

Community Development Strand

Unit 3: Technology

Module 3.2 Practical Applications



Student Support Material

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Unit outline

Unit	#	Modules
Unit 3 Technology	3.1	Introduction to Technology Core
	3.2	Practical Applications Core

Icons



Read or research



Write or summarise



Activity or discussion

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Module: 3.2 Practical Applications

Rational

Practical technology is basic technology designed to meet the needs and improve the lives of the people it serves. Practical Technology is also people's response to the challenges of their environment using the available resources. The Technology Unit is made up of two core modules. The first, **Introduction to Technology** deals with basic principles and the history of technology. It encourages you to draw on their cultural backgrounds to discuss and share a range of technologies that exist in Papua New Guinea today.

This module, **Practical Applications**, focuses on basic technologies that can be tackled within the Teachers College environment requiring a minimum of technological expertise from the lecturer. Where appropriate other staff can be invited to cross-lecture and skilled community people share their expertise. **Practical Applications** looks at applying technology for personal use as well as for self-employment purposes. Links are established with CD and AG Units in particular; CD Unit 2 Module 2.2 Integrated Community Projects (1) and Module 2.3 Integrated Community Projects (2)

The scope of the technologies chosen is represented by six broad '**technological themes**' likely to be important to schools and their communities. These themes and the course generally also prepares you to implement the '**Making a Living Syllabus**' for grade 6, 7 and 8 students in primary schools.

General aims

By the end of this module you will be able to:

- Have personal mastery over several basic technical skills in particular sewing, cooking and woodwork.
- Share and transfer these skills to the school and village/community environments
- Apply a range of teaching methods for teaching basic technology to their students

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Module 3.2 Practical Applications – Course Overview

Themes and topics

Themes	Topics	Objectives- students will be able to:
Home Economics (1) –Sewing and making	Fibres and Fabric Basic stitches project – done by hand. Basic sewing machine project. Clothes care and maintenance	- explain fibre to fabric processes, sewing stitches. - complete a basic sewing project without a sewing machine. - demonstrate proper care and use of a sewing machine. - complete a basic sewing project with the aid of a sewing machine. - describe clothes care and maintenance.
	Handcrafts	- design handcrafts to be made from local materials (bamboo, cane, coconut, sea shells, bush fibre, clay) and a range of methods such as weaving, knitting, pottery, etc.
Home Economics (2) Cooking	Food and meals	- describe cooking equipment, recipes and methods. - plan nutritious meals for different numbers of people and a variety of occasions, describe attractive presentations.
Basic Woodwork	Basic Woodworking project	- name, describe and demonstrate a range of basic woodworking tools and list appropriate safety rules. - prepare a project plan for making a woodwork project following a plan.
Water, power and sanitation.	Basic plumbing and water supply maintenance.	- describe the features and operation of different community water supply systems. - identify and use tools and materials correctly to replace washers and taps, unblock sinks, maintain toilets and drains; - care for and prolong the life of septic tank systems - describe the function and usefulness of composting toilets
	Basic Electrical repairs	- list and revise safety rules for working with electrical appliances, describe faults, tools, materials and methods to replace parts - explain how to replace bulbs, tubes, fuses and plugs.
	Alternative energy	describe the use, operation and maintenance of solar, wind generators and micro-hydro electricity generators.
Household equipment and machines	Basic car and engine maintenance Mechanics tools Small appliance maintenance	- describe the basic operation and maintenance of a small engine and if possible carryout minor repairs. - list the tools required for small engine repairs and maintenance. - describe appropriate care and safe use of appliances such as stoves, jugs, irons, refrigerators, toaster and washing machines.
Building Maintenance	Maintenance of walls, windows, doors, floors and roofs.	- describe and demonstrate how to repair most common problems on external and internal walls, floors, gutters and down pipes. - describe and demonstrate how hang a door, replace fly wire, fit locks and replace a broken window
	Basic concreting and painting	- describe and where possible demonstrate how to prepare a site for concreting, lay foundations, use and care for concreting tools, mix and pour concrete and finish off. - describe and demonstrate if possible the preparation new and old surfaces for painting, the preparation and use of paint, correct brush techniques and safe and careful cleanup methods.

Module 3.2 Practical Applications

Theme: Home Economics (1)

Sewing and making



Home Economics (1) Sewing and Making

Rationale

Home Economics (1) Sewing, introduces you to the basics of sewing. You will be given opportunities to practice the use of needles, basic stitches, patterning, cutting, the use and care of a sewing machine and developing teaching resources. Through this theme several topics will guide you through practical activities and sewing projects. For those of you with proficiency in sewing, your lecturer will select extension projects to challenge you.

Objectives

By the end of this module you will be able to:

1. Explain fibre to fabric processes, sewing stitches.
2. Complete a basic sewing project without a sewing machine.
3. Demonstrate proper care and use of a sewing machine.
4. Complete a basic sewing project with the aid of a sewing machine.
5. Describe clothes care, laundering processes and explain or demonstrate ironing of clothes.
6. Design money-making projects caring for clothes (repair, washing, ironing)
7. Produce teaching and learning resources suitable for Grades 6-8

Suggested topics

1. Fibres and fabric
2. Basic stitches – done by hand project
3. Basic sewing machine project
4. Clothes care
5. Clothing project

Topic 1: Fibres and fabric

Objectives

By the end of this topic you will be able to:

- Identify and name common sewing tools used in basic hand sewing
- Discuss the uses, care and storage of tools and equipment used in sewing
- Describe natural and human-made fibres
- Produce a teaching and learning resource suitable for Grades 6-8

Scope

This topic as a quick introduction to the Home Economics (1) Sewing course. You may already acquainted with different types of fibre and the tools used in hand sewing – if you are think of ways you can teach this topic to Grades 6-8 and plan teaching and learning resources.

Where do fibres come from?

Originally, all fibres came from natural sources such as sheep and cotton. Today many fibres are created from natural products such as woodchips or chemically and are known as synthetic fibres.

Textile fibres				
Natural fibres			Human made fibres	
Animal	Vegetable	Mineral	Human modified	Synthetic or chemical base
wool silk mohair hair	cotton linen coconut (coir) kapok sisal coir jute	asbestos metallic	viscose rayon acetate rayon	nylons polyesters (terylene, crimplene, dacron) acrylics (cashmilon, orlon) spandex (lycra)

3.2 Activity 1

In your books draw up the Fibre family tree as shown above. Find as many samples of fibres as you can.

Choose 1 fibre from each of the following categories; animal, plant and synthetic. Research to find as much as you can about each and make a chart display suitable for use in a classroom. Make a display which could be used as a classroom resource.

Include questions to challenge students at Grade 6-8 level.

Qualities of fabrics

The source of these fibres and their own specific nature will affect the characteristics of the fabrics made from them. For example, whether they are: warm to wear and water resistant like wool.

3.2 Activity 2

Match each fabric with the quality that is associated with that fabric.

- Cotton
- Wool
- Polyester
- Nylon
- Linen
- Kapok

a) Absorbent – tea-towels are made of this.   b) Warm to wear, water resistant, natural.   c) Strong and elastic, synthetic   d) Crease resistant, synthetic   e) Natural, strong, versatile, grown, creases.

Make a word-find with at least 15 fibre related words - stress that it must challenge Grade 6-8 pupils

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Sewing equipment

It is important to have the right sewing equipment before you start to sew. All sewing equipment particularly small items can be stored in a patrol type box.

3.2 Activity 3

Think of the primary school environment and teaching sewing to a Grades 6,7, or 8 class using the equipment shown at Figure 1.

Make a list of the basic hand sewing equipment and materials you would need to complete a sewing project and give all students experience with sewing and making.

Share your ideas with your peers.

In small groups, discuss how you would:

- *Get this basic equipment*
- *Care for it and maintain it*
- *Secure it to ensure it is not lost or borrowed*

Write these ideas up in your portfolio under the heading 'Equipment Guidelines'.

Equipment for working with textiles

An effective craftsperson always has efficient tools with which to work. Tools should be looked after carefully, and should be used for the purpose for which they were intended.

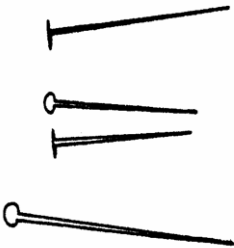
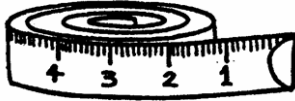
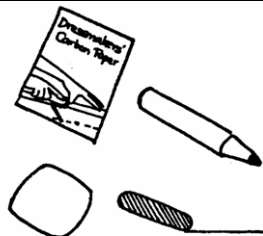
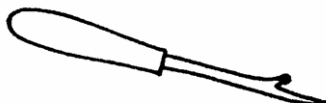
- Check through the items of equipment listed below
- Locate each item and test it out for its intended use

In your book, copy out this list of equipment. Beside each item, write points that you consider are necessary for the equipment to function correctly and well. These points could include:

- Factors to consider when buying a new piece of equipment
- Points for caring for it properly

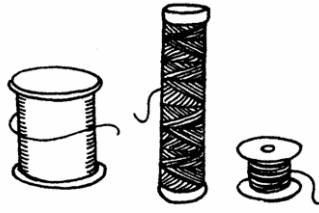
Some items of equipment that you are most likely to use are listed here. As you develop your skills, you will want to use a greater variety of special items

Scissors		Used to cut out patterns in fabric
• Cutting out scissors		Small scissors used for finer handwork, such as cutting threads, and nicking into seams. Have fine, sharp points
• Embroidery/handwork scissors		
• Pinking shears		
		Used to cut fabrics which do not fray easily

Pins • Lace pins • Dressmakers pins • Berry pins	 Very fine pins which bend easily. Used on fine fabrics These pins vary in thickness. Used to pin patterns on to fabric, and to pin garments together Berry pins have large heads, and are usually longer than regular pins
Needles • Sharps • Crewel • Darners • Bodkin	 These are long with an oval eye Available in many sizes Crewels are usually the best for hand sewing and embroidery, as they are fine, and have long oval eyes which are generally easy to thread. Large needles with large eyes to take wool or thick threads The bodkin is a large needle, with a blunt point and a large eye. Used for threading ribbon, elastic, or cords through holes or hems
Tape measure	 Used to measure fabric seams etc. It is marked in cm and mm
Fabric markers • Dressmaker's carbon • Marking pencil • Marking chalk	 These markers are used to transfer pattern markings to the fabric, usually on the wrong side. The chalk pencil may be sharpened to get a fine point This is a flat pillow of chalk available in several colours
Tracing wheel	 Used to copy patterns by tracing through an original to a second or third piece of paper underneath. Also used to transfer fitting lines to fabric using dressmaker carbon.
Unpicker	 Used to unpick rows of machining when incorrectly sewn or when a seam requires undoing

Thread

- Mercerised cotton
- Polyester Variety of brands available. Should be used with polyester fabrics



Available in a great variety of colours. Thickness varies. Size 40 is generally used for hand and machine stitching.

Topic 2: Basic stitches project – hand sewing

Objectives

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

- Demonstrate correct use of basic stitches, cutting and safe use of equipment
- Measure and mark the correct size of the materials needed for the hand sewing project
- Complete a basic sewing project without a sewing machine

Scope

This topic is an introduction to sewing. It is written as a series of lesson which should take not more than three 45 minutes periods.

Two basic projects are given for the lecturer to choose from:

- Pillow case
- School bag, for students until little prior sewing skill

You will have been introduced to the sewing room and any rules for use and care of equipment explained. By the end of this topic most of you should have completed a basic carry-bag or pillowcase. If you have some expertise in sewing please assist your peers who may struggle.

Hand sewing basic stitches

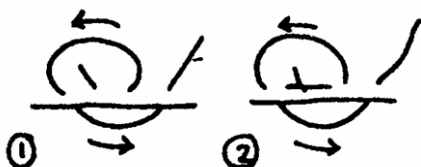
When hand sewing

When hand-sewing fibres, yarns, and fabrics, a great variety of stitches can be used. Each stitch has its own specific purpose. If you can carry out correct fastening on, working and joining, and fastening off, you will be able to improve the efficiency of the stitch in doing its job, and also be able to work more efficiently.

Check your hand-sewing

1. Select the correct thread for the task
2. Select the correct size of needle for the fabric and thread
3. Fasten on and off securely
4. Always note carefully the direction that the thread unwinds from the reel of cotton. Thread the needle with the end coming off the reel. Keep this end the shorter of the two. This thread will be less likely to fray or knot.
5. Work stitches one at a time.

Fastening on and off



Always secure your thread at the beginning and the end by doing a few small back-stitches

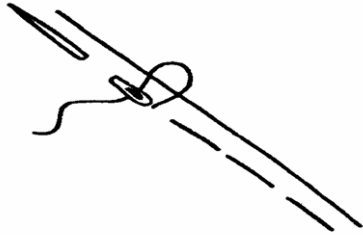
Some people start with a knot. This should be used only if it is a small, and well hidden from view.

Hand sewing technique



Work from the front, inserting the needle through the back, and then the front, before pulling the thread through. (See diagrams for tacking running and back-stitching)
Most hand –stitching is worked from right to left for right-handed people; overcasting and herringbone are worked from left to right. Follow the diagrams carefully to see how the stitches are completed.

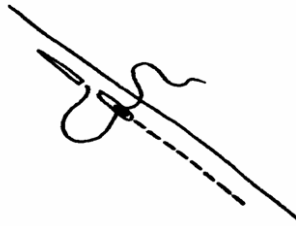
Tracking or basting



A temporary stitch used to hold fabric in place. Can be even or uneven.

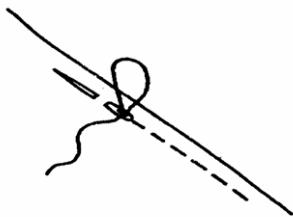
Running Stitch

Can be used to hold fabric in correct shape or to pull up or case the fabric.



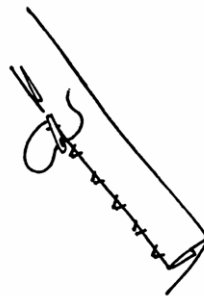
Back stitch

Used to give a firm seam.



Slip hemming

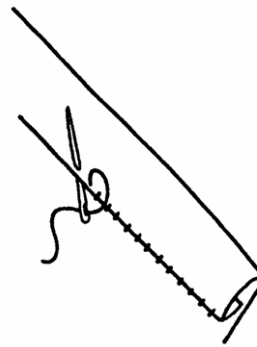
Used to hem fine fabrics and to catch facings.



Hemming

Firm hemming used to hem binding and the back of waistbands, cuffs, and collars.

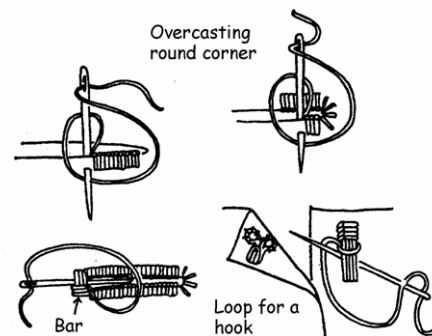
Used to hem woollens and stretch fabrics.

**Over casting**

Used to neaten single or double raw edges, to prevent fraying.

Buttonhole

Used to neaten raw edges to make belt carriers, button loops eyes for hooks and buttonholes.

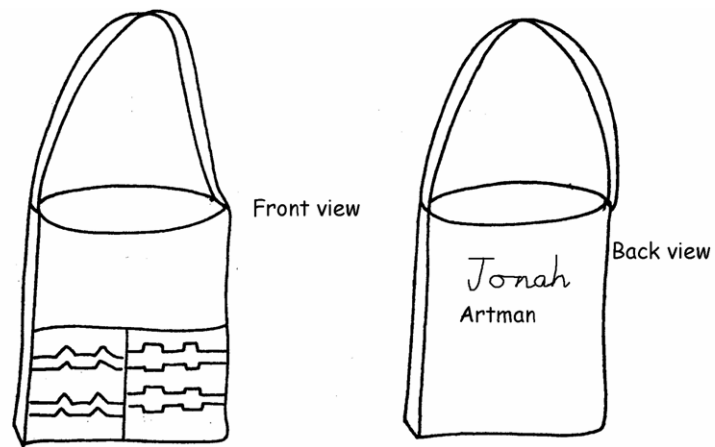
**Project 1: School bag****Objectives**

By the end of the project you will be able to:

- Identify and name common sewing tools used in basic sewing.
- Measure and mark the correct size of the materials needed for the project.
- Cut the materials with straight lines on all sides. Sew the seams of the project using appropriate hand-stitches
- Practise safety precautions in handling and using some sewing tools.
- Sew suitable embroidery stitches to decorate the pockets of the project.
- Attach the pockets correctly using suitable hand stitches
- Sew the handles correctly with appropriate stitches
- Finish the project neatly and attractively

Materials needed

- 1 metre of plain material preferably thick and strong fabric like calico or denim. If these are not available, rice bag or flour bag can be used
- Sewing cotton, needle - larger size would be better.
- Embroidery cotton or bright coloured sewing cotton
- Sharp pair of scissors, pins



If a plastic rice bag is used, it is a good idea to sew a lining out of thinner fabric. This will make the bag stronger, protects the books from rain and make it more attractive.

Procedure

You can make a pattern using old newspaper of your project including the different parts such as the handle, pockets and lining if the project will be lined.

Check carefully that all measurements for all sides of the project are correct.

Layout the pattern on the fabric correctly. Pin the patterns in place and mark the sewing line on the fabric. Do this for all the pattern pieces.

Check to see that all the pattern pieces are laid out properly and that sewing lines are correctly marked on the fabric.

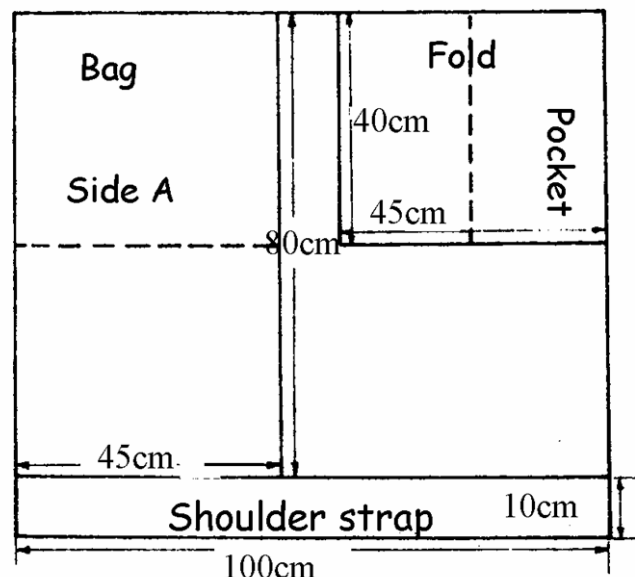
Cut out your fabric using the full length of the scissor blades.

Fold and tack the sides of the pocket. Sides and bottoms of pockets have 2 cm. allowance while the top has 0.5 cm. The top-side should have a narrow fold of about 0.5 cm along the edge, than the wider fold. Finish the top-side with fine hem stitching.

Mark decorative patterns on the pocket and sew embroidery stitches or cut and sew on appliqué patterns.

Mark the centre of the pocket from top to bottom. Pin and tack on the side of the bag about 8 cm from the bottom. Back stitch the pocket to attach, then backstitch the marked centre in order to have two pockets.

Tack side seams with wrong sides together. Back stitch the seams. Turn inside out with right sides together to sew French seam. This would give a neat finish and strong seam.



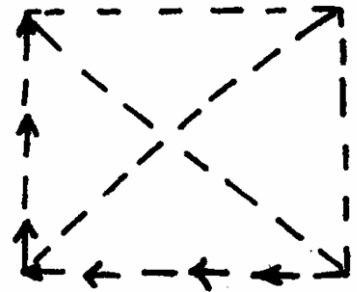
When backstitching the side seams, use two or more strands of cotton to make the stitches stronger.

Square the corners of the bottom of the bag by measuring 8 cm across the middle of the bag. Then sew with back-stiches along the line. Do this on both corners of the bottom. Squared corners provide space in the bag to carry bulky things such as books. See illustration on how to square the corners.

Fold the shoulder strap in the middle. Fold the edges with a narrow fold and tack the folds. Back stitch the edges of the shoulder strap. Make sure to use two or more strands of cotton to make the stitches stronger.

Measure 4 cm. all around the bag opening. Make a narrow fold along the edge and fold inside following the markings. Pin and tack all around. Insert each end of the strap along the side seams. Hem stitch along the edge. On the right side, sew a row of running stitches about 0.5 cm from the edge of the fold and the top of the bag. These rows can be sewn using contrasting colours of thread to make the bag stronger and attractive.

Sew the shoulder strap in place as shown:



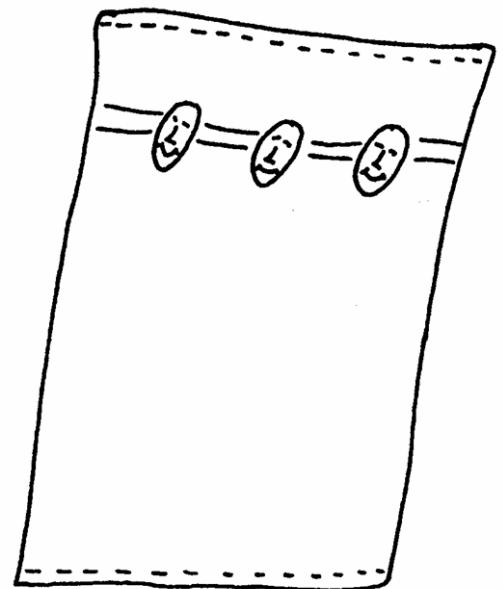
Project 2: Pillow case

Objectives

- Use correct sewing tools and equipment
- Observe and practise safety precautions when using sewing, tools and equipment
- Measure the required size of pillow case correctly
- Identify suitable materials for pillow case
- Cut the material along a straight line with smooth edges
- Sew the seams with suitable type of seam treatment
- Apply suitable decoration on pillow case

Materials needed

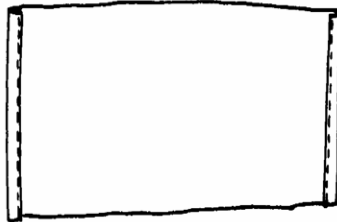
- 1.5 metres material, either printed or plain (this length of material is enough to make 2 pillow cases)
- Sewing thread - matching colour with the fabric embroidery thread - different colours



Procedure

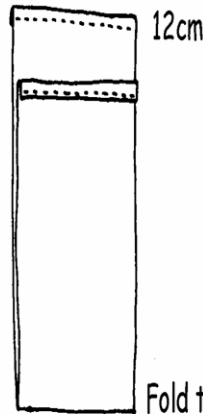
Using a newspaper to mark your pattern, measure 145cm x 145cm. Mark the measurements and draw straight lines along the sides. Check your measurements. Cut along the marked lines.

Making a pillowcase with the envelope style

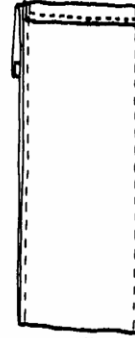


Hem the ends

Fold



Fold the 12cm flap down.



Layout the pattern on the material and mark the edges of the pattern with a pencil. Measure and mark 2 cm. all around for seam allowance.

Cut along the seam allowance line with straight and smooth edge.

Turn and tack a hem along each end of the

fabric on the wrong side of the material. Each hem should be about 2 cm wide, turn in for a double fold of even width. Hem stitch into place.

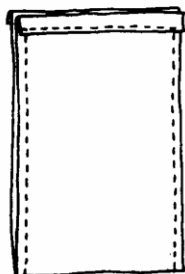
With the wrong sides of the fabric together, fold the material so that one side is 12 cm. longer than the other. Pin/tack the seams and backstitch about 0.5 cm. from the edge with the 12 cm flap down onto the edge. Sew along straight lines.

Turn the pillowcase inside out, right sides are together. Backstitch about 1.5 cm from the edge making sure that the first row of stitches are enclosed. Complete stitching on the other side.

Turn the pillowcase inside out. Trace the decorative design on the closed end or on both ends with a pencil.

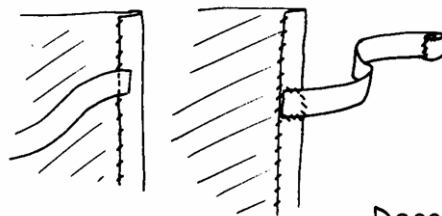
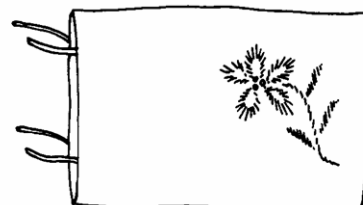
Using simple embroidery stitches, embroider the patterns with contrasting colours of thread. Complete the embroideries making sure that the first and last stitches are well fastened.

If an iron is available, iron the pillowcase to remove creases and flatten the seams.



Sew the sides and hem the opening

Attach the ties



Decorate with your choice of design

Embroidery

Embroidery stitches are decorative stitches used to apply a design to an article using thread. Embroidery gives extra texture to the fabric thus creating special interest

Threads

Many different types of thread can be used from shiny to dull and fine to thick from cotton linen, silk or wool.

Needles

Needles which may be used for embroidery include:

- Crewel needles, which are usually best for fine work
- Darners, which may be required if thick woollen yarns are being used on thick fabrics such as hessian

Embroidery hoop

An embroidery hoop can be used to hold the fabric firm and taut, thus producing more even stitching. It also helps to prevent puckering of the fabric.

Beginning and ending

Many people prefer to start their stitching with a small back-stitch on the reverse side of the work; then run in the ends.

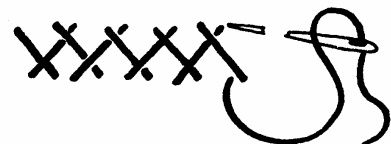
Some basic embroidery stitches

There is a great variety of embroidery stitches which can be created. Note the basic stitches which follow. Vary them to produce your own creative stitchery

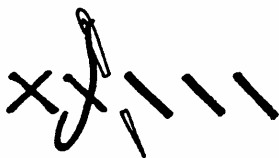
Stem Stitch



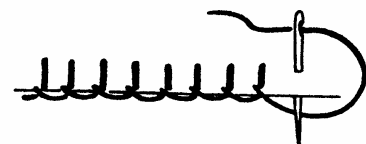
Herringbone Stitch



Cross stitch



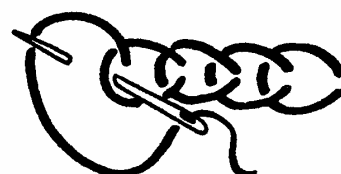
Blanket Stitch



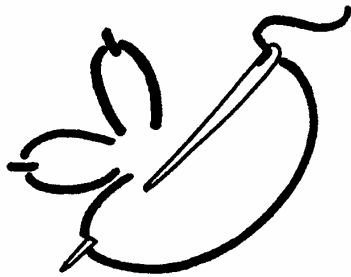
Slanted blanket stitch



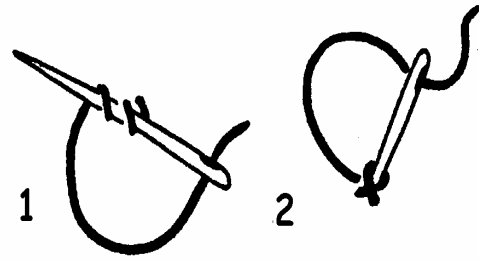
Chain stitch



Lazy Daisy stitch



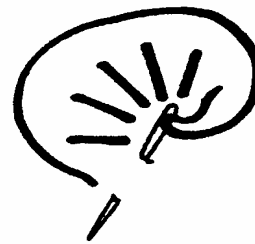
French knots



Feather Stitch

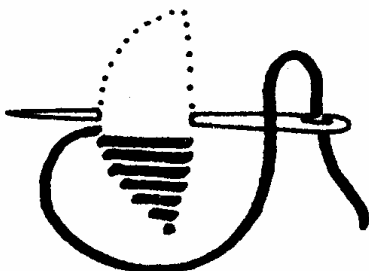


Straight Stitch

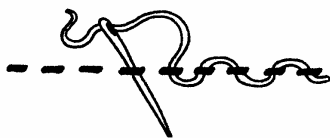


Satin Stitch

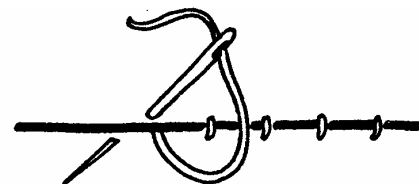
Twisted Running Stitch



Threaded Running Stitch



Couching



Topic 3: Basic sewing machine project

Objectives

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

- Draft a pattern form an item of clothing
- Demonstrate care and safe use of a sewing machine
- Complete a basic sewing project with the use of a sewing machine

Resources

- Pins
- Cotton
- Buttons
- Scissors
- Sewing needles
- Sewing machine
- Fabric (cotton) enough for each student to complete the project activity
- Pattern paper

Scope

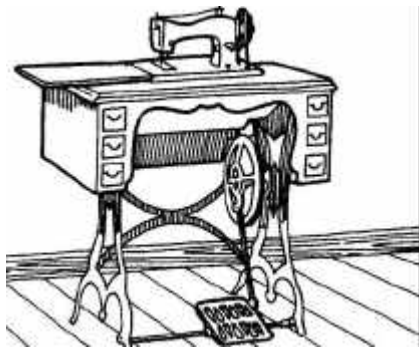
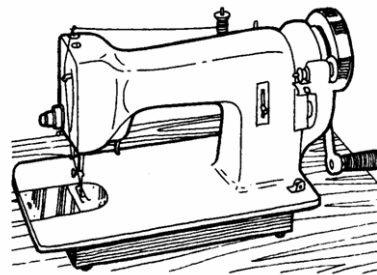
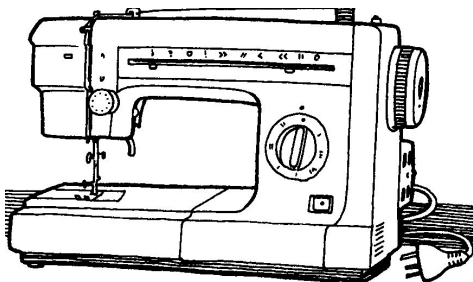
This topic offers a progression from hand- sewing to use and care for sewing machines. The machines available are modern ‘Singer Sewing Machines’ which can be electrically or hand operated. Extension activities for the competent sewers are provided. By the end, you should have completed one finished article.

Through this topic you are encouraged to develop teaching resources suitable for Grades 6-8

Use and care of a sewing machine

The sewing machine

The sewing machine is a simple piece of technology very appropriate to most parts of Papua New Guinea. The following are the most common types of machine found in Papua New Guinea.

Treadle machine*Hand sewing machine**Electric machine*

3.2 Activity 1

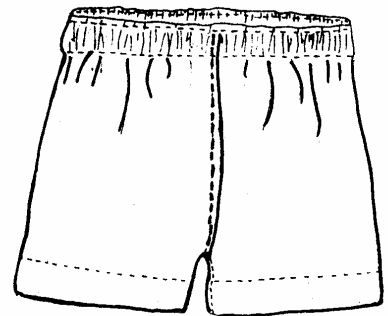
Carryout an evaluation of these three machines to determine what maintenance and operating expenses are required. Do a cost comparison and make a recommendation of a machine suitable for a teachers college. Justify your choice with sound reasons.

Project 1: Sports shorts

Objectives

By the end of the project, you will be able to:

- Use the tape measure correctly
- Identify and use suitable sewing tools and equipment
- Identify suitable materials for the project
- Adapt patterns to suit the required size of garment
- Take the required body measurements correctly and accurately
- Identify the right side and wrong side of the material
- Identify the lengthwise and crosswise grain of the material
- Layout pattern(s) following the lengthwise grain of the material
- Mark the sewing lines and the cutting lines on the material
- Cut the material along the cutting lines with straight and smooth edges
- Sew the garment using suitable seam finishes
- Use the sewing machine correctly
- Measure the required length of elastic or cord for the waistline
- Sew elastic/cord casing on the waistline of the garment



- Insert elastic/cord in the waistline casing
- Join the elastic ends correctly
- Sew the hems with even folds

Materials needed

- 1 metre of material - preferably thick and strong
- 50 cm. elastic or cord, if using elastic you will need about 2.5 cm wide
- Sewing cotton - matching colour with the material

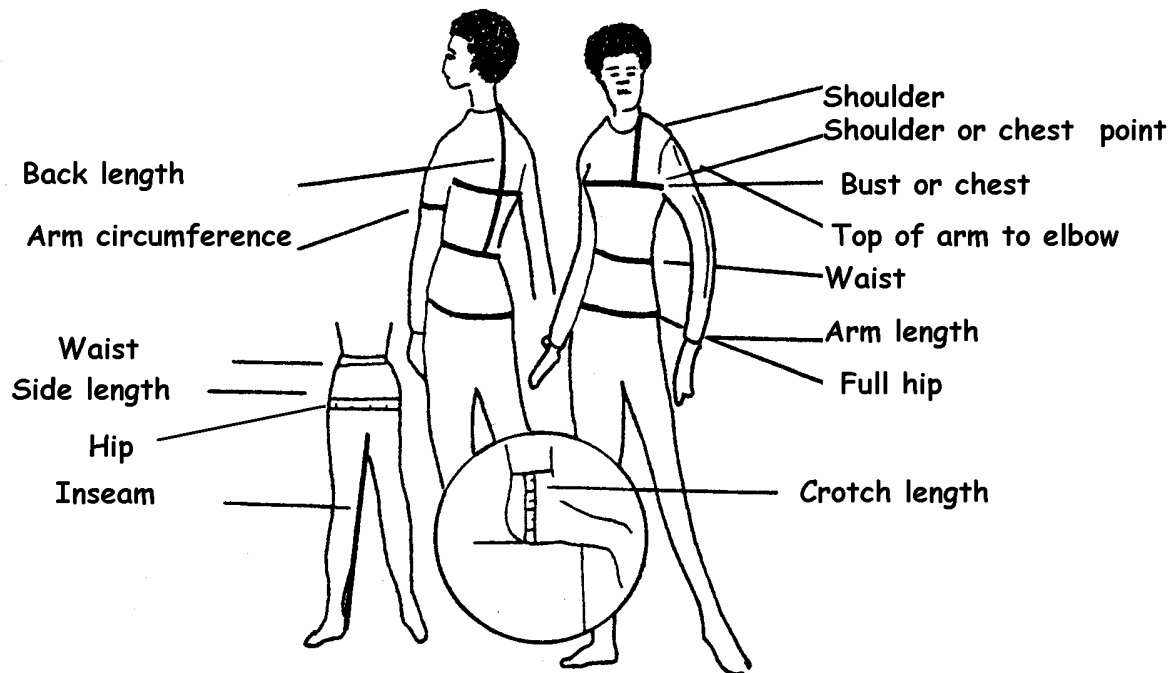
Procedure - making sports shorts

Different body parts to be measured:

- **Waistline** - is measured just above the hipbone. Hold one end of the tape measure firmly in front of the person you are measuring, take the tape measure around the waist until it meets the end which is held in front. Hold the tape measure firmly while moving the tape measure around the waist to check for comfort. Read the measurement where it meets the end of the tape measure.
- **Hip-line** - is measured around the fullest part of the hips (around the buttocks).
- **Length** - the length of the shorts is measured from the waistline to the desired length above the knee. Let the person stand straight when taking the measurement.
- **Crotch / seat height** - measured while the person is seated on a chair. Measure from the waistline to the seat of the chair.

