



DEPARTMENT OF EDUCATION

**GRADE 8**

**SCIENCE**

**STRAND 1**



**WORKING SCIENTIFICALLY**



**FLEXIBLE OPEN AND DISTANCE EDUCATION**  
**PRIVATE MAIL BAG, P.O. WAIGANI, NCD**  
**FOR DEPARTMENT OF EDUCATION**  
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**Writer**

Selected Contract Writers

**Content Editors**

Science Department

FODE Edit Team

Subject Content Adviser

Science Review Committee

**Course Format Editor**

Joydee Mabbagu

**GRADE 8**

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DIANA TEIT AKIS

PRINCIPAL



Flexible Open and Distance Education  
Papua New Guinea

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## 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.

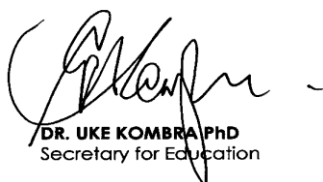
Flexible, Open and Distance Education curriculum is guided by the Department of Education's Mission which is fivefold:

- 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

## COURSE INTRODUCTION

---



Dear Student

Welcome to Grade 8 Science Course with FODE. We hope that you will find this Course interesting.

### About this Course

Your Grade 8 Course consists of four Strand Books, Six Assignments and an Examination.

- Strand 1, consists of your ability to work scientifically. Lessons are from Lesson 1-10.
- Strand 2 – 4 has Lessons on different Sub strands, Practice Exercises and Answers to the Practice Exercises. You will correct your own Practice Exercises using the answers given at the end of each sub-strand.
- Each Assignment has Sub Strand Tests on each Sub-Strand and a Strand Test on what you have covered. Your Distance Teacher will mark the assignment.

The marks you score in your six assignments and your final examination will count towards your Final examination.

### Repeat Assignment and Cancellation

If you score less than 50% in any assignment, you will repeat that Assignment. If you fail three assignments, you cannot continue with the course. Therefore you need to;

- Revise well before doing the assignments and
- Check them well before sending them in for marking

### Plan well, work regularly

Students at school have regular hours of study. They also have a teacher to help them with their work. But you have to work on your own. So, plan well and work regularly. It should you take about 6-10 weeks to complete this course.

Whenever you need help ask your;

- friends
- any high school teachers near you
- distance teachers near you
- Provincial coordinators

Another good idea is to do combine studies with other students who are also doing the same course as you are. In this way you can make sure of your success. We in the Science Department at FODE wish you well, in your studies.

**STRAND 1: INTRODUCTION**

---



Welcome to Strand 1 of your Grade 8 Course! I hope 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. The lessons are numbered from Lesson 1 to Lesson 10 in the Course Book. In the other Strands, the Lessons are listed under each Sub Strand. The reason for this is because this course is a skills course.

This Strand is based on the Outcome Based Curriculum used in the Primary School. Some changes were designed to help you study.

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

If you have any problems in understanding any of the 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 through 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: Laboratory Apparatus

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.

## **STRAND 1**

### **WORKING SCIENTIFICALLY**

**IN THIS STRAND YOU WILL LEARN MORE ABOUT:**

- **THE SCIENCE LABORATORY AND THE SAFETY RULES**
- **THE SENSE ORGANS IN DETAILS**
- **MEASUREMENTS**
- **YOUR SKILLS OF INFERENCES AND PREDICTION**
- **HOW TO DISPLAY DATA**
- **HOW TO WRITE A SCIENCE REPORT**
- **DOING AND WRITING UP AN EXPERIMENT**

## INTRODUCTION

---

In this Strand, you will learn more about the skills you need to develop through out your study of science.

This strand helps you to develop the skills needed for scientific investigations and the collection and recording of information. You will learn to measure, organise data into tables, draw, graph and label diagrams.



Scientists observe



Scientists infer



Scientist measure



Scientists predict



Scientists classify



Scientist hypothesis



Scientists make models



Scientists analyze



Scientist work with others

All of these activities show what a science student is expected to do in this strand.

## Lesson 1: Laboratory Apparatus

---



In Grade 7, you learnt briefly about the science lab and how you are supposed to behave in the science lab. You were also shown science equipment and how science diagrams are drawn. In this lesson you will learn about the laboratory apparatus.



### Your Aims:

- identify and draw the science apparatus found in the Science Laboratory
- state the general rules of drawing diagrams of science apparatus

If you have not been in a proper science laboratory before, organize with a school and visit their laboratory. Study its set up and ask as many questions as you can.



I saw all sorts of items from equipment to chemicals. I think some chemicals must be dangerous to handle.

In the Science Laboratory you may probably find items that are in many different shapes and sizes. Before you use any of them for experiment, you need to identify the equipment and know what they are used for. It is important that you know how to spell the equipment. When you write reports on experiments, draw the apparatus correctly.

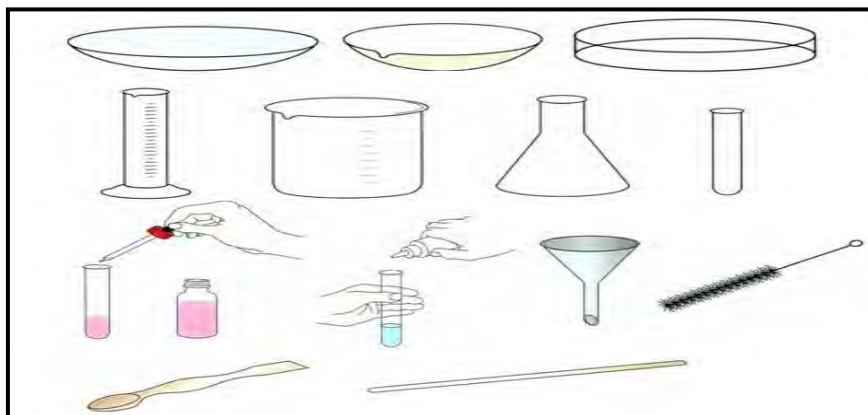
You should have some knowledge on the equipment and the apparatus that will be used in this lesson. A **science laboratory** is a specially designed room where you carry out experiments safely.

Now let us have a look at some of the items and equipment you find in the science laboratory.

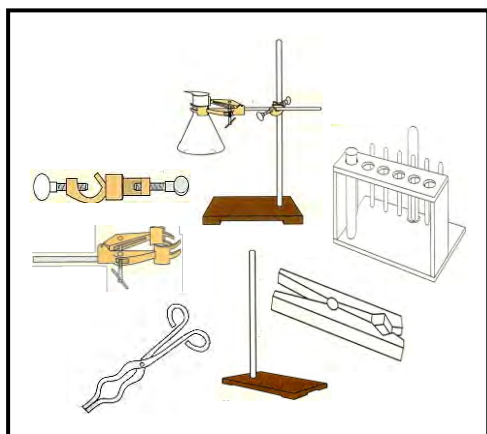
**REMEMBER: When Science equipment is put together for a purpose, it is called apparatus.**

### Some science apparatus used in the science laboratory.

Can you recall the names of some of these equipment from Lesson 18 in your Grade 7 Strand 1 course.



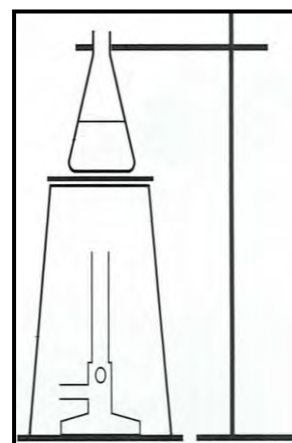
#### Holding Things



#### Heating Apparatus



Picture of the heating apparatus

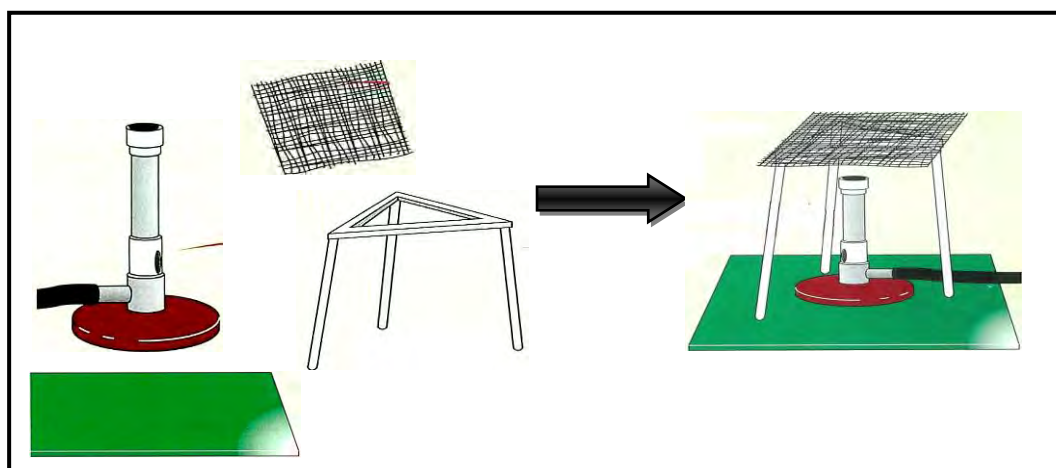


Drawn diagram of the heating apparatus

### Drawing Science Equipment

It is important to know how to draw simple science equipment because when you are asked to write a report, you maybe required to draw the apparatus.

Are you able to match the pictures of equipment with the drawings below?

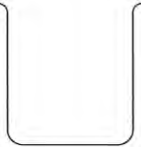
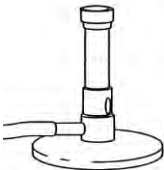
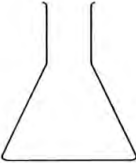
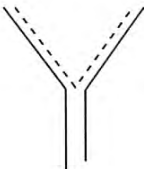
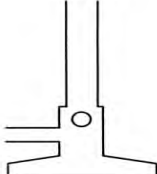




**Activity:** Now test yourself by doing this activity.

### Scientific drawing of laboratory apparatus

**Instructions:** Match the equipment in COLUMN A with their correct drawings in COLUMN B by writing the number of your choice next to the letters in column A.

| COLUMN A                                                                                   | COLUMN B                                                                                |
|--------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| A ____    | 1    |
| B ____   | 2   |
| C ____  | 3  |
| D ____  | 4  |
| E ____  | 5  |

Yes, although the equipment are drawn differently, they are actually the same items. The ones on the right are simple two dimensional views. The ones on the left are three-dimensional views.



The drawings in the previous page show how you should draw your equipment or apparatus for science investigations.

When you are drawing science equipment or apparatus, remember there are basics rules you must follow.

You must:

- use a pencil for ease of correction,
- label the drawing using label lines,
- use a ruler for all straight lines and,
- do not use shading or colouring.

**REMEMBER: It is best to keep the drawings simple.**



## Summary

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

- science diagrams of apparatus must be kept simple when drawn.
- there are basic rules to follow when drawing diagrams.
- It is important for you to identify the simple equipment or apparatus in the science laboratory before you carry out an experiment or investigation.

