The overall concentration of the population especially in the towns is mild, and therefore does not pose a serious threat of overcrowding.



The foreing exchange earned in the tourist industry is also important to the economy.

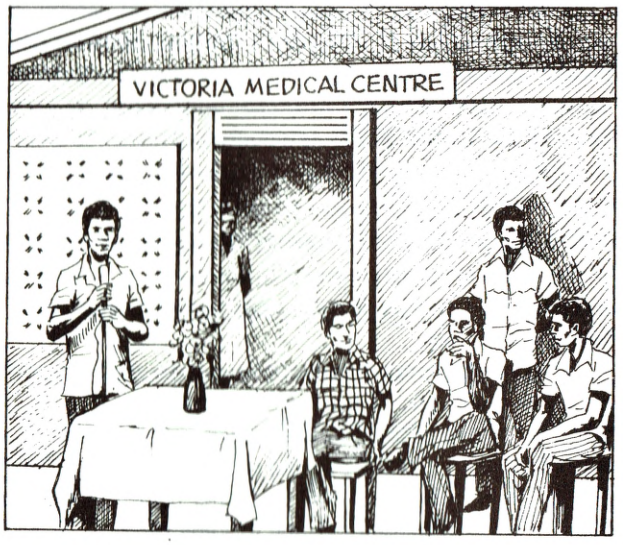
• ECONOMIC CHARACTERISTICS OF THE POPULATION

The total labour force of Grenada, based on Ministry of Planning 1980 estimates is 36,000. Of this amount, 25,200 are employed while the other 10,800 are unemployed. This gives an unemployment rate of 30 percent.

The major areas of employment, are Agriculture, Forestry, Fisheries, Services, Manufacturing, Construction, Trade and Commerce, Transportation and Storage.

A breakdown of employment by sectors shows the following:

Service Sector	30 %
Agricultural Sector	25 %
Trade/Commercial Sector	11 %
Tourist Sector	10 %
Industrial Sector	7 %

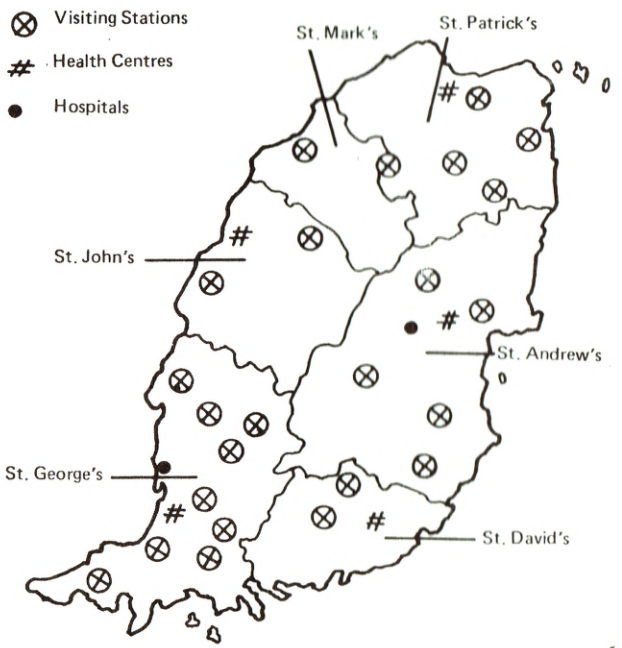


One of the newly opened Medical Centres.

The high rate of unemployment especially among youth is a major concern. Serious efforts are being made by the Government to develop and expand the economy so as to provide every possible avenue of employment for those who are out of work.

• SOCIAL CHARACTERISTICS OF THE POPULATION

The Revolution has moved to the stage of providing free health care at all health centres, medical stations and hospitals in the country. This is a significant step in the health care available for all the people. There are three hospitals in the state and a number of medical stations located in the main communities throughout the country.



Map showing Medical Stations, etc., throughout the country.

This situation, plus the new thrust for primary health care being made by the Ministry of Health, provides fairly good public health facilities for the population. But even so, more efforts are being made to continuously upgrade these facilities. Vaccinations are also provided for children in schools and in medical stations to protect people some dangerous diseases.

Education is provided mainly through the pre-primary, primary and secondary schools in the country. Ten day-care centres also provide early childhood education in a few communities.

There are approximately: 21 secondary schools, 58 primary schools, 77 pre-primary schools.