Use the following measurements as your own body measurements. You need to find out the size of garment that fits you. Use the following guide for graded size:

	Women	Men
Small:		
Waistline (cm)	64	66
Hipline	88	79
Medium:		
Waistline	67	69
Hipline	92	83
Large:		
Waistline	76	71
Hipline	97	87



Maybe you have different body measurements from the above standardised measurements. It will be a good guide to use the next bigger size if the actual measurements are slightly bigger than the standard measurements.

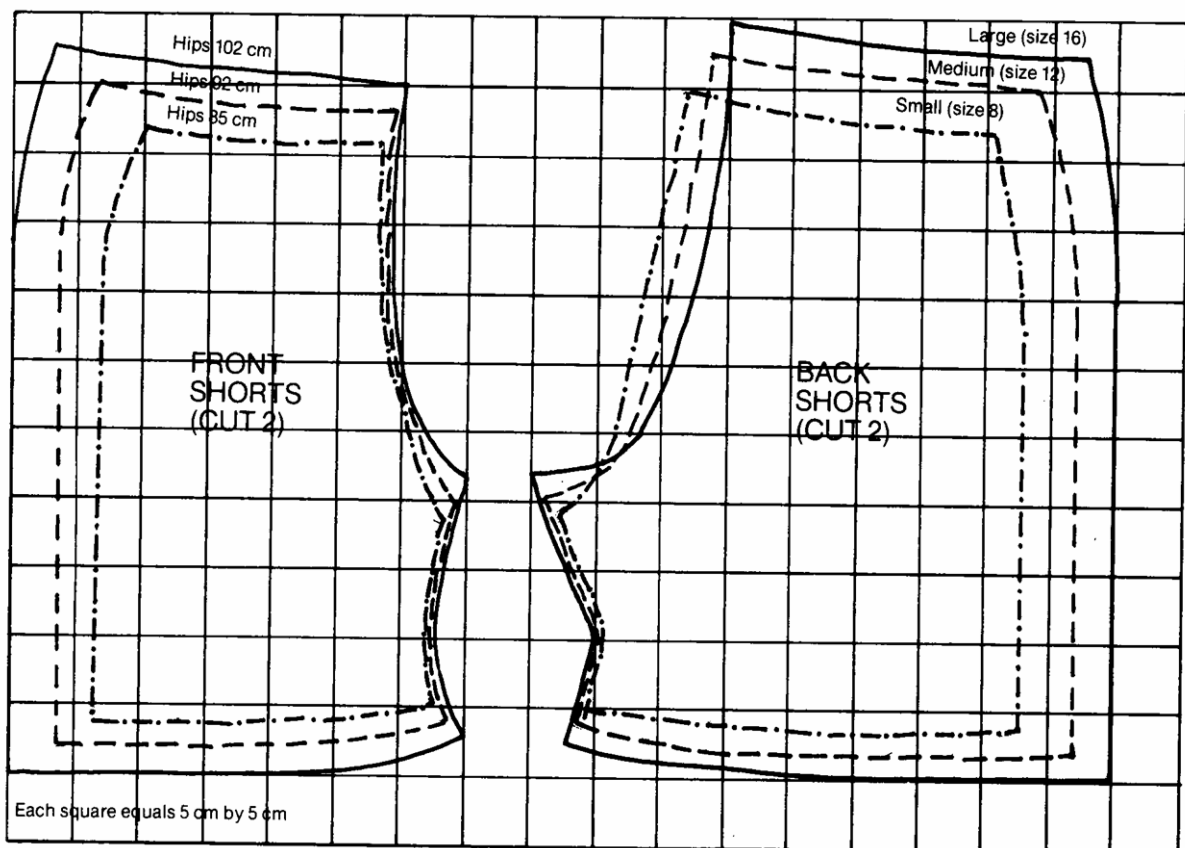
Try to work out a suitable pattern size that you will use based on the above table of sizes and measurements.

Using newspapers, trace the correct pattern size they need and cut the patterns neatly along the marked lines.

Calculate the length of material required for the project. Estimate the length of material needed, the length of the garment is doubled, then add 15cm for the hem allowance. Then measure the widest part of the garment and double the measurements and add 5 cm. for seam allowance. If the material is not wide enough, the length of the material will be 4 times the length of the garment.

Mark the sewing line and the cutting line on the fabric. Cut along the cutting line with a smooth and straight edge.

Match the pieces together, back and front piece with the right sides together. Pin and tack the outside seams. Sew the seams together using a run and fell seam.



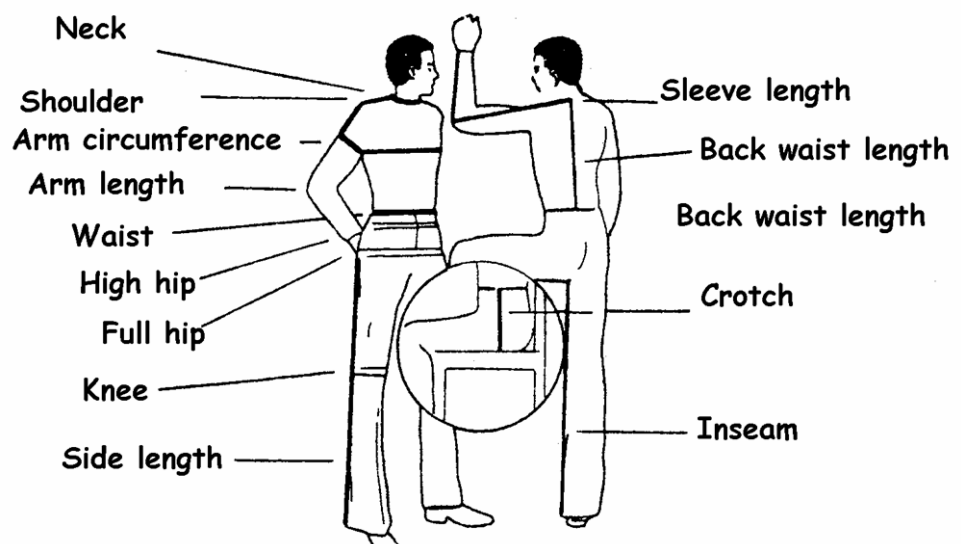
Match the inside seams together. Pin, tack and sew the inside seams.

Match the centre seam together, with the back pieces together and front pieces together.

Fold the edge of the

waistline (about 0.5 cm) then turn in a fold of 2.5 cm. for the elastic / cord casing. Pin, tack and sew the fold along the edge making sure that the narrow fold is sewn in. Leave 1 cm opening for the elastic/cord to be inserted. Sew a row of stitches about 0.5 cm from the top edge to complete the casing. If a cord will be used, a narrow casing can be sewn.

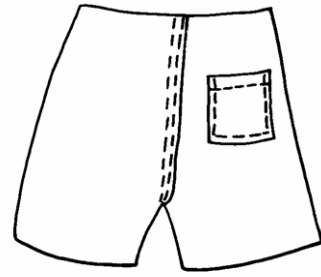
Fold the edge of the hemline (about 0.5 cm) then turn in a fold of 2.5 cm. for the hem. Pin, tack and sew the hemlines on both legs. Check the lengths of each leg, to make sure that they are the same. Fine hemstitch should be used to finish the hemline.



Measure the elastic needed for the waistline. Subtract 8 cm. from the waistline measurement to determine the length of elastic required. Measure the elastic on the table or flat surface without stretching.

Insert the elastic through the opening in the waistline casing.

Trim off excess cotton and press to iron out wrinkles and folds if an iron is available.



Extension activity: making a shirt

Adapted from Home Economics for Papua New Guinea Bk3. (1988) Norman, P.

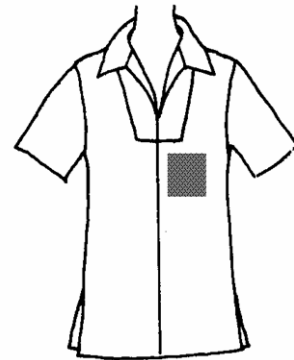
Style of shirt

When you choose a shirt, you may think; “Will this look good on me?”,

“Where will I wear it?” “What have I got that I can wear it with?”

“Will it keep me warm /cool?”

For this project we are going to make the style of shirt shown here.



3.2 Activity 1

What are the advantages of this style? List six good reasons for making this design.

Cut out pictures from newspapers and magazines of clothing styles particularly of shirts. Look for a variety of sleeve and collar types, which may be a good source of design ideas.

Pattern and size

Five pattern pieces are needed to make this shirt.

These are:

1. Shirt front
2. Shirt back
3. Collar
4. Front facing
5. Sleeve
6. Look at the pattern pieces on the squared paper

What size are you?

Use a tape measure to measure your chest size.

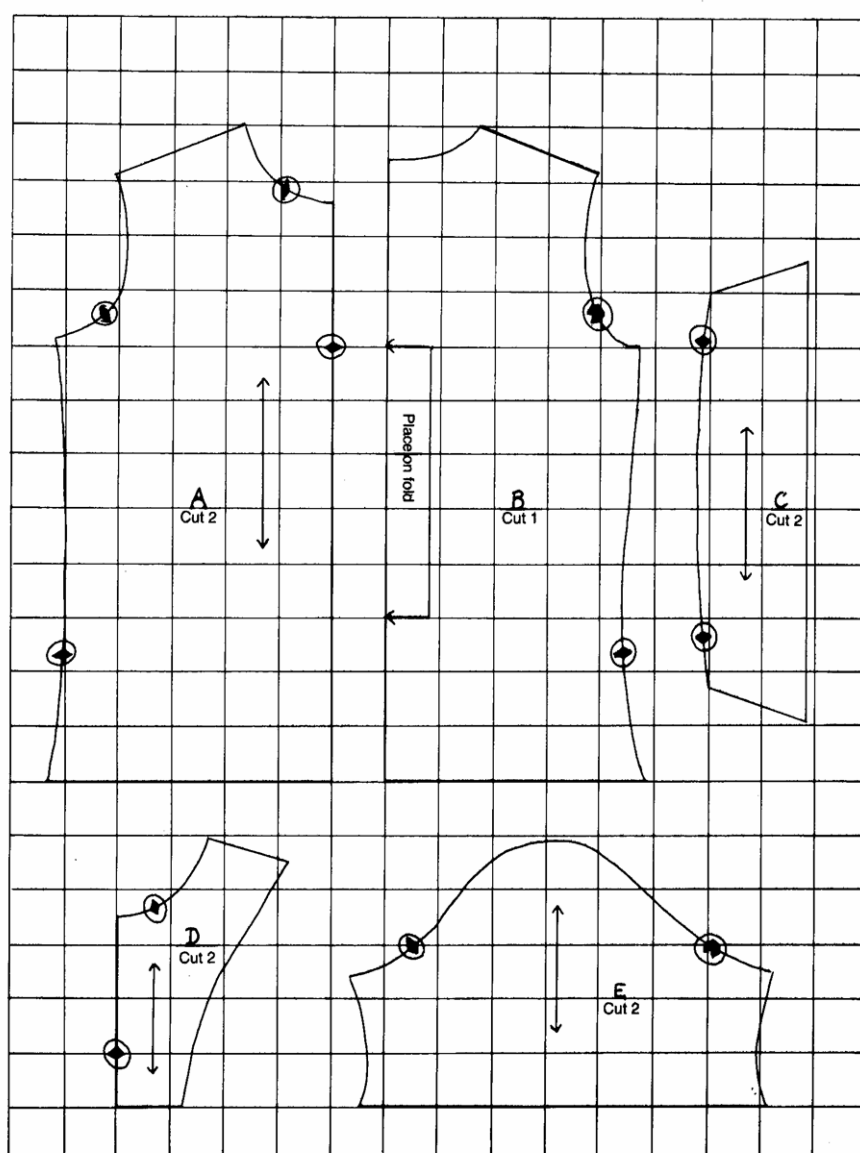
The following is a guide to the squared paper that has to be drawn up for your size:

Calculate the missing measurements.

Squared paper size	Chest measurement
5cm	87cm
5.5cm	92cm
6cm	97cm
6.5cm	?
7cm	?
?	?
?	117

Making the pattern

You can use newspaper for you pattern. Glue together four sheets (newspaper size) of



Key
 A Front D Facing
 B Back E Sleeve
 C Collar
 Circles indicate notches to be cut outwards.

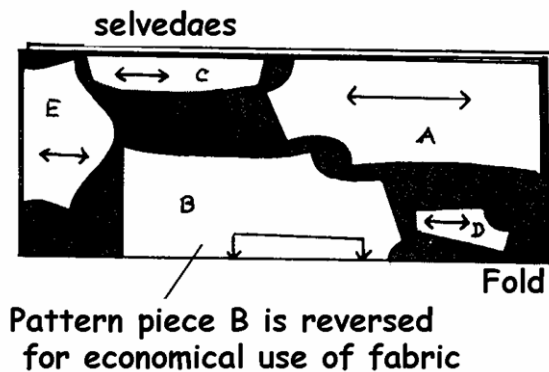
paper. Mark it into the correct squared cm according to your chest size. Copy the five

pattern pieces onto your paper and label each piece. Check your measurements before cutting each piece out. Remember seam allowances of 1.5 cm are included in the pattern.

Fabric

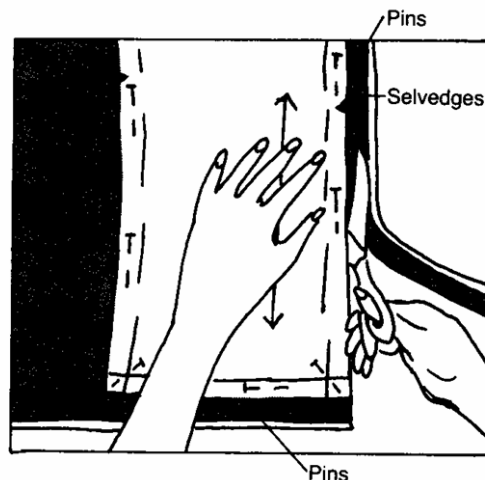
Depending on the arrangements the college makes with sewing projects, you may or may not have much choice in the type of fabric used to make this shirt. Hopefully you are able to choose a fabric that suits you.

1. You need 1.5m of 115cm width fabric to make this style of shirt.
2. Fold the fabric in half with the wrong side on the outside.
3. Layout you pattern pieces as shown in the pattern layout diagram. The arrows indicate the straight or lengthways grain of the fabric.
4. Put your pattern as close together without overlapping and pin them to the fabric.



Cutting out

1. Check that the centre front of the shirt pattern piece is pinned next to the selvedge.
2. Check that the centre back of the shirt is pinned next to the fold of the fabric.
3. Use your free hand to keep the pattern and fabric flat and using proper material scissors cut with long even strokes exactly along the pattern cutting edges.
4. Cut around the notch on the back of the sleeve. Make small v-cuts where indicated, making sure you are cutting through both fabric layers.
5. Keep your pattern pieces pinned to the fabric until you are ready to sew that piece.



3.2 Activity 2

Make a packet for your pattern pieces. Draw the front and back view of your shirt on the front of the packet. Use it to store your pattern as a teaching resource for Grades 6-8.

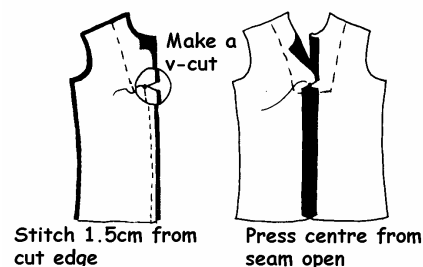
Making the shirt

These are the steps involved in making the shirt.

1. Centre front seam	5. Insert sleeves
2. Shoulder seams	6. Underarm seams
3. Make and attach the collar	7. Hems and side openings
4. Attach front facing	

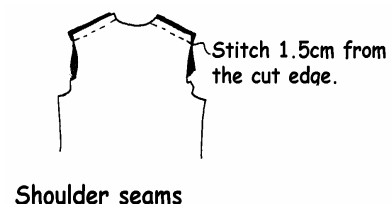
1. Centre front seam

- Remove the pattern from the shirt fronts
- Pin and tack the centre front seam 1.5 cm from the cut edge.
- Machine stitch from the lower edge to the notch.
- With a pair of scissors, make a v-cut at the notch. Above this is the front shirt opening.
- Remove the tacking and tie and cut thread ends. Press the seam open.



2. Shoulder seams

- Remove the pattern from the shirt back.
- With the right sides of fabric together and the cut edges even, pin and tack the front and back shoulders together.
- Machine stitch 1.5cm from the cut edge starting at the neck edge.
- Remove the tacking and tie and cut thread ends.
- Press the shoulder seams open.

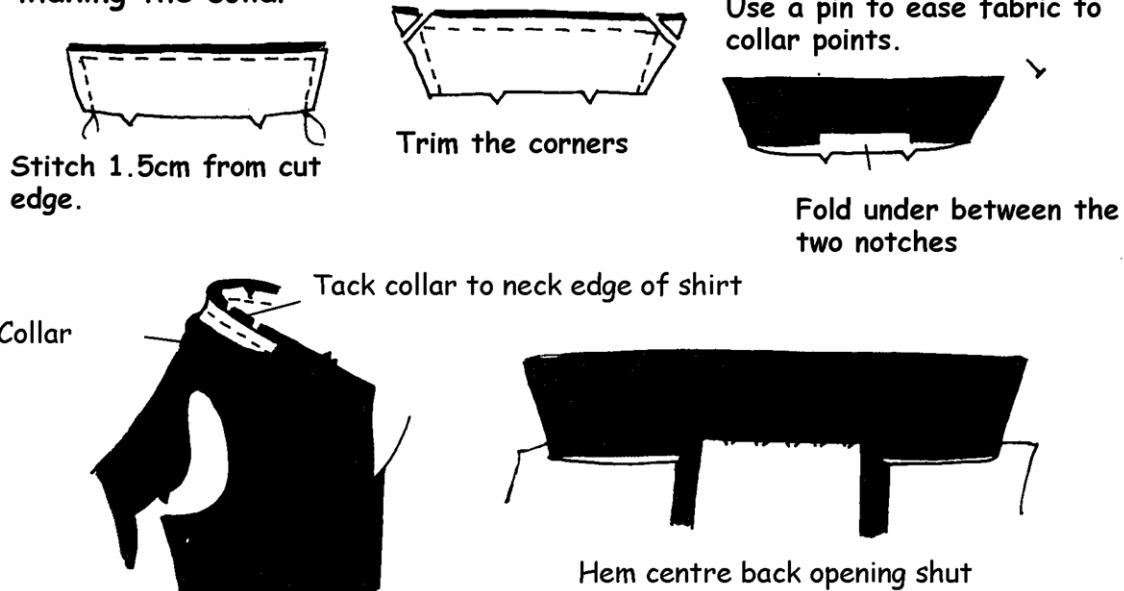


3. Making and attaching the collar

- Remove the pattern from the collar fabric pieces.
- With the right sides of fabric facing, pin and tack the pieces together.
- Machine stitch 1.5 cm from the edge along the ends and the longer side of the collar.
- Trim the corners.
- Turn the collar to the right side and gently use a pin to ease fabric out at the collar points.
- On the neck edge of the collar there are two small notches. On one fabric piece only, make a 1.5 cm cut at the notches. Turn under the 1.5 cm fold between these notches. Press the collar to sharpen edges so that it sits evenly and flat.
- Pin and tack the collar to the neck edge of the shirt. The shirt centre front edges extend 1.5 cm beyond the collar. The folded-under collar edge should be on top.

- The collar should be eased into the shirt neck edge to fit smoothly without any tucks or puckering.
- Machine stitch 1.5 cm from the cut edge.
- Remove the tacking and tie and cut thread ends.

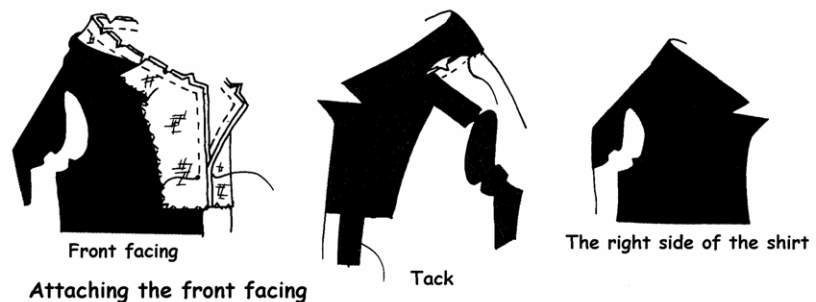
Making the collar



Attaching the collar to the shirt.

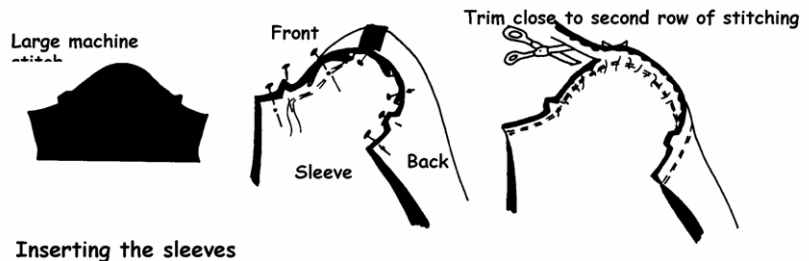
4. Attach front facing

- With the right sides together and the cut edges even, pin and tack the facing to the shirt front
- The facing is pinned over the collar. It should reach the shoulder seam at the upper end
- Match the notches at the lower end of the neck opening
- Machine stitch the facing to the shirt
- Trim the neck edge seam
- Turn the facing to the wrong side. Press the edges flat and turn under 1 cm on the outer edge of the facing
- Pin, tack and machine the facing to the shirt
- Hand-stitch to close the opening at the centre front of the facing
- Remove the tacking and tie and cut thread ends
- Press



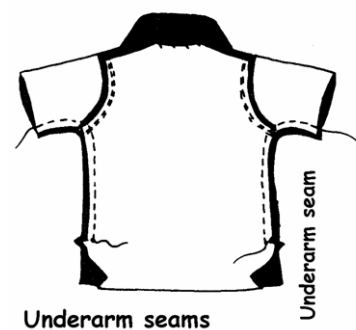
5. Inserting the sleeves

- Remove the pattern from the sleeve fabric pieces
- The notch on the curved edge indicates the back. Sew a large machine stitch around the curved edges. This allows the sleeve to be eased into the armhole to fit evenly without any gathers.
- With the right sides of the fabric together, pin the sleeves into the shirt armholes
- Start at the shoulder and work towards the underarm. Check notches to see that the back of the sleeves are pinned to the back part of the shirt.
- Pull on the large machine stitch to ease the sleeve curve into the armhole curve. There should be no tucks or gathers.
- Tack the sleeves into position carefully
- Machine stitch 1.5 cm from the edge
- Remove tacking
- Tie and cut thread ends
- Sew a second row of machine stitching 1cm from the edge for added strength. Use scissors to trim the seam close to the second row of stitching



6. Underarm seams

- With the right sides of the fabric together, pin the underarm edges of the shirt front to the underarm edges of the shirt back
- Match the armhole seams at the underarm
- Pin and tack from the sleeve edge to the notch that indicates the side opening
- Try the shirt on. Adjust the fit if necessary
- Machine 1.5cm from the edge
- Remove the tacking
- Tie and cut thread ends
- Press seams open



7. Hems and side opening

- The hems on the lower edges of the sleeves may be hand or machine-stitched. Make the hems by first turning a 1 cm fold and then making a 2 cm fold.
- Pin into position and sew
- Press
- Make a double fold (1 cm and then 2 cm) on the lower edge of the shirt front and back. Pin and tack into position

- Turn a narrow hem (5 mm then 1 cm) around the side opening of the shirt. Pin and tack into position.
- Machine or hand-hemstitch around the hem and side openings
- Remove the tacking and tie and cut thread ends
- Press



Sew the hems and side openings

Topic 4: Clothes care and maintenance

Objectives

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

- Describe and demonstrate the laundering process and prepare teaching resources suitable for grades 6-8
- Repair rips and holes in clothing
- Sew on buttons
- Repair a seam
- Remove stains

Scope

This topic looks at practical techniques for repairing and maintaining clothes in good condition. Basic laundering practices are described including when to wash, soaking and washing clothes through to folding and storing. Many of you will already have these skills well developed and so an emphasis will be made to encourage you to develop teaching and learning resources suitable for Grades 6 – 8.

Basic laundering processes

Adapted from 'Home Economics for Papua New Guinea Book 2'. Norman. P

When we talk of doing our laundry we usually mean washing clothes however the term laundering means a little bit more.

When we wash clothes properly we do many things. We collect the clothes: *mend* them, if necessary: *remove stains*, if we can: *sort* them into groups: *soak* some clothes to loosen dirt: *boil* some clothes to kill germs: *wash*, *wring*, *rinse*, and *peg* clothes on lines to dry: and *iron*, *fold* and *store* clothes. All of these processes must be done properly if clothes are to last as long as possible and keep looking like new. Laundering includes all the processes just mentioned.

Laundering is the care necessary to clean clothes and fabric items so that they look attractive and last as long as possible.

3.2 Activity 1

In your group do some research about the laundry processes you have been asked to investigate.

You should be able to answer these questions:

What does the process involve?

Why is it done?

How is it done and what if any equipment or materials are needed?

Your presentation should involve a short (2-3 minute) practical demonstration to the class.

A useful reference is ,Home Economics for Papua New Guinea Book 2', Norman. P (1985).

When to wash

Many people wear their clothes until they are really dirty before they wash them. It is common for a primary school child to wear the same clothes for a whole week or longer. It is common for high school students to wear the same underclothes for a whole week.

Why are these are very poor and unhygienic customs?

How often do you change and wash your clothes?

Most clothes in Papua New Guinea are made from cotton fabric, which is easy to wash. Ideally, most clothes should only be worn for one - two days and then taken off for washing. Even though you may not see the soiling agents, they are there, on your clothes. Bedding, such as sheets and pillowcases, should be washed once a week. Curtains, bedspreads and blankets are washed less often. Don't wait until you see the dirt. Wash clothes often to keep them fresh, clean and nice to wear.



3.2 Activity 2

Conduct a quick market survey amongst fellow students to determine what washing agents /materials they use and why.

How many people buy /use a product based on the cost and or effectiveness of the product?

Be prepared to report your findings to the whole group.

How does soap work? Describe using drawings.

Stain removal

Stains are marks on clothing that shouldn't be there. Like weeds in the garden, they are unwanted and need to be removed. Generally, stains cannot be removed by normal washing. Special treatment is needed to try and get rid of them.

When contemplating removing a stain three factors need to be considered:

1. The age of stain
2. The cause of stain, and
3. The fabric type and colour

Fresh stains are easier to remove than old stains. Once a stain is allowed to dry or is exposed to light and heat, it becomes set or ingrained into the fabric.

It is necessary to know the cause of the stain to know how to remove it.

Some stain-removal substances that can be used on white fabric can't be used on coloured fabric. Bought stain-removal substances are mixed to different strengths for cotton and synthetic fabrics.

Remember:

1. Stains are best removed when fresh
2. Try the easier methods first
3. Try to remove stains *before* washing, as the washing process could 'set' the stain
4. Some stains are permanent. Not **all** stains can be removed.

3.2 Activity 3

Discuss methods of stain removal that you use and have been taught. As a group fill the table in and add other stains and removal methods if you know any.

Cause of stain

Method of removal

Betel nut spit

Blood

Grass

Ink

Paint

acrylic

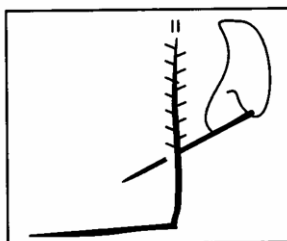
enamel

Tea, coffee and cocoa

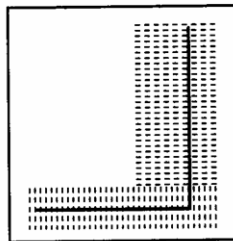
Repairs

Clothes should be repaired before they are washed to prevent the damage becoming worse. Here are some methods for repairing common damage to fabric articles.

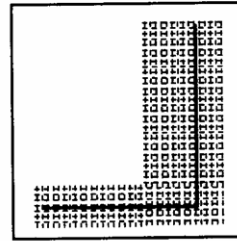
Always try to make the repair as unnoticeable as



Darning the edges of a tear using fish bone stitch



Using a machine to make small running stitches across the tear.



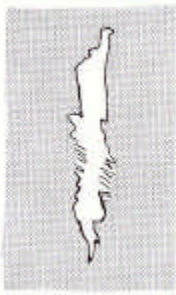
possible. The garment should still have its original shape after the repair is done. Choose matching coloured scrap fabric and sewing thread to patch tears and holes. Avoid sewing dark-coloured fabric with light-coloured thread. Check clothes thoroughly both inside and outside to see that all repairs have been done.

To mend a large hole or tear

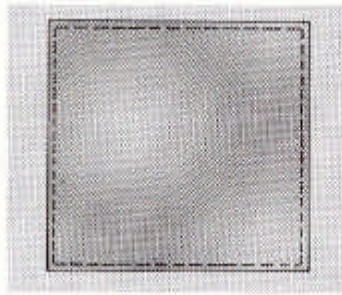
1. Turn the garment to the wrong side.
2. Cut a large rectangular piece of scrap fabric to cover the damaged area totally.
3. Place scrap fabric over the damaged area and either:
  - a) machine it to the garment around the edge;
  - b) turn the edges under and hem-stitch neatly to the garment.
4. Turn the garment to the right side.

S Depending on the nature of the damage and the type of garment either:

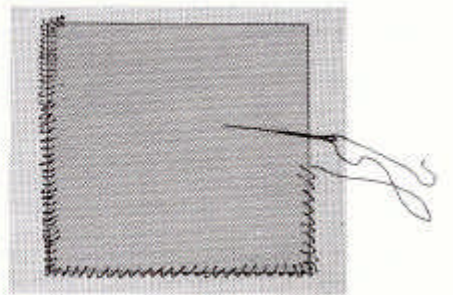
- a) machine around the damaged area in rectangular rows of machining;
- b) machine backwards and forwards across the damaged area;



Tear or
hole



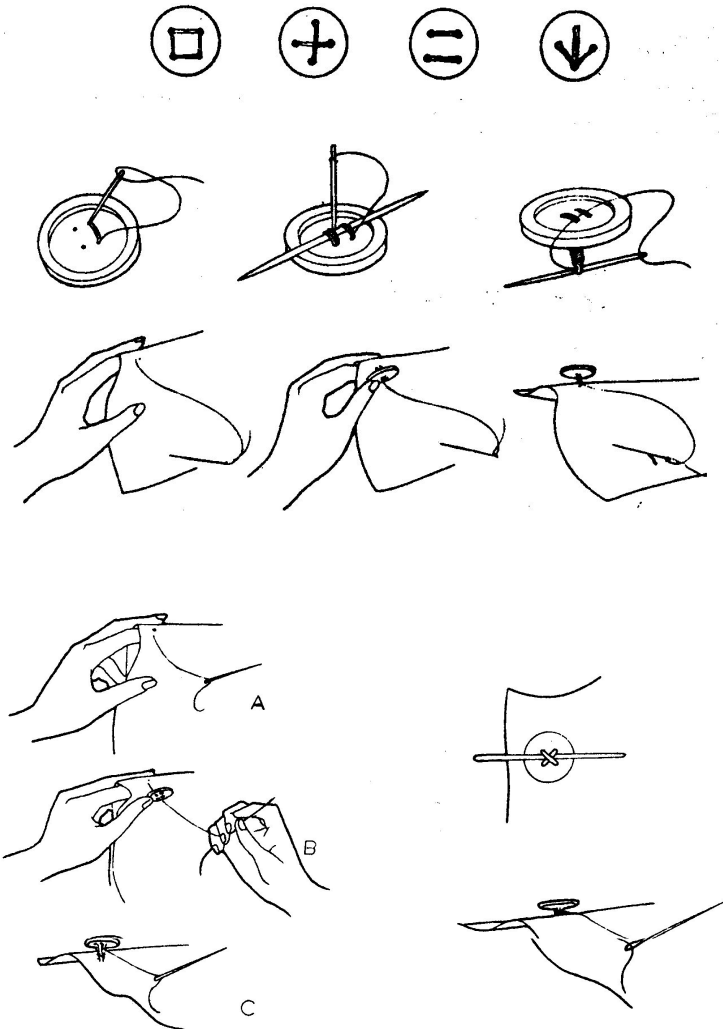
Machine patch over
or damage



Hem patch over
damage

Sewing on a button

Bring articles of clothing that need repair. Follow the following diagrams and sew a button onto one of your clothes



Topic 5: Handcrafts - making crafts using coconut shells

Objectives

By the end of this topic you will be able to:

- Follow the given design brief and design process to produce a plan and prototype for a product made from coconut shell
- Use the design process and follow a design brief to produce a product

The design process

Whenever a new product is designed and produced, the manufacturer will begin by developing a '**design brief**'. A design brief includes specific information about the type of product needed.

The designers then 'investigate' information that will help them 'design' a range of possible options from which they will produce their 'preferred option'.

