TEACHER'S GUIDE

# MECHANICAL TECHNOLOGY

GRADE 9



basic education
Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

KAGISO TRUST
Overcoming poverty

sasol

**Mechanical Technology Grade 9 Teacher's Guide**

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# Table of Contents

# Introduction

## Planning

This involves planning, preparing, and timing the activities following the Annual Teaching Plan (ATP). Planning for the teaching, learning and assessment process includes making the presentations and deciding how to approach the activities.

Once you have planned the broad term schedule for Mechanical Technology, start concentrating on the detailed planning for each topic and class session.

Here you will have to consider the:

- content of activities
- timing of activities
- methods of teaching, learning and assessment
- resources
- facilitating/teaching techniques.

## Teaching-learning protocols

- Subject Annual Teaching Plans/Programme
- Attendance and punctuality
- Signing of learner attendance registers
- Monitoring of the adherence to classroom etiquette
- Strategies for how learners will share their inputs, for example, raising a hand to speak

### The purpose of these support resources

These support resources aim to guide the teaching, learning and assessment, with the requisite balance in the cognitive levels and subject-specific aims.

It should be read in conjunction with the subject policy to ensure that the process in the subject has integrity and yields high-quality, competent learners, who can be relied on by all stakeholders.

## Learner's Book

Introduce the textbook resource to the learners and discuss the teaching-learning programme.

| Introduction to the lesson, outcomes and expectations |
|---|
| All target learning styles (differentiation and inclusion) |
| Activity: learner's expectations of the lesson |
| Suggested time allocation: 30 min |
| **Resources**<br>• Learner textbook |
| **Method**<br>• Individual, pair, team inputs and discussion |

## Outcomes

Learners should be given an opportunity to:

- express and discuss their expectations regarding School Based Assessment (SBA)
- check whether the lesson is responsive to their expectations.

### Group/Team Learning

Number your learners 1 – 10. Repeat four times (if you have a total of 40 learners). Group all the 1s together at Table 1, Group all the 2s together at Table 2, Group all the 3s together at Table 3; Group all the 4s together at Table 4; Group all the 5s together at Table 5; Group all the 6s together at Table 6; Group all the 7s together at Table 7; Group all the 8s together at Table 8; Group all the 9s together at Table 9; Group all the 10s together at Table 10. (Remember to make table numbers)

*(You may find it is useful to change groups/teams every day so that participants get an opportunity to interact with more peers.)*

- Learners introduce themselves in the group/team. (3 minutes)
- Make sure all learners are seated in a group/team and your tables are numbered.

## Teacher's input

**Individual activity**

Ask the learners to record their expectations of the lesson in the classwork books.

**Group/Team activity**

In their groups/teams, ask learners to discuss and record their expectations on their group/team poster.

### Presentations and discussion

- Allow time for group/team presentations.
- Take note of common expectations.
- Display posters on the wall.

### Consolidation and reflection

- Summarise learners' expectations.
- Highlight those expectations that will be covered in the lesson.
- Ask learners to track which of their expectations (tick off in a red pen) are met as the lesson unfolds.

## What is facilitation?

*Facilitation* means doing something that makes a lesson more effective and productive. Facilitation can also mean all the teacher's behaviours and actions that positively influence the experiences and learning of the learners and the groups/teams.

- Through the facilitation process, learners can develop a product much more quickly in a group/team setting.
- Everyone involved "*owns*" the product and understands how it came to be.

Effective facilitation ensures group/team success because a facilitator guides learners to interact with one other in a safe and trusting environment.

When you conduct a lesson, you have a group of participating learners, and you want that group to perform at an optimal level where there is maximum participation. You can use a variety of facilitation strategies.

## Understanding pedagogy

A pedagogically skilled teacher:

- **Plans** their teaching, learning, and assessment processes to achieve lesson objectives.
- Creatively **prepares** and **develops** lessons.
- Can make a **distinction** between **pedagogy** and **curriculum**.
- Can **deliver lessons effectively** and within the parameters of the curriculum, and **assess** in a way that supports learning and measures learning reliably.
- Can use **open-ended questions** to break points down, critique them, and apply critical thinking to formulate thoughts.
- Sets high expectations for all learners to try their best and attain the envisaged high standards.
- Can use **differentiation and inclusion** to allow each learner to succeed.

## Other pedagogical skills

- **Scaffolding:** systematically building on learners' experiences and knowledge as they are learning new skills.
- **Repetition:** teachers need to repeat things to reinforce learning (informal assessment is vital).
- **Inquiry-based teaching:** a form of active learning that starts with the teacher posing questions, problems, or scenarios. Learners get a better understanding from doing and discovering.
- **Classroom layout:** use a conducive setting to experience an increase in academic engagement and a decrease in disruptive behaviour.
- **Trimmed information:** small, manageable amounts of information provide for effective assimilation of knowledge.

**We make use of facilitation to:**

- work better, smarter, and faster
- encourage better participation, interaction, collaboration, and cooperation
- get better and new ideas
- foster deeper levels of understanding
- promote a higher level of ownership of the product

## The Facilitator/Teacher

| A facilitator/teacher is someone who… | A facilitator/teacher is not someone who… |
|---|---|
| • is knowledgeable and well prepared<br>• is flexible but firm when necessary<br>• is friendly and approachable<br>• is willing to listen and learn<br>• is tactful but honest<br>• brings out the full potential of the learners in a group/team<br>• keeps the training on track<br>• helps resolve conflict<br>• draws out participation from all the participants<br>• organises the work of a group/team and makes sure that the outcomes of the lesson are met<br>• manages group/team dynamics | • is unprepared or disorganised and cannot respond satisfactorily to questions from participants<br>• marginalises a learner<br>• ignores an idea (looks tired and gets distracted because too many ideas are coming at once)<br>• becomes emotional and defensive<br>• solves the problem for the group<br>• dominates the discussion<br>• manipulates people and behaviours through their own feedback<br>• tries to have all the answers<br>• uses the cell phone all the time<br>• is unable to integrate the life experiences of learners into the classroom for a more meaningful learning experience |

# Overview

## Overview of topics per term and Annual Teaching Plans (ATPs)

### Content overview

| TOPIC | GRADE 8 | GRADE 9 |
|---|---|---|
| 1. **Safety** | • Definition of an accident<br>• Causes of accidents<br>• Identify and respond to unsafe or potentially unsafe conditions or acts<br>• Personal safety equipment and performing housekeeping duties<br>• Purpose of demarcated areas, emergency stops, first aid stations, safety signs, ventilation, lighting, electricity supply | • Firefighting.<br>• Identify and respond to unsafe or potentially unsafe conditions or acts<br>• Explain the rights and responsibilities of workers with HIV/AIDS |
| 2. **Graphic Communication** | **Introduction of Graphic Communication**<br>• What is Graphic Communication?<br>• The purpose of Graphic Communication<br>• General drawing principles<br>• Safety precautions when using drawing instruments<br>• Correct use and care of drawing instruments<br>• Freehand sketches<br>• Types of lines<br>• Lines (SANS0111 guidelines)<br>• Dimensions, lettering, and border lines.<br>• Freehand drawing<br>• Scale drawing 1:1 and 1:2<br>• Pictorial drawings (using drawing instruments)<br>» Isometric drawings<br>» 1st Angle Orthographic | **Demonstrate and apply all aspects of drawing.**<br>• Revision of Grade 8 work<br>• Free-hand drawings<br>• Geometrical drawings<br>• Isometric drawings<br>• 3rd angle Orthographic drawings |

| TOPIC | GRADE 8 | GRADE 9 |
|---|---|---|
| 3. **Tools, instruments and equipment** | • Identify tools, instruments and equipment and their uses (theory and practical application)<br>» Select and use hand tools<br>» Select and use measuring equipment (theory and practical application)<br>» Identify different lifting equipment used in the automotive workshop, i.e. hydraulic trolley jack, bottle jack, scissor jack<br>» Safety equipment needed when using lifting equipment, i.e. chock block, jacking points on the vehicle, trestles and creepers | • Care and maintenance of tools and equipment<br>» Work safely with due care for self, fellow learners and equipment<br>» Care and maintenance of measuring equipment<br>» Recognise, and report wear or damage to measuring equipment<br>» Power supply and connection to equipment<br>» Recognise and report any damage to any power tool<br>» Care and maintenance of power tools<br>» Discuss operation, functions and components of lifting equipment<br>» Carry out precautionary measures before operating the lifting equipment<br>» Use lifting equipment to change a wheel of a vehicle |
| 4. **Entrepreneurship** | • What is entrepreneurship?<br>• Who is an entrepreneur?<br>• Types of entrepreneurship<br>• Marketing and branding products<br>• Advertising on a media platform | • What is entrepreneurship?<br>• Who is an entrepreneur?<br>• Type of entrepreneurship.<br>» Small Business entrepreneurship<br>» Scalable start-up entrepreneurship<br>» Large company entrepreneurship<br>» Social entrepreneurship<br>• Why is entrepreneurship important?<br>• What factors affect entrepreneurship?<br>• Business Plan |

| TOPIC | GRADE 8 | GRADE 9 |
|---|---|---|
| **5. Materials** | • Introduction to and classification of material:<br>» Ferrous metals<br>» Non-ferrous metals | • Classification and application of materials:<br>» Ferrous alloys<br>» Non-ferrous alloys (Sheet metals, cold-rolled sheets, galvanised sheets, expanded sheets)<br>» Plastics |
| **6. Joining methods** | • Definition of joining methods<br>• Types of joining methods<br>» Permanent joining methods (definition only)<br>» Semi-permanent joining methods<br>• Semi-permanent joining methods<br>• Apply procedures of basic semi-permanent joining processes<br>» Bolt and nuts (and washers)<br>» Screws | • Demonstrate the processes of joining methods<br>• Apply permanent joining method<br>» Soldering<br>» Arc welding<br>• The Teacher demonstrates screw thread-cutting procedures<br>• Screw cutting (Tap and Die ONLY)<br>• ISO metric threads |
| **7. Terminology** | • Identify the different machines used in the Fitting and Machining Workshop and their uses.<br>» Centre Lathe<br>» Milling Machine<br>• Engines<br>» Engine components and their functions: crankshaft, connecting rods, cylinder block, combustion chamber, inlet valve, cam, camshaft, spark plug, valve spring, exhaust valve, cylinder head, water jacket, piston and crankcase.<br>• **Practical task 1**<br>On Centre Lathe and Milling Machine (cleaning and oil). | • Identify the different components (and their functions) of the machines used in the Fitting and Machining Workshop<br>• Centre Lathe (tailstock, chuck, chuck key, tool post. lead screw, compound slide, cross slide, emergency brake and headstock)<br>• Milling Machine (table, motor, levers, switches, spindle, stand)<br>• Surface grinder (table, base, feed lever, grinding wheel, switches)<br>• Operations that can be done on a milling machine (Boring, Drilling, Indexing, Gear cutting, Keyways, Splines) |

| TOPIC | GRADE 8 | GRADE 9 |
|---|---|---|
| **7. Terminology** *(continued)* | • **Practical task 2**<br>Use of an engine for learners to identify and explain the purpose of different engine components. | • **Terminology**:<br>» Engine designs<br>» Engines<br>» TDC<br>» BDC<br>» Stroke<br>» Bore<br>• Fundamentals engine technology:<br>» FOUR (4) Stroke (Petrol) Engine<br>» Operation<br>» Intake<br>» Compression<br>» Power<br>» Exhaust<br>» Function of engine systems<br>• FOUR (4) Stroke (Petrol) – 1 cylinder<br>» Comparison of the two engines<br>» Inspect parts |
| **8. Maintenance** | • Introduction to machine maintenance<br>• Lubrication<br>» Definition<br>» Identify lubricant for different components (engine oil, gear oil, automatic transmission fluid).<br>» Correct handling and storage of lubricants.<br>• **Practical task**<br>» Plan and prepare to inspect and lubricate machines and equipment | • Introduction to machine maintenance (Grade 8 revision)<br>• Lubrication:<br>» Definition<br>» The purpose of lubrication<br>» Inspection frequency<br>» Types of maintenance<br>» Inspection and fluid top ups<br>» Inspection of defects on motor vehicle<br>• Engine maintenance<br>» Importance of regular maintenance<br>• Automotive batteries (lead, acid storage and gel type batteries)<br>» Handling and care |

