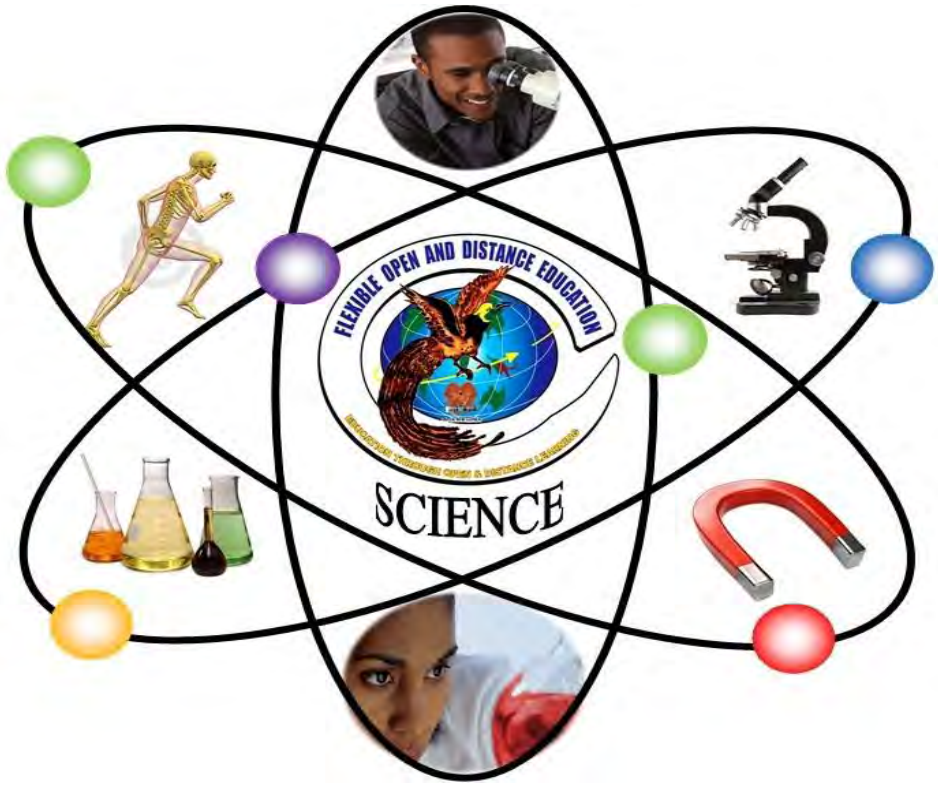
DEPARTMENT OF EDUCATION

GRADE 7

SCIENCE

STRAND 1



WORKING SCIENTIFICALLY

FLEXIBLE OPEN AND DISTANCE EDUCATION
PRIVATE MAIL BAG, P.O. WAIGANI, NCD
FOR DEPARTMENT OF EDUCATION
PAPUA NEW GUINEA
2017

Writer
Selected Contract Writers

Content Editors
Science Department
FODE Edit Team
Subject Content Adviser
Science Review Committee

Course Format Editor
Joydee Mabbagu

GRADE 7

SCIENCE

STRAND 1

WORKING SCIENTIFICALLY

Acknowledgement

We acknowledge the contributions of all secondary teachers who in one way or another have helped to develop this Course.

Our profound gratitude goes to the former Principal of FODE, Mr. Demas Tongogo for leading FODE team towards this great achievement.

Special thanks to the staff of the Science Department of FODE who played active roles in coordinating writing workshops, outsourcing lesson writing and the editing processes involving selected teachers of Central Province and NCD.

We also acknowledge the professional guidance provided by Curriculum and Development Assessment Division throughout the processes of writing and the services given by members of the Science Review and Academic Committees.

The development of this book was co-funded by the GoPNG and World Bank.

DIANA TEIT AKIS

PRINCIPAL

Flexible Open and Distance Education
Papua New Guinea

Published in 2017 by Flexible Open and Distance Education

Printed by Flexible Open and Distance Education
ISBN 978-9980-87-294-4
National Library Services of Papua New Guinea

CONTENTS

SECRETARY'S MESSAGE

Achieving a better future by individual students and their families, communities or the nation as a whole, depends on the kind of curriculum and the way it is delivered.

This course is part and parcel of the new reformed curriculum. The learning outcomes are student-centred with demonstrations and activities that can be assessed.

It maintains the rationale, goals, aims and principles of the national curriculum and identifies the knowledge, skills, attitudes and values that students should achieve.

This is a provision by Flexible, Open and Distance Education as an alternative pathway of formal education.

The course promotes Papua New Guinea values and beliefs which are found in our Constitution and Government Policies. It is developed in line with the National Education Plans and addresses an increase in the number of school leavers as a result of lack of access to secondary and higher educational institutions.

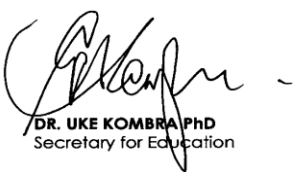
Flexible, Open and Distance Education curriculum is guided by the Department of Education"s Mission which is fivefold:

- To facilitate and promote the integral development of every individual.
- To develop and encourage an education system that satisfies the requirements of Papua New Guinea and its people.
- To establish, preserve and improve standards of education throughout Papua New Guinea.
- To make the benefits of such education available as widely as possible to all of the people.
- To make the education accessible to the poor and physically, mentally and socially handicapped as well as to those who are educationally disadvantaged.

The college is enhanced through this course to provide alternative and comparable pathways for students and adults to complete their education through a one system, two pathways and same outcomes.

It is our vision that Papua New Guineans" harness all appropriate and affordable technologies to pursue this program.

I commend all the teachers, curriculum writers and instructional designers who have contributed towards the development of this course.



DR. UKE KOMBRA PhD
Secretary for Education

STRAND INTRODUCTION

Dear Student,

Welcome to Strand 1 of your Grade 7 Science Course! I hope that you like studying science. And that this Strand, Working scientifically will be an interesting and enjoyable subject to study.

This strand is quite different from strands 2, 3 and 4 which you will encounter later, the other strands the lessons are further divided into sub stands. In this strand there are no sub strands like the other strands. Instead there are 18 lessons.

The reason for this is because this course is a skills course which teaches you important skills you should know and use when doing science.

This strand is based on the Outcome Based Curriculum used in Primary Schools with some changes done to help you study well.

Therefore in this Stand you will learn important skills such as:
Measuring - length, volume, mass, weight, force, temperature and time, also be able to **Drawing graphs** and Sorting things into groups based on their similarities and properties. Furthermore you will be introduced to the skills and attitudes that you should know when you are working in a laboratory.

Remember to do all the activity that you are asked to do. You must also complete the practise exercises at the end of each lesson.

If you have any problems in understanding any lessons in this strand, write your comments and hand it to your Provincial Coordinators.

You may now study this strand following the Study Guide on the next page.

All the best!

STUDY GUIDE

Follow the steps given below and work though the lessons.

Step 1. Start with Lesson 1, and work through it in order.

Step 2. When you complete Lesson 1 do Practice Exercise 1.

Step 3. After you have completed the exercise, correct your work. The answers are given at the end of the unit.

Step 4. Then revise well and correct your mistake, if any.

Step 5. When you have completed all these steps, tick the check-box on the content page like this:

√	Lesson 1: Properties of Substances

Then go on to the next lesson. Repeat this process, until you complete all the lessons in the Strand. When this is done, revise using the Review Section.

As you complete each lesson, and tick the box for that Lesson, this helps you have a check on your progress.

Assignment
When you have completed all the lessons in this Strand, do the Test for the Strand. Remember this Strand does not have any sub-strand like Strands 2, 3 and 4.

When you have completed all the Questions for this Strand, Check your Assignment book carefully before sending it to the Provincial Centre.

If you have any Questions or problems, write it on the **STUDENT'S PAGE.**

Your teacher will advise you when he/she returns your marked assignment.

The **Assignment** will be marked by your **Distance Teacher**. The marks that you score will count towards your final marks and grade. If you score less than 50% in an assignment you will repeat that assignment.

REMEMBER: If you score less than 50% in three assignments your enrolment will be cancelled. So, work carefully and ensure you pass your assignments.

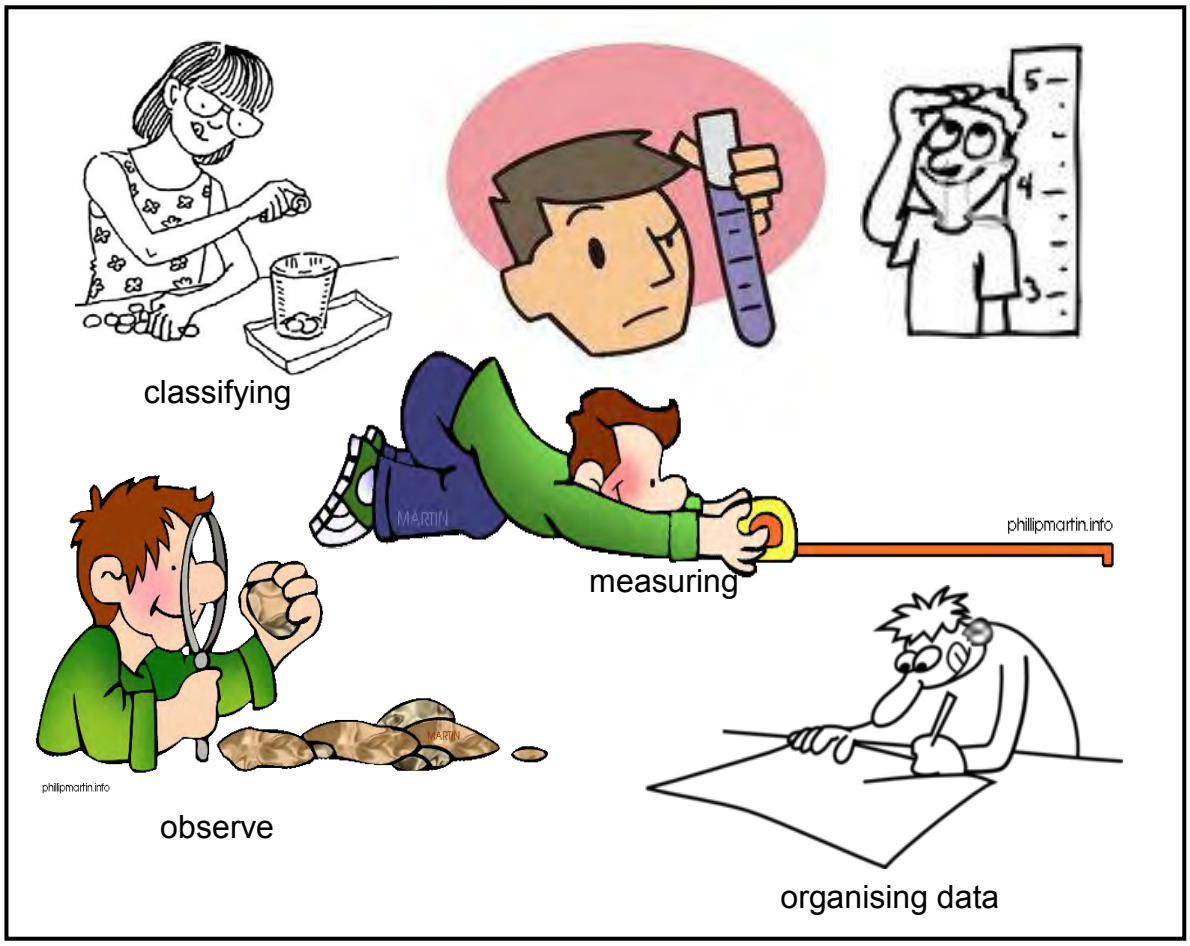
WORKING SCIENTIFICALLY

In this strand you will learn more about:

- **using your senses to observe**
- **standard units, instruments and scales**
- **measuring length, volume, mass and weight**
- **classification**
- **displaying data**
- **working in a science laboratory**

INTRODUCTION

In this strand, you will learn more about skills you will need to develop throughout your study of science.
This strand helps you to develop your skills needed for scientific investigations. You will learn to measure and organise data into graphs, and draw and label diagrams.



All of the above activities show what a science student will learn in this strand.

Lesson 1: Properties of Substances

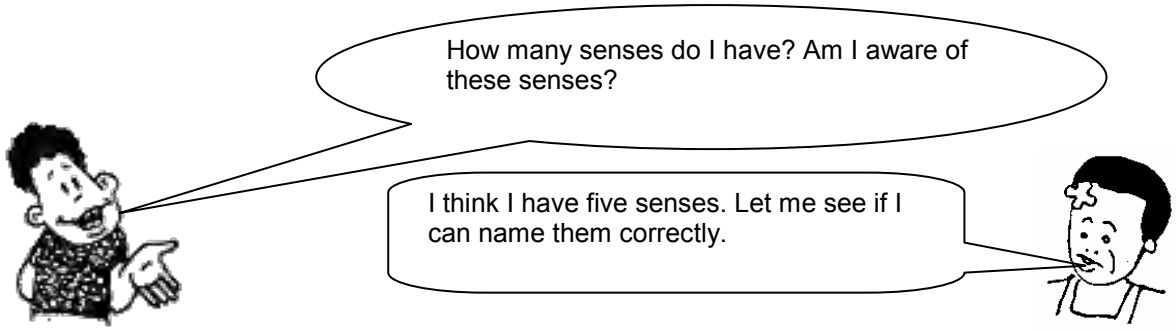
Welcome to Lesson 1 of Strand 1 of your Grade 7 Science Course. In this lesson you will learn about properties of substances or the things that make up something.

We all observe things around us. To be able to find out we use the senses that we have. Scientists must know too. They use all their senses to find out about things around them. To understand you need to know all the senses that you have.

Your Aim:

- observe, identify and describe the properties of substances or objects using the senses

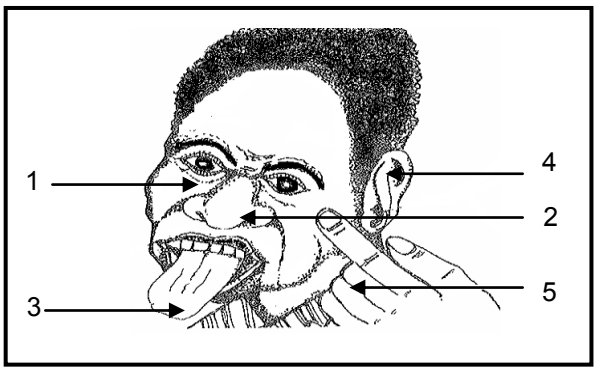
To be able to do this, you will first identify the five senses that we use to find out.



Activity 1: Now test yourself by doing this activity.

Look at the picture below and identify the different senses. Write your answer on the space provided.

1. _____
2. _____
3. _____
4. _____
5. _____



The Five Senses

1. Sight

The most important sense is the sense of sight. You use your eyes to observe the size, shape, colour, and place of things. Here are some words to describe the way things look.

Size:	big, small, tall, long, wide,
Shape:	round, square, narrow, curve, pointed, flat and others
Colour:	red, blue, white, black, green, yellow
Place:	far, near, on top, under, next to, inside

2. Hearing

You use your ears to hear sounds. Sounds can be soft or loud and can be high or low.

For example, when you hit a bottle it makes a high sound. When you hit a large drum it makes a low sound.

3. Touch

You can use your fingers to feel things. You can feel things with other parts of your body as well. Here are some words to describe the way things feel.
Wet, dry, rough, smooth, heavy, light, sticky, hot, cold, shape, blunt, soft, hard and others.

4. Smell

You use your nose to smell things. Some smells are pleasant, some are bad. These are some words to describe smells.

Sharp: burning meat, burning plastic, smoke, vinegar
Sweet: flowers, fruit, soap.

5. Taste

You use your tongue for tasting things. There are four main kinds of taste

Taste	Examples
Sweet	sugar, lolly water, candies
Salty	salt, sea salt, sea water
Sour	unripe fruit, lemons, vinegar, some bad food.
Bitter	coffee powder, chloroquine tablets,

REMEMBER: Many things are poisonous so do not try to taste

Activity 2: Now test yourself by doing this activity.

Answer the following:

1. Name the sense organs given below and what they are used for.

a. 

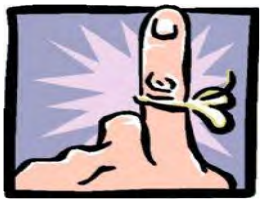
_____ used for _____.

b. 

_____ used for _____.

c. 

_____ used for _____.

d. 

_____ used for _____.

e. 

_____ used for _____.

2. Describe what sense you would use in this following situations. Write one or two words to describe it.

a. lemonade

_____

b. the band

_____

c. clown

_____

d. lolllies

_____

e. dirty socks

_____

f. pizza

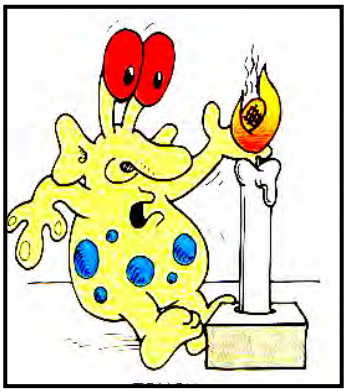
_____

g. fluffy cat

_____

Activity 3: Now test yourself by doing this activity.

3. Can you able to tell what senses these cartoons are using? Name them.

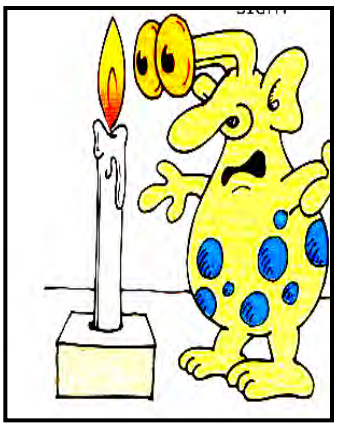


a. _____

b. _____

c. _____

d. _____



e. _____

f. _____

Summary

You have come to the end of lesson 1. In this lesson, you have learnt that:

- there are five senses.
- the five senses are the sense of sight, hearing, touch, smell and taste.
- all the five senses are used for finding out or investigating.
- you use your tongue to taste, eyes to see, ears to hear, nose to smell, body to feel.

NOW DO PRACTICE EXERCISE 1 ON THE NEXT PAGE.

Practice Exercise 1

Answer the following:

1. Name the five senses.
   (i)
   (ii)
   (iii)
   (iv)
   (v)

2. Read and answer the questions carefully. Give an explanation for your answer. Can you

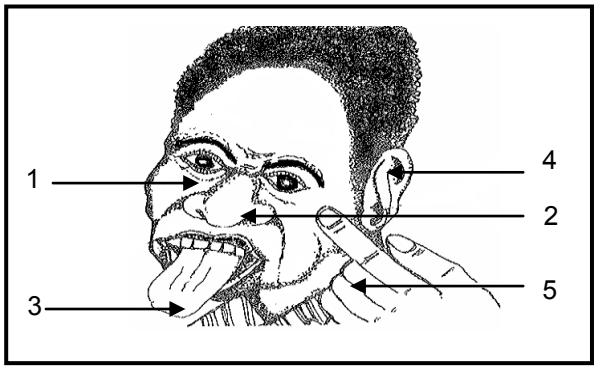
a. taste the apple? _____

b. touch the wind? _____

c. hear the table? _____

d. see the rain? _____

3. Label parts A to E in the diagram below.



CHECK YOUR WORK. ANSWERS ARE AT THE END OF THIS STRAND.

Answers to Activities

Activity 1

1. sight
2. smell
3. taste
4. hearing
5. touch

Activity 2

1. a. Eyes, seeing
   b. Tongue, tasting
   c. Nose, smelling,
   d. Finger, touching/feeling
   e. Ear, hearing.

2. a. drink to taste
   b. use ears to hear the band
   c. eyes to see the clown
   d. tongue to taste the lollies
   e. use our nose to smell the dirty socks
   f. eat to taste the pizza
   g. use the palms of our hand to fell the cat‟s fluffy fur

Activity 3

1. feel/touch
2. smell
3. taste
4. hearing
5. seeing
6. hearing

Lesson 2: Using Your Senses

Welcome to Lesson 2 of Strand 1. In the last lesson you identified the five senses and described the properties of some substances or objects. In this lesson you will learn more about your senses.

Your Aim:

- carry out some activities and identify the senses you used

Are you able to recall your five senses?

My five senses are, sight, touch, hearing, smell and taste.

Now you will do some simple activities by using some of your senses.

Activity 1: Now test yourself by doing this activity.

Using your senses to observe changes

You will need:
1. a ball of steel wool
2. a chemical called dilute sulphuric acid
3. a small beaker or empty peanut butter bottle

Instructions:
1. Put the ball of steel wool in the beaker or bottle
2. Cover the steel wool with the sulphuric acid **(be careful when using sulphuric acid it must not touch your skin because it is corrosive**).
3. Observe and record what you observed.

Questions

1. What can you smell? Can you smell anything? Write your observations down.

   _____

   _____

2. What senses did you use in this activity? Name them.

   _____

   _____

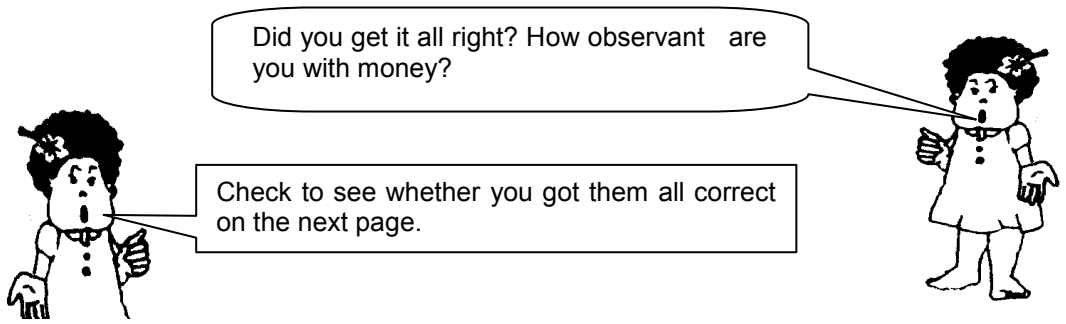
Activity 2: Now test yourself by doing this activity.

Testing your sense of Sight

In this activity you are going to test how you can observe using your sense of sight. Do you look at your coins very often? Have a good look at your 10t, 20t, and 50t coins. Do you know what features are on the money?

Exercise:
In PNG currency, we have K100.00, K50.00, K20.00, K10.00 K5.00 and K2.00 notes. Match the amount of the note on the left by drawing a line from the note to the feature on the money. The first one has been done for you. **Do not look at the notes on the next page.**

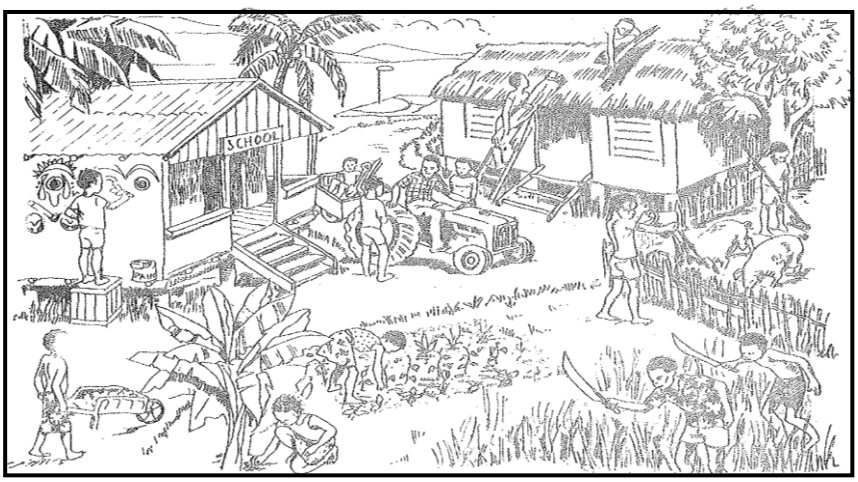
K 100	**A**	1	Pig"s head and shell money
K 50	**B**	2	Stone axe
K 20	**C**	3	Sir Michael Somare
K 10	**D**	4	Carving and shell money
K 5	**E**	5	Wooden bowl
K 2	**F**	6	Oil tanker, plane and truck



Activity 3: **Now test yourself by doing this activity.**

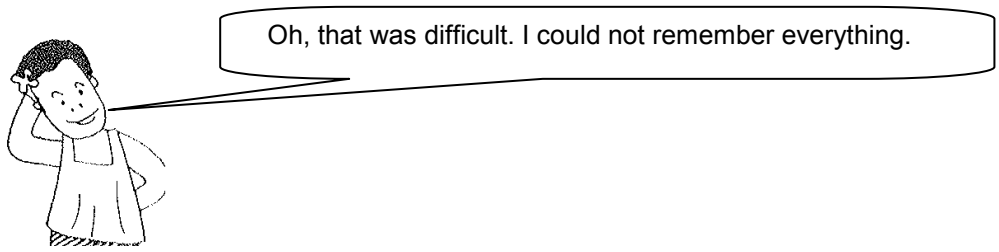
Follow these instructions carefully.

1. Do not read the questions that are written on the next page.
2. Look at the picture very carefully.
3. When you have observed the picture, cover the picture with a piece of paper and begin answer the questions on the next page..



Now answer the following questions. **DO NOT LOOK AT THE PICTURE.**

1. What sort of place does the picture show? _____
2. What sort of animal did you see in the picture? _____
3. How many boys are cutting grasses? _____
4. Write the name of one type of tree in the picture. _____
5. One boy is painting. What is he standing on? _____
6. What sporting activity can people play in this place? _____
7. How many people are in this picture? _____



Now LOOK at the picture. If you answered over 5 to 6 questions without looking at the picture, your observation is very good.

Activity 4: Now test yourself by doing this activity.

What senses are used when you observe a candle? Using all your senses you should be able to observe a candle.

Follow these steps.

1. Light the wick on your candle.
2. Observe what happens
3. Write what happens on the given space.

<u>Observations on the Burning Candle</u>

_____

_____

_____

_____

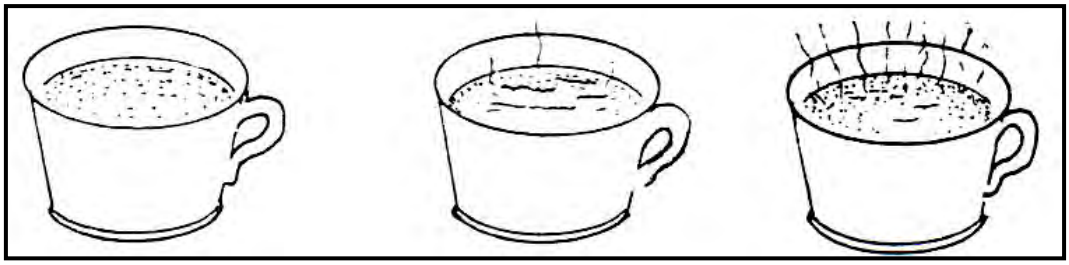
_____

Activity 5: Now test yourself by doing this activity.

Can you trust your sense of touch?

You will need

1. a cup of cold water
2. a cup of warm water
3. a cup of hot water



Cold water Warm water Hot water

Follow these steps on the next page.

Steps:

1. Put a finger of your left hand into the cold water and finger of your right hand into the hot water.

2. Leave them there while you count up to 20.

3. Put both fingers quickly into the cup with warm water.
   Write down what you feel when you put your fingers in the cup with the warm water.
   _____
   _____
   _____
   _____
   _____

Activity 6: Now test yourself by doing this activity.

Can you trust your sense of touch?

You will need:

1. some sugar
2. a sweet fruit such as pawpaw, mango, orange or guava
3. a cup of water

Steps:

1. Mix some sugar with water in a cup to make a very sweet drink. Do not taste it yet.
2. Start eating your fruit.
3. Drink some of your very sweet water.
4. Take another bite of your fruit.

Write down what you tasted.

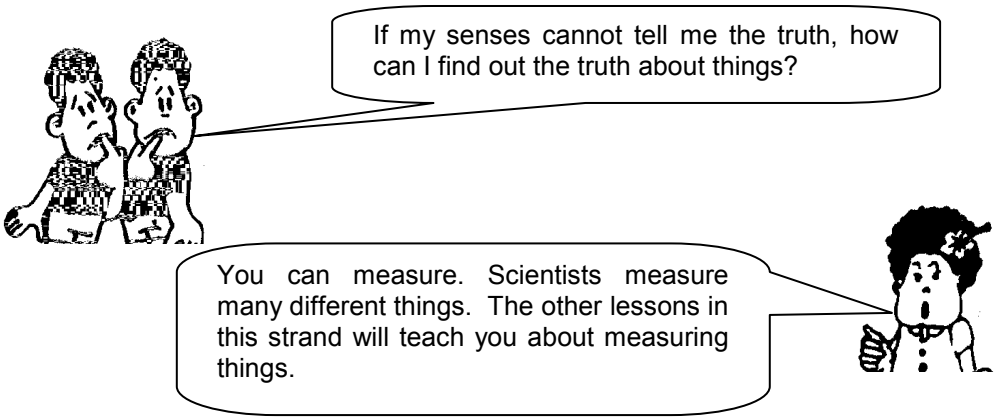
_____

_____

_____

_____

Did you find that you are eating the same fruit but it tastes different? It is easy to fool your sense of taste.



Summary

You have come to the end of lesson 2. In this lesson, you have learnt that:

- observations are made very carefully so that we can find out more about things around us.
- different types of senses are used to make observations.
- your five senses cannot always tell you the truth.

NOW DO PRACTICE EXERCISE 2 ON THE NEXT PAGE

Practice Exercise 2

Answer the following questions:

1. For each item listed, place a tick in the column(s) for the sense(s) you could use when you make an observation of that item

Item	Sight	Hearing	Touch	Smell	Taste
Motorbike					
Guava leaf					
Jet plane					
Soup					
Rice					
Brick					

2. What sense would you use to detect

   a. the temperature of water _____

   b. the presence of salt in your food. _____

   c. the location of key dropped in the dark _____

   d. rice left on the fire for too long _____

3. Imagine that you have seen a cat eating near the airport. Suddenly the cat picks up its head and runs off to the nearby bushes. What can you conclude from this?

   _____

4. Your small sister cries when she is eating the fruit that she is holding. What can you conclude about that?

   _____

CHECK YOUR WORK. ANSWERS ARE AT THE END OF THE STRAND

Answers to Activities

Activity 1

1. Yes a gas smells and a boiling sound occurs with the formation a new orange or grey substance.
2. Seeing, hearing and smelling and touching.

Activity 2

A. 6
B. 3
C. 1
D. 5
E. 4
F. 2

Activity 3

1. A school
2. Pigs
3. 2
4. Banana or coconut tree
5. Wooden box
6. Net ball
7. 14

Activity 4

Orange flame, candle getting short, wax melt and flame dances when a slight breeze blows

Activity 5

One of your fingers tells you that the warm water is cold. The other finger tells you that the warm water is hot. They both cannot be right. Your sense of touch can be wrong.

Activity 6

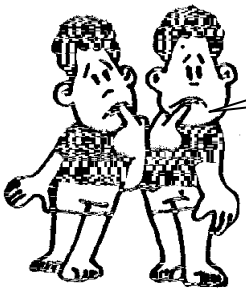
You are eating the same fruit but it tastes different.