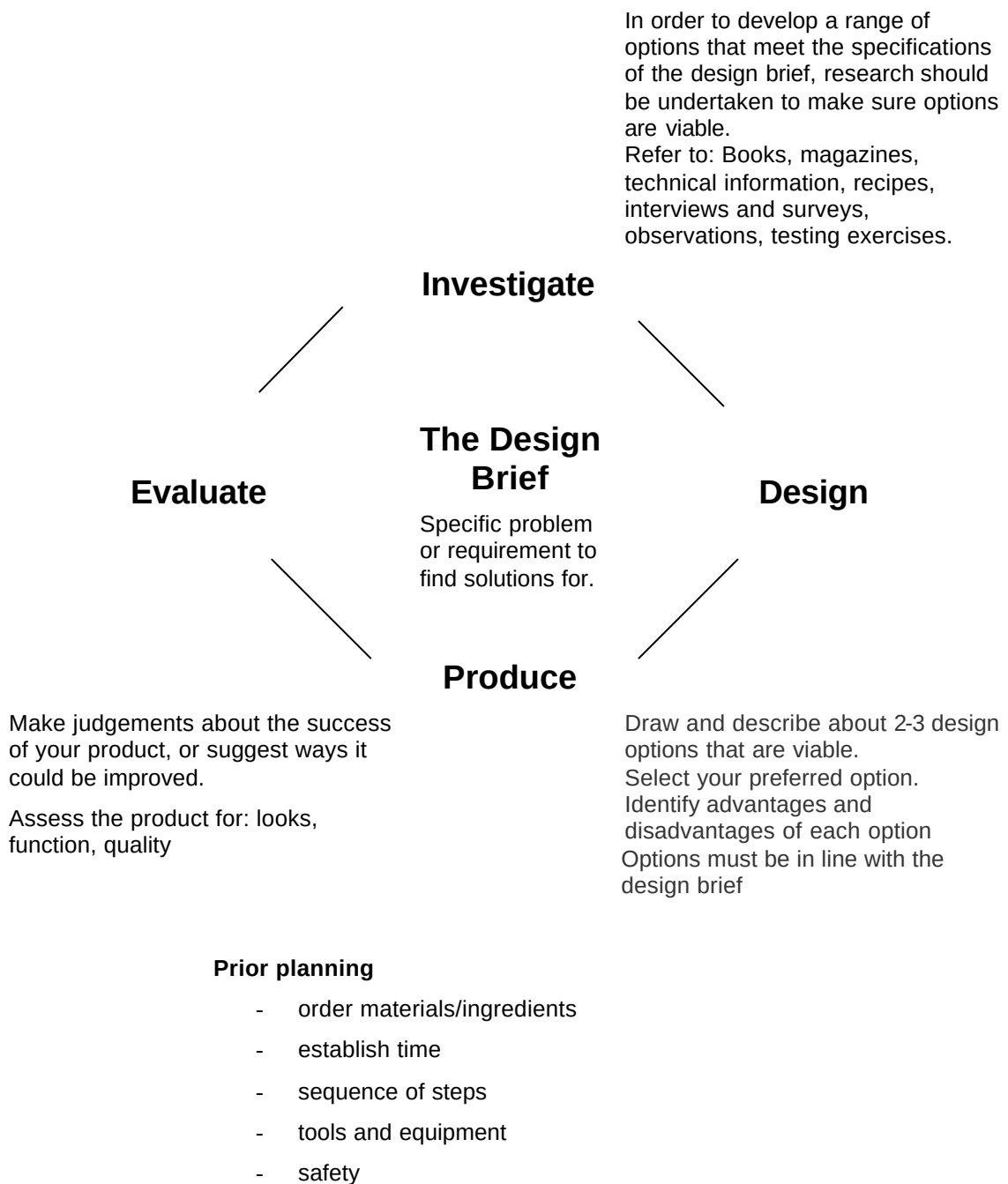
Finally the manufacturer will evaluate the product to make sure people will buy or whether any modifications to the product are needed.



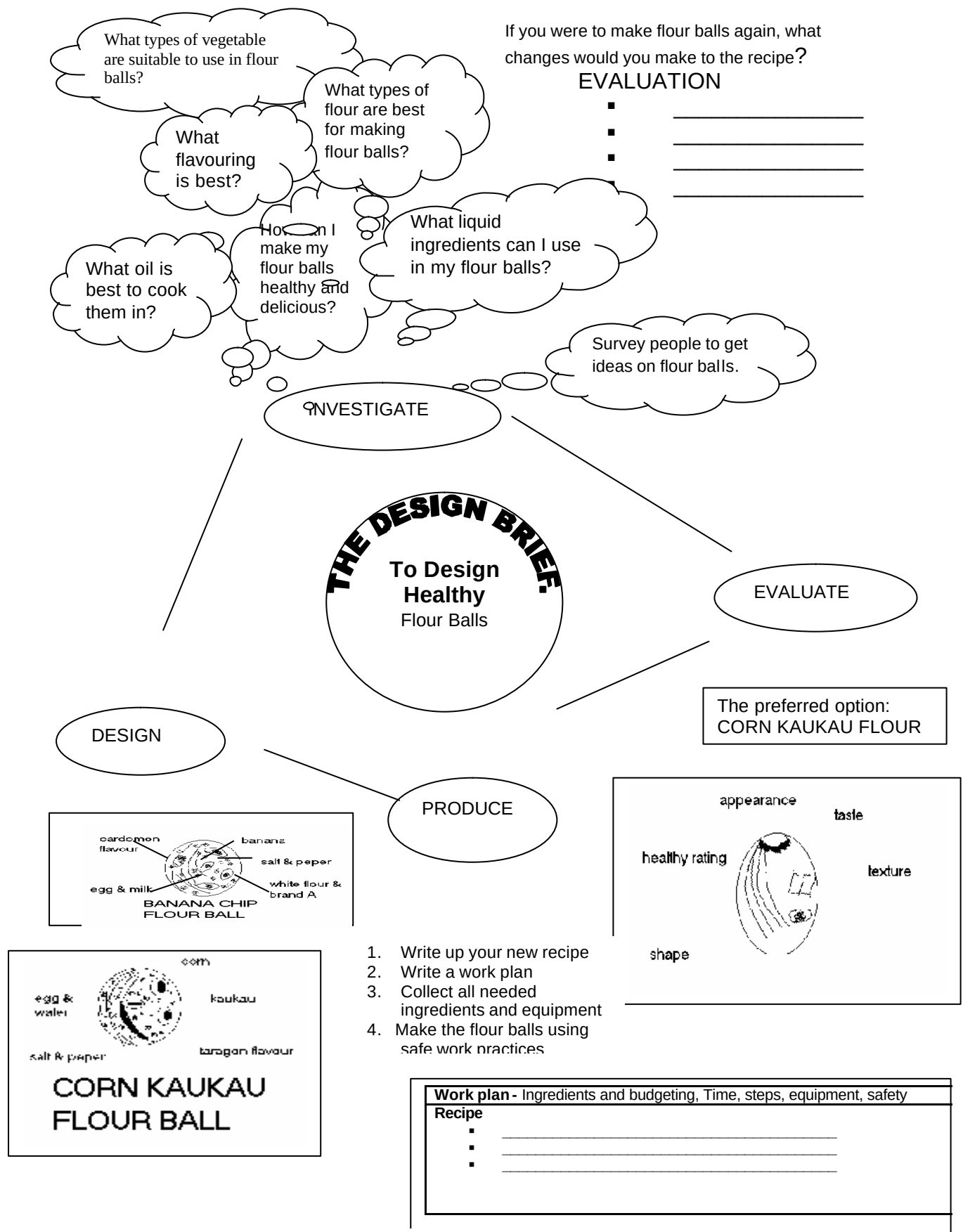
3.2 Activity 1

Explain in your own words the purpose of a design brief.

Explain how a design process is useful in the production of new products.

The design brief

Example of a design process for: Home Economics – cooking / food design



Source: Adapted from – **Food by Design Bk1**. G.Heath, H.McKenzie, L.Tully, Longman, 1999.

An example of an investigation form

INVESTIGATION
Design Brief (outline of what is required)   Tools/ Equipment: Method   - Research   - Design, options & prototype   - Produce- make   Evaluation

---

 3.2 Activity 2

Read and follow the following design brief, use the examples of coconut products to help you.

INVESTIGATION
Design brief   Through this investigation, you are asked to design and produce products made from coconut shell.   Your production materials for prototype models are: • Cardboard   • Split pins   Tools: • Scissors   • Craft knife   • Felt pens   Method (research, design, produce, evaluate):   Follow the design process to produce and then evaluate a product made from coconut shell. As part of the 'design stage' you are required to produce a model or 'prototype' before you use the actual coconut shell.   Use the example of the products already made from coconut shells to give you ideas. Your product can be for domestic use, tourists, or social function.   When you have completed your product(s) develop a marketing leaflet to promote them. Your flier should include the following information: • Description of product   • Illustration   • Use and purpose   • How and where made

Hanging curtain holder

The curtain holder shown here can be made in different sizes to suit any size of curtain. It is very easy to make. Determine the coconut shell size suitable for the purpose. Always make a pair of the same size, or more, depending on the total number of windows and doors of the house.



Curtain rings

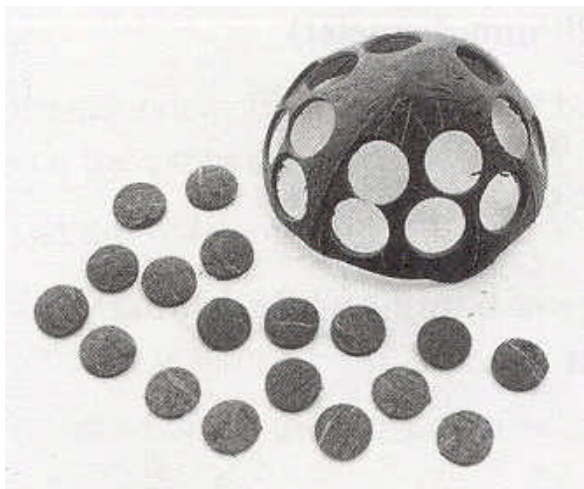
Materials

- 1 set of coconut shells of variable size
- 2 sand paper #120
- ¼ litre varnish
- 1 table spoon of glue – either PVA or araldite
- 1 set of water colour paints

Tools and equipment

- Tenon saw
- Cross cut saw
- Work bench
- Ruler
- Vice
- Marking gauge
- Disc sander or sand paper
- Half round file
- Varnish and brush

Other examples of coconut shell products.



Buttons

Module 3.2 Practical Applications

Theme: Home Economic (2)

Cooking



Home Economics (2) Cooking

Objectives

By the end of this topic you will be able to:

- Explain and demonstrate safety and personal hygiene in the kitchen
- Use and describe basic cooking equipment, recipes and methods
- Plan nutritious meals for different numbers of people and a variety of occasions, describe attractive presentations
- Produce teaching and learning resources suitable for grades 6-8

Suggested topics

1. Basic safety and personal hygiene.
2. Equipment recipes and methods
3. Nutritious meal preparation

Topic 1: Basic safety and personal hygiene in the kitchen

Objectives

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

- Develop a resource about safety and personal hygiene in the kitchen
- Examine the urban and rural home kitchen environments and look at potential danger spots and precautions

Scope

Use the topic as quick introduction to Home Economics (2) Cooking. You will be introduced to the equipment and any rules for safe use and care of materials.

You are encouraged to produce teaching and learning resources for Grade 6-8 students on personal hygiene and safety in and around the kitchen.

Personal hygiene in the kitchen and food

Just as it is in put to take care when working with equipment in the kitchen it is also important to prepare food hygienically to avoid problems with food contamination.



3.2 Activity 1

As a class we have considered personal hygiene rules. Look at the example of personal hygiene poster at Figure 2.

Using the rules developed by the class make your own poster as a classroom resource suitable for Grades 6-8.

Add this resource to your teaching portfolios.

An example of a Year 3 student's poster developed for a Grade 6 class.

Figure 1 Personal hygiene poster. Source: Barnabas Walbe, Year 3 Student Teacher, KTC, 2001



Source: Barnabas Walbe, Year 3 Student Teacher, KTC, 2001

Kitchen hygiene

Working in a clean environment and using hygienic practices in the kitchen are just as important as following the rules for personal hygiene.

Safety in the kitchen

There are many risks areas in traditional and modern kitchens. Electric stoves, gas cookers and wood fires all have dangers and must be treated carefully. So too kitchen tools and equipment must be handled with care.



3.2 Activity 2

Investigation – risk areas in the kitchen

Working with a partner, make a list of the main risk areas you can see in the technology kitchen, or the college kitchen (mess)

For each risk area you identify suggest a rule which could be followed to avoid accidents occurring

Set them out in the table like this one.

<i>RISK AND SAFETY TABLE</i>	
<i>Risk area</i>	<i>Safety rule</i>
1.	
2.	
3.	

Adapt this activity and make a lesson(s) for Grade 6-8 on Safety in the home kitchen. In this lesson, plan activities which ask students to carry out safety in the home kitchen investigation.

Topic 2: Recipes and equipment

Objectives:

By the end of this topic you will be able to:

- Identify and name different cooking utensils
- Practice safe and efficient use of all cooking utensils and equipment
- Describe different cooking methods commonly practiced
- Read, interpret and follow a recipe

Scope

This topic provides you with the opportunities to explore a recipe, understand the language and instruction of recipes, and utensils and equipment used. Larger appliances such as oven/stove will be looked at.

You will also be encouraged to conduct individual research into different cooking methods practiced around the country.

Explaining a recipe

A recipe is one way we communicate food preparation in home economics. A recipe is an idea for mixing and preparing food.

There are two styles of presenting a recipe.

Carrot soup with orange

Peel and chop 250 g of carrots. Peel and slice half an onion and half a leek (white part only) Heat 1 tablespoon of oil in a saucepan and sweat the vegetables over medium heat for 2 to 3 minutes. Add 500 ml of chicken stock, juice of 1 orange and one clove of crushed garlic. Bring to boil, reduce temperature to simmer and cover saucepan with a tight fitting lid. Cook until carrots are very tender. Check the liquid occasionally so the pot does not boil dry. Puree in a blender or food processor or use a stick mixer directly into the saucepan. Season to taste. If too thick, add a little water or carrot juice. Serves 2 to 3.

A recipe has several parts

- A name
- A list of ingredients with the quantities and sometimes details about preparation
- A method that explains how to prepare the ingredients and the order in which the process should be completed
- Cooking temp and time
- Required special equipment
- Serving suggestions
- Sometimes serving ideas as included about garnishes or decorations and complementary foods. Often recipes will suggest how many people they will serve.

Minestrone soup

(serves 3-4)

1 onion, diced
 1 carrot, diced
 1 stalk celery, sliced
 1 potato, diced
 10 green beans, sliced
 1 zucchini, sliced
 1 cup cabbage, shredded
 1 clove garlic, crushed
 3 cup beef stock
 1 tablespoon tomato paste
 250 g canned tomatoes
 2 tablespoons canned cannelloni beans
 2 tablespoons small pasta
 1 tablespoon olive oil
 2 tablespoon parmesan cheese, grated

Method

1. Wash, peel and prepare vegetable in separate piles, as they will be cooked at different times
2. Heat the oil in large saucepan, add onions and cook over medium heat until they are transparent
3. Add carrot and cook for 1-2 minutes. Stir occasionally and take care not to brown the vegetables
4. Repeat this process, adding the celery, then green beans, zucchini then potato.
5. Add the cabbage and cook until it wilts.
6. Add garlic, tomato paste, canned tomatoes and stock and bring to boil.
7. Turn heat to simmer and place lid on saucepan. Cook for 15-20 minutes until vegetables are soft.
8. Add cannelloni beans and pasta. Cook for 10 minutes. Adjust liquid
9. Season with salt and pepper
10. Serve and garnish with parmesan cheese
11. Serve with crusty bread and extra cheese on the table

 3.2 Activity 1

Look at the two recipes both for soup, Minestrone soup and Carrot soup with orange.

Which is easier to follow – why?

What are the advantages and disadvantage of each style of recipe?

Re – organise the format for the Carrot soup with orange and re-write in the same style as the Minestrone soup.

Collect samples of recipes from product labels, magazines, friends and compile into a book or file which you can refer to again and again

---

3.2 Activity 2

Copy the following words and write abbreviations beside each. Include others that you use:

Gram

Kilogram

Measurements for recipes

Accurate measurement in food preparation is important to ensure success in recipes and to be able to make the same product again.

3.2 Activity 3

Make a small reference chart with drawings to illustrate these standard measurement tools

tablespoon – 20ml

teaspoon – 5ml

1 cup – 250 ml

Show as many fraction/part measurements as you think useful. For example: $\frac{1}{2}$ tbs, $\frac{1}{4}$ cup

- *What types of recipes do not have accurate measures for their ingredients?*
- *Apart from reading a recipe-how else do cooks share recipes?*
- *Explain how you would measure;*

$\frac{1}{3}$ cup of flour, 150 ml water, $\frac{1}{4}$ tsp of curry powder

Using metrics measuring tools or the standard measuring tools, calculate equal measures for the following

1 tablespoon = ____ ml

1 tablespoon = _____ tsp

1 teaspoon = _____ ml

1 cup= _____ ml

$\frac{1}{2}$ teaspoon = _____ ml

1 litre = _____ cups

$\frac{1}{4}$ teaspoon = _____ ml

1 kilogram=_____ gram

- *Think of ways you could integrate a maths lessons with a simple recipe*

Exploring equipment

Utensils

1. Biscuit cutters	13. Bread knife
2. Kitchen scissors	14. Whisk
3. apple corer	15. Egg beater
4. Parisienne cutter	16. Rolling pin
5. Fork	17. Draining spoon
6. Skewer	18. Potato masher
7. Vegetable peeler	19. Egg lifter
8. Pastry brush	20. Soup ladle
9. Cleaver	21. Tongs
10. Vegetable knife	22. Plate scraper
11. Spatula	23. Wooden spoon

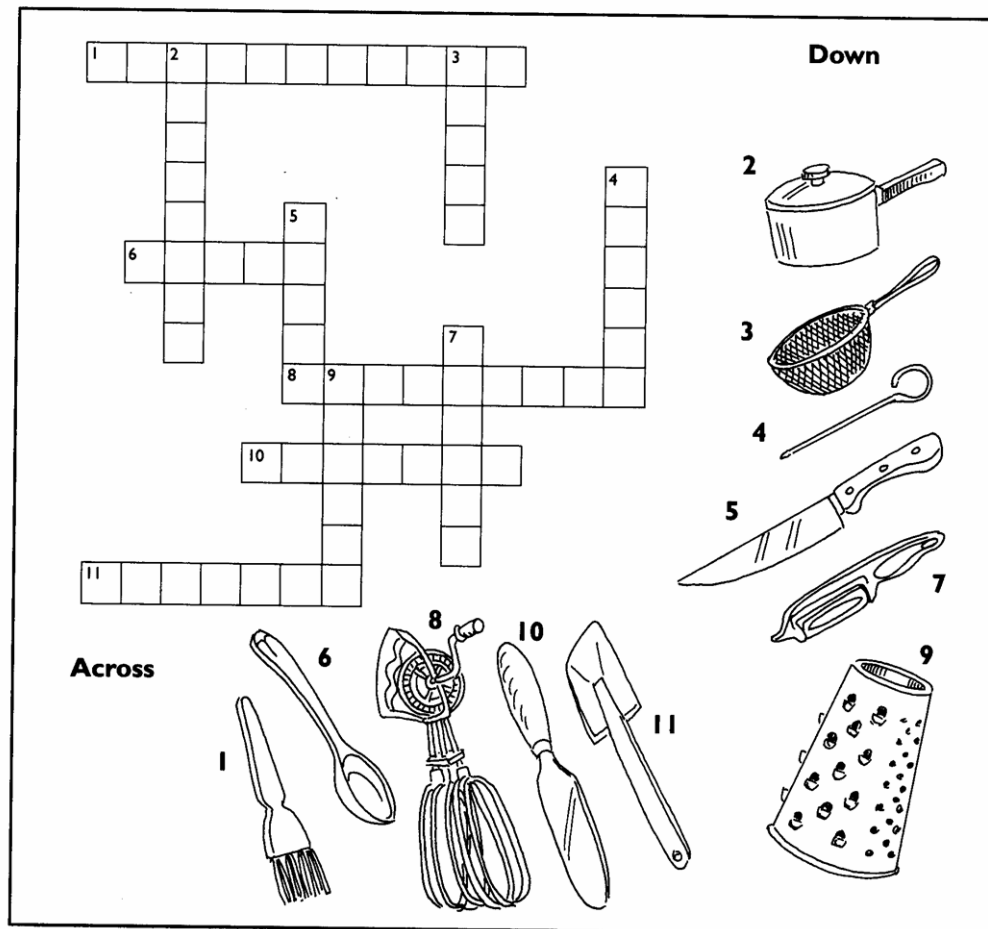


3.2 Activity 4

List five foods you can grate

Complete the puzzle below with the names of equipment

Now design you own puzzle and make it at a level to challenge Grade 6-



Large appliances

Stoves and cookers

A large amount of the food we eat is cooked. To cook our food- large appliances such as stoves and cookers are used. Stoves are fuelled by:

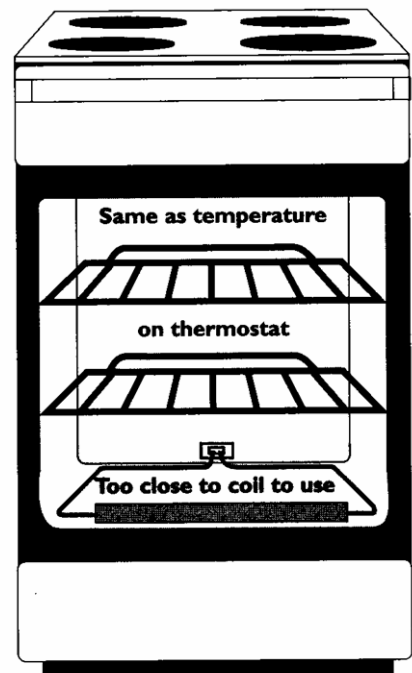
- Gas
- Electricity
- Wood and or kerosene

3.2 Activity 5

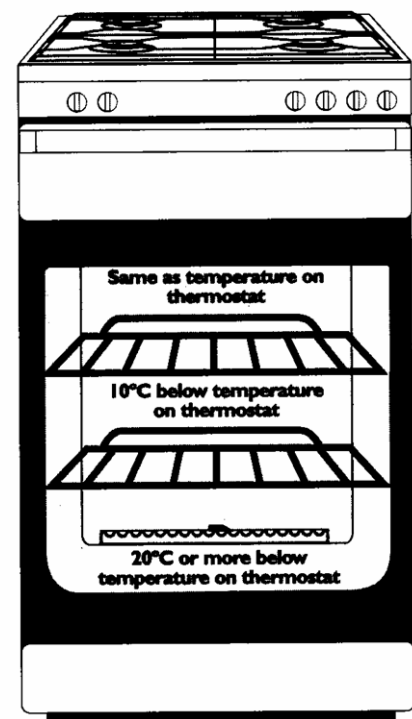
The normal modern stove has three parts what are they?

What are the three zones of heat in a gas stove?

If you want to cook food slowly in a stove, in which part of the stove would you place it, why?



An electric oven has the same heat in 3/4 of the oven.



A gas oven has three zones of heat.

Scones

Ingredients

- 1 cup wholemeal SR flour
- 1 cup SR flour
- 1 tb margarine
- 1tb powdered milk
- $\frac{3}{4}$ cup water

Method

1. Collect all your ingredients
2. Arrange the shelves in the oven. Set oven on 230 C
3. Sift the flour and powdered milk
4. Rub the margarine into the flour with your fingertips
5. add nearly all the water at once. Mix lightly and quickly with a spatula. Mix to a soft dough.
6. Turn the dough onto a lightly floured board and knead lightly for thirty seconds. Remember to handle the dough as little as possible as it will become tough if you work it too much
7. Lightly roll out the dough to 2 cm thickness and cut into shape using a cutter.
8. Place the shapes close together on a tray. Glaze lightly with milk (collect the milk from your teacher).
9. Bake for 10-15 minutes
10. While your scones are being baked, wash up your dishes and tidy your bench. Check with your teacher when you are finished.
11. Remove your scones from the oven when cooked and place on a cooling



3.2 Activity 6

List the ingredients that could be used to flavour scones. Classify them into two groups – sweet and savoury

What herbs would give the best flours?

The basic scone dough is a great base to design your own scope recipe.

Use the basic recipe and your selected ingredients and design your scone recipe. Remember the more you handle the dough the tougher it becomes.

Cooking methods

3.2 Activity 7

In this activity you will need to refer to and NDOE text – Basic Technology Nutrition for Grades 7 and 8

Read about Dry and moist Heat Cooking

Make a teaching resource chart which explains the advantages and disadvantages of the different types of dry and moist heat cooking

Include 1 recipe for each type.

Topic 3: Food nutrition

Objectives

By the end of this topic you will be able to

- Identify and describe different nutrients found in food
- Name and identify the food sources and functions of the different nutrients
- Prepare a simple meal using a variety of nutritious food

Scope

This topic reintroduces you to the main food groups and the nutrients found in each. Proteins, Carbohydrates, Fats and oils vitamins and minerals

You will learn about these in the context of preparing a simple nutritious meal. This topic can also be the source of independent activities where you produce teaching resources for Grade 6-8.

What is food?

Food is any substance we eat or drink that provides the body with nutrients to produce energy and to enable us to grow and maintain good health. All food contains chemical substances called nutrients which are broken down during digestion into tiny molecules. These molecules are absorbed into the bloodstream and then into the cells of the body. The nutrients which provide our body with energy and help to produce new cells and repair damaged cells are – protein –carbohydrate – fat – vitamins and minerals



3.2 Activity 1

How do you know when you are hungry?

How do you know when you had enough to eat?

How do you know you have eaten the foods your body needs?

A definition of food is hidden in the puzzle below. Find the definition.

Make a similar word find puzzle for Grade 6-8 students using the following words.

Protein, carbohydrate, fat, vitamins, minerals, diet, nutrients, balanced diet, energy, cells

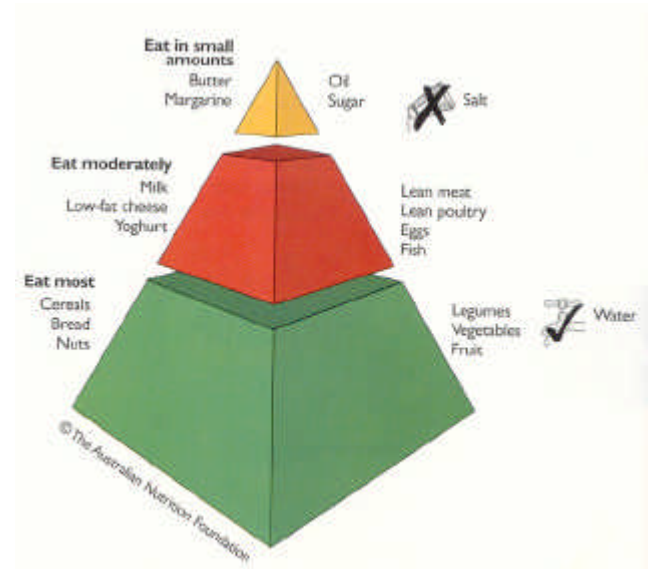
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Food for good health

The Health Eating Pyramid shown is a useful model because it introduces the idea of balance in your diet.

The foods in the pyramid have been put into groups

- Eat most
- Eat moderately
- Eat in small amounts



Health Eating Foods	Nutrients and their uses	
Eat most Cereals and cereal products Bread, legumes, vegetables Fruits, nuts	Carbohydrates Proteins Minerals	Vitamins Water
Eat Moderately Meat, poultry, fish, eggs Milk, cheese, ice cream	Protein Vitamins	Minerals Fats
Eat in small amounts Butter, margarine, oil cream, sugar, salt, animal fat	Fats and oils Carbohydrate Minerals	

3.2 Activity 2

In this activity you are asked to design a teaching resource suitable for Grade 6-8 pupils

Design your own version of the Health Eating Pyramid under each heading – Eat in small amounts, Eat moderately, Eat most, list some typical foods eaten – use sketches/drawings of the types of food and use examples of local foods in each section.

*Recipe to try***Pizza****Ingredients**

- 1 c SR flour (white or whole meal)
- 1tb olive oil
- 90ml water (approximately)
- 2 tb tomato paste
- ½ grated onion or 2 spring onions
- 100 g pineapple pieces
- ¼ green capsicum or ½ c slice mushrooms
- 4 sliced stuffed olives

Method

- 1 Grease a pizza with a tiny amount of the oil
1. Sift flour. Mix to a soft dough with the oil and the water
2. Roll the dough into a round to fit the pizza tray. Line tray with dough
3. Spread tomato paste on dough
4. Top with olives, onion, pineapple, mushroom or green pepper (capsicum) finally the grated mozzarella
5. Bake at 25c for 15-20 minutes or until golden

**3.2 Activity 3**

Plan Healthy Eating Pyramid meals for yourself for one day. Include breakfast (Lunch) dinner.

Explain why your planned diet is balanced.

Topic 4: Family meals

Objectives

By the end of this topic you will be able to:

- Plan and budget for nutritious family meals
- Prepare a range of nutritious foods understanding how best to prepare and cook vegetables and meats and fish
- Plan teaching resources suitable for grade 6-8
- Practice clean and hygienic habits in preparing and serving foods

Scope

This topic pulls together many of the activities from previous topics. The emphasis should be on nutritious affordable and practical meals for a family. The connection with the vegetable garden should also be made. A variety of recipes are provided to choose from. It should be remembered that one of the main purposes of this topic is for you to develop teaching resources for use with Grade 6-8 as well as learn/practice basic skills.

Planning

Some of the factors that influence the planning of family meals include:

- Age of individual family members; young children have very different food needs to those of older family members
- Growth rate of young children and adolescents during periods of rapid growth, children and teenagers need additional nutrients for growth including proteins and calcium
- Activity level of individuals within the family. Some family members have higher energy levels than others
- Gender of family members; males utilise more energy and nutrients for growth because of their larger body mass than females, however females need higher levels of iron than males because iron is lost during menstruation
- Individual likes and dislikes of family members
- Amount of money available to purchase food
- How much time is available to prepare and cook the meal
- Skills knowledge and experience of the person preparing the meal
- Cooking facilities available to prepare the meal
- Availability of food from market trade store or garden



3.2 Activity 1

Work with a partner to plan two course meal for four people. You should base your meals on the recipes collected by the class or choose a recipe from this section

Your meal should be suitable for a weeknight and therefore must be suitable to prepare and cook in approximately 75 minutes

Make a list of all the ingredients you would need to prepare the meal. Write it up as a shopping list

Design a work plan to show how you could prepare the meal in less than 75 minutes

Name of recipe			
Ingredients			
Time	Important steps	Equipment	Safety

Example of a work plan

Prepare your menu to other class members and ask them what they liked and dished. Ask how you could modify your menu to make improvements

(It might be useful to prepare a brief peer evaluation form on the bottom of your menu.)

Soups

Soups can be served as a first course for a family meal or they can make a quick main course.

Soups made with vegetables are quick and easy to prepare, as well as being a good source of carbohydrate, vitamins, minerals and water. Different types of vegetables can be used to make soups for example pumpkin, carrot, pea, tomato, bean, broccoli, cauliflower, potato, cucumber, leek and zucchini

The following are simple recipes to try:

Pumpkin Noodle Soup**Ingredients**

(serves 4)
1 butternut pumpkin
(approximately 500g after it has been
peeled and seeded
1 onion, diced
1 packet regular chicken noodle soup
5 cups water
Ground pepper
1 tablespoon chopped parsley

Method

Carefully peel the pumpkin and remove
the seeds. Cut into small pieces
Peel the onion and dice finely
Place the pumpkin and onion in a saucepan
with the water
Add the packet of chicken noodle soup
mix, cover with a lid and bring to the
boil.
Simmer for approximately 30 minutes or
until the pumpkin is tender
Puree the soup in blender or with a stick
mixer
Season to taste with pepper
Sprinkle with a little chopped parsley to
garnish
Serve hot with garlic bread, toast, or
warm savoury scones

Vegetable Soup**Ingredients**

1/3 carrot
¼ onion
1 stick celery
1/3 parsnip
2 sprigs parsley
1 stock cube
500 ml water
2 tb rice

Method

1 Wash and peel vegetables
2 Dice the vegetables neatly
3 Crumble stock cube into water and place all
ingredients except parsley into a saucepan
Bring to the boil

Lentil Soup**Ingredients**

1 c lentils

450 g pumpkin

1 onion

1 tb Bonox

1 ½ L water

¼ tsp pepper

Method

1 Peel pumpkin and onion and slice finely, in a food processor if possible

2 Place all ingredients into a large saucepan, cover and bring to the boil

Simmer for 60 minutes, stirring occasionally

Serve 4-6

**3.2 Activity 2**

What is the value of soup as a meal for a family? Think of nutritional and financial factors.

Make a collection of soup recipes which are economical and nutritious.

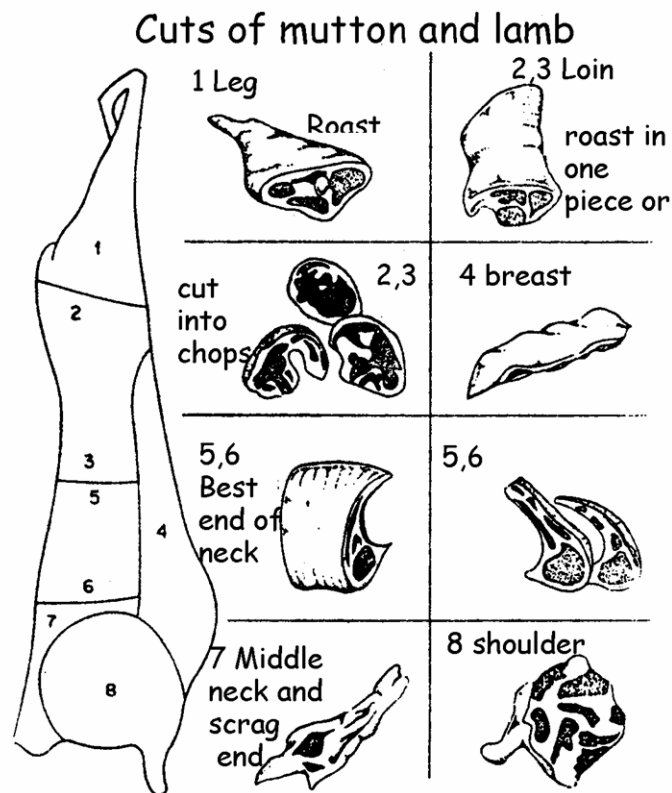
Meat

Meat is one of the foods found in the Eat Moderately section of the Healthy Eating Pyramid. Red meat, especially lean cuts, contains readily absorbed forms of iron and zinc, iron helps oxygen moves around the body and is important in producing energy. Meat also contains a high proportion of protein that is essential for growth and to repair and maintain tissues in active people

The main sources of meat in Papua New Guinea are:

Cattle	-	beef
Sheep	-	pork ham, bacon
Poultry	-	chicken duck turkey

Many people also eat goat, rabbit rainforest game such as kapel, cassowary pigeon flying fox, tree kangaroo small mammals (rots bandicoots and pukpuk)



3.2 Activity 3

How can you prepare and cook lamb or mutton in order to reduce the amount of fat eaten?

Find out how you would best cook breast meat.

Research to find the best cuts of pork, make a drawing or table.