| TOPIC | GRADE 8 | GRADE 9 |
|---|---|---|
| **8. Maintenance** *(continued)* | | • **Practical task 1**<br>» Drain, refill or top up fluids and lubricants<br>» Inspect for leaks and defects<br>• **Practical task 2**<br>» Remove and install battery in vehicle |
| **9. Body Works** | **PANEL BEATING**<br>**Repair different coin-sized dents on ferrous body shells while applying safety rules**<br>**Practical demonstration**<br>• Repair a coin-sized dent on a body panel.<br>**Tools**<br>• Identify and assess the damage<br>• Select appropriate tools to be used for repairs:<br>» Planishing hammer<br>» Cross-pane and finishing hammer<br>» Curved pane and finishing hammer<br>» Pick finishing hammer<br>» General purpose dolly<br>» Heel dolly<br>» Toe dolly<br>» Curved dolly<br>» Beating file<br>» Adjustable body file<br>» Orbital sander<br>» Steel brush<br>**Perform surface preparation of a body panel**<br>**Practical demonstrations**<br>• Identify and assess the damage on the panel<br>• Clean panels in accordance with the workshop procedures<br>• Apply spot putty (if needed) in accordance with job requirement | **PANEL BEATING**<br>**Perform surface preparation of a body**<br>**Panel grind and feather edging operations**<br>• Identify the type of panel and name the material it is made from<br>• Identify and assess the body panel to be repaired<br>**Practical demonstration**<br>• Wash panels in accordance with the workshop procedures<br>• Grind and feather edging operations<br>**Tools**<br>• Electric disc sander/Air driven disc sander<br>• Orbital sander<br>• Sanding blocks<br>**Material/Abrasives**<br>• P150 Hook it disc<br>• P80 sandpaper<br>• P180 sandpaper<br>• Prep sol<br>• Metal cleaner<br>**Practical task**<br>• Wash panels in accordance with the workshop procedures<br>• Grinding and feather edging operations |

| TOPIC | GRADE 8 | GRADE 9 |
|---|---|---|
| 9. **Body Works** *(continued)* | • Select the appropriate sandpaper (Wet or Dry)<br>• Demonstrate and perform the sanding operation in accordance with the job requirement.<br>• Clean and store tools, equipment and material in accordance with workshop procedures<br>**Practical task**<br>• Clean body panels using water<br>• Select the appropriate sandpaper (Wet or Dry)<br>• Apply spot putty if needed in accordance with job requirement<br>• Demonstrate and perform the sanding operation in accordance with the job requirement<br>• Assess and inspect the sanding and masking procedures<br>• Clean and store tools, equipment, and material in accordance with workshop procedures | **Tools**<br>• Electric disc sander/Air driven disc sander<br>• Orbital sander<br>• Sanding blocks<br>**Material/Abrasives**<br>• P150 Hook it disc<br>• P80 sandpaper<br>• P180 sandpaper<br>• Prep sol<br>• Metal cleaner<br>• Body Filler<br>• Spot putty<br>• Rags<br>**Identify the various types of primers**<br>**Practical demonstration**<br>• Identify and explain the use of the primer<br>• Masking of a panel that needs to be primed<br>• Demonstrate the correct use of primers in accordance with the manufacturer's manuals<br>**Practical task**<br>• Identify and explain the use of the primer<br>• Masking of a panel that needs to be primed<br>• Demonstrate the correct use of primers in accordance with manufactures manuals<br>• Clean and store tools, equipment and material in accordance with workshop procedures |

# Content outline per term

## Grade 9

### TERM 1

| WEEKS | TOPIC | CONTENT |
|---|---|---|
| 3 WEEKS | OCCUPATIONAL HEALTH AND SAFETY | **General Safety rules** (Grade 8 work revision)<br>• Accidents<br>• Unsafe Acts<br>• Unsafe conditions<br>» Use personal protective equipment<br>» (PPE)<br>• Good housekeeping<br>• Safety signs<br>• First Aid stations<br>• Fire prevention and protection<br>» Elements of fire<br>» o Classification of fires<br>» Causes of fires<br>• Types of firefighting equipment<br><br>**Basic First Aid – incident management**<br>• Define first aid<br>• Basic first aid kit content<br>• Types of injuries<br>» Cuts<br>» Burns<br>» Fractures<br>» Trauma (shock) |
| 2 WEEKS | GRAPHIC COMMUNICATION | • Demonstrate and apply all aspects of drawing.<br>» Revision of Grade 8 work<br>» Free-hand drawings<br>» Geometrical drawings<br>• Isometric drawings and Orthographic drawings |

| WEEKS | TOPIC | CONTENT |
|---|---|---|
| 3 WEEKS | TOOLS, INSTRUMENTS AND EQUIPMENT | • **Classification and application of Hand tools**<br>» Screw drivers<br>» Spanners<br>» Pliers<br>» Cutting tools<br>» Marking off tools<br>» Hammers<br>• **Classification and application** of measuring equipment:<br>» Vernier calliper<br>» Inside micrometre<br>» Outside micrometre<br>» Combination set<br>» Thread Pitch gauge<br><br>**Power tools**<br>• Power supply and connection to equipment<br>» Pedestal Drill press (levers, base, table, depth gauge, column, motor, chuck, spindle and safety guards)<br>» Angle grinder (disc safety guards, switches)<br>• **Vehicle lifting equipment:**<br>» Trolley jack (revision from Grade 8)<br>• Four-Post Hoist<br>» Description<br>» Safe Operation of the four-post hoist<br>• Safety equipment needed when using lifting equipment:<br>» chock blocks<br>» trestles<br>» creepers.<br>• How to safely lift a vehicle<br><br>Practical Skill – Removing and fitting of a vehicle wheel |
| 1 WEEK | ENTREPRENEURSHIP | • What is entrepreneurship?<br>» Advertising on media platform<br>» Sourcing of funds<br>» Costing<br>• Business Plan<br><br>**Practical task**<br>• Conduct research and create a Business Plan. |

| WEEKS | TOPIC | CONTENT |
|---|---|---|
| 1 HOUR | **Formal Assessment** | The weeks allocated for formal assessment are integrated across the weeks planned for teaching and learning.<br>The assessment will consist of Practical Task/s with a 60% weighting and a Theory test with a 40% weighting. |
| **Revision and assessment**<br>Assignment = 50 marks: 40%<br>Practical = 50 marks: 60%<br>Time: 1 hour<br>Assignment to cover all work done in Term 1 | | |

## TERM 2

| HOURS | TOPIC | CONTENT |
|---|---|---|
| 2 WEEKS | MATERIALS | **Classification and application of materials:**<br>• Description<br>• Types of materials<br>• Introduction and classification of ferrous alloys, non-ferrous alloys, sheet metals and plastics.<br>• **Alloys**<br>» Ferrous Alloys<br>» Non-Ferrous Alloys<br>• **Sheet metals**<br>» Cold rolled sheets<br>» Galvanized sheets<br>» Expanded metals<br>• **Plastics**<br>» **Introduction to plastic**<br>» Thermoplastics<br>» Thermosetting<br>» Coding of Plastic<br><br>Practical Skill – Classification of plastics (chart with samples) |

| HOURS | TOPIC | CONTENT |
|---|---|---|
| 2 WEEKS | JOINING METHODS | • Introduction to Joining Methods<br>» Pop Riveting (theory and applications)<br>» Soldering – soft, silver and brazing (theory and applications)<br>» Arc welding theory only<br>• Identification of components (Welding machine)<br>• Identification of the following welding joints and symbols<br>» Lap joint<br>» Butt joint<br>» Welding symbols<br>• Robotic welding (introduction)<br><br>**Practical application**<br>• Learners to be exposed to the practical application of soldering. |
| 4 WEEKS | TERMINOLOGY | **Introduction to Centre Lathe, Milling machines and Heat Engines**<br>• Identification and purpose/function of machines and their components:<br>• **Centre lathe**<br>» Main function<br>» Components and their functions (headstock, chuck, chuck key, tool post. compound slide, cross slide, bed, lead screw, switch lever, tailstock and emergency brake).<br>• **Milling Machine**<br>» Main function<br>» Components and their functions (table, motor, levers, switches, spindle and stand)<br>• **Heat Engines**<br>» Main function<br>» Components and their functions – ***Grade 8 revision*** - (crankshaft, connecting rod, cylinder block, combustion chamber, inlet valve, cam, camshaft, spark plug, valve spring, exhaust valve, cylinder head, water jacket, piston, crankcase). |

| HOURS | TOPIC | CONTENT |
|---|---|---|
| **4 WEEKS** *(continued)* | | Engine terms (Top Dead Centre, Bottom Dead Centre, Stroke, Bore and Engine cycle)<br>• Operation: (FOUR (4) Stroke Petrol Engine)<br>» Intake<br>» Compression<br>» Power<br>» Exhaust |
| **Revision and Assessment**<br>Practical =50 marks =60%<br>• Mid-year Examination =80 marks = 40% | | |

## TERM 3

| HOURS | TOPIC | CONTENT |
|---|---|---|
| **3 WEEKS** | **MAINTENANCE** | • Definition of Maintenance<br>• Definition of Lubrication<br>• Lubrication services:<br>» The purpose of lubrication.<br>– Inspection frequency<br>– Types of maintenance<br>• Liquids:<br>» Inspection of levels and top up<br>– Inspection for defects (motor vehicle)<br>Engine Maintenance:<br>» Importance of regular maintenance<br>» Different replaceable components during a service.<br>• Automotive Batteries:<br>» (Lead, Acid Storage and Gel type batteries) –<br>» Handling and care.<br>– Identifying correct size and type for application<br><br>**Practical Skill** – Demonstration:<br>• Adherence to the OHSA procedures<br>• Using the template and identifying vehicle's replaceable components and fluids and check if they need maintenance/replacement/top up or not. Completion of the condition or maintenance report based on the findings. |

| HOURS | TOPIC | CONTENT |
|---|---|---|
| 5 WEEKS | BODY WORKS<br>PANEL BEATING | • **INTRODUCTION TO BODY WORKS**<br>» **Tools and materials**<br>– Disc Sanders<br>– Sanding blocks<br>– Body filler Grind and feather edging operation tool<br>– Electric disc sander/ Air driven disc sander<br>• **MATERIAL / ABRASIVES**<br>» P150 Hook it disc<br>» P320 Hook it disc<br>» P80 sandpaper<br>» P180 Sandpaper<br>» prep sol<br>» Metal cleaner<br>» Body Filler<br>» Spot putty<br>» Rags<br><br>**Perform surface preparation on a body panel grind and feather edging operations**<br>Practical demonstration<br>• Identify the type of panel and name the material it is made from.<br>• Identify and assess the body panel to be repaired.<br>• Wash panels in accordance with the workshop procedures.<br>• Grind and feather edging operations. |

| HOURS | TOPIC | CONTENT |
|---|---|---|
| **5 WEEKS** *(continued)* | **SPRAY PAINTING** | • **INTRODUCTION TO SPRAY PAINTING**<br>» PRIMERS<br>» Materials (identify the various types of primers)<br>– Primers<br>– Etch primer/ filler<br>– Plastic primers<br>– Medium Solid Spray filler<br>– 1K primers<br>– Guide Coats<br><br>**Practical demonstration**<br>• Identify and explain the use of the primer<br>• Masking of panel that need to be primed<br>• Demonstrate the correct use of Primers in accordance with manufactures' manuals<br>• Clean and store tools, equipment and material in accordance with workshop procedures. |
| **Revision and assessment** | | |
| Term3 Test = 50marks = 40%<br>Practical formal Assessment = 50 Marks, 60% | | |

## TERM 4

| WEEKS | TOPIC | CONTENT |
|---|---|---|
| **8 HOURS** | **REVISION AND PRACTICALS** | TERM 1-3 WORK |
| 2 HOURS | Formal Assessment – EXAMINATION | |

CHAPTER 1

# SUGGESTED ANSWERS

# Occupational health and safety

Learner's Book page 1

## Activity 1 Occupational Health and Safety

Learner's Book page 8

1. State the Act that regulates the health and safety in workshops.

**Model answer**

The Occupational Health and Safety Act, Act 85 of 1993.