**NOW DO PRACTICE EXERCISE 1 ON THE NEXT PAGE.**



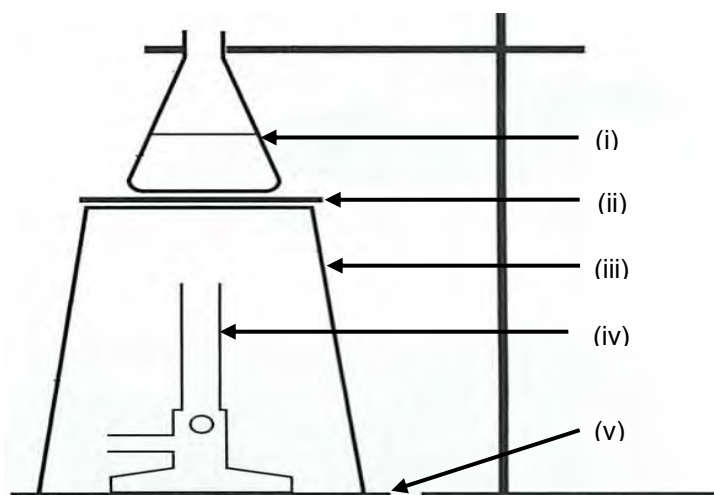
## Practice Exercise 1

**Answer the following questions:**

1. State the basic rules for drawing science apparatus.

- (i) \_\_\_\_\_
- (ii) \_\_\_\_\_
- (iii) \_\_\_\_\_
- (iv) \_\_\_\_\_

2. Label the parts numbered of this apparatus correctly. Spelling must be correct.



3. Draw the following equipment using the basic rules.

| EQUIPMENT        | DRAWING |
|------------------|---------|
| 1. Beaker        |         |
| 2. Conical flask |         |
| 3. Test tube     |         |

**CHECK YOUR WORK. ANSWERS ARE AT THE END OF THE STRAND 1.**

**Answers to Activity**

(i) A – 4

(ii) B - 3

(iii) C – 5

(iv) D - 2

(v) E - 1

## Lesson 2: Safety in the Laboratory

---



Welcome to Lesson 2 of Strand 1. In your last lesson you learnt about some simple science laboratory apparatus and how you can draw them correctly. In this lesson you will learn about the safety rules of a science laboratory.



### Your Aims:

- identify the safety rules for the laboratory and,
- list reasons for having a science laboratory

As you already know, a science laboratory is a place for doing experiments. It is a safe place where harmful chemicals and other expensive materials are kept. When you are in a laboratory, follow these two rules.

1. Know what you are doing in the laboratory. Read all instructions carefully before you start.
2. Always think of others and behave responsively and sensibly.

Why do you think these two rules above are very important?



I could blow the laboratory if I do not know what I am doing or even cause accidents if I do not behave sensibly.

You could make up your own rules for a science laboratory by studying carefully the rules above. Accidents occur, but we can prevent them by using common sense and keeping alert.

---



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

#### Making Laboratory Rules

Answer the following questions to make at least two of your own lab rules.

1. What can you do to avoid poisoning?

---

2. What must you do to prevent eye injuries?

---

---

Now read about the types of accidents that can occur and how to avoid them. If an accident occurs, always report it to your teacher.

### Eye Injuries

It can cause by liquids splashing into your eye during investigations.

- Always wear safety glasses. There is a chance of liquid splashing into your eyes, especially when heating things.
- Always wear safety glasses when you see the safety glasses symbols on investigation pages.
- Never point a test tube towards yourself or anyone else. If you get chemical in your eye wash it immediately with lots of water and tell your teacher.

### Poisoning

It can cause by breathing in fumes during an investigation, by tasting chemicals or spilling them on your skin.

- Never taste anything, and never bring food or drink into the laboratory.
- Check the labels on chemicals before you use them.

### Cuts

These are caused mainly by broken glass.

- Use gloves, a brush and shovel or dustpan to clean up any broken glass and put it into a special bin.

### Burns

It can cause by touching hot equipment, or by spilling hot liquid.

- Treat these types of burns with cold water for about 10 minutes.
- More serious burns can occur when using a burner. If this happens, tell your teacher immediately.

### SAFETY RULES

1. Do not enter the laboratory unless you are with a teacher.
2. Never touch equipment in the laboratory unless you are told to use it.
3. Do not eat or drink in the laboratory.
4. Always walk and not run.
5. Wear protective clothing – a laboratory clothing or apron, when appropriate. Use safety glasses.
6. Never taste anything.
7. Do not use paper to light burners, and don't put burning or hot things in the rubbish bin.
8. Keep books, papers and clothing away from flames. Tie long hair up.
9. Always point test tubes away from people.
10. Check with your teacher on how to dispose of waste liquids and solids. Broken glasses should be cleaned up using gloves, a brush and dustpan, and placed in a special bin.
11. If you spill a chemical or acid on your skin, wash it off immediately with lots of water and tell your teacher.
12. Report all accidents and breakages to your teacher.
13. After heating equipment let it cool on a heat proof mat before picking it up. This will avoid burns.
14. Clean all the equipment after use and put it back where you got it from. Clean and dry your work bench.

## Fires

It is always possible when using burners.

- Do not use a paper to light a burner, and never place a burning paper in rubbish bins.
- If you have long hair, it is important for you tie it whenever you use a burner.
- If there is a fire, stay calm and call for help. If a person's hair or clothing catches fire, remember the three rules: stop, drop and roll. The person must stop moving around, drop to the floor and roll. While the person is rolling, a fire blanket should be wrapped around the person to smother the flames.

## Damage to clothing and skin

This can occur when the chemicals, especially **corrosive** liquids such as acids, and alkalis, are spilt. To avoid this you should:

- Wear a laboratory coat or other protective clothing when doing investigations.
- If there is a spill, wash the area immediately with lots of water and send someone to tell the teacher.
- In serious cases it may be necessary to use the safety shower.

You still need to know these rules as they are very important in science investigations. Follow the safety rules to avoid accidents.

Do you know what these symbols stand for?



In the science laboratory as well as outside the laboratory, you will also find these signs. It is very important that you know these signs to avoid accidents. Remember what each of them warns you about. **Do not ignore the warnings!**

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

1. Select Safety Rules 3 to 10 listed on the previous page and explain why each is important.

Rule 3: \_\_\_\_\_

Rule 4: \_\_\_\_\_

Rule 5: \_\_\_\_\_

Rule 6: \_\_\_\_\_

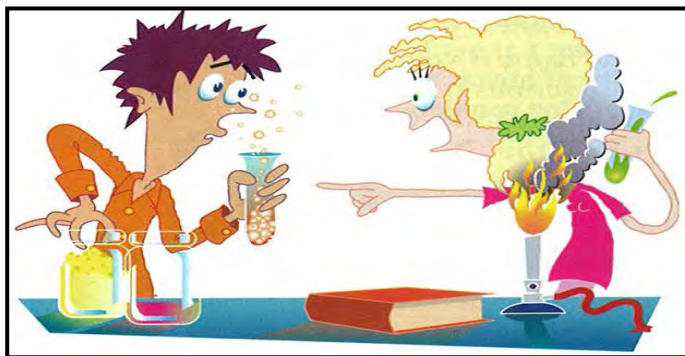
Rule 7: \_\_\_\_\_

Rule 8: \_\_\_\_\_

Rule 9: \_\_\_\_\_

Rule 10: \_\_\_\_\_

2. Look at the cartoon below. Make a list of the laboratory rules that are being broken.



- i. \_\_\_\_\_
- ii. \_\_\_\_\_
- iii. \_\_\_\_\_
- iv. \_\_\_\_\_
- v. \_\_\_\_\_



## Summary

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

- Science laboratory rules are very important as they will help you avoid accidents.
- you must know what you are doing in the laboratory and read all instructions carefully before you start any experiment.
- you must always think of others and behave responsively and sensibly when working on a science laboratory.

---

**NOW DO PRACTICE EXERCISE 2 ON THE NEXT PAGE.**



## Practice Exercise 2

**Answer the following questions:**

1. Look at the cartoon showing Paul and Alice in the laboratory.



- a) What has happened to Paul?  
\_\_\_\_\_
- b) What did he do wrong?  
\_\_\_\_\_
- c) What should Alice tell him to do?  
\_\_\_\_\_
2. Here are some chemical hazard signs you are familiar with. Each of them warns you about a danger. Write the correct warning under each sign. Use these words to describe each. **Corrosive, radioactive, flammable, toxic**



A. \_\_\_\_\_ B. \_\_\_\_\_ C. \_\_\_\_\_ D. \_\_\_\_\_

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

## Lesson 3: Sense Organs

---



Welcome to Lesson 3 of Strand 1. In your last lesson you learnt more about the safety rules of a science laboratory. In this lesson you will learn about our sense organs. Are you able to recall the five senses?



### Your Aim:

- identify and describe the sense organs

You will describe these sense organs a bit more in detail than you did in Grade 7.

So, you should now know how many senses you have and the sense organs.

Make a quick list of all the senses you can think of.

---



### Activity 1:

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

### Describing senses

1. Which two senses do we use when we watch a Rugby League game on television.  
a) \_\_\_\_\_  
b) \_\_\_\_\_
2. The sweet smell of roasted chicken caused Nigel to feel hungry.  
What sense was used here? \_\_\_\_\_
3. What sense do you use when you are cold and sit by the fire? \_\_\_\_\_
4. Joyce said the cup of tea did not have any sugar although mum put some sugar.  
\_\_\_\_\_



So, you listed down five senses in the exercise above.

You observed and were able to name what sense you used to get your answers to the questions above. When we observe, we are collecting information directly from our surroundings. We use our senses of sight or seeing, hearing, smell, touch and taste. Our senses are elements of survival for all living things through smelling, hearing, touching, tasting and looking.

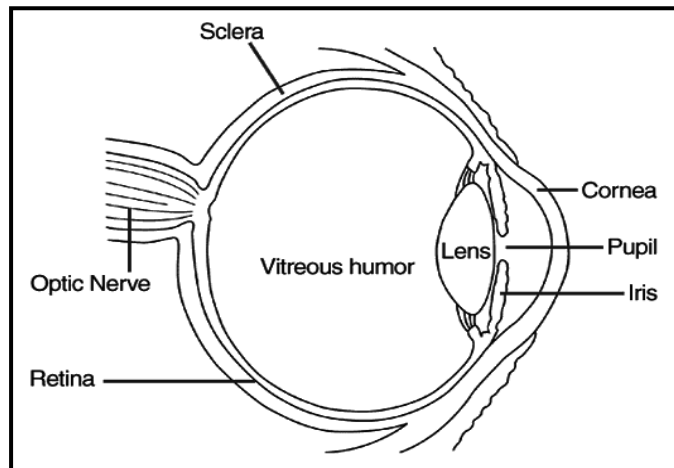
Sometimes our senses are not sensitive enough to detect slight changes in our environment. To overcome this, we use instruments that can help increase our power of observations. Thermometers, microscopes, watches, rulers, and other instruments help us make more accurate observations.

**Sense organs** are special structures that detect different changes in the environment and send messages to the brain. The brain then sends the messages to other parts of the body in response to the change. Each sense collects information about the world and detects changes within the body. Both humans and animals get all of their knowledge from their senses making very important.