The Technical and Vocational Institute is the main institution for technical training of school-leavers. The Nurses Training School and a few other institutions of its type provide specialised training in some fields.

The decision taken by the Government,-early in the Revolution to make secondary education free for all, is a major step in the thrust to make education available for all.

The Centre for Popular Education was also set up to deal with mass adult education programmes.

A great deal has been done in the field of education, which now makes it possible to raise the cultural level of all Grenadians.

The problem of poor housing is being partly resolved by the new house repair programme as well as the housing scheme. Seventy-three percent (73 %) of the population have access to electricity, while only thirty-eight percent (38 %) have access to pipe-borne water.

The social life of the people includes education, recreation, health care, housing and other facilities including transport, pipe-borne water, electricity, etc. The development of these factors is essential in raising their living standards.

EXERCISE

1. Find out and discuss the origins of the different races of the Grenadian population e.g. country of origin, history, cultural heritage. Are there any cultural activities that are directly linked with these?
2. Draw a map of Grenada and use symbols to show the main population centres or communities in the country.
3. What do you think can be done to upgrade the standard of living of the people in your community?

UNIT 3

GENERAL ASPECTS OF THE ECONOMY

• MAIN FEATURES OF THE GRENADA ECONOMY

Agriculture is the mainstay of the Grenadian economy, mainly because the greatest natural resource of this three island state is rich fertile soil. The climate of intense rainfall as well as year-round sunshine also contribute to this. These two geographical factors, greatly influence the economic activity of the country.

Tourism is the second largest industry. Fisheries and Agro-Industries are two other important industries that are being developed. A limited number of domestic animals are raised. There are no known mineral resources of any commercial value, and therefore industry is limited to simple processing of agricultural products, for home consumption and some export, and to small workshop and cottage type handicraft and other products.

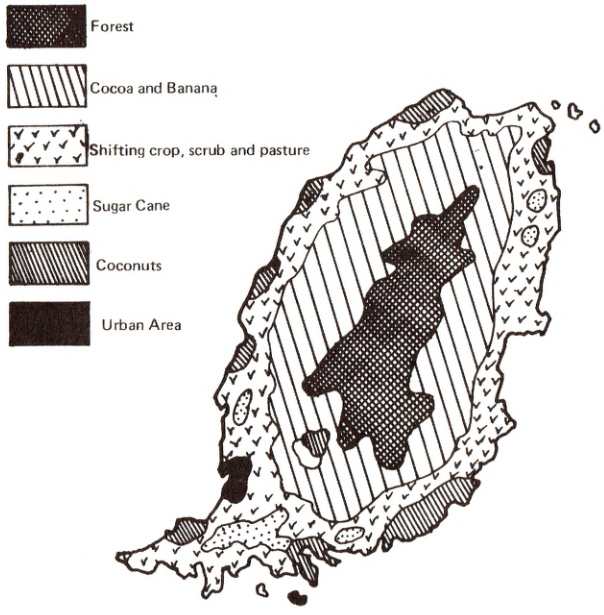
• AGRICULTURE

As pointed out before, agriculture is the island's major industry, providing employment for over 6,599 workers. The wide variety of crops produced, has greatly contributed to the success of this industry and its input to the economy. Another important feature of this industry is the mixing of crops in one field.

Cocoa, nutmegs - mace, and bananas, are the chief crops grown for export. Other important crops are sugar-cane, coffee, coconuts, citrus fruits (mainly limes), spices and cotton, which is produced in Carriacou. A wide variety of other annual and "cash" crops are grown. These include corn, pigeon peas, beans, sweet potatoes, yams, tannia, dasheen, cassava, onions, pumpkins and peanuts. (See Fig. 3.1.)

Nutmegs

Nutmeg is the number one export crop of Grenada, earning the largest amount of foreign exchange, among all the export crops. The trees are concentrated in the wetter, more mountainous agricultural areas. There are few pure nutmeg fields as it is usually planted between cocoa and other crops. There are about 4,000 acres planted, and an estimated number of 600,000 trees. The Grenada Nutmeg Co-operative Society processes and markets all nutmegs and mace. Production appears to be equally divided between small and large farms. The total revenue earned from nutmeg in the year 1980 was $98,513.68. And the amount earned from mace was for Grade A $13,254.11, Grade B $6,632.19 grade.



Map showing the main crops grown in Grenada.