2. Explain FIVE (5) general safety rules that must be adhered to when working in the workshop.

**Model answer**

Any FIVE (5) safety rule requirements:

- Do not enter or leave the workshop without your teacher's permission.
- Do not play or run around in the workshop.
- Know where the emergency stop buttons are positioned in the workshop.
- Wear an apron or an overall as it will protect your clothes and hold loose clothing.
- Always wear personal protective equipment (PPE) when in the workshop.
- Do not use a machine if you have not been shown how to operate it safely.
- Do not use machinery without permission.
- Wear goggles or a face shield when working on machines.
- Keep hands away from moving/rotating machinery.
- Use hand tools carefully, keeping both hands behind the cutting edge.
- Report any damage to machines/equipment as this could cause accidents.
- No food or drink are allowed in the workshop.
- Wear the correct protective equipment for the tools you are using.
- Tie up long hair.
- Turn off the machine before cleaning it.
- No one is permitted in a workshop under the influence of any illegal substance.
- No unauthorised people are allowed in the workshop.
- Never use tools and equipment without authority.

- Report any broken tools or machinery in the workshop.
- Never put sharp tools or instruments in your pocket.
- Return tools to their correct places after use.
- No smoking or drinking is allowed in the workshop.
- Always clean your workbench or work space before leaving the workshop.

3. Define an accident.

**Model answer**

An accident is an unplanned and uncontrolled incident caused by unsafe acts and unsafe conditions. Accidents caused by unsafe acts are the result of human error.

4. List FOUR (4) causes of accidents in the workshop.

**Model answer**

- Loose clothing
- Poor housekeeping
- Improper use of tools
- Inaccurate setting up of machinery

5. State FIVE (5) examples of unsafe acts in the workshop.

**Model answer**

Any FIVE (5) examples of unsafe acts:

- fooling or teasing your fellow learners
- failing to secure machinery
- placing objects in unsafe places
- making safety devices inoperative
- working without permission
- working at unsafe speeds
- using equipment carelessly
- lack of/or improper use of PPE
- bypass or removal of safety devices
- unsafe position/posture
- wearing loose clothing near machines
- failure to put warning signs where they are needed
- entering the workshop without permission
- improper adjusting of machines while it is in operation.

6. State FIVE (5) examples of unsafe conditions in the workshop.

**Model answer**

Any FIVE (5) examples of unsafe conditions:

- overcrowding in the workshop
- poor workshop ventilation
- poor lighting (dull) and unsafe workshop lighting (flashing)
- poor housekeeping
- unsafe constructed buildings
- overcrowding in the workshop
- working without the correct PPE
- no machine guards on machines and equipment
- wet slippery floors
- defective hand tools, machines, equipment, etc.
- poor workshop layout or workflow.

7. Collect FIVE (5) or more pictures and paste them into your writing book showing different personal protective equipment needed in your workshop.

**Model answer**

Learner's own work.

Learners are to research on the internet or in magazines. They are to print from the internet or cut out from magazines examples of personal protective equipment. It can be any of the following examples, but if not listed, an educator must then use their discretion.

Here are 10 different criteria used in PPE. It can include any of the following:

- Clothing such as overalls, high visibility vests, life jackets and padded suits. Each employee must have their own set in the correct size.
- Respiratory protective equipment, including masks.
- Eye and face protection, for example, safety glasses and face shields.
- Head protection with safety helmets.
- Hearing protective devices such as earplugs and earmuffs.
- When working at high levels, fall arrest harnesses.
- Skin protection (gloves and fire-resistant clothing)
- Protective footwear (safety boots and rubber boots with steel toe guards)
- Sun and heat protection when working outdoors (hats, sunscreen, shaded rest areas)
- Disposable protective clothing for working with chemical and biohazards.

8. State the safety features you would find with safety boots.

**Model answer**

Safety boots have the following safety features:

- steel-capped toe protection to protect your toes
- a non-slip sole to prevent slipping when the floor surface is wet from oil.

9. List FIVE (5) injuries that can be avoided when wearing gloves in the workshop.

**Model answer**

Any FIVE (5) injuries that can be avoided by selecting the correct safety gloves and ensuring that they are worn at the right times:

- puncture wounds
- cuts and scrapes
- heat and chemical burns
- hazardous substances that can irritate or be absorbed by the skin
- extreme heat or cold
- biological agents like bacteria and viruses
- loss of fingers, nails and skin
- needle stick injuries.

## Activity 2 **Housekeeping**

1. Why is it important to maintain good housekeeping in the workshop?

**Model answer**

Housekeeping is a crucial aspect of workplace safety and may prevent accidents and reduce the severity/consequences of accidents.

2. State FIVE (5) advantages of good housekeeping.

**Model answer**

Any FIVE (5) advantages of good housekeeping:

- fewer accidents
- increased life of the building, machinery, tools, etc.
- improved morale
- increased production and decreased costs
- better product quality with less spoilage and rework

- reduced costs as occasional clean-up is more expensive
- little or no time is lost in searching for tools
- material handling and transportation pick-up speed
- supervision, inspection, maintenance and production control functions become easier
- better use of floor space.

3. List THREE (3) ways to prevent workplace accidents due to slips, trips, and falls.

**Model answer**

- good housekeeping
- quality walking surfaces
- proper footwear.

**Notes to educator**

Split the learners into groups. Task them with investigating the current situation in the workshop and to identify possible unsafe conditions.

They then need to write a short report on the unsafe conditions and provide possible solutions to the unsafe conditions. The report can consist of the following headings:

The type of unsafe condition

Location in workshop

Solution for rectifying unsafe conditions.

Remember that:

learners must be taken to the workshop.

learner numbers must be controlled as overcrowding in workshops is not allowed.

learners must never enter a workshop without proper supervision.

## Activity 3 **Safety signs**

1. Classify each safety sign into its related group.

| | Sign | Group |
|---|---|---|
| A |  | |
| B |  | |
| C |  | |
| D |  | |
| E |  | |

**Model answer**

| | Sign | Group |
|---|---|---|
| A |  | Mandatory (Compulsory) signage |
| B |  | Informative signage |

| | Sign | Group |
|---|---|---|
| C |  | Prohibition signage |
| D |  | Fire prevention signage |
| E |  | Danger signage |

## Activity 4 **Fire safety**

1. What are the basic elements of fire?

**Model answer**

- heat
- fuel
- oxygen

2. What are the common causes of fires in the workshop?

**Model answer**

Possible cause of fire in a workshop could include:

- faulty electrical equipment
- clutter
- combustible materials
- human error
- negligence
- arson

3. State the practical ways to prevent fires from spreading.

**Model answer**

If a fire occurs in the workshop, follow these practical steps to prevent it from spreading:

- use fire safety equipment such as fire extinguishers or fire blankets
- regularly check smoke alarms
- close doors and windows
- have a clean and tidy workplace
- call emergency services as soon as possible.

4. List FIVE (5) fire equipment needed to conduct firefighting.

**Model answer**

Any FIVE (5) of the following firefighting equipment:

- fire extinguishers
- fire alarm systems
- smoke detectors
- fire extinguisher cylinder type
- fire suits
- fire sprinklers
- fire hydrants
- sand buckets

**Notes to educator**

Split the learners into groups. Task them with identifying the firefighting equipment currently available in the workshop. Instruct them to write a short report on the following:

- type of fire extinguisher
- date of service
- current condition
- the placement of fire extinguishers.

**Remember that:**

- learners must be taken to the workshop.
- learner numbers must be controlled as overcrowding in workshops is not allowed.
- learners must never enter a workshop without proper supervision.

## ACTIVITY 5 **FIRST AID**

1. Define the term first aid.

**Model answer**

First aid is defined as the initial care for an injured person when an injury happens. This is usually done by people who are not medical professionals, and happens before the medical staff arrive.

2. Explain the 3Ps for first aid.

**Model answer**

- Preserve life: Your first aim when providing first aid is to save lives.
- Prevent deterioration: You can stop the situation from worsening or complicating.
- Promote recovery: You can promote faster recovery by applying first aid.

3. What is the main principle in first aid response?

**Model answer**

Your safety comes before anyone's else safety – you should keep yourself alive and healthy to help others.

4. Name FIVE (5) appropriate factors that should be considered when providing first aid.

**Model answer**

Important factors to consider when providing first aid:

- call the appropriate emergency service number
- list all emergency telephone numbers for immediate access
- make sure you wear appropriate footwear – sharp object could be lying around
- there could be exposed electrical wiring in the workshop
- never place yourself between an injured person and the threat
- always keep a safe distance from the incident
- be aware of the risk of more fire and explosions

5. Explain how you would treat an open wound.

**Model answer**

Apply pressure around the wound and not over the protruding bone, to control any bleeding. Then secure the dressing with a bandage. Advise the casualty to keep still while you support the injured part to stop it from moving.

6. State THREE (3) causes of fractures.

**Model answer**

Any THREE (3) causes of fractures:

- falls from heights
- falls resulting from oil spills or water spills
- tripping over electrical wiring
- equipment falling on you
- accidently putting a limb in a machine.

7. List FIVE (5) symptoms of a person who suffers from a fracture.

**Model answer**

Symptoms of fractures include:

- pain
- swelling
- a snapping sound heard when bones break
- the deformed appearance of a limb
- skin bruising or bleeding

8. Explain how you would assist a person in shock while providing first aid treatment.

**Model answer**

The following steps should be taken when a person is in shock:

- Call the emergency response team.
- Lay the person down, if possible: elevate the person's feet about 30 centimetres unless head, neck, or back is injured or you suspect broken hip or leg bones; do not raise the person's head; turn the person on the side if they are vomiting or bleeding from the mouth.
- Begin CPR if the person is not breathing or breathing seems weak. Continue CPR until help arrives or the person wakes up.
- Treat obvious injuries.
- Keep the person warm and comfortable: loosen restrictive clothing; cover with a coat or blanket; keep the person still – do not move the person unless there is danger; reassure the person; do not give anything to eat or drink.

## Practical tasks

Demonstrate how to treat a person using suitable first aid.

### Model answer

Assist the learners with this task. You could arrange a demonstration of first aid equipment.

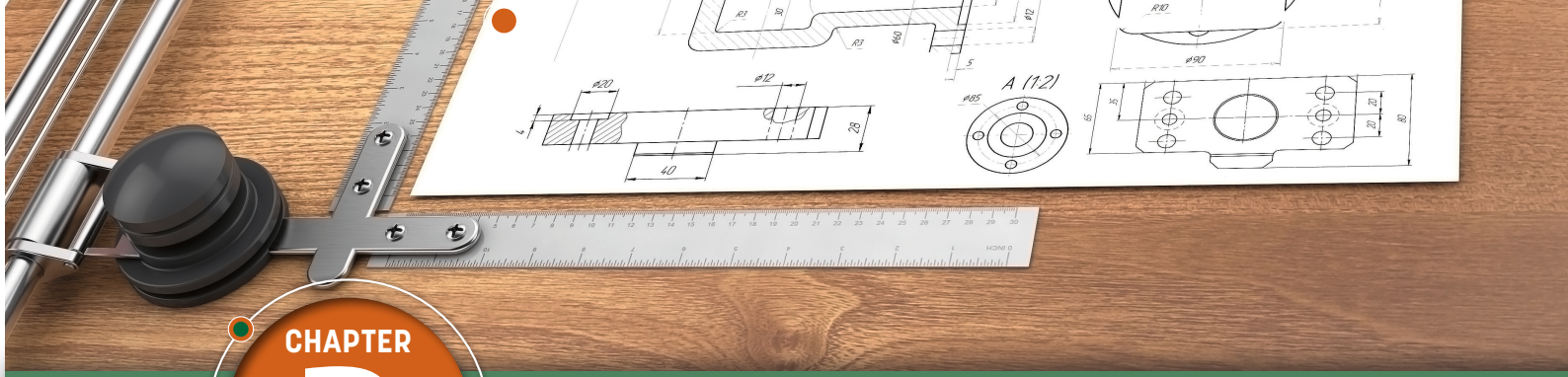
### Notes to educator

Prepare for the exercises. Practice equipment must be at hand. Divide learners into groups to practice on one another. Role play can be a very good form of teaching.