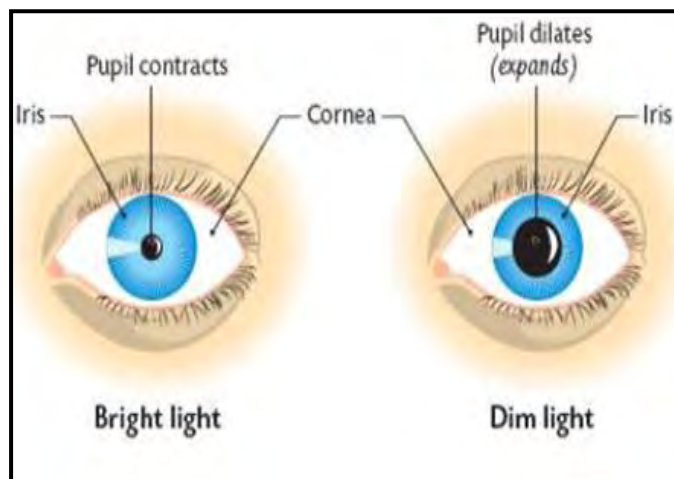
Now we will look at the sense organs in detail.

### The eye - sense organ of sight

Your eyes are the sense organs involved in sight. Eyes are important for us to see things. In every second, the beams of light bouncing off from objects go straight into your eyes. These are light rays that enter the eye through the **cornea**, which is a thick, transparent and protective layer on the surface of the eye. The light rays then pass through the **pupil**, the dark circle in the centre of your eye and into the lens.



When light rays pass through your pupil, the muscle called the **iris** makes the size of the pupil bigger or smaller depending on the amount of light. You may have noticed this with your own eye if you have looked at it closely in a mirror. If there is too much light, your pupil will shrink to limit the number of light rays that enter.



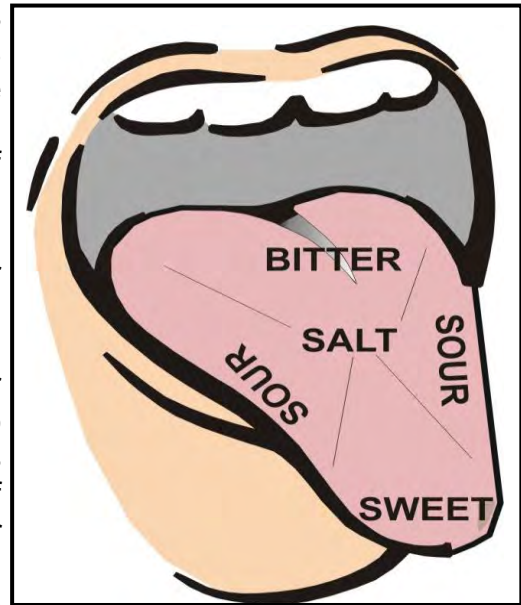
However, if there is very little light available, the pupil will enlarge to let in as many light rays as it can. Just behind the pupil is the **lens** that focuses the image through a jelly-like substance called the **vitreous humour** onto the back surface of the eyeball, called the **retina**.

**The tongue - sense organ of taste**

Have you ever thought about why foods taste different? Your **tongue** is the sense organ involved in taste. The surface of your tongue is covered with thousands of very tiny onion shaped clusters called **taste buds**. The taste buds can detect the different tastes; sweet, salty, sour and bitter. Substances in food that has one of these tastes can only be detected after they have been dissolved in saliva and seeped down the taste buds. Your taste bud sends the messages to your brain and your brain then tells you what flavours you taste. Taste buds probably play the most important part in helping you enjoy the many flavours of food.

The diagram of the tongue with its taste buds is seen on the left. The salty and sweet taste buds are located near the front of your tongue; the sour taste buds line the sides of your tongue; and the bitter taste buds are found at the very back of your tongue.

Everyone's tastes are different. In fact, your tastes will change as you get older. When you were a baby, you had taste buds, not only on your tongue, but on the sides and roof of your mouth. This means you were very sensitive to different foods. As you grew, the taste buds began to disappear from the sides and roof of your mouth, leaving taste buds mostly on your tongue. As you get older, your taste buds will become even less sensitive, so you will be more likely to eat foods that you thought were bitter as a child.



The different taste buds of the tongue.

There are times when you could not taste anything? Things like medications, smoking, not getting enough of the right vitamins, injury to the head, brain tumours, chemical exposure, and the effects of radiation can cause taste disorders.

**Activity 2:**

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

**Everyone loves cool-C**

Here's something you can try to test your taste buds. You may find out that you need more than just your tongue to know what you taste. You will need.

- 3-5 flavour packets of Cool-C
- a blindfold
- something on which to record your results
- your tastebuds

**Instructions:** Have someone blindfold you and then one by one taste each type of Cool- C. Record your results. Find out how well you were able to identify the different flavours.

**Note:** Use different flavours of drinks, for example coke, sprite, orange, and other types of drinks you may wish to use instead of Cool-C.



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

#### Find out more about your sense of taste

To find out more about your own sense of taste and the different taste areas on the tongue, do the following activities.

- Wipe your tongue with a towel so that it is dry. Now put a little sugar on the dry part. You will not be able to taste it. Your tongue must be wet for your taste buds to work!
- Put some salt water on the back of your tongue. You can hardly taste it. Now put it on the front. It tastes very salty. Different taste buds are located on different parts of your tongue. So tastes are stronger in some spots than in others.



You were testing your sense of taste.

#### The nose - sense organ of smell

Your nose is the sense organ involved in smell. At least 20 different types of smells can be detected by humans. Smelling takes place deep inside the nasal cavity. That is because there is nerve endings called **olfactory nerves** located there.

When a very small amount of a substance with an odour hits the olfactory nerves, these nerve endings send a signal to your brain. The brain then determines what the smell is, and you recognise it. Smell plays a big part in the sense of taste, too. The taste buds can only detect four tastes: sweet, sour, salty, and bitter. Your sense of smell adds to these tastes. That is why food is so rich and varied in taste. That is also why if your nose is blocked, your taste buds do not work. People who cannot smell have a condition called **Anosmia**.



So what part does the nose play in smelling? If you lost your nose, would you still be able to smell?

The answer is yes!

Even though the nose is for smelling, it is only the outside part. There is an inside part that you can not see. That is where the smelling gets done.

There are all kinds of noses in the animal world: big or small, flat or round, and long or short. In people, what we call the nose is the formation of a **cartilage bone** (soft bone tissue), and skin on the front of the face. The nose has two openings called **nostrils**. They allow air to come in and go out. When that happens, the nose collects the molecules of substances that cause odours.

Did you know that taste and smell go together? The senses of taste and smell are intimately linked to one another. Often the loss of one will result in the loss of the other.

Your sense of smell helps you taste things. Hold your nose tight so that you can not smell anything. Now put a piece of onion on your tongue. You can barely taste it. But as soon as you let go of your nose you will find that the taste seems much stronger.

### **Sense organ of touch**

Your **skin** is the organ involved in touch or feel. It can detect feelings including heat cold, pain and pressure. While your other four senses (sight, hearing, smell, and taste) are located in specific parts of the body, your sense of touch is found all over. This is because your sense of touch originates in the bottom layer of your skin called the **dermis**.

The dermis is filled with many tiny nerve endings which give you information about the things with which your body comes in contact. They do this by carrying the information to the spinal cord, which sends messages to the brain where the feeling is registered.

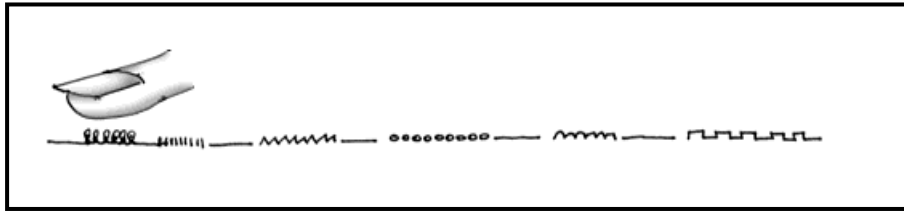
The nerve endings in your skin can tell you if something is hot or cold. They can also feel if something is hurting you. Your body has about twenty different types of nerve endings that all send messages to your brain. However, the most common receptors are heat, cold, pain, and pressure or touch receptors. Pain receptors are probably the most important for your safety because they can protect you by warning your brain that your body is hurt.

Some areas of the body are more sensitive than others because they have more nerve endings.

Have you ever bitten your tongue and wondered why it hurt so much?

It is because the sides of your tongue have a lot of nerve endings that are very sensitive to pain. However, your tongue is not as good at sensing hot or cold. That is why it is easy to burn your mouth when you eat something really hot.

Your fingertips are also very sensitive. For example, people who are blind use their fingertips to read **Braille** by feeling the patterns of raised dots on their paper.



Reading the braille

### Sense organ of hearing

Your two ears are the sense organs involved in hearing. Some living things are more sensitive in hearing than others. Like the other sense organs, your ears are extremely well-designed. They serve two very important purposes. You were able to figure out that your ears help you to hear sounds, but what you did not know is that your ears also help you to keep your balance.

When an object makes a noise, it sends vibrations known as **sound waves** speeding through the air. These vibrations are then funnelled into your ear canal by your outer ear. As the vibrations move into your middle ear, they hit your eardrum and cause it to vibrate as well.

This sets off a chain reaction of vibrations. Your eardrum, which is smaller and thinner than the nail on your last finger, vibrates the three smallest bones in your body. These are the **hammer**, **anvil**, and **stirrup**. The stirrup passes the vibrations into a coiled tube in the inner ear called the **cochlea**.

The fluid-filled cochlea contains thousands of hair-like nerve endings called **cilia**. When the stirrup causes the fluid in the cochlea to vibrate, the cilia move. The cilia change the vibrations into messages that are sent to the brain through the auditory nerve. The auditory nerve carries messages in your ear to your brain. Your brain then makes sense of the messages and tells you what sounds you are hearing.

Apart from using your ears to hear with, your ears do something else very important. They help you keep your balance. You can walk and ride a bike without falling over because of your ears.

The table below shows the different five senses of the body and their functions:

| SENSE ORGAN | SENSE            | FUNCTION                                             |
|-------------|------------------|------------------------------------------------------|
| Eye         | Sight            | For seeing                                           |
| Ear         | Hearing          | For hearing sounds and balance                       |
| Tongue      | Tasting          | For tasting flavours like sweet, salty and bitter    |
| Skin/Hands  | Feeling/Touching | For feeling of pain, hotness, coldness, and texture. |
| Nose        | Smell            | For smelling                                         |



## Summary

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

- the ear is the sense organ for hearing.
- the nose is the sense organ for smelling.
- the eye is the organ used for seeing.
- the tongue is the sense organ used for tasting.
- the skin is the sense organ for feeling or touch.