Lesson 3: How Much is How Good

Welcome to Lesson 3 of Strand 1.In the last two lessons you learnt about the five senses that you can use for observing. In this lesson you will learn about how to use your senses to make measurements.

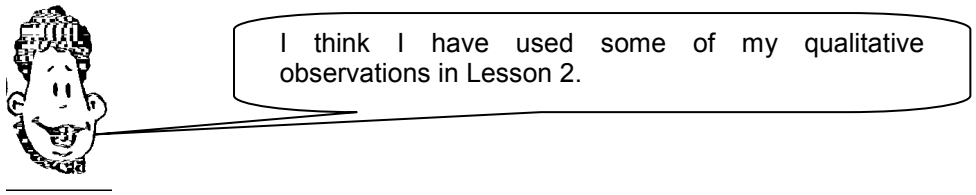
Your Aims:

- define the terms qualitative and quantitative observation
- identifies the senses used to gain information on qualitative and quantitative observations
- identify the instruments used to help your senses to make these measurements



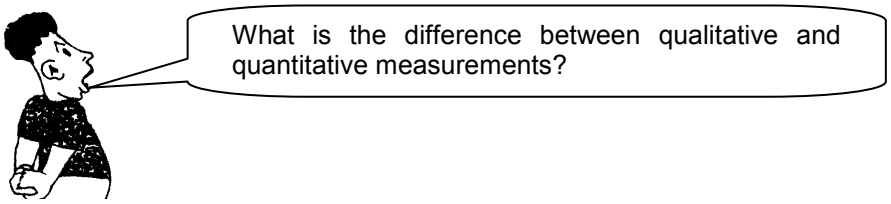
As said earlier, there are two types of Observations. One is a description in words, such as the colour of a book or a smell of a flower. A qualitative property is something that cannot be measured.

These observations are said to be **qualitative** (kwa-li-tate-ive).



The other type of observations involves measurements for example, a 70kg person or a 3cm tail of a gecko. This measurement involves numbers and are said to be **quantitative** (Kwon-ti-tate-ive). A measurement must be quantitative, as the result is a quantity.

Measurements are made up of numbers and units. For example: your height might be 127 centimetres. Centimetres are the units. Without the units the number has no meaning. Your friend may tell you she has 1000 in the bank. You may think she or he is rich until she says it is 1000 toeas. So the unit is as important as the number. Some measuring instruments have digital readout. For example, digital watches. Others have a scale with numbers unit and a pointer which moves along the scale.



Difference between qualitative and quantitative observations

In science it is important to record our observations by describing the characteristics that are important in understanding the object of interest. We can describe a characteristic qualitatively or quantitatively.

A qualitative description of a relevant characteristic does not include a numerical measurement.

Example: This bird has a large wingspan.

Qualitative observations use your senses to observe the results. (Sight, smell, touch, taste and hear.)

A quantitative description of a relevant characteristic involves a numerical measurement.

Example: This bird has a wingspan of two metres.

Quantitative observations are made with instruments such as rulers, balances, measuring cylinders, beakers, and thermometers. These results are measurable.

For example: Have a look at the table on the next page.

All the basketball players named below would be considered very tall but who is the tallest?

You could compare them by asking them to stand next to each other, if you can get them together. But even then you wouldn't be able to compare them to a new player in a distant land or in the past. However, a quantitative measurement can allow us to compare characteristics made in different places or times.

For Example:

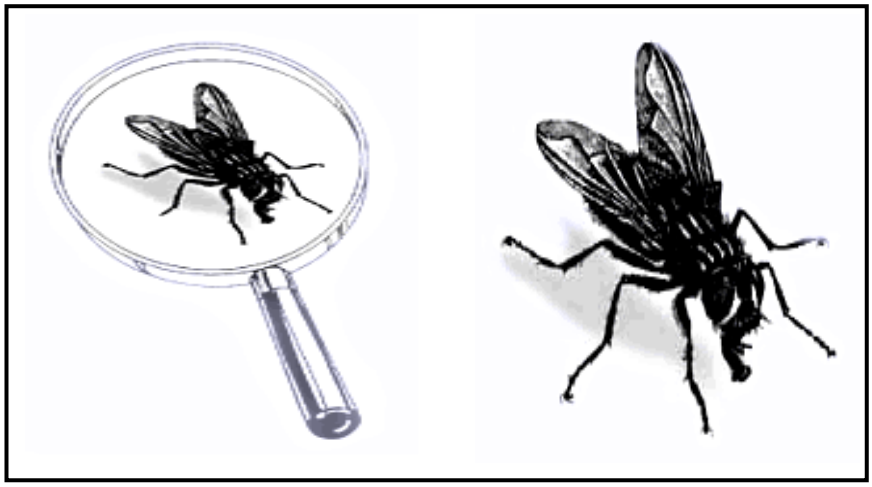
Player	Qualitative Data	Quantitative Data (cm)
Tony "Gamma" Beta	Very Tall	2.00 m
Susan "Traipla" Bouncer	Very Tall	2.10 m
Maria "The Natural" Bean	Very Tall	2.15m
Dean “Kapul” Tom	Very Tall	2.16 m
Bill "Kanage” Funny	Very Tall	2.20m
Lisa "Paitim Mi" Strong	Very Tall	2.29 m
Tom "Mt Wilhelm" Mountain	Very Tall	2.31 m

When we are recording and analysing numbers, it is important to know the limits of the data and/or the equipment. What do we mean by this?

For example, if you were measuring the length of an insect with a ruler using only your eye, you would not be able to record the length as **15.347 mm**.

How did you come up with this figure, **15.347 mm**?

If you did report this as the length of the insect it would be misleading since you are not able to correctly measure the length down to a thousandth of a millimetre using your eyes. Therefore it is necessary to use significant figures when reporting numbers using correct equipment or instrument to measure.



It is necessary to use the correct instrument to make quantitative measurements.

Activity 1: Now test yourself by doing this activity.

Read the following examples and tell whether the example is qualitative or quantitative. Write A for qualitative or B for quantitative.

1. It is light green in color. _____
2. It tastes sour. _____
3. One leaf is 9 cm long. _____
4. It makes a loud pop sound. _____
5. The mass of the computer is 1 1/2 kg. _____
6. It smells sweet. _____
7. The temperature of the room increases by 8 degrees C. _____
8. It gets darker over a period of time. _____
9. The flower clusters in 3 blooms. _____
10. Feels very rough. _____
11. The plant is short. _____
12. Leaves are stiff. _____
13. The veins are 3 mm wide. _____

Summary

You have come to the end of lesson 3. In this lesson you have learnt that:

- qualitative observations use your senses to observe the results. (Sight, smell, touch, taste and hear.)
- quantitative observations are made with instruments such as rulers, balances, graduated cylinders, beakers, and thermometers. These results are measurable.
- a quantitative description of a characteristic involves a measurement using numbers.
- a qualitative description of a characteristic does not include a measurement using numbers.

NOW DO PRACTICE EXERCISE 3 ON THE NEXT PAGE

Practice Exercise 3

Answer the following questions:

1. Complete the following sentences.

   a) Every quantity has a _____ of measurement.

   b) An instrument for measuring mass is called _____.

   c) An observation which does not contain a measurement is said to be _____.

2. Identify the following.

   a) The gas has an odour like rotten egg. _____

   b) This soft drink contain 35mls _____

   c) The ant has six legs. _____

   d) This rock contains large purple crystals. _____

3. Define

   a) quantitative measurement
   _____
   _____

   b) qualitative measurement
   _____
   _____

CHECK YOUR WORK. ANSWERS ARE AT THE END OF THE STRAND.

Answers to activity

1.	A	2.	A	3.	B	4.	A	5.	B	6.	A
7.	B	8.	A	9.	B	10.	A	11.	A	12.	A
13.	A										

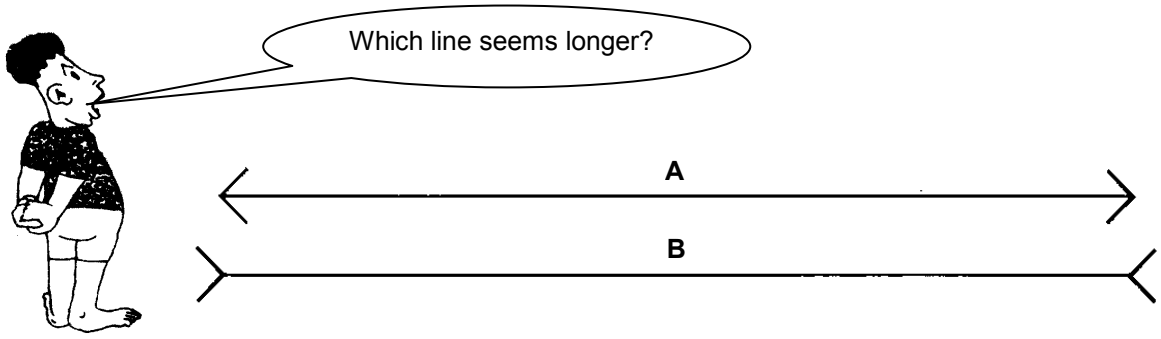
Lesson 4: Standard Unit of Measurements, Instruments and Scale

Welcome to Lesson 4 of Strand 1. In lesson 2, you looked at the five senses that you are able to use to make observations. You also learnt about the two types of observations in lesson 3. In one type of observation we use our senses. Our senses enable us to learn about the world around us. But our senses have limits.

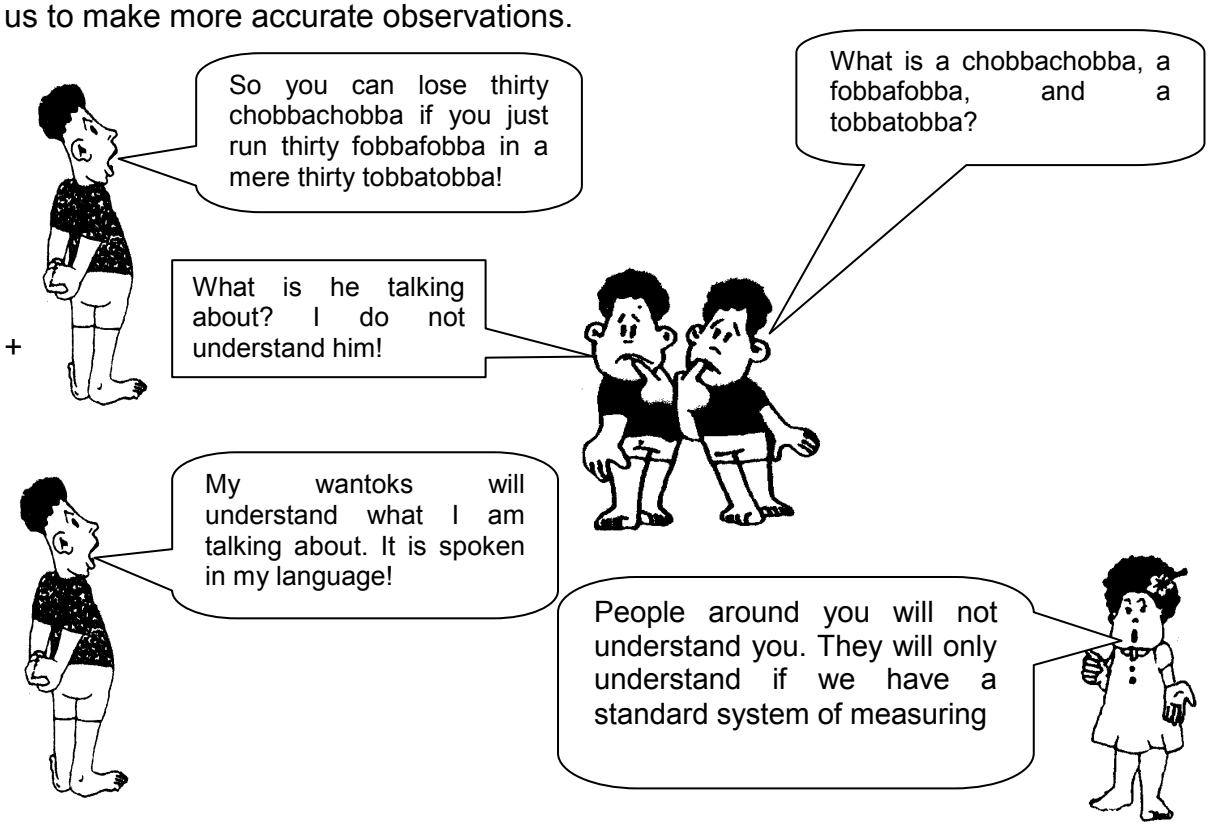
Your Aim:

- identify the standard units, instruments and scales used in measuring

We cannot detect or see small temperature changes; we cannot measure accurately by just observing. Our senses can sometimes lead us into making mistakes. For example, look at the lines labelled **A** and **B** below.



You cannot really tell whether the lines are the same or not unless you measure them. The skill of measuring is an important one in scientific work. Measuring allows us to make more accurate observations.



All measurements are made of two parts: a number and a unit. Most of the units used are based on the **metric system** of measurements.

What is the metric system?

The **metric system** is the measurement system most commonly used in Science. Metric units are sometimes called SI units. SI stands for International System. It is called that because these units are used around the world. The SI is now the standard system being used all over the world. That is also known as the **standard unit**.

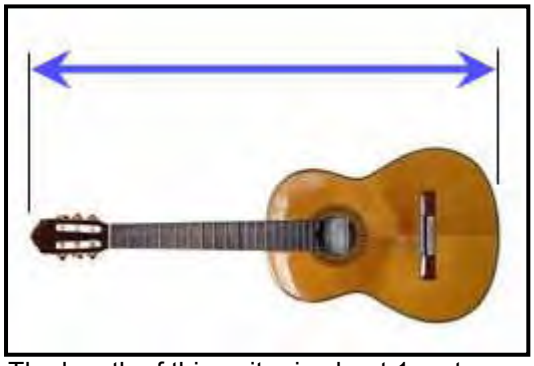
The metric system is a system of measuring. It has three basic units:

Metre(m)		the unit for length
Kilogram(kg)		the unit for mass
Seconds (s)		the unit for time

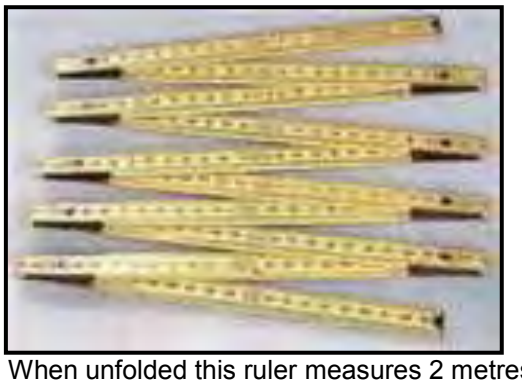
With those three simple measurements we can measure nearly everything in the world!

Examples:

Metre



The length of this guitar is about 1 metre



When unfolded this ruler measures 2 metres

Kilogram

This gold bar has a mass of **1 kilogram**.

A dictionary has a mass of about **1 kilogram**.

Second
1 second is about as long as it takes to say "one thousand and one"

Larger or Smaller
But what if we want to talk about very big or very small things?

We can use **Metric Number Prefixes.** Prefixes are used with units to extend their meaning. For example, the prefix **kilo** means one thousand. The prefix **mega** means one million. Therefore, five mega litres of water means five million litres of water. Six kilograms of rice, means six thousand. From knowing what prefix is, we are able to convert from smaller units to bigger units or from bigger units to smaller units.

like "kilo" (a thousand)
and "milli" (one thousandth) and so on

Example: something that is 1,000 metres is a "kilometre"

Something that is one thousandth of a second is a "millisecond"

In fact the kilogram already uses this method, because it is a thousand grams, a kilogram. So one thousandth (1/1000) of a kilogram is simply a "gram"

The table below shows a summary of the special prefixes of large numbers and small numbers.

Large Numbers

Name	deca	hecto	kilo	mega	giga	tera	peta	exa	zetta	yotta
Symbol	da	h	k	M	G	T	P	E	Z	Y

Example: A million litres would be called a megaliter and written as ML

Small Numbers

Name	deci	centi	milli	micro	nano	pico	femto	atto	zepto	yocto
Symbol	d	c	m	µ	n	p	f	a	z	y

Example: A thousandth of a second would be called a millisecond and written as ms

You will learn more about this when you are in higher grades

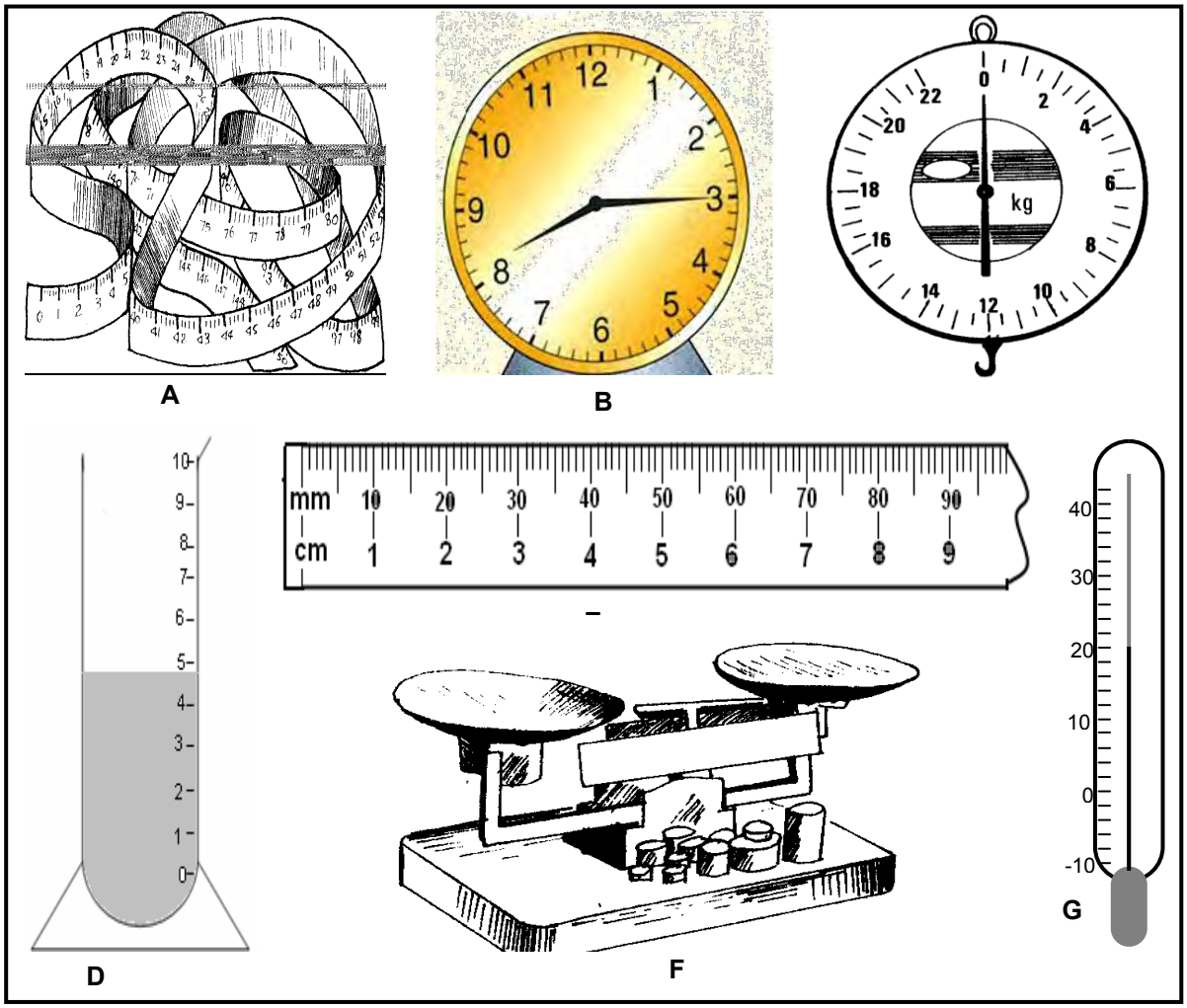
REMEMBER: A standard unit of measurement is a unit generally accepted and made possible by international agreements

Units of measure and measuring instruments

For each measurement, a **standard** is chosen. Every measuring instrument has to be compared with that standard.

We use special instrument to take measurements.

Some instruments that you will use to measure with are **thermometres, rulers, measuring cylinders, watch or clock and scales.** Are you able to name the instruments below?



To get the size of the object, we need to measure them. The most convenient measure to use depends on the size of the object being measured.

Length can be measured in **millimetres, centimetres, metres and kilometres**.

Time can be measured in **seconds, minutes, hours, days, years and centuries**

Mass can be measured in **milligrams, grams, and kilograms**.

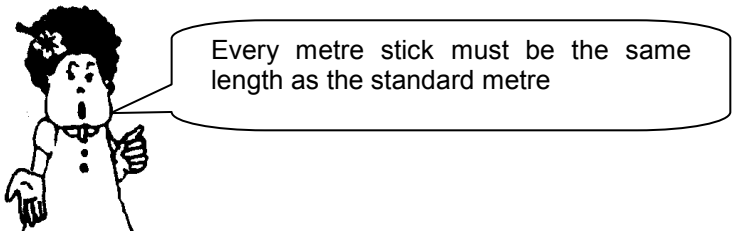
Temperature can be measured in **Degree Celsius and Kelvin**.

REMEMBER: All measurements are made of two parts: a number and a unit.

Measures of length

The metre is the fundamental unit of length in the metric system. The metre is divided into ten equal parts called the **decimetres**. Each of these parts is divided into ten equal parts called the **centimetres**. Each centimetre is further divided into ten smaller parts called **millimetres**.

10 millimetres (mm)	1 centimetre (cm)
10 centimetres (cm)	1 decimetre (dm)
10 decimetres (dm)	1 metre (m)
10 metres (m)	1 decametre (dam)
10 decametres (dam)	1 hectometre (hm)
10 hectometres (hm)	1 kilometre (km)



Measures of weight

The **gram** (g) is the basic unit of weight.

10 milligrams (mm)	1 centigram (cg)
10 centigrams(cg)	1 decigram (dg)
10 decigrams (dg)	1 gram (g)
10 grams (g)	1 decagram (dag)
10 decagrams (dag)	1 hectogram (hg)
10 hectograms (hg)	1 kilogram (kg)
1000 kilograms (kg)	1 tonne (t)

Measures of volume and capacity

The litre (L) is the basic unit for measuring capacity and volume.

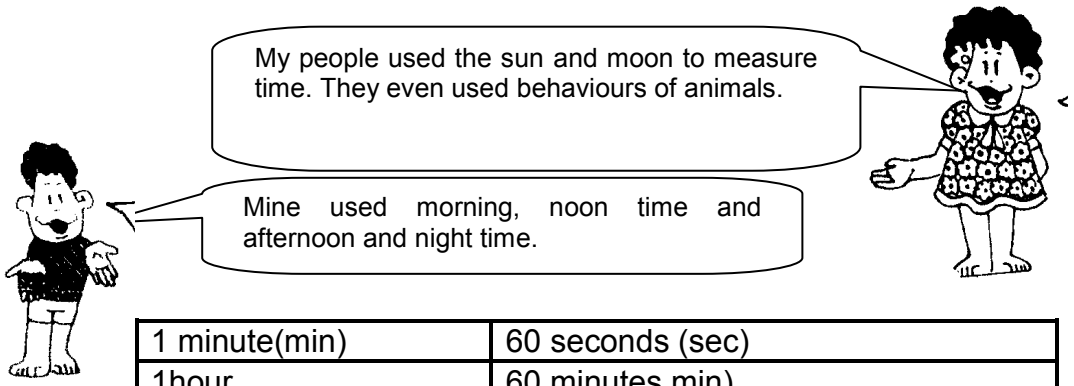
10 millilitres (ml)	1 centilitre (cL)
10 centilitres(cL)	1 decilitre (dL)
10 decilitres (dL)	1 L (l)
10 litres (L)	1 decalitre (daL)
10 decalitres (daL)	1 hectolitre (hL)
10 hectolitres(hL)	1 kilolitre(kL)

Measures of temperature

A **thermometre** is used in measuring temperature. The unit used to tell the temperature are the Celsius, the centigrade degrees and the Fahrenheit (fa-ren-haiet) degree. In Papua New Guinea we normally use **Degree Celsius**.

Measuring time

The basic unit of time is the **seconds (s),** clocks and watches are used to measure time.



1 minute(min)	60 seconds (sec)
1hour	60 minutes min)
1 day	24 hours (hr)
1week (wk)	7 days
1 month	28 t0 30 days
1 year	12 months or 365 days
1 leap year	366 day

The days per month are as follows;

31	30	28 or 29
January	April	February
March	June	
May	September	
July	November	
August		
October		
December		

a.m from ante-meridian means the time from 12 midnight up to before 12 noon.
p.m from post-meridian means the time from 12 noon up to 12 midnight.

Activity: **Now test yourself by doing this activity.**

Convert the following**:**

1. How many centimetres in 4metre? _____
2. How many metres in 5km? _____
3. How many millimetres in 8cm? _____
4. How many grams in 6kg? _____
5. How many litres in 20ml? _____
6. How many kilometres in 4500m? _____
7. How many seconds in 24hours? _____
8. How many minutes in 12hours? _____

Summary

You have come to the end of lesson 4. In this lesson you have learnt that:

- the metric system is the measurement system most commonly used in Science.
- metric units are sometimes called SI units.
- the standard unit for length is metre.
- the standard unit for weight is grams.
- the standard unit for volume is litre.
- the standard unit for time is seconds.

NOW DO PRACTICE EXERCISE 4 ON THE NEXT PAGE

Practice Exercise 4

Answer the following questions.

1. What is the instrument used to measure volume in liquids?

   _____
   _____

2. What is the instrument used to measure time?

   _____
   _____

3. What is the instrument used to measure temperature?

   _____
   _____

4. What is the instrument used to measure length?

   _____
   _____

5. a. What is the weight of an eight kilogram boy in grams?

   _____

   b. If Alice is 40 cm in height, what is her height in metre and millimetres?

   _____

   c. Convert 3 hours into second, and minutes.

   _____
   _____

CHECK YOUR WORK. ANSWERS ARE AT THE END OF STRAND.

Answers to Activity

1.	400	2.	5000	3.	80	4.	600	5.	0.2
6.	4.5	7.	86400	8.	720				

Lesson 5: Measuring Length

Welcome to Lesson 5 of Strand 1. In the last lesson you identified the instruments used to measure length and the scale that is used to measure length. In this lesson you will learn the how to measure lengths of different objects.

Your Aims:

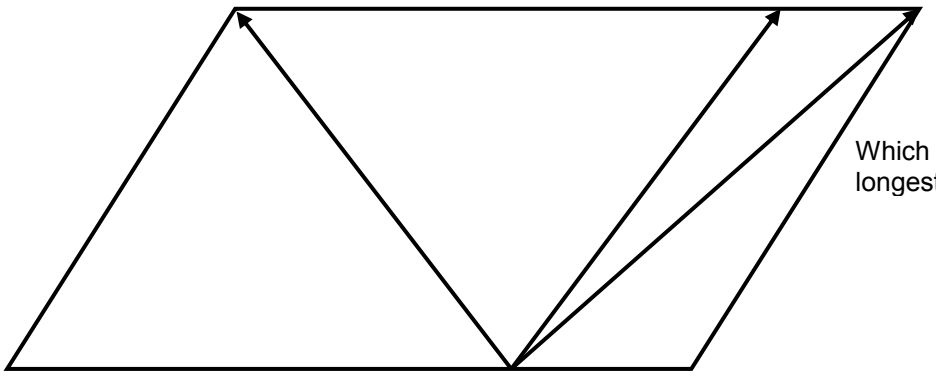
- measure length of irregular objects
- calculate the average of readings
- identify the appropriate unit used to measure certain objects

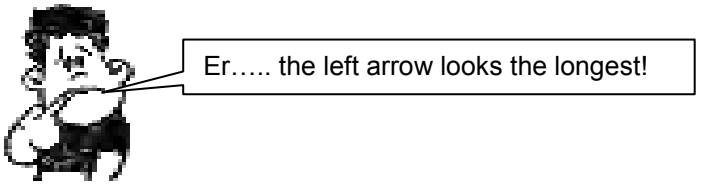
You now know, our senses are not very good at measuring length, therefore we will use some instruments that you have stated in lesson 4 for measuring length.

Some of the instruments used for measuring length are; ruler, tape measure, trundle wheel.

1. Ruler is a simple measuring instrument used for measuring shorter lengths.

Now, have a good look at this diagram.

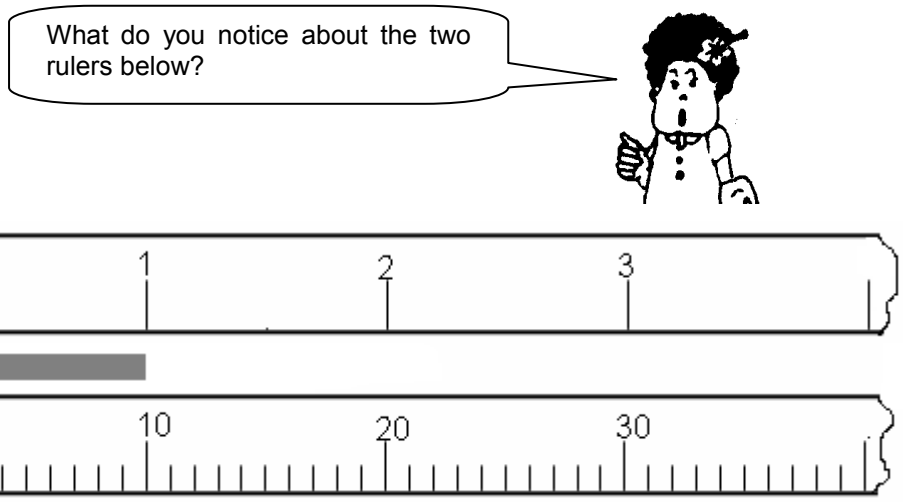




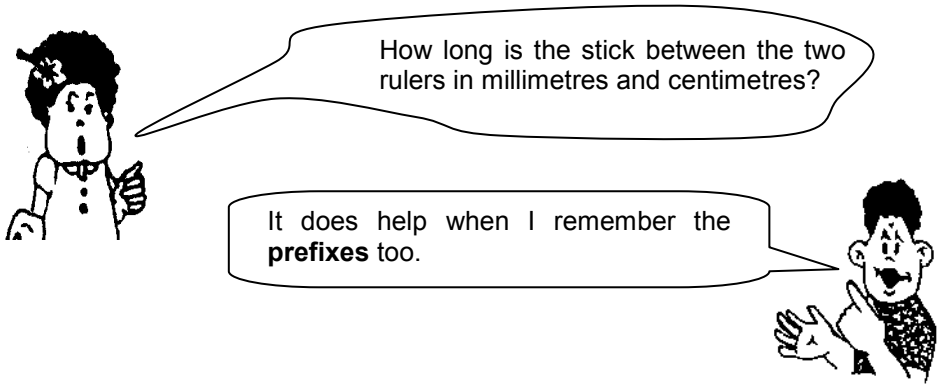
REMEMBER: Rulers, metre-sticks and tape measures are used to measure length. Metres (m), centimetres (cm), and millimetres (mm) are the units of length.