**How to use role play:**

- Step 1: Identify the situation. To start the process, gather learners together, introduce the problem, and encourage an open discussion to uncover all of the relevant issues.
- Step 2: Add details.
- Step 3: Assign roles.
- Step 4: Act out the scenario.
- Step 5: Discuss what they have learnt.

Once learners have completed practicing, ask them to work in their groups and to use the knowledge they have gained to prepare the posters, which they will present to the rest of the class.



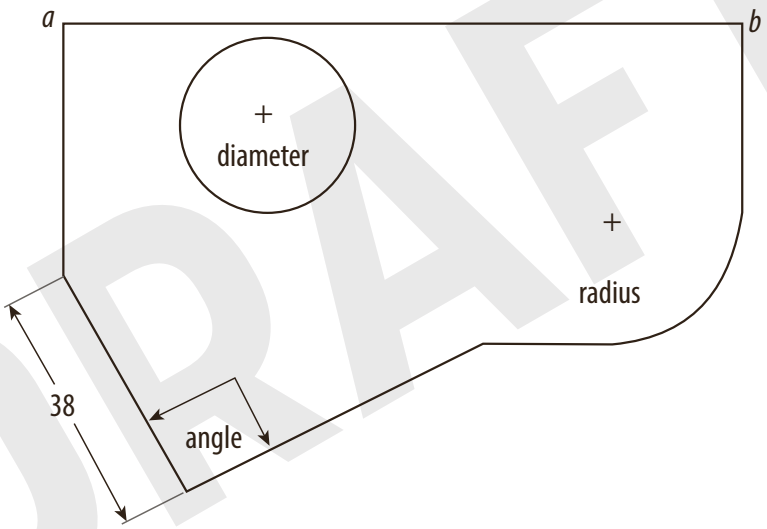
CHAPTER 2

# Graphic Communication

## Activity 1 **Types of lines**

Learner's Book page xx

1. Measure and insert dimensions on:
   a) line ab
   b) the diameter
   c) the radius
   d) the angle






### Model answer

Make copies of this figure and instruct the learners to use a pair of dividers to measure line ab, the diameter and the radius. They will then use the protractor to measure the angle.

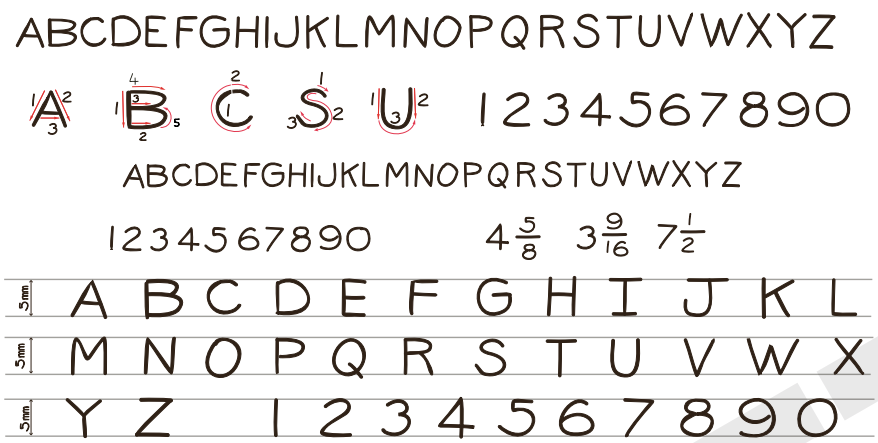
Measure your own copy to determine the marking guide.

## Activity 2

Learner's Book page xx

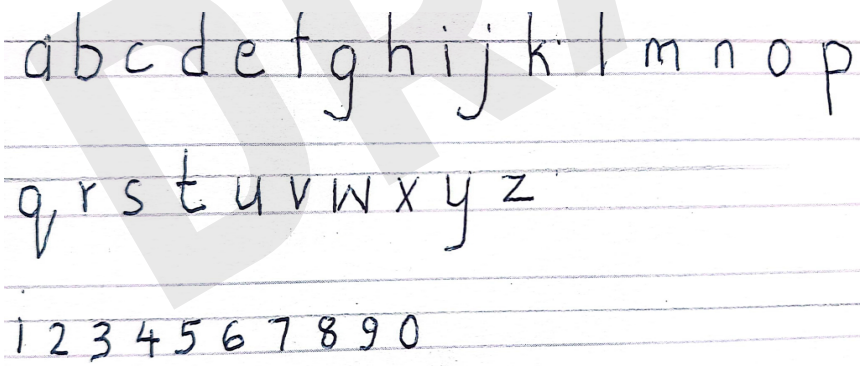
1. Print the given alphabet letters in capitals and print the given numbers.
   Use very feint **5 mm** guide lines.
   A B C D E F G H I J K L M N
   O P Q R S T U V W X Y Z
   1 2 3 4 5 6 7 8 9 0

**Model answer**




2. Print the given alphabets in small caps/lower case letters and print the given numbers.
   Use very feint **3 mm** guide lines.
   a b c d e f g h i j k l m n o p q r s t u v w x y z
   1 2 3 4 5 6 7 8 9 0

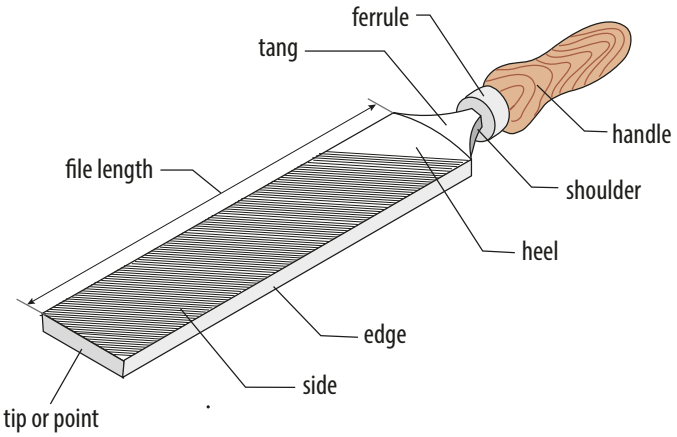
**Model answer**



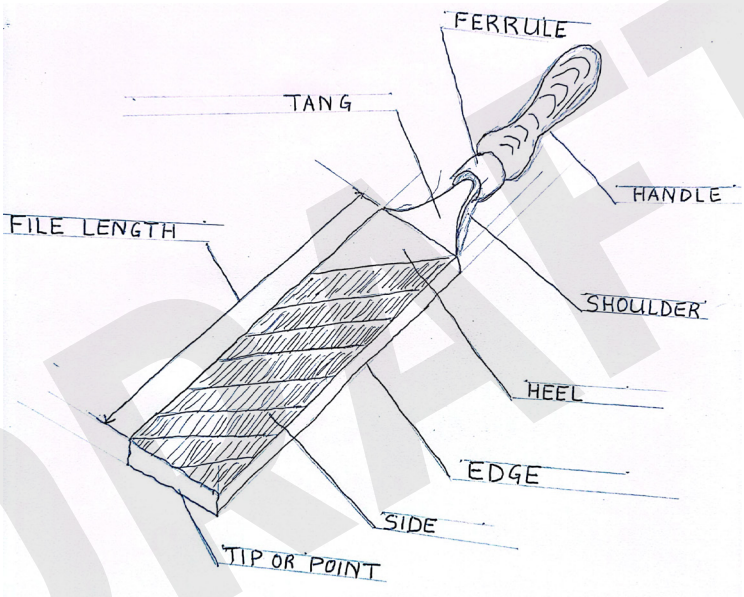
## Activity 3

Learner's Book page xx

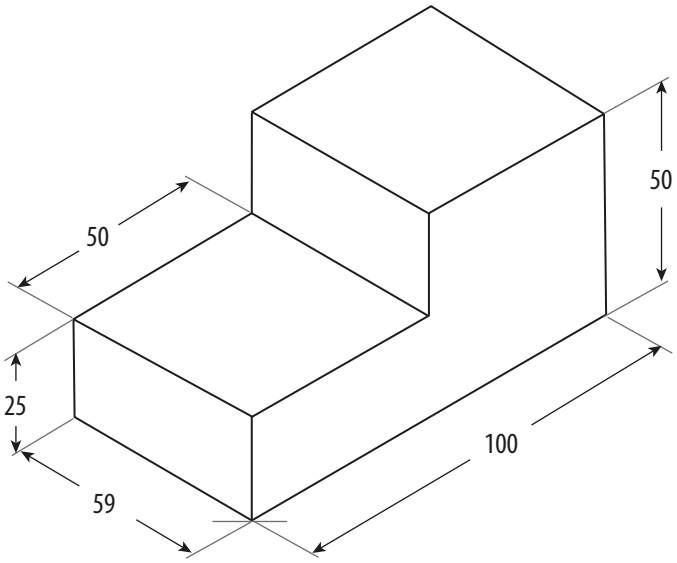
1. Using a freehand drawing, redraw the following tool and label it using freehand lettering.



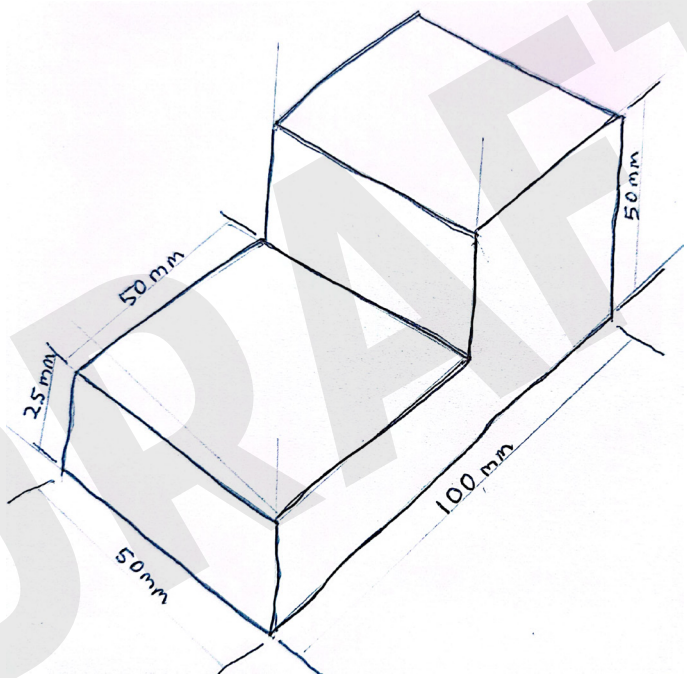

### Model answer



2. Using a freehand drawing, redraw the following figure and insert freehand dimensions.



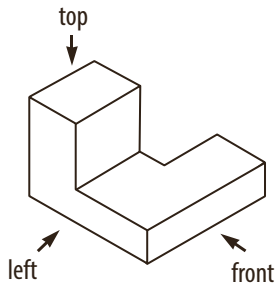
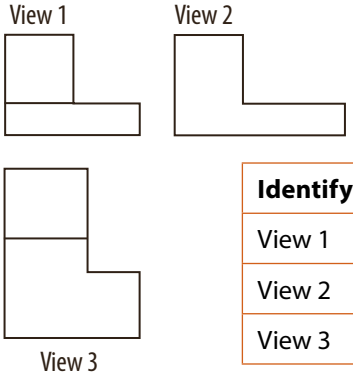
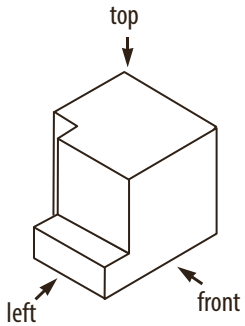
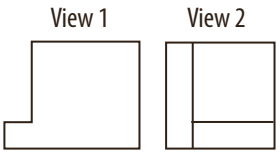
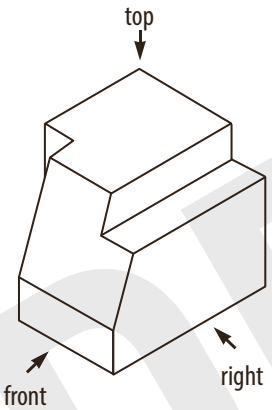
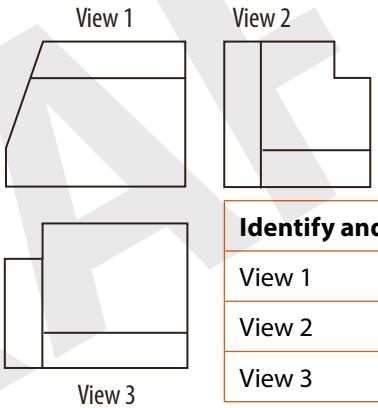

**Model answer**






## Activity 4 **Orthographic projections and isometric drawings** Learner's Book page xx

1. Study the drawings in the pictorial view column of the table below.
   The column labelled ORTHOGRAPHIC VIEW shows three views of an object.
   Each orthographic drawing represents either the Front, Left, Right and Top view.

| Pictorial view | Orthographical view |
|---|---|
|  |  |
|  |  |
|  |  |

| Identify and name each view | |
|---|---|
| View 1 | |
| View 2 | |
| View 3 | |

| Identify and name each view | |
|---|---|
| View 1 | |
| View 2 | |

| Identify and name each view | |
|---|---|
| View 1 | |
| View 2 | |
| View 3 | |

Identify the views and present your answer in a table as shown.
Write one of the following: Front, Left, Right or Top.