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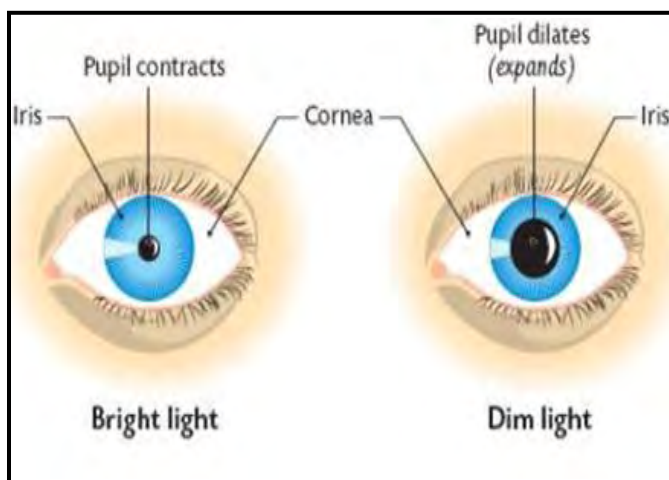
**NOW DO PRACTICE EXERCISE 3 ON THE NEXT PAGE.**



### Practice Exercise 3

Answer the following questions:

1. Name the five senses of the body.
  - (i) \_\_\_\_\_
  - (ii) \_\_\_\_\_
  - (iii) \_\_\_\_\_
  - (iv) \_\_\_\_\_
  - (v) \_\_\_\_\_
2. Name the sense organs of smell, taste, sight, touch, and hearing.
  - (i) smell \_\_\_\_\_
  - (ii) taste \_\_\_\_\_
  - (iii) sight \_\_\_\_\_
  - (iv) touch \_\_\_\_\_
  - (v) hearing \_\_\_\_\_
3. Which nerve ending of the nose will send signal to the brain when a person smell something? \_\_\_\_\_
4. Which of the two diagrams below will show less light shining into the eye?



Answer: \_\_\_\_\_

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

**Answers to Activity**

1.     a) Sight/ Seeing  
       b) Hearing
2.     Smelling
3.     Feeling/ Touch
4.     Taste

## Lesson 4: Measurement - Time and Temperature

---



Welcome to Lesson 4 of Strand 1. In your last lesson you learnt about the different sense organs. In this lesson you will learn about Measurement.



### Your Aims:

- identify qualitative and quantitative measurement, scales and units,
- discuss time and temperature
- discuss the correct ways of reading from given instruments

You have again covered these topics in your grade 7 course but we will have a look at it again and do more exercises.

What is the difference between qualitative and quantitative measurement? You have already learnt in Grade 7 the difference between the two measurements. We will revise it again. Let us see if you can still remember these two terms.

---



### Activity 1:

Now test yourself by doing this activity.

**What are qualitative and quantitative measurements?**

**Instructions:** Write down an explanation of the following:

1. Qualitative observations

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2. Quantitative observations

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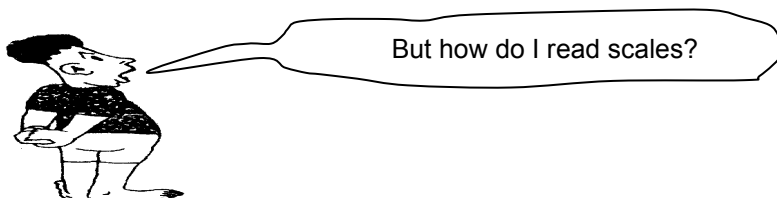
**Activity 2:****Now test yourself by doing this activity.****Use the qualitative and quantitative measurements**

**Instructions:** Read the following examples carefully and then write if the example is qualitative or quantitative.

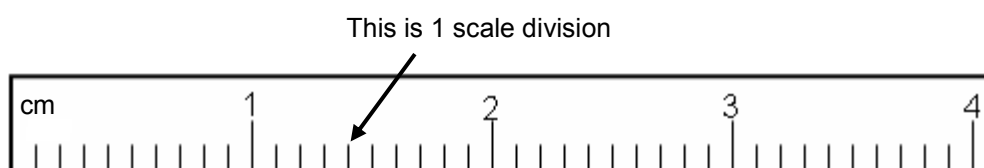
- |     |                                              |       |
|-----|----------------------------------------------|-------|
| 1.  | It tastes sour.                              | _____ |
| 2.  | It smells sweet.                             | _____ |
| 3.  | Leaves are stiff.                            | _____ |
| 4.  | Feels very rough.                            | _____ |
| 5.  | The plant is 3m tall.                        | _____ |
| 6.  | One leaf is 9cm long.                        | _____ |
| 7.  | It is light green in colour.                 | _____ |
| 8.  | The veins are 3mm wide.                      | _____ |
| 9.  | It makes a loud pop sound.                   | _____ |
| 10. | The flower clusters in 3 blooms.             | _____ |
| 11. | The mass of the rice bag is 1.5kg.           | _____ |
| 12. | It gets darker over a period of time.        | _____ |
| 13. | The room temperature increases by 8 degrees. | _____ |

We have used the qualitative methods of measuring the leaves. This means we used our senses. Do not depend on our senses only – use a measuring instrument whenever you can.

In this lesson we will look mostly at the Quantitative measurements. But we will see if you can still remember how to read scales.

**Reading scales**

Different measuring instrument display their reading in different ways. For example, a watch has a scale with a number and a pointer. Others show an exact reading, for example, a digital watch or digital weighing machines. To read a measurement, you must be able to read the scale. You do this by judging the position of the pointer against the background scale. You must also work out what each scale division on the instrument represents. Have a good look at your ruler. Notice that the numbers on the scale are spaced at regular intervals.



One scale division is equal to 1. For this particular ruler, 1 scale division equals to 1mm

### Estimating a reading

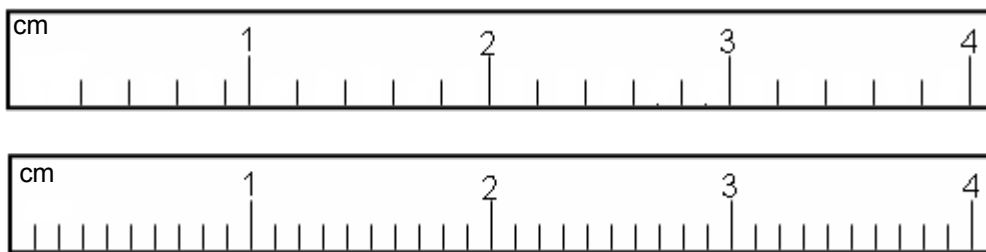
When reading a scale you often find that the pointer lies between two lines. In this case you have to estimate the reading. For example, if the pointer on the scale is between the 6 and 7 position, but not exactly in the middle. The reading is more than 6.5 but less than 7. It can be estimated at 6.8



### Accuracy

Remember you cannot get a better measurement than your measuring instrument allows. All measuring instrument are accurate only with written limits. Scales used on any instrument are marked off into smaller and smaller divisions. The smaller division determines the accuracy of the instrument

### For example



Now let us look at time.

### Time

What is the name of the instrument shown below?

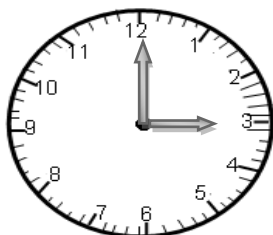
This is a clock



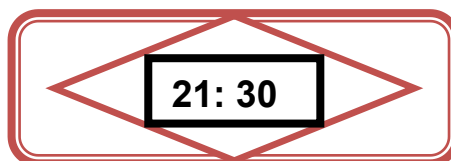
A **watch or clock** is an instrument for measuring time. Minutes and second are units of time.

There are two types of clocks used, the analogue clock and the digital clock.

The **analogue clock** has the hour and the minute hands that move around the clock-face and describe time using a 12-hour system.



Analogue clock



Digital clock

The **digital clock** displays time using either a 12-hour or a 24-hour system.

The 24-hour system continues beyond 12 noon so 1pm is written as 1300hours, 2 p.m. is written as 1400 hours and midnight is written as 0000 hours.

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

**(This includes the morning from 6.00am – 11.30am)**

**p.m** from post-meridian means the time from 12 noon up to 12 midnight.

**(This includes the afternoon from 1.00pm – 11.30pm)**

Read the digital clock with the time shown, what time is that in twelve hour time?



The time is 9.30 p.m. in twelve hour time.

The following 24-hour times are written in 12 hour times using a.m. or p.m. equivalents

- a) 0955 h = 9.55 a.m.
- b) 2030 h = 8.30 p.m.
- c) 1300 h = 1:00 p.m.
- d) 1230 h = 12.30 p.m.
- e) 1715 h = 5.30 p.m.
- f) 0430 h = 4.30 a.m.
- g) 1118 h = 11.18 a.m.

Measurement of time in seconds, minutes, hours, days, weeks, months, & year

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

The days per month are as follows:

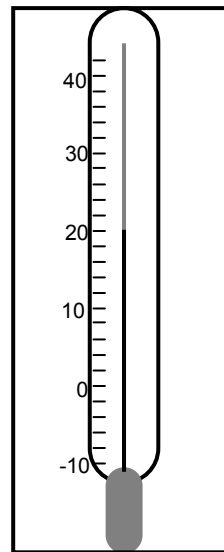
| Months with 31days | Months with 30 days | 28days or 29 (every 4 yrs) |
|--------------------|---------------------|----------------------------|
| January            | April               | February                   |
| March              | June                |                            |
| May                | September           |                            |
| July               | November            |                            |
| August             |                     |                            |
| October            |                     |                            |
| December           |                     |                            |

## Temperature

What is temperature? What is this instrument?

This is a thermometer. It is used for measuring **temperature**.

**Temperature** is how hot or cold something is.



### Measures of temperature

A **thermometer** is used in measuring temperature. The unit used to tell the temperature are the Celsius, the centigrade degrees and the Fahrenheit (fa-ren-hait) degree. In Papua New Guinea, we normally use **degree Celsius (°C)**. Because PNG lies close to the equator; daily temperatures are fairly constant although the temperature gets cooler the higher you go.

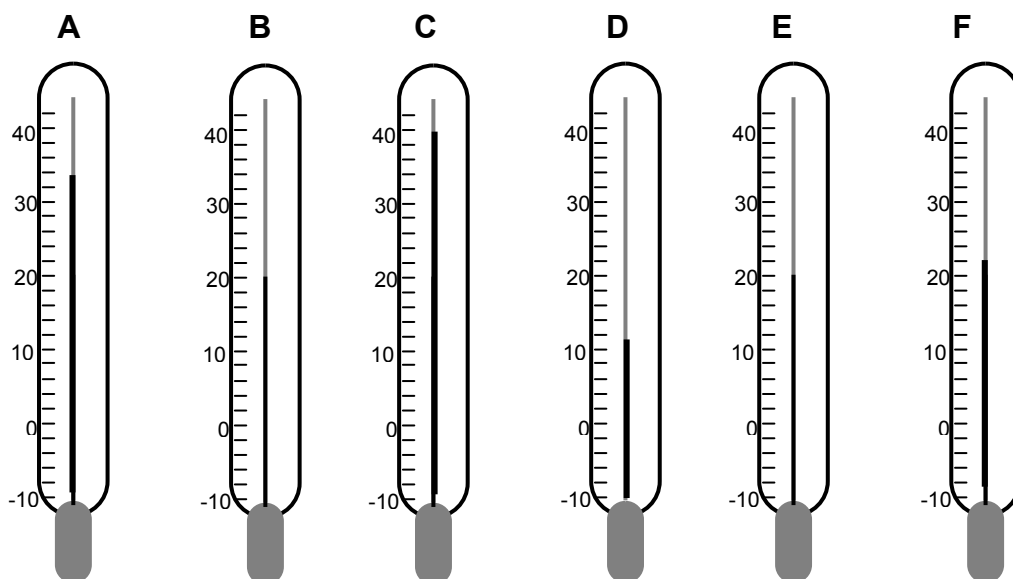


### Activity 3:

Now test yourself by doing this activity.