You can use your **30 cm ruler** or the **10 cm** ruler to do some of the exercises if you have one with you now. If you do not have a ruler please borrow one from your friends or your Provincial Coordinator.

Have a look at the sample of rulers below. Look at the difference between the two rulers?

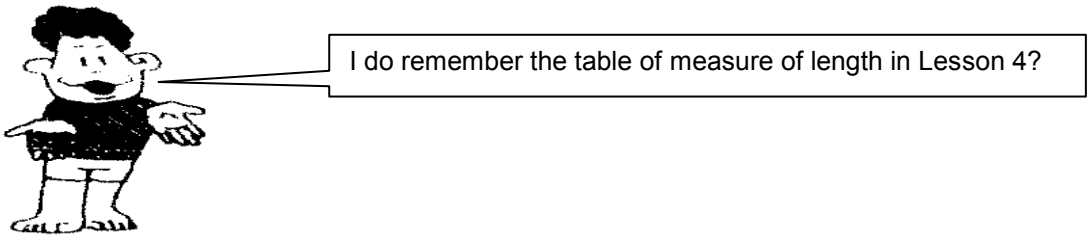


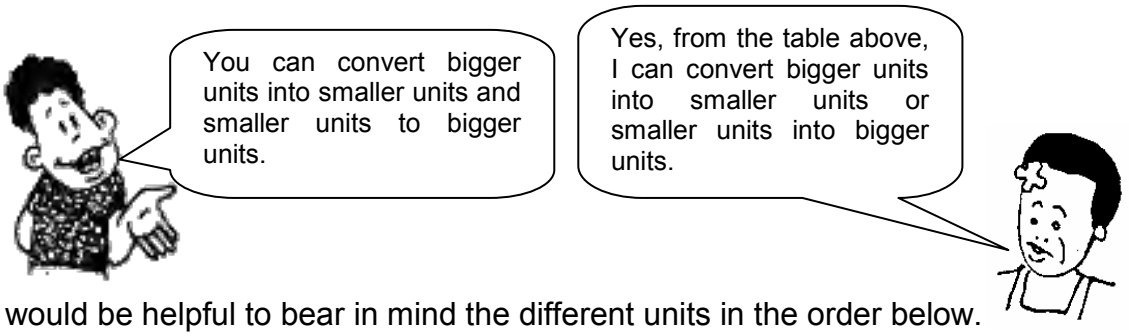
One ruler measures in **millimetres** and the other measures in **centimetres**.



REMEMBER:	10 millimetres is the same length as 1 centimetre **10 mm = 1 cm**

Length	Metre ruler or tape measure	1 metre = 1000 millimetres 1 metre = 100 centimetres 1000 metres = 1 kilometre

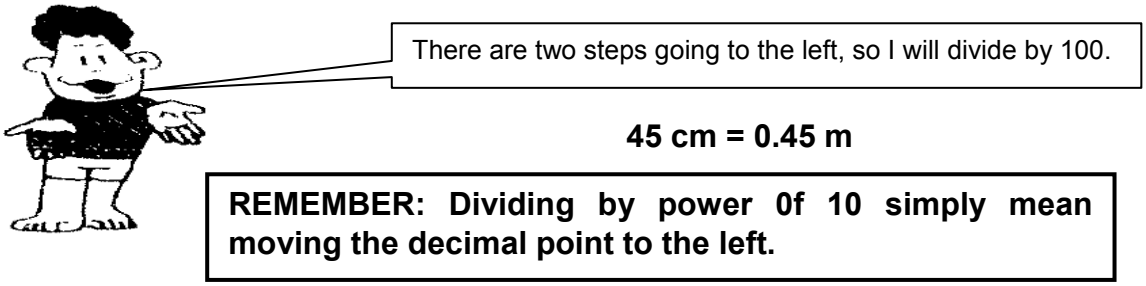




It would be helpful to bear in mind the different units in the order below.

Kilo – hecto – deca, - g, L, m – deci – centi – milli

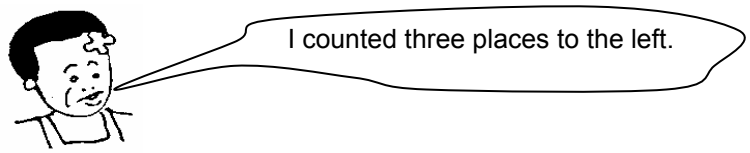
If you are asked to express 45 cm in metres, you count how many steps there are until you reach metres.



45 cm = 0.45 m

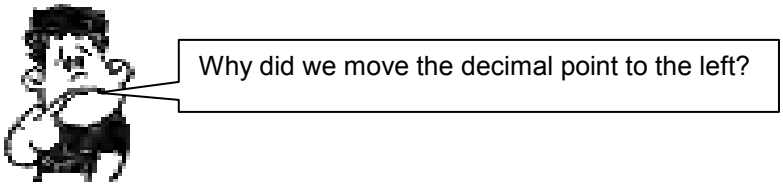
REMEMBER: Dividing by power 0f 10 simply mean moving the decimal point to the left.

What if you are asked to convert 4.5 m in kilometres? How many steps are there to kilometres?



We have 4.5 m to 0.0045 = 0.004.5 km

Therefore, 4.5 m = 0.0045 km.



When we are changing smaller unit to bigger units we, **divide**. So when converting bigger units to smaller unit, we **multiply** by the power of 10 or we move the decimal point as many place as the power indicates.

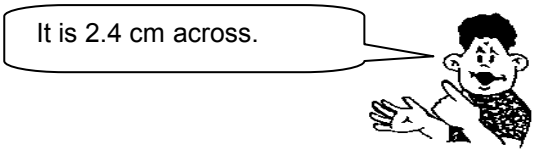
Activity 1: **Now test yourself by doing this activity.**

Convert the following.

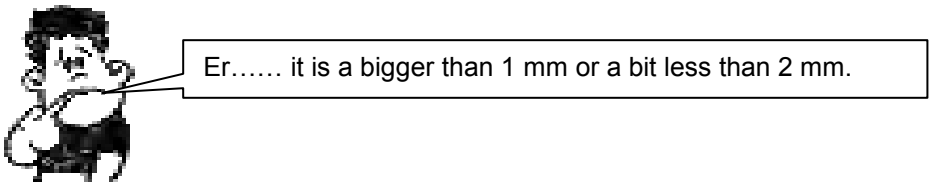
1. 69 cm = _____ mm
2. 41m = _____ cm
3. 95 km = _____ m
4. 568 cm = _____ km
5. 0.025 km = _____ m
6. 50 mm = _____ m

Measuring very small things and irregular objects.

How **wide** is 10 toea coin?



How **thick** is it?



You can measure the thickness of a coin more accurately than that.

Here is how you can measure the thickness of the coin.

First measure the thickness of 10 coins. Then you get the average of the reading. That will be the thickness of 1 coin.

For example if the thickness of the 10 toea coin is 17. Divide 17 by 10 because you measure by 10 coins so your answer would be 1.7

Activity 2: Now test yourself by doing this activity.

Measuring the length of irregular objects

You will need

1. an object, a stone
2. two match boxes or cardboards
3. a ruler

Follow these steps.

Step 1 Place the object in between the two boxes or the pieces cardboard

Step 2 Tilt the ruler on its edge and put it along the object and the pieces of cardboard or matchboxes

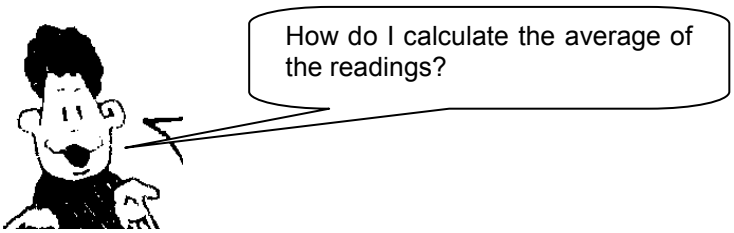
Step 3 Close one eye. Move the ruler until a mark on the ruler is against the end of the matchboxes. Have your eye straight above the end of the matchbox

Step 4 Move your eye so that it is now above the other end of the object. Count the millimetre marks between the pieces of cardboard or matchboxes.

This is the length of the object to the nearest millimetre.

Write your answer in your book.

Then let your other friends measure the object. Take the **average** of the readings.



To take the average add all the numbers and divide this by the number of readings taken by your friends.

Now you can measure the length of other irregular objects. You can also read from given diagrams and pictures their length.

Summary

You have come to the end of lesson 5. In this lesson you have learnt that:

- the standard unit for length are the millimetre, the centimetre and the metre.
- the instruments used for measuring length are the ruler, tape measure.
- to take the average add all the numbers and divide this by the number of readings taken

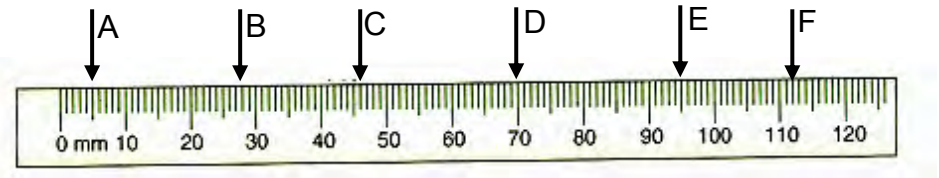
---

NOW DO PRACTICE EXERCISE 5 ON THE NEXT PAGE

Practice Exercise 5

Answer the following questions:

1. Write down the measurements shown by the arrow in millimetres or to the nearest millimetre.



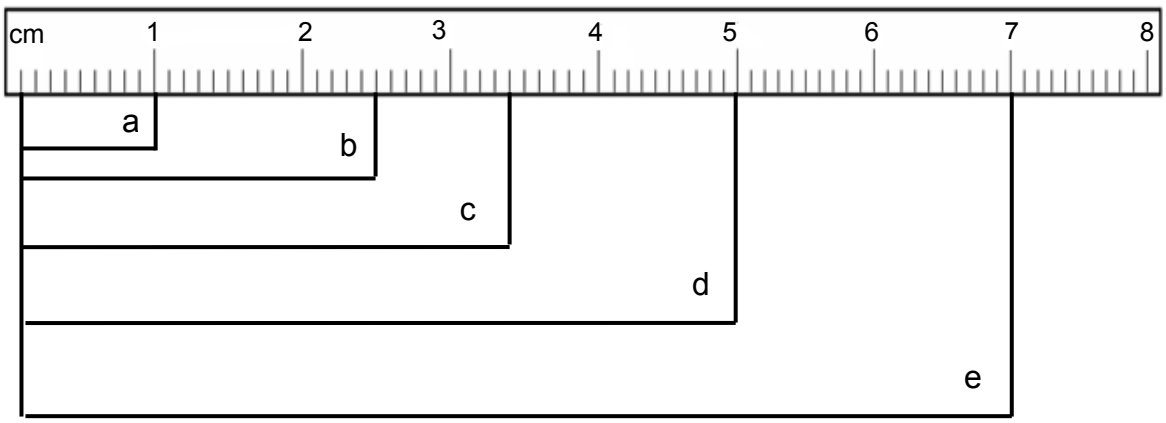
A. _____ B._____ C. _____ D. _____ E. _____

F. _____

2. Read the measurement carefully and write down the answers for;

   i) Write down the length of the intervals in centimetres

   ii) Write down the readings above (i) in millimetres.



i) a. _____
   b. _____
   c. _____
   d. _____
   e. _____

ii) a. _____
   b. _____
   c. _____
   d. _____
   e. _____

3. Convert this measurements into the units indicated.

a)	200 cm	=	_____ m
b)	6 m	=	_____mm
c)	25 km	=	_____ m
d)	2.3 m	=	_____ cm
e)	6 700 m	=	_____ km
f)	26 mm	=	_____ m
g)	52 00 mm	=	_____ m
h)	93 600 mm	=	_____ m
i)	0.17 km	=	_____ m
j)	870 m	=	_____ km

CHECK YOUR WORK. ANSWERS ARE AT THE END OF THE STRAND.

Answers to Activity 1

1) 690

2) 4100

3) 95 000

4) 0.00568

5) 25

6) 0.05

Lesson 6: Using a Metre Stick

Welcome to Lesson 2 of Strand 1. In the last lesson you learnt how to measure length of irregular objects. Also you already know that the unit you could use to measure length, the metre, centimetre and the millimetre are all metric units or standard units. They are all used to measure length. You have identified the instruments used to measure length. In this lesson you will learn to will make your own ruler

Your Aims:

- construct a metre stick
- use the stick to measure certain things
- recall the unit used to measure big and small things

REMEMBER, there are 100 cm in a metre
100 cm = 1m

Activity 1: Now test yourself by doing this activity.

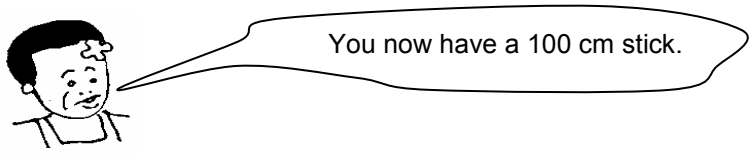
Making a metre stick

You will need: a knife and a long piece of stick

ALWAYS BE CAREFUL WHEN YOU USE A KNIFE

Steps to follow;

1. Work how long is 100 cm.
2. Find a long stick, bamboo or piece of wood that is more than 100 cm long
3. Start from one end and measure 10 cm interval along he stick.
4. Draw or carve a mark 10 cm along the stick. Write 10 cm
5. Measure another 10 cm. Make a mark. Write 20 cm next to the mark
6. Keep on measuring and making marks every 10 cm until you have made 10 marks
7. Cut the stick at a 100 cm mark.



Your metre stick has marks on it. That means you have put a scale on the stick. Most things used for measuring have a scale on them.

Now, you can use your metre stick to measure how tall you are.

Activity 2: Now test yourself by doing this activity.

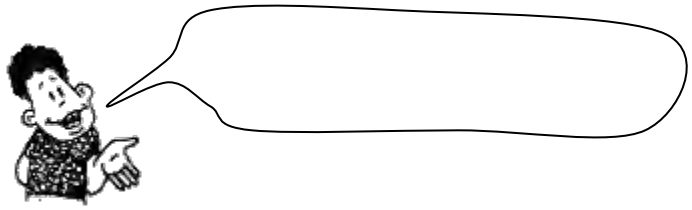
Measuring your Height

Follow these Steps

Step 1 Stand against a tree or wall
Step 2 Make a mark on the tree right at the top of your head.
Step 3 Measure how far that mark is from the ground

For this example, Paul"s height is 1 metre and 30 centimetres.

You can write 1 metre and 30 centimetres as a decimal.



There are 100 centimetres in 1 metre. 30 centimetres is the same as **30/100** or **0.30** m. Therefore we write 1 metre and 30 centimetres as **1.30 m.**

Activity 3: Now test yourself by doing this activity.

Write these distances in metres.

1. Alice jumped 2 metres and 20 centimetres. This is the same as 2 m and 20/100. = _____ m

2. Gloria jumped 1 metre and 96 centimetres. This is the same as _____ m.

3. Joyce threw a stone 15 metres and 15 centimetres. This is the same as _____ m.

4. Peter threw a stone 23 metres and 5 centimetres. This is the same as _____ m

Now you can use your metre stick to do the following activities in metres and convert it into centimetres.

1. Measure your height
2. The distance you jumped
3. The distance you threw a stone.

Summary

You have come to the end of lesson 6. In this lesson you have learnt that:

- you can use millimetres, centimetres and metres to measure length.
- a millimeter is used to measure small length.
- you measure bigger length using metres.
- you can construct your own metre stick if you have centmetre or millimeter ruler.

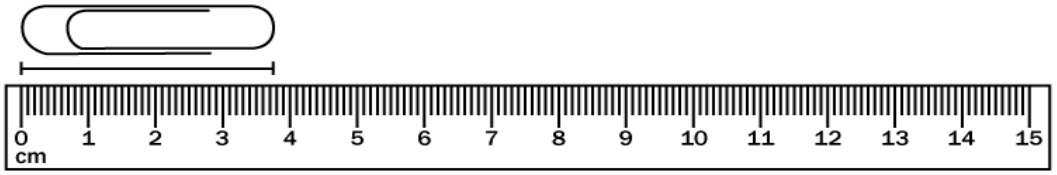
NOW DO PRACTICE EXERCISE 6 ON THE NEXT PAGE.

Practice Exercise 6

Answer the following questions.

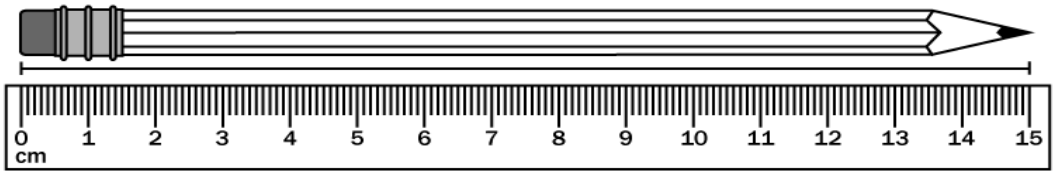
1. Measure each object with the ruler shown. Round all answers to the nearest centimetre.

a.



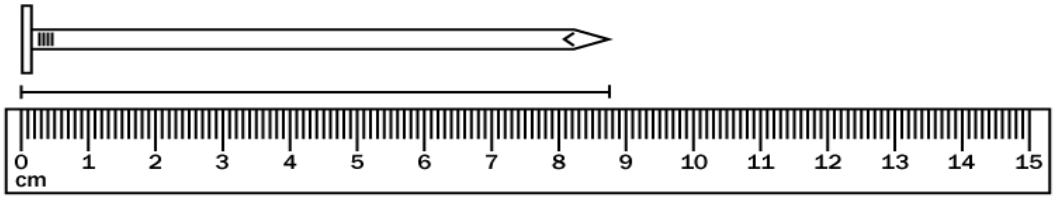
_____

b.



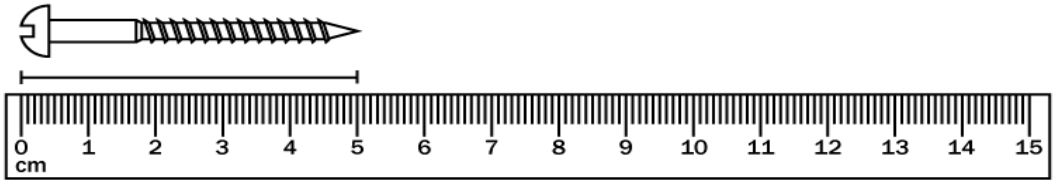
_____

c.



_____

d.



_____

2. Identify which unit you will use to measure the length of the following:

a. Rugby Field _____

b. Pencil _____

c. Thickness of your course book _____

d. Your height _____

CHECK YOUR WORK. ANSWERS ARE AT THE END OF THE STRAND.

Answers to Activity 3

1) 2.2m

2) 1.96m

3) 15.15m

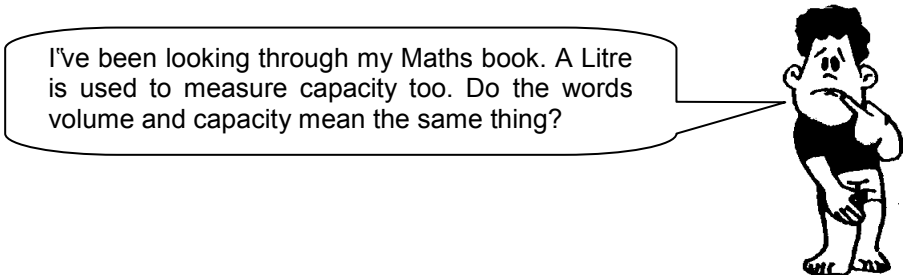
4) 23.05m

Lesson 7: Volume and Capacity

Welcome to Lesson 7 of Strand 1. In the last lesson you learnt about how to make a metre stick to measure length. In this lesson you will learn about volume and capacity. What do you know about volume? What is volume and what is capacity? We will learn more about them in this lesson.

Your Aims:

- define volume and capacity
- identify the units used to measure volume and capacity

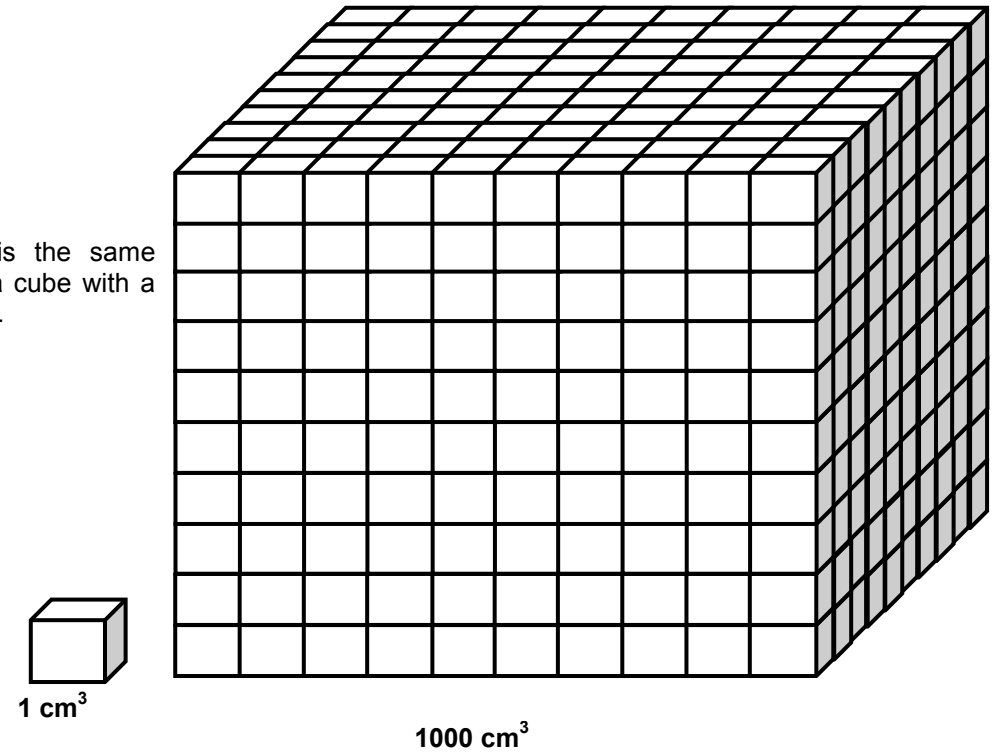


Volume

Scientist use a volume measurement when they answer the question "how much liquid" or „how much gas". **Volume** refers to the amount of space that an object takes up. The volume of a brick or a ball is how much space the object takes up. Volume is measured with units such as **cubic centimetres** or **cubic inches**.

A millilitre is the same volume as a cube with a side of 1 cm.

1ml = 1 cm^3



You will learn more about this in your maths courses.

Capacity

We often measure things that can be poured into or out of containers such as liquids, rice grains, salt, sugar and so on. The volume of a container that is filled with a liquid or a solid that can be poured in is often called its **capacity**.

Capacity is usually measured in **gallons, quarts, pints, cups, ounces litres and millimetres.** The units of capacity are not cubic units, but litres and millilitres are easily converted to cubic units. A graduated cylinder is used to measure the volume of liquids. The cylinder is separated into scale divisions (graduations) for accurate measurement

1 millilitre = 1cm^3 **1 litre = 1000 cm^3**

The table below shows the different units of capacity.

Metric Units	
1 litre (L)	1000 millilitres (ml)
1 millilitre	1/1000 litre
1 litre	1000 cubic centimetres
1 millilitre	1 cubic centimetre

The Sirinumu Dam. People in Port Moresby like to know how much water is in this dam. The water helps to make electricity for the city. When the volume of water is small, there is a danger of power cuts. What is the capacity of this dam?

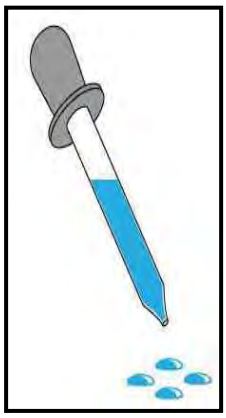
These containers are large therefore their volume will be in litres

This syringe and cup are small so their volume will be in millilitres

Activity: **Now test yourself by doing this activity.**

A **liter** (L) and a **milliliter** (mL) are both units for measuring capacity, or volume, in the metric system.

This bottle holds 1litre of water.



A millilitre is about 20 drops of water.

1. Mr. Franklin filled a bucket with water to clean his floor. Does his bucket probably hold 9litres or 9millilitres of water? _____

2. A baker adds half of a teaspoon of vanilla to her cake recipe. Did she use 2.5L or 2.5mL of vanilla? _____

3. Chris bought a cup of hot chocolate. Does his cup probably hold 400litres or 400millilitres of hot chocolate? _____

4. Kaylee bought juice for her friends to drink at her birthday party. Did she probably buy 5L of juice or 5mL? _____

5. Miss Marge has a large fish tank in her office. Does her fish tank hold 100litres or 100mL of water? _____

Summary

You have come to the end of lesson 7. In this lesson you have learnt that

- volume refers to the amount of space that an object takes up.
- volume is measured with units such as cubic centimetres or cubic inches.
- the term capacity is generally used to refer to the amount that a container will hold.
- standard units of capacity include gallons, litres and millilitres.

NOW DO PRACTICE EXERCISE 7 ON THE NEXT PAGE.

Practice Exercise 7

Answer the following questions:

1. Define the following terms:
   a. Volume
   _____

   b. Capacity
   _____

2. What is the instrument used to measure volume?
   _____

3. List the units used to measure volume and capacity.
   _____

CHECK YOUR WORK. ANSWERS ARE AT THE END OF STRAND.

Answers to Activity

1) 9litres

2) 2.5ml

3) 400milliliters

4) 5L

5) 100litre

Lesson 8: Marking a Volume

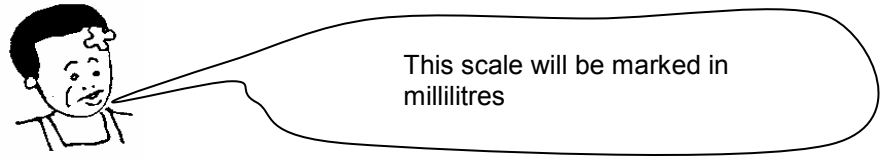
Welcome to Lesson 8 of Strand 1. In the last lesson you learnt about volume and capacity. The Instruments for measuring are generally used for small amounts of liquids or pourable materials such as rice or water. These tools are generally found in the kitchen and science laboratories. In this lesson you will make your own measuring scale.

Your Aim:

- construct a measuring scale

You can be able to use this measuring scale if you do not have a proper measuring cylinder near you.

So get your materials ready.



Activity 1: Now test yourself by doing this activity.

Marking a Volume Scale

You will need

1. an empty match box
2. a glass jar with straight sides. Not a big jar. A coffee jar would be alright
3. a strip of paper 2 cm wide
4. glue or sticky tape.
5. some paper

Follow these steps:

Step 1 Stick the piece of paper on the side of jar. This piece of paper is for you to write a volume scale on.

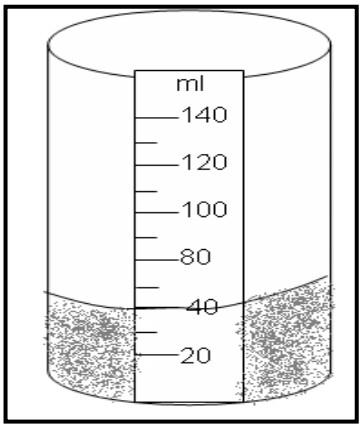
Step 2 The inside of the match box hold about 20 ml. Fill the inside of the match box with water and tip the water into the jar.

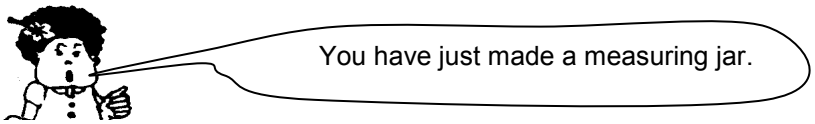
Step 3 Draw a line on the paper strip to show the level of water in the jar. Write 20 ml next to this line.

Step 4 Fill the match box with water again and pour this water into the jar. You have added another 20 ml of water into the jar so now you have 40 ml of water in the jar.

Step 5 Draw a line at the new level. Write 40 ml next to this line.
Keep on adding water to the jar from the match box. Every time you add 20 ml of water draw a line to show the level of water and write how much water is in.

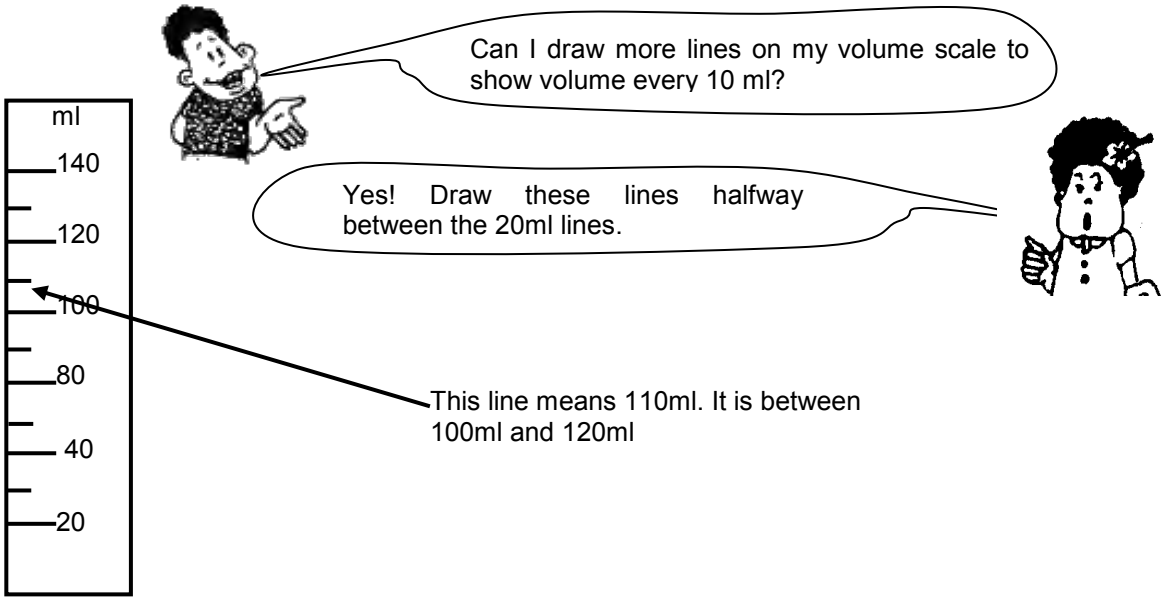
When you have finished, your jar should have looked something like this.

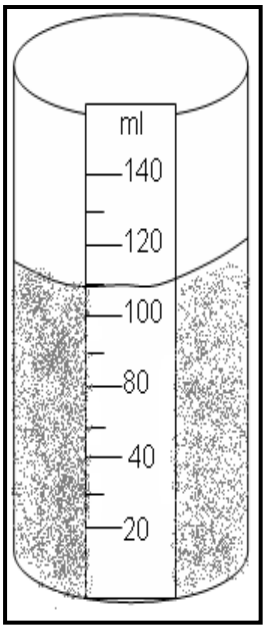




You may have different number of marks than the jar shown in the drawing. That depends on how big your jar is.