Cocoa

Cocoa is cultivated on some 15,000 acres of land with some 4,500,000 trees. It is most successfully grown in areas receiving between 7 - 130 inches of main annually. Cocoa is extensively grown by large and small farmers except in the dry south and north-east coasts, and in the central highland areas over 1,200 feet. The most productive areas lie in a horse-shoe shaped belt on mountain slopes in the northern, western and eastern parts of the country. It is estimated that one fifth of the total production, originates from small farmers and the remainder, from medium and large growers. Some nutmeg, bananas, bluggoe and bread-fruit trees occur in most mature cocoa fields.

The Grenada Cocoa Association is responsible for marketing cocoa, and for regulation and control of its export. The total amount earned from the sale of cocoa in 1980 was $18,193,960.

Bananas

Bananas have become a major crop in Grenada since the 1955 hurricane, when farmers rapidly expanded production, in order to be able to export bananas, while battered cocoa and nutmeg recovered. Bananas are now the island's third major export crop.

Harvesting Bananas.

There are about 4,000 acres planted, with approximately 2,720,000 trees. Bananas are grown together with both nutmegs and cocoa, and only about 5% of the land used for banana cultivation are pure fields. Small farms produce about one-quarter, while medium and large growers, about three-quarters of the export.

The Grenada Banana Co-operative Society is responsible for marketing bananas through Geest Industries Limited.

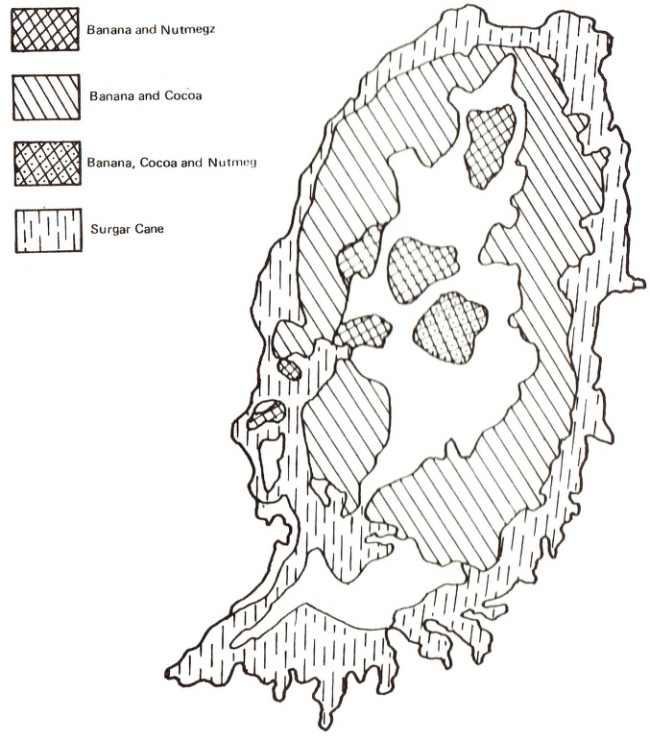
$10,672,711.53 worth of bananas was sold in 1980.

Other annual crops, tree crops and cash crops

Coconuts are grown by all but a half a dozen estate producers for local use. The majority of trees are of the tall variety, but dwarf varieties are also grown. Sizeable areas are under pure cultivation, but almost half of the crop occurs as scattered trees. The soap factory at Tempe processes copra, but a significant amount of the coconuts is used as water and dry nuts.

Cotton is grown in Carriacou. Marie Galante is the variety grown, and the crop is cultivated by peasant farmers. Ginning is done in a central government established ginnery, and lint produced is sold to Trinidad.

Sugar-cane is grown on over 600 acres of land. It is converted either to brown sugar at one factory or rum in a few distilleries. Most of the cane is grown in the south, and the efficiency, especially of small scale producers, is fairly low. The Grenada Sugar Factory located at Woodlands, has been upgraded to improve its output of sugar, for local use.



Major Commercial Crops.

A wide variety of other food crops are grown for local use. These include vegetables, tropical fruits and some grain. However, this is far from sufficient to meet the island's needs, as more food is imported than is produced locally. This causes a serious imbalance in the economy, and serious efforts are being made in the drive to grow more local food to reduce the cost of imports. (See fig. 3.3)

• TOURISM

The high income from tourism, places this industry second only to Agriculture in the island's economy. Tourism is on the upward trend, and considerable effort is being made to boost it. It includes yachting, cruise ship passengers, and stay over visitors.