### Measuring Time and Temperature

1. Study the thermometers below and answer the questions on the next page?



- (i) Which thermometer has the reading of  $20^{\circ}\text{C}$ ? \_\_\_\_\_
- (ii) Which thermometer has the highest reading in  $^{\circ}\text{C}$ ? \_\_\_\_\_
- (iii) Which thermometer has the reading of  $34^{\circ}\text{C}$ ? \_\_\_\_\_
- (iv) Which thermometer has the lowest reading? \_\_\_\_\_
- 

2. Answer the following.

How many:

- (i) seconds in 1 minute? \_\_\_\_\_
- (ii) minutes in an hour? \_\_\_\_\_
- (iii) hours in 1 day? \_\_\_\_\_
- (iv) days in a week? \_\_\_\_\_
- (v) days in a forth night? \_\_\_\_\_
- (vi) weeks in a month? \_\_\_\_\_
- (vii) weeks in a year? \_\_\_\_\_
- (viii) days in a year? \_\_\_\_\_
- (ix) days in a leap year? \_\_\_\_\_
- (x) months in a year? \_\_\_\_\_
- (xi) years in a decade? \_\_\_\_\_
- (xii) years in a century? \_\_\_\_\_
- 

3. Convert these units of time.

- a.) 4 hours to minutes \_\_\_\_\_
- b.) 3 weeks to days \_\_\_\_\_
- c.) 96 hours to days \_\_\_\_\_
- 



## Summary

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

- a thermometer is used to measure temperature in degree Celsius
  - a clock is used to measure time in seconds, minutes and hours.
  - scales can be estimated.
  - scales used in instruments are marked in smaller and smaller divisions for accuracy.
  - to make a measurement, you must be able to read what each scale division on the instrument represents.
- 

**NOW DO PRACTICE EXERCISE 4 ON THE NEXT PAGE**



## Practice Exercise 4

Answer the following questions:

1. Name the instrument used for measuring time. \_\_\_\_\_
2. Name the instrument used for measuring temperature. \_\_\_\_\_
3. Write these times using 12-hour time including a.m. or p.m.
  - a. 0500 \_\_\_\_\_
  - b. 0830 \_\_\_\_\_
  - c. 1145 \_\_\_\_\_
  - d. 1900 \_\_\_\_\_

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

### Answers to Activities

#### Activity 1

1. **Qualitative** observations include the use of senses such as sight, smell, touch taste and hear to observe the results.
2. **Quantitative** observations include the use of instruments such as rulers, balances, graduated cylinders, beakers, and thermometers for measuring. The results of experiments conducted are measurable.

#### Activity 2

- |                 |                  |
|-----------------|------------------|
| 1. qualitative  | 8. quantitative  |
| 2. qualitative  | 9. qualitative   |
| 3. qualitative  | 10. quantitative |
| 4. qualitative  | 11. quantitative |
| 5. quantitative | 12. qualitative  |
| 6. quantitative | 13. quantitative |
| 7. qualitative  |                  |

#### Activity 3

1. (i) E  
(ii) C  
(iii) A  
(iv) D

- |    |       |            |        |           |
|----|-------|------------|--------|-----------|
| 2. | (i)   | 60 seconds | (vii)  | 52 weeks  |
|    | (ii)  | 60 minutes | (viii) | 365 days  |
|    | (iii) | 24 hours   | (ix)   | 366 days  |
|    | (iv)  | 7 days     | (x)    | 12 months |
|    | (v)   | 14 days    | (xi)   | 10 years  |
|    | (vi)  | 4 weeks    | (xii)  | 100 years |
- 
- |    |    |             |  |  |
|----|----|-------------|--|--|
| 3. | a) | 240 minutes |  |  |
|    | b) | 21 days     |  |  |
|    | c) | 4 days      |  |  |

## Lesson 5: Volume and Capacity



Welcome to Lesson 5 of Strand 1. In the previous lesson you looked at measuring temperatures and time. In this lesson you will still continue to learn and understand more on measurements.



### Your Aims:

- identify the correct instrument and scales used to measure volume
- describe the accurate ways of reading volume, capacity, mass and weight.

Do you still remember what you have learnt in your Grade 7 on volume, mass, weight and the instruments and correct ways of measuring?



I think I can recall the definitions for weight, mass and volume from the Grade 7 Course

What is Volume?

**Volume** means „space taken up“. A measuring cylinder is used to measure the volume of liquid or how much space is taken up by the liquid. The cubic centimetre ( $\text{cm}^3$ ) is the unit for measuring the volume. Millilitres (ml) and litres (l) are other units of volume.

$$1\text{cm}^3 = 1\text{ml}$$

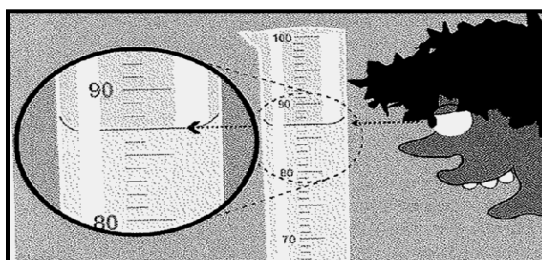
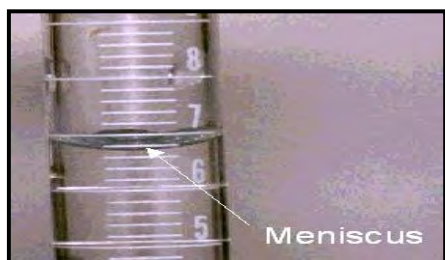
In order for you to get a correct or accurate reading there is a correct way of reading the volume of measuring cylinder.

Always have your eyes level with the level of the cylinder and read from the bottom of the meniscus.



**Meniscus** is where the water is pulled up when it touches the glass.

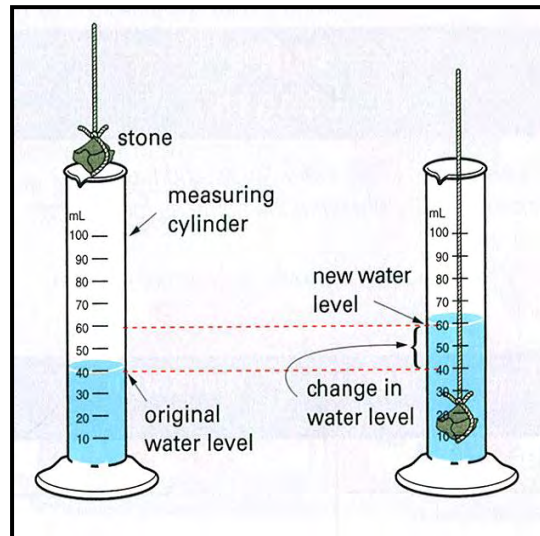
The diagrams below show the meniscus and the correct way of reading the volume.



You measure the volume of the liquid using a measuring cylinder. But you can also measure the volume of an irregular object like a stone using the measuring cylinder. This is how you do it.

First you get some water in the measuring cylinder and measure the volume. Drop the stone in and measure the volume again. Then subtract the two volumes. The difference (measurement) is equal to the volume of the object.

You will do exercises later in the lessons to practice reading volume of liquids and irregular objects.



## Weight

What is weight?

**Weight** is the measure of the downward pull of an object.

The most common units used to measure weight are

|                      |   |                 |
|----------------------|---|-----------------|
| 1000 milligrams (mg) | = | 1 gram (g)      |
| 1000 grams           | = | 1 kilogram (kg) |
| 1000                 | = | 1 tonne (t)     |

Balances and spring scales are used to measure weight.



### Activity:

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

### Measuring volume, weight and mass

- What unit would you use to weigh the following things?
  - coin
  - truck
  - chicken
- Convert these units of weight.
  - 50g to mg
  - 24,500mg to kg
  - 1600kg to tonnes
  - 2000mg to grams
- How many 250ml bottles can be filled with the following amount of liquid?
  - 1 litre
  - 4 litres
  - 2 litres

4. A full pot of pineapple juice holds 5 litres. How many bottles can be filled if each bottle has the capacity of?
- a) 125ml                      b) 300mL                      c) 0.75L
- 



### Summary

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

- mass is how much matter or substance is in an object.
  - weight is the measure of the downward pull of an object.
  - the units used for measuring weight and mass are kilogram, gram and milligram.
  - the instrument used to measure weight and mass is scale and balance.
  - volume is how much space something takes up and is measured in millilitres, and litres.
  - the instrument used to measure volume is a measuring cylinder.
- 

|                                                     |
|-----------------------------------------------------|
| <b>NOW DO PRACTICE EXERCISE 5 ON THE NEXT PAGE.</b> |
|-----------------------------------------------------|



## Practice Exercise 5

Answer the following questions:

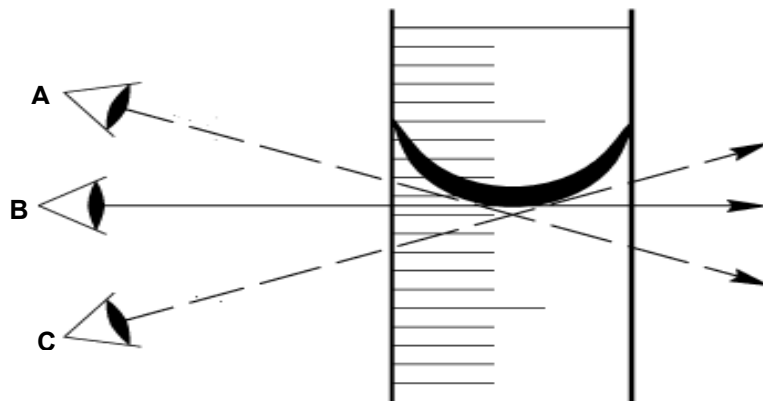
1. Alice sells cordial at the market from a 1L container.
  - a) How many 200ml glasses of juice can she fill from the container? \_\_\_\_\_
  - b) How many 400ml glasses of juice can she fill from the container? \_\_\_\_\_

---

2. Piglet A weighs 1.3kg and Piglet B weighs 970g.
  - a) Which is heavier? \_\_\_\_\_
  - b) What is the difference in their weight? \_\_\_\_\_

---

3. Which of the letters below correctly represent the correct way of reading the volume of a liquid from a measuring cylinder?



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

### Answers to Activity

- |    |    |           |    |             |    |                 |
|----|----|-----------|----|-------------|----|-----------------|
| 1. | a) | <b>mg</b> | b) | <b>kg</b>   | c) | <b>g</b>        |
| 2. | a) | <b>2g</b> | b) | <b>1.6t</b> | c) | <b>50 000mg</b> |
|    |    |           |    |             | d) | <b>0.0245kg</b> |
| 3. | a) | <b>4</b>  | b) | <b>16</b>   | c) | <b>8</b>        |
| 4. | a) | <b>40</b> | b) | <b>17</b>   | c) | <b>7</b>        |

## Lesson 6: Distance

---



Welcome to lesson 6 of Strand 1. In lesson 4 and 5 you looked at measuring time, temperature, volume, mass and weight. In this lesson you will measure distance and length.



### Your Aims:

- describe distance and length
- identify the instruments used to measure distance and length
- describe accurate ways of measuring distance and length

### What is Distance and Length?

**Distance** is the space between two things or places. It can be measured using a ruler or tape measure. **Length** is the measure of distance between two objects or places.

The units for measuring lengths and distances are millimetre (mm), centimetre (cm), metre (m), and kilometre (km).