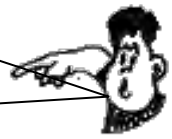
The lines on your paper are the **scale** on your measuring jar.

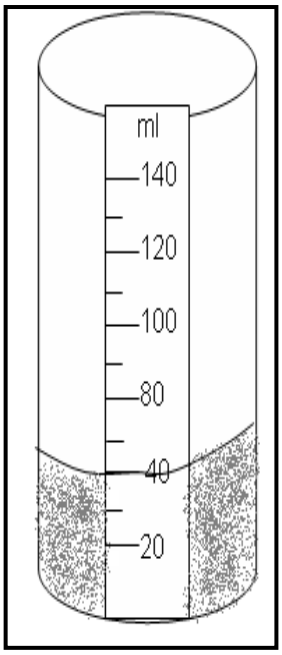




The water in my jar comes up to this mark. I have 40ml of water in the jar.

The water in my jar is half way between the 100 and 120 marks. There is 110ml of water in the jar





Now you can use your jar to measure volumes.

Summary

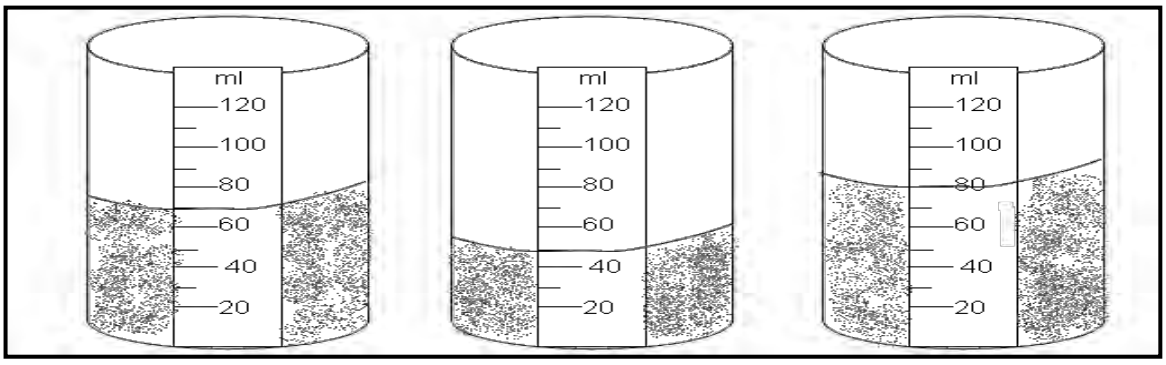
You have come to the end of lesson 8. In this lesson you have learnt that:

- you can now construct your own measuring scale if you have a container that you already know how much liquid or water that container can hold.

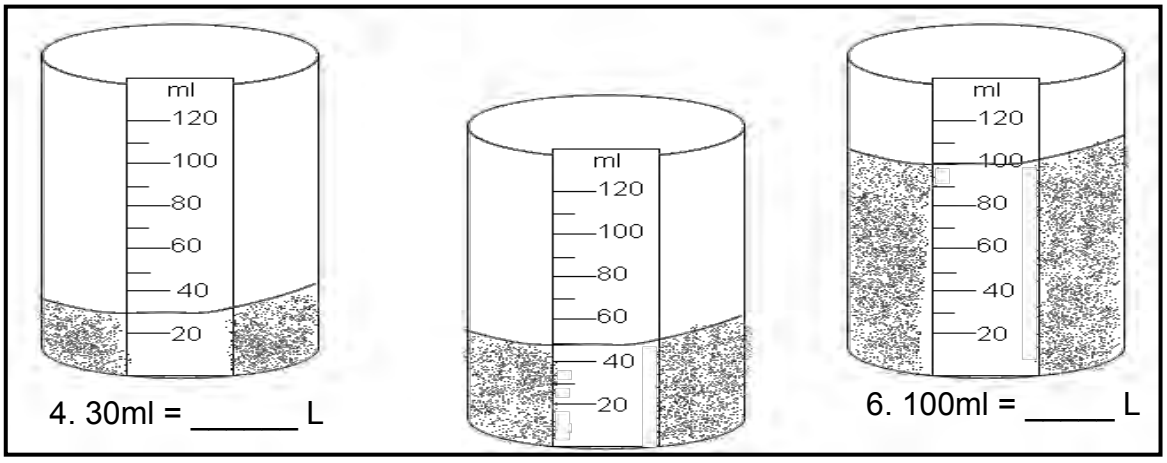
NOW DO PRACTICE EXERCISE 8 ON THE NEXT PAGE.

Practice Exercise 8

Read the volume of water in the jar and write the volumes of the jars in millitres and litres.



1. ____ml =____ L 2. ____ml = ____L 3. ____ml = ____L



4. 30ml = _____ L

5. 50ml = _____ L

6. 100ml = _____ L

CHECK YOUR WORK. ANSWERS ARE AT THE END OF STRAND.

Lesson 9: Measuring Volume

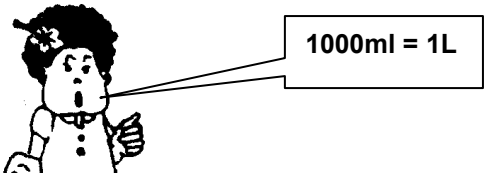
Welcome to Lesson 9 of Strand 1. In the last lesson you learnt about how to construct a measuring scale to measure volume. In this lesson you will learn more about volume. You have also constructed your own measuring cylinder so now you can use that to do the next activities if you do not have a proper measuring cylinder.

Your Aims:

- define volume
- measure volume correctly
- measure volume of objects by taking away water is called displacement of water

Measuring VolumE

Volume is the amount of space that something takes up. The standard unit of volume is the **litre (L)**. For convenience, smaller volumes are often measured in millilitres (ml).

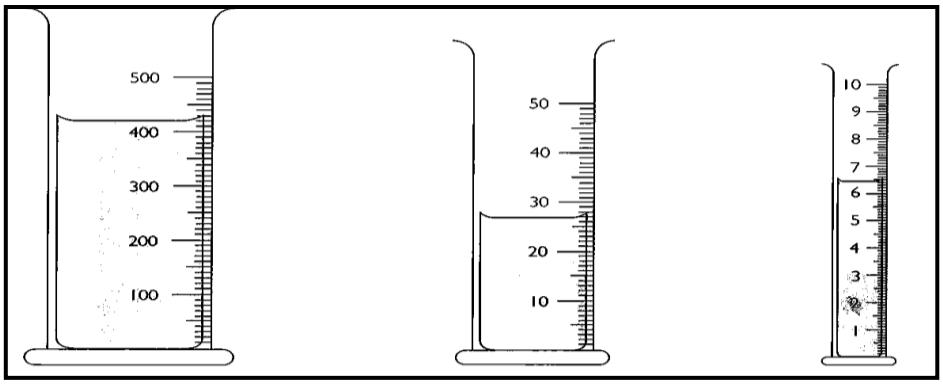


Volumes of liquids are usually measured in millilitres (mL) for small volumes and litres (L) for larger volumes. Measuring cylinder is used to measure volume in a laboratory. The cylinders come in different sizes; each cylinder has its own scale marked on the side of the cylinder. Care must be taken when reading a scale.

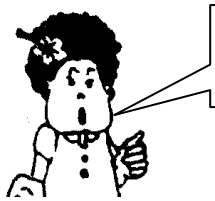
To read the volume in a measuring cylinder the surface of the liquid is used as a pointer.

Look at the measuring cylinders below.

The reading on the first cylinder is 42ml, the second cylinder is 27ml while the third one reads 6.4ml

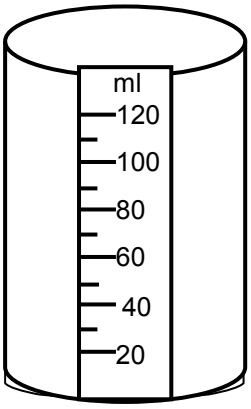


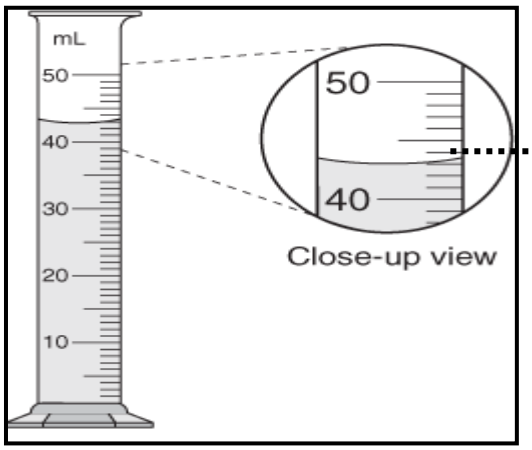
It is really important to choose the correct size of a measuring cylinder for the task. For example, if you want to measure 10ml of cough mixture, then a 15ml measuring cylinder will be more accurate than a 100ml cylinder.



In lesson 8, you marked your own measuring scale. Did you notice anything about the meniscus in the jar?

To read the scales on the measuring cylinder, your eyes must be level with the level of the water. The surface of the water is always curved. This is called the **meniscus**.



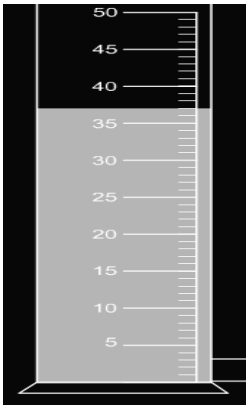


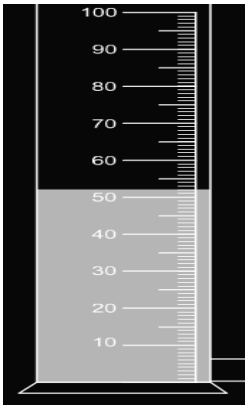
Read the measurement based on the bottom of the **meniscus** or curve. When using a real cylinder, make sure you are eye-level with the level of the water.

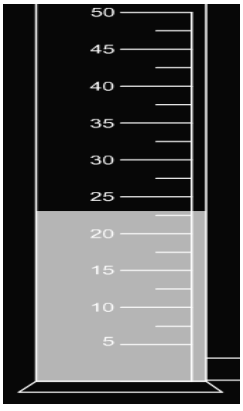
Activity 1: Now test yourself by doing this activity

What is the volume of the each measuring cylinder?

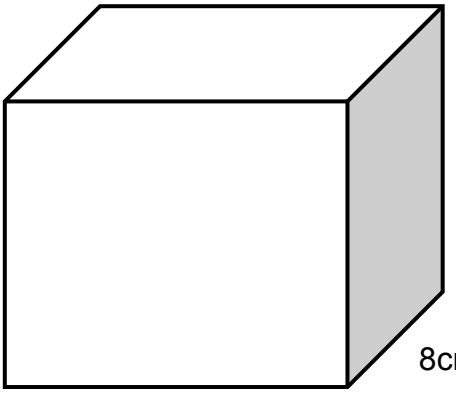
a) _____ b) _____ c) _____







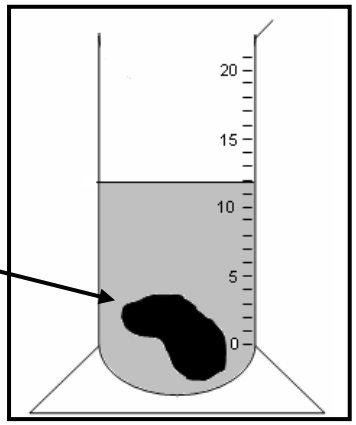
We can measure the volume of regular object using the formula **length x width x height.** You will do this in your math lesson



____ X ____ X ____ = ____

What is the volume of the stone?

Er….I think it is 12ml



There is a way to find the volume of the stone.

You cannot measure the volume of the stone by just putting it into a measuring jar.

Yes I know! I can also measure the volume of regular objects using water displacement.

Activity 2: **Now test yourself by doing this activity.**

Experiment: Finding the Volume of a stone.

You will need
1. your measuring jar
2. stone that fits into the jar
3. some water
4. a piece of string

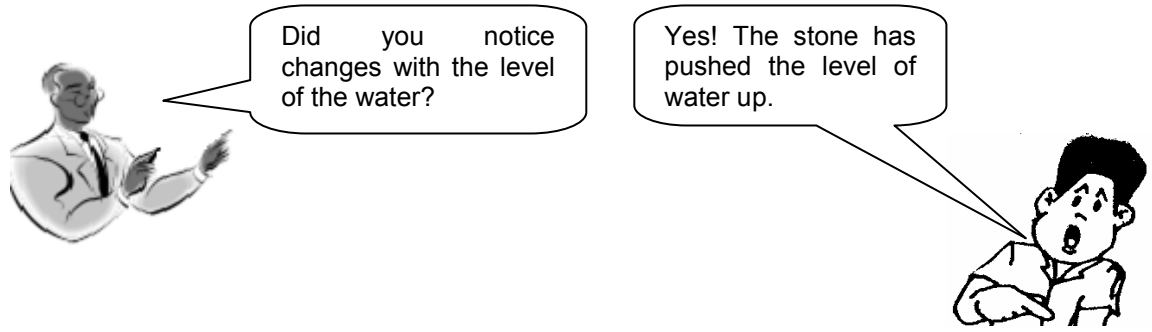
Follow these Steps.

Step 1. Tie a piece of string onto the stone.

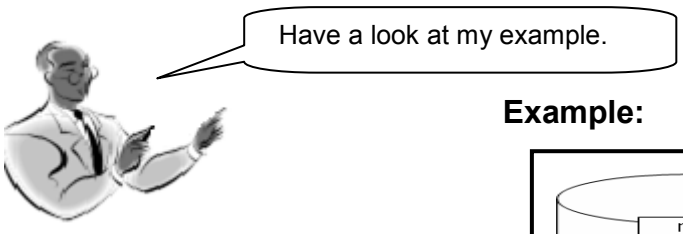
Step 2. Put some water into the jar so that the water is about half-full. Make the water level line up with a line on your volume scale. Write the volume of the water in the jar down. _____

Step 3. Put the stone into the water. The stone must go under the water. Water must not spill out of the jar.

Step 4. Now look at the new level of the water in the jar. Write the new level of the water down. New level _____

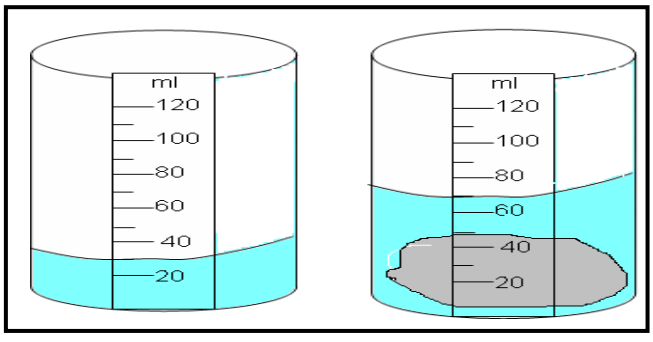


Now you can measure how much water was pushed up the jar. That is the space occupied by the stone.



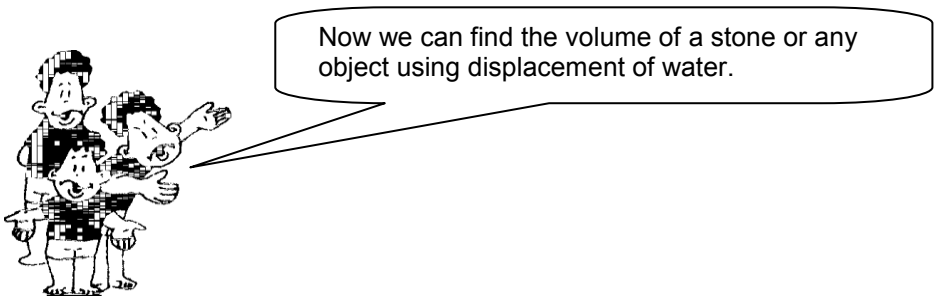
Example:

The water level started at 30ml. The water level was pushed up to 70ml when the stone is put in the cylinder. So the volume of the water was 70 – 30 = **40ml.**



Set your work as shown in the box below.

Amount of H_2O with object = _____
Amount of H_2O without object = _____
Difference = Volume

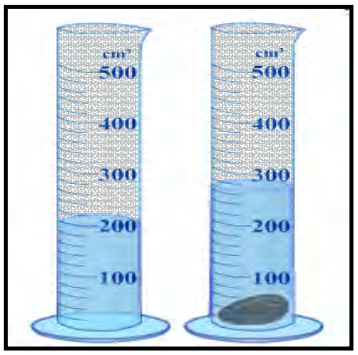


Activity 3: **Now test yourself by doing this activity.**

Find the Volume of an object

Answer the following questions.

1. Find the volume of the object in the measuring cylinder shown below.

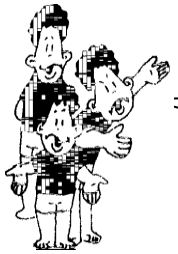


Amount of H_2O with object = ____ ml

Amount of H_2O without object = ____ ml

Volume = 300 ml – 200 ml = _____

REMEMBER: The volume of the object is the volume of water that has been pushed up or is the amount of water that has been displaced.



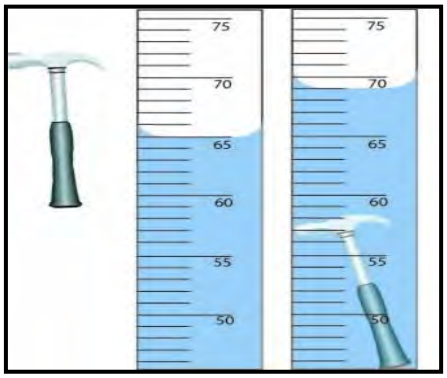
Now let us see if you can read scales on your measuring cylinders

Oh, I think I can convert millilitres into litres.

Activity 4: Now test yourself by doing this activity.

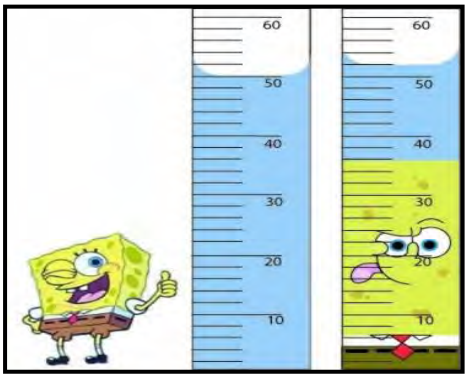
Read and complete the following exercises.

1. What is the volume of the objects?



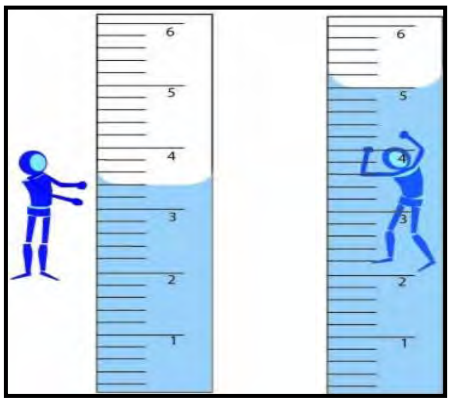
L

a) Answer = _____



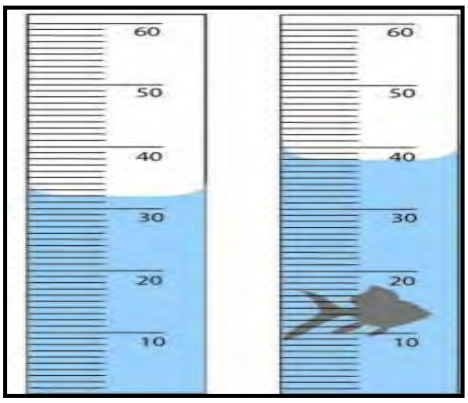
L

b) Answer = _____



mL

c) Answer = _____



mL

d) Answer = _____

Summary

You have come to the end of lesson 9. In this lesson you have learnt that:

- the metric unit for volume is millilitre and litres.
- the amount of water that is displaced by the object is its volume.
- to read the scales on the measuring cylinder, your eyes must be level with the level of the water.
- the surface of the water that is always curved is called the meniscus.

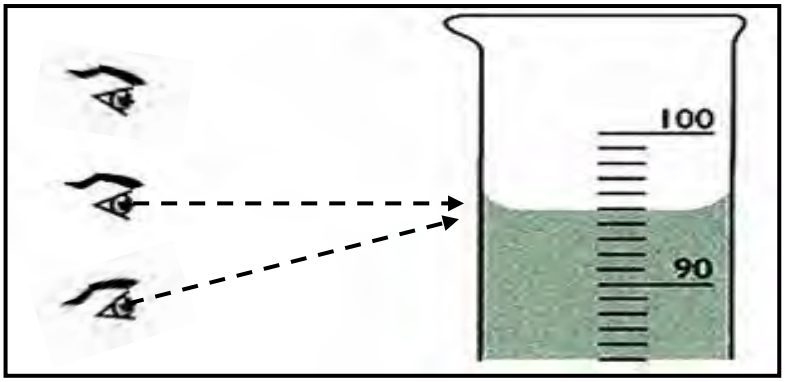
NOW DO PRACTICE EXERCISE 9 ON THE NEXT PAGE

Practice Exercise 9

1. Look at diagram below and answer the questions

   a) Which demonstrates the correct way of reading the scale from the measuring cylinder? _____

   b) What is the reading on the measuring cylinder? _____



2. Alice used her measuring jar to measure the volume of a stone, a marble and a kaukau. Here are Alice‟s results. Write down the correct volume of the objects in the table.

Objects	Volume of water	Volume of water and the object	Volume of object
Stone	150 ml	200 ml	
Marble	50	65	
Kaukau	100	200	

3. Covert the following measurements.

   a. 750millitres = _____litres

   b. 50litres = _____millilitres

   c. 4.5litres = _____millilitres

   d. 1050millilitres = _____litres

   e. 2000litres = _____gallon

CHECK YOUR WORK. ANSWERS ARE AT THE END OF STRAND.

Answers to Activities

Activity 1

a) 37ml

b) 52ml

c) 22ml

Activity 3

Volume of object 100ml

Activity 4

a) 4l

b) 1l

c) 1.8ml

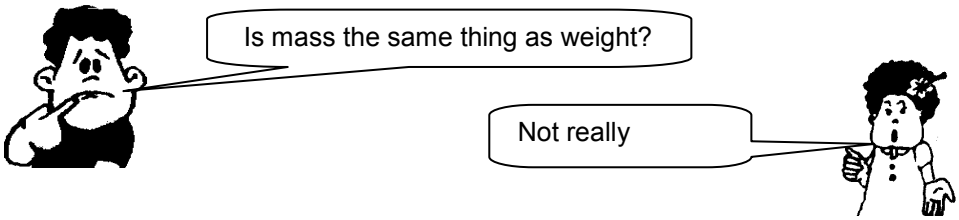
d) 6ml

Lesson 10: Mass and Weight

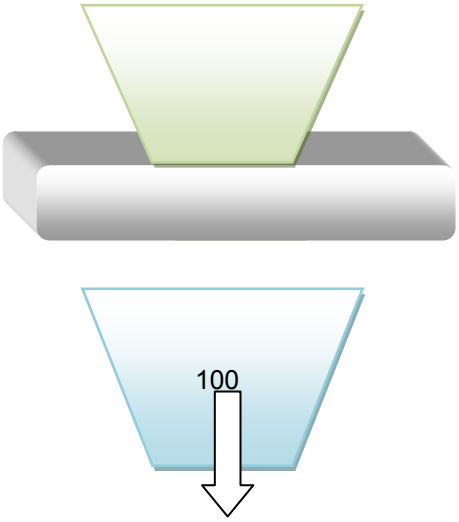
Welcome to Lesson 10 of Strand 1. In the last lesson you learnt about how to measure volume. In this lesson you will learn about what is mass and weight?

Your Aims:

- define mass and weight
- identify the units used to measure mass and weight
- identify the instruments used to measure weight and mass



Many times we get confused with mass and weight. We think they are the same thing but mass and weight are not the same thing. To be able to fully see the differences we will look at the definitions that are accepted by scientists today

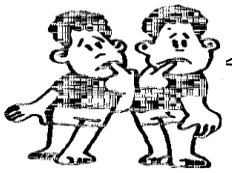


An objects **weight** is how hard gravity is pulling on it. We think the weight is the same everywhere because we all live on the surface of the planet Earth!

But if the object were far out in space it would exerting little or no force on the scales. Eg. On the moon the gravity is less, therefore object will have less weight on moon than on Earth.

The scales would show **0kg** ... but the mass is still **100kg**

An object's **mass does not change** (unless you remove some!), but its **weight can change.**



People often use "weight" to mean "mass", and vice versa.
We do not notice a difference because gravity is pretty much the same everywhere on Earth,

But remember, they do not mean the same thing, and they can have different measurements.

Here are some conditions where the Weight might change:

- in space (can be weightless!)
- on the moon (a 100kg mass would weigh 16.6kg)
- you can even get very slight differences in weight in different locations on earth!

Weight is a Force

So, if weight and mass are different, why are they both in kilograms? Well, weight should not really be in kilograms!

We have used "kilogram" so far because that is what you would see on the scales, but it is technically wrong to talk about weight in kilograms but there is a better unit, **Newtons.** The correct unit for force is N.

Gravity makes a 1kilogram **mass** exert about **9.8** Newton of force.

So a 100kg mass really weighs about 980 Newtons on Earth.

What would be the weight in Newtons if you were **40kg** in mass?

40 kg = _____ N

1 kg = 9.8

9.8 N = 40 kg

= 392 N

Why do scales show kilograms or grams?

The unit of weight is the Newtons (N). Although many people use grams (g) or kilograms (kg), these are really units for mass.

Scales should really show Newtons, but that might confuse people!

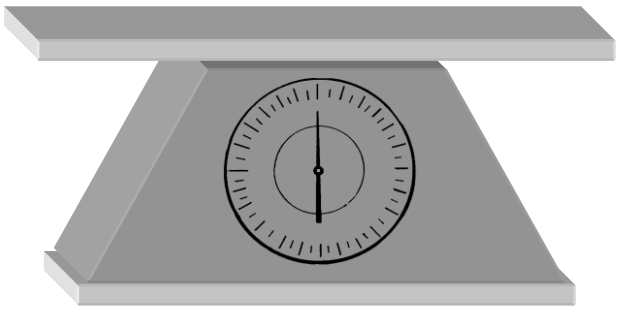
Activity 1: **Now test yourself by doing this activity.**

1. How many Newtons should the scales show if your mass was 67kg? _____

2. How many Newtons would 1kg of bananas weigh on earth? _____

3. Alice is 15kg. What would Alice‟s mass be if she travels in space? _____

So **mass** is the measurement of the amount of matter in an object. The amount of mass affects the weight of an object, but mass is not the same as weight. Moving an object to the top of the mountain does not change the amount of matter in an object. Its mass stays the same. Mass is measured by using a **balance**, often using the units of grams, milligrams or kilograms.



Remember: A Balance is used for measuring mass because a balance compares an object's mass to a set of standards.

A **scale** is a device used to measure mass.

A **calibrated scale** has a bar at the top that can be read in a manner similar to that of a ruler.

A **two-arm balance** is used by adding weights to one side of the scale until this amount is equal to the mass of the object being weighed on the other side.

A **triple beam balance** or nowadays an **electronic scale** is used to measure weight and mass. A triple-beam balance gets its name because it has three beams that allow you to move known masses along the beam

Weight is a measure of the force of gravity acting on an object‟s mass. The weight of the object is the force of gravity on the object and it is measured in Newtons. The instrument used to measure weight is a spring balance.
If the force of attraction changes, the weight will also change. The word mass refers to the total amount of material in a substance.

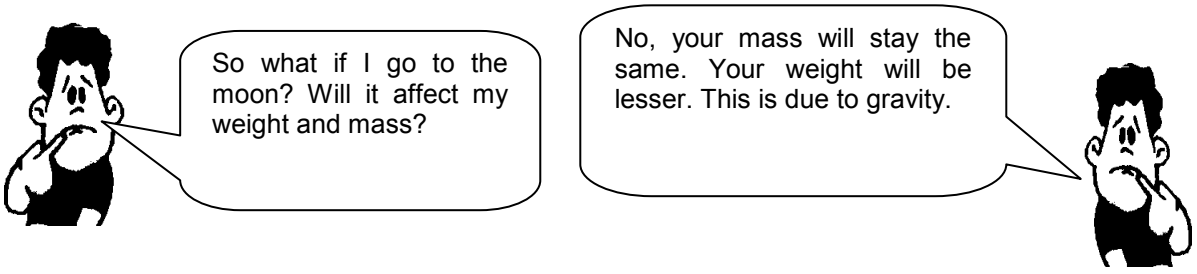
The scales of weighing machines are usually marked in units of mass, that is, kilograms and grams. This is the main reason why most people think mass and weight are the same. They are not the same! When you weigh something or yourself, you are actually measuring the force, that is the pull of gravity, and not mass. Weight is the measure of the pull of gravity on an object.

So **Gravity** is a force that pulls two objects toward each other. The force (on the objects) is a measure of the amount of push or pull exerted on an object and it is measured in Newtons.

When measuring with a spring scale, a spring scale is stretched or compressed by the object. The amount that the spring length changes, indicates the object‟s weight.

If an object is too large to hang from a scale, you can add up the weight of all the object‟s parts. The total weight of the parts always equals the weight of the whole object. Weight changes when the pull of gravity changes

Gravity is not the same everywhere on Earth. For example, the pull of gravity decreases slightly as you go to the top of a mountain. Therefore, the weight becomes a little less. But your mass remains the same. As discussed earlier, the mass of the object stays the same anywhere, but the weight changes depending on the gravity.



Remember: A spring scale is used for measuring weight because it measures the force of gravity pulling objects downwards.

Remember the measure of mass? They are shown in the table below.

10 milligrams (mm)	1 centigram (cg)
10 centigrams(cg)	1 decigram (dg)
10 decigrams (dg)	1 gram (g)
10 grams (g)	1 decagram (dag)
10 decagrams (dag)	1 hectogram (hg)
10 hectograms (hg)	1 kilogram (kg)
1000 kilograms (kg)	1 tonne (t)

REMEMBER: 1000g = 1 kg

Activity 2: Now test yourself by doing this activity.

Answer the following questions:

1. What unit would you use to measure the weight of an elephant? _____

2. What unit would you use to measure the weight of a new born baby? _____

3. What unit would you use to measure the weight of an average man? _____

4. How many kilograms is equal to 1tonne? _____

5. How many milligrams is equal to 1gram? _____

When to Use Which Unit?
When measuring the mass of a very small object, such as a leaf, the best unit to use is the **milligram**.

The mass of a slightly larger object, such as an apple, is measured using **grams**.

Large objects, such as a person, can be measured using **kilograms** or pounds.

When measuring even **larger** objects, like a whale, or a truck, the best units to use are **tons** or **kilograms**.

Activity 3: Now test yourself by doing this activity.

1. Fill in the blanks, using either mass or weight.

   a. The amount of matter in an object is called its _____.

   b. The force of gravity on an object is called its_____.

   c. If you take a spaceship into space, your _____stays the same.

   d. If you take a spaceship into space, your _____changes.

   e. The force of gravity when one object has a much larger _____ than the other object.

   f. If you double the mass of an object, you double the object‟s _____.

g. On Earth you can compare the masses of different objects by comparing their _____.

h. _____ is measured in grams or kilograms.

i. _____ is measured in Newtons.