Many Papua New Guineans are developing heart disease and other related diseases. Often these diseases can be related to eating too much fat with meat as well as the way in which the meat is cooked.

Discuss this problem with your peers and common up with a simple set of guidelines for preparing and cooking meat.

Spaghetti Bolognaise

Spaghetti ingredients

90 g spaghetti
1 L boiling water
1 tb oil

Sauce Ingredients

1 tb oil
1 diced onion (small)
2 tsp Worcester sauce
a little garlic
1 tsp salt-reduces soy sauce
1 tb tomato paste
 $\frac{1}{2}$ c water

Method

1 Heat oil gently, add diced onion and garlic, then meat. Fry for 10 minutes
2 Add all other ingredients. Mix well. Simmer for 15 minutes
3 Serve spaghetti on a warm plate, top with sauce and sprinkle with 15 g grated cheese if desired
Serves 2

Meat Loaf

You will need

500 grams of minced meat 6 cups of bread crumbs
 $\frac{1}{2}$ cup evaporated milk 1 bunch spring onions, chopped finely
ground pepper 1 egg, well beaten
salt

Mix all the ingredients together. In a baking tin or empty tinned fish container, place the meat mixture, flatten the top. Cover and bake in a moderate oven until cooked.

If there is no oven, the container with the meat mixture can be steamed in a well covered saucepan until the meat is cooked.

Tinned Meat in Taro Leaves

You will need

$\frac{1}{2}$ tin meat 1 cup coconut milk
1 bunch spring onions young taro leaves
1 tomato salt, ground pepper

In a dish, mix meat, chopped onions and tomatoes. Sprinkle some salt and ground pepper on the mixture. Mix well, adding 2 tablespoon of coconut milk.

Wrap the mixture carefully and neatly into a parcel. Arrange the parcels in a saucepan or cooking pot and pour on the remaining coconut milk. Boil slowly for about 20 minutes or until the coconut milk thickens. Serve with boiled yam, kaukau of rice.

Some meat recipes to try

When cooking with meat, you need to find meat that is lean and economical. The following recipes make a little bit of meat go a long way.

Surprise Hamburgers

(Shallow frying method)

Ingredients

200 g minced steak
1 tb bran
 $\frac{1}{4}$ chopped onion
 $\frac{1}{2}$ an egg (this is an example of egg being used as a binding agent)
4 stuffed olives
1 tsb chopped parsley
2 tsp olive oil
4 hamburger buns
tomato slices
shredded lettuce
beetroot

Method

- 1 Collect all ingredients
- 2 In a large bowl, place the bran, meat, onion, parsley and egg. Mix together with a wooden spoon
- 3 Divide the mixture into four portions. Shape each portion into a patty with an olive in the centre
- 4 Heat oil in a large frypan. Add hamburgers to pan and cook for 4-5 minutes on each side
- 5 Drain on absorbent paper
6. Slice hamburger buns in half, and toast the sliced side
- 7 Place the hamburgers and salad ingredients between the toasted buns

Lamb Stew

Ingredients

Your will need:

500 grams lamb chops 4 potatoes or root vegetables
2 medium sized carrots or pumpkin 1 bunch snake beans or wing bean
2 tablespoon flour salt pepper, curry powder
2 cups water 2 tablespoon cooking oil
Cut lamb into small pieces, about 2 cm cube. Remove fats and grizzle from the meat

Method

Roll meat pieces in seasoned flour. (Mix flour with salt, pepper and curry powder) and fry lightly in a little oil. Add chopped onions. Add water and cook slowly in covered pot until the meat is tender.
Add peeled, washed and cubed root vegetables to the meat. Continue cooking for about 10 minutes, then add the other vegetables. When all the vegetables are cooked, remove the cooking pot from the stove and serve hot.

Sweet and sour pork

1 kg (2lbs) lean pork cut into strips
1 350 g (12oz) tin of pineapple and juice
2 tablespoons butter or oil 2 cups Green Beans
1 Onion (sliced) water to cover
3 stalks Celery (sliced) 1 teaspoon Salt

Irish stew

1 kg (2lbs) Neck of Mutton or Stewing Chops 3 carrots
6 potatoes 2 beef cubes
3 onions Boiling Water (about 2 cups)
Pepper and Salt to taste

or to taste

2 tablespoons sugar if necessary 2
tablespoons Soya sauce

¼ cup Cider Vinegar Edmonds Corn flour

Brown pork strips in hot butter or oil and add onion, celery, vinegar, pineapple pieces, juices and crumbled Beef cubes. Add barely enough water to cover, also 2 tablespoons Soya Sauce. Cook until pork is tender 20-40 minutes depending on the pieces used. Add green beans, cook further 7 minutes, or until beans are tender. Adjust seasoning, thicken slightly with corn flour. Serve with hot noodles

Trim fat off meat and cut into pieces of trim chops. Pare the potatoes. Cut onions and carrots into thick slices. Put meat into a saucepan, add Beef cubes crumbled and dissolved in boiling water then vegetables and seasonings. Bring to the boil, then simmer gently for 1 ½ to 2 hours.



3.2 Activity 4

Find out where tough and tender cuts of meat come from.

Why is it usual for us to cook meat?

Discuss the ways that meat changes when it is cooked. Look at samples (pictures) if possible. Collect meat recipes, traditional as well as modern

Group these under Lamb Beef Pork Poultry

Poultry

Chicken like other meats is a very good source of complete protein and therefore helps build and repair body tissue.

A chicken recipe to try:

Curried chicken

- ½ cup balanced Almonds
- ½ cup Butter
- 1 1/3 cups chopped onions or
- 4 tablespoons curry powder
- ¾ cup diced Green peppers
- chutney
- 1 teaspoon salt
- 4 cups diced cooked chicken
- 6 cups chicken broth
- 1 dessertspoon sugar



Light Sussex



Hybrid egg layer



Hybrid broiler

*Which of these chickens would you eat? Why?
How would you kill it and what's your favourite recipe?*

Sauté almonds, onion and green pepper in butter. Stir in flour. Gradually mix in the chicken broth, salt, and curry powder. Cook until sauce is thickened. Stir occasionally, then add chicken. Continue to cook until well heated. Serve with rice and pineapple pieces. Serve eight

3.2 Activity 5

Visit the supermarket or trade store where chicken is sold- note the different chicken cuts available. List these and record the price per kilogram. Which were the cheapest cuts of chicken and which were the most expensive?

In a small groups work on the following tasks

Find 4-5 chicken recipes that you would enjoy making and which could be taught in the primary school – look on packages tins bottles of sauce in shops to make your collection.

*Write out the recipes listing the ingredients – list all equipment needed
Design a work plan to show how you could prepare one recipe.*

Eggs

Eggs are another ingredients that can form the basis of a quick and easy family meal. Eggs contain most of the important nutrients needed for growth and repair of body tissue.

Many uses of eggs

- Lightening mixtures,
- As thickening foods
- Enriching foods, as in cakes
- Holding foods together (binding) as in meatballs and fish cakes
- Protecting foods during cooking for example some goods are cooked in egg and breadcrumbs before cooking
- Eggs are often used as a main course for example –omelette

Nutrient content of an egg

Approximate nutrient content of a 55 g egg

		Whole egg
KJ		297
Water	g	37.7
Protein	g	6.35
Fat	g	5.05
Carbohydrate	g	0.15
Cholesterol	mg	187.5
Sodium	mg	66.5
Potassium	mg	57
Calcium	mg	19.5
Iron	mg	0.8
Zinc	mg	0.45



3.2 Activity 6

List as many courses as you can think of that use eggs

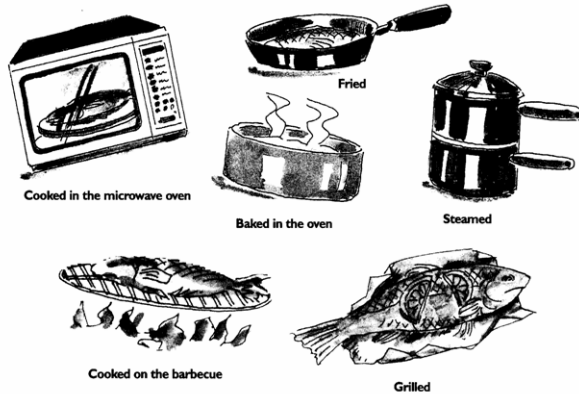
-Make a collection of egg recipes that could be suitable for breakfast.

Check the recipe for omelette. Make a list of ingredients that you could use to add to the filling of the omelette. Next to each of the ingredients you have listed, explain how you would need to prepare them before adding them to the omelette

Fish and other seafood

Fish is lower in fat and more easily digested than other flesh foods. Canned fish with bones is a good source of calcium for bones and teeth

Fish may be cooked in many ways.



Egg and Bacon Pie

Ingredients

Pastry
 1/3 c flour
 25 g margarine
 2-3 tsp water
 Filling
 1 egg
 2 tb milk
 ½ tsp chopped parsley
 25 g bacon pieces

Method

1. Sift flour
2. Rub in margarine
3. Add water and mix to a soft dough. Knead lightly
4. Roll pastry out to an oval shape about 3 mm thick and about 2 cm larger than pie tin base (single meat pie tin)
5. Line pie tin neatly making sure that pastry is not pulled away from tin. Trim edge neatly
6. Mix egg milk and parsley
7. Place bacon in pastry case. Pour egg mixture over bacon
8. Place pie tin on a tray. Bake at 190c for 30 minutes

3.2 Activity 7

Try to name as many different types of fish which are available either canned, frozen, smoked or fresh.

Which is the best type of canned fish to eat?

Give reasons.

What are the advantages of eating fish rather than red meats?

Begin collecting fish recipes.

Recipes to try with fish

Grilled fish

Ingredients

1 filleted fish
2sp lemon juice
tsp oil
1 thin slice lemon
1 thin slice tomato
1 sprig parsley
aluminium foil

Method

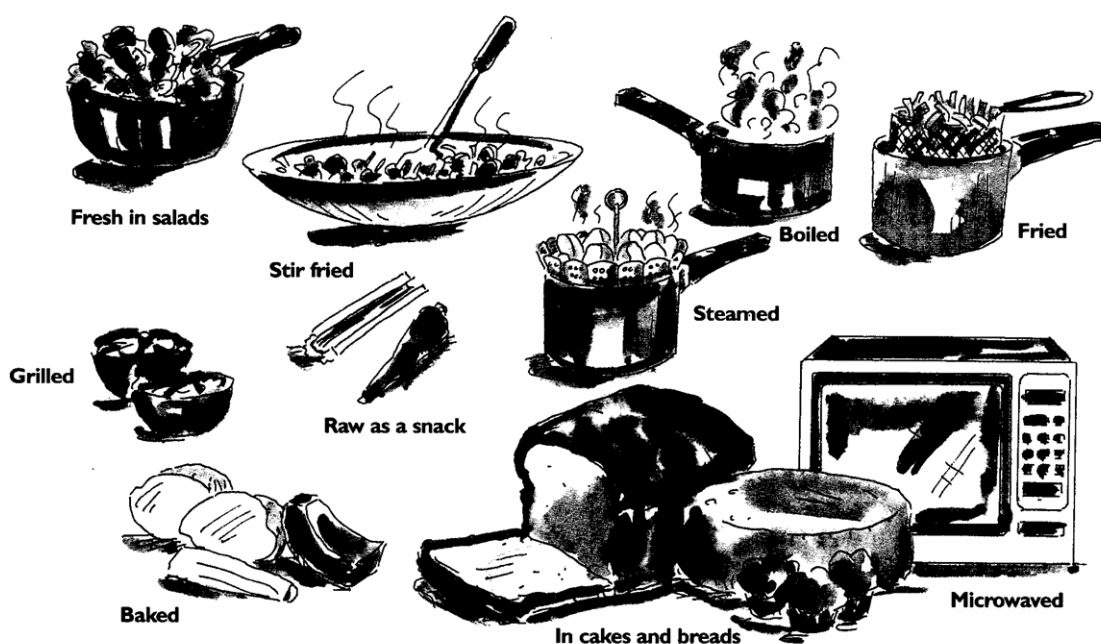
Whisk the lemon juice and oil together,
Brush the juice and oil mixture over the fish.
Place the fish on a piece of foil. Curl the edges of the foil up so that the juice cannot run off.
Place the fish under a medium griller. Cook for 5 minutes one side then carefully turn the fish. Cook for a further 7 minutes or until the flesh is white right through.
Serve the fish with a little juice trapped in the foil.
Garnish with tomato, lemon and parsley.

Vegetables

Vegetables are important in your diet because they provide

- Vitamins
- Energy from carbohydrates
- Minerals
- Colour and texture
- Dietary fibre
- A variety of flavours
- Water

Ways of serving vegetables



Serving vegetables

Vegetables come in many interesting shapes colours and textures. The methods used to prepare and cook vegetables directly affects the enjoyment of the person eating them.

Vegetable can be:	They can be served:
• Raw • Stir fried • Roasted • Steamed • Baked • Grilled • Boiled • Micro-waved • Char-grilled • Barbecued	• As dips • In a salad • Sliced, diced or in chunks • Whole • In an omelette • As an accompaniment to meats, chicken or fish • As a sauce • In breads • In muffins • In cakes • In soups



3.2 Activity 8

Investigate how best to cook vegetables so that the important nutrients are not lost. Present your information as a poster resource.

Refer to the text: Basic Technology for Grade 7-8.

Vegetarian meals

There are some people who because of religious beliefs, views on health, or opposition to the killing of animals, maintain a vegetarian diet.

These are two main types of vegetarians:

Lacto-ovo vegetarians do not eat meat, but will eat dairy products and eggs

Vegans will not eat meat or any other product that comes from animals

It is important for vegetarians to ensure there is an adequate supply of complete protein. Soya beans and Soya products such as soya milk and tofu are good sources of complete protein.

Vegetarian meals need to a variety of plant food to build up the complete protein requirements needed for a balanced diet. To do this foods from cereals including wheat rice pasta are combined with pulses, such as dried beans (soy, haricot or cannelli) lentils, chickpeas or nuts in the one meal.



3.2 Activity 9

Vegetarian Meals

Investigate throughout the library and internet if it is available for:

- a) the variety of foods that can be combined or complemented to provide complete protein for vegetarians and*
  - b) recipes suitable for vegetarians.*
-

Module 3.2 Practical Applications

Theme: Basic Woodwork

Basic Woodwork



Basic Woodwork

Rationale

Basic woodwork, introduces you to the basics of working with wood. You will be given opportunities to practice the use of basic equipment such as saws, hammers, planes, hand drills, rulers, set square and chisels. A variety of projects will be offered allowing you to practice wood working skills. Most importantly, you will be expected to develop teaching and learning materials suited to Grades 6-8.

Objectives

By the end of this module you will be able to:

- Use tools and materials safely and with minimal wastage
- Produce a scale drawing of a project
- Measure, mark and cut out shapes for a project
- Prepare joints, assemble and finish a woodwork project to a high standard
- Carryout basic maintenance of windows, doors, floors and roofs

Suggested topics

1. Basic woodworking projects

Topic 1: Basic woodworking projects

Objectives

By the end of this topic you will be able to construct a woodwork project which involves the following skills:

- Draw neat and accurate scale drawings of top, front and end views of a project
- Accurately measure and mark-out timber ready for cutting
- Identify tools used in marking-out and describe their function
- Take necessary steps to minimise wastage
- Identify different cutting tools and their uses
- Cut out different pieces of timber to the correct length
- Identify the features of a good joint
- Select the correct joint for a particular project
- Use a saw and chisel effectively to make joints
- Plane timber using the correct plane
- Use a plane, holding tool and hammer correctly and safely
- Describe uses of nails, screws and adhesives and assemble pieces with nails, screws and adhesives in the correct way
- Describe and use the different finishing materials (putty, sandpaper, and varnish) and describe the uses of each
- Apply paint or varnish correctly
- Maintain finishing equipment properly

Scope

This topic covers a basic range of wood working skills needed for most projects. You will be helped to select a suitable project that suits the college and is appropriate to your wooding skills. Examples of possible projects are given.

Through this topic you will gain experience at using a variety of tools and materials, you will have the opportunity to demonstrate skill and proficiency at different stages of design, making and finishing. The knowledge and skills taught are general enough that they can be applied to any project.

The projects

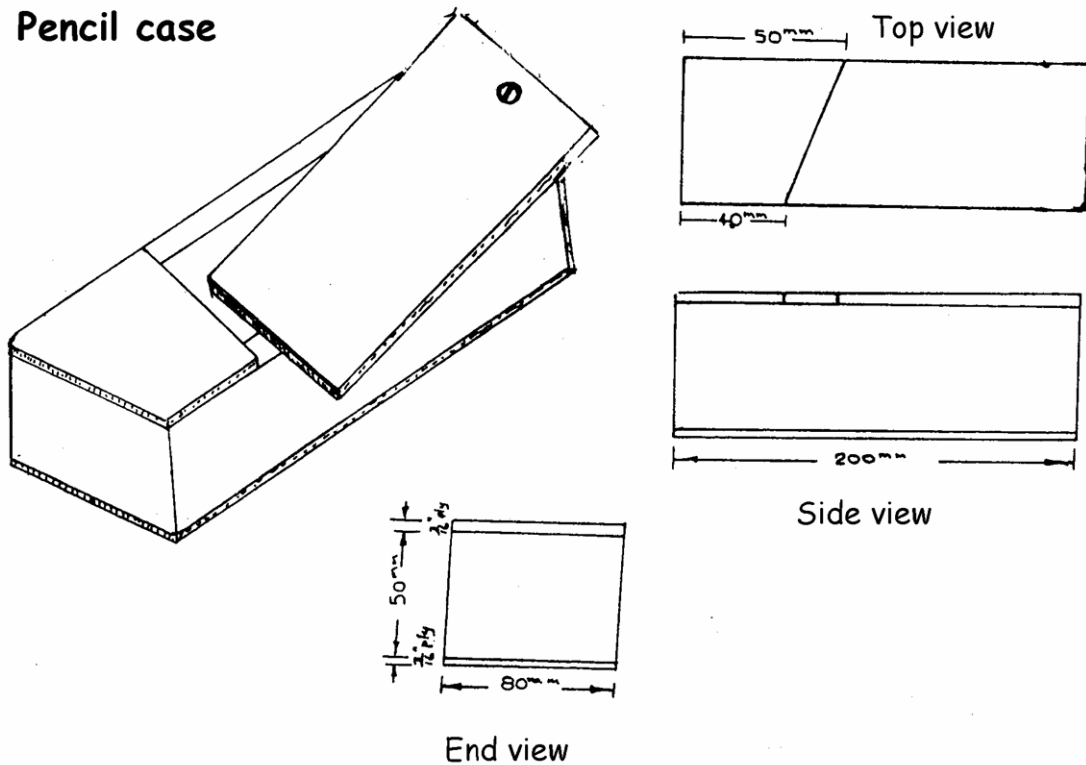
Project 1: a pencil case

Materials (plywood may be the most practical timber to use)

1. 2 sides 210mm x 50mm x 10mm
2. 2 ends 60mm x 50mm x 10mm
3. 1 base 210mm x 80mm x 3mm
4. 1 lid 210mm x 80mm x 3mm
5. Sandpaper

6. Small nails and screws
7. Varnish / paint and glue

Pencil case



Project 2: a basic stool/table

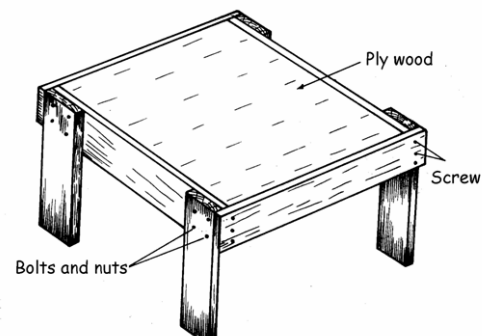
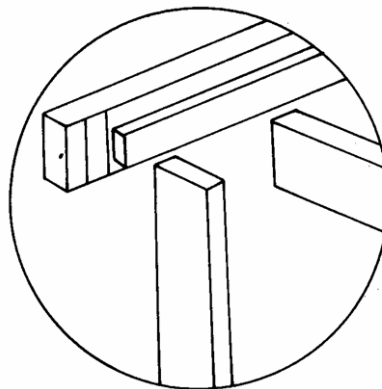
Size: Top 400mm x 400mm

Rail 4/400mm x 60mm x 20mm

Leg 4/300mm x 30mm x 20mm

Materials

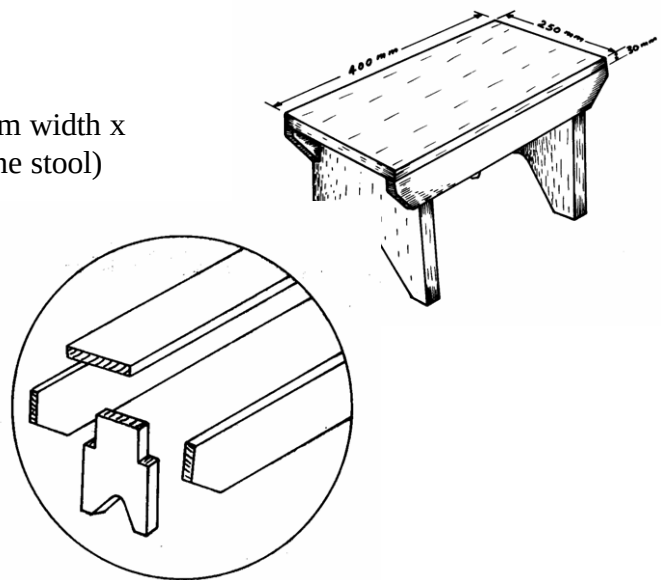
1. Top: 400mm x 400mm x 10mm. (plywood)
2. Rails: 1.8m x 60mm
3. Braces: 1.6m x 30mm x 20mm
4. Legs: 1.6m x 60mm x 20mm
5. 12 bolts and nuts. (50mm)
6. 24 clout nails (40mm)
7. Sandpaper
8. Glue, varnish



Project 3:stool #1

Materials

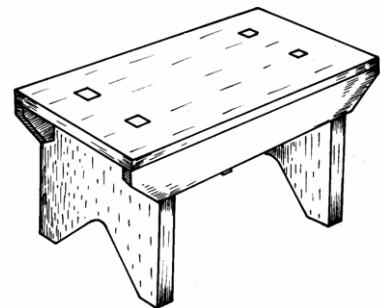
1. One piece 1 metre long x 250mm width x 20mm thick (top and legs for one stool)
2. One piece 1 metre long x 80mm width x 20mm thick (rails for one stool)
3. 20 clout nails
4. Sandpaper
5. Varnish /paint and glue



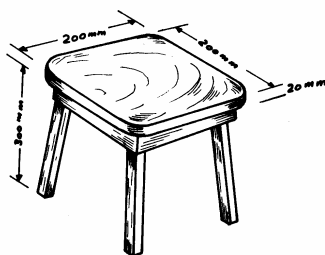
Project 4: stool #2

Materials

1. One piece 1 metre long x 250mm width x 20mm thick (top and legs for one stool)
2. One piece 1 metre long x 80mm width x 20mm thick (rails for one stool)
3. 20 clout nails (40mm)
4. Sandpaper
5. Varnish / paint and glue

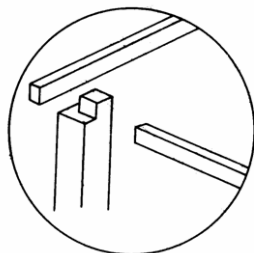


Project 5: stool # 3



Materials

1. Top piece: 200mm x 20mm
2. Rails: 760mm x 40mm x 20mm
3. Legs: 1.3m x 40mm x 40mm
4. Approximately 40 clout nails (24 @ 40mm and 16 @ 30mm)
5. Sandpaper
6. Varnish/paint and glue

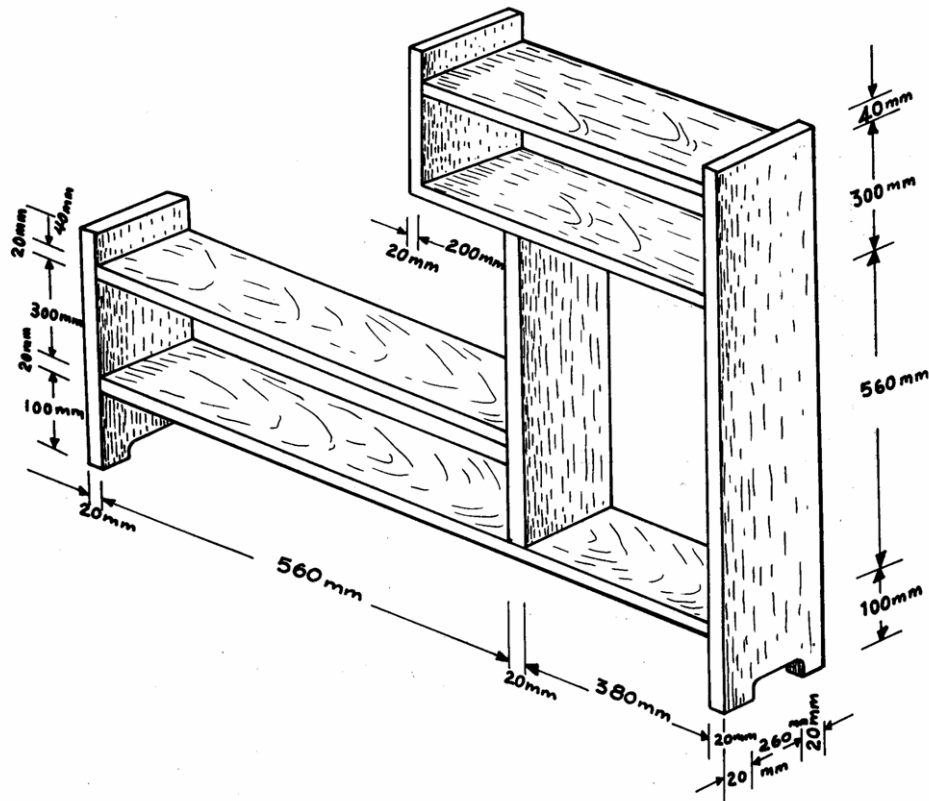


Project #6: shelf

The measurements for this project could be modified to make it more affordable to the college.

Materials

1. 5 metres long x 400mm x 20mm for all members of shelves.
2. Approximately 36 clout nails (40 –50mm)
3. Sandpaper
4. Glue, varnish or paint



Safety rules

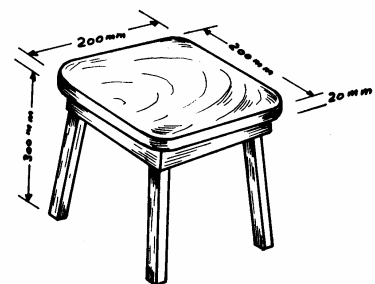
1. Give all your attention to the job and don't distract others.
2. Be sensible in your behaviour, don't play with tools or run about the building site or workshop.
3. Be alert, watch out for any dangerous situations, warn your peers, and report it to the lecturer in charge.
4. If you are not sure of the correct way to use a tool, ask your lecturer.
5. Make sure that your project work is safe and securely fastened in place before you start cutting or any work.
6. When cutting wood, guide the cutting tool in the correct way and keep your hands away from the cutting edge. Always cut away from yourself.
7. Wear safety goggles when cutting blocks, breaking concrete or grinding tools.
8. Carry tools with the pointed ends down.
9. When you finish working with a tool, clean it and return it to the toolbox.
10. Never throw or drop tools. Keep the place tidy. A workplace scattered with tools is dangerous.
11. Maintain your tools, work only with clean and sharp tools. A good quality well maintained tool can do half the work for you.

Scale drawing

Scale drawing is a useful skill in planning the construction of a project. To draw an object to scale means reducing each of its measurements by a standard ratio so that its proportions are accurate on paper.

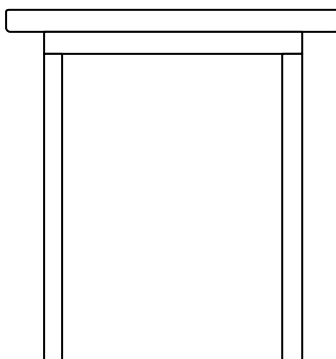
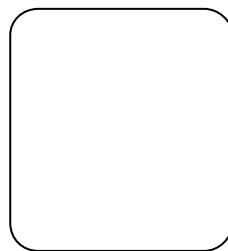
For example:

6:2 is a ratio which can also be written as 3:1.
In terms of scale and measurement, a 3cm measurement on a chair = 1cm on paper.



Isometric drawings are two dimensionally accurate drawings of a project.

Orthographic drawings give us a clear view of all faces of an object: top, front and end.



Example of an isometric drawing of a stool

Example of an orthographic drawing of a stool.



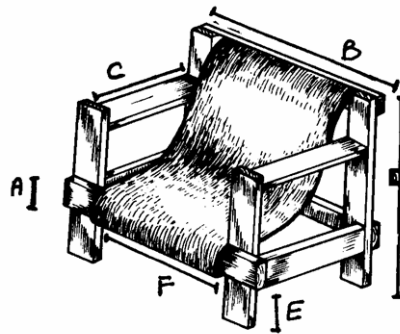
3.2 Activity 1

Isometric Drawing

Look at this drawing. It is $1/20$ th of the size of the actual chair.

Calculate the measurements of the actual chair. Record them in this table.

	Part	Sketch Of chair	X 20 Actual chair
Orthographic drawing	A	1cm	20cm
	B	3cm	?
	C	2cm	?
	D	?	?
	E	?	?
	F	?	?



Orthographic drawing

- How is an orthographic drawing arranged?
- What sections of a stool would we see in the three views? List them.

Doing a scale drawing

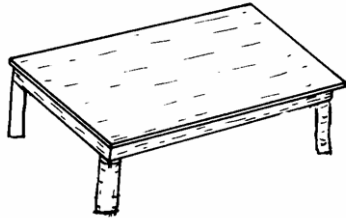
For scale drawings we use orthographic drawings – these drawings give us a clear view of all faces of an object – top, front and end.

1. Prepare a detailed list of all the parts of the item and the actual measurements
2. Reduce these measurements to drawing measurements according to a common ratio (a reduction ratio)
3. Divide these drawing measurements into those required for top, front and end views
4. Carefully do the three drawings
5. Record the scale

Case study – Dorish does a scale drawing

Dorish is planning to make a coffee table. She wanted a scale drawing to help her so she did the following:

1. First, she looked at her sketch and she listed the parts of the table and their measurements.



Top length	2m	___mm
Width	1m	___mm
Legs height	48cm	___mm
diameter	2cm	___mm

2. Next, she reduced these actual measurements to a size suitable for a scale drawing. She did it this way:

- a. She converted all the measurements to mm

Complete these measurements and check with a friend.

- b. She chose a reduction ratio.

She did some rough calculations and decided to reduce all her calculations by a factor of 40. This meant her drawing would be 40 times smaller than the actual table.

Think of two good reasons why Dorish chose 40.

- c. She did all the calculations

Please complete these for Dorish and check with a friend.

- i. Actual Table Length = 2000mm

Reduction ratio = 40

Scale Table Length = $2000/40 = \underline{\hspace{2cm}}?$

- ii. Actual Table Width = 1000mm

Reduction ratio = 40

Scale Table Width = $1000/40 = \underline{\hspace{2cm}}?$

- iii. Actual Leg Length = 480mm

Scale Table Width = $\underline{\hspace{2cm}}?$

- iv. Actual leg diameter = 20mm

Scale Leg Diameter = $\underline{\hspace{2cm}}?$

- d. She recorded the information in a table like this:

Measurements for Scale Drawing (mm)			
Parts	Actual size	Reduction ratio	Drawing size
Top-length	2000	40	___?
Width	1000		___?
Legs –length	480		___?
Diameter	20		___?

3. After that, she divided her drawing measurements into those needed for the three views: front, top and end. She found she was missing a measurement for the front and end views: the thickness of the tabletop.

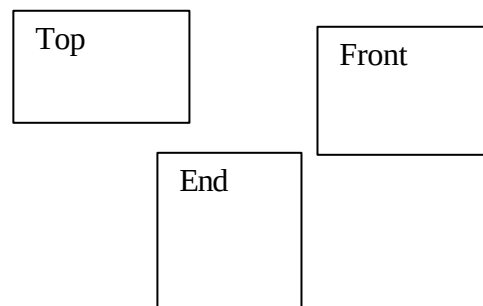
Explain why she would need this measurement.

She recorded the measurements like this:

Transfer the measurements from the previous table and include table thickness of 0.5

Views	Parts	Drawing size (mm)
Top	Table width	-
	Table length	-
Front	Table width	-
	Table thickness	-
	Leg height	-
	Leg diameter	-
End		

4. Then she did her three drawings using this layout.



5. Finally, she recorded the scale. Her reduction ratio was 40 and she was working in mm so her scale was 1:40

Marking out

Marking out is the accurate drawing of the shapes of your project from your plan onto the timber.

Skills you need to acquire are:

- Scaling up from your plan
- Using the marking out tools correctly

1. Top piece: 200mm x 20mm
2. Rails: 760mm x 40mm x 20mm
3. Legs: 1.3m x 40mm x 40mm

- Measuring accurately in cm and mm
- Assessing and measuring angles

Carefully mark out your timber. Have a peer check it for accuracy and wastage. Mark final marks ready for cutting. Make a parts / cutting list ready for cutting.

Example of a parts/cutting list:

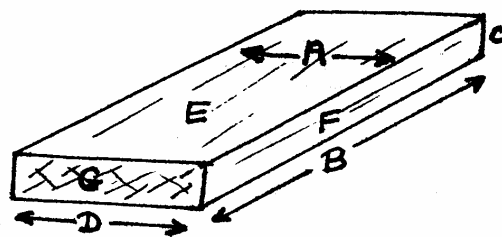
3.2 Activity 2

List the marking out tools you used.

Describe the function of each.

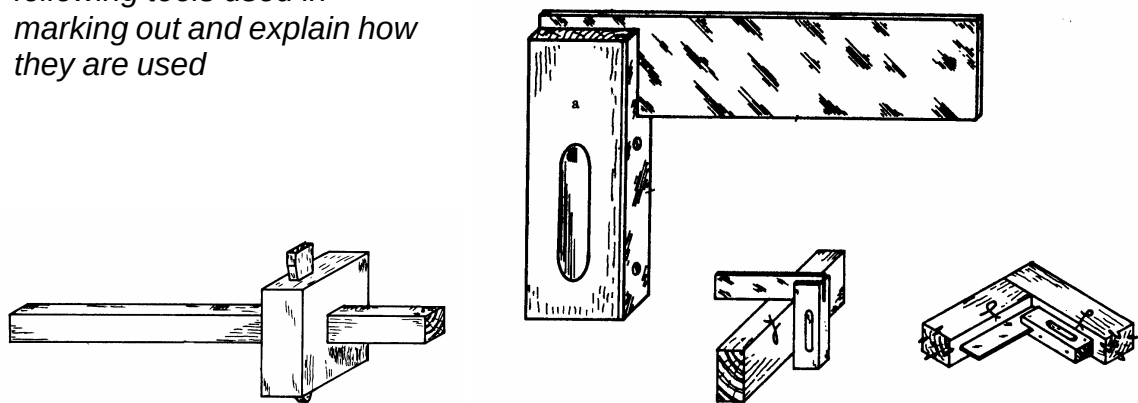
Use the list provided to label the parts of this piece of wood:

Length, width, thickness, face-side, face edge, end grain, across the grain.