Length or the space between certain objects is measured in the units called **millimetre (mm)**, **centimetre (cm)**, **metre (m)**. For long distances, units called **kilometres (km)** are used. The instrument used to measure length and distances are trundle wheel, ruler and tape measure.

---



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

#### Measuring short and long distances

- Convert the following
  - 1km to metres \_\_\_\_\_
  - 5mm to centimetres \_\_\_\_\_
  - 10mm to centimetres \_\_\_\_\_
  - 100m to centimetres \_\_\_\_\_
  - 2km to centimetres \_\_\_\_\_
- If you were travelling from Mt Hagen to Lae, what is the best unit that you would use to measure the distance? \_\_\_\_\_
- If you were measuring the width of a 10t coin what unit would you use? \_\_\_\_\_



There is a good reason for you to measure the width of 10t coin in millimetres

The reason is that you will get more accurate measurement. Sometimes two lengths may look the same although they may be a little different. It is good to measure small things using the units of millimetre than centimetre because millimetre will give you an accurate measurement.



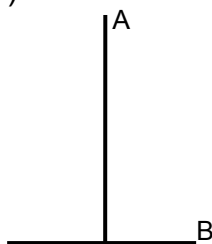
### Activity 2:

Now test yourself by doing this activity.

### Measuring length

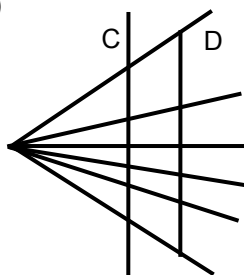
- Look at the diagrams below:  
For each of the diagram write the letter on the line that looks longer.

a)



Answer: \_\_\_\_\_

b)



Answer: \_\_\_\_\_

c)



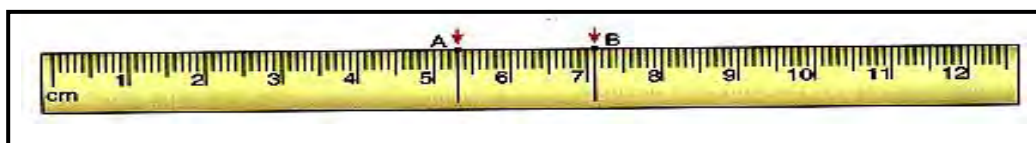
Answer: \_\_\_\_\_

- Now use your ruler to measure the lines. Write your answers on the spaces provided below

Answer: Length of A. \_\_\_\_\_ B. \_\_\_\_\_ C. \_\_\_\_\_

Length of D. \_\_\_\_\_ E. \_\_\_\_\_ F. \_\_\_\_\_

Here are some important tips to remember when measuring lengths using a ruler.



Using a ruler to measure

- Start measuring from the zero on the ruler's scale. If you have a bad ruler that does not have the zero mark, make sure the line showing the unit is right on the starting point of the line.
- Look straight down on the ruler to see the ends of the line.

3. Check the units on the ruler's scale. Write the units with the answer.
  4. If the length is longer than your ruler, you make a mark at the end of the scale and the start measuring again from there again.
- 

**Activity 3:****Now test yourself by doing this activity.****Measuring length, width and diameter using a ruler**

Use your ruler to measure some of these items.

1. Length of this page \_\_\_\_\_
  2. Width of this page \_\_\_\_\_
  3. Diameter of a new K1 coin \_\_\_\_\_
  4. Length of a new K2 note \_\_\_\_\_
  5. Length of a 500ml coke bottle \_\_\_\_\_
- 

Do you still remember how to convert from small units to larger units or from large units to small units?

|                  |                        |          |                     |
|------------------|------------------------|----------|---------------------|
| <b>REMEMBER:</b> | <b>10 millimetres</b>  | <b>=</b> | <b>1 centimetre</b> |
|                  | <b>100 centimetres</b> | <b>=</b> | <b>1 metre</b>      |
|                  | <b>1000 metres</b>     | <b>=</b> | <b>1 kilometres</b> |

---

**Summary**

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

- distance and length are measured in mm, cm, m, km
  - short distances are measured in mm and cm
  - long distances are measured in metre and km
  - the instruments used to measure distances are ruler, trundle wheel and tape measure
- 

|                                                     |
|-----------------------------------------------------|
| <b>NOW DO PRACTICE EXERCISE 6 ON THE NEXT PAGE.</b> |
|-----------------------------------------------------|



## Practice Exercise 6

---

**Answer the following questions:**

1. What are the three instruments used to measure distance?

- (i) \_\_\_\_\_
- (ii) \_\_\_\_\_
- (iii) \_\_\_\_\_

---

2. What instrument could you use to measure long distance? \_\_\_\_\_

---

3. Convert the following

- a) 2km to metres \_\_\_\_\_
- b) 1cm to metres \_\_\_\_\_
- c) 20mm to cm \_\_\_\_\_
- d) 200m to km \_\_\_\_\_

---

4. Convert the following:

- a) metres are in 5 kilometres? \_\_\_\_\_
- b) centimetres are in 3 metres? \_\_\_\_\_
- c) millimetres are in 10 centimetres? \_\_\_\_\_

---

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

**Answers to Activities:**

### Activity 1

- 1.
  - a) 1000m
  - b) 0.5cm
  - c) 1cm
  - d) 10,000m
  - e) 200,000cm
- 2. kilometer (km)
- 3. millimetre(mm)

**Activity 2**

1.    a)    A  
      b)    C  
      c)    E
  2.    A = 3cm  
      B = 2.5cm  
      C = 3.5cm  
      D = 3cm  
      E = 4cm  
      F = 3cm
- 

**Activity 3**

1.    27cm
2.    21cm
3.    3cm
4.    14cm
5.    23cm

## Lesson 7: Inferring and Predicting

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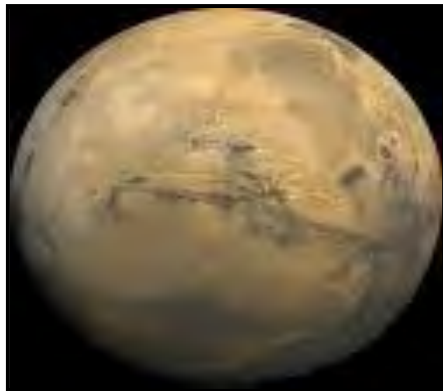
Welcome to Lesson 8 of Strand 1. In your last lesson you learnt about that scientists plan investigations and write reports. In this lesson you will learn about inferring and predicting. **Inferring** means working out from evidence, fact or truth. **Predicting** is say something that will happen in future. Inferring and predicting are important aspects in life.



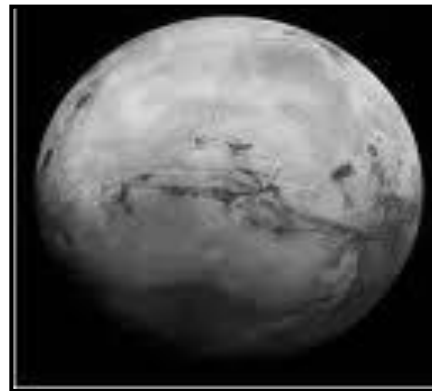
### Your Aims:

- define inference and prediction
- discuss inference and prediction in situations

### Inferring and Predicting



Picture 1



Picture 2

Look at picture 1 and 2. Both are pictures of the same structure on planet Mars. Can you see the difference? Picture 1 was taken in 1976 and Picture 2 was taken 25 years later in 2001.

In 1976, scientist wondered about the origin of the „face“. People thought massive structure has been curved or eroded. These two statements are called **Inferences**.

Another example: A person walking along a river thought a sleeping crocodile in the water had three eyes. When that person throws a piece of meat to the crocodile, the crocodile raised its head to eat the meat. The crocodile had two eyes and its nose to make it seems like three eyes.

So how can you define inference from the two examples?

An inference is an explanation of an observation of the face on Mars, one of them is certainly wrong. The photo taken in 2001 shows that the „face“ was a geological structure of Mars most likely than likely being curved from erosion.

Second the three eyes on the crocodile in the water was an inference statement and it was wrong. The crocodile has two eyes ready to tear the flesh from the man.

Inference is an important skill that you need to remember thin Science.

1. You can usually make several inferences from the same observation.
2. Observations are correct, provided the observer has been honest and careful in reporting the observations. However, inferences made from these observations can be incorrect. They can be tested by further observations.
3. It is important not to confuse observation and inferences otherwise you may think something is a fact when it seems right but guessed.

### Making Predictions

Predicting is another important skill. This is making a forecast of what a future observation maybe. Predictions are based on your observations and what you already know. For example, if you have been observing the moon for a number of nights you can confidently predict whether there will be full moon tonight. Otherwise you can be wrong.



#### Activity:

Now test yourself by doing this activity.

1. Look at the cartoon below



- a) What was the boy's inference?

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- b) On what observation did he based his inference?

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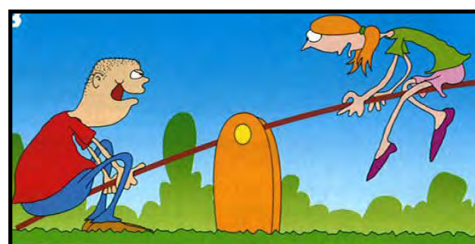
- c) Was his inference right?

---

2. Predict what will happen next in each of the situations.



The weight is too heavy for the man.



The seesaw might break



## Summary

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

- inferences are explanation of an observation a conclusion drawn from evidence or reasoning.
- prediction is making of a statement or forming of an opinion about what will happen in the future.
- predictions are usually based on past observations and experiences.
- both are important skills in science

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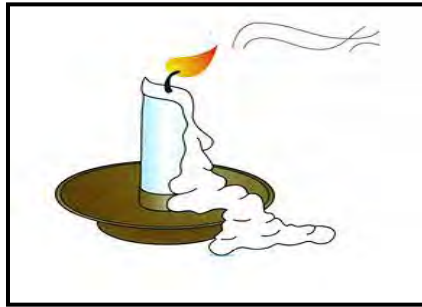
**NOW DO PRACTICE EXERCISE 8 ON THE NEXT PAGE.**



## Practice Exercise 7

**Answer the following questions:**

1. When Joyce saw the burning candle below she made an inference that candle flame will be put off.



- a) What observation made her think of this?  
\_\_\_\_\_
- b) Use her inference to predict what might happen to the candle if it keeps burning.  
\_\_\_\_\_

2. Study this picture carefully and answer the following questions



- a. Which of the three people is making an inference?  
\_\_\_\_\_
- b. Which person made a prediction and what was the observation that made him make that prediction?  
\_\_\_\_\_

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

**Answers to Activity**

1.
  - a) The dog was nice.
  - b) Just by looking at the dog he thought the dog looked nice and friendly.
  - c) No, because when he touched the dog, it bit his hand.
2.
  - a) In less than 5 seconds the man will drop the bar.
  - b) If the person on the left-hand end gets off, the right-hand end will fall.

## Lesson 8: Displaying Data



Welcome to Lesson 9 of Strand 1. In your last lesson you learnt about inferring and predicting which are important skills in science. You have also learnt about different types of graphs in your grade 7 course. In this lesson you will learn about displaying data.