2. If you drop a 50 toea coin and a 10 toea coin from a tall building,

a. Do the objects have the same mass? _____

b. Will both coins hit the ground at the same time? _____

Note: Run your own test with 2 objects of very different mass, and see what happens.

REMEMBER: The weight of an item refers to the force of gravity acting on an object.

Summary

You have come to the end of lesson 10. In this lesson you have learnt that:

- weight is the measure of the pull of the gravity on an object.
- if the force of attraction changes, the weight will also change.
- the mass of an object is the measurement of the amount of matter in an object. The mass of objects do not change anywhere in the universe.
- for any given object on earth, its mass and weight are equal due to only one full force which is the gravity.
- the units of mass are grams and kilogram
- 1kg is equal to 9.8 Newtons

NOW DO PRACTICE EXERCISE 10 ON THE NEXT PAGE.

Practice Exercise 10

Answer the following questions:

1. Define the following terms

   a) Weight _____

   b) Mass _____

2. What unit would we use to measure the weight of a baby? _____

3. How many kilograms can you find in 1000g? _____

4. Convert the following into Newtons

   a) 56 kg = _____ N

   b) 98 kg = _____ N

   c) 100 kg = _____ N

CHECK YOUR WORK. ANSWERS ARE AT THE END OF STRAND.

Answers to Activities.

Activity 1

1) 656.6N
2) 9.8N
3) 147N

Activity 2

1) kilograms 2) kilograms 3) kilogram 4) 1000kg 5) 1000 mg

Activity 3

1. a) mass b) weight c) mass d) weight e) mass f) weight

   g) weight h) weight i) mass

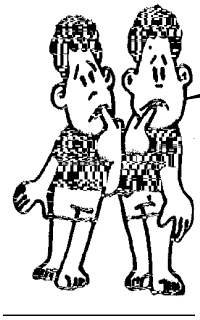
2. a) no b) yes

Lesson 11: Measuring Mass

Welcome to Lesson 11 of Strand 1. In the last lesson you learnt about mass and weight. In this lesson you will learn to estimate the mass and use the instruments used to measure mass and weight.

Your Aims:

- estimate the mass of different objects or substances
- measure the actual weight of different objects or substances
- compare the mass of different substances



Well, you will be guided through this lesson carefully as you do not have a formal teacher with you.

There are some objects that you come across every day of your life. Can you estimate their mass? There are some things that you see in shops. They have their weight written on them. Can you think of others?

For example: Can you state the mass of a 1.5V battery? You have most probably seen mass of things like can of coke written on the side of the can.

Now let us try out this activity to see whether we can measure the mass of certain objects using our spring balance.

Activity 1: Now test yourself by doing this activity.

Estimating and Measuring Mass

This is what you must do; you will first estimate the mass of each object you see on the given table and then measure each object using the spring balance that you have made or you can use a spring balance or scale already available near you.

Estimate the mass of the given items and use a measuring scale to get the correct measurement.

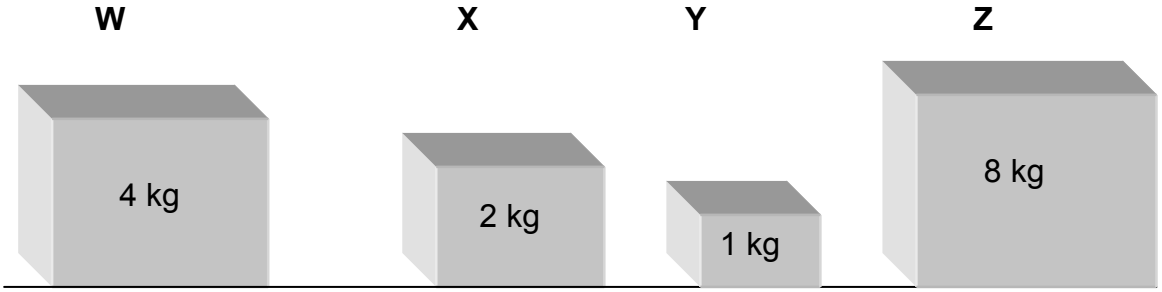
Object	Estimated Masses	Measured Mass
Big Battery		
Small battery		
Klina laundry soap		
Small ox & palm (red)		
Can of Sprite (full)		

What were you answers? Were your estimates close to the actual mass of the object measured?

Do not cheat. Try to estimate the mass before you measure then compare your answers.

Activity 2: Now test yourself by doing this activity.

Read and answer the questions carefully.



Which object will move?

a. _____ the farthest distance?

b. _____ the least distance?

c. _____ twice as far as W?

d. _____ half as far as X?

e. _____ less far than Y?

f. _____ farther than X?

The objects are being pushed, not falling.
The 4 objects have different amounts of mass.
The same amount of force is used in pushing all 4 objects.

Summary

You have come to the end of lesson 11. In this lesson you have learnt that:

- mass and weight of objects can be estimated.
- mass of objects can be measured using the correct scale.

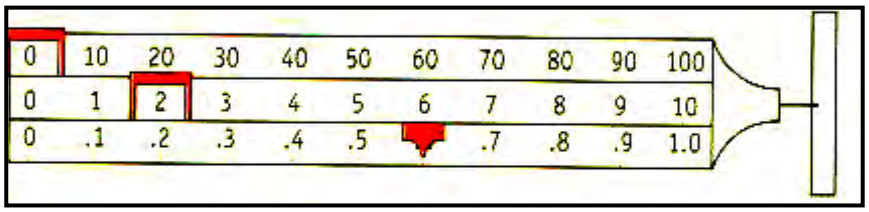
NOW DO PRACTICE EXERCISE 11 ON THE NEXT PAGE

PRACTICE EXERCISE 11

Answer the following questions:

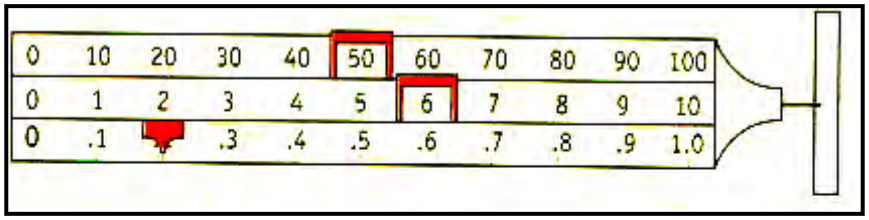
1. Read the following scales on the triple beam balance correctly and write the weight in grams.

a)



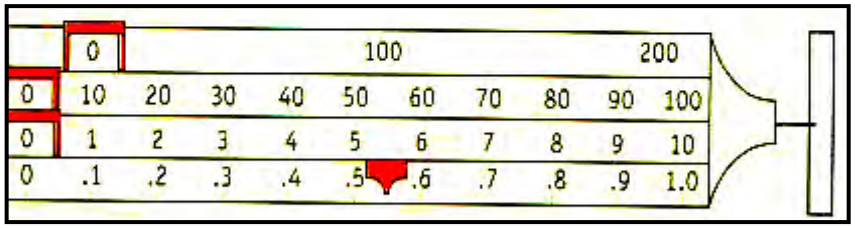
_____

b)



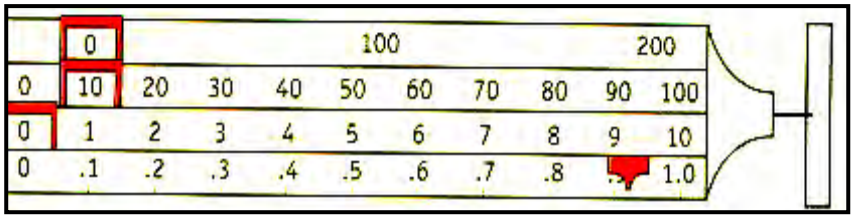
_____

c)



_____

d)



_____

2. Estimate the mass of the following items. Use your spring balance to measure the mass of each one of them and the go to your local store or supermarket and check to see if you have weighed the items correctly.

Object	Estimated Masses	Measured Mass
Big ox and palm		
Can of coke		
Tin of Besta tin fish (big)		

CHECK YOUR WORK. ANSWERS ARE AT THE END OF STRAND.

Answers to Activity 2

a) Y

b) Z

c) X

d) Y

e) Z

f) Y

Lesson 12: Making a Spring Balance

Welcome to Lesson 12 of Strand 1. In the last lesson you learnt that we use a spring balance to measure weight. Well! In this lesson you will learn to construct a simple spring balance.

Your Aims:

- construct a spring balance
- use the spring balance to measure certain mass of different objects

Making a Spring Balance

You will be able to use your spring balance to measure weight of different small objects.

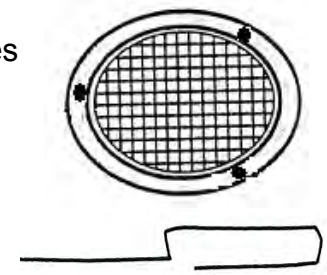
Now what do you need to do?

You will need:

1. a drawing pin or a nail
2. a thin rubber band
3. four paper clips or four pieces of wire
4. a thin lid or a lid of a jar
5. a strip of paper 2cm wide
6. something to stick the paper into wood
7. six 20 toea coins

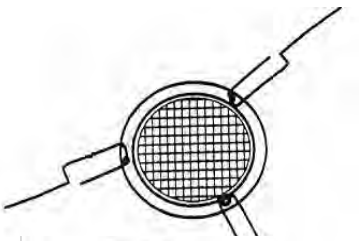
Follow these steps

1. Use the drawing pin or nail to make three holes around the edge of your lid

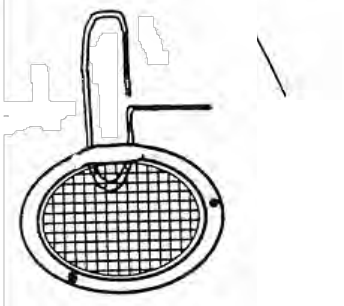


2. Open out three of the paper clips so that they are this shape

3. Put this end of a paper clip though each of the holes in the lid. Bend a small piece of the paper clip do that it stays in the hole. Your lid and the paper clips should look like this



4. Bend another paper clip to this shape. This will be the pointer of your spring balance

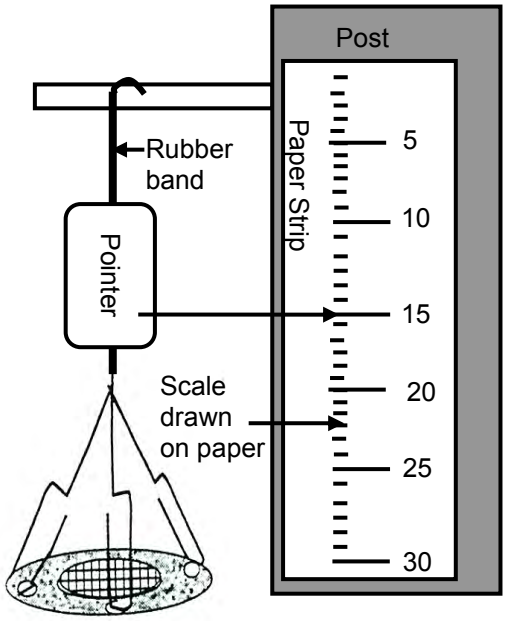


5. Hang the lid from the pointer. The lid must not tip to one side.

6. Cut the rubber band and tie one end of the rubber band to the loop of the pointer.

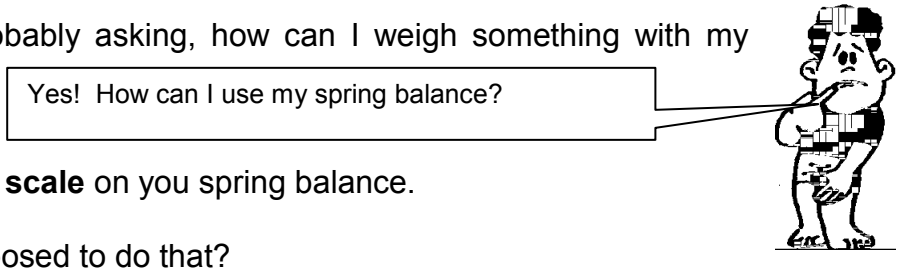
7. Put a nail in a wooden post. Tie the rubber to it so the lid hangs. The lid must not touch the post.

8. Stick a strip of paper onto the post so that the pointer is pointing near the top of the paper.



Your spring balance is nearly finished.

Now, you are probably asking, how can I weigh something with my spring balance?



You need to put a **scale** on you spring balance.

How are you supposed to do that?
Well, you should remember making a volume scale in lesson 8. The next four steps will guide you how to make a **weight scale**

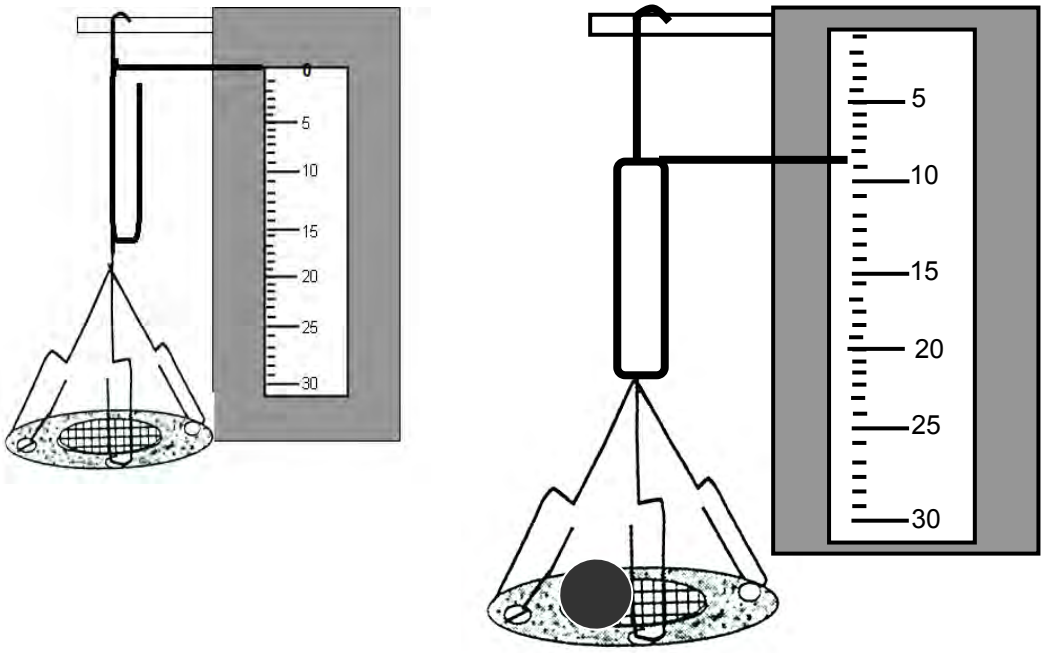
9. When there is nothing in the lid, draw a line on the paper strip to show the position of the pointer, write **0** by the line

10. Put **one** 20 toea coin in the lid. The pointer should move down. A 20 toea coin weighs about 10 grams. Draw a line to show the new position of the pointer. Write 10 by this line.

11. Put another 20 toea coin in the lid. Draw a line to show the positing of the pointer. Write 20 by this line.

12. Keep adding 20 toea coins to the lid. Each time you add a coin draw a line to show the position of the pointer and write the number of grams in the lid.

13. **Do not** stretch the rubber too much. About 6 coins are enough.



Now you will learn how to use your spring balance in the next activity.

Make sure that your spring balance measures accurately by checking that the pointer points at the 0 grams. Get your reading where the rubber band stops stretching

---

Summary

You have come to the end of lesson 12. In this lesson you have learnt that:

- you can make your own spring balance when required and use it to weigh small objects or things. In order for you to get accurate results the experiment has to be fair.

NOW DO PRACTICE EXERCISE 11 ON THE NEXT PAGE

PRACTICE EXERCISE 12

Answer the following questions:

Alice used her spring balance to weigh some things around her house. You must use your spring balance to weight the two things that Alice weighed.

She weighed an egg. What is the weight of your egg? _____

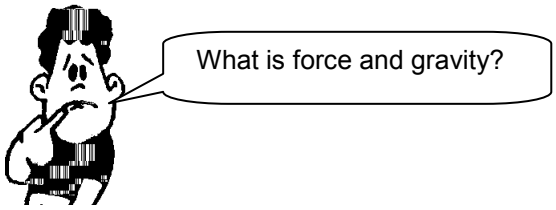
She weighed a small stone. What is the weight of the stone? _____

Lesson 13: Measuring Force

Welcome to Lesson 13 of Strand 1. From the last lessons, you should by now know the basic meaning of weight and mass. In this lesson you will learn that weight and mass are directly related to force and gravity. Therefore you will learn what force and gravity is and how to measure them correctly.

Your Aims:

- define force and gravity
- identify the metric unit for measuring force
- read spring balances correctly and
- convert units from kilograms, grams to Newton correctly



Activity 1: Now test yourself by doing this activity.

1. What happens in a wind storm? _____
2. What happens in a tug of war?
   _____
3. What happens in arm wrestling?
   _____
4. What do these things have in common?
   _____

Activity 2: Now test yourself by doing this activity.

This time you will be investigating a different push and pull.

Ask yourself: What do you predict will happen when I drop the ball and let it bounce?

Then do the following:

1. Drop the ball from the top of the metre stick. (You can now use your metre ruler)

2. Measure the height of the first bounce.

3. Record the results on the table below

4. Predict what you think will happen to the height of the ball on the second bounce. Drop the ball a second time from the top of the metre stick and record the height of the second bounce. Record it.

5. Continue dropping the ball to collect the height of the third and fourth bounce, predict what you think the height of the bounce might be each time.

	Height of bounce
1metre	
2metre	
3metre	

6. What causes the ball to fall to the floor?

   _____

7. Why is there a difference in the height of each bounce?

   _____

What other natural push or pulls on the Earth can you think of?
(Wind, electric force, magnetic force)

Activity 3: Now test yourself by doing this activity.

Try to demonstrate these forces, yourself:

1. Use a magnet to pull a paper clip across a desk or overhead.

2. For electric force, you can run a plastic comb briskly through someone‟s hair and bring the comb close to little pieces of paper.

3. For the force of wind, simply blow on a piece of paper.

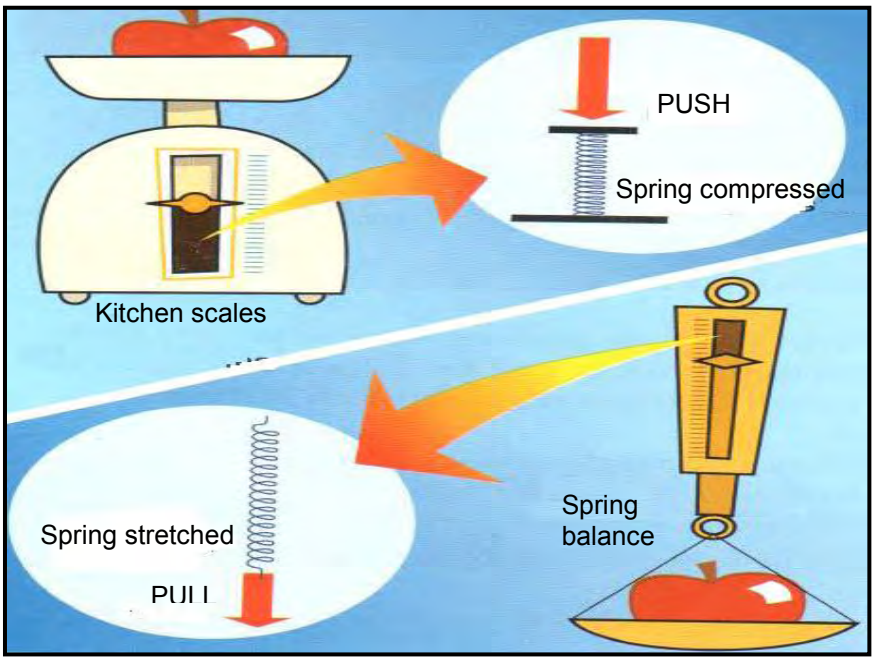
What is force?
A **force** is a push or a pull. You will also learn more about forces in your Grade 7 Strand 3 course.

Gravity is the invisible force that holds us on the surface of the Earth or it is also known in simple terms as the pull of the Earth. Everything is pulled towards the Earth by the force of gravity. Weight is the measure of the force of gravity acting on the objects mass.

Measuring forces
A spring stretches when a pulling force acts on it and it is squashed or compressed when a pushing force acts on it. A **force metre,** often called a **spring balance,** consists of a spring attached to a pointer. The bigger the force, the more its spring stretches. For this reason, a spring can be used to measure the strength forces. A pointer attached to the spring moves as the spring changes its length and the force can be read on a scale.

A spring balance or a spring scale is one instrument used to measure the push force.

A spring balance or spring scale has a hook on the bottom, measures the pull force.



The heavier an object is the, the stronger the force. And the stronger the force, the more the spring will stretch or compress.

The marker on the spring shows the size of the force that has stretched the spring. As the spring stretches, the marker moves along a row of numbers on the scale. These numbers are the unit of force are the unit of force the scientists call the Newton. As shown in the picture, One Newton (1 N) is the force you need to lift one small apple.

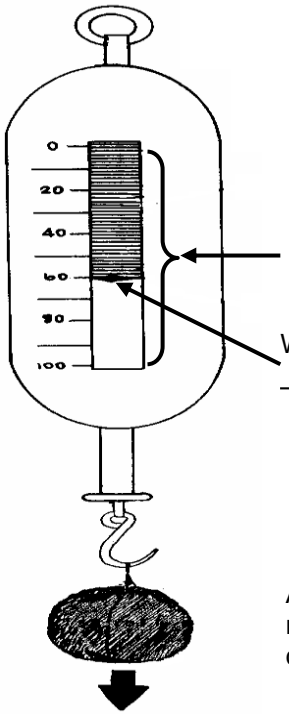
The Newton was name after Sir Isaac Newton, who explained how force and motion was linked.

REMEMBER: The unit of force is Newton, N

Activity 5: Now test yourself by doing this activity.

Study the diagram of the spring balance and out the weight of the stone.

The force of gravity pulls the stone. The spring stretches and the pointer moves down



This is the spring inside.

What is the weight of the stone?

_____

A heavier stone stretches the spring more, so the pointer moves further down.

The table below gives you some idea about approximate sizes of some forces.

Force to lift one mango	1N
Force to lift 1kg bag of sugar	10N
Force you exert sitting on someone	500N
Force needed to launch a rocket	33 000 000

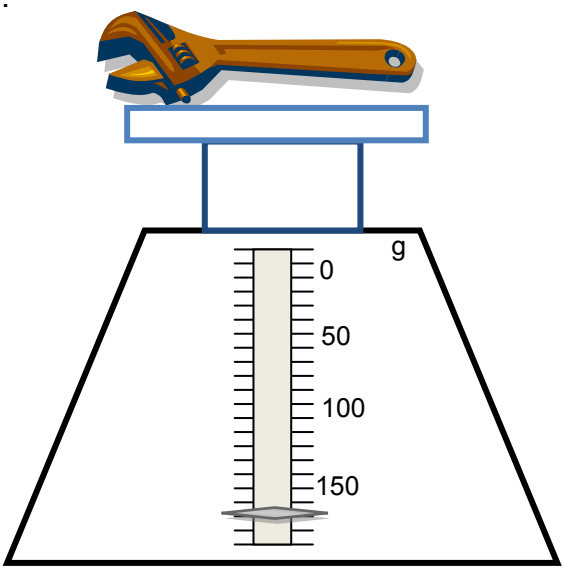
REMEMBER
Mass is measured in kilograms and weight is measured in newtons. The weight of the object depends upon its mass.

Activity 6: Now test yourself by doing this activity.

Read the weight on the scales and write the correct answers down.

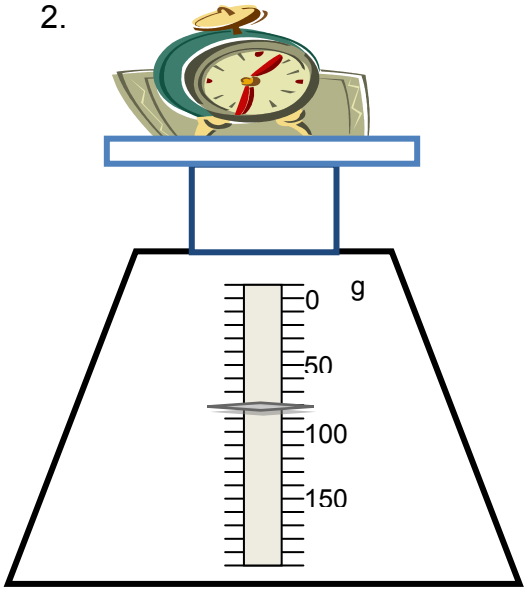
Write the answers down and convert to Newtons. (Hint: 1g is approximately 0.01N)

1.



Answer: _____

2.



Answer: _____

Summary

You have come to the end of lesson 13. In this lesson you have learnt that:

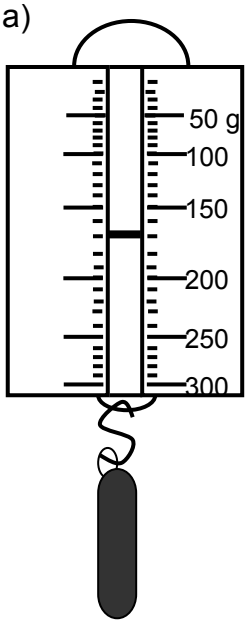
- a force is any push or pull.
- weight is the measure of the force of gravity acting on the objects mass.
- gravity is the invisible force that holds us on the surface of the Earth.

NOW DO PRACTICE EXERCISE 13 ON THE NEXT PAGE

Practice Exercise 13

Read the following scales correctly and write the weight in **grams** and then convert your answers to **newtons** where required.

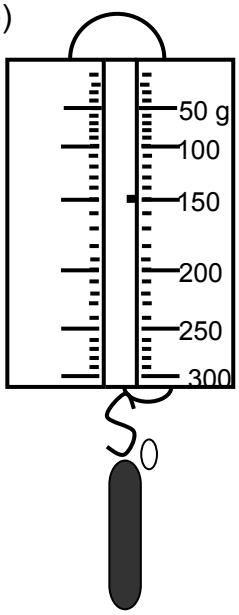
a)



Weight = _____

Newtons = _____

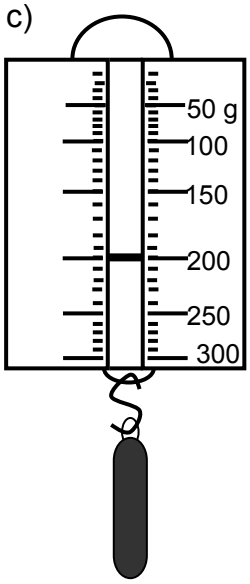
b)



Weight = _____

Newtons =_____

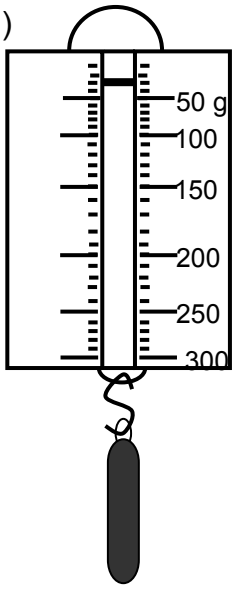
c)



Weight = _____

Newtons = _____

d)



Weight = _____

Newtons =_____

CHECK YOUR WORK. ANSWERS ARE AT THE END OF THE STRAND.

Answers to Activities

Activity 5

60N

Activity 6

1) 180g = 1.8N

2) 80g = 0.8N

Lesson 14: Temperature and Time

Welcome to Lesson 14 of Strand 1. In the last lesson you learnt what force is and how to measure forces. In this lesson you will learn how to measure temperature and time correctly.

Your Aims:

- define and discuss temperature and time
- identify instruments used to measure time and temperature and
- take the temperature from given instruments that are used to measure time and temperature

Time

Can you recall the basic units of measuring time?

Time is measured in a number of units. That is seconds, minutes and hours for short periods and days, months and years for long period.

The table below shows the basic measures of time and their conversions

Measures of Time		
1 minutes (min)	=	60 seconds (s)
1 hour (h)	=	60 minutes (min)
1 day	=	24 hours
1 month	=	28 days
	=	4 weeks
1 year (yr)	=	52 weeks
	=	12 months
	=	365 days
1 leap year	=	366 days
1 decade	=	10 years
1 century	=	100 years
1 millennium	=	1000 years

Using the information above, when you are asked to solve problems to do with time, you can change or convert the units.

For example; **60 seconds = 1 minute**, so to change if you were asked to find how many seconds were there in 3 minutes, you simply **multiply** 60 seconds by 3.

What would be your answer? _____,

Yes, your answer will be **180 seconds**.

So remember, when you want to change large units to small units, you **multiply** by the unit. When you want to change smaller units to large units you **divide** by the units.

Activity 1: **Now test yourself by doing this activity.**

Complete the following.

a) 2 mins = _____ seconds b) 3 hours = _____ minutes.

c) 5 days = _____ hours d) 12 hours = _____ seconds

How do we tell the time of the day?
We use clocks to tell the time. Clocks and watches are the instrument used to measure time. Clocks use the unit of time and constantly repeat that unit and give a count of the number of times the unit is used.

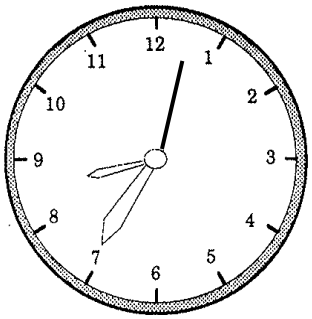
Today, we basically have two types of clocks;

1. the **digital clocks**

Digital clocks show us the time using numbers. The number of the left side of this mark (**:**) is the Hour and the number on the right side of the (**:**) is the Minutes.

This clock shows 8 hours and 53 minutes.

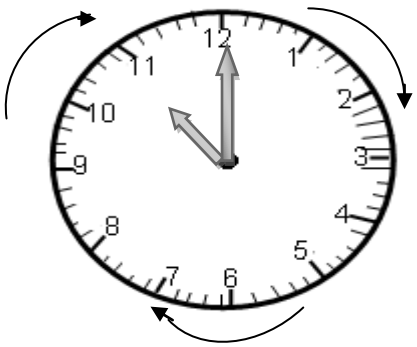
2. and the **analog clocks** (this clocks have hands)



The analog clock has an hour hand, minute and second hand. The hour hand is shorter than the minute and second hand and they both move around the clock face. This type of clock tells the time using the 12 hour system.

Here is an analog clock with 12 hours mark on it.

The short hand is the hour hand. It moves very slowly. It takes **one hour** to move from one number to the next.



Both hands of the clock move in a clockwise

The short hand is the minute hand. It goes around once in 1 hour. The space between any two numbers on the clock face is divided into divisions of 5. Each part is 1 minute.

Now, by learning about the two types of clocks above, you can already tell that there are two ways of showing time.