The tourist industry provides employment for about 10% of the working population, and absorbs a great deal of the local products.

The New International Airport will provide this industry with a major facility for realizing its full potential.

Figure 3.4 shows one of the natural attractions of the island that lure tourists to our shores every year.

The natural beauty of Carriacou and the other Grenadine islands, is another important contributing factor to this thriving industry.

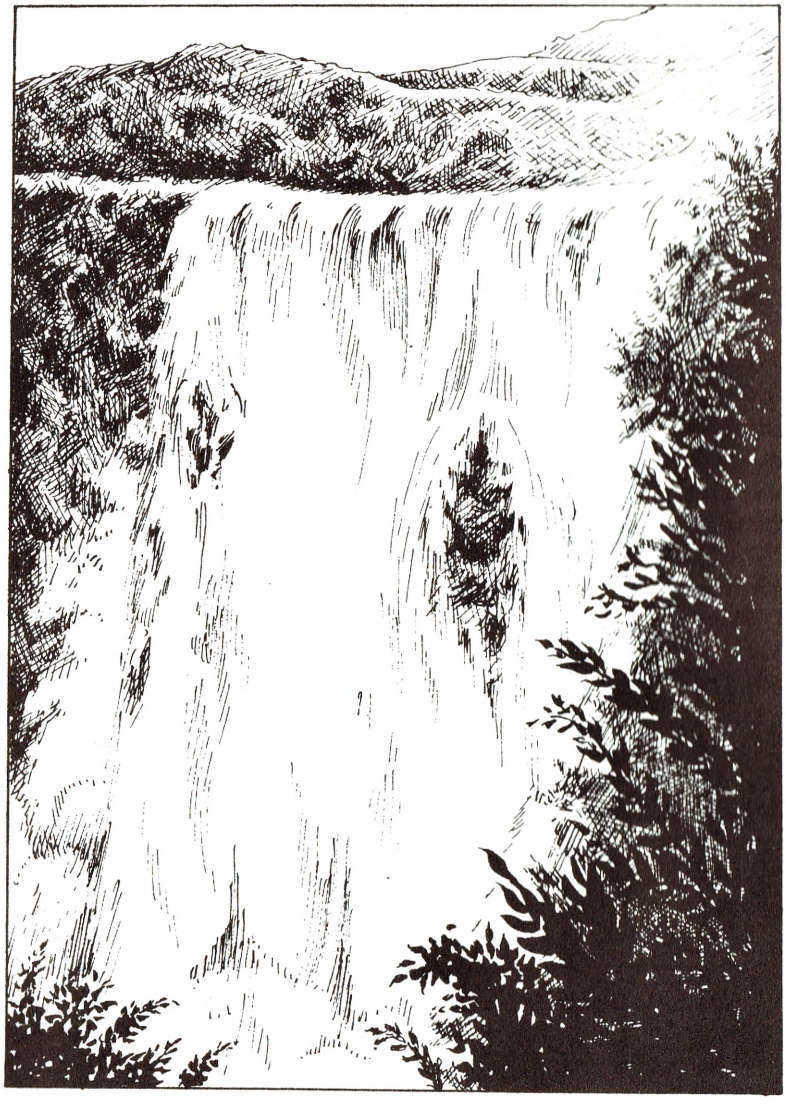
The foreign exchange earned and employment opportunities provided by the tourist industry, makes it very important to the economy of Grenada.

• FORESTRY

Rain forest area in Grenada is estimated at 10,000 acres. Approximately 75 per cent of this is owned by Government, including the Grand Etang forest, while the remainder is made up of reserved areas on large estates which in most cases adjoin the Government owned forests.

Since the devastation of the forests in Grenada by hurricane Janet, a re-afforestation programme has been started. The yield of the forests, cannot yet meet local needs, but the commercial value of the wood produced so far, cannot be under-estimated. At the same time, the programme is being expanded to increase the output.

The following chart shows the uses of the forest species that are produced.



Annandale Water Falls a tourist attraction.