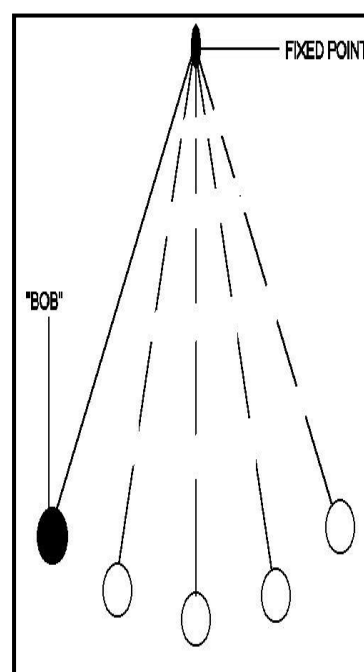
### Your Aim:

- devise a data table and graphs from observations

Now can you construct a pendulum and use it. If you have lost your course books you can follow these instructions.

### Method:

1. Set up the diagram as shown on the right.
2. Draw the line on the paper directly under the hanging pendulum. This is the **zero mark**.
3. Measure 5cm from the zero mark and draw a line parallel with it. Hold the ruler vertically on this line.
4. Now pull the weight so that it touches the ruler. Let the weight go and pull the ruler away. Have another person time how long it takes to swing (and to the 5cm mark. (Record the time).
5. Repeat this 3 more times (you can have more results if you times four swings and divide by four to get the average time)
6. Repeat step 3–5 but this time, pull the weight out. Read your results and find the average time for a swing.
7. Predict what will happen if you pull the weight out 15cm or 20cm. Test your prediction.



A pendulum

You may do the same table of results below using **distance x time** to record your observations.

| Number of swing   | 1 | 2 | 3 | 4 | 5 |
|-------------------|---|---|---|---|---|
| Time for 5 swings |   |   |   |   |   |
| Time for 1 swing  |   |   |   |   |   |

### Changing the Length

In this part of the investigation keep the swing the same distance 5cm away and the same mass but change the length of the pendulum.

Shorten the string by 5cm. Time the swing, then shorten the length by another 5cm. Time the swings. Use the results to predict what will happen if you shorten the string by another 5cm.

So far you have performed the experiment.

Now you must devise a data table. So far you have practiced and learnt new skills. Not only from Grade 8 course but also from the Grade 7 Course. Now, you have;

- recorded observations
- devised data tables (in Grade 7)
- made inference from observations
- made predictions from observation, inference and your experience as well as these skills .

You have learnt to use the laboratory equipment, read scale and calculate average and reduce errors.

Another important part of the investigation is to display your data in a graph, diagram or chart. You have done this in your Grade 7 course.

You will write your observations and findings on the table of results and make a line graph for it.



### Activity:

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

### Table of data

So when you record a set of measurements you end up with a list of numbers. These numbers can be presented in a table. Such table is called a **table of data**. Tables are often used to sort data in specific order so that it is easier to use.

For example:

The table below shows the temperature of different objects. It was sorted out in order from highest to lowest.

| Object              | Average temperature | Hot, warm, cool or cold. |
|---------------------|---------------------|--------------------------|
| Surface of the sun  | 6000°C              | Extremely hot            |
| Oxy-acetylene flame | 3000°C              | Very hot                 |
| Gas flame           | 600°C               | Hot                      |
| Boiling water       | 100°C               | hot                      |
| Human body          | 37°C                | Warm                     |
| Tap water           | 20°C                | cool                     |

Data can be displayed in a form of graph, diagrams or charts. **Graphs** are a way of presenting a „picture“. Each type is used to show particular forms of information. You have drawn graphs in your Grade 7 Strand 1 course and also in your mathematics course.

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## Summary

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

- data tables and graphs are important part of an investigation.
  - graphs are a good way of displaying data.
  - a graph can be used to make predictions and conclusions.
- 

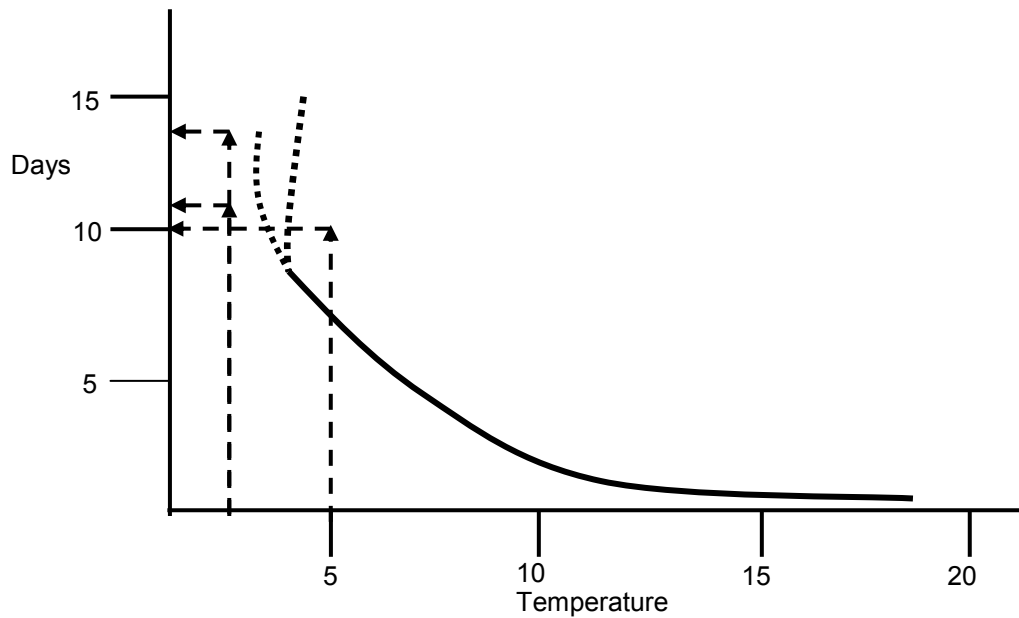
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| <b>NOW DO PRACTICE EXERCISE 9 ON THE NEXT PAGE</b> |
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## Practice Exercise 8

Answer the following questions:

1. Read the following graph and answer the following questions.



The data was obtained by storing milk at various temperatures and recording.

- (i) How long will the milk last at  $5^{\circ}\text{C}$ ? \_\_\_\_\_
- (ii) A carton of milk stayed for 9 days. At what temperature was it likely stored? \_\_\_\_\_
- (iii) Predict how long the milk will last at  $2^{\circ}\text{C}$ ? \_\_\_\_\_
- (iv) Write a conclusion about the graph by completing this sentence.  
The lower the temperature the \_\_\_\_\_.

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

## Lesson 9: Writing a Scientific Report

---



Welcome to Lesson 7 of Strand 1. In your last lessons you looked at measurements. In this lesson, you will ask to investigate and carry out experiments in the laboratory or outside the laboratory. You will also write a report on what how you have carried out the investigation or experiment.



### Your Aims:

- identify parts of writing a report
- define new terms that we come across

When a scientist carries out an investigation, he or she answers questions like, why plants need sunlight to produce food. He or she plans the investigation and makes observations. An **observation** is something you do using your senses. He or she also measures and records the data or information.

### Writing Reports

When planning investigations, scientists also plan on how they are going to record their observations and write how they conduct their investigations. They write a report. A report is very important because other people can find out what the scientists have done and discovered from the experiment.

A good experimental report usually has the following parts:

- A. Title of the investigation
- B. Aim or the objective of the investigation
- C. Hypothesis is what you expect from the investigation
- D. Lists of materials to be used
- E. Procedure or orderly steps of things to do in the investigation
- F. Results of the experiment
- G. Discussion of the results
- H. Conclusion

The report often has drawings showing apparatus used and how it was set up. This is when you are required to use your skills in drawing.

**Activity 1:****Now test yourself by doing this activity.****Writing a Report****Instructions:**

Study this Investigation report carefully and put them in order from 1 – 7 headings. There are seven parts to it and they are all mixed up. Using the parts on the previous page, rewrite them in order.

1. Making Milk Glue.
2. To find out if glue can be made from milk.
3. 100ml skim milk, 25ml white vinegar, 5g baking soda, spatula, stirring rod, filter funnel, filter paper, stand with clamp, Bunsen Burner, tripod, gauze mat, heatproof mat and matches.
4. Method
  - (i) About 100ml of milk was added to a 250ml beaker, then about 25ml of vinegar was added.
  - (ii) The mixture was heated slowly with a burner while stirring.
  - (iii) When white curds were noticed, the burner was turned off.
  - (iv) The mixture was set aside to cool, while the filtering apparatus was set up.
  - (v) The liquid was decanted from the mixture and the curds were filtered.
  - (vi) The curds were scraped into a beaker.
  - (vii) About 20 ml of water and a spatula of baking soda were added to the curds.
  - (viii) The mixture was stirred to make a paste.
5. The glue paste was tested with paper and with wooden ice-cream sticks. We found that the glue stuck paper together really well. But the wooden ice-cream sticks came apart with a little force.
6. We think milk glue works really well with paper. However, we found out on the internet that the curds are actually made from casein which is a protein in milk. This casein glue was used by the Egyptians as wood glue.  
We do not know why our glue did not work well on wood. But we think, we should have dried the curds better before we added the baking soda.
7. A glue can be made from milk.

**Write the report in order using the spaces given in your Answer Booklet.**

1. \_\_\_\_\_  
\_\_\_\_\_
2. \_\_\_\_\_  
\_\_\_\_\_
3. \_\_\_\_\_  
\_\_\_\_\_
4. \_\_\_\_\_  
\_\_\_\_\_

5. \_\_\_\_\_  
\_\_\_\_\_
6. \_\_\_\_\_  
\_\_\_\_\_
7. \_\_\_\_\_  
\_\_\_\_\_

Did you manage to put them in order? Now, you can do your own investigation.

---



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

**Writing a Report on whether plants need sunlight to grow.**

Your aim is to practice skills of observing and recording.

---



**Summary**

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

- a report allows people to understand how the experiment was conducted and what was found out.
- a good report usually has the following parts:
  - Title
  - Aim
  - Hypothesis (sometimes omitted)
  - Materials
  - Methods
  - Results
  - Discussion
  - Conclusion

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|                                                     |
|-----------------------------------------------------|
| <b>NOW DO PRACTICE EXERCISE 7 ON THE NEXT PAGE.</b> |
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## Practice Exercise 9

Answer the following questions:

1. List down the parts used in report writing?

---

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2. Explain the term report.

---

---

3. Explain term observation.

---

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

### Answers to Activity 1

1. **Title:** Making Milk Glue
2. **Aim:** To find out if glue can be made from milk
3. **Materials:** 100ml skim milk, 25ml white vinegar, 5g baking soda, spatula, stirring rod, filter funnel and paper, stand and clamp. Bunsen burner, tripod, gauze mat, heatproof mat and matches.
4. **Method:**
  - (i) About 100ml of milk was added to a 250ml beaker, then about 25ml of vinegar was added.
  - (ii) The mixture was heated slowly with a burner while stirring.
  - (iii) When white curds were noticed, the burner was turned off.
  - (iv) The mixture was set aside to cool, while the filtering apparatus was set up.
  - (v) The liquid was decanted from the mixture and the curds were filtered.
  - (vi) The curds were scraped into a beaker.
  - (vii) About 20 ml of water and a spatula of baking soda were added to the Curds
  - (viii) The mixture was stirred to make a paste.
5. **Results:** The glue paste was tested with paper and with wooden ice cream sticks. We found that the glue stuck paper together really well. But the wooden ice-cream sticks came apart with a little force.
6. **Discussion:** We think milk glue works really well with paper. However, we found out on the internet that the curds are actually made from casein which is a protein in milk. This casein glue was used by the Egyptians as wood glue.
7. **Conclusion:** Glue can be made from milk.