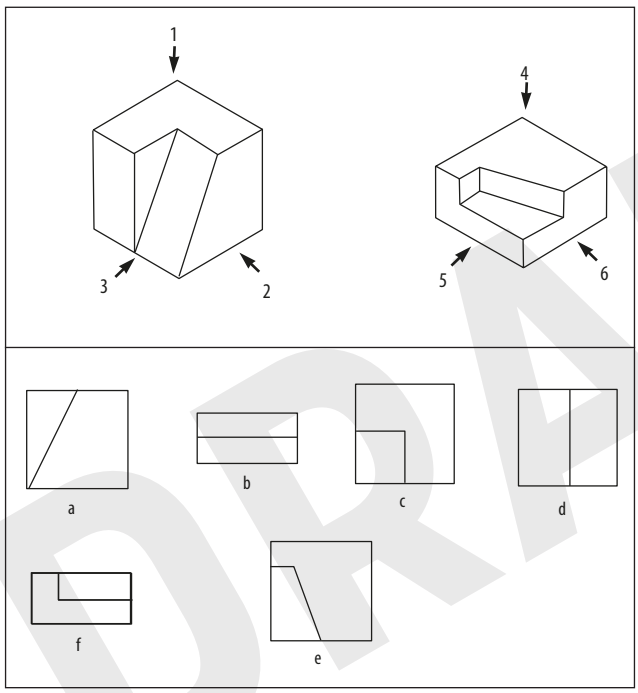
**Model answer**

| Identify and name each view | |
|---|---|
| View 1 | **Front** |
| View 2 | **Left** |
| View 3 | **Top** |

| Identify and name each view | |
|---|---|
| View 1 | **Right** |
| View 2 | **Left** |

| Identify and name each view | |
|---|---|
| View 1 | **Right** |
| View 2 | **Front** |
| View 3 | **Top** |

**2.** Study the isometric drawings in the upper block, below.
The lower block shows letters on orthographic views, which can be linked to the numbers on the isometric drawings.
Match the letters with the corresponding numbered isometric drawing.




| Match the numbers with the letters | | Front, Left, Right or Top |
|---|---|---|
| **1** | | |
| **2** | | |
| **3** | | |
| **4** | | |
| **5** | | |
| **6** | | |



**Model answer**

| Match the numbers with alphabets | | Front, Left, Right or Top |
|---|---|---|
| **1** | c | Top |
| **2** | a | Right |
| **3** | d | Left |
| **4** | e | Top |
| **5** | b | Right |
| **6** | f | Left |

CHAPTER 3

# Tools, instruments and equipment

## Activity 1 Screwdrivers

1. Name the THREE (3) parts of the screwdriver and state what materials are those parts made of.

| Part | Material |
|---|---|
| | |
| | |
| | |

### Model answer

Screwdriver parts and material, they made off.

| Part | Material |
|---|---|
| handle | Made from hardened plastic to improve grip and prevent the tool from slipping when is used. |
| shaft | Made from tough steel to resist bending or twisting |
| tip | Hardened to resist wear and treated with dark tip coating for improved visual contrast between the tip and screw. |

2. Explain FOUR (4) ways to care for screwdrivers.

### Model answer

Follow these guidelines to care for your screwdrivers:

- never use the screwdriver as a chisel
- do not put the screwdriver in your pocket
- do not use the screwdriver on screws that are hard to turn
- clean the tool after use and oil lightly.

3. State the use of offset screwdrivers.

**Model answer**

Used where space is limited and where ordinary screwdrivers will not reach or fit.

## Activity 2 **Spanners**

4. When would you use an open-ended/flat spanner?

**Model answer**

Open-ended or flat spanners are single-piece tools that can be used on most fasteners around the home and across industries. The open-ended spanner is generally used for loosening or fastening bolts and nuts.

5. Why would you use a ratchet?

**Model answer**

A ratchet is used to loosen and tighten bolts and nuts, without taking it out to turn it again.

6. Which accessories would you use with rachets?

**Model answer**

Accessories that are used with ratchets:

- T-handle
- speed handle/the brace
- extension
- universal coupling
- sockets

7. Choose the correct answer from the list to make the following statement correct.
   When working with hand tools, always…
   a) push the wrench – do not pull toward you.
   b) pull a wrench – do not push a wrench.

**Model answer**

b) pull a wrench – do not push a wrench.

## Activity 3 **Pliers**

1. What are circlip pliers generally used for?

**Model answer**

A circlip plier fits or removes inside or outside circlips in/from grooves.

2. Name the pliers used to cut split pins.

**Model answer**

side cutter

3. Name the reasons why the handles of pliers are insulated.

**Model answer**

The metal handle of the pliers is insulated for better handling to prevent electrical shock.

4. Give FOUR (4) uses of pliers.

**Model answer**

They are used to grip, position, tighten, loosen, and cut certain metal elements.

5. Explain how the lifespan of pliers can be enhanced.

To care for pliers:

- either hang pliers on the pegboard or put them in the toolbox
- keep the pliers in a dry place
- clean the plier after each use
- prevent corrosion and rust as it shortens the lifespan of tools
- oil the pliers on the pivot joint.

## Activity 4 **Chisels**

1. Explain the uses of the following chisels.
   a) flat chisel
   b) crosscut chisels
   c) round nose chisel
   d) diamond chisel

**Model answer**

a) A flat chisel is used for general dressing, chipping, and cutting.

b) A cross-cut chisel cuts grooves, slots, recesses and keyways.

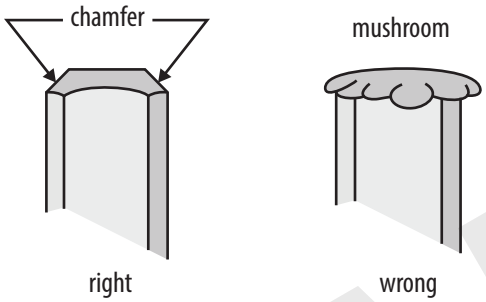
c) Round nose chisels are used for cutting oil grooves on a long flat, or convex surface. The curved type is used for cutting oil grooves along the curved surface of a bearing.

d) A diamond point chisel is used for finishing off and cleaning out corners and for cutting "v" grooves.

2. The term *mushroomed* refers to the damage the hammer does to the chisel head. Draw a freehand sketch to show a mushroomed head.

**Model answer**

Sketch to show a mushroomed head:




## Activity 5 **Hacksaw**

1. The type of hacksaw blade will determine what material you can cut. Indicate the type of blade needed to cut the following material:
   a) copper pipe
   b) high carbon steel

**Model answer**

a) copper pipe – medium carbon-steel blades.

b) high carbon steel – high-speed steel blades.

2. Name THREE (3) reasons that will cause a hacksaw blade to snap or break.

**Model answers**

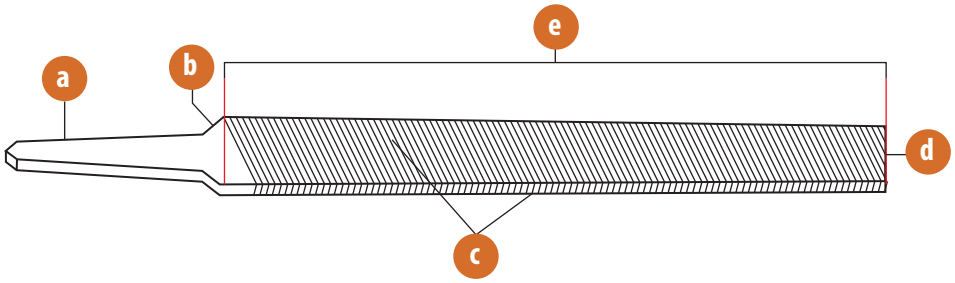
Any of the following THREE (3) reasons will cause a hacksaw blade to snap or break.

- skewed sawing motion
- incorrect tension
- cutting at sharp angles

- metal not firmly clamped
- blade binding in the cut

## Activity 6 Files

1. Label the parts on a file A – E.




### Model answer

1. File labels
   a) tang
   b) shoulder
   c) cutting edges
   d) point/tip
   e) file length

2. Name TWO (2) materials that file handles are made of.

### Model answer

File handles are made of wood or plastic.

3. Complete the following table by inserting the file name and stating their use.

| File | Name | Uses |
|---|---|---|
|  | | |
|  | | |
|  | | |
|  | | |
|  | | |

**Model answer**

| File | Name | Uses |
|---|---|---|
|  | triangular file | The file is used to sharpen saw teeth and to file corners less than 90° |
|  | square file | It is used for filing corners, slots, and square holes. |
|  | round file | It is used for open-up holes and for filing around corners. |
|  | flat file | It is used for general work. |
|  | half-round file | It is used for filing corners of less than 90° and concave surfaces. |

## Activity 7 **Stocks, taps and dies**

1. What tool is used to cut external threads?

**Model answer**

Die

2. Name the tools used to cut internal threads in their correct sequence?

**Model answer**

Stage 1 – taper tap is used to start a tap or used in a blind hole.
Stage 2 – second or intermediate tap is used to cut more deeply where the taper tap could not reach
Stage 3 – plug or bottoming tap is used as a final tap threading to the bottom of the hole

3. What tool is used to hold the taps?

**Model answer**

stock

## Activity 8 **Dividers and dalipers**

1. Name TWO (2) methods to care for an engineer's square.

**Model answer**

Any TWO (2) of the following to care for an engineer's square.

- never drop it on the floor as it will lose accuracy
- oil it with a thin film of oil to prevent rust
- return in its place after use.

2. When will a calliper be used?

**Model answer**

Callipers take measurements when a steel rule cannot be used.

3. Which calliper is used to measure?
   a) internal dimensions
   b) outside shapes

**Model answer**

a) Inside callipers are used to measure the inside hole diameter/Internal dimensions.

b) Outside callipers are used to measure outside shapes, such as round or square workpieces.

4. What are the following dividers used for?
   a) straight divider
   b) odd leg dividers/Hermaphrodite divider

**Model answer**

a) The straight divider is used to layout circles and curves for lathe drilling, cutting, or shaping.

b) The odd leg divider is used to find the centre of round objects as well as to scribe lines parallel to the edge of the stock.

## Activity 9 **Hammers**

1. Name THREE (3) types of hammers and their uses.

**Model answer**

| | |
|---|---|
| ball pein | • It is used for hitting and the peen is used for riveting. |
| cross-peen | • A ball-peen hammer has a cross peen and a face and is used in metalworking. The most important use of the cross-peen hammer is forging and riveting. |
| mallet | • A soft-face hammer is good for working on gearboxes, final drive components and surfaces that may be damaged by using a metal hammer. |

2. Which materials are commonly used on the head of a mallet?

**Model answer**

- rubber
- copper
- plastic

3. Why must you wear safety goggles when using a hammer?

**Model answer**

To prevent flying chips or nails from injuring your eyes.