The two main ways of showing the time are:

1. With the 12 hour time
2. With the 24 hour time.

The 12-hour time
The 12-hour clock is the time conversion in which the 24 hours of the days are divided into period called the;

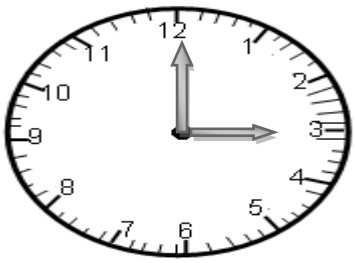
a.m. - that is the time from 12 midnight to twelve noon. It means morning. (before midday)

p.m. – that is the time from 12 noon up to before 12 midnight. It means evening. (after midday)

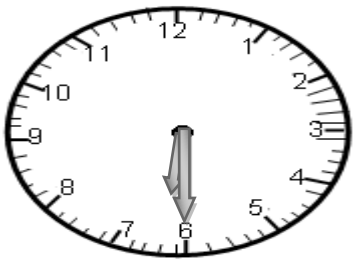
The 24-hour time
We have learnt that a 12-hour clock has 12 hours marked on it, but there are 24 hours in a day. This means the hours hands goes around **once in the morning** and once again in the evening.

Activity 2: **Now test yourself by doing this activity.**

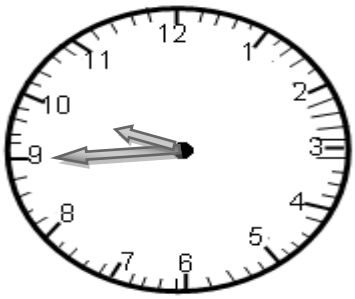
Tell the time given on these clocks correctly.



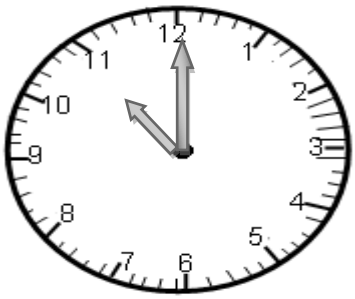
a) _____



b) _____



c) _____



d) _____

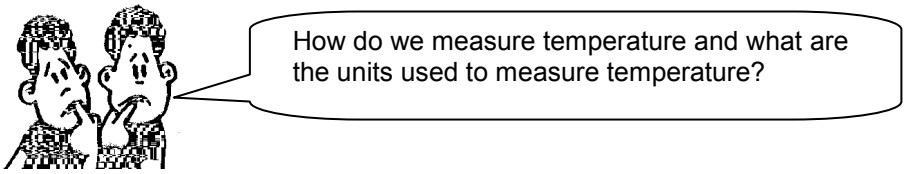
Now let us look at Temperature

What is Temperature?
Is temperature the same thing as heat? Temperature and heat are not the same thing. Temperature is a measurement of heat. Temperature tells whether something is hot or cold.

You measure temperature with a thermometer. A thermometer has a scale, such as Fahrenheit or Celsius. A thermometer hanging outdoors measures the temperature of the air. Air that is 32° Fahrenheit (0° Celsius) does not have much heat energy. At that temperature, water can freeze into ice. Air that is 100° Fahrenheit (38° Celsius) can make you feel very warm.

The higher the temperature the hotter it is, the lower the temperature, the colder it is.

It is easy to demonstrate how hot or cold something is when we place two objects of the same material together. You can use your senses to detect whether the materials are hot, warm or hot. But to get an accurate measurement of the temperature we use the instrument called **thermometer**. This is the instrument used to measure temperature.



There are different temperature scale that are used today in science.

1. Celsius or Centigrade Scale – The unit used to express the temperature is the Degree Celsius. We use the symbol ^{0}**C.**

2. Fahrenheit Scale – The unit used to express temperature is Degree Fahrenheit. We used the symbol ^{0}**F**

3. Kelvin Scale – The unit to express temperature is the Kelvin. The symbol used if **K**. Degree is not used in this scale.

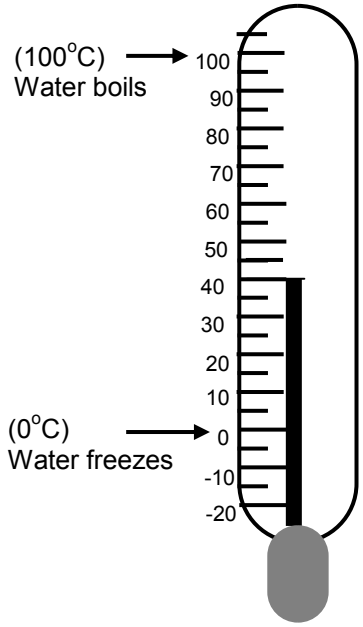
Temperatures today are mostly measured in degree Celsius. Sometimes you will see that both the Fahrenheit and degree Celsius are both marked on the scales of instrument used for measuring temperature.

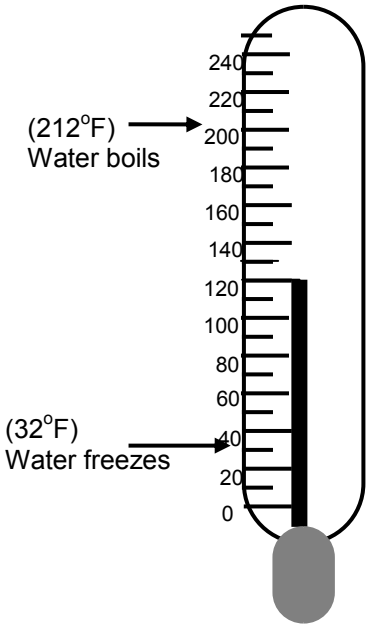
They are used mainly to make references to the **Freezing point** and the **Boiling point.**

Freezing point is the temperature at which liquid changes to solid.

Boiling point is when water changes from liquid to gas. You will learn more about these changes in Strand 3 of your course.

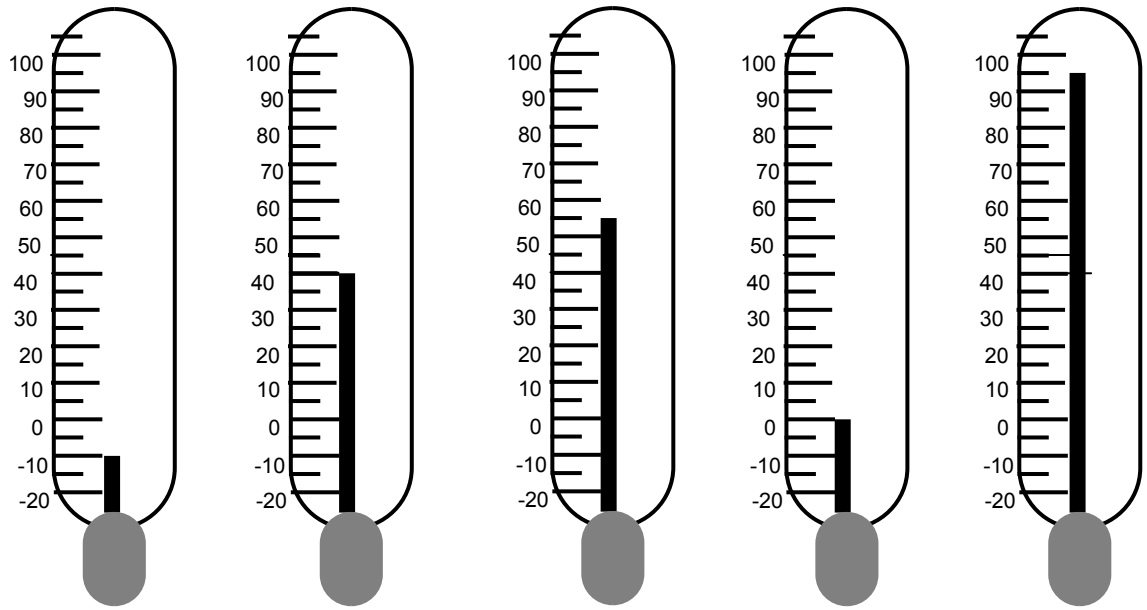
These thermometers below are here just for you to compare the boiling point. You will also learn more about this two measurement in your Grade 7 Math course.





Activity 3: Now test yourself by doing this activity.

Now let us read some scales of temperature from the diagrams given below. All readings are in Degree Celsius.



a) _____ b) _____ c) _____ d) _____ e) _____

Summary

You have come to the end of lesson 14. In this lesson you have learnt that:

- time is measured in seconds, minutes and hours for short periods and days, weeks, months and years for long period.
- the instrument used to measure time is clock or watch
- temperature is how hot or cold something is.
- the instrument used to measure temperature is thermometer.
- the unit used to measure temperature is Degree Celsius .
- the symbol for degree Celsius is ^{0}C**.**

NOW DO PRACTICE EXERCISE 14 ON THE NEXT PAGE

Practice Exercise 14

Answer the following questions:

1. What is the instrument used to measure temperature?

   _____

2. What is the instrument used to measure time?

   _____

3. What is the symbol used to express Degree Celsius?

   _____

4. There are 365 days in a year? How many weeks are there in a year?

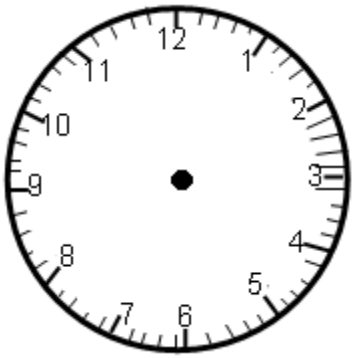
   _____

5. How many seconds equals 60 minutes?

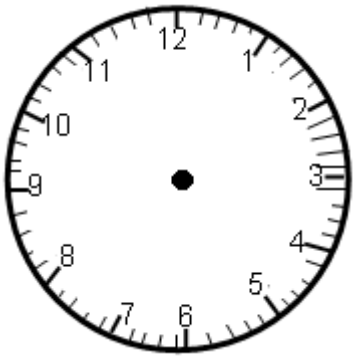
   _____

6. Draw the hands on the given clock face to show the times given

   a) Quarter to 5



   b) 10 minutes past 12



CHECK YOUR WORK. ANSWERS ARE AT THE END OF STRAND.

Answers to Activities

Activity 1

a) 120 seconds b) 180 seconds c) 120 hours d) 43 200 seconds

Activity 2

a) 3:00 or 3 o‟ clock b) 6:30 or Half past 6
c) 9:45 or quarter to 10 d) 11:00 or 11 o‟clock

Activity 3
a) -10^{o}C b) 40^{o}C c) 55^{o}C d) 0^{o}C e) 95^{o}C

Lesson 15: Plotting a Graph

Welcome to Lesson 15 of Strand 1. In the last lesson you learnt about how to correctly measure time and temperature. In this lesson you will learn about graphs. Reading scales is an important skill in science. You must also be able to read and record information in tables and graphs.

Your Aims:

- define graphs
- describe different graphs
- draw a line and bar graph
- draw conclusion from graphs

You will use the data you collected from the last lessons to draw your graphs. But first of all what is a column or bar graph and line graph? And what is a graph?

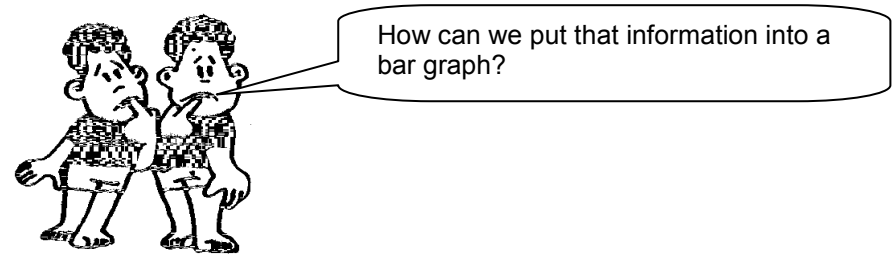
A graph is a means of displaying data. A **graph** is a chart or drawing that shows the relationship between changing things.
They are a diagram displaying the relationship between numbers or amounts. Common graphs use bars, lines, or parts of a circle to display data.

Line graphs are useful to use when you want to show relationships between two things being measured. There are types of graphs that you could also use, for example the pie graph or chart but we will look at the bar graph and the line graph first. From these two graphs you can be able to read the other graphs. We will also do some activities in plotting line graphs and column graphs, and also you will read from the graphs to answer some given questions.

Bar Graphs
Bar graphs are very useful ways of comparing data. Bar graphs are sometimes called bar charts.

Suppose you were investigating how long it took different model cars to travel down a wooden ramp. Here are the results.

Model Car	A	B	C	D	E
Average time to travel down ramp (seconds)	7	9	4	6	5

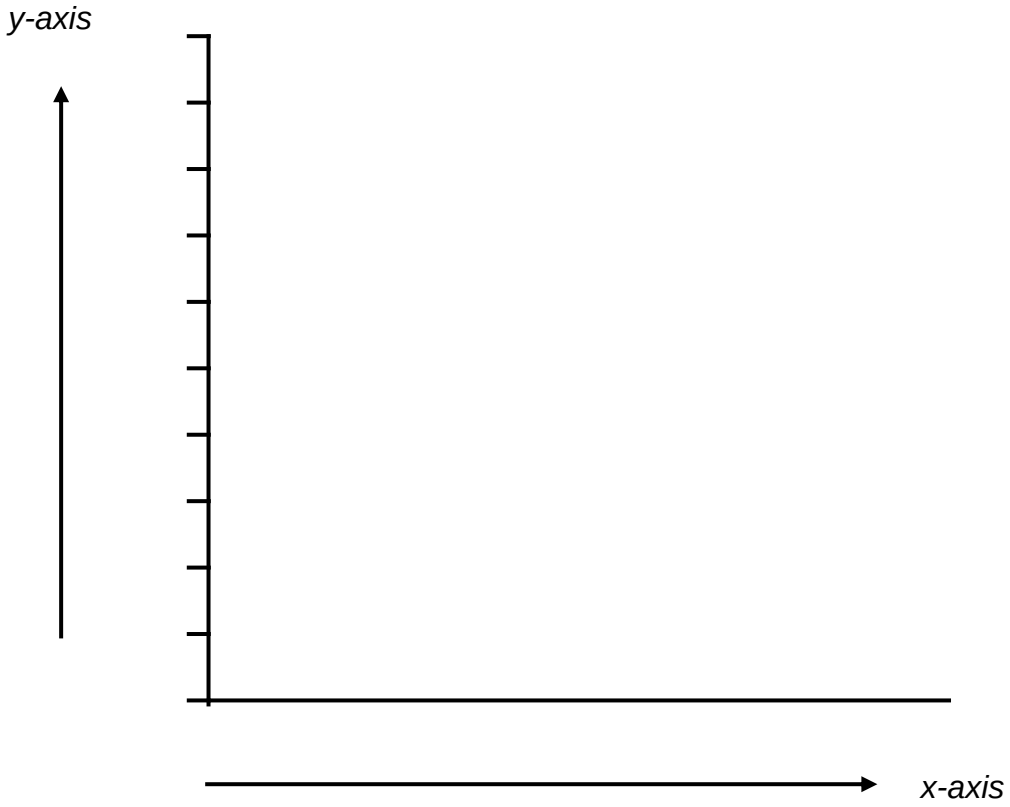


Activity 1: Now test yourself by doing this activity.

Plotting a Bar Graph

Now let us see if you can plot a bar graph using the information given above.

In this case time (in seconds) is on the vertical or *y*-axis and the type of car is on the horizontal or *x*-axis. Do not forget to put your title.



Check to see whether you have the same bar graph of chart as the one on the next page.

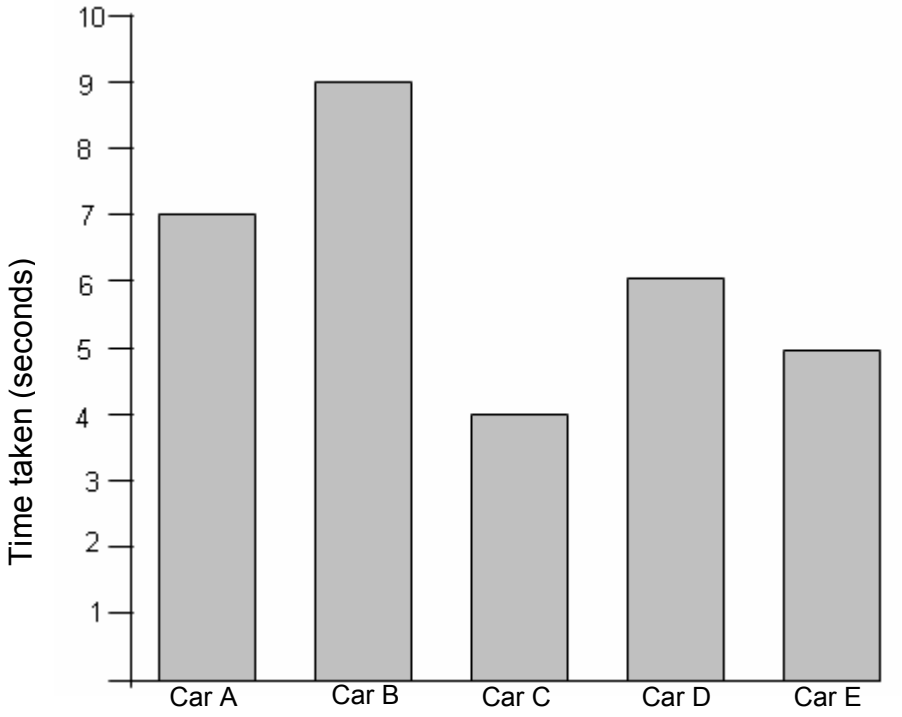
Remember:

This is the vertical axis or the y-axis (that is the line going up)

This is known as the horizontal axis or the x-axis (this is the line going across)

Your bar graph should look like this.

Time taken for Cars to travel down ramp



Activity 2: **Now test yourself by doing this activity.**

1. Look at the graph and answer the questions that follow.

   a) Which car is the fastest down the ramp?

   _____

   b) Which car is the slowest down the ramp?

   _____

   c) How many seconds did it take Car A to go down the ramp?

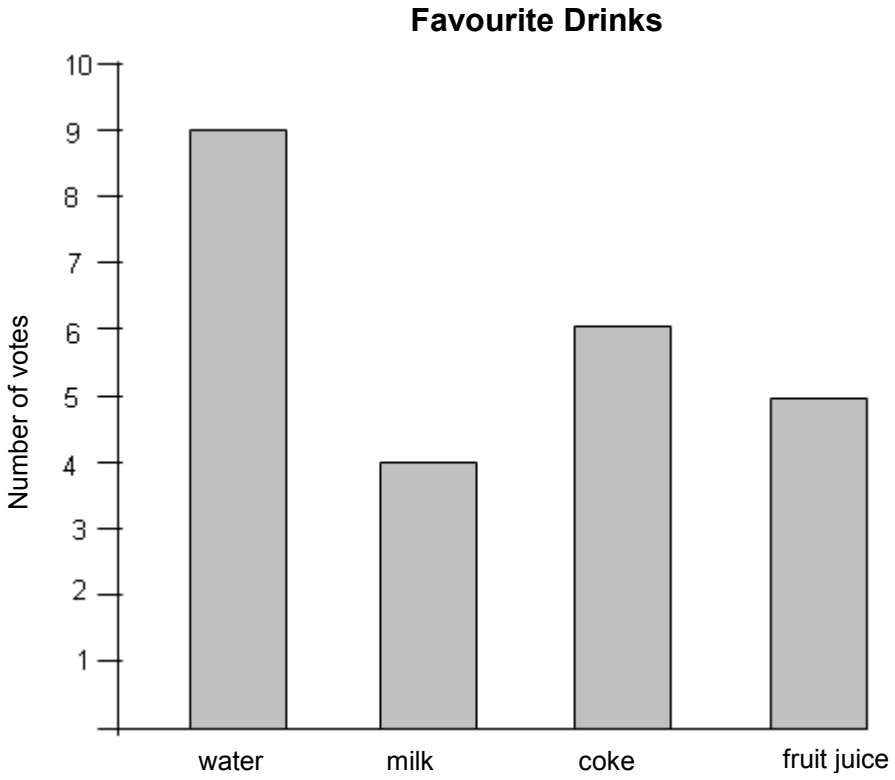
   _____

   d) How many seconds did Car A need to equal the time of Car B?

   _____

Activity 3: Now test yourself by doing this activity.

1. Study the bar graph carefully and answer the questions that follow



The bar graph shows the number of vote students in a certain class took for different drinks

a) How many students voted for water as their favourite drink? _____

b) How many votes is there altogether? _____

c) How many more students voted for water than milk? _____

d) If one more person voted for water, how many votes would water have? _____

e) What conclusion can you draw about the favourite drinks shown in the graph? _____

Line Graphs

Sometimes you want to know the relationship between two things being measured. In this case you would draw a line graph of the data.

For example, a group of students was investigating the growth of seedlings. They measured the height of the seedlings every day. Here are their results

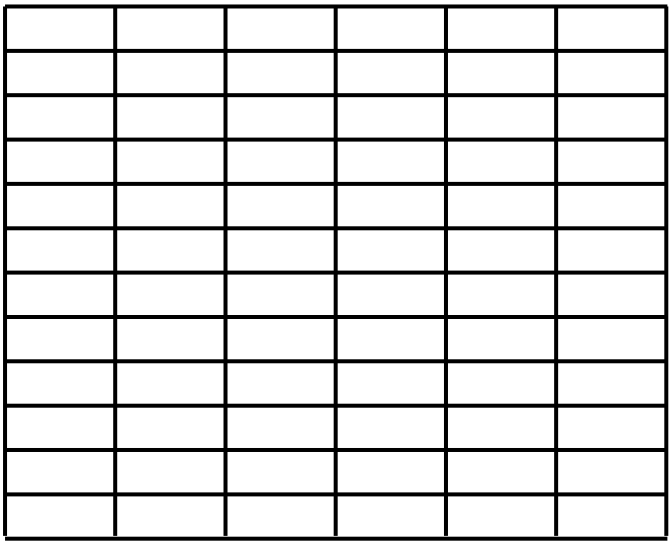
Time (days)	Height (cm)
0	0
1	1.0
2	2.1
3	2.8
4	3.8
5	5.0
6	5.8

Before you start your line graph, you have to decide which measurement goes on which axis. On the line graph, the **independent** measurement goes on the horizontal axis. The dependent measurement goes on the vertical axis. In this case, time is the independent measurement, and height is the dependent measurement. Height is dependent because the height the seedlings grow **depends** on how many days (time) you let them grow.

Activity 4: **Now test yourself by doing this activity.**

Drawing the Line Graph

Instructions
Use the information on the table to draw your line graph. Part of the graph has been given to you. Fill in the necessary information to complete the graph.



Check at the end of the lesson to see whether you have correctly.

Summary

You have come to the end of lesson 15. In this lesson you have learnt that:

- a graph is a chart or drawing that shows the relationship between changing things.
- bar graphs are very useful ways of comparing data.
- line graphs show the relationship between two things being measured.

NOW GO AND DO PRACTICE EXERCISE 15 ON THE NEXT PAGE

Practice Exercise 15

Look at the table data for Gloria"s height from ages 2 – 10.

AGE	HEIGHT
2	88
3	92
4	94
5	94
6	98
7	102
8	104
9	110
10	116

1. Display this data as a line graph.

2. What pattern can you see in the line graph?
_____

3. Write a conclusion to explain the pattern seen in the line graph.
_____
_____
_____

4. Use the same data on Gloria"s height in the table to draw a bar graph.

(Use this space to draw your graph)

CHECK YOUR WORK. ANSWERS ARE AT THE END OF STRAND.

Answers to Activities

Activity 2

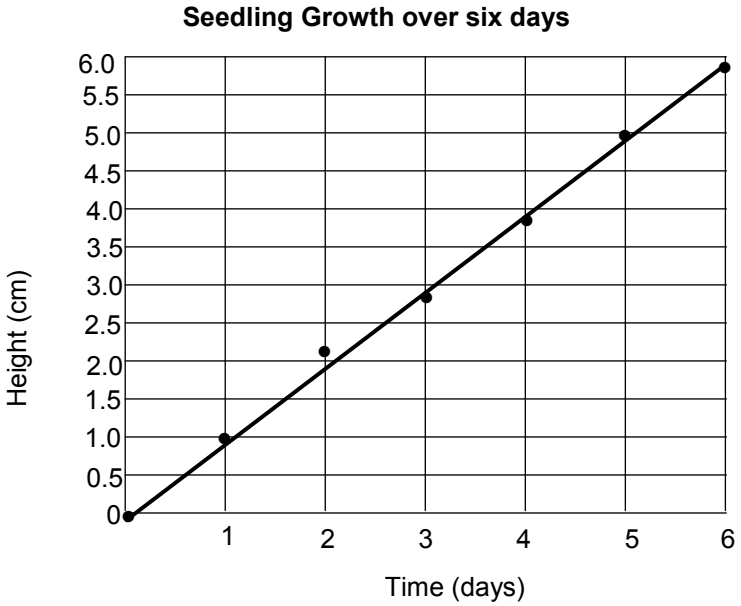
a)	Car C	b)	Car B	c)	7 seconds	d)	2 seconds

Activity 3

a)	9	b)	24	c)	5	d)	10

e) Conclusion: the favourite drink of the class is water and the least favoured drink is milk (more students like water than milk.)

Activity 4.
Your line graph should look similar to this.

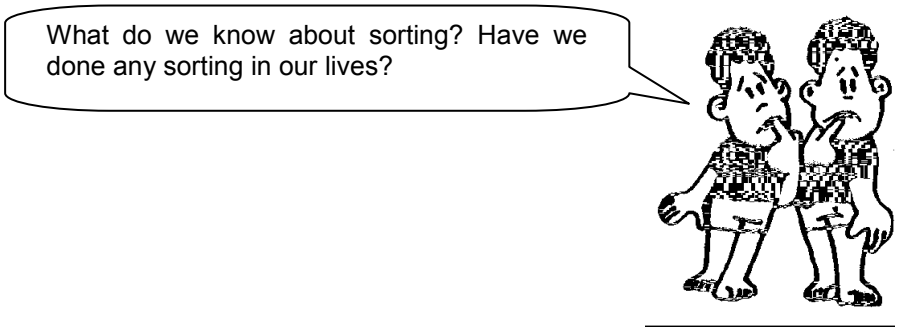


Lesson 16: Sorting Properties

Welcome to Lesson 16 of Strand 1. In the last lesson you learnt about graphs and how to plot one. In this lesson and the next one we will look at sorting properties or putting things into groups with similar characteristics or properties.

Your Aims:

- sort objects into two common sets of subsets and
- complete a classification tree about the object



Every day, you sort things in your house. Think about it. Sorting objects and putting them in a specific place is classification. If you are in an urban area, in your room, do you have a socks drawer in your dresser? How about a cabinet in your kitchen for storing your cups and saucers or spoons and forks? In the village you sort kaukau, potato, fish and many more things. Do you collect marbles, or rubber bands or stamps? You classify them and put them into their groups.

Classifying using keys

There are different ways to sort or classify items. Scientist use a variety (different) methods to classify living things. They use a key to classify things. Because classifying organisms is very complicated, you will start by classifying something simpler.

In this lesson we will practice classifying objects according to their physical structure and characteristics.

Activity 1: Now test yourself by doing this activity.

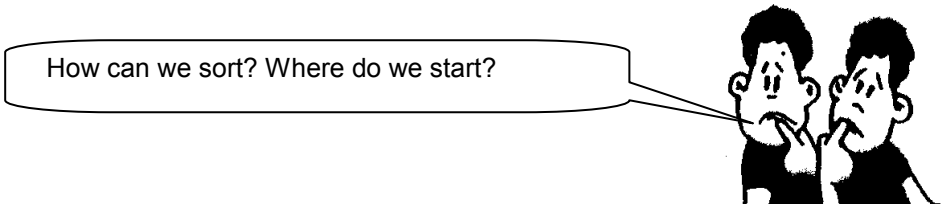
Situation 1

Alice has a box full of assorted buttons. There were a hundred buttons altogether. They came in three colours, Red, Blue and Green. There were 25 green buttons, 25 red buttons and 50 blue buttons. Each of the hundred buttons had either two, three of four button holes on them and came in two sizes only, large and small.

Of the 25 red buttons, 15 were large. Out of the 15 buttons, 4 had four button holes, 7 had three button holes and 4 had two button holes. The other 10 small buttons, 5 had three button holes button hole and the other 5 had two button holes.

Of the 50 blue buttons, 10 buttons were large, and 35 were small. Four of the 10 large buttons had two button holes, 3 had two button holes and the other 3 had three button holes. The rest of the blue buttons were small and all had two button holes.

The Green buttons were all large ones. There were no small ones but of the 25 buttons, 9 had four button holes, 10 had three button holes and 6 had two button holes



Have you read the situation carefully? Now can you sort the buttons out?

Procedure

Read the situation carefully and Group the buttons according to any characteristics you choose. (For example, size, colour, number of holes, etc.)

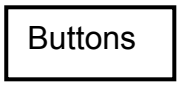
1. Ask yourself these questions and start sorting .

   a. What are the objects I am trying to sort? (Buttons)

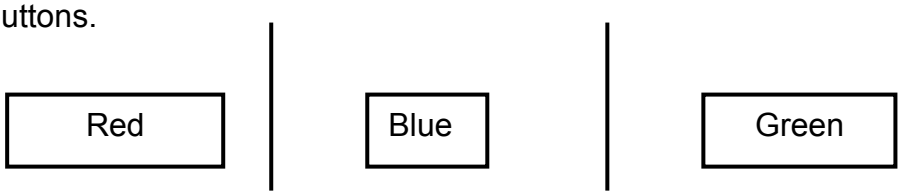
   b. What are their characteristics? (size, colour and number of holes they have)

   c. Imagine that you are really sorting out the buttons in front of you.

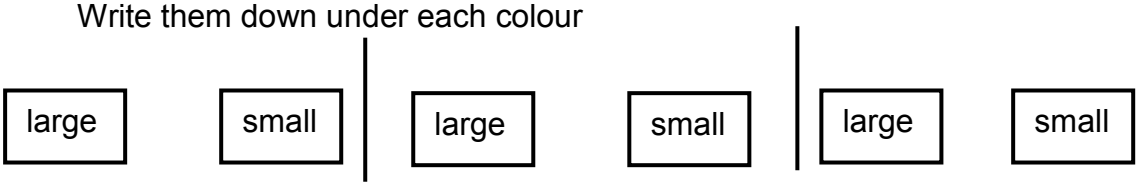
2. Start by writing buttons down as your heading.



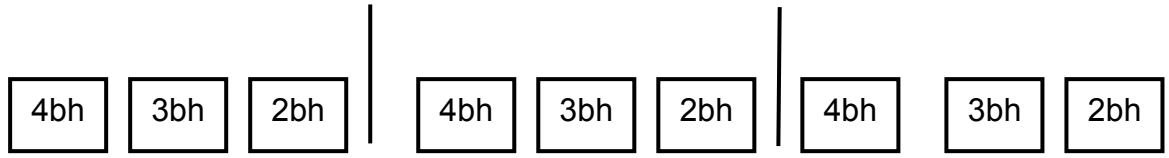
3. How many colours are there? Name and write them down under the word buttons.