## Lesson 10: Doing and Writing an Experiment

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Welcome to Lesson 10 of Strand 1. In the previous lesson, you learnt the basic skills of measuring and identifying problems. You also learnt the skills of inferring and predicting. They are also very important to write a report. Therefore in this lesson you will be doing and carrying out an experiment



### Your Aim:

- plan and perform an experiment from a given topic

There are a number of basic steps you must go through in planning out your experiment. These steps are:

1. Selecting a problem
2. Clarifying the problem
3. Designing an experiment
4. Conducting the experiments
5. Making a conclusion and writing a report.

Each step will allow you to develop and practice a wide range of science skills. You will be able to demonstrate your creativity, imagination and perseverance

There are question you ask when you want to carry out experiments.

1. How will I select a problem to investigate?
2. How do I clarify the problem?
3. How do I design an experiment?
4. How will I carry out my experiment and record the observations?
5. How will I make my conclusion and write my report?

You have already learnt the steps involving report writing in Lesson 7.

### Title

Think up a short name or title for your experiment which gives the reader an idea what the topic of your research project would be.

### Aim

In the aim you state the purpose of your experiment. This can be used to find out the answer to the question you wanted to investigate.

### Hypothesis (would be possible)

The hypothesis is the possible answer to the question you asked. Write this as a simple statement.

### Method

The method is the steps you follow when carrying out your experiment. This section can include labelled drawings showing how the equipment was set up.

**Results**

This section contains your observations and measurements neatly set out in data tables or represented as graphs. You may also include sketches or photographs to illustrate what you observed.

**Discussion**

This section is used to write about the experiment and the results. Write about what the results show. Also describe any problems you experienced with your experiment. You may be able to suggest how you could improve on its design.

**Conclusion**

The conclusion should be a brief statement on whether your results supported or rejected your hypothesis.

**Always remember that an experiment always involves designing tests to answer a question or solve a problem.**

For example, when you cut a fresh kaukau and leave it outside for a few days, it starts to rot. You have an idea that it is something in the air that makes it go bad. So your aim might be, if a cut kaukau is covered it will not go bad. You design test to show whether that is true or not true.

The most important thing to remember about designing experiments is that your aim must be a question or statement that can be tested.

For example: Plants grow better in white light than in blue light.

Your planning then involves the steps in Lesson 7 and in the previous page.

So now let us see if you can design an experiment.

**Activity:**

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

Write an aim that could be tested in an experiment for each part below.

- a) Dark coloured clothes seem hotter during a hot day than light clothes.

---

- b) Our main door seems to close well on cold days than hot days.

---

**Practice Designing an Experiment****The problem to be solved**

How quickly can you catch a falling ruler? When a person holds a ruler between their thumbs and fingers and let it go, they see it fall and then their fingers quickly try to catch it. You can measure a person's reaction time by finding out how far the ruler fell before it was caught.

The problem in this experiment is to find out which of your senses – sight, hearing or touch reacts fastest to catch a falling ruler.

### Designing your experiment

**1. Setting up the test**

Have one person hold a metre ruler (a 50cm one can be used) between another person's thumb and fingers. Make sure the 0cm mark is level with the top of their thumb and fingers.

**2. Testing the senses**

Drop the ruler and measure how far it falls before it was caught. Do this 4 times and average the results. Repeat the test but this time blindfolds the person or ask them to shut their eyes. They have to catch the ruler after they hear you shout NOW or GO. To test a person's touch reaction, tap them on their arm or hand.

**3. Designing tests**

Work in a small group and design the tests to solve the problem. Make sure you write a draft of your method, list the materials needed and discuss safety issues.

**4. Plotting graphs**

Include bar graphs of the results in the Results Section of your report.

**5. Writing your report**

Write a full report of the experiment which include diagram where appropriate. You could also take a digital photo of the test to include in your report.

Were you able to follow the steps in writing a report?

From what you have learnt, can you plan an experiment using this statement, „I find sugar dissolves faster in hot water than in cold water.“



### Summary

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

- experiments and investigations must be planned carefully before investigating.
- an aim must be a question or statement that is able to be tested.

---

|                                                      |
|------------------------------------------------------|
| <b>NOW DO PRACTICE EXERCISE 10 ON THE NEXT PAGE.</b> |
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## Practice Exercise 10

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**Describe the following terms:**

a. Aim

---

---

---

b. Hypothesis

---

---

---

c. Conclusion

---

---

---

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

### Answers to Activity

1.
  - a) To find out if dark coloured clothes are hotter during a hot day than light clothes.
  - b) To find out if our main door closes well on cold days than hot days.

## REVIEW OF STRAND 1: WORKING SCIENTIFICALLY

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### Lesson 1: Laboratory Apparatus

- Science diagrams of apparatus must be kept simple when drawn.
- There is a basic rule that you use when you are drawing diagrams.
- It important to be able to identify the simple equipment or apparatus in the science laboratory before you carry out an experiment or investigation.

### Lesson 2: Safety in the Laboratory

- Science laboratory rules are very important as they will help you avoid accidents.
- Know what you are doing in the laboratory – read the instructions carefully before you start.
- Always think of others and behave responsively and sensibly.

### Lesson 3: Let us Measure (1)

- Ear is the organ of hearing.
- Nose is the organ of smelling.
- Eye is the organ used for seeing.
- Tongue is the organ used for tasting.
- Skin is used for feeling.

### Lesson 4: Let us Measure (2)

- A thermometer is used to measure temperature in degree Celsius( $^{\circ}\text{C}$ ).
- A clock is used to measure time in seconds and minutes.
- Scales used in instruments are marked in smaller and smaller divisions for accuracy.

### Lesson 5: Let us Measure (3)

- Mass is how much matter or substance an object contains.
- Weight is the measure of the downward pull of an object.
- The units used for measuring weight and mass are kilograms(kg), grams(g) and milligrams(mg).
- The instrument used to measuring weight and mass are scales and balances.
- Volume is how much space something takes up and is measured in millilitres(ml) and litres(L).
- The instrument used to measure volume is a measuring cylinder.

**Lesson 6: Writing a scientific report**

- Distance and length are measured in metre (m), centimetre (cm), kilometre (km), and millimetre (mm).
- Short distances are measured in centimetre (cm) and millimetre (mm).
- Long distances are measured in kilometre (km) and metre (m).
- The instruments used to measure distances are ruler, trundle wheel and tape measure.

**Lesson 7:**

- A report allows people to understand how the experiment was conducted and what was found out.
- A good report usually has the following parts:
  - Title
  - Aim
  - Hypothesis (sometimes omitted)
  - Materials
  - Methods
  - Results
  - Discussion
  - Conclusion

**Lesson 8: Inferring and Predicting**

- Inferences are explanation of an observation.
- Predictions are usually based on past observations and experiences.

**Lesson 9: Displaying Data**

- Data tables and graph are important part of an investigation.
- This is where you display your data in a graph, diagram or chart.
- Graphs are a good way of displaying data.
- A graph can be used to make predictions.

**Lesson 10: Doing and Writing an Experiment**

- Experiments and investigations must be planned carefully before investigating.
- An aim must be a question or statement that can be able to be tested.

**Answers to Practice Exercises 1- 10**

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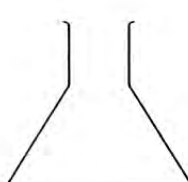
**Practice Exercise 1**

1.
  - (i) use a pencil for ease of correction if you make a mistake
  - (ii) label the drawing using label lines
  - (iii) use a ruler for all straight lines, and
  - (iv) do not use shading or colouring
2.
  - (i) flat bottom flask
  - (ii) wire gauze
  - (iii) tripod stand
  - (iv) Bunsen Burner
  - (v) heatproof mat
3. Draw the following equipment correctly.

Beaker



Conical Flask



Test Tube



---

**Practice Exercise 2**

1.
  - a. He has spilled chemical on his face.
  - b. He looked directly into the test tube.
  - c. Point the test tube away from his face.
2.
  - A. flammable
  - B. toxic
  - C. corrosive
  - D. radioactive

**Practice Exercise 3**

1.
    - (i) touch
    - (ii) smell
    - (iii) taste
    - (iv) seeing
    - (iv) hearing
  2.
    - (i) nose
    - (ii) tongue
    - (iii) eyes
    - (iv) skin
    - (v) hear
  3. olfactory nerves
  4. Eye B
- 

**Practice Exercise 4**

1. clock
  2. thermometer
  3.
    - a) 5:00am
    - b) 8:30am
    - c) 11:45am
    - d) 7:00pm
- 

**Practice Exercise 5**

1.
  - a) **50 glasses**
  - b) **20 glasses**
2.
  - a) The pig weighing 1.3kg is heavier.
  - b)  $1300\text{g} - 970\text{g} = \underline{330\text{g}}$

## 3. Letter B

**Practice Exercise 6**

1.
    - (i) trundle wheel
    - (ii) ruler
    - (iii) tape measure
  2. Trundle wheel
  3.
    - a) 2000m
    - b) 100cm
    - c) 2cm
    - d) 0.2km
  4.
    - a) 5000m
    - b) 300 cm
    - c) 100 mm
- 

**Practice Exercise 7**

1. A title, an aim, a hypothesis (sometimes omitted), a list of materials, an outline of the methods used, the results of the experiment, a discussion of the results and a conclusion.
  2. A report is an organised using seven headings. A report is very important because other people can find out what he did and what he discovered.
  3. An observation is something you find out using your senses.
- 

**Practice Exercise 8**

1.
  - a) Flame blowing in one direction and burning faster
  - b) The wax will melt out quickly. The candle will go out.
2.
  - a) The girl and boy on the left.
  - b) The boy on the right made a prediction. He felt the ground shaking and saw the smoke coming out of the volcano.

**Practice Exercise 9**

- 1) **10 days**
  - 2.) **About 4 degree Celsius**
  - 3.) **About 15 days (more than 10 days is also an acceptable answer).**
  - 4.) The lower the temperature the **longer the milk will last.**
- 

**Practice Exercise 10**

1.
  - a. In the aim you state the purpose of your experiment. This can be to find out the answer to the question you wanted to investigate.
  - b. The hypothesis is the possible answer to the question you asked. This is written as a simple statement.
  - c. The conclusion should be a brief statement on whether your results supported or rejected your hypothesis.

**GLOSSARY**

|             |                                                                                                                                |
|-------------|--------------------------------------------------------------------------------------------------------------------------------|
| Corrosive   | A substance that has the ability to destroy or eat away other substances such as metal, skin and bones by a chemical reaction. |
| Disorder    | Lack of order or regular arrangement                                                                                           |
| Flammable   | Material that ignites easily and burns rapidly with a flame.                                                                   |
| Radioactive | Material that give off radiation energy which can damage living tissue.                                                        |
| Receptors   | An organ or cell that responds to light, heat or other external stimulus.                                                      |

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## 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                       | <b>Science Stream:</b> Biology, Chemistry and Physics                                     |
| 2                                    | English 2                       | <b>Social Science Stream:</b> 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.