FOREST PRODUCTION													
TYPES OF WOOD	Fencing	Telegraph Poles	Tanning	Charcoal	Furniture	Boat Building	Produce Crates	Housing Construction	Farm Construction	Handicrafts	Turned Wood	Burial Caskets	Christmas Trees
Blue Mahoe	*	*			*	*	*	*	*	*	*		
Mahogany					*	*		*		*	*	*	
Caribbean Pine	*				*	*		*		*	*		
Cuppressus	*	*				*	*	*	*			*	*
Gommier	*						*		*				*
Laurier				*	*	*	*	*	*	*	*		
Maruba				*	*	*	*	*	*	*	*	*	
Tapana	*				*		*	*	*	*	*	*	
Galba	*				*	*	*	*	*	*	*		
Balata	*			*				*	*		*		
Bois Gris	*	*		*	*	*		*	*	*	*		
Bois Blanc	*	*		*				*	*	*	*		
Mauricif	*		*		*	*	*	*	*			*	
Red Cedar	*			*	*	*	*	*	*	*	*		
White Cedar					*	*		*	*	*	*	*	
Saman					*	*	*	*	*	*	*	*	
Bamboo	*				*	*	*	*	*	*	*	*	
* shows use													

Chart showing the usen of various types of wood that grou in our forest.

• FISHERIES

Nets, pots, lines at sea and seines along the beaches, provide an important part of Grenadian,s diet. However, methods and equipment of the fishing industry are primitive, and though there have been recent improvments, the present supply of fish and other sea foods cannot meet local demands.

With the setting up of a fishing fleet about a year ago, the size of the catch has increased remarkably, and local fish processing has started. Expansion of this industry will make a significant contribution to the economy, by reducing the import bill of fish, and by providing additional revenue that will be brought, by exporting processed fish. Some of the major fish caught includes flying fish, dolphin, tuna, kingfish, shark, couvalli, bonito, snapper and jack-fish.

• MANUFACTURIN-INDUSTRIES

Although provision is made for the encouragement of pioneer industries, there is very little manufacturing other than the processing of local produce.

These industries include a sugar mill, a few rum distilleries, a few small mills producing "wet sugar", a soap factory, coconut meal and oil from the Tempe factory and a small ginnery in Carriacou. Other industries include two ice factories, a few small aerated drink factories, a brewery, a perfume factory, cigarette factory and the agro-industries plant. The latter has great potential for expansion to meet the local need for canned fruits and vegetables.

Some of these products are exported, but on a very small scale. Building the export trade can go a long way in strengthening the economy of Grenada.

• LIVESTOCK

Livestock production is an important part of the economy, but local requirements of meat, milk and eggs are not met. Animal rearing is done mainly on a small scale, as an aspect of peasant farming. There are only a few medium to large operators.

The animals reared are usually cattle, pigs, goat, sheep and poultry. Rabbit rearing is done to a much lesser extent in some areas.

• TRADE AND COMMERCE

Commerce in Grenada is made up largely of the distribution of goods and services. This commerce is based on large scale importation of nearly all goods, while the country only exports a few of the major agricultural products i.e. nutmeg and mace, cocoa, banana and a few spices.

The agricultural products are exported mainly to some of the Western European countries — the United Kingdom, Belgium, Netherlands. We import goods from a wider range of countries - Western European countries, Canada, the U.S.A., Japan, some Eastern European countries and the Caricom States, especially Trinidad.

The five banks and insurance companies, control most of the financial negotiations that are made in the process of trade and commerce. Only one of the banks is owned by the people of Grenada.

The heavy imbalance between Grenada's import and export trade relations, must be on a better footing, and so help to provide more employment and other opportunities for the working people.

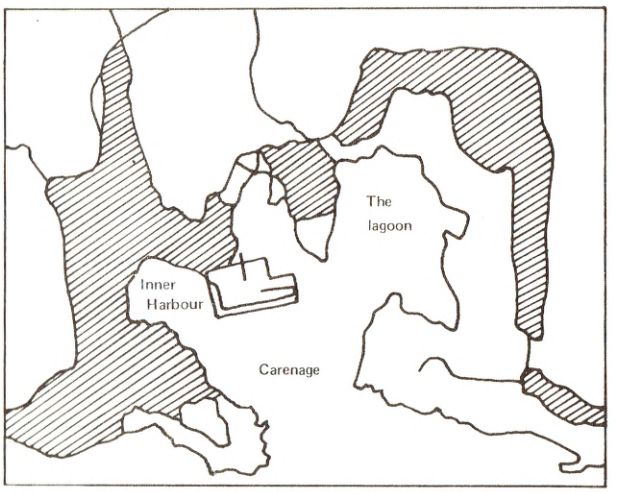
EXERCISE

Try to make a list of the countries from which we import things, giving examples of goods imported from each.