- A.
- B.
- C.
- D.
- E.
- F.
- G.

Identify the following tools used in marking out and explain how they are used



Cutting out

Using cutting out tools

The size of the saw is determined by the length of the blade in mm or cm.

The coarseness or fineness of the saw is determined by the number of teeth or points per mm or cm.

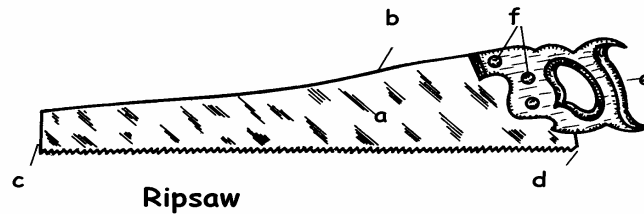
A course saw is better for fast work and for green wood.

A fine saw is better for smooth accurate cutting and for dry seasoned timber.

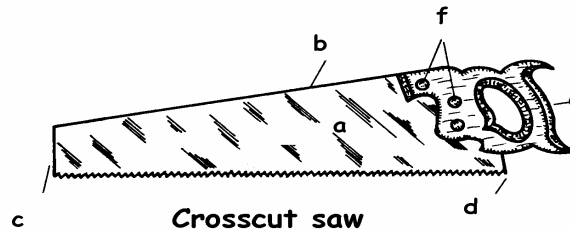
Cut your timber according to the markings

Handsaws

The parts of the saw are: the blade (a) which has a back (b), toe (c) and heel (d), the handle (e) and the saw screws (f) which hold the handle to the blade. A good saw-blade makes a clear sound when it is slightly bent and struck on the back with a fingernail. The handle should be made of good hard wood and have a comfortable grip.



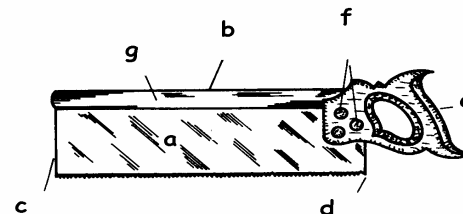
Ripsaw



Crosscut saw

The ripsaw - because of the special shape of its teeth, is used only to cut with the grain of the wood. The length of the saw can vary from 66 to 71 cm. A long saw can cut faster, but it is harder to control.

Tenon or backsaw



The crosscut saw - is designed for cutting across the grain. Its length can vary from 51 to 66 cm.

The tenon saw or backsaw - is used to make fine and finished cuts. In general, the blade of the backsaw is thinner than that of a ripsaw or crosscut saw. The fold of steel that sits on the back of the blade (g) makes it stiff and it can be removed if necessary to make deep cuts. This saw is used when making joints.



3.2 Activity 3

Carefully select the correct saw and cut-out your project pieces.

Describe three different types of saws and the function of each.

Which type of saw did you use in the construction of your project?

Describe the steps necessary to properly maintain a saw

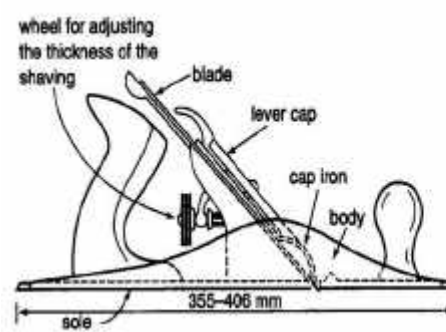
Planing timber

Together with the hammer, try-square and chisel, the plane is one of the principle tools used for carpentry work.

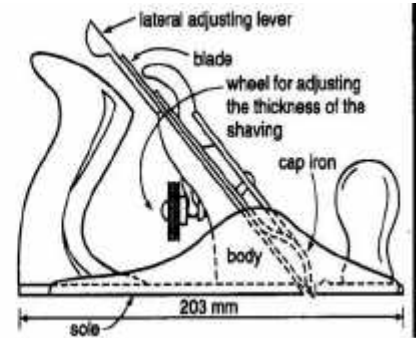
When timber comes from the sawmill it is generally quite rough from saw blade marks. Before any rough sawn timber can be used for any finished work,

it must be prepared so that all edges and sides are square, flat and smooth. This preparation is done by planing first and later smoothing.

The tool used for the rough part of this work is called the **jack plane**. The jack plane is used for planing purposes – to reduce the wood to the correct size. After the timber has been planed to a true surface, we use a smoothing plane to remove the rough marks of the jack plane.



Jack plane



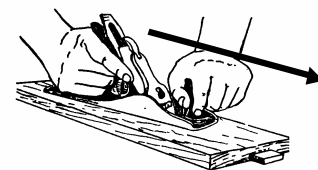
Smoothing plane

3.2 Activity 4

Name the different planes and their parts

Make a drawing.

The arrow shows the direction a carpenter is moving the plane. Use a dotted arrow to show the direction of the force of friction.



Imagine you are instructing a Grade 7 pupil on how to plane timber. Write a brief instruction for him /her.

Different types of joints

Angle joints

Angle joints are joints where the sides of the pieces (the wide surfaces) meet at right angles to each other. Angle joints are used for box-like constructions such as small boxes, tool boxes etc.

Nailed butt joint

The simplest angle joint is the nailed butt joint. The end of one piece of wood is cut square, then butted against the face of the other piece. It is held in place with nails, or both nails and glue.

Plain mitred joint

The ends of the pieces are mitred (cut at 45 degrees) across the thickness. The mitred ends are butted together and held in place with glue and nails.

This is a weak type of joint although it is stronger than the butt joint because it is nailed from two sides. Its advantage is that the end grain is not exposed to damage from water or insects, and it has a neater appearance.

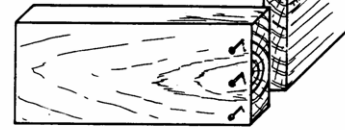
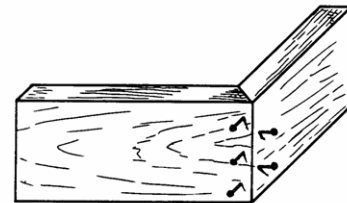
Rebated butt joint

The end of one piece fits into a rebate at the end of the other piece. This joint is strong because two surfaces are available for nailing, and because the shoulder of the rebate supports and helps to hold the other piece.

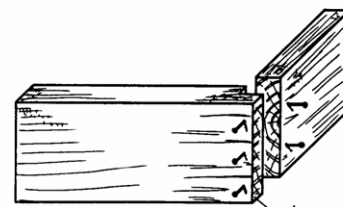
The lap is the section of wood which is left projecting after the rebate is cut. The lap is usually one-half of the thickness of the board. This lap will be important later when we are figuring out the length of our pieces for making a box.

Angle Joints

Nailed butt joint



Plane mitred joint



Rebated butt joint

Lap

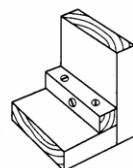


3.2 Activity 5

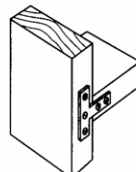
Make a sketch of these three angle joints. Think as you read which joints will be best for your project.

What tools would you use to make the rebated-butt joint?

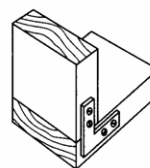
Think of situations when the following temporary wood joinery would be useful.



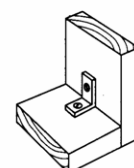
Corner block



T-plate



L-plate



Corner bracket

Constructing a box with the rebated butt joint

Step1. Preparation of the timber

- Make a cutting list. The end pieces can be cut to the required length, that is the outside width of the box minus the width of the two laps. Allow 3 mm extra at each end of the side pieces, for planing off after assembly (Fig. 2).
- Prepare the pieces

Step 2. Marking out

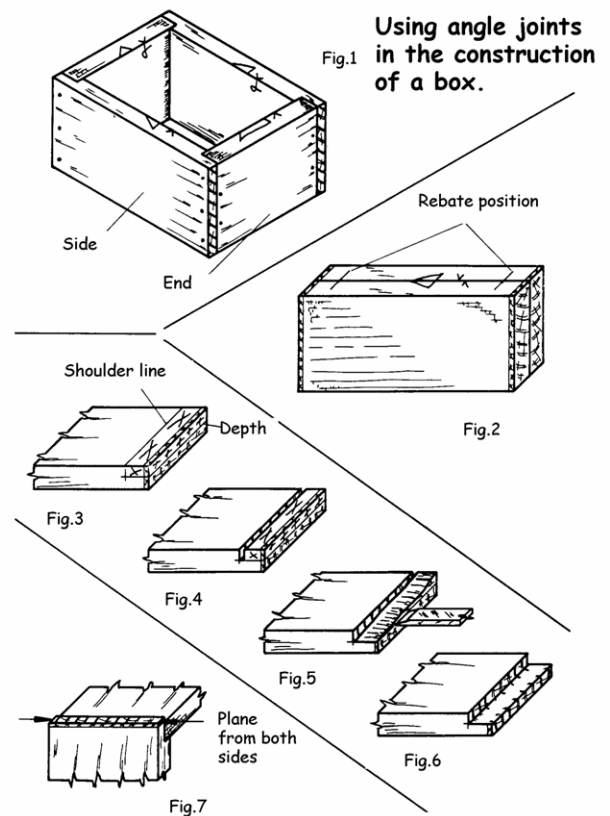
- Mark the sides and ends as shown in Fig. 1, on the face edges. All further marking will be done from the sides with these marks.
- Place the two sides together and mark the position of the rebates, squaring with the try square (Fig. 2).
- Mark the shoulder lines of the rebate on the inside face of the piece, using the try square (Fig. 3).
- Mark the depth of the rebate on the end grain and the edge, using a marking gauge (Fig. 3). Show the waste with crosses.

Step3. Cutting the rebate

- Saw the shoulders down to the gauge line. Cut on the waste side of the line. If the piece is very wide, nail or clamp a guide over the line to guide the saw. (Fig. 4).
- Remove the waste carefully to the gauge line with a firmer chisel (Fig. 5). Find out the direction of the grain by chiselling out small pieces first, so that you don't accidentally chisel too deep.

Step 4. Assembling

- Clean up the inside faces with a smoothing plane (Fig. 6)
- Assemble the box with glue and nails.
- Measure the diagonals to check for squareness.
- Clean up the face and bottom edges with a smoothing plane
- Plane off the waste from the sides with the smoothing plane. Prevent splintering by working inwards from the ends (Fig. 7).



3.2 Activity 6

This activity could be a good basic project for Grades 6-8. Using the information on 'constructing a box with the rebated butt joint' make a lesson plan for teaching the skills involved in this activity and making the box.

Housed joint

Housed Joint

These joints are types of angle joints, also used in box-like construction. Housing consists of sinking the end of one piece into a trench which is cut into the face of another piece (Fig.1).

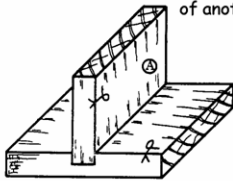


Fig.1

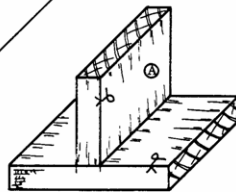


Fig.2

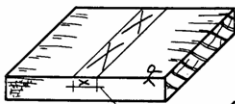


Fig.3

Depth

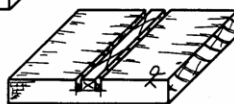


Fig.4

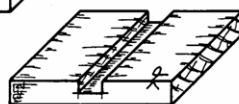


Fig.5

Steps in constructing the housed joint

Step 1. Preparation of the timber

- Make a cutting list.
- Prepare the timber

Step 2. Marking out

- Mark one edge of the trench with a try square and the other edge by using piece A as a guide (Fig. 2). (Smooth piece A before using it to mark the trench.)
- Gauge the depth of the trench at each edge (Fig. 3)
- Show the waste with small crosses (Fig. 3)

Step 3. Cutting the trench

Saw the sides of the trench (on the waste side of the lines) down to the gauge lines (Fig. 4).

Step 4. Assembling

- Assemble the two parts with nails and glue
- Clean up the edges with a smoothing plane

Halved Joints

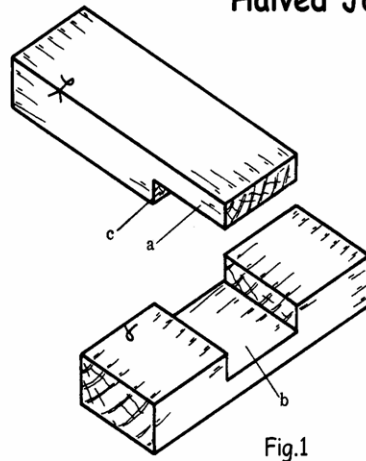


Fig.1

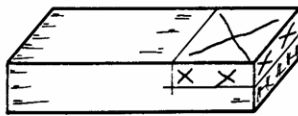


Fig.2

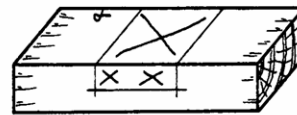


Fig.3

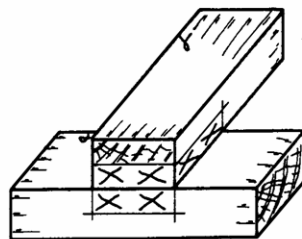


Fig.4

Halved joints

Halved joints are one type of framing joint. The name is applied to joints where the pieces of timber which meet or cross each other are halved; that is, at the place where they cross, each piece is $\frac{1}{2}$ the thickness of the rest of the piece. The result is that in the assembled joint, the surfaces of both pieces are flush.

Halved joints are used for constructing simple frames.

The tee-halved joint consists of a pin (a) on the end of one piece which fits into a socket (b) in the other piece (Fig. 1).

The pin is half the thickness of the timber, and the depth of the socket equals the thickness of the pin. The shoulder of the pin (c) fits against the face edge of the socket (Fig. 1).

Steps in constructing a tee-halved joint

Step 1. Preparation of timber

- Make a cutting list
- Prepare the pieces to the required size

Step 2. Marking out

- Mark the length of the pin

by placing the socket piece on top of it and marking at the width. A small amount of waste can be left on the end of the pin, to be planed off after the joint is assembled.

- Make lines square at the shoulder of the pin, drawing them across the side and halfway down the edges, with a try square and pencil (Fig. 2). Mark the waste.
- Mark the position of the socket, using the piece with the pin as a guide. Smooth the pin before using it to mark the socket
- Square the lines across the side and halfway down the edges with a try square. Mark the waste (Fig. 3).
- Gauge the thickness of the pin around its edges and mark the waste (Fig. 2)
- With the same setting, gauge the depth of the socket on both edges and mark the waste (Fig. 3)
- Both pin and socket should be gauged from the face side

- Place the pin over the position of the socket and check the fitting (Fig. 4)

Step 3. Cutting the pin

- Rip the thickness of the pin. Cut in stages as shown in Fig. 5, a through d. Take care to keep on the waste side of the line.
- Saw the shoulder of the pin, keeping on the waste side of the line (Fig. 6).

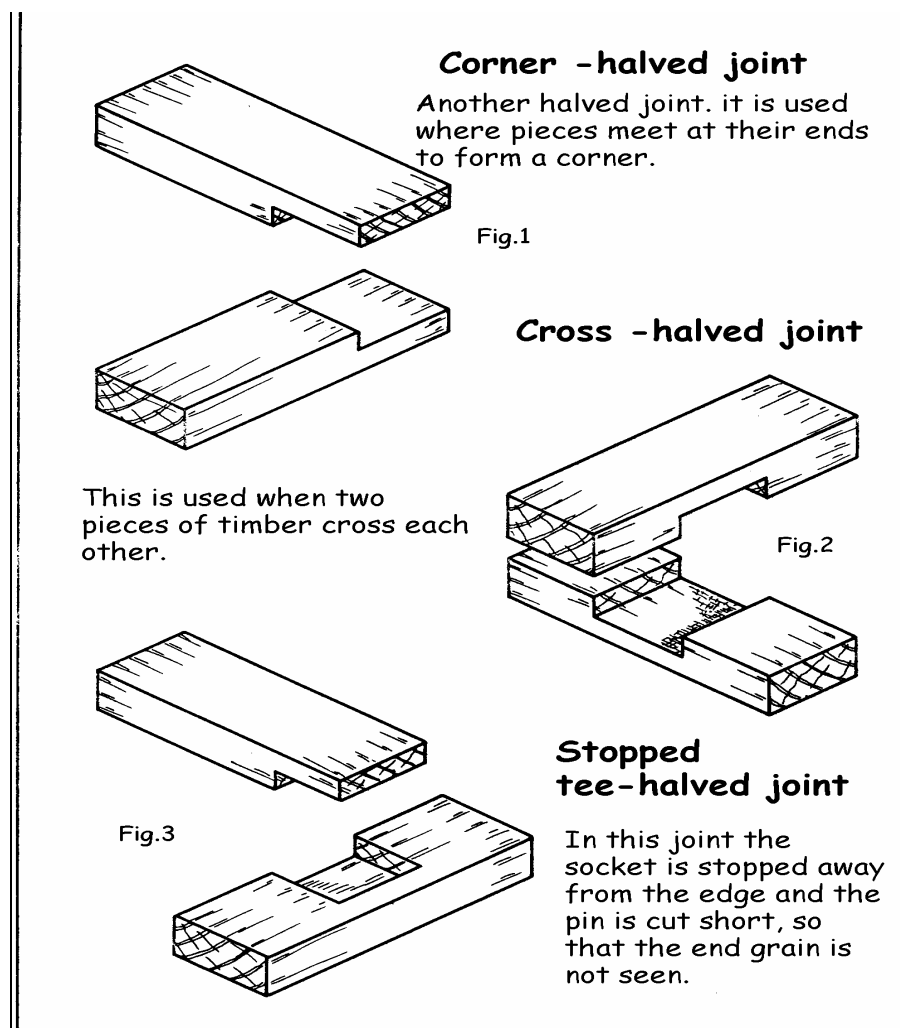
Step 4. Cutting the socket

- Saw down to the gauge lines of the socket, keeping on the waste side of the lines (Fig. 7).
- Chisel out the waste, chiselling halfway through from both edges (Figs. 8 and 9).
- Test the flatness of the socket with the blade of the try square.

Step 5. Assembling the joint

- Clean up the inside edges with a smoothing plane.
- Assemble the joint with glue and nails.
- When the joint is dry, plane off the waste of the pin.
- Clean up all sides and edges with the smoothing plane.

Other types of halved –joints:



 3.2 Activity 7

When would you use halved joints – list the types of constructions.

What is the advantage of protecting the end grain as with the stopped tee-halved joint?

Why is it always good practice to when sawing to cut on the waste side of the cutting line?

Mortice and tenon joint

This is one of the commonest and strongest joints. The two parts are (Fig. 1) the tenon (B), which is a projection on the end of one part and the mortice (A), the hole in the other part into which the tenon fits. The tenon is usually $\frac{1}{3}^{\text{rd}}$ of the width of the board.

Steps involved in constructing this joint

Step 1. Preparation of timber

- Make a cutting list.
- Prepare the timber to the required sizes. (In the following steps, the piece with the mortice is “piece A” and the one with the tenon is “piece B”.)

Step 2. Marking out

- Mark out the length of the tenon on piece B. Allow 3 mm waste in the length and
- Make square lines all around with a try square and pencil (Fig. 2).
- Take piece A and mark out the position of the mortice on the face edge and make square lines on the edges on both sides with the try square (Fig. 3).
- Set the marking gauge to the width of the tenon and mark the lines around piece B at the width. Mark the waste with small crosses (Fig. 4).
- Use the same setting to mark both faces of piece A and use a try square and (already smoothed) piece B to mark the remaining two lines for the width of the mortice (Fig. 5). Mark the waste with a small cross.
- Always mark from the face edge. Check the marking by setting piece B against the marks on piece A to see if they fit. Piece B must be smoothed first.

Step 3. Cutting the mortice

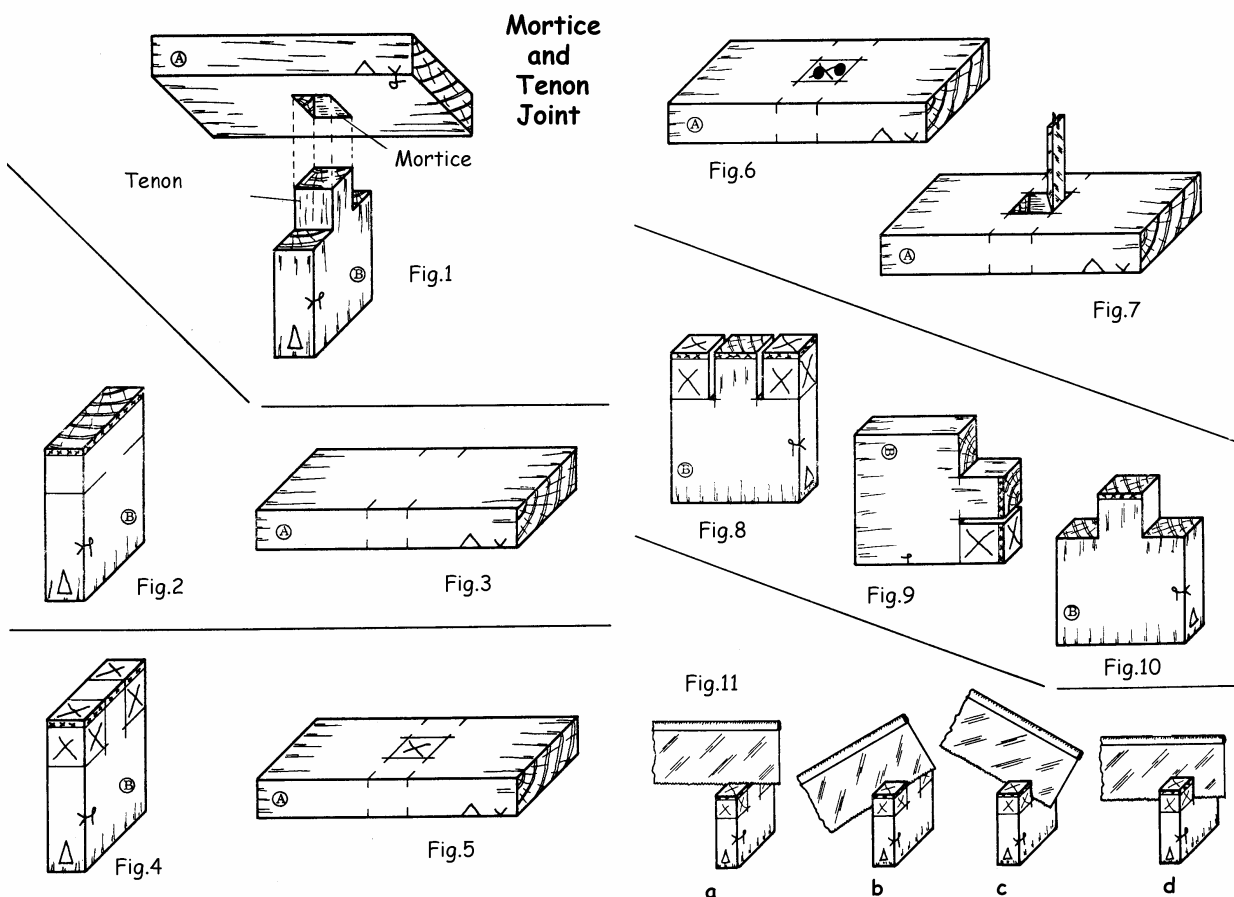
- Bore out most of the waste, using a brace and bit (Fig. 6). Clamp a piece of wood to the underside to prevent splintering and damage to the bench.
- Chop out the remaining waste with a mortice chisel, chiselling halfway through from both sides. Leave about 2 mm extra waste on all sides to prevent damage to the sides. Keep the cutting edge of the chisel across the grain.
- Carefully chop out the rest of the mortice up to the lines (Fig. 7). Keep the bevel of the chisel towards the inside of the mortice. Do not use the mallet.

Step 4. Cutting the tenon

- Rip the sides of the tenon, sawing on the waste side of the line (Fig. 8). Cut in stages as shown in Fig. 11, a, b, c, & d).
- Carefully saw the shoulders, making sure to hold the saw straight. Keep on the waste side of the line (Figs. 9 & 10).

Step 5. Assembling the joint

- Check the fit of the members. The tenon should fit tightly into the mortice without splitting the morticed piece. There should be no gap between the shoulders of the tenon and the morticed member. Don't force the members together. If they don't fit, find the problem and correct it.
- Clean up the inside of the joint where it can't be reached after assembly with a smoothing plane. (Remember that the tenon should be smoothed before using it to mark out.)
- Assemble the joint.
- Plane off the waste end of the tenon, clean up all sides and edges with the smoothing plane.

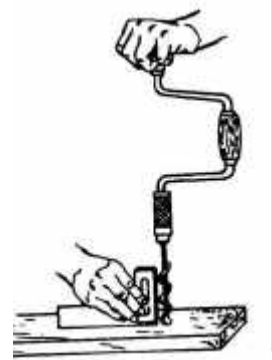


3.2 Activity 8

What is the purpose of making joints in woodwork?

Choose one joint you think you could use and draw the sequence of steps in making it.

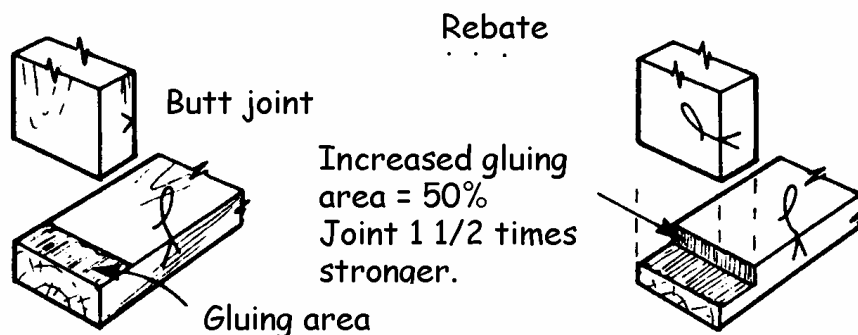
What is this tool and when would you use it? Label the main parts and be able to show how it works.



Features of good joints

- The joint is accurately made so it fits well.
- The correct type of adhesive is used.
- There is sufficient surface area on which to apply the glue to make a strong joint.

Large gluing area = strong joint



Compare the gluing area on the butt joint and the rebate joint. What conclusion can you make?

- The glue is spread evenly over the whole joint area
- Adequate and even pressure is applied to the glued joints when they are being made

3.2 Activity 9

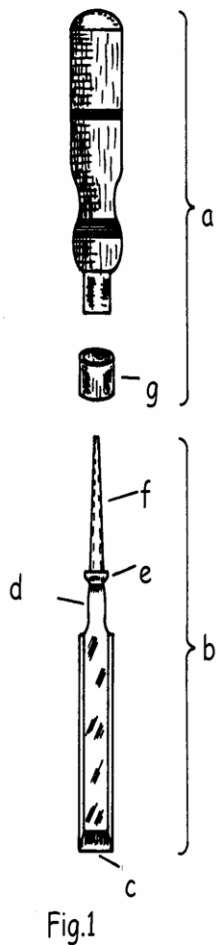
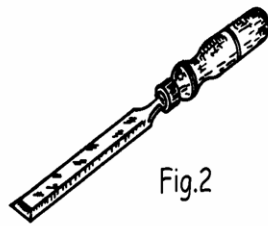
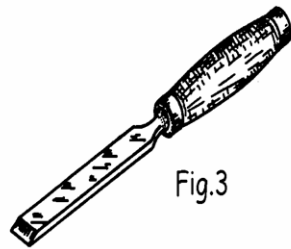
List the features of good joinery.

Select the best joint for your project – draw it and name the main tools used to make the joint.

Find the meaning of these terms: butt, rebate, flush, rip, bevel.

Preparing the joints

The Firmer Chisel



Chisels are used for shaping wood in places where the plane cannot be used.

They have two main parts (Fig. 1): the blade (a) and the handle (b). The blade is made of steel, with a cutting edge (c) which is 3 to 32 mm wide and ground at an angle of 25 degrees. The neck (d) is the narrow part at the top of the blade. The shoulder above the neck (e) is to prevent the blade from being driven too far into the handle and splitting it. The tang (f) is the end of the blade which fits into the handle and holds the two parts together.

The ferrule (g) at the bottom of the handle keeps the wood from splitting where the blade enters the handle. The handle itself is made from hard wood or plastic and it is slightly rounded on top to prevent splitting.

The two most common ones are the firmer chisel and the mortice chisel.

The firmer chisel - Most of the firmer chisels (Fig. 2) are the type with a bevelled edge. The firmer chisel is normally driven into the wood by hand and is used only for light cutting and shaping work.

The mortice chisel - The blade of the mortice chisel (Fig. 3) is thicker and stronger than that of the firmer chisel, as it is used for heavy work. This chisel is driven into the wood with a mallet (never with a steel hammer), so it is usually fitted with two ferrules, at the top and bottom of the handle, to prevent splitting.

How to use the chisel

To do good work, you need a sharp chisel.

To prevent dulling the chisel, do not allow the cutting edge to touch other tools or the bench-top. Always lay the chisel on the bench with the bevel side down.

Chiselling with the grain

When chiselling with the grain, observe the following points (see Fig. 4):

- Always work with the grain, to avoid splintering or splitting the wood.
- Fasten the work securely so your hands are both free for the chisel.
- Always push the chisel away from yourself, keeping both hands behind the cutting edge. Use your left hand to guide the chisel, and your right hand to push on the handle.

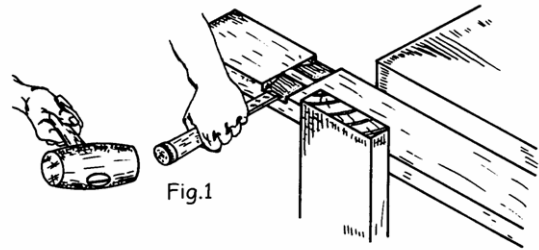


Fig.1

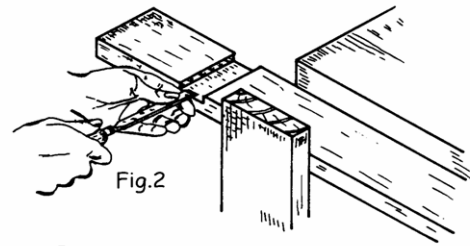


Fig.2

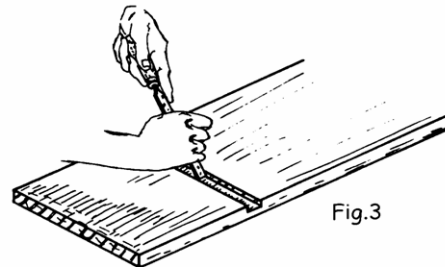


Fig.3

Fig.1

As you push the chisel forward, move the handle slightly from side to side. Prevent splintering in bevels by working part way from one edge and part way from the other.

Making a bevel edge with or across the grain.

Making a mortice joint

Cutting curves with the chisel

Fig.3

Convex curves shown in Fig.3
Use chisel with bevel side up.
Guide with your hand as shown.
Concave curves shown in Fig.4
Use the chisel with bevel side down

Fig.4

Chiselling across a board

When chiselling across the grain, observe the following:

- Grasp the blade of the chisel between the thumb and forefinger of your left hand, to guide it and act as a brake, while the pushing is done with your right hand (Fig. 2).
- Cut with the bevel side up, raising the handle just enough to make the chisel cut. For heavier chiselling and for rough cuts, the mallet may be used as is shown in Fig. 1.
- When chiselling across wide boards, where the chisel cannot reach to the centre of the board, work with the bevel side down, Fig.3



3.2 Activity 10

Draw a chisel and name its parts.

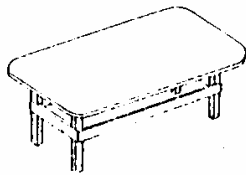
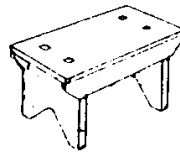
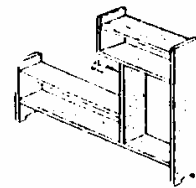
Describe how and when you would use a firmer chisel and mortice chisel.

Why do you never use a steel hammer with a woodworking chisel?

Draw a handsaw and name its parts.

Describe how best to care for chisels and handsaws.

Make a sketch of three common joints and label the main parts.



What sorts of joints would you use in these items of furniture?

Cut your project joints.

Assembling

Fastening tools

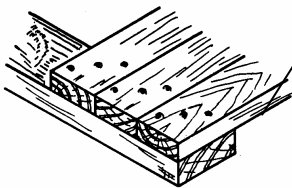
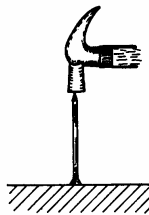
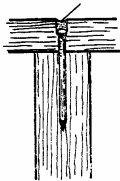
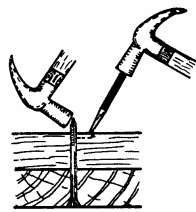
Nails

Nailing is a fairly strong, cheap and quick method of fastening wood.

Nails have a head, shank and a point and are usually made of mild steel wire. Galvanised, copper-plated or aluminium nails are used for work which will be in contact with the water.

Using nails

Nails can be staggered to prevent splitting.



Lost head nails can be punched into the timber with a nail punch and the hole filled with putty.

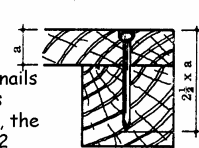
Nailing into hard and softwood

To start a nail, hold it steady between your thumb and fingers, and strike 1-2 light blows with the hammer.



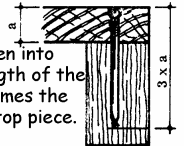
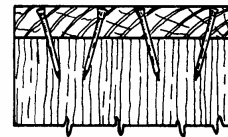
Drive the nail well into the timber, this increases its holding power

End grain doesn't hold nails very well. If the nail is driven across the grain, the nail's length should be 2 and 1/2 times the thickness of the top piece.



Hardwood holds better than softwood.