## Activity 10 **Measuring tool**

1. Name THREE (3) types of vernier callipers.

**Model answer**

digital vernier, dial type vernier and vernier scale calliper

2. Which THREE (3) measurements can be measured using the vernier calliper?

**Model answer**

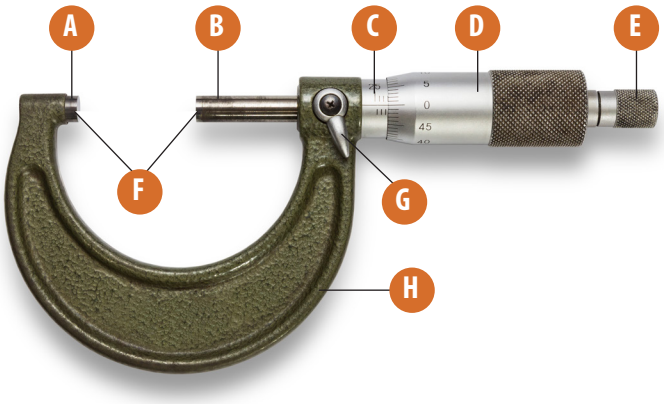
inside diameter, outside diameter and depth length/height

3. What tool is used to find the thread pitch?

**Model answer**

thread pitch gauge

4. Below is the inside micrometre. Label it from A – H.




**Model answer**

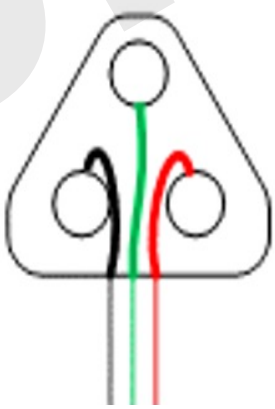
a) anvil
b) spindle
c) sleeve with vernier graduations
d) thimble
e) ratchet
f) measuring faces
g) lock
h) frame

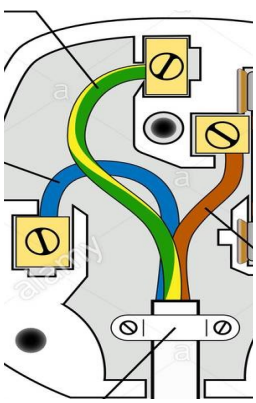
## Activity 11 Power Tools

1. Draw a neat sketch of the correct wiring and the colour of the wiring of a three-point plug.

**Model answer**

Three-point plug





Bottom right: Brown/red cable: Live
Bottom left: Blue/black cable: Neutral
Top: Green/Yellow cable: Earth

2. Name FOUR (4) safety rules that you must apply before you can work on a power tool.

**Model answer**

Any FOUR (4) safety rules before working on a power tool:

- When working with power tools, the plug must be wired correctly.
- Ensure there are no frayed cables.
- Do not use a machine with loose wires.
- The area around the operator must be dry.
- There must be no oil or water spills on the floor.

3. State FOUR (4) rules to observe when working on the drill press.

**Model answer**

When working on a drill press, follow the following guidelines:

- ensure that you do not use excessive force when drilling
- use coolant to keep the tool cool
- ensure the drill press is switched off after each use
- clean the machine after each use.

4. Name TWO (2) pre-checks on a grinding wheel.

**Model answer**

Any TWO (2) of the following pre-checks on a grinding wheel.

- ensure the gap between the grinding wheel and the tool rest is not more than 3 mm
- ensure the spark deflector is in place
- always check the grinding wheel for cracks
- use a ring test to ensure the grinding wheel is not hollow.

5. Name THREE (3) safety rules to observe when working with an angle grinder.

**Model answer**

Any THREE (3) safety rules when working with an angle grinder.

- always wear goggles when using an angle grinder
- use only the front of the cutting disc while the workpiece is on a workbench vice
- ensure the safety guard is in place
- never leave the angle grinder on after the task is done
- after switching the angle grinder off, wait until the disc stops rotating to prevent damage to the machine.

## Activity 12 **Vehicle Lifting Equipment**

1. Which hoist is commonly used in an automotive workshop?

**Model answer**

four-post hoists

2. What are the THREE (3) ways used to operate these hoists?

**Model answer**

electrical, pneumatics and hydraulics

3. What is the advantage of using the trolley jack in the workshop?

**Model answer**

It can be moved to the needed jacking points to raise a vehicle off the ground on one side.

4. When is it necessary to use the following items?
   a) chock blocks
   b) trestles

**Model answer**

a) Chock blocks prevent the vehicle wheels from rolling when the car is jacked.

b) Trestles support a vehicle when it is jacked to prevent it from falling.

## Practical task

Safely lift a vehicle to remove and replace a wheel.

**Model answer**

Assist the learners with this task.

### Notes to educator

You could demonstrate how to safely lift a vehicle to remove and replace a wheel before allowing the learners to work in groups to complete the task. The vehicle jacking points can be found in the manufacturer's manual.

**How to safely lift a vehicle**

Explain to learners that they need to understand how to do this activity safely by following these steps to lift a vehicle:

- make sure the vehicle is on a flat, level surface
- turn the engine off
- put automatic vehicles in park and manual vehicles in neutral
- engage the handbrake
- chock the wheels that will not be lifted by wedging chock blocks in front of and behind the wheels
- jack the vehicle with the correct capacity on the jacking points
- make sure the vehicle is raised slowly. Check that the vehicle is balanced.
- use trestles to support the weight of the raised vehicle
- lightly knock the vehicle to ensure it is properly supported and will not fall once you start working underneath it
- lay on a creeper when working underneath the vehicle
- remove the trestle before you lower the vehicle.

CHAPTER 4

# Entrepreneurship

## ACTIVITY 1 DEFINING ENTREPRENEURSHIP

1. Define the term "entrepreneurship" and list FIVE (5) reasons why someone would choose to become an entrepreneur.

### Model answer

An entrepreneur is a person who starts with an idea, then takes the risk of investing money into that idea in order to start a business. They see a problem in the world and immediately focus on creating a solution. It could be a problem that many people struggle with daily; a way in which to unite people in a unique way; or a way in which to build a revolutionary product that benefits society at large. But being an entrepreneur is not always easy – but entrepreneurs take action to make a positive change in the world. They are leaders that strike out on their own to improve society – whether they are creating jobs or a new product – they constantly take action to ensure world progress.

Here are some of the reasons why people become entrepreneurs:

- **To change the world:** Many entrepreneurs strive to make the world a better place for themselves and future generations. Whether they believe in space exploration, eliminating poverty, or creating a practical but game-changing product, they ultimately build a brand in service of others. Some entrepreneurs use their businesses as a way to raise capital quickly to funnel into their causes. For these social entrepreneurs, building an empire is about creating a better world for everyone.
- **They don't want a boss:** Entrepreneurs often struggle with having a boss. They feel suffocated, restricted, and held back. Some may feel that they have a more effective way of doing things. Others may dislike the lack of creative freedom. Ultimately, they become attracted to entrepreneurship to succeed on their own terms. Being the boss can be more fulfilling than having one!
- **They want flexible working hours:** Entrepreneurship is often popular among those who need flexible working hours. Many people with disabilities often enjoy entrepreneurship because it allows them to work when they are able to. Parents with young children might also prefer entrepreneurship because it allows them to raise young children at home or pick them up from school without having to feel guilty about it.

- **They're risk-takers:** Calculated risk-taking and entrepreneurship go hand in hand. Entrepreneurs don't apply for jobs – they create them. But with that comes risk – whether it's the financial risk of starting your first brand or the risk of not knowing what to expect – business is risky. Entrepreneurs are often taking risks by trying things the average person would not normally do, to do things the average person can't normally do.
- **They can't find a job:** Many stumble into entrepreneurship when they can't find a job. Getting fired or a lack of experience, etc., can prevent a person from getting a job. Instead of being satisfied with their situation, these entrepreneurs create new opportunities for themselves.
- **They don't fit into the corporate environment:** Entrepreneurs don't often thrive in corporate environments because it often restricts their growth. They may dislike the lack of control they have in their role or they may dislike having to deal with every day office politics. These entrepreneurs usually try to gain more control in their roles and they tend to learn about their co-workers' responsibilities to better understand how everything fits together.
- **They're curious:** Entrepreneurs love finding out the answer to the question, 'what will happen if…'. They're experimental and love to learn. They regularly read business and other books to advance their knowledge.
- **They're ambitious:** Those who love reaching difficult goals and milestones are made to be entrepreneurs. There's no limit to how much an entrepreneur can earn, so they can always work to achieve higher levels of greatness. Entrepreneurs constantly grow and achieve more than they ever imagined. (ANY 5)

2. There are four major types of entrepreneurships. Explain TWO (2) types and provide examples of companies/businesses in your community that fits into that type.

**Model answer**

There are four major types of entrepreneurship. These are:

- small business entrepreneurship, which makes up 99% of all companies and employs more than half of the non-government workforce.
- scalable start-up entrepreneurship, which focuses on finding a scalable business model.
- large company entrepreneurship, where large conglomerates work together to remain innovative and create cutting-edge businesses.
- social entrepreneurship, which uses an approach in which entrepreneurs develop, fund and implement solutions to solve social, cultural or environmental issues. (ANY 2)

## ACTIVITY 2 WHAT AFFECTS ENTREPRENEURSHIP

1. Name FOUR (4) factors that influence entrepreneurship and explain each one.

**Model answer**

- Political factors play a big role in the development of entrepreneurship. Most of the time, politicians have the responsibility to decide what type of market is in place in a country. Some countries may adopt a capitalistic or communist economy, while other countries may adopt a mixed economy. Each market has different implications for how entrepreneurs are required to function – capitalism requires innovative entrepreneurs, whereas communism requires well-connected entrepreneurs.
- **Legal factors** – Entrepreneurs are governed by the laws of the country in which they operate. These laws affect entrepreneurship because entrepreneurs need to abide by several legal requirements to operate successfully, for example, courts can enforce contracts that were entered into by an entrepreneur and another contracting party. The provision of declaring bankruptcy has also been positively associated with the development of entrepreneurship because many entrepreneurs fail a few times before they find the right innovation that leads to their success.
- **Taxation** – The government controls the market through provisions of taxation, which is necessary to maintain legal and administrative systems for the entire economy. Where tax regimes are restrictive, many entrepreneurs leave because they want to operate in places where there is minimal interference from the government.
- **Availability of capital** – Entrepreneurs require capital to start risky ventures and also require instant capital to scale up the business quickly if the idea is successful. Therefore, countries that have a well-developed system of providing capital at every stage – seed capital, venture capital, private equity, and well-developed stock and bond markets – experience a higher degree of economic growth led by entrepreneurship.
- **Labour markets** – Labour is an important factor of production for almost any kind of product or service. The availability of skilled labour at reasonable prices is an important factor for any entrepreneur. With the advent of globalisation, entrepreneurs have the freedom to move their operations to countries where labour markets are more favourable to them.
- **Raw materials** are natural resources that are essential for any industry. Entrepreneurs source raw materials that are affordable so that their business can remain profitable.

(ANY 4)

2. a) Explain these terms: online presence and brand identity.
   b) Find an example of an online brand and write a brief report about their online presence and brand identity.

### Model answer

a) Online presence is the existence in digital media through the different online search systems; brand identity is the visible elements of a brand, such as colour, design, and logo, that identify and distinguish the brand in consumers' minds.

b) Learner's own work.

3. Name the elements that must be included in your business plan.

### Model answer

A business plan includes the following elements:

- **Executive summary** – a snapshot of your business and its offerings
- **Company description** – a description of what the business does
- **Market analysis** – research on the industry, market and competitors
- **Organisation and management** – your business and management structure
- **Service or product** – the products or services the business offers
- **Marketing and sales** – how the business will handle marketing and your sales strategy
- **Funding request** – how much money you will need for the next three to five years
- **Financial projections** – supply information like balance sheets and income projections
- **Appendix** – an optional section that includes CVs and permits

## Practical task

Draw up a business plan including all the requirements covered in this chapter that you will present to potential investors.