• TRANSPORT AND COMMUNICATION

All the first and second class, and to a lesser extent the third and fourth class roads are suitable for motor traffic. Private bus passenger services operate along the eastern and western coast roads, as well as along the Grand Etang road. Apart from this, taxis are available throughout the island.

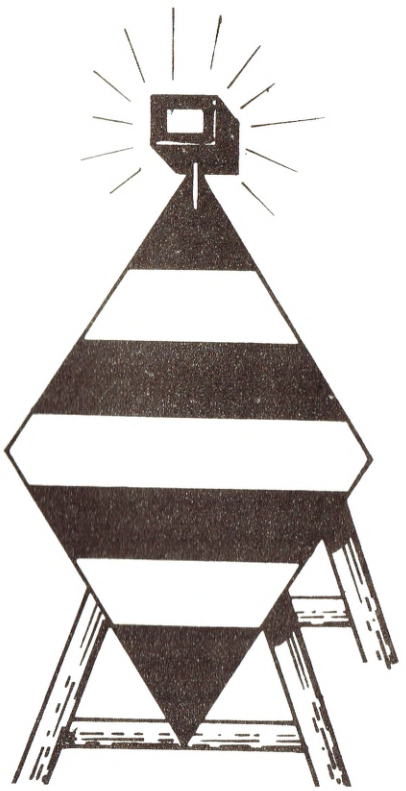
St. George's harbour at the south-west of the island is Grenada's chief port. Its outer harbour is an open roadstead (place near a shore, where ships may ride at anchor) 5-15 fathoms deep. The inner harbour or carenage is a well sheltered natural harbour located between Fort Rupert and a point about quarter mile to the south east.



Harbour at St. George's.

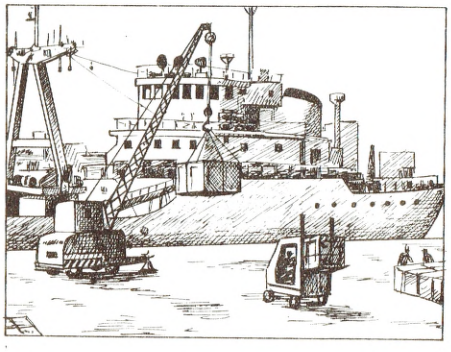
Berths for two ocean-going vessels with lengths of 400 - 500 feet are available on the eastern side of the harbour along an 800 feet long pier, with a minimum depth of 30 feet. Berths for small crafts are available on the eastern face of the pier.

Entrance to the inner harbour is through a channel with a minimum width of 600 feet and depth of 45 feet. The channel and entrance are marked with bouys. Leading marks, located on the shore, lead to the pier.



Leading Marks are used to guide ships into the harbour.

The turning basin in the inner harbour is 900 feet by 60 feet approximately. Pilots are also available to guide ships through the channel into the inner harbour. Cargo is usually handled by equipment on the ships, but a 10-ton mobile crane is also available.