If the nail is driven into end grain, the length of the nail should be 3 times the thickness of the top piece.



Nails hold better in end grain if they are dovetailed, which means the nails are hammered at slight angles, rather than straight.



Blunting the nail on the tip also helps to prevent the nail from splitting the wood.

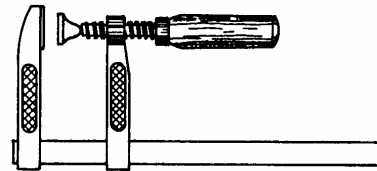
When the sharp points of nails come through the timber and out the other side. Deal with them this way.

Clamps

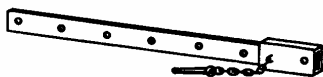
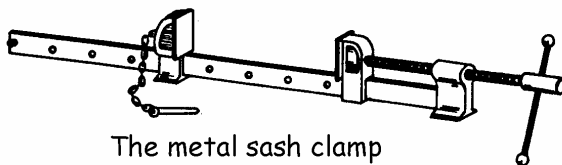
Clamps



Shivel shoe



The G -Clamp



The metal sash clamp

Clout nails: made in steel and sometimes galvanised



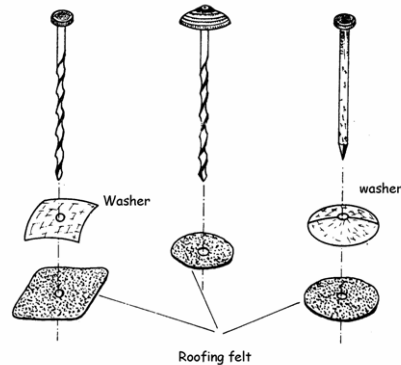
Flat head

Lost head nail

Concrete nails

Staple

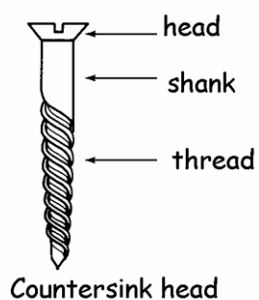
Roofing nails



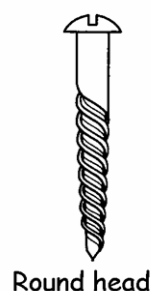
Using wood screws

Wood screws are commonly used for temporary and permanent fitting together of wood and metal fittings. Wood screws are made from different types of metal, e.g. brass or steel and may be galvanised to protect the metal from chemicals in the wood.

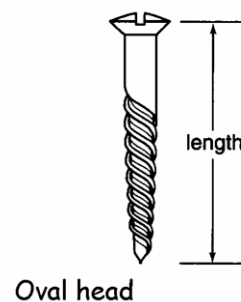
When putting in a wood screw, holes must be pre-drilled in both pieces being fastened together.



Countersink head



Round head



Oval head

i Discuss the advantages of using wood screws, and how they are used. Demonstrate and have examples to show the class.

When would you use a countersink screw?

Find out the main difference between a metal screw and a wood screw.

3.2 Activity 11

Do a trial assembly of your work and after it is checked, do the final assembly.

You want to pull this nail from this piece of timber.



Use an arrow to show the direction of force you would apply.

What should you put under the hammer in order to withdraw the nail properly? Why?

Draw three different sorts of nail. Explain when each type is used.

List the steps you went through to assemble your item once you had finished making the joints.

Finishing

Finish is the final stage in the woodwork project. It is where any marks or rough parts on the timber are carefully removed and a protective covering of paint or varnish is applied.

3.2 Activity 12

Read the following section and locate the information needed to complete this table. Information on putty and sandpaper will have to be sourced from a hardware store.

Different Finishing Materials				
Material	Types	Uses	Cost	Advantages
Putty				
Sandpaper				
Paint				
Varnish				

Glues

Gluing is a process of fastening pieces of wood together with a bonding process. This bond or glue can be made from natural materials such as milk, or resin taken from trees or synthetic like PVA.

Some glues set or cure best under pressure and have to be clamped together. Others can be held together and set successfully with nails and screws.

Glues can be waterproof, moisture-proof and heat resistant. The most popular glues used in woodwork are:

1. Casein
2. Polyvinyl – acetate
3. Epoxy-resin
4. Contact



3.2 Activity 13

Do some research on any of the glues listed above.

Find out where you buy it, how much it costs, how it is applied, and for what purposes it is recommended.



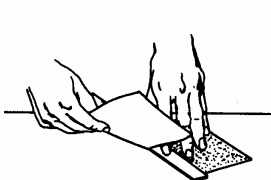
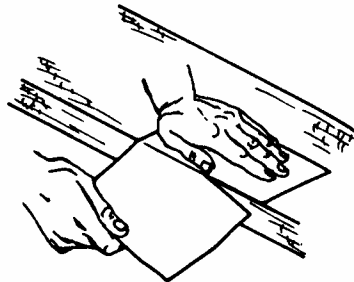
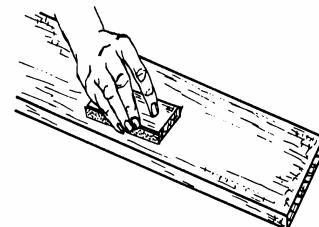
Sandpaper

Sandpaper is used to smooth wood surfaces, remove old paint, etc. It is used after all the planing work is done; sandpaper cannot be used instead of the smoothing plane.

Sandpaper is made from grains of very hard material glued to paper. The sharp edges of the grains are what cut into the surface of the wood. The sharper the grains, the better the sanding effect.

Sandpaper is graded according to the space between the grains: the more widely spaced the coarser the grade. Use coarse grades for rough surfaces or for the first sanding and finer grades for the final sanding. The commonly used grades are from No. 00 (fine) to No.2 (coarse). Usually No. 1/2 or No.1 is satisfactory for coarse sanding on wood and No. 0 for the final or finished sanding.

How to use sandpaper



The best way to cut sandpaper is folding and tearing the sandpaper along a straight edge.

Sand the timber with the grain moving in one direction.

 3.2 Activity 15

What is sandpaper and when is it used?

Make a drawing to show the correct sanding technique.

What is the other name often used for sandpaper?

Sandpaper comes in different grades. List three types and the different uses of each.

Applying finish

This is the stage when your project can become a fine piece of craft work. Any mistakes such as joints with large gaps and rough marks can be removed or camouflaged. Take great care during this stage and the reward will be a finely finished project.

Sequence of finishing putty – sandpaper – paint or varnish

 3.2 Activity 16

Why do we put finish on timber? Give two reasons.

A ___litre tin of___ is estimated to cover _____ and costs K_____

How many ___m x ___m tabletops can be covered?

How much will it cost for each one?

How do you avoid getting a skin on paint in the tin?

Carefully apply the correct finish to your project.

Module 3.2 Practical Applications

Theme: Household equipment and machines



Household Equipment and Machines

Rationale

Household equipment and machines need constant upkeep and maintenance if they are to work as intended and last. You will be taught a basic understanding of the operation of small engines and their maintenance. This is especially important in isolated areas where self-reliance is vital.

Objectives

By the end of this module you will be able to:

- Describe the basic operation and maintenance of a small engine and if possible carry out minor repairs.
- Identify, explain the use and if possible use the tools needed for basic mechanics
- Carryout simple repairs and maintenance tasks on home appliances such as fridges and stoves

Suggested topics

1. Basic car and engine maintenance
2. Mechanics tools
3. Home appliance repair and maintenance

Topic 1: Basic car maintenance

Objectives

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

- Describe the basic operation of petrol and diesel engines
- Describe and recognise problems in the fuel system of a petrol engine
- Recognise the importance of oil to engine maintenance
- Describe the electrical system and be able to recognise basic problems
- Change a tire and maintain correct tire pressure
- Perform a basic service check of a vehicle

Scope

This topic covers the basic mechanics of car engine operation and maintenance with an emphasis on the petrol engine. (Diesel engines are too complex and require specialist mechanics.) The purpose of this topic is for you to develop a basic competency and confidence to carry out simple repairs and maintenance tasks on a motor vehicle. You will be encouraged whenever possible to view and use a motor vehicle to practice these basic skills.

The operation of an engine

An understanding of the working of an engine and its major parts will help in the care and maintenance of the machine. The life will be extended and service costs reduced. An engine converts liquid fuel into heat and mechanical energy. There are two basic types of engines:

1. Internal combustion engines burn a mixture of petrol and air. The heat for ignition is created by an electric spark
2. Compression ignition engines burn a mixture of diesel and air. The heat for ignition is created by the high pressures of compression of the mixture. A diesel engine is more economical because a more complete burning of the fuel occurs.



3.2 Activity 1

Make a list of vehicles and machines which are petrol operated and those which are diesel operated.

Try to explain the advantages of one over the other in different situations.

The four stroke engine

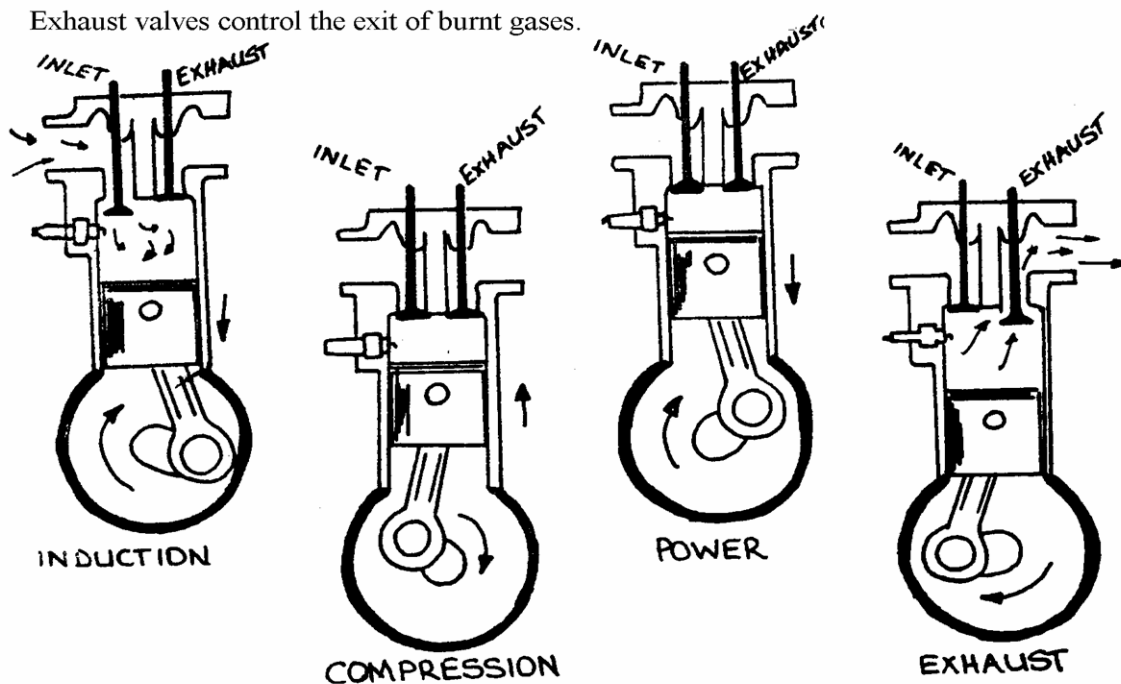
The four stroke engine is the most common. They are found in cars, trucks, boats, power plants and pumps. Four stroke engines use less fuel than two stroke engines and are therefore more economical to run.

Four stroke means, the piston moves four times for every sparking. Each spark makes a power stroke.

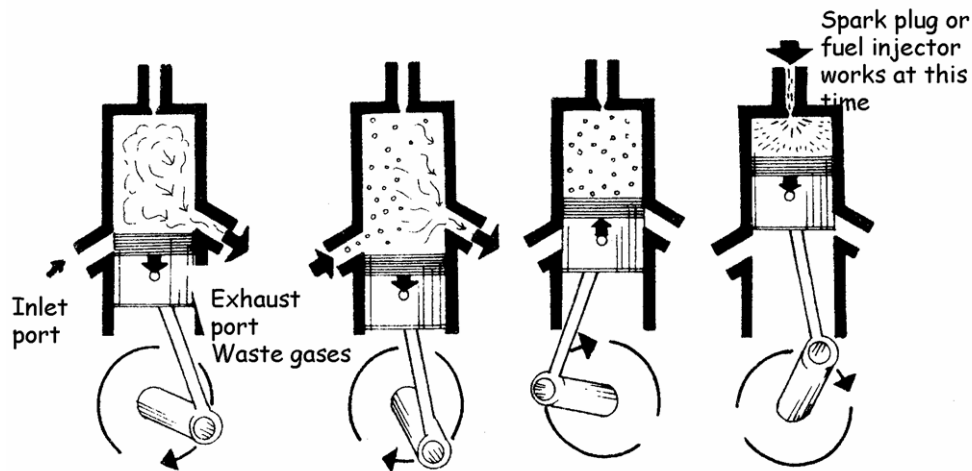
1. Down	INDUCTION - sucks in fuel / air mix (inlet valve opens)
2. Up	COMPRESSION - the mixture is compressed (valves closed) ignition at top of piston stroke
3. Down	POWER - explosion forces piston down (valves closed)
4. Up	EXHAUST - burnt gases are exhausted (exhaust valve opens)

Valves control the entry and exit of gases. Each cylinder has one Inlet and one Exhaust valve.

The four stroke engine cycle is illustrated below.



The two stroke engine



Two stroke engines are usually small engines such as those used in a chainsaw, motorbike or outboard motor. Although these engines are quite simple care must be taken with the fuel mix in particular and also with the spark plugs and exhaust system.

The oil in two stroke engines is either put into the petrol or pumped into the engine from a special oil tank.

3.2 Activity 2

Which type of engine do you prefer, two or four stroke? Please explain your choice.

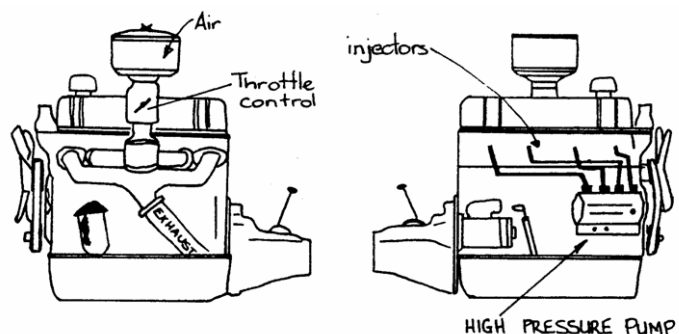
What are the advantages of a two stroke engine?

What type of engine does Honda produce?

Diesel

A diesel engine does not need a spark plug or an electrical system (some diesel engines have a glow plug for cold starting) Called compression ignition (C.I.) engines, because the heat caused by the compression is enough to ignite the diesel fuel/ air mixture. Most diesel engines are *four*

stroke similar in construction to car engines. As mentioned above, they do not have spark plugs or carburetors. The fuel



List the main differences between this diesel engine and a petrol engine.

is squirted directly into the cylinder (by a high pressure pump) as the piston comes up on the second stroke of the cycle.

Air in the fuel pumping system will cause a bubble of air. This bubble will block the injectors (needle valves) and stop the engine operating. It is a long process to remove all the air to restart the engine. Do not let diesel engines run low on fuel.

 3.2 Activity 3

Do some research on diesel and find out what it is and how it is different from petrol.

Most vehicles in this country are diesel. Why do you think this is the case?

In some circumstances, a diesel engine is superior to a petrol engine and vice versa. Do a short comparison of the two and draw some conclusions about maintenance, economy and operating conditions.

Describe some of the maintenance issues with diesel engines.

The importance of oil

Oil performs four major functions, they are:

1. Lubrication - slip between two surfaces
2. Sealing - filling the small gaps between parts
3. Heat Removal - heat of friction will cause expansion
4. Cleaning - remove carbon, moisture, dust, acids

Oils have a working life which depends on the amount of work they do and the condition of the engine. The life of common engine oils is about 5,000 kilometres.

Oil becomes worn out because: fuels escape past the rings and dilute it; excessive heat destroys its qualities; and it becomes saturated with particles of dust and moisture.

Oil changes

Each month the engine oil should be drained from the sump and replaced with new clean oil of the same grade. The colour of the oil is no indication of its quality.

Gearbox oil is not subjected to heat and fuels. It should be replaced every three months.

Grades of oil

Oil	Application
Engine oil sae 30	A light oil for petrol engines. It is pumped through all moving parts.
Diesel engine oil sae 30	For diesel engines as above
Gear oil sae 90	A thick heavy oil for heavy moving parts in gearboxes and differentials. It is splashed over the gears.
Two stroke oil sae 50	A special oil to be mixed with petrol for two stroke engines

Oil Filters

Oil is filtered through a paper type element (disposable) to remove the larger pieces of rubbish. A filter should be replaced every 15,000 km. On vehicles working all day everyday, they should be replaced every three months.

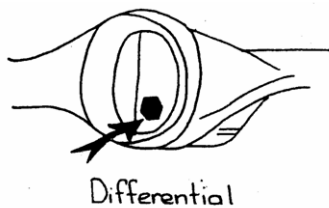
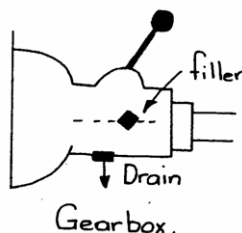
Oil level

The engine oil level is shown on the dip stick. The level must be at the 'f' mark. Half a litre (500 ml) is required to bring the level from 'l' to 'f' mark. Oil level should be checked daily.

Gearbox and differential oil levels are shown at an inspection plug on the side of the housing. Oil must be visible when the plug is removed. These levels are checked monthly at the service station and topped up if necessary.



What is this and how is it used?



Two stroke oil mixtures

Machine	Brand	Mix ratio	Quantity of oil
Lawn mowers	Almost all	25:1	40 ml per litre
Chain saws	Stihl, Pioneer, Homelite	16:1	60 ml per litre
	Mcculloch	40:1	25 ml per litre
Motor bikes	Yamaha, Suzuki, Kawasaki	25:1	40 ml per litre
Outboard motors	Johnson, Evinrude, Mercury	50:1	20 ml per litre
	Yamaha	25:1	40 ml per litre

Use only two stroke oil. When you are not sure of the mixture, use a ratio of 25:1. Too much oil will cause the spark plugs to foul up.

Too little oil will cause the engine to overheat and stop.

Engine oil, SAE 30, may be used in an emergency, but it is not as good as the outboard oils.

Mixing the oil

Measure the oil into a small amount of petrol. Shake well. Add the rest of the petrol and shake again.

3.2 Activity 4

Measuring the oil mixture with the aid of an SP bottle.

(An SP beer bottle contains 333 ml (1/3 litre))

If one bottle in 4 litres is about 12:1, calculate the following:

One bottle in 5 litres is about _____

Half bottle in 4 litres is about _____

One third bottle in 4 litres about _____

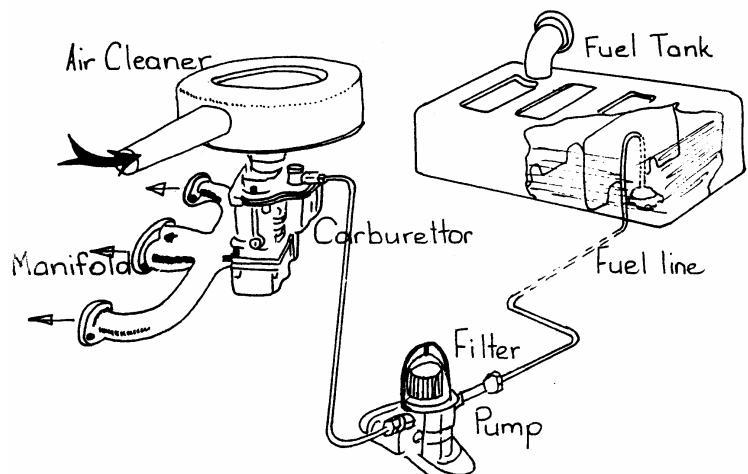
One third bottle in 5 litres about _____

Fuel system

The fuel system is made up of the above parts and is responsible for the fuel/air mixture being delivered to the combustion chamber.

Air

The air drawn into the carburettor must be clean. The dust must be stopped from entering the engine, as it would be like sand- paper on the moving parts. A paper type air cleaner (disposable) is placed at the top of the carburettor. It must be kept clean (blow-out with bath type air cleaners must be washed)



A fuel system for a petrol engine. What is the manifold for?

Fuel

Fuel is stored in the fuel tank. Rust, water and dirt often get into petrol and must be stopped reaching moving parts. A filter is placed between the tank and the fuel pump.

Replacement of this filter is needed when it shows signs of being full of dirt, usually every three months.

Diesel engines often have two filters in line. It is important that the small holes in the injectors are not blocked.

Fuel must be fresh. Drain all fuel tanks every 12 months to remove rubbish that has settled. Keep tanks full to stop condensation of moisture.

Fuel pump – a low pressure pump lifts the fuel to the float chamber of the carburettor. Dirt in the system may block the two valves in the pump.

Carburettor – a supply of fuel is stored in the float chamber. The float makes sure the chamber is always full. From here the suction of the air will pull fuel out through the jets. The small stream of fuel is then mixed with air and drawn into the engine.

3.2 Activity 5

Fault finding - identify four places you would look for a problem in the fuel system.

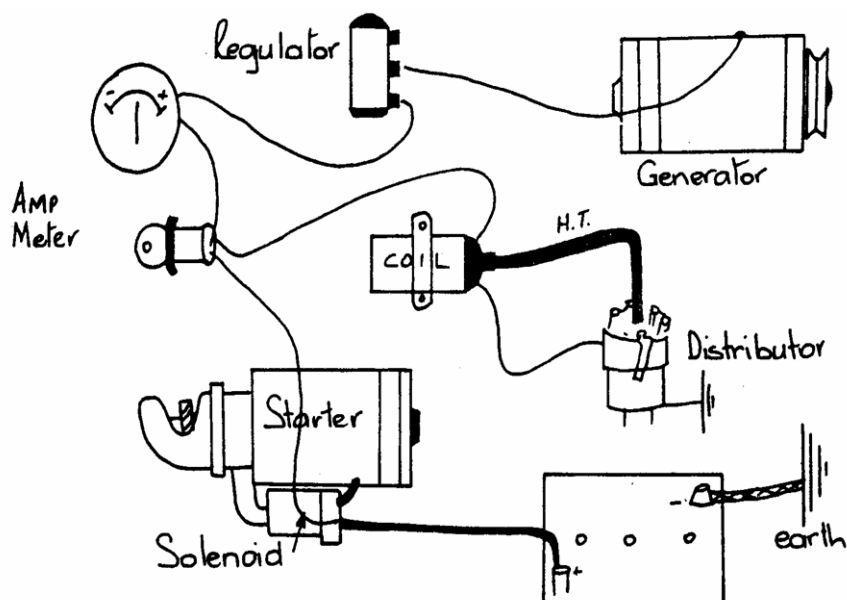
Describe the basic maintenance requirements you might be able to perform on a fuel system for a petrol engine

Why is a real problem for you if your vehicle runs out of diesel? (apart from having to walk)

Electrical System

The electrical system provides an easy way for us to start the engine. The engine must be turned until the fuel / air mixture is sucked in, compressed and fired. This must happen fast enough for the engine to turn itself.

This can be done by turning the flywheel very quickly. On lawnmowers, chainsaws and outboards we pull the rope starter which turns the flywheel quickly until the engine fires.



On motorcars and trucks we use a powerful electric motor (12 volt) called a starter motor to turn the flywheel.

The battery is connected to the body of the car (negative) and the starter motor (positive). The key is a switch which operates a heavy duty switch (solenoid) for the starter motor.

The key is switched to the start position. The solenoid switches the starter motor which turns the flywheel very quickly. The pistons move up and down sucking and compressing until the engine fires.

When the engine fires by itself, the key is released to the on position.

The only purpose of the electrical system is to turn the motor.

When the engine is running the generator/alternator supplies electricity to recharge the battery and for the lights. The regulator regulates the amount of electricity produced by switching the alternator on or off.

When the electrical system will not turn the engine check the following.

BATTERY   SWITCH   WIRES   STARTER MOTOR

3.2 Activity 6

How does a starter motor work?

If you have a flat battery, what can you do to start the vehicle? List four things.

If the vehicle is automatic and has a flat battery what can you do?

Explain the function of: jumper leads, an alternator and the starter motor.

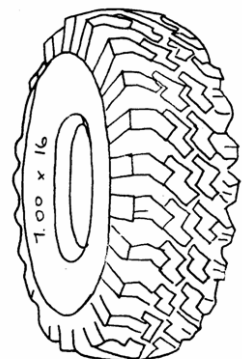
Tires

Tyres provide a cushion of air for the vehicle to ride on. They also provide contact with the road for traction (grip) and braking.

The tyre tread is designed to provide traction on various surfaces. Some tyres are made for rough bush work, other tyres are made for smooth asphalt roads.

Tyre tread patterns are also made so that they will not skid when cornering or braking.

A tube is provided to maintain the cushion of air. A valve allows the tube to be inflated to its correct pressure.



Tyres pressures

Proper inflation is necessary to protect the tyre from excessive heat build up. With the correct pressure, all the tread pattern for the whole width of the tyre will be in contact with the road surface.



Tyres sizes

Tyre sizes are stamped on the wall of the tyre.

For example: 7.00 x 16 8 ply

7.00 is the width of the tread in inches 16 is the diameter of the steel rim

8 ply is the number of layers of material which hold the tyre in its correct shape.



3.2 Activity 7

How do you determine the correct tire pressure?

If you run a vehicle on tires that are too flat, what problems will you have?

Similarly, if you run your vehicle on tires that are over inflated, what problems will you have?

A Breakdown

When an engine will not start there are two basic functions to be checked.

1. Ignition system and
2. Fuel system

By working through each in order as shown below it is possible to locate the fault.

Problem check

Electrical problems

1. Starter turns
2. Battery – check terminals and water levels.
3. All wires connected

Ignition Problems

1. Spark at plugs

2. All thick black leads correct
3. Spark at points
4. Points opening
5. Power at coil
6. All wires and parts in place

Fuel system

1. Fuel in tank
2. Fuel in carburettor
3. Fuel at pump
4. Fuel at filter bowl.

3.2 Activity 8

What areas do you check when your vehicle breaks down?

How would you know if the problem was with the fuel system?

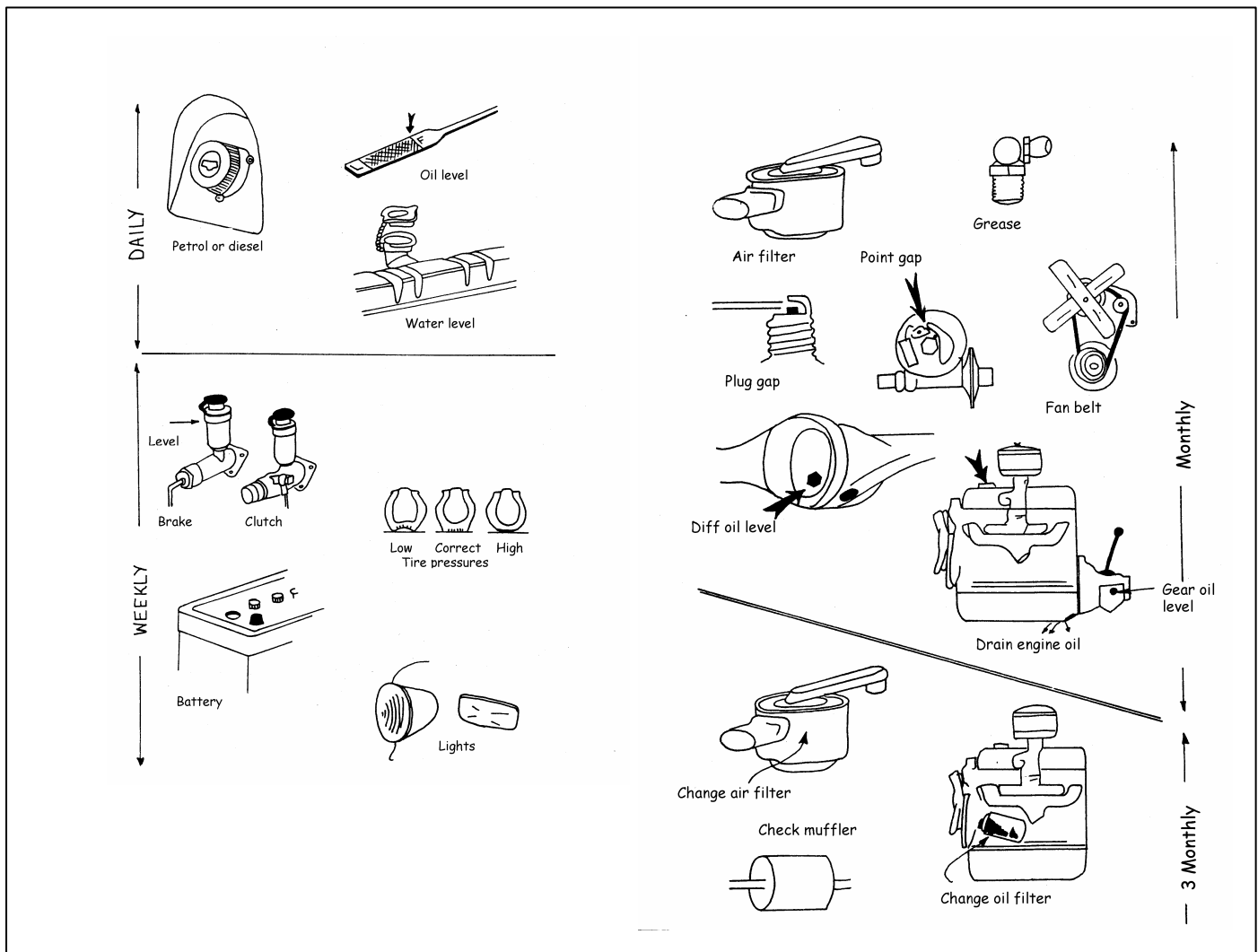
If the fuel filter is blocked what can you do?

If you do not have a replacement fuse, what could you use?

Servicing Check

The following is a basic servicing check for motorcars. It is divided into daily, weekly and monthly checks. Obviously, it is a guide and many people could not afford to service their vehicles in the ways suggested, e.g. changing engine oil each month. However regular vehicle maintenance is preventative medicine which will save the owner expensive repairs in the long run.

Regular Basic Vehicle Servicing



3.2 Activity 9

Look at the servicing guide. Modify it to fit in a motor vehicle as a reminder for the owner. Think of a practical place where it could be stored and regularly seen by the driver. It must be a practical reminder for the vehicle driver.

Topic 2: Mechanics tools

Objectives

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

- Identify and use a range of mechanics tools to perform simple tasks
- Use a vehicle jack and wheel brace to change a wheel

Scope

This topic is designed to provide you with hands on experience with a variety of mechanics tools. These are the tools most likely to be used by you for basic maintenance of mechanical things.

Basic tools

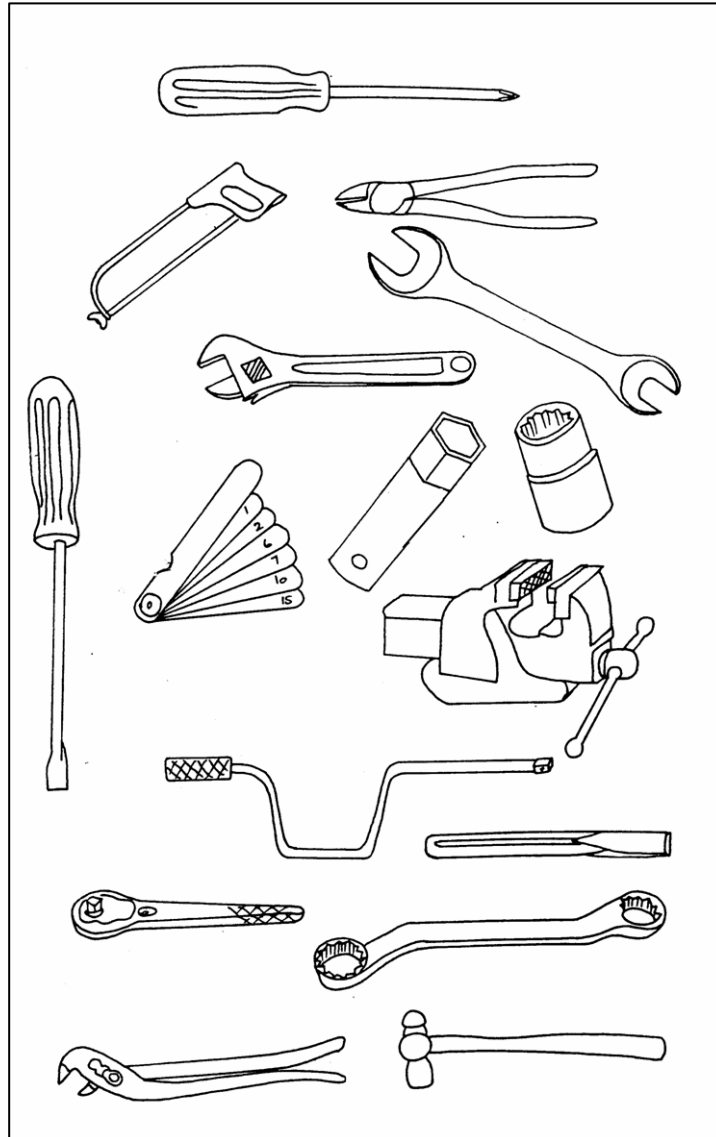
The basic tools used most often in mechanics are shown below. Most of these tools are steel and are also used for metal work.

3.2 Activity 1

Look carefully at the following drawings of mechanics tools. Many of these tools are also used in metal work.

Identify and make a sketch of each tool and briefly describe its use.

Basic mechanics tools



Using spanners, sockets and cresants

Materials

- Different sizes and types of spanners and cresants
- An old bicycle or lawn mower engine

Objectives

- To become familiar with different spanners and cresants, how they work and what functions they have.

 3.2 Activity 2

You have to remove every nut and bolt from the engine or bicycle and then replace them so that the engine or bicycle is in the same condition as when you started.

Agree on a plan or strategy for removing and storing all the parts and being able to replace them correctly.

Ensure that everyone in the group has the chance to use the tools.

Using a vehicle jack

Materials

- Vehicle
- Wheel brace
- Jack
- Wheel chucks

Objectives

- To safely remove and replace the wheel of a vehicle using a wheel brace and jack.
-

 3.2 Activity 3

Be clear about the objective:

- *Loosen all the nuts on the wheel*
  - *Chuck or put blocks under the wheels*
  - *Make sure the vehicle is in gear and has the handbrake on*
  - *Place the jack under a strong part of the vehicle chassis near the wheel to be removed*
  - *Jack up the vehicle until the wheel is able to be freely turned*
  - *Remove the wheel nuts and place them in a container*
  - *Remove the wheel*
  - *Replace the wheel and reverse the above procedure*
-

Identification of engine parts

In a small engine do you know where to locate these major parts: carburettor, fuel line, fuel tank, oil reservoir, oil filter, spark plug and starter?