### Model answer

Assist the learners with this task.

### Notes to educator

Give the learners ample time to complete this task. It can be done at home and must include all the resources the learners used to do this task, including the research websites. The learners must be creative on this task and hand it in as a portfolio task.

Explain to them that they can use the links provided in the Learner's Book, or find information of their own for their research to start to draft a business plan. The business plan needs to be presented to possible investors to obtain funding for your business. Therefore, it must include all nine requirements they have learnt about in this chapter.

CHAPTER 5

# Materials

## Activity 1 **Materials**

Learner's Book page xx

1. What is an alloy?

**Model answer**

An alloy is a mixture of two or more elements.

2. Explain the difference between ferrous and non-ferrous alloys.

**Model answer**

Ferrous alloys are alloys that contain iron in their composition.
Non-ferrous are alloys that do not contain iron.

3. What is the composition of stainless steel?

**Model answer**

An alloy is a mixture of two or more elements.

4. Give TWO (2) examples where stainless steel is used in our daily lives.

**Model answer**

Stainless steel comprises iron + carbon + chromium.
They are used in cutlery and kitchen utensils.

5. What is the composition of brass?

**Model answer**

An alloy is a mixture of two or more elements.
Brass consists of copper + zinc.

6. Name TWO (2) uses of silver.

**Model answer**

They are used in jewellery and silverware.

## Activity 2 Alloys and sheet metals

1. How does an expanded steel metal differ from ordinary sheet metal?

**Model answer**

The expanded sheet has been slit and stretched; ordinary sheet metal is not slit and stretched.

2. Expanded steel metal offers advantages compared to sheet metal.
   Mention TWO (2) of these advantages.

**Model answer**

Any TWO (2) of advantages of expanded steel:

- light weight
- free passage for light
- free passage for liquid
- free passage for sound
- free passage for air
- decorative

(ANY 2)

3. What is the importance of galvanising?

**Model answer**

Galvanising prevents rust on steel or iron.

4. Briefly explain how galvanising is done.

**Model answer**

Sheet metal is dipped in a bath of molten hot zinc.

## Activity 3 **Materials**

1. Explain the differences between thermoplastic plastic and thermosetting plastic?

### Model answer

Thermoplastics:

- Thermoplastics can soften when heated and harden again when cooling. They are more like candle wax melting when heated than solidify when cooled.
- They are less rigid and can be moulded.

Thermosetting plastics

- Thermosetting plastic (Thermosets) can soften when heated and then cooled and cannot return to its original state when reheated.
- They are hard and cannot be softened again.

2. Coding is very important in the usage of plastic.
   a) What is the importance of this coding?
   b) Choose TWO (2) plastic codes, then explain what it means and discuss whether they can be recycled or not.

### Model answer

a) The Plastics Industry Association codes plastics for easy classification and recycling purposes. Each plastic product that is manufactured will have a code (1 – 7) that can be used to sort materials for recycling. Figure 5.6 shows the different codes for the types of plastics.

b) Any TWO (2) of the following:

- The identification code with a **1** is used for PET plastic, which is widely used for food and beverage packaging. It is also used for carbonated drink bottles, water bottles, plastic jars, punnets, trays, strapping tape, etc.
- The identification code with a **2** means the plastic is made from PE-HD plastic. This type of plastic is known for its strength and hardness and is often used to manufacture milk bottles, fruit juice bottles, plastic drums, buckets, crates, bins and shampoo bottles.
- The identification code with a **3** means the plastic is made from PVC, a sturdy and durable polymer. PVC is commonly used to manufacture irrigation pipes, toys, tamper-proof medicine seals, plastic gutters, shrink wrapping, conduit and more.
- The identification code with a **4** means the plastic is made from PE-LD plastics, and includes products such as grocery bags, packets, cling film, bubble wrap and sandwich bags.
- The identification code with a **5** means the plastic is made from PP plastic, a temperature-resistant polymer used to manufacture ice cream containers, kettles, straws, microwave dishes, garden furniture, bottle caps and takeaway cutlery.

- The identification code with a **6** means the plastic is made from polystyrene, which comes in two types: expanded PS and hardened PS. Expanded PS is often used as packaging fillers and takeaway food containers, while hardened PS is used to manufacture coat hangers, bread tags and yoghurt cups.
- The identification code with a **7** means the plastic is made from any other type of plastic polymer, which could contain several acronyms such as ABS, E/VAC, POM, PC, PETG, PA and a combination of these acronyms. These types are difficult to recycle, and they are frequently used to manufacture jungle gyms and walkways that will last for years despite weather conditions, outdoor furniture, etc.

## Practical task

Identifying the different types of plastics and their uses.

### Notes to educator

Have several plastic objects available. Learners must turn the objects upside down and look for the symbol for the recycling codes. Provide the worksheet for the learners to complete.

## Practical task worksheet

GRADE 9 _____

PRACTICAL APPLICATION (Application of plastics)

Group work

Group member names and surnames

| | |
|---|---|
| | |
| | |
| | |

| | Code and name of the type of plastic | Properties | Products that could be made from this plastic | Reason |
|---|---|---|---|---|
| Object 1 | | | | |
| Object 2 | | | | |

| | Code and name of the type of plastic | Properties | Products that could be made from this plastic | Reason |
|---|---|---|---|---|
| Object 3 | | | | |
| Object 4 | | | | |

**Model answer**

## Practical task worksheet

GRADE 9 _____

PRACTICAL APPLICATION (Application of plastics)

Group work

Group member names and surnames

| | |
|---|---|
| | |
| | |
| | |

| | Code and name of the type of plastic | Properties | Products that could be made from this plastic | Reason |
|---|---|---|---|---|
| Object 1 | PET<br>polyester | Heat-resistant.<br>Clear; tough; | Cool drink bottles; food containers | |
| Object 2 | HDPE<br>High-density polyethene | Chemical-resistant; tough.<br>rigid | Pipes; bottles.<br>Bins; buckets | |
| Object 3 | PVC<br>Polyvinyl chloride | Tough; flexible.<br>Electrical insulation | Garden hoses; gutters; electrical boxes | |
| Object 4 | LDPE<br>Low density polyethene | Flexible; tough.<br>Good for sealing moisture | Garbage bags.<br>Floor tiles; bins | |

CHAPTER 6

# Joining methods

## Activity 1 Soldering

1. Name THREE (3) examples of permanent joints.

**Model answer**

riveting, soldering and arc welding

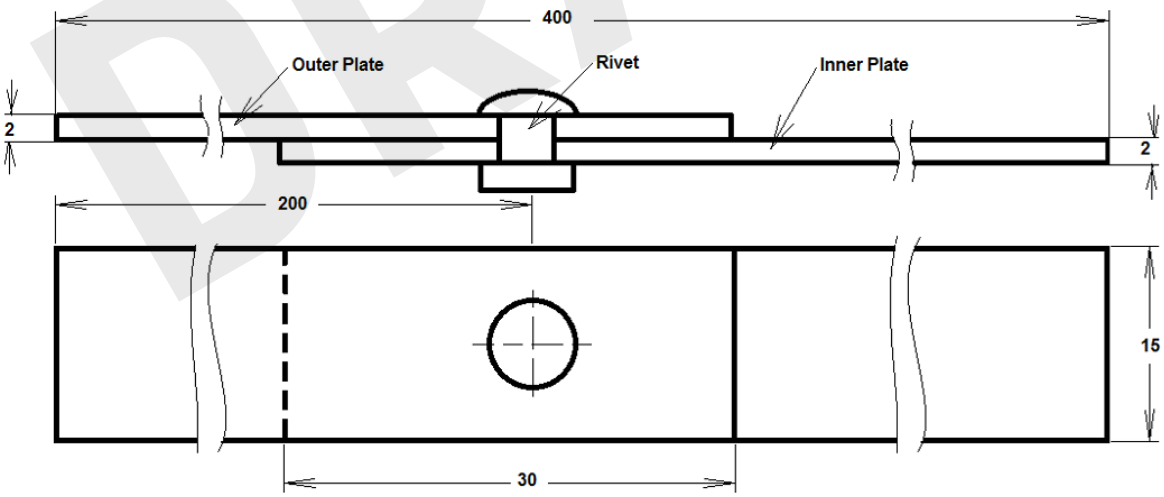
2. Explain what a rivet joint is.

**Model answer**

A riveted joint uses a headed pin or bolt of metal used for uniting two or more pieces bypassing the shank through a hole in each piece and then beating or pressing down the plain end to make a second head.

3. Draw a neat simple sketch of a lapped riveted joint.

**Model answer**



4. Give THREE (3) forms of soldering and explain each one.

**Model answer**

There are three types of soldering. These are:

- **soft soldering**, which originally used a tin-lead alloy as the filler metal
- **silver soldering**, which uses an alloy containing silver
- **brazing**, which uses a brass alloy for the filler.

5. List ONE (1) advantage and ONE (1) disadvantage of soft solder.

**Model answer**

Any ONE (1) of the following advantages:

- Soft soldering uses the lowest temperatures
- It thermally stresses components the least

Any ONE (1) of the following disadvantages:

- Soft soldering does not make a strong joint and is unsuitable for mechanical load-bearing applications
- It is unsuitable for high-temperature applications as it loses strength and eventually melts

6. List ONE (1) advantage and ONE (1) disadvantage of brazing.

**Model answer**

Advantage:
Brazing provides the strongest of the non-welded joints

Disadvantage:
Brazing requires the hottest temperatures to melt the filler metal, requiring a torch or other high-temperature source and darkened goggles to protect the eyes from the bright light produced by the white-hot work

7. Define the following terms:
    - joint design
    - pre-cleaning
    - fluxing
    - proper fixtures or alignment of parts
    - heating of the base metal

**Model answer**

- **joint design**: should be designed bearing in mind the requirements of solders and their limitations.

- **pre-cleaning**: the surfaces must be thoroughly cleaned to allow the solder to wet the base metal.
- **fluxing**: must be provided to remove traces of surface film or oxides and to prevent the formation of oxides during the soldering operation. Flux should promote the wetting of the surface by the solder.
- **proper fixtures or alignment of parts**: must be maintained to ensure a sound soldered joint.
- **heating of the base metals**: should be uniform or even on base metals, to ensure good penetration of the filler alloy into the joint. if a non-corrosive flux is used no further cleaning is necessary. the use of a corrosive flux makes flux residue removal imperative.

## Activity 2 Arc welding

1. Name the welding joints shown in A and B.


**Model answer**

a) Butt joint

b) Lap joint

2. Explain the term arc welding.

**Model answer**

Arc welding is a type of welding process that uses an electric arc to create heat to melt and join metals. A power supply creates an electric arc between a consumable or non-consumable electrode and the base material using either direct current (DC) or alternating current (AC). The welding area is usually protected by some type of shielding gas, vapour, or slag.