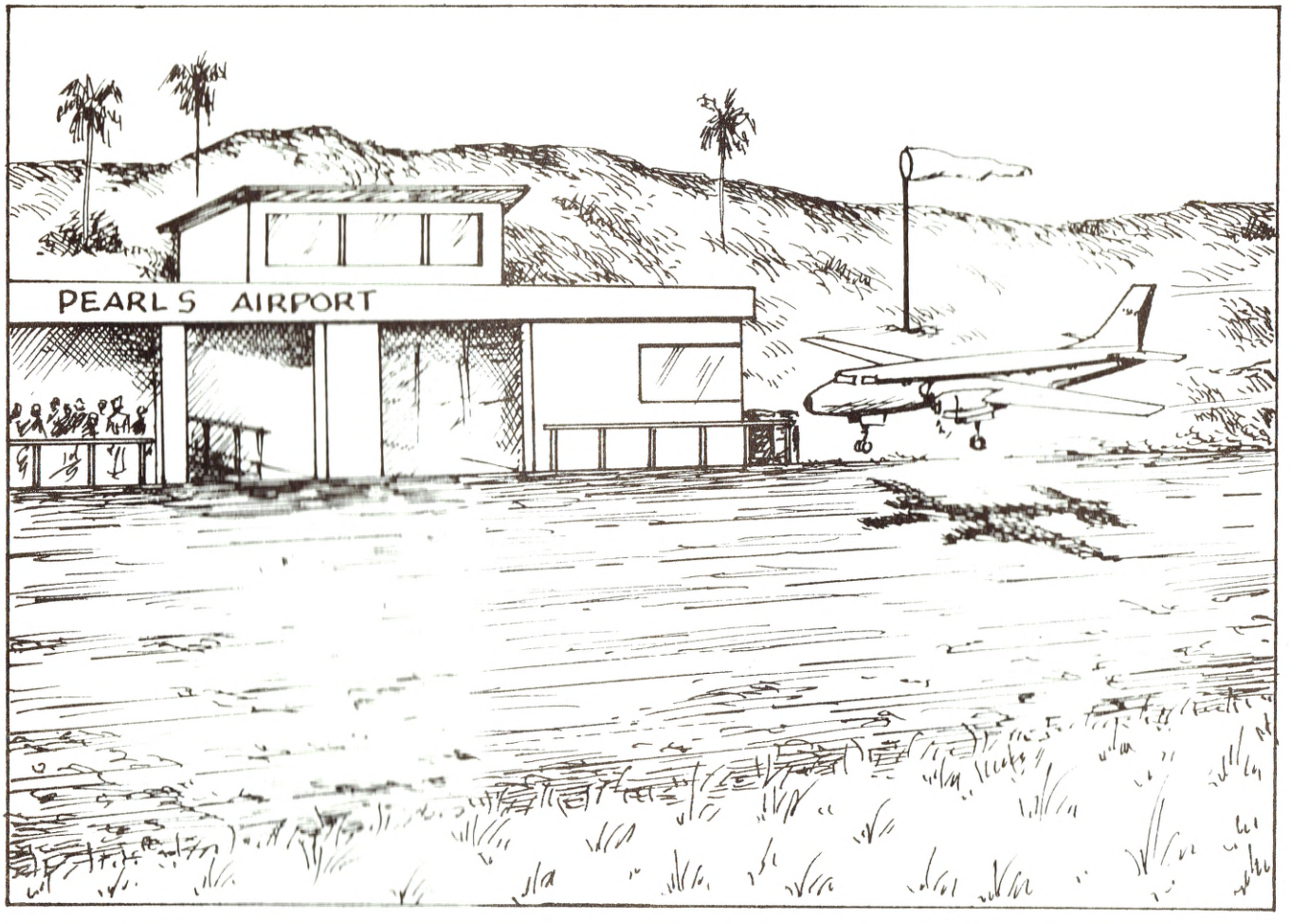
Picture showing crane off-loading ship at the harbour.

The other ports of entry are Grenville in Grenada, and Hillsborough in Carriacou, which are mostly used by small crafts. There is also a 270 feet T-shaped jetty at Tyrrel Bay, built initially to serve the Esso bulk station at Harveyvale in Carriacou.