Small engines, two stroke and four stroke have most of these parts and depending on the make and model they are likely to be in different and unusual positions on the engine. The operation is the same despite their location.

3.2 Activity 4

Look at these two examples of small engines. If possible, find actual examples and locate the following parts:

fuel tank, fuel lines, oil filter, starter, carburettor, spark plug.

Using the appropriate tools find and remove a spark plug, check the points and replace. Do the same with an oil filter, checking how much dirt it has.



Look at the pros and cons of owning a 40HP outboard motor compared with a 25 HP.

Module 3.2 Practical Applications

Theme: Water, Power and Sanitation



Water, Power and Sanitation

Rationale

Water, power and sanitation are essentials to basic human survival today. Most villages have access to clean drinking water. Electricity is available in many places through a variety of sources: mains power, battery, and generator. Good sanitation practices are vital for the maintenance of a healthy population. This topic introduces you to the basics in village water supply systems, the safe use of electricity and basic sanitation systems including composting toilets.

Objectives

By the end of this module you will be able to:

- Describe the features and operation of different community water supply systems
- Plan for a rainwater tank as part of a community water supply system
- Describe and illustrate the operation and maintenance a rainwater tank
- Describe the basic operational features of different toilet systems
- Apply various sanitation measures to improve the lives of a community.
- Identify and use a range of electrical tools safely
- Re-wire a plug for an electrical appliance
- Maintain a car battery

Suggested topics

1. Water and water supply systems
2. Basic sanitation
3. Electrical tools and appliances

Topic 1: Water and water supply systems

Objectives

By the end of this topic you will be able to:

- Describe the features and operation of different community water supply systems
- Plan for a rainwater tank as part of a community water supply system
- Describe and illustrate the operation and maintenance a rainwater tank
- Be familiar with a range of plumbing tools



*Plastic tanks being transported up the Sepik River.
Source: WWF, Sepik*

List 6 advantages of plastic water tanks.

Scope

Through this topic, you will study the basic water supply systems that are found in most villages. Basic supply systems and maintenance will be discussed.

Water supply

Sources

All fresh water has come from rain at some time or other. It can be collected either before it hits the ground (rainwater), after it hits the ground (run off-rivers, streams) or after it has soaked into the ground (springs, groundwater).

Rainwater

Rainwater which is collected before it hits the ground is usually very clean. It may sometimes have dust particles trapped, but generally needs no treatment.

It is usual to catch the rain on the roof of the house, channel it through gutters and downpipes into storage tanks.

The materials used must not contaminate the water, be able to keep themselves clean and be free from fungus growths. An economical life is also an important consideration.

Run-off

Water which runs off the surface of the ground is contaminated with particles of soil and bacteria from decaying vegetable and animal matter. The rivers and streams fed by run off are usually dirty and have to be settled before use. In settling, the heavy materials separate out leaving clean water. The bacteria has to be treated with chemicals. All run-off water should be tested by the Department of Health before human consumption and if necessary chlorinated (an expensive process).

Run-off water is settled in large dams or reservoirs before reticulation.

Groundwater

Water which has soaked through the top layers of soil will reach the resistant rocks and clays and then saturate the upper layers. At some point, the water will start to flow towards the sea (down-hill) and will level itself out. It will seep along under the ground as moving water.

Sometimes the water may come to the surface (a spring) or be present as moisture below the ground (Groundwater).

When a hole is dug in the ground at some point water will begin to fill the hole. The top level of this water is called the water table. It may be 1 metre below the surface or 100 metres depending upon the structure of the land. It will be different in the wet and dry seasons. Groundwater is usually clean.



3.2 Activity 1

Make a drawing to show the water table where a source of ground water could be drawn from.

How would you access the water from a ground water source?

What does reticulation mean?

Methods of moving water

Water will flow downhill due to the forces of gravity. To move water uphill it has to be forced under pressure (pumped).

It is therefore better to find a source above the supply so that the water can be piped without the need for expensive pumps.



3.2 Activity 2

Moving water through pipes is the best way to get it economically from the source to the people who need it.

There are different types of pipes, which can be used in different conditions. Use the glossary to help work out what types of pipe should be used in the home.

Home water use:

For cold water use –

For waste disposal use ---

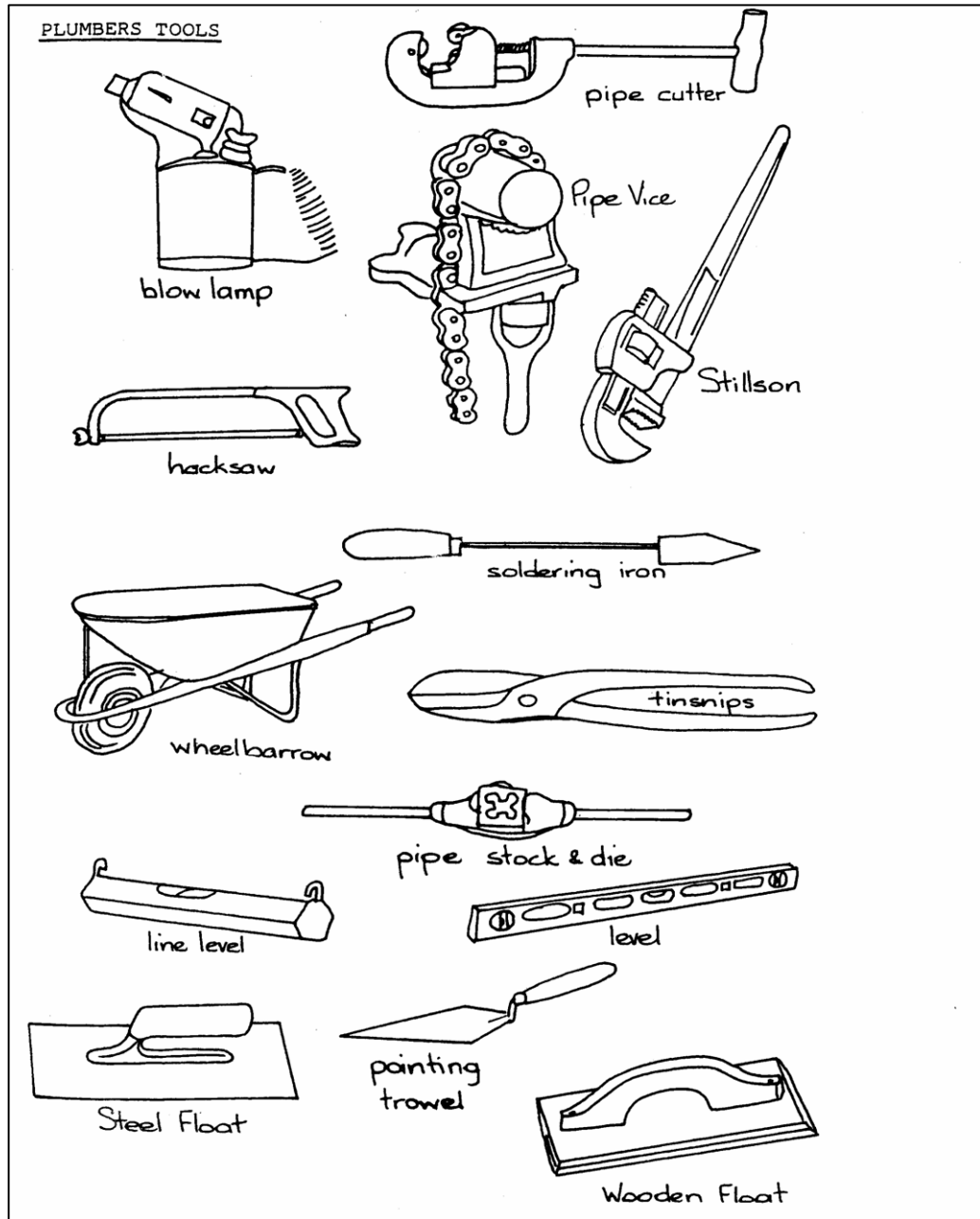
For hot water use ---

For below ground water supply use----

For above ground water supply use---

For each type of pipe you recommend give reasons.

Plumbers tools



3.2 Activity 3

Be able to explain what each of the above tools is used for. Make a word-find of as many of these tools for a Grade 6-8 class.

Water supply water pumps

Water pumps, may be hand operated, engine driven or wind powered. The type used will depend upon individual cases. The two factors which determine the size of the pump required are the depth of the water and quantity of water per hour.

Hand-operated pump

Used on shallow wells where the depth of the water is less than 8 metres. The sizes are chosen according to the 'volume of water delivered each stroke of the pump. Hand operated pumps are fairly simple and providing a filter is placed at the foot valve (stops the water draining out when the pump is not being used) they require little maintenance.

Engine driven pump

Operated by small petrol engines or large diesel engines. Water can be pumped at up to half a million litres per hour. These engines require daily servicing (fuel, oil) and regular maintenance. They are costly to buy and operate and should be avoided unless necessary and a capable operator available. When placing an engine driven pump access must be available for fuel delivery, speedy repair and maintenance. Do not position it in out-of-the-way places.

Electric pumps

Small electric pumps are fitted to houses but require constant power supplies. Large electric pumps are available but not suitable for village type supplies. All electric pumps require fitting and connecting by electricians. They are extremely dangerous.

Wind powered pumps

Wind mills (wind powered pumps) are used in isolated areas to lift water from deep holes in the ground. Apart from initial high cost and construction, they are maintenance free except for occasional greasing. They are used where winds blow for about 8 hours every day.

Portable pumps

Small portable pumps can be used to supply water for many purposes but are not built for permanent pumping stations. They are temporary measures only for filling tanks, draining dams or lifting irrigation water for short periods.

Hydraulic rams

As water falls it builds up a pressure, this pressure is then used to pump some of the falling water to a height about 10 times greater than the fall. Once the ram has been started, it should operate for many years without service or repair. Initial purchase and labour are the only costs involved.

3.2 Activity 4

You have been asked to recommend a pump for your village's water supply. After reading the above information about pump types, make your recommendation and give good reasons for your choice. (Think of the local conditions that exist in your place)

In what circumstances would a well be ideal?

Identify the conditions which would not be suitable for a well.



Water supply calculation of water quantity

Water is required on the basis of a 'volume per person per day' and is usually regarded as:

Village supply = 40 litres/person/day

Low cost houses = 80 litres/person/day

High cost houses = 160 litres/person/day

A village with 250 people will require (250 x 40) litres of water each day. The system will have to supply 10 000 litres over the period when the people are going to use it. There is no value supplying water at midnight because no one is going to use it. Water is required between 7am - 11am, 3pm - 7pm, a total of 8 hours each day.

Rate of water flow

The 10 000 litres the village required will now have to be supplied over an 8 hour period.

Rate of water = $10000 / 8 = 1250$ litres/hour stored water

When the water is required to be stored in either galvanised or concrete tanks all that would be required would be a supply capable of filling the storage capacity in one full day.

Our village = 10 000 litres storage

Supply rate = $10\,000 / 24 = 400$ litres/hour pipe length

The measured ground distance will be the length of pipe required.

An allowance now has to be made for the inaccuracies in measurement (For example - the chain was pulled tightly and not rested on the ground and the 'snaking' of the pipe in the trench to allow for earth movements.

An estimate of 10% additional length will be required.

Animal consumption

Cows and horses = 40 litres/day

Pigs = 12 litres/day pigs (feeding sows)= 23 litres/day

Poultry (100 birds)= 30 litres/day



3.2 Activity 5

Calculate the quantity of water needed for a village supply with a total population of 300 people. Work out the rate of flow based on 8 hours use per day

If you had 5 pigs, including two feeding sows and 500 chickens calculate the amount of water needed for these animals per day.

Rainwater catchment

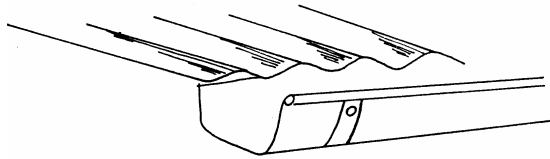
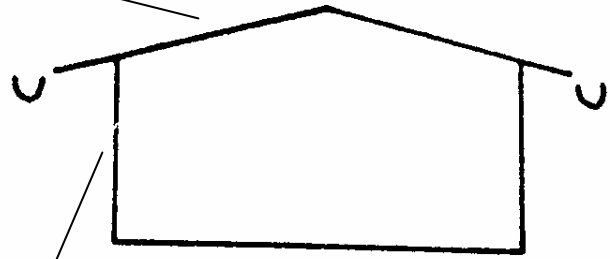
Rainwater is usually collected on the roof of a house and channelled off into storage tanks. Roofing materials are made from something that will collect the water that lands on it, will not let the water through into the house and will not gather moss or fungus.

What is the normal roofing material used in Papua New Guinea?

The slope of the roof is called the pitch.

Why is pitch needed?

Guttering is a channel of galvanised iron which is fixed under the edge of the roof to collect the water run-off. It usually comes in standard 1800mm lengths



A circular or rectangular downpipe is used to carry water from the gutters to a storage tank.

Storage tanks

Estimation of rainfall

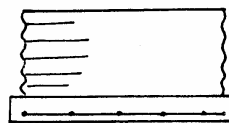
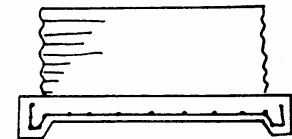
Calculation of rainfall catchment from a roof is found by multiplying the area of the roof (square meters) by the rainfall (mm).

For example: 20mm of rain falls on a classroom 6m x 20m in one night

$$\begin{aligned}\text{Catchment} &= \text{area} \times \text{rainfall} \\ &= (6 \times 20) \times 20 \\ &= 120 \times 20 = 2400 \text{ litres}\end{aligned}$$

Tank stands

To distribute the weight of a water tank (1000 litres = tonne) evenly over the ground



and to protect it from earth movements it is necessary to provide a base for it to sit on. A reinforced concrete base of 200mm is required under water tanks – this is particularly important in wet areas. A timber stand must be made from at least three solid timber bearers (75 x 200) with the planking across the top of at least (50 x 1500). The stumps must be braced if well off the ground and made from either 200 x 200 treated timber or 75mm diameter pipe.

3.2 Activity 6

Make a drawing of a typical classroom. Mark in all measurements of the roof.

Calculate the catchment area of the roof and work out the catchment for an average rainfall of 20mm.

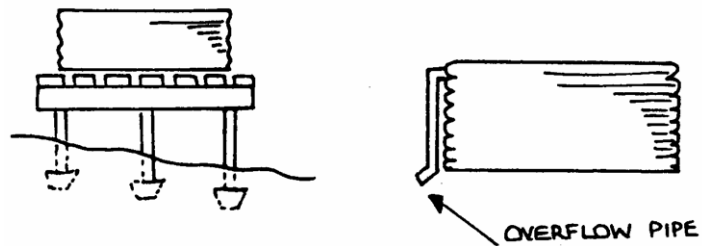
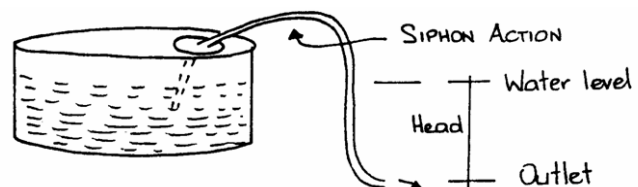
Decide what type of tank would be best: plastic (Tuffa), galvanised or concrete (fero-cement), and design either a stand or concrete base.

Research to find the capacity of the available tanks and their costs.

Describe how an elementary 'bush material' school could harvest clean rainwater for drinking.

Make a drawing of your idea.

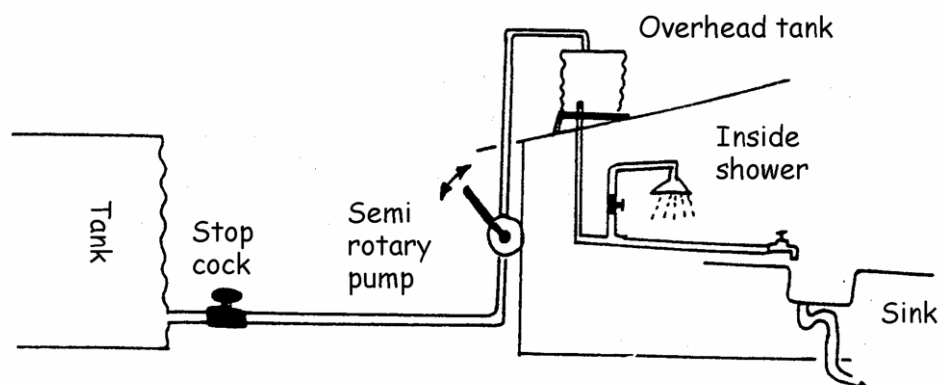
Look at this drawing of siphon action – describe how it could work in a village situation. Use drawings.



Overhead water

Many houses in Papua New Guinea have an overhead water supply. The following diagram illustrates how such a system operates.

Overhead water system

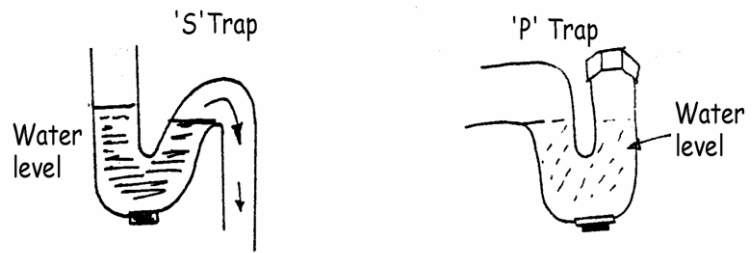


Adapt this system to work in a village without a pump. Make your design on paper and be prepared to share it with the class.

Traps

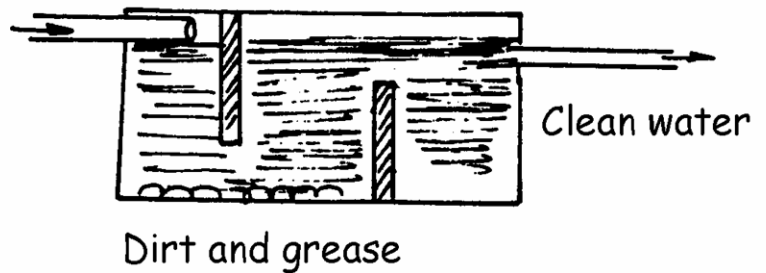
'S' and 'P' traps

A trap in a pipe can usually be seen under a sink bench. It is to stop insects, rats and smells coming up the drain pipe into the house. A trap of water is held in the neck of the pipe.



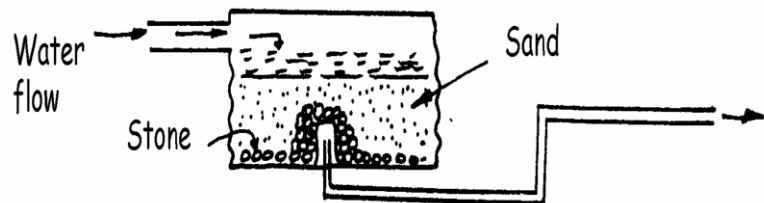
Grease trap

Usually used to collect grease and waste from kitchen water by trapping dirt as it moves through a series of baffles.



Water filter

Sand may be used to filter dirt and mud from water. When the sand becomes too dirty it can be thrown away and replaced or washed back.



3.2 Activity 7

Charcoal is also used as a water filter. Find out about other types of water filters especially one with charcoal. Make a drawing of one of these filter and explain how it works.

What is the purpose of a grease trap and where would you most likely find one?

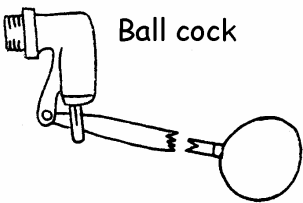
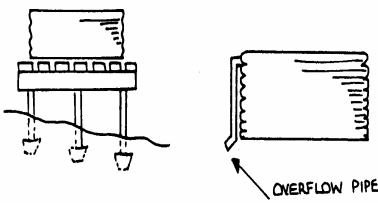
Basic maintenance

Ongoing maintenance of taps, tanks and other plumbing fittings is important not only to save money but also to save resources.



3.2 Activity 8

Work in groups to complete these activities

 Bib cock tap	 Ball cock	 OVERFLOW PIPE
<i>Describe how you would repair this leaking tap. If possible give a practical demonstration</i>	<i>Describe what a ball cock is and how it operates to save water. Find an example and demonstrate how it works and how it can be adjusted</i>	<i>Describe the basic maintenance required for a galvanised water tank. Visit a tank and inspect it carefully. You should be able to find at least 5-6 maintenance tasks</i>

Topic 2: Basic sanitation

Objectives

By the end of this topic you will be able to:

- Describe the basic operational features of different toilet systems
- Apply various sanitation measures to improve the lives of a community

Scope

Through this topic, you will study the basic sanitation systems that are found in most villages. You will also be introduced to a number of practical

sanitation practices.



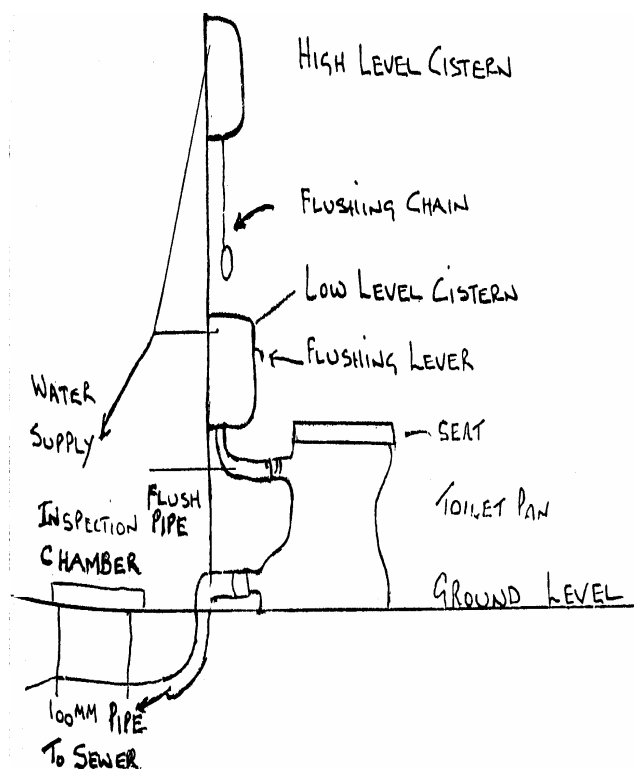
What type of toilet is this?

Flush toilet system

A flush toilet system consists of a toilet pan with seat and lid, a water tank which holds water to flush away the excrement and pipes which connect the toilet pan to a main sewer or a septic tank.

For a water borne system to work well it requires the following conditions:

1. Adequate uninterrupted water supply;
2. Heavy duty (tamper proof toilet cisterns)
3. Education in the use of the system.
4. Toilet paper or water.
5. Regular cleaning and inspection.
6. Inspection chambers to allow cleaning.
7. Well laid discharge pipes of the correct diameter.



Common faults

1. Water supply is intermittent or of very low pressure. This means that the toilet cannot be flushed after each use which is unhygienic and causes blockages.
2. Cheap plastic cisterns which do not stand up to constant use. High quality commercial cisterns as found in hotels should only be installed.

3. Toilet paper is not always available which results in other materials being used most of which block up the system immediately.
4. Toilet blocks are not inspected and cleaned on a regular basis.

3.2 Activity 1

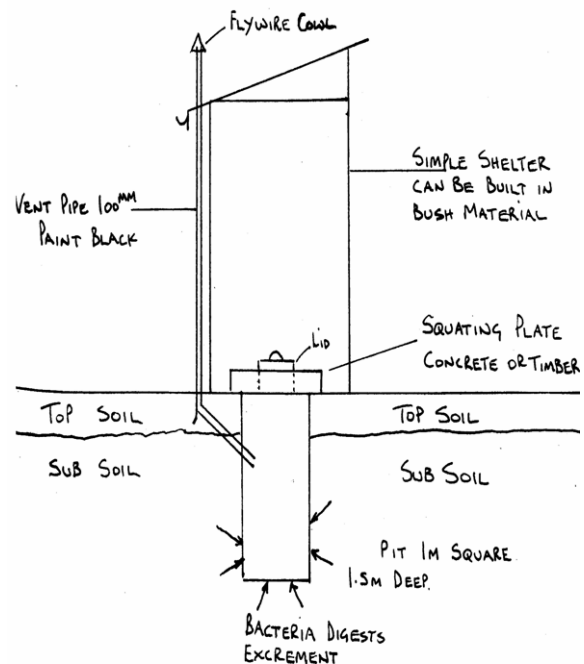
*In what situation would this be the best option? Explain your reasoning.
What is a septic tank and how does it work?*

Pit toilet

The pit toilet is widely used throughout Papua New Guinea especially in rural areas. It has many advantages over the western system in that it is not dependant on constant supplies of water for it to be useable. It consists of a basic shelter built over a pit which is covered by a squatting plate.

The hole in the plate is fitted with a lid which must always be replaced after to ensure sanitary conditions can be maintained. If the pit is correctly vented as shown in the illustration, all flies and smells can be completely eliminated. For a pit toilet to work well it requires the following conditions.

1. Pit to be not more than one metre square. Large pits do not allow the bacteria to attack the excrement and break it down.
2. Pit toilets are not suitable in areas with high water tables i.e. less than one metre.
3. A reinforced concrete squatting plate is installed. These are simple to make (refer to section on concrete and cement)
4. A 100mm ventilation pipe is installed as shown this must be painted black to build up the heat and draw fumes away from the pit. Flywire should be fitted to the top of this pipe to keep out flies.
5. The pit should not be lined with oil drums or similar, this restricts the bacteria and the excrement will not break down.



Conclusion

The pit toilet has many advantages in that it is simple and cheap to construct, it needs no water to flush and is easy to use. The building of improved, ventilated and well constructed pit toilets would be of great advantage in many schools around the country.

 3.2 Activity 2

What are the main maintenance issues with a pit toilet?

How long can you expect one to last if it is well maintained?

Do a rough cost estimation of what you think a pit toilet might cost.

Composting toilets – appropriate technology for Papua New Guinea

Sustainable strategies to sewage problems for Island Nations of the Pacific

Adapted from an article by: David Del Porto - "Sustainable Strategies"

Sewage is the most significant source of marine pollution throughout the Pacific region. Nearly every Pacific Island nation has identified critical environmental and public health problems resulting from the disposal of human excrement. These have included algae blooms and eutrophication in lagoons, dying reefs, contaminated drinking water wells and outbreaks of gastro-intestinal disease, Leptospirosis and cholera. The causes of this pollution include overflowing latrines, water-sealed toilet, septic systems, piggeries and sewage treatment plans as well as the complete lack of sanitation facilities in some places.

In 1992, the South Pacific Regional Environment Programme (SPREP) stated that the disposal of solid and liquid wastes (particularly of human excreta and household garbage in urban areas), which have long plagued the Pacific, emerge now as perhaps the foremost regional environmental problem of the decade.

In additions, septic systems used in some tidal areas are said to be of poor design and construction, while poor flush toilets and latrines -- which frequently overflow in heavy rains -- are more common. Over the edge latrines are found in many coastal areas as well.

What is the answer to this problem? A possible solution is the building of composting toilets. Already there are many communities in Papua New Guinea with this type of technology.

Composting toilets

Composting toilets are much different from pit toilets! They range from simple twin chamber designs through to advanced systems with rotating chambers, temperature and moisture probes and electronic control systems.

They are effective biological converters of human and household "wastes", saving money and energy for the person and community and starting the regeneration of the planet's environment that is long over-due.

What are they?

Composting toilets are toilet systems which treat human waste by composting and dehydration to produce a useable end-product that is a valuable soil additive.

They come in a variety of models and brand names as well as different shapes and designs to enhance the natural composting process.

They use little or no water, are not connected to expensive sewage systems, cause no environmental damage and produce a valuable resource for gardening.

The systems can be broadly divided into two different types:

Batch Systems - With the batch systems, a container is filled and then replaced with an empty container. The composting process is completed inside the sealed container.

The system may have a single, replaceable container, or it may be a carousel system where 3 or 4 containers are mounted on a carousel and a new container is spun into the toilet area when the other is full. After a full cycle is complete, the first container is fully composted and ready for emptying.

Continual Process Systems - These systems are in a constant state of composting. "Deposits" are put into the system, composting reduces the volume and moves it downward where it is harvested after 6-12 months as fully composted material.

All systems are designed to treat the "deposits" by composting, worm processing, micro and macro - organism breakdown, and by dehydration and evaporation of moisture.

What is wrong with the present sewage and septic systems?

Besides pit toilets, present toilet systems are either "sewered systems" or on-site "septic or mini-treatment systems". Both are based on the principle of using water to transfer the "wastes" to a treatment system or tank. Whether this is a septic tank just outside the house, or a sewage treatment plant 10 miles away, both must treat a large volume of raw effluent.

This historical use of water to "cleanse" away the toilet wastes is where the **first problem** occurs.

Raw sewage starts to break down by a process that utilises oxygen within the water.

Once this oxygen has been used up, the breakdown of sewage is changed to micro-organisms that perform anaerobic (non-oxygen) respiration.

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ENVIRONMENT
EQUIPMENT

The by-products of anaerobic respiration are nutrient-rich effluent and flammable methane and other foul smelling gases. This is the traditional smell associated with septic tanks and sewage treatment plants.

In many cases around the world, untreated effluent is left to run down natural streams and rivers into lakes and oceans. The high nutrient value of the effluent causes algal blooms in these waterways, which as they die and are decomposed by microbes which use up the dissolved oxygen in the water. This in turn reduces dissolved oxygen levels which kills marine animals. The effects can be quite devastating up the marine food chain.

What are the benefits?

The advantages of natural waste treatment systems are many and varied. The following section shows the benefits of the system in comparison to existing water-borne waste treatment systems. These benefits improve conditions for the individual, the community and the environment.

Benefits to the householder - water use reduction (20 -50%)

A significant savings in water storage will result if the household is not on town supply water supply.

End product recycled

While only small in amount, the solid end product is a valuable humic fertiliser that can be utilised around trees and gardens.

Independence

A household with a composting system is independent from potential problems of the water-borne sewage system. If future water shortage or system backup problems occur with conventional systems, there is not much that you can do personally about it. On-site composting systems are much more flexible, they are easier to fix and have less damage potential if operated incorrectly.

Recycling

The composting toilet possesses the ability to recycle much of your household waste. Food scraps, paper, lawn clippings and grease from you grease traps and grey-water systems can be composted back through the toilet.

Unusual sites

Composting toilets can be installed in many different situations which would not accommodate other systems. Rocky sites, high water table, no water storage, environmentally sensitive, close to running watercourses, and swampy ground. All these difficult site situations can be accommodated with a small amount of alteration to the basic system design.

Together with the personal benefits of the composting toilet, there are overall benefits to the society and the environment.

Reduced marine pollution

Nutrient load on streams and rivers is almost negligible. This results in more oxygen being available in the water and a return to improved activity of marine life.

3.2 Activity 3

In simple easily understood language summarise what a composting toilet is and describe how it works.

Do you think your community would use such a toilet system? Discuss with a peer.

What could be the benefits to the environment and to the community water use?

Village sanitation

You will probably not see a village quite as bad as this but some settlements can be worse. People don't plan to live in poor sanitary conditions. People don't want their children to die of cholera or diarrhoea. So how do conditions like this come about and why do people tolerate them?



3.2 Activity 4

Discuss with a peer all the sanitation and health issues evident in this drawing. On chart paper, plan improved sanitation facilities for this village. Use appropriate technology.

Discuss how conditions might have reached this poor standard and why people tolerate them.

In a small group prepare and share a role-play in which you attempt to educate people about three or four good health and sanitary practices. Involve the audience by asking them to participate in the role-play.

Topic 3: Electrical tools and appliances

Objectives

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

- Identify and use a range of electrical tools safely
- Re-wire a plug for an electrical appliance
- Maintain a car battery
- Explore alternative energy sources such as micro-hydro power and bio-diesel.

Scope

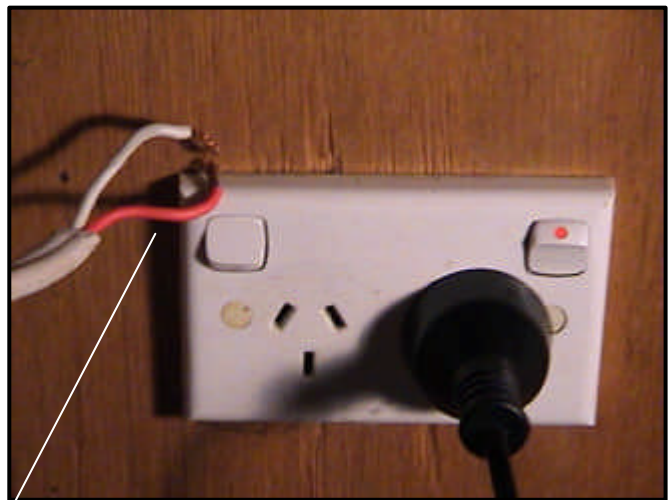
This topic offers you an introduction to electrical tools and appliances. Through it you will be taught how to handle electricity safely. The colour coding used for electrical wires will be explained and you will be encouraged to follow this code when rewiring a plug.

You will gain familiarity with small electrical appliances, how an electric motor works and simple, safe maintenance. Alternative energy sources are also explored and you will be introduced to micro-hydro power and bio-diesel technologies.

Using electricity safely

There are some basic common sense precautions to be taken when working with electricity. An obvious one is not to use electrical appliances near water. Why is this dangerous?

Water is a conductor of electrical current and if your hands are wet when handling electrical appliances that are live then you increase the possibility of being electrocuted.



What's wrong in using an electrical appliance with out a plug?

Name the red wire.

3.2 Activity 1

Design and make an electrical safety chart suitable for Grade 6-8 students. The chart should cover 4-5 basic safety precautions and ask several open-ended questions to challenge the students. Include drawings to illustrate your message.

3.2 Activity 2 - Wiring a plug

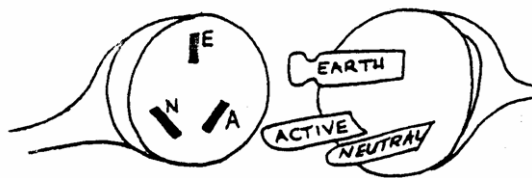
Materials

- 3 point plug
- screw driver
- power cord
- wire cutters(pliers)

Objectives

To rewire a three-point plug correctly following the safety colour code of the wire.