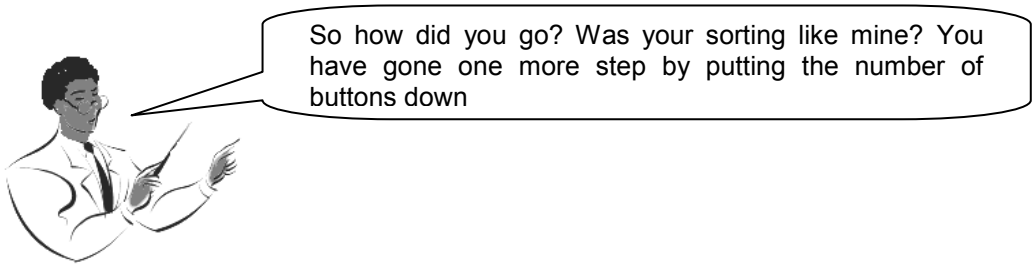
4. What size are the buttons? (All the colours come in large and small sizes) Write them down under each colour



5. Did all the colours have all the different button holes on them? (Yes) and how many different types of button holes did each colour have? Write these down

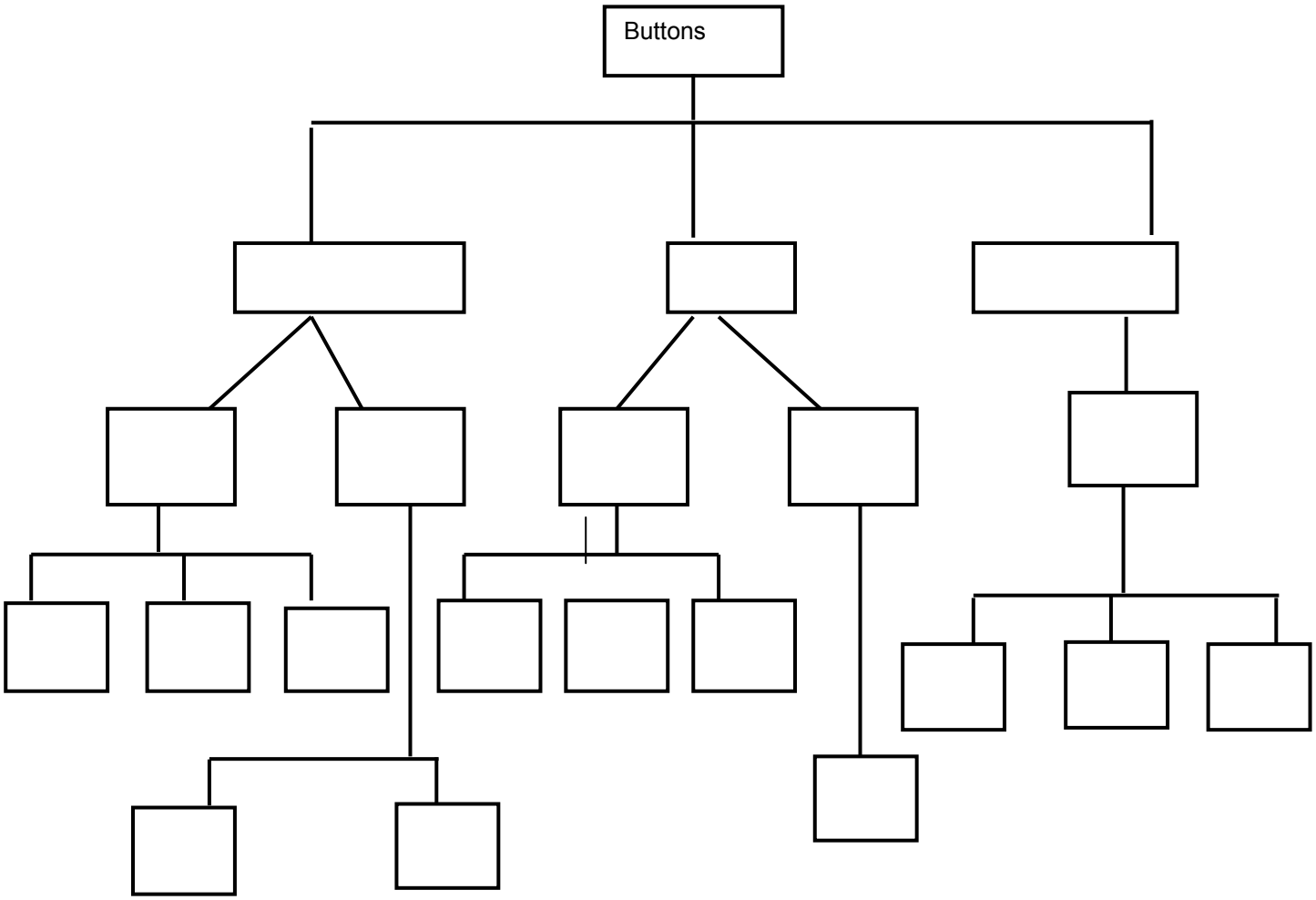


You have sorted the buttons down already. Now you can put them on the classification tree.



Your classification tree should look something like this.

Now complete the classification tree below.



Did you find it difficult to sort the buttons out?

You will read and answer more questions about sorting and classification in the next lessons.
Always remember that things are sorted out according to their different features. These features you observed care called **characteristics** or **properties**. Not all keys will be the same. So to classify or sort things out you look for similarities and differences.

Summary

You have come to the end of lesson 16. In this lesson you have learnt that:

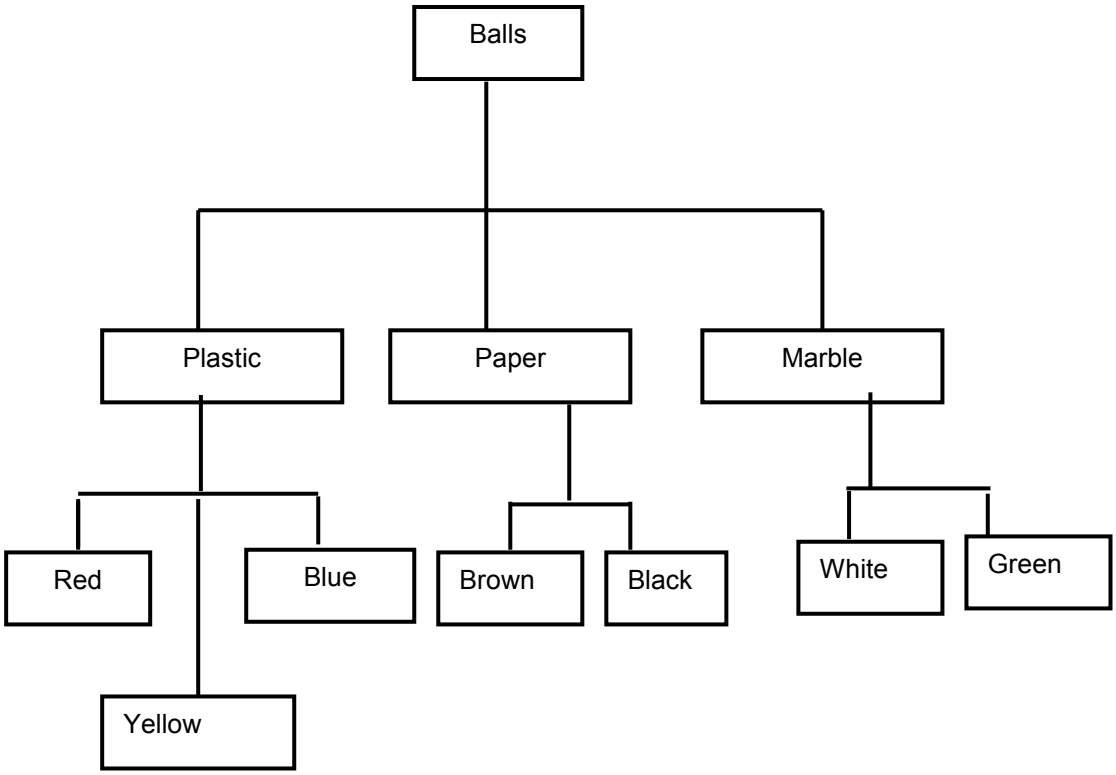
- sorting objects or things and putting them in a specific place is classification.

NOW GO AND DO PRACTICE EXERCISE 16 ON THE NEXT PAGE.

Practice Exercise 16

Answer the following questions.

1. Study the classification table carefully and answer the questions that follow.



a) What is being sorted out? _____

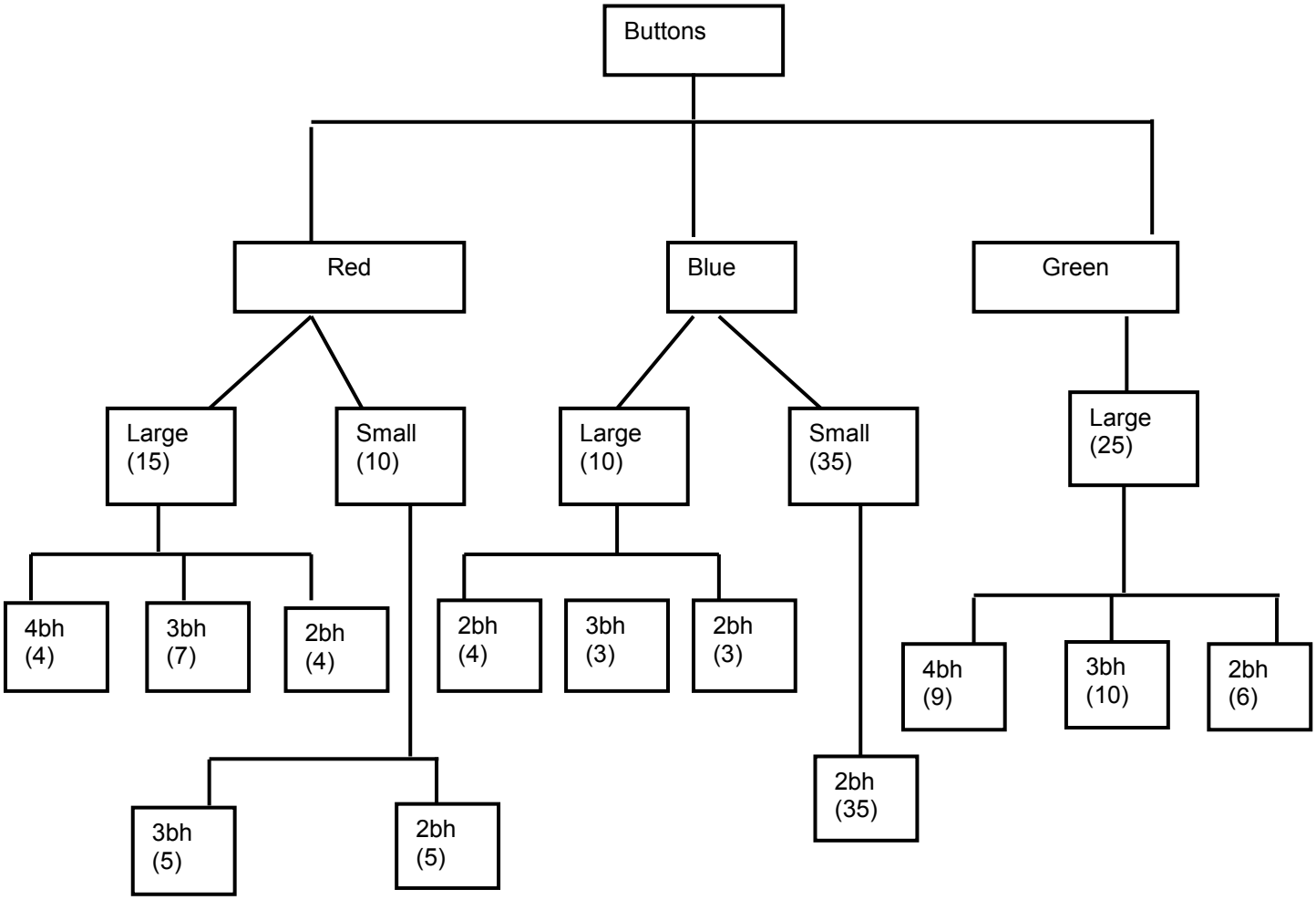
b) How many different types of balls are there? _____

c) Which type of ball has yellow colour? _____

d) How many different colours do the marble balls has? _____

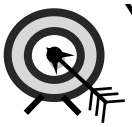
CHECK YOUR WORK. ANSWERS ARE AT THE END OF STRAND.

Answers to Activity



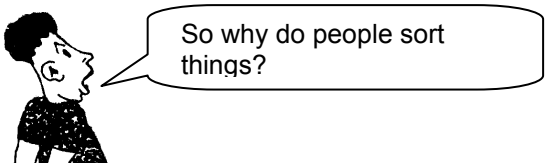
Lesson 17: Sorting Properties (2)

Welcome to Lesson 17 of Strand 1. In the last lesson you learnt about sorting objects into subsets. In this lesson you will learn to classify subsets by their own properties.



Your Aims:

- sort subsets until each subset has its own property
- identify each subset by one or more property



People have been grouping things in ways that make sense to them. The groups they chose were often different because they chose different features to group them by. If other people like their groupings, they can use them as well.

The reason why we sort things or classify them is because; Items can be easily found, similar items can be compared easily, and some features of the item can be predicted because we know the group.

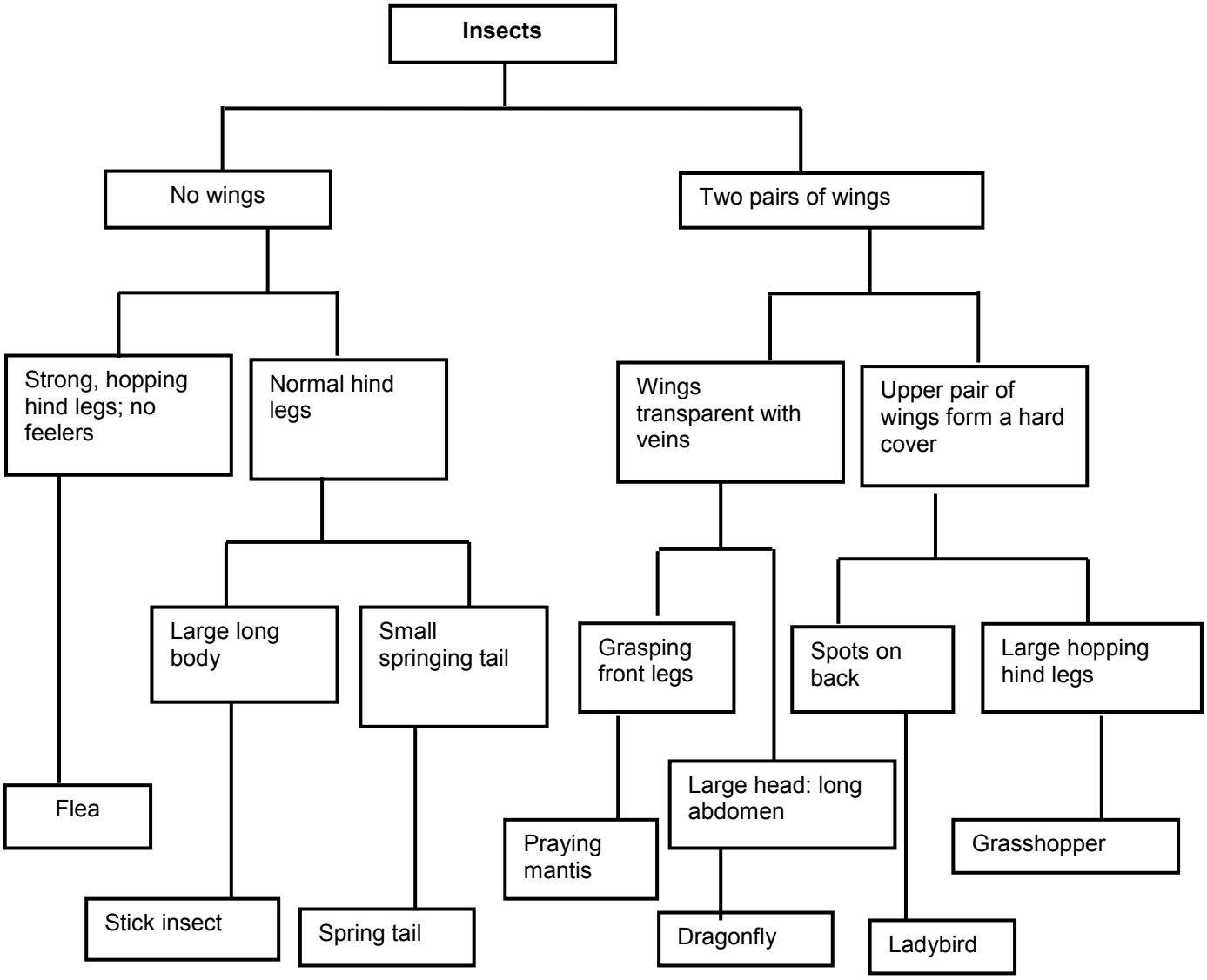
Classifying using keys

In your last lesson, you used buttons to sort, and group. There are different ways to sort or classify items. Scientist use a variety of different methods to classify living things. You too were able to use the simple keys in your last lesson to practice classifying shapes and animals.

So, let us do more activities in classifying items but this time identifying more than one feature or characteristic of something.

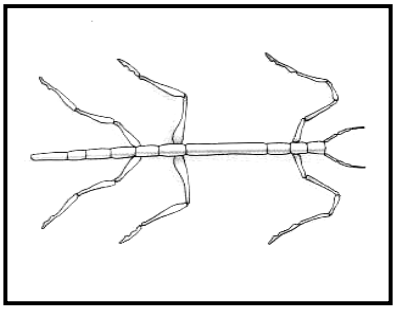
Activity 1: Now test yourself by doing this activity.

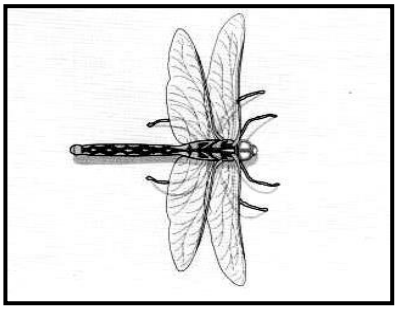
Study the classification key below and answer the questions that follow.



1. Identify the two insects pictured below.

a) _____ b) _____





2. Which insect has no wings, no feelers but has strong hopping hind legs?

_____

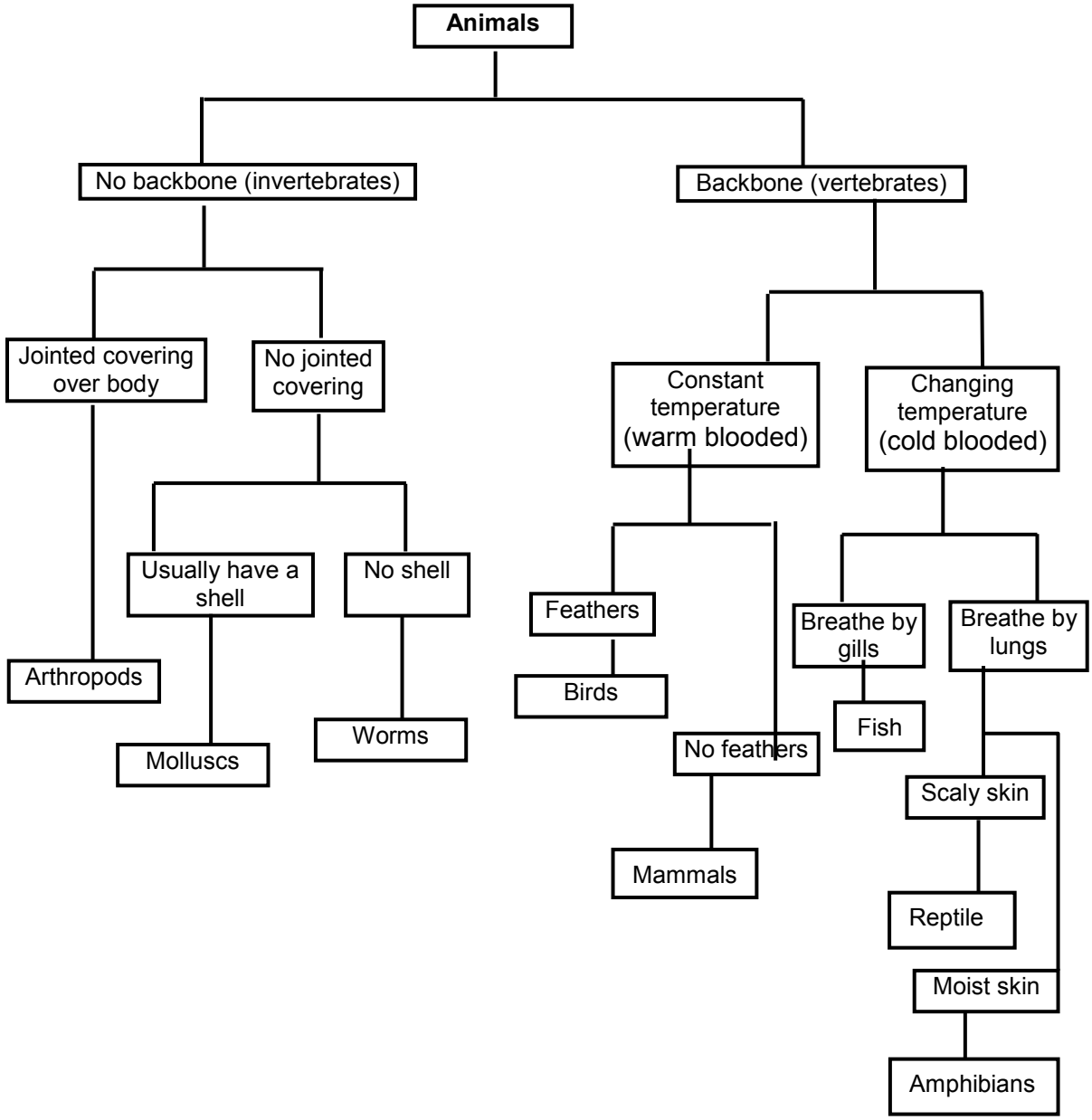
3. Write the description of the ladybird.

_____

_____

Activity 2: Now test yourself by doing this activity.

Study the classification key below and answer the questions that follow.



Please note that not all animals are included.

1. What are animals with backbones called?

   _____

2. What is the difference between a worm and molluscs?

   _____

3. Write down the simple keys of animals with backbones.

   _____

   _____

   _____

   _____

   _____

By now you should be able to sort things out and also draw and put them in a classification tree or key. In the activity below, you must draw a classification tree.

Activity 3: Now test yourself by doing this activity.

The classification tree or key on previous page includes only three invertebrate groups – arthropods, worms and molluscs. However there are other invertebrate groups. Use the information below to do up the invertebrate part of the animal key.

Arthropods (insects, spiders, crabs): jointed covering over body

Molluscs (snails, clams, oysters, mussels, squid, and octopuses): soft body not segmented, usually with shell.

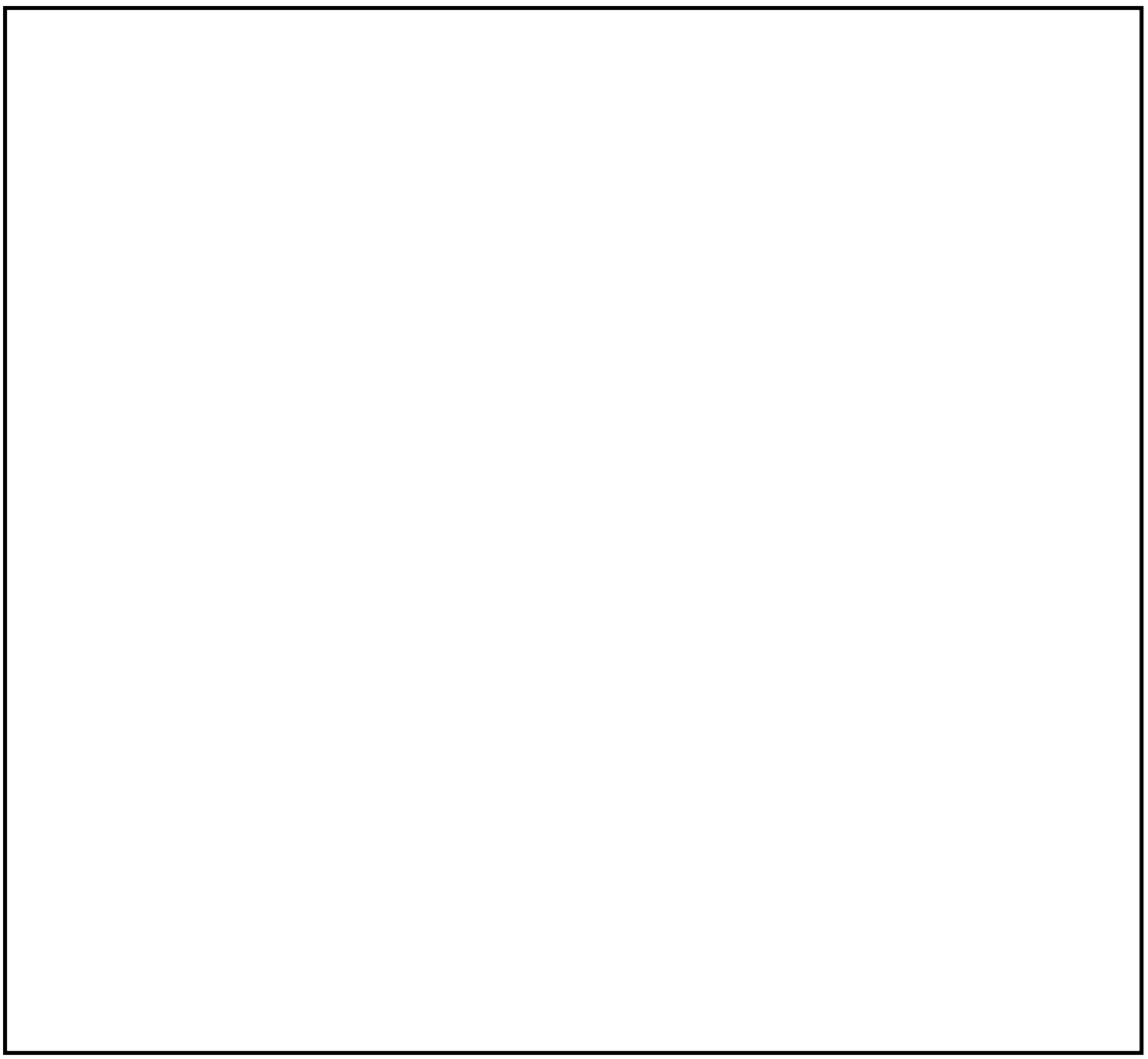
Echinoderms (starfish, sea urchins, sea cucumbers): hard, spiny skin, all live in the sea.

Flatworms and roundworms (tapeworms, liver, flukes, threadworms, nematodes): long, flat or round soft body with no body segment, poorly developed gut.

Segmented worms (earthworms, leeches, beach worms): long, round and soft body divided into segments, well developed gut.

Use the space on the next page to do your classification tree.

Draw your Diagram here.



Summary

You have come to the end of lesson 17. In this lesson you have learnt that:

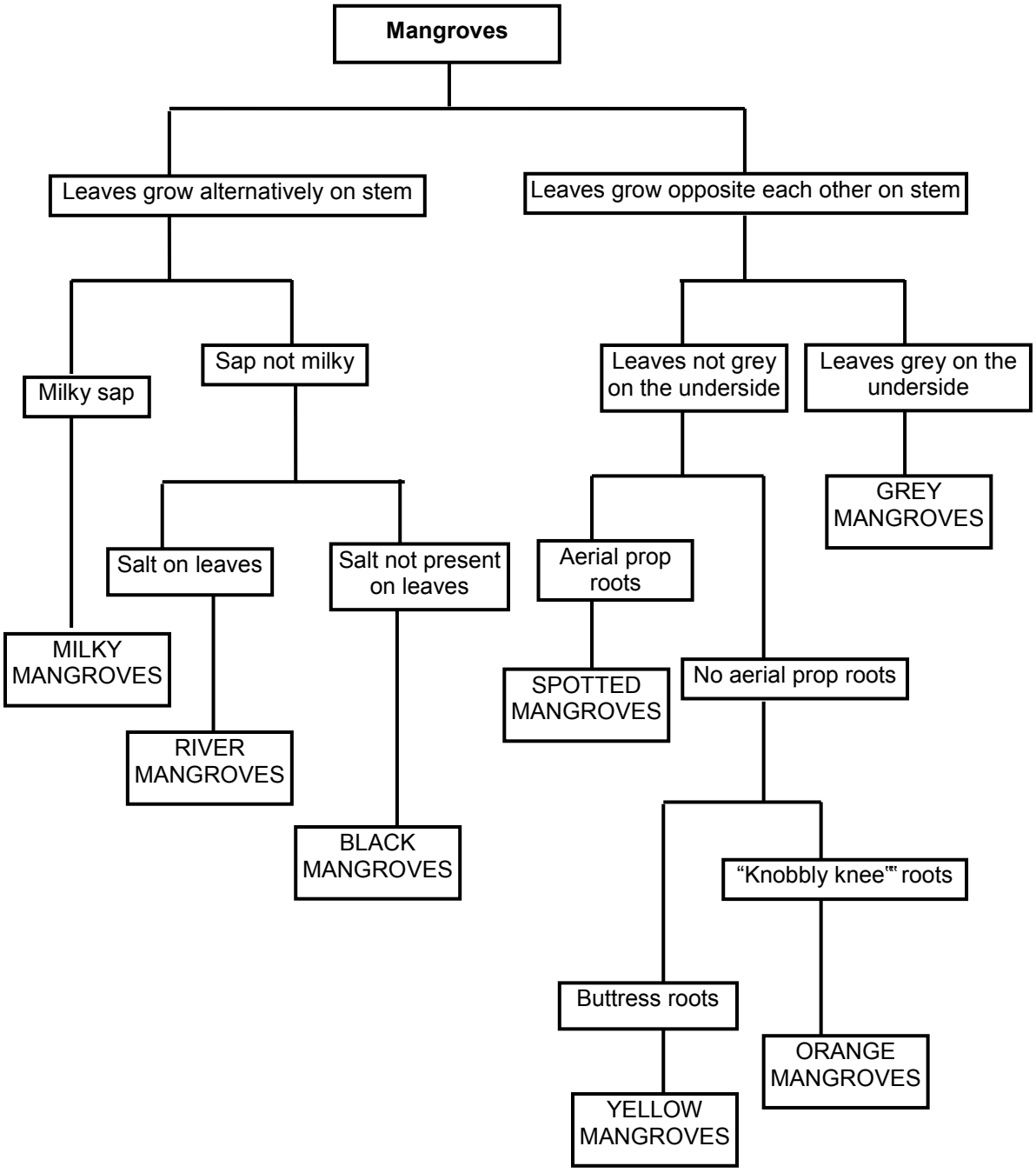
- items are sorted because they can be easily found, similar items can be compared easily, and some features of the item can be predicted.
- classification helps in comparing and studying characteristics of different things.

NOW GO AND DO PRACTICE EXERCISE 17 ON THE NEXT PAGE.

Practice Exercise 17

Answer the questions that follow.

Alice and Joyce were studying mangroves. These are flowering plants that grow in salty water along the coast. They used the key below to identify the mangroves.



1. Alice observed a mangrove that had salt crystals on its leaves, and the leaves were growing alternately on the stem. Which mangrove was she observing?

   _____

2. Write a description of the yellow mangrove.

   _____
   _____

3. Joyce noticed a mangrove with opposite leaves and aerial prop roots.

   a) Which mangroves was she observing?