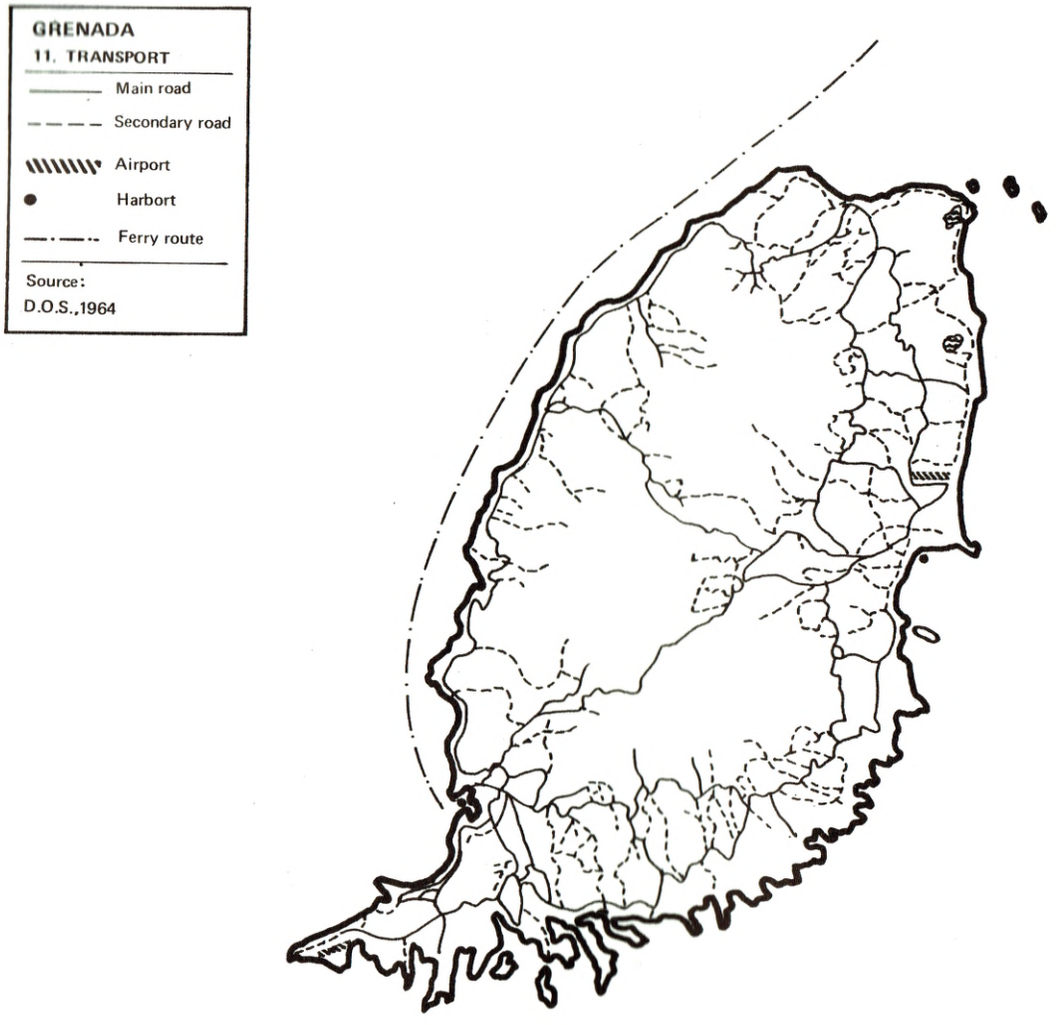
The main commodities handled in the ports are imports of motor vehicles, petroleum products, building materials, general cargo and exports of cocoa, nutmegs, spices, and bananas. Many shipping lines use the port - mainly to and from North America, Europe and the Caribbean.

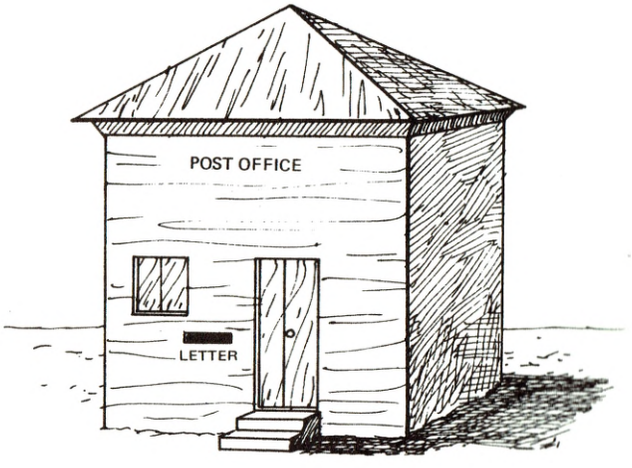
Pearls Airport is located in the north eastern part of the island, with LIAT as the main airline service. Lauriston Airport is located in Carriacou, but the small size of the airstrip restricts access to only small craft landing.

Postal services are provided by the General Post Office, six District Post Offices which do all the postal work, and over forty postal agencies for receipt and delivery of ordinary mail, and the sale of postage stamps.



Landing at Pearl's Airport.





Telephone services are operated by the Grenada Telephone Company Limited, in which the Government is a shareholder.

International Telegraph, Telephone and Telex services are provided by Cable and Wireless (West Indies) Limited. The Government owns and operate the Telephone Service in Carriacou.

Apart from the above-mentioned aspects of communications, the national radio station, Radio Free Grenada, provides the only broadcasting service in the country. Other radio stations in the region can also be heard on radio.

The systems of transport and communications in the island are still inadequate, and the lack of a public night transportation system is a serious disadvantage to the social and economic life of the people.

Major upgrading and expansion of these facilities have become necessary in the process of raising living standards of the people, and for general economic development of the country.

EXERCISES

1. Name four things that can be done to develop the economy of Grenada, explaining how each will help.
2. What are the main features of the Grenadian economy?
3. Name five or six food items that we import from abroad. For each of these, think of one local product that could be developed to repalce it.

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