- Describe what each colour represents.
- Which wires are live?
- If someone was electrocuted describe what steps you would take?
- Prepare the wire for the plug.
- Fit the wires into the correct sockets in the plug.
- Check
- Replace the cover on the plug.
- Test.



3.2 Activity 3 - Battery and switches

Materials

- torch batteries
- electric wires –short lengths 30cm x6
- torch bulbs
- tacks or small nails
- paper clips

Objectives

- To make a simple circuit to light a bulb
- To create a circuit with a bulb, battery and switch
- To draw an electrical circuit

Using the available materials design and make a circuit to make the bulb light up.

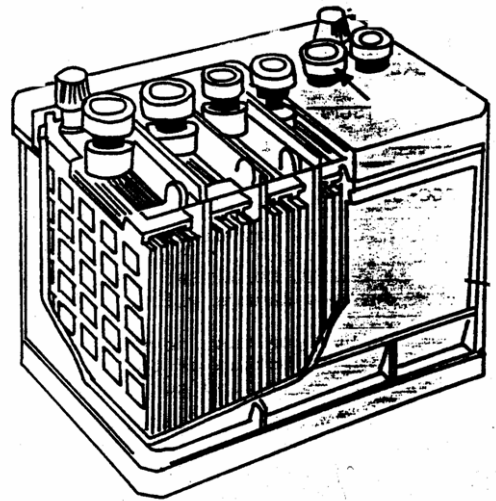
Repeat but include an on/of switch.

Make a drawing of the circuits made.

Practice joining pieces of wire and use the insulation tape to cover the bare wires.

Make a simple drawing of this car battery.

Label the positive and negative terminals and briefly describe how to maintain it properly.



3.2 Activity 4 - Electric fan or electric jug

Materials

- an operating electric fan
- screw drivers

Objectives

- To disassemble and reassemble the main parts of an electric fan
- To remove and replace the electric plug, fitting the colour coded wires correctly to make the fan work

Remove the fan protection cover and blades

Unscrew the motor casing and examine the electrical motor. Write any questions down.

What is the voltage of the fan?

What is a volt and what is an amp?

What are AC and DC?

Remove the cover from the three-pin plug and disconnect the wires

Take special note of which wires went where

Reconnect the wires carefully

Check

Plug the fan in and turn the power on

Research to find how an electric motor works. Make a drawing and label the main parts.

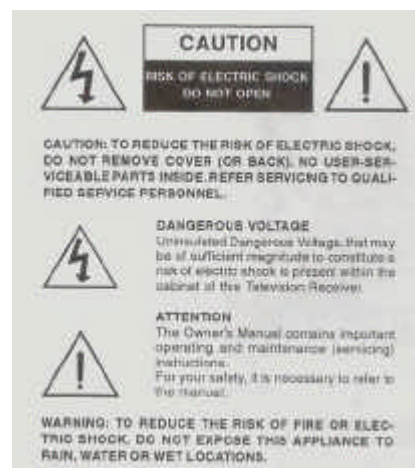
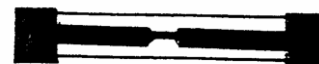
Trouble shooting

There are some electrical repairs which can be safely carried out by a non-electrician. These include; changing a fuse, replacing light bulbs, installing light fittings, rewiring an electric plug. However, there are some jobs that only an electrician should handle. Many appliances carry warnings telling people not to touch the electrical parts.

Fuses

Safety fuses are used to protect valuable equipment against faulty power supply. They are placed anywhere in the circuit between the power source and the appliance. In houses, a fuse box usually has a number of fuses for things such as: water heating, lights, stove, and different power points around the house.

If a fuse blows, replace it with a fuse or fuse wire of the same strength – stated in AMPS. If it blows frequently, check further to locate the fault.



3.2 Activity 5

Draw a simple circuit and include a fuse in the correct position.

Why would you never use a heavier fuse or any other object to replace a blown fuse?

3.2 Activity 6

Working in small groups, complete this table.

<i>Item</i>	<i>Problem</i>	<i>Possible cause</i>	<i>Home repair</i>	<i>Call an electrician</i>
<i>Television</i>	<i>No picture</i> <i>Will not start</i>	<i>Blown tube</i> <i>No power to set</i> <i>Problem with cord</i>	 Yes	Yes
<i>Video</i>				
<i>Fridge</i>				
<i>House lights</i>				

Alternative energy sources



Bio-diesel

Bio-diesel is the name for a variety of ester-based oxygenated fuels made from soybean oil or other vegetable oils. The concept of using vegetable oil as a fuel dates back to 1895 when Dr. Rudolf Diesel developed the first diesel engine to run on vegetable oil. Diesel demonstrated his engine at the World Exhibition in Paris in 1900 using peanut oil as fuel.

Key advantages of Bio-diesel:

1. Bio-diesel is the only alternative fuel that runs in any conventional, unmodified diesel engine. It can be stored anywhere that petroleum diesel fuel is stored.
2. Bio-diesel can be used alone or mixed in any ratio with petroleum diesel fuel. The most common blend is a mix of 20% bio-diesel with 80% petroleum diesel, or "B20."
3. The lifecycle production and use of bio-diesel produces approximately 80% less carbon dioxide emissions, and almost 100% less sulphur dioxide. Combustion of bio-diesel alone provides over a 90% reduction in total

unburned hydrocarbons, and a 75-90% reduction in aromatic hydrocarbons. Bio-diesel further provides significant reductions in particulates and carbon monoxide than petroleum diesel fuel. Bio-diesel provides a slight increase or decrease in nitrogen oxides depending on engine family and testing procedures.

4. Bio-diesel is 11% oxygen by weight and contains no sulphur. The use of bio-diesel can extend the life of diesel engines because it is more lubricating than petroleum diesel fuel, while fuel consumption, auto ignition, power output, and engine torque are relatively unaffected by bio-diesel.

5. Bio-diesel is safe to handle and transport because it is as biodegradable as sugar, 10 times less toxic than table salt, and has a high flashpoint of about 148 C compared to petroleum diesel fuel, which has a flash point of 52 C.

6. Bio-diesel can be made from domestically produced, renewable oilseed crops such as soybeans.

7. Bio-diesel is a proven fuel with over 30 million successful US road miles, and over 20 years of use in Europe.

8. When burned in a diesel engine, bio-diesel replaces the exhaust odour of petroleum diesel with the pleasant smell of fried potato chips (fries).



3.2 Activity 7

What is bio-diesel and how is it made?

What possible relevance could it have to Papua New Guinea?

Does soybean grow in Papua New Guinea? What alternatives could be used? Think of other alternative fuel crops to help make this country less reliant on imports. For example: in Brazil, sugarcane that originated here, is grown in huge plantations to make methanol a substitute for petrol.

Micro-hydro power

Siting a hydro system is much more site-specific than a wind or photovoltaic (PV — solar electric) system. A sufficient quantity of falling water must be available.

Where in Papua New Guinea would micro-hydro be best?

The vertical distance the water falls is called **head** and is usually measured in feet, meters, or units of pressure. The quantity of water is called **flow** and is measured in gallons per minute (gpm), cubic feet per second (cfs), or litres per second (l/s). More head is usually better because the system uses less water and the equipment can be smaller. The turbine also runs at a higher speed. At very high heads, pipe pressure ratings and pipe joint integrity become a problem. Since power is the product of head and flow, more flow is required at lower head to generate the same power level. More flow is better, even if not all of it is used, since more water can remain in the stream for environmental benefits.

A simple equation estimates output power for a system with 53% efficiency, which is representative of most micro hydro systems:

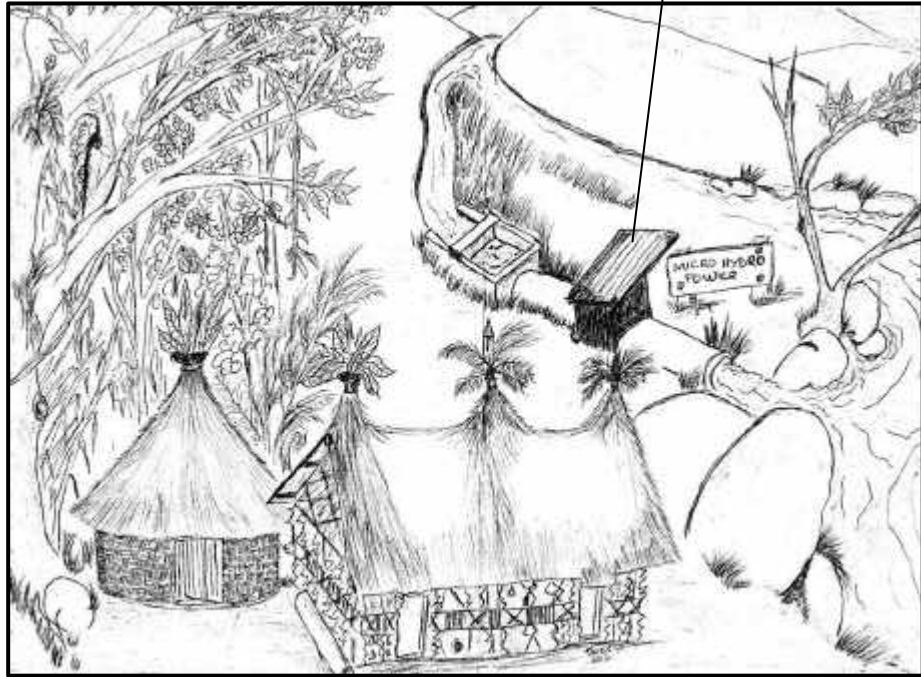
$$\text{Net Head* (feet)} \times \text{Flow (US gpm)} / 10 = \text{Output (Watts)}$$

* Net head is the pressure available after subtracting losses from pipe friction.



A typical micro-hydro generator. What impressed you about it?

Most hydro systems are limited in output capacity by stream conditions. That is, they cannot be expanded indefinitely like a wind or a solar power system. This means that the sizing procedure may be based on site conditions rather than power needs. The size and/or type of system components may vary greatly from site to site. System capacity may be dictated by specific circumstances (e.g. water dries up in the summer). If insufficient potential water is available to generate the power necessary to operate the average power needs, you must use appliances that are more energy-efficient and/or add other forms of generation equipment to the system.



The systems described in this module are called **"run of river"**; i.e. water not stored behind a dam. Only a diversion of sufficient size to direct the water into the pipeline is required. Power is generated at a constant rate and if not used, it is stored in batteries. Therefore, there is little environmental impact since minimal water is used.

In this Highlands scene, what do you think they will be using the power for? Can you identify the filter used to remove rubbish? Why is this important?

System types

Most micro-hydro generators can provide sufficient output to provide power for one house or an entire village. It just depends on the size of the system. Energy efficient appliances such as a refrigerator/freezer, washing machine, lights, entertainment and communication equipment, can be operated.

What is meant by energy-efficient appliances and lights?

What is the difference between voltage and wattage?

What are DC and AC?

Power can be supplied by a micro hydro system in two ways. In a battery-based system, power is generated at a level equal to the average demand and stored in batteries. Batteries can supply power as needed at levels much higher than that generated and

during times of low demand the excess can be stored. If enough energy is available from the water, an AC-direct system can generate power as alternating current (AC). This system typically requires a much higher power level than the battery-based system.

Battery-based systems

Most home power systems are battery-based. They require far less water than AC systems and are usually less expensive. Because the energy is stored in batteries, the generator can be shut down for servicing without interrupting the power delivered to the loads. Since only the average load needs to be generated in this type of system, the pipeline, turbine, generator and other components can be much smaller than those in an AC system.

**Power = The rate of doing work
(IE Watts or horsepower)**

1 Watt = 1 Volt X 1 Ampere

1 Horsepower = 746 Watts

**1000 Watts consumed = 1 kilowatt-Hour
(IE the unit found on utility bills)**

Very reliable inverters are available to convert DC battery power into AC output (120 volt, 60 Hz). These are used to power most or all home appliances. This makes it possible to have a system that is nearly indistinguishable from a house using utility power.

The input voltage to the batteries in a battery-based system commonly ranges from 12 to 48 Volts DC. If the transmission distance is not great then 12 Volts is often high enough. A 24 Volt system is used if the power level or transmission distance is greater. If all of the loads are inverter-powered, the battery voltage is independent of the inverter output voltage and voltages of 48 or 120 may be used to overcome long transmission distances. Although batteries and inverters can be specified for these voltages, it is common to convert the high voltage back down to 12 or 24 Volts (battery voltage) using transformers or solid-state converters.

Wind or solar power sources can assist in power production because batteries are used. Also, DC loads (appliances or lights designed for DC) can be operated directly from the batteries. DC versions of many appliances are available, although they often cost more and are harder to find, and in some cases, quality and performance vary.

System components

An intake collects the water and a pipeline delivers it to the turbine. The turbine converts the water's energy into mechanical shaft power. The turbine drives the generator which converts shaft power into electricity. In an AC system, this power goes directly to the loads. In a battery-based system, the power is stored in batteries, which feed the loads as needed. Controllers may be required to regulate the system.

Pipeline

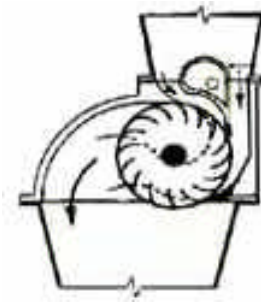
Most hydro systems require a pipeline to feed water to the turbine. The water should pass first through a simple filter to block debris that may clog or damage the machine. The intake should be placed off to the side of the main water flow to protect it from the direct force of the water and debris during high flows. It is important to use a pipeline of sufficiently large diameter to minimize friction losses from the moving water. When possible, the pipeline should be buried. This stabilizes the pipe and prevents damage. Pipelines are usually made from PVC or polyethylene although metal or concrete pipes can

also be used.



Turbines

Although traditional waterwheels of various types have been used for centuries, they aren't usually suitable for generating electricity. They are heavy, large and turn at low speeds. They require complex gearing to reach speeds to run an electric generator. Water turbines rotate at higher speeds, are lighter and more compact. Turbines are more appropriate for electricity generation and are usually more efficient.



Crossflow Turbine

There are two basic kinds of turbines: impulse and reaction.

Impulse machines use a nozzle at the end of the pipeline that converts the water under pressure into a fast-moving jet. This jet is then directed at the turbine wheel (also called the runner), which is designed to convert as much of the jet's kinetic energy as possible into shaft. Common impulse turbines are pelton, turgo and cross-flow.

Turbine applications

In the family of impulse machines, the pelton is used for the lowest flows and highest heads. The cross-flow is used where flows are highest and heads are lowest. The turgo is used for intermediate conditions. Propeller (reaction) turbines can operate on as little as two feet of head. A turgo requires at least four feet and a pelton needs at least ten feet. These are only rough guidelines with overlap in applications.



Underneath view of a turbine

The cross-flow (impulse) turbine is the only machine that readily lends itself to user construction. They can be made in modular widths and variable nozzles can be used.

Most developed sites now use impulse turbines. These turbines are very simple and relatively cheap. As the stream flow varies, water flow to the turbine can be easily controlled by changing nozzle sizes or by using adjustable nozzles.

Generators

Most battery-based systems use an automotive alternator. If selected carefully, and rewound when appropriate, the alternator can achieve very good performance. A rheostat can be installed in the field circuit to maximize the output. Rewound alternators can be used even in the 100–200 Volt range.

For higher voltages (100–400 Volts), an induction motor with the appropriate capacitance for excitation can be used as a generator. This will operate in a small battery charging system as well as in larger AC direct systems of several kilowatts.

Another type of generator used with micro hydro systems is the DC motor. Usually permanent magnet types are preferable. However, these have serious maintenance problems because the entire output passes through their carbon commutators and brushes.

Batteries Lead-acid deep-cycle batteries are usually used in hydro systems. Deep-cycle batteries are designed to withstand repeated charge and discharge cycles typical in RE systems. In contrast, automotive (starting) batteries can tolerate only a fraction of these discharge cycles. A micro hydro system requires only one to two days storage.

Conclusions

Despite the careful design needed to produce the best performance, a micro hydro system isn't complicated. The system is not difficult to operate and maintain. Its lifespan is measured in decades. Micro hydro power is almost always more cost-effective than any other form of renewable power.

3.2 Activity 8

Write a case for publicly funded micro-hydro power in areas of Papua New Guinea which have the right environmental conditions. Base your argument on sustainability and self-reliance.

Write to any of the following contacts for more information on micro-hydro power.

Look at the following photograph, identify it and be able to give a brief description of how it works in the micro-hydro system



For more information on micro-hydro power, contact:
South Pacific Solar Supplies,
83 Buchan St, Cairns, Queensland, 4870

Module 3.2 Practical Applications

Theme: Building maintenance



Building Maintenance

Rationale

Being self-sufficient enough to be able to carry out simple building repairs and maintenance tasks is the aim of this topic. Teachers and schools generally will not have the resources to employ trades people to maintain buildings. This topic introduces some basic maintenance tasks and encourages the lecturer to include others.

Objectives

By the end of this topic you will be able to:

- Describe and demonstrate how to repair most common problems on external and internal walls, floors, gutters and down pipes
- Describe and demonstrate how to hang a door, replace flywire, fit locks and replace a broken window
- Describe and where possible demonstrate how to prepare a site for concreting, lay foundations, use and care for concreting tools, mix and pour concrete and finish off
- Describe and demonstrate if possible the preparation new and old surfaces for painting, the preparation and use of paint, correct brush techniques and safe and careful cleanup methods

Suggested topics

1. Basic concreting
2. Painting
3. Maintenance of walls, windows, doors, floors and roofs

Topic 1: Basic concreting

Objectives

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

- Prepare a site for concreting
- Mix and pour concrete using the correct proportions of water, gravel and cement

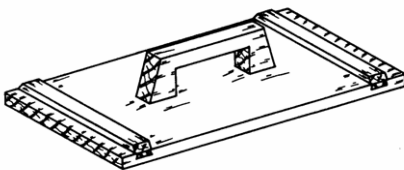
Scope

This topic introduces you to the basics of making good concrete and proper site preparation. You will be encouraged to mix and make concrete for an actual job at the college.

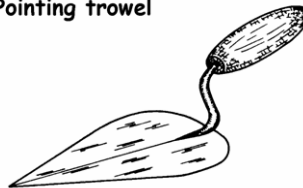
Tools

The essential tools needed for concreting are shovel, bucket, spirit level, trowel, float and sometimes a wheelbarrow. Occasionally a mechanical concrete mixer is used. Any metal tool that comes into contact with concrete must be washed immediately after use.

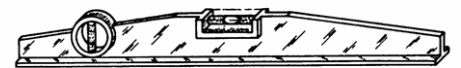
Wood float



Pointing trowel



Wooden spirit level



Metal spirit level



3.2 Activity 1

Look at the above concreting tools, what are the different jobs a trowel and float do?

Why do you need to wash tools immediately after you have finishing using them with concrete?

How does a spirit level work?

The ingredients of good concrete

Cement

Must be fresh, dry and stored in a dry place off the ground. Used only when a fine grey powder.

Water

Water for cement work should be drinkable. Dirty water reduces the quality of the cement / water paste and so the strength of the concrete.

Salty water or salty sand causes a stain and powdery effect on the finished product.

Sand and gravel

Aggregates must be free of dirt, grass and other rubbish. River sand can be screened to give sand and gravel in separate piles.

Concrete must be a dense mass. There should be very little empty spaces in the concrete (honeycomb). As all the spaces must be filled, gravel and sand must vary in size from fine to coarse.

Sand should be sharp when rubbed between the hands.

Gravel should be sharp and broken to help with the binding process. Do not use gravel over 70mm.

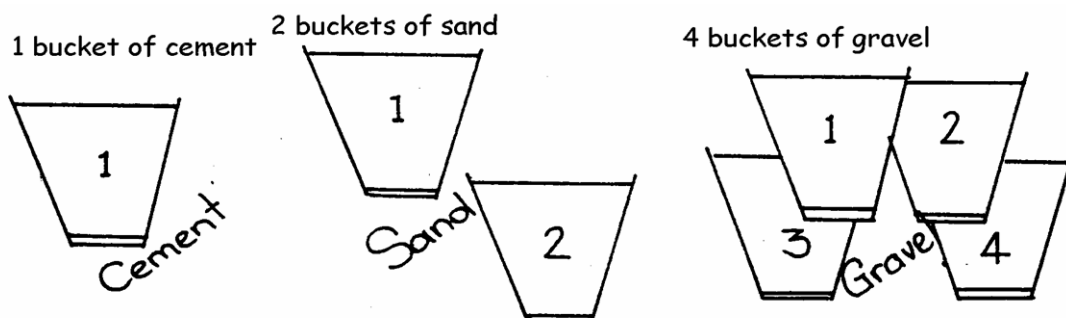
3.2 Activity 2

What do you think would be the problem caused by too much water and too little water in the concrete mix?

Why would smooth river pebbles not be the best for the concrete mix?

Proportions

The strength of the concrete depends on the quantities of cement, sand, gravel and water mixed together. The usual mix is 1:2:4 mixed by volume. An old bucket makes a good measure.



The cement, gravel and sand are mixed dry until they are an even grey colour.

Water is added until the mixture becomes easy to mix with a shovel. Not enough water and it will be difficult to move and pour, too much water and the water will run away carrying the cement / water paste with it.

Mixing board

Concrete can be mixed on a large board. Hand mixing in this way is suitable for small quantities

Site preparation

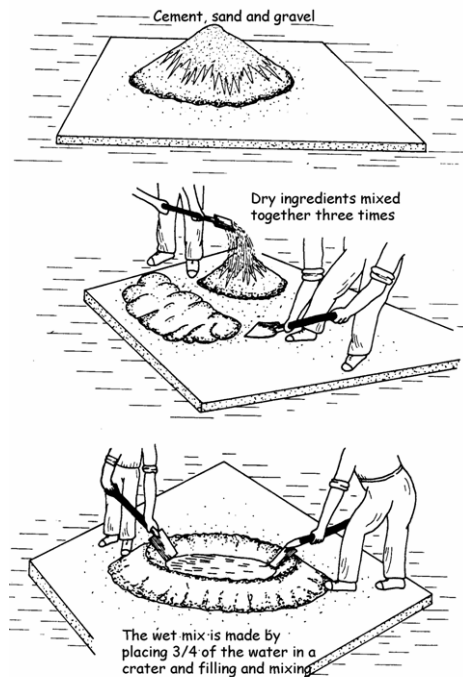
Remove all vegetation, tree roots and other vegetable matter from the site and level as much as possible.

Prepare a box framework, the top edge of which will be the top level of the slab. All formwork must be level in all directions.

Drainage may require a slope on the slab.

Formwork must be constructed so that:

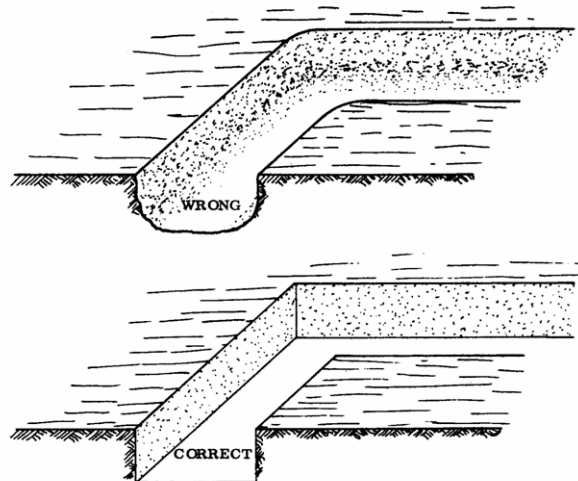
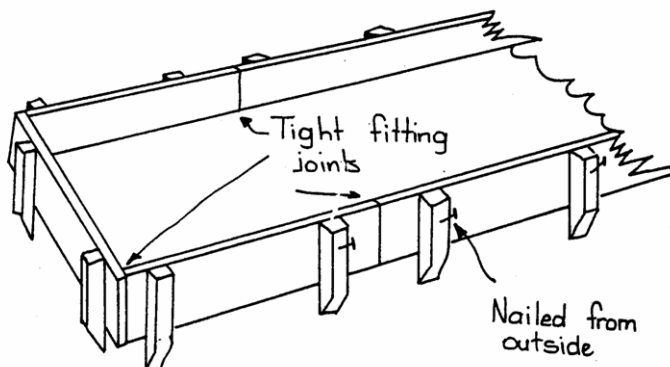
- It is strong enough to withstand the weight of concrete
- It is easily removed after the concrete has hardened
- The top edge is level for screeding
- Timbers are oiled or at least smooth so that the concrete will not stick to it
- There are no gaps for the cement/water paste to escape
- It is left in place until concrete hardens



Foundations

A foundation is the strong base of a building. The purpose of the foundation is to receive the loads from the structure above and to spread them over a larger area of soil and rocks.

The sides of the foundation trench must be vertical and the bottom level.



Pouring concrete

Start pouring the concrete at one end of the formwork and work towards the other.

Trample the concrete with a shovel or piece of timber to remove airspaces and pack it tightly.

Screed across the top with a straight edge and lightly smooth out with a wooden float. Push larger pieces of aggregate under the surface. Push the gravel away from inside of formwork to make a neat edge.

When the concrete is almost set, smooth again with a wooden float. Edges may be finished with an edging tool.

A steel float will give a very smooth finish. A straw broom will give a non-slip finish.

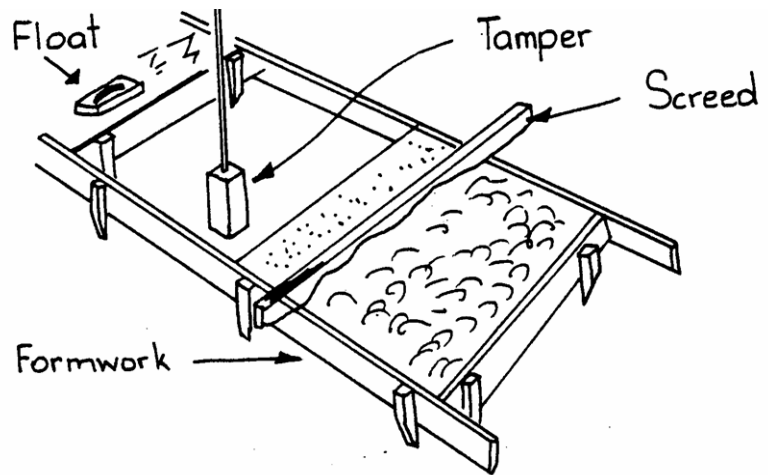
Curing and hardening

When the slab is completed, it should be covered with 50 mm of fine sand, watered down and allowed to cure. (Plastic sheets, old cement bags or banana leaves may be used).

The concrete will start to set in one hour of its pouring but the hardening process takes-up to SEVEN DAYS. For this reason it must be kept damp for this period.

Hardening can only take place with moisture, when the chemical reaction is allowed to continue.

This final condition is the most important part if the finished surface is to withstand the wear it will receive.



Thickness

The following are recommended thicknesses:

Foot path	50mm
Houses	75mm
Car drives	100mm
Heavy trucks	150mm

3.2 Activity 3

Why is it important to handle cement very carefully?

What problems would you have with nails poking through the boxing into the concrete?

Topic 2: Painting

Objectives

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

- Prepare a surface for painting
- Identify the best paint for the job
- Paint and care for paint brushes

Scope

The purpose of this topic is to introduce you to the basics of painting using enamel and acrylic paints. You will be expected to know the difference between these two paints and what surfaces they are best applied.

Preparation of surfaces before painting and cleaning up and care of paintbrushes will also be taught.

Types of paint

Oil paint

Most paints for use outside are oil based paints, or **enamel paints**. That is, they have a linseed oil base to which other things are added to give the paint colour, body and durability. These paints can be cleaned off when wet with mineral turpentine.

Oil paint is usually applied in three coats. Each coat is of a different composition and they cannot be mixed.

- Primer
- Undercoat
- Finishing coat

Follow the directions on the tin when using these paints. Oil paints can be thinned only with thinners such as turpentine.

Water paint

Some paints, including some of those made for use indoors, are water based or **acrylic paints**. That is, they are made with water. They are often called emulsion paints because the ingredients are not dissolved in the water but are suspended: that is, very tiny particles are floating around in the water. These paints can be washed off with water when they are wet but once the water has dried away, they cannot be washed off.

Paints also have different surfaces when dry. Some are shiny and are called gloss paints others are less shiny and have other names like, semi-gloss, matt and semi-matt.

Gloss paints are often used for outside work because the shiny surface allows rain to run off easily. Matt paints are often used indoors so that the light doesn't reflect off them and cause a glare for your eyes.

Varnish

Varnish is like a clear paint with no colour to it. It is used when you want to protect the wood and give it a nice surface but you do not want to cover it up because the wood grain or colour looks nice as it is. As with paints, varnish comes in different finishes such as: gloss, semi-gloss, matt and semi-matt.

 3.2 Activity 1

What are the main disadvantages of using oil paint?

In what circumstances is acrylic paint best used?

What is varnish and why would you use it?

Surface preparation - painting

Shake the (paint) tin well then open carefully and stir the paint with a stick of wood (not a screw-driver!) If the paint has a 'skin' on it or is 'lumpy', you might have to strain it.

When the paint is stirred and ready, dip your brush in, covering only the bottom half of the bristles. Wipe off the excess paint from the brush on the side of the tin and apply the paint to the job in straight strokes along the grain, then across at 90 degrees and finally along the grain again to finish off. You have to work the paint into the wood otherwise it will just sit on the surface and very soon peel off in hot sun or damp weather.

For new timber and especially exterior (outdoor) work the first coat should be of **primer** The next coat should be **undercoat** which is usually a dull finish. Finally, apply a second coat.

Between each coat the work should be rubbed down with smooth or worn sandpaper and dusted. The final **top coat** should be applied in a dust free place.

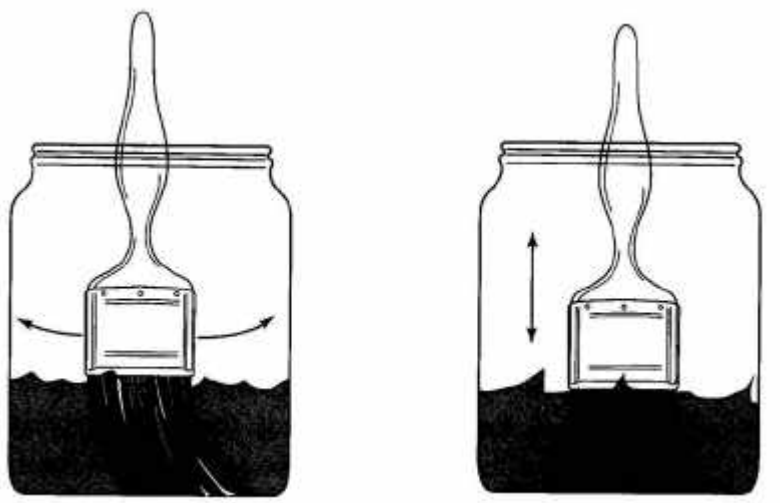
Finally, make sure that the paint goes on the job and not all over the yourself and the workshop. Put newspaper down to protect surfaces, have the pupils wear old clothes and when the painting is finished make sure the lids of the tins of paint are securely replaced and the brushes cleaned thoroughly with turpentine or water.

 3.2 Activity 2

Write a simple illustrated guide for Grades 6-8 on how to use water and oil based paints and how to care for brushes.

Clean-up and care of brushes

Depending on the paint used brushes are cleaned with either water or turpentine.



Don't just put the brushes in water or turpentine after use.

What should you do?

Glossary

Additives	Substances added to food in small amounts
Aggregate	The sand, rocks, gravel which make up concrete
Appliqué	Ornamental work (in dress making) made of one kind of material, or of a materials of one colour, applied to the surface of another.
Ball pein hammer	A commonly used hammer for metal work. Instead of a claw it has a rounded ball shaped end.
Bamboo	Natural, cheap to use, may be used for downhill supplies.
Bevel	A sloping edge; the edge of a piece of timber which is cut off so the angle is no longer 90 degrees
Calico	Unbleached fabric
Cement	Cement is a fine grey powder which is made from a mixture of chalk or limestone and clay.
Concrete	A mixture of sand, stones, cement and water which hardens into a rock-like substance
Copper	An expensive piping system usually restricted to hot-water pipes in houses. Fittings are soldered.
Countersink	To enlarge the top of a screw hole so that the head of the screw will be flush.
Cross-grained	The wood fibres do not run parallel to the length of the piece of wood, so it is difficult to work with the wood.
Cure	A term used for the hardening of glues and adhesives.
Design brief	Forms the basis of the process of design including a description of the problem and the specification which identifies the main parts of the problem to be solved.
Design process	Include the design brief, evaluation criteria, design options, work plan, production, evaluation and modification.
End grain	The end surface which is exposed when wood is cut across the grain.
Flush	When two surfaces are flush, we mean they are in the same plane.
Galvanised	A metal pipe with galvanising on both in- side and outside to stop rust. Obtained in 6 metre lengths with provision for screwed ends and fittings. Requires a plumber to construct but main advantage is that it is difficult to damage. Do not use in- corrosive position (salt water, hard water).
Gauge	A measure, a means of comparing sizes.
Grain	The natural arrangement of the wood fibres.
Hard water	Is difficult to lather because of the dissolved minerals (limestone, corals, chalks).

Level	A line or surface which is parallel to the horizon.
Marking out	To make marks on a surface to show where for example a chisel will work or a saw will cut.
Mitre	This refers to a joint where the two pieces are cut at a 45 degree angle so that they form a corner.
Mortar	A mixture of sand, cement and water which is used to form the joints between blocks, or as plaster.
Mortice	A hole which is cut in a piece of wood to receive the end of another piece of wood.
Pinking scissors	Scissors with zigzag cutting edges.
Plumb	Vertically straight.
Polythene	A black plastic, semi-flexible pipe obtained in sizes 12, 20, 25, 32, 40, 50mm diameters. It is purchased in rolls. Easily carried but easily damaged by vandals. Bury under about 450mm of soil. Fittings require very little effort.
PVC	A white non-flexible plastic pipe obtained in common pipe sizes in lengths of 6 metres. Is joined with glued fittings and used for domestic water supplies. Requires very little time to assemble.
Rebate	A step-shaped rectangular cut in the edge of a piece of wood.
Right angle	A 90 degree angle
Selvedge	The bound edge or neatened side of the fabric; the threads will not come loose or fray.
Soft water	Lathers very easily and should be preferred for domestic water.
Square	That a piece of timber has all its sides at right angles to each other or that all the angles are right angles.
True	A description meaning that a surface is completely straight