      _____

   b) What further observation would be necessary to be sure of the type of mangrove it was?

      _____
      _____

4. In which way is black mangrove different from an orange mangrove?

   _____
   _____

CHECK YOUR WORK. ANSWERS ARE AT THE END OF THE STRAND.

Answers to Activities

Activity 1

1. a. stick insect b. dragonfly

2. flea

3. It has two pairs of wings, the upper pair of wings form a hard cover and has spots on the back.

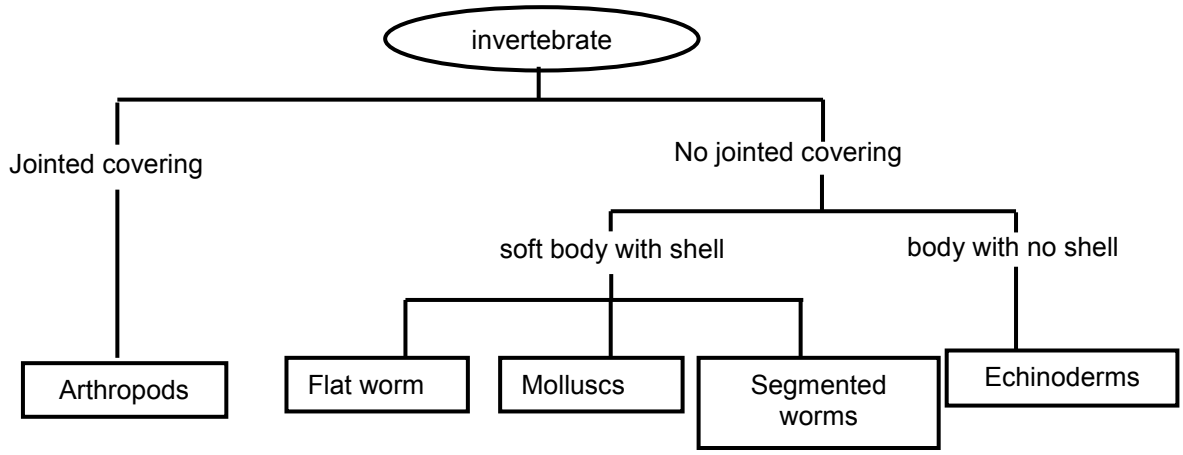
Activity 2

1. invertebrates

2. Worms have no shell while molluscs usually have a shell.

3. the keys are:
   - body temperature
   - body covering
   - breathing organs

Activity 3


invertebrate
Jointed covering
No jointed covering
soft body with shell
body with no shell
Arthropods
Flat worm
Molluscs
Segmented worms
Echinoderms

Lesson 18: In the Laboratory

Welcome to Lesson 18 of Strand 1. In the last lesson you learnt about classification or sorting things into groups. In this lesson you will learn about a Science laboratory. Maybe you have already heard about or used a Science laboratory in the lower grades, but do you really known what a Science Laboratory is? What do you find in a Science laboratory? You probably will not use a science laboratory yet but it is best for you to learn about the basic equipment that is found in the science lab and how to use them.

Your Aims:

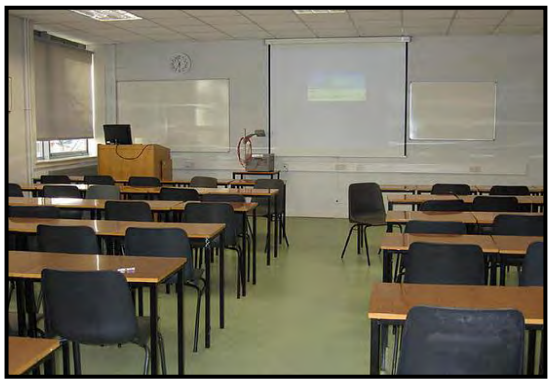
- describe and identify the common equipment used in the laboratory
- differentiate between a drawing and pictures used in the laboratory
- describe the safety rules briefly

A science laboratory (la-BOR-a-tray) or science lab is a specially designed room where you can carry out experiments safely.

How is a science lab different from a classroom? Are you able to tell?

A

B



C

D

Activity 1: **Now test yourself by doing this activity.**

Refer to the pictures on the previous page. Write down whether picture A, B, C and D is a normal classroom or a science lab

A. _____ B. _____

C. _____ D. _____

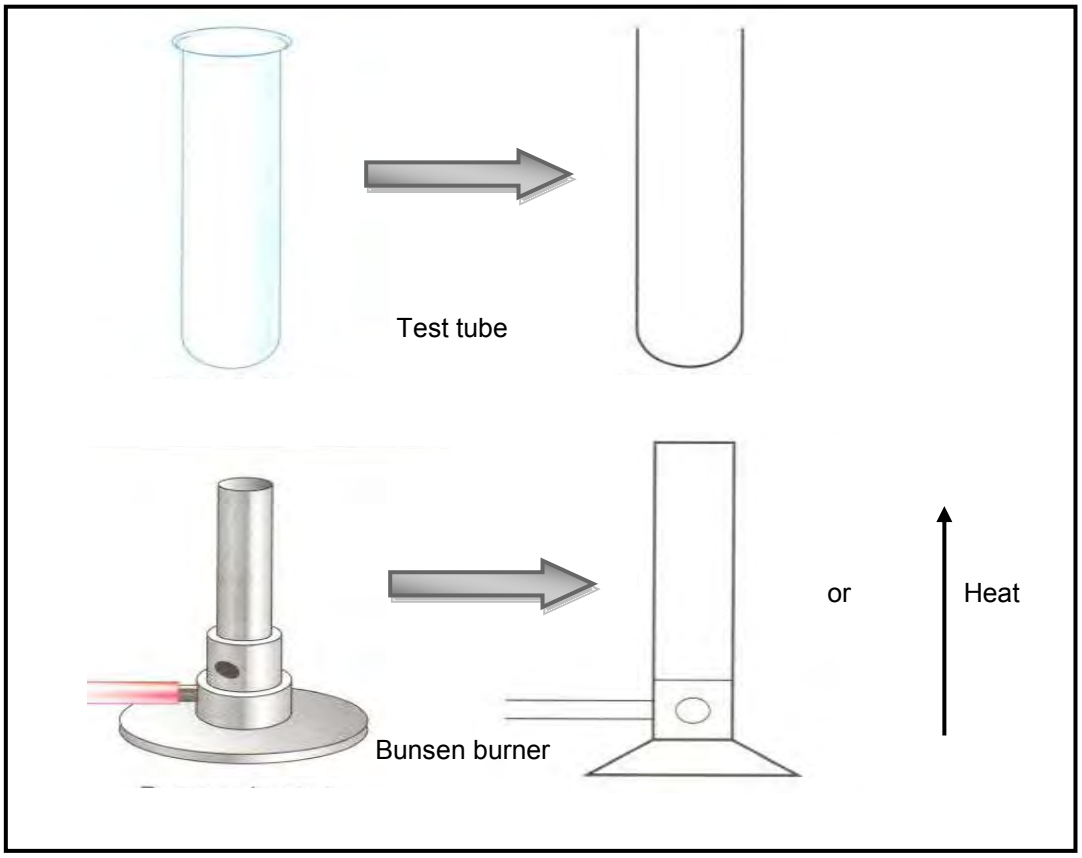
Science Equipment

In the Science Laboratory you will find many pieces of equipment. Before you can use the equipment you need to know these items. You must be able to identify these items and know what they are used for. You also need to be able to draw them when you write up reports of experiments and you have to spell them correctly.

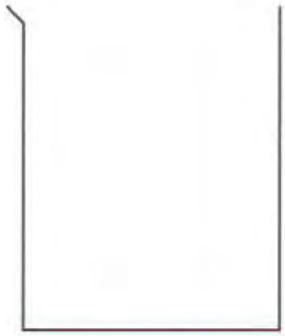
It is also a must that you follow the instructions of drawing given, when you are drawing the apparatus. Here are the rules you should follow.

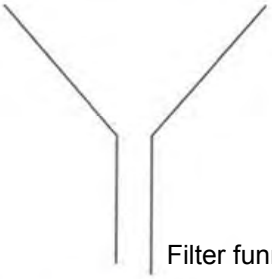
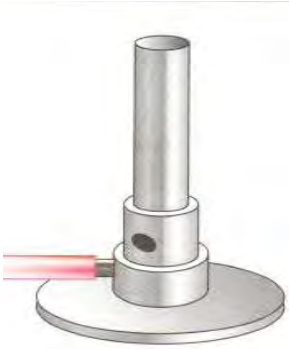
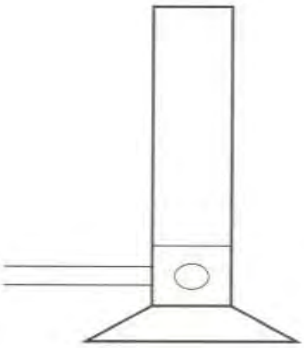
- use a pencil
- label the drawing use label lines
- use a ruler for all straight lines
- do not use colour or shading

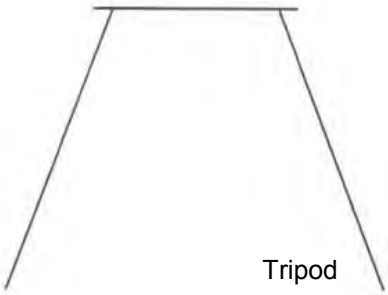
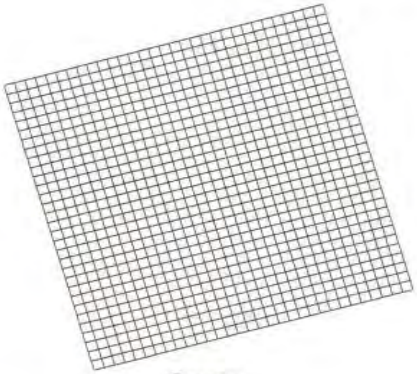
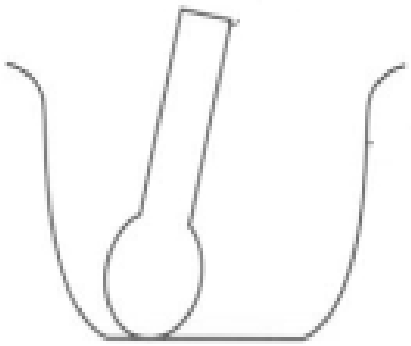
For example: Look at the diagrams below. The one on the right are drawn diagrams of the ones on the left. Look at how simple the drawing is.

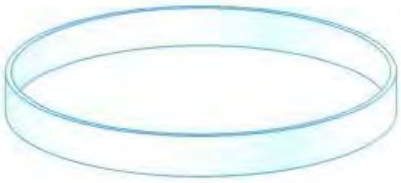


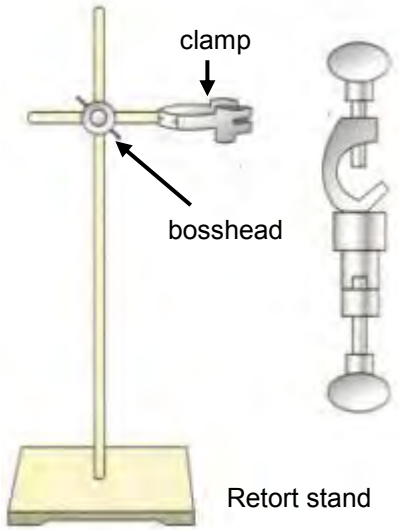
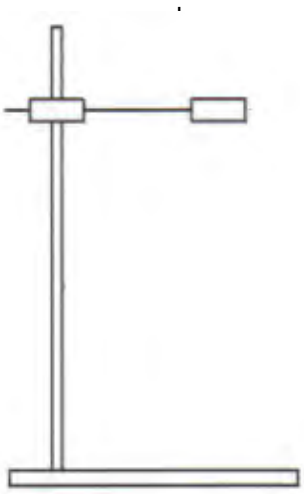
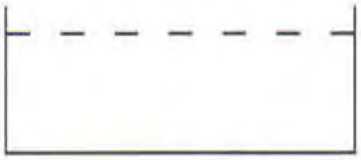
Here are some of the basic equipment‟s found in the laboratory, how they are drawn and their uses.

Equipment	How it is drawn	What it is used for
 Test tube	 Test tube	-observing reactions when chemicals are mixed -heating solids, liquids, solutions over a burner using a test tube holder to hold the test
 Beaker	 Beaker	-temporary storage of liquids and solutions. -observing reactions involving larger quantities of liquid than in test tubes -heating solutions
 Conical flask	Conical flask 	-observing reactions in solutions; often used when the contents need to be kept well mixed by swirling -temporary storage of liquids and solutions -boiling solutions

Equipment	How it is drawn	What it is used for
 Measuring cylinder	 Measuring cylinder	-measuring quantities of liquids or solutions
 Filter funnel	 Filter funnel	-support for filter paper during filtration
 Bunsen burner	 Bunsen burner	-heating materials and equipment during experiments

Equipment	How it is drawn	What it is used for
 Tripod	 Tripod	-support for gauze and equipment during experiment
		-support for beakers, conical flask or evaporating basins during experiments
 Mortar and Pestle	 Mortar and Pestle	-grinding materials to fine powder or to extract materials into liquids

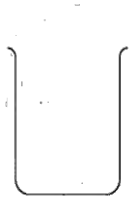
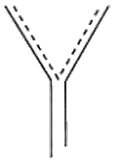
Equipment	How it is drawn	What it is used for
 Evaporating basin	 Evaporating basin	-evaporation of solutions to dryness or partially to allow crytallisation
 Petri Dish	 Petri Dish	-temporary storage of specimens -growing cultures of micro organisms -natural evaporation of small quantities of solutions -weighing of small quantities of solids
 Watch glass	 Watch glass	natural evaporation of small quantities of solutions -weighing of small quantities of solids

Equipment	How it is drawn	What it is used for
 Retort stand	 Retort stand	-support for various equipment
 Themormeter	 Themormeter	-measuring temperature
 Test tube rack or holder	 Test tube rack or holder	-support for test tubes

Notice how much simpler the diagrams are?

Activity 2: Now test yourself by doing this activity.

Name this equipment correctly with correct spelling.

NAME	DRAWING
A.	
B.	
C.	

Safety in the Laboratory

You have already seen the difference between a Science Lab and a classroom. You have already seen that a laboratory is a place for doing things. You will enjoy working there.

To make sure the Science laboratory is a safe place to work for everyone. There are two main rules to follow.

1. Know what you are doing in the Science Laboratory and Read instructions before you start.

2. Always think of others and behave sensibly.

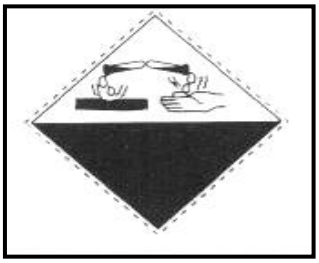
Follow the safety rules and accidents should not happen. Many accidents can be avoided and by keeping alert and using common sense. If you are in a science laboratory and accidents occur, report to your teacher immediately. You will learn more about rules in your Grade 8 Strand 1 Course.

The Science lab has some very dangerous chemicals that are stored in it. You will find different symbols labelled on the chemicals to tell you what harm it can cause.

Some of these common symbols are given on the next page. Study them so if you see one, you will know exactly what the symbols stand for.

Safety Symbols

Flammable chemicals

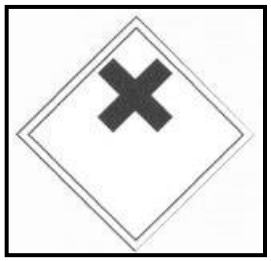


Corrosive chemicals

Oxidising chemicals

Radio Active chemicals

Toxic chemicals



Harmful chemicals

Summary

You have come to the end of lesson 18. In this lesson you have learnt that:

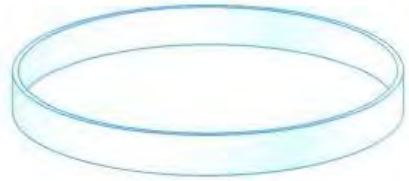
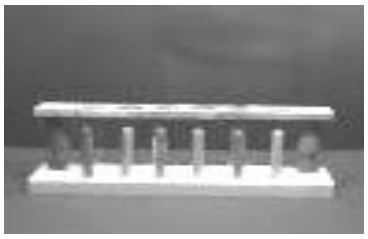
- a science laboratory or science lab is a specially design room where you can carry out experiments safely.
- when drawing a scientific diagram always use a pencil, label the drawing using label lines, use a ruler for all straight lines and do not use colour or shading.
- there are two main safety rules to follow.
  1. Know what you are doing in the Science Laboratory and read instructions before you start.
  2. Always think of others and behave sensibly.

NOW GO AND DO PRACTICE EXERCISE 18.

Practice Exercise 18

Answer the following questions.

1. Write down the name and the use of each of the equipment below.

	Apparatus	Use
1.		
2.		
3.		
4.		

2.. Why is safety important when using the science laboratory?

_____
_____
_____
_____

CHECK YOUR WORK. ANSWERS ARE AT THE END OF THESTRAND.

Answers to Activities

Activity 1

A. **classroom**

B. **classroom**

C. **science laboratory**

D. **science laboratory**

Activity 2

A. **beaker**

B. **filter funnel**

C. **test tube**

REVIEW OF STRAND 1: WORKING SCIENTIFICALLY

Revise all the Lessons in this Sub Strand and then do **ASSIGNMENT 4.**
Here are the main points to help you revise.

Lesson 1: Properties of Substances

- There are five senses
- The five senses are the sense of sight, hearing, touch, smell and taste
- All the five senses are used for observing.
- You use your tongue to taste, eyes to see, ears to hear, nose to smell, body part to feel.

Lesson 2: Using Your Senses

- Observations are made very carefully so that we can find out more about things around us.
- Different types of senses are used to make observations.

Lesson 3: How Much is How Good

- Qualitative observations use your senses to observe the results. (Sight, smell, touch, taste and hear.)
- Quantitative observations are made with instruments such as rulers, balances, graduated cylinders, beakers, and thermometers. These results are measurable.
- A quantitative description of a relevant characteristic involves a numerical measurement.
- A qualitative description of a relevant characteristic does not include a numerical measurement

Lesson 4: Standard Unit of Measurements, Instruments and Scale

- The metric system is the measurement system most commonly used in Science
- Metric units are sometimes called SI units
- The standard unit for length is metre
- The standard unit for weight is grams
- The standard unit for volume is litre
- The standard unit for time is seconds

Lesson 5: Measuring Length

- The standard unit for length are the millimetre, the centimetre and the metre.
- The instruments used for measuring length are the ruler, tape measure.
- To take the average add all the numbers and divide this by the number of readings taken

Lesson 6: Using a Metre Stick

- You can use millimetres, centimetres and metres to measure length.
- A millimetre is used to measure small length.
- You measure bigger length using metres.
- You can construct your own metre stick if you have a centimetre or millimetre ruler.

Lesson 7: Volume and Capacity

- Volume refers to the amount of space that an object takes up.
- Volume is measured with units such as cubic centimetres or cubic inches.
- The term capacity is generally used to refer to the amount that a container will hold.
- Standard units of capacity include gallons, litres and millilitres

Lesson 8: Marking a Volume

- You can now construct your own measuring scale if you have a container that you already know how much liquid or water that container can hold.

Lesson 9: Measuring Volume

- The metric unit for volume is millilitre and litres
- The amount of water that is displaced by the object is its volume
- To read the scales on the measuring cylinder, your eyes must be level with the level of the water.
- The surface of the water that is always curved is called the meniscus.

Lesson 10: Measuring Mass

- Weight is the measure of the pull of the gravity on an object.
- If the force of attraction changes, the weight will also change.
- The mass of an object is the measurement of the amount of matter in an object.
- For any given object on earth, its mass and weight are equal.
- The units of mass are grams and kilogram
- 1kg is equal to 9.8 Newtons

Lesson 11:

- Mass and weight of objects can be estimated.
- Mass of objects can be measured using the correct scale

Lesson 12: Making a Spring Balance

- You have learnt that you could make your own spring balance when required and use it to weigh small objects or things. In order for you to get accurate results the experiment has to be fair.

Lesson 13: Measuring Force

- A force is any push or pull
- Weight is the measure of the force of gravity acting on the objects mass.
- Gravity is the invisible force that holds us on the surface of the Earth

Lesson 14: Temperature and Time

- Time is measured in seconds, minutes and hours for short periods and days, weeks, months and years for long period.
- The instrument used to measure time is clock or watch
- Temperature is how hot or cold something is.
- The instrument used to measure temperature is thermometer.
- The unit used to measure temperature is degree Celsius
- The symbol for degree Celsius is ^{0}C**.**

Lesson 15: Plotting a Graph

- A graph is a chart or drawing that shows the relationship between changing things.
- Bar graphs are very useful ways of comparing data.
- Line graphs show the relationship between two things being measured.

Lesson 16: Sorting Properties

- Sorting objects of things and putting them in a specific place is classification.

Lesson 17: Sorting Properties (2)

- items are sorted because they can be easily found, similar items can be compared easily, and some features of the item can be predicted
- Classification helps in comparing and studying characteristics of different things.

Lesson 18: In the Laboratory

- A science laboratory or science lab is a specially design room where you can carry out experiments safely.
- When drawing a scientific diagram always use a pencil, label the drawing use label lines, use a ruler for all straight lines, do not use colour or shading
- There are two main safety rules to follow.
  1. Know what you are doing in the Science Laboratory and read instructions before you start.
  2. Always think of others and behave sensibly.

REVISE WELL AND THEN THE STRAND IN YOUR ASSIGNMENT 1.

Answers to Practice Exercises 1- 18

Practice Exercise 1

1. sight/seeing, hear, taste, smell and touch (in any order)

2. a) Yes, because I am using my sense of taste
   b) No,
   c) No. but I can use my sense of feeling to feel it.
   d) Yes, because I can use my sense of seeing.

3. A) seeing/sight B) smell C) taste D) hear E) touch/feel

Practice Exercise 2

1.

Item	Sight	Hearing	Touch	Smell	Taste
Motorbike	√	√	√		
Guava leaf	√		√	√	√
Jet plane	√	√			
Soup	√			√	
Rice	√			√	√
Brick	√		√		

2. a) touch b) taste c) feel/touch d) taste/smell

3. it probably heard the plane engine.

4. the fruit is probably bitter or she probably bit her tongue.

Practice Exercise 3

1. a) unit b) spring scale of balance c) qualitative

2. Observations **b** and **c**.

3. a) A quantitative measurement is a measurement that we make using required instruments and involves a unit and number.

   b) A qualitative measurement description of a relevant characteristic does not include a numerical measurement

Practice Exercise 4

1. measuring cylinder

2. Clock or watches

3. thermometer

4. Rulers, tape measures, trundle wheel

5. a) 0.04 m and 400mm

   b) 180 minutes, and 10800 seconds

   c) no answer

Practice Exercise 5

1. A. 5 mm
   B. 27mm
   C. 41mm
   D. 70mm
   E. 90mm
   F. 112mm

2. i)
   a) 1cm
   b) 2.5cm
   c) 3.4cm
   d) 5cm
   f) 7cm

   ii)
   a) 10mm
   b) 25mm
   c) 34mm
   d) 50mm
   f) 70mm

3. a) 0.2m
   b) 1000mm
   c) 25 00m
   d) 230cm
   e) no answer
   f) 260cm
   g) 52m
   h) 936m
   i) 170 m
   j) no answer

Practice Exercise 6

1. a) 4cm
   b) 15cm
   c) 9cm
   d) 5cm

2. a) metres
   b) centimetres
   c) millimetres
   d) centimetres

Practice Exercise 7

1. a) Volume refers to the amount of space that an object takes up.
   b) The volume of a container that is filled with a liquid or a solid that can be poured in is often called its capacity.

2. Measuring cylinder

3. Litres, millilitres, cubic centimetres

Practice Exercise 8

No Practice Exercise

Practice Exercise 9

1. a) B b) 95ml

2. 50 ml, 10 ml, 100 ml

3. a) 0.75l
   b) 50 000ml
   c) 4500ml
   d) 1.05l
   e) 2 L

Practice Exercise 10

1. a) Mass is the amount of matter in an object
   b) Weight is the measure of pull of gravity on an object.

3. grams

4. a) 548.8N b) 60.4N c) 980N

Practice Exercise 11

1 a) 2.6 g b) 56.2 g c) 0. 55g d) 10.9 g

Practice Exercise 12

No Practice Exercise

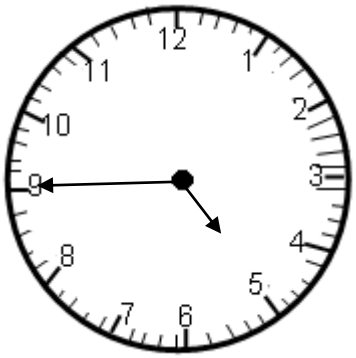
Practice Exercise 13

a) 170g, 1.66N
b) 150g, 1.47N
c) 200g, 1.96
d) 30g, 0.294N

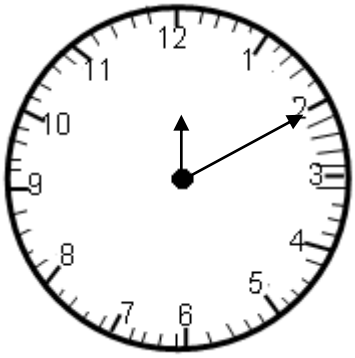
Practice Exercise 14

1. Thermometer
2. Clock or watch
3. ^{o}C
4. 52weeks
5. 600 s

6. a)



b)



Practice Exercise 15

No Practice Exercise

Practice Exercise 16

1. a) Ball
   b) Three
   c) Plastic
   d) seven

Practice Exercise 17

1. River mangroves

2. Leaves grow opposite, leaves not grey. It has no aerial prop roots but have buttress roots.

3. a) Spotted roots
   b) Leaves are not grey on the underside

Practice Exercise 18

1 For temporary storage of specimens, -growing cultures of micro-organisms, natural evaporation of small quantities of solutions, weighing of small quantities of solids

2. Support for test tubes or to hold test tubes.
3. For heating materials and equipment during experiments
4. Observing reactions involving larger quantities of liquid than in test tubes, heating Solutions

5. Safety is important because the science lab contains some very dangerous chemicals and equipment"s that can be cause harm if we are not very careful.

GLOSSARY

Gravity	A force that pulls objects downwards towards the centre of the earth.
Laboratory	A special room used for science experiments
Mass	The amount of matter in an object.
Meniscus	Curved upper surface of liquid in a measuring cylinder.
Mollusc	invertebrate animal that has a soft body and lives in water or in moist surrounding, most mollusc have a shell, eg. snail
Observations	Information about objects and event collected by using your senses
Predicting	Making a forecast of what a future observation will be, based on a past observation
Parallax error	Error that occurs when you don‟t look square-on to a measuring cylinder
Qualitative	Type of observation made using words, without measurements
Quantitative	Type of observation that involves measurements
Weight	A measure of the pull of gravity on an object.
Volume	The amount of space that an object takes up.

FODE PROVINCIAL CENTRES CONTACTS

PC NO.	FODE PROVINCIAL CENTRE	ADDRESS	PHONE/FAX	CUG PHONE (COORDINATOR)	CUG PHONE (SENIOR CLERK)
1	ALOTAU	P. O. Box 822, Alotau	6411343/6419195	72228130	72229051
2	BUKA	P. O. Box 154, Buka	9739838	72228108	72229073
3	CENTRAL	C/- FODE HQ	3419228	72228110	72229050
4	DARU	P. O. Box 68, Daru	6459033	72228146	72229047
5	GOROKA	P. O. Box 990, Goroka	5322085/5322321	72228116	72229054
6	HELA	P. O. Box 63, Tari	73197115	72228141	72229083
7	JIWAKA	c/- FODE Hagen		72228143	72229085
8	KAVIENG	P. O. Box 284, Kavieng	9842183	72228136	72229069
9	KEREMA	P. O. Box 86, Kerema	6481303	72228124	72229049
10	KIMBE	P. O. Box 328, Kimbe	9835110	72228150	72229065
11	KUNDIAWA	P. O. Box 95, Kundiawa	5351612	72228144	72229056
12	LAE	P. O. Box 4969, Lae	4725508/4721162	72228132	72229064
13	MADANG	P. O. Box 2071, Madang	4222418	72228126	72229063
14	MANUS	P. O. Box 41, Lorengau	9709251	72228128	72229080
15	MENDI	P. O. Box 237, Mendi	5491264/72895095	72228142	72229053
16	MT HAGEN	P. O. Box 418, Mt. Hagen	5421194/5423332	72228148	72229057
17	NCD	C/- FODE HQ	3230299 ext 26	72228134	72229081
18	POPONDETTA	P. O. Box 71, Popondetta	6297160/6297678	72228138	72229052
19	RABAUL	P. O. Box 83, Kokopo	9400314	72228118	72229067
20	VANIMO	P. O. Box 38, Vanimo	4571175/4571438	72228140	72229060
21	WABAG	P. O. Box 259, Wabag	5471114	72228120	72229082
22	WEWAK	P. O. Box 583, Wewak	4562231/4561114	72228122	72229062

FODE SUBJECTS AND COURSE PROGRAMMES

GRADE LEVELS	SUBJECTS/COURSES
Grades 7 and 8	1. English
	2. Mathematics
	3. Personal Development
	4. Social Science
	5. Science
	6. Making a Living
Grades 9 and 10	1. English
	2. Mathematics
	3. Personal Development
	4. Science
	5. Social Science
	6. Business Studies
	7. Design and Technology- Computing
Grades 11 and 12	1. English – Applied English/Language& Literature
	2. Mathematics - Mathematics A / Mathematics B
	3. Science – Biology/Chemistry/Physics
	4. Social Science – History/Geography/Economics
	5. Personal Development
	6. Business Studies
	7. Information & Communication Technology

REMEMBER:

- For Grades 7 and 8, you are required to do all six (6) subjects.
- For Grades 9 and 10, you must complete five (5) subjects and one (1) optional to be certified. Business Studies and Design & Technology – Computing are optional.
- For Grades 11 and 12, you are required to complete seven (7) out of thirteen (13) subjects to be certified.

Your Provincial Coordinator or Supervisor will give you more information regarding each subject and course.

Notes: You must seek advice from your Provincial Coordinator regarding the recommended courses in each stream. Options should be discussed carefully before choosing the stream when enrolling into Grade 11. FODE will certify for the successful completion of seven subjects in Grade 12.

GRADES 11 & 12 COURSE PROGRAMMES			
No	**Science**	**Humanities**	**Business**
1	Applied English	Language & Literature	Language & Literature/Applied English
2	Mathematics A/B	Mathematics A/B	Mathematics A/B
3	Personal Development	Personal Development	Personal Development
4	Biology	Biology/Physics/Chemistry	Biology/Physics/Chemistry
5	Chemistry/ Physics	Geography	Economics/Geography/History
6	Geography/History/Economics	History / Economics	Business Studies
7	ICT	ICT	ICT

CERTIFICATE IN MATRICULATION STUDIES		
No	**Compulsory Courses**	**Optional Courses**
1	English 1	**Science Stream:** Biology, Chemistry and Physics
2	English 2	**Social Science Stream:** Geography, Intro to Economics and Asia and the Modern World
3	Mathematics 1	
4	Mathematics 2	
5	History of Science & Technology	

REMEMBER:

You must successfully complete 8 courses: 5 compulsory and 3 optional.