3. Give SIX (6) tools and equipment that are essential in welding.

**Model answer**

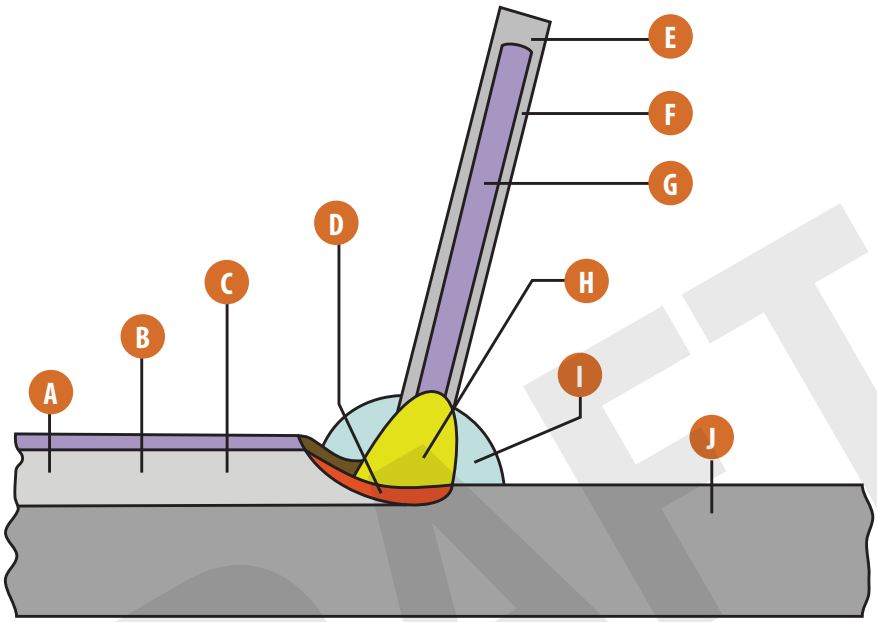
- electrode lead and electrode holder
- work lead/earth clamp
- AC or DC machine
- chipping hammer
- wire brush
- electrodes/welding rods

4. State FIVE (5) personal protective equipment for welding.

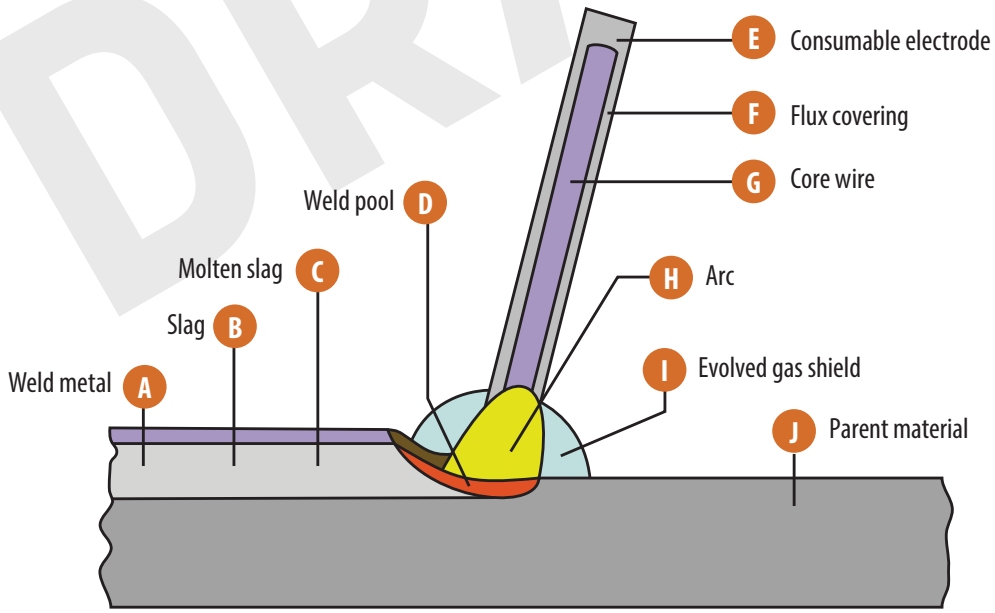
**Model answer**

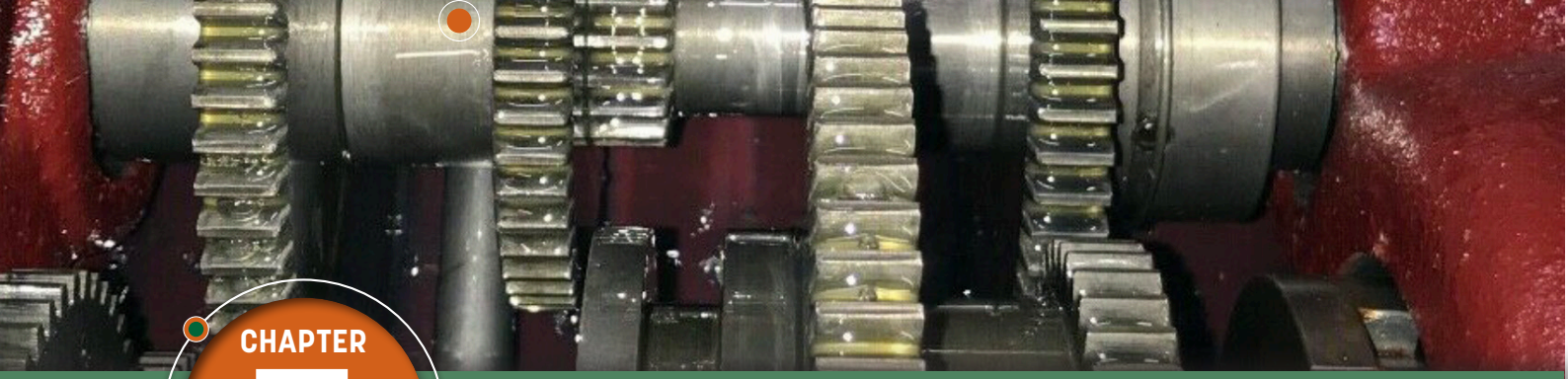
- welding helmets
- apron
- overall
- leather gloves
- boots

5. Supply labels on the sketch below.




**Model answer**



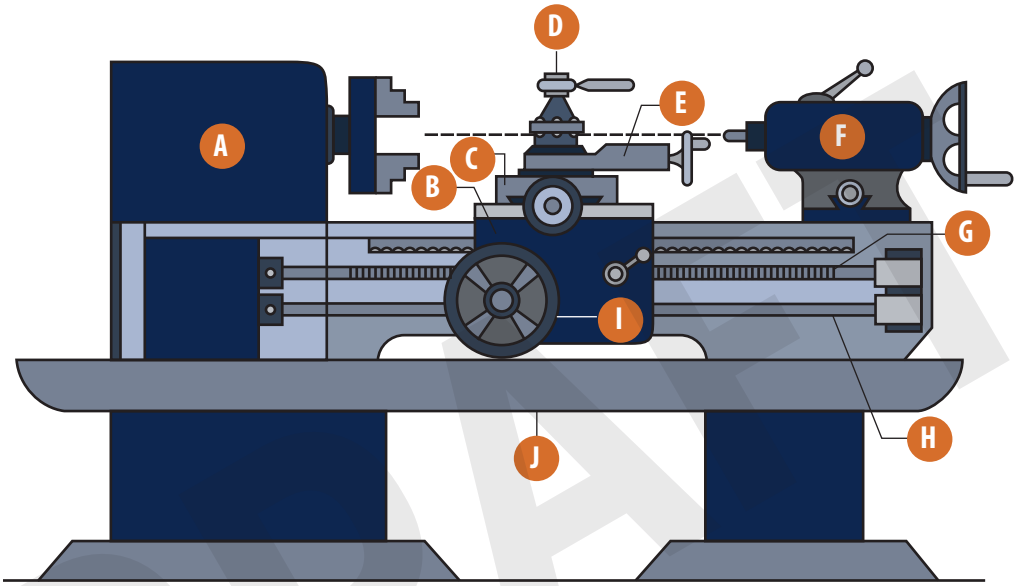


CHAPTER 7

# Terminology

## Activity 1 The lathe machine

1. Study the following machine and supply the labels




### Model answer

A. headstock
B. carriage
C. cross slide
D. toolpost
E. compound slide
F. tailstock
G. lead screw
H. feed shaft
I. handwheel
J. bed

2. State the function of the following lathe parts:
   a) tailstock
   b) tool post
   c) chuck
   d) chuck key
   e) headstock.

**Model answer**

a) **tailstock** – used in drilling, reaming and taper turning operations.

b) **tool post** – used to hold the cutting tool.

c) **chuck** – grips the workpiece when it is turned and worked on the lathe.

d) **chuck key** – used for tightening or loosening the jaws of a chuck.

e) **headstock** – provides the rotational power for the lathe's operations.

3. Give THREE (3) reasons why a coolant is used on the lathe.

**Model answer**

Any THREE (3) of the following:
The coolant is the liquid that is used on the lathe to:
- cool down the cutting tool and the workpiece
- prolong the cutting tool life
- lubricate the cutting tool face
- safeguard the operator from extra-fine cuttings (small debris).

4. State whether the following rules are True or False:
   a) The chuck key must be always in the chuck.
   b) The cutting is adjusted only when the lathe is in motion.
   c) Always wear safety goggles.
   d) Never wear loose clothing.
   e) Switch it off after use.

**Model answer**

a) False

b) False

c) True

d) True

e) True

## Activity 2 The milling machine

1. What is the purpose of a milling machine?

**Model answer**

It is used to machine plain surfaces, keyways, dovetails, and gears.

2. Name TWO (2) types of milling machines.

**Model answer**

horizontal milling machine, vertical milling machine

3. What is the function of the following Milling machine components?
   a) spindle
   b) table
   c) switch

**Model answer**

a) **spindle** – used to hold and drive the milling machine's cutting tool. The spindle is driven by an electric motor via gear trains, and it is perpendicular to the table

b) **table** – where different attachments are mounted for milling operations to be performed. The milling machine table can be moved up and down, backwards, and forward manually and automatically.

c) **switches** – an electric device that switches the machine on and off.

## Activity 3 Engines

1. Explain the following terms:
   a) bore.
   b) bottom dead centre.
   c) stroke.
   d) top dead centre.

**Model answer**

a) bore – the diameter of each cylinder.

b) bottom dead centre – the lowest point the piston can reach in the cylinder.

c) stroke – the distance the piston moves between the top dead centre and bottom dead centre in the cylinder.

d) top dead centre – the highest point the piston can reach in the cylinder.

2. What are the functions of the following parts?
   a) crankshaft
   b) intake valve
   c) spark plug
   d) cam
   e) combustion chamber?

### Model answer

a) Changes the linear movement of the piston to a rotary motion.

b) Controls the entry of fresh air/fuel mixture.

c) Ignites the air/fuel mixture in the combustion chamber.

d) Controls the opening and closing of the valves at different intervals.

e) The space where the burning of gases happens.

3. Describe the operation of all four strokes of the petrol engine.

### Model answer

**Intake stroke:**

- The piston moves from top dead centre to bottom dead centre.
- The inlet valve opens, allowing the air-fuel mixture into the cylinder.
- The exhaust valve is closed.
- Before the piston reaches the bottom dead centre, the inlet valve closes.

**Compression stroke:**

- The piston moves from bottom dead centre to top dead centre.
- Both inlet and exhaust valves remain closed.
- The air-fuel mixture is compressed in the small combustion chamber.

**Power stroke:**

- Both the inlet valve and exhaust valve remain close.
- Just before the piston reaches the top dead centre, the spark from the spark plug ignites the air-fuel mixture.
- Combustion of the air-fuel mixture causes the gasses to expand, forcing the piston to move to the bottom dead centre.

**Exhaust stroke:**

- As the piston reaches the bottom dead centre, the exhaust valve opens, and the inlet valves remain closed.
- The piston moves from bottom dead centre to top dead centre.
- The upward movement of the piston forces the burnt gases out of the opened exhaust valve.

CHAPTER 8

# Maintenance

## Activity 1 Maintenance

1. Define maintenance.

**Model answer**

Maintenance can be just a simple cleaning or lubrication process, or it may involve all the maintenance tasks (the work being done) on machinery and mechanical equipment to keep them functional.

2. Name and explain THREE (3) types of maintenance that can be carried out in the Mechanical Technology workshop.

**Model answer**

Types of maintenance to be carried out:

- preventative maintenance – maintenance that is regularly performed on equipment to lessen the likelihood of it failing
- predictive maintenance – maintenance that monitors the performance and condition of equipment during normal operation to reduce the likelihood of failures
- reliability-centred maintenance – maintenance that is performed after every operation has been completed to ensure that the machinery will be ready and functional during the next operation

3. True or False: There are different inspection or service intervals or frequencies for maintaining smooth and continuous operation.

**Model answer**

True – the inspection frequency for maintenance depends on:

- the level of the oil/lubricant before operating the machines/equipment
- the conditions a machine or the equipment is subjected to.

4. List THREE (3) things maintenance can include.

### Model answer

Any THREE (3) of the following:

- simple cleaning or lubrication
- functional checks
- servicing
- repairing or replacing devices, equipment and machinery over a certain period

## Activity 2 **Lubrication**

1. List and explain FOUR (4) characteristics a good lubricant possesses.

### Model answer

Any FOUR (4) of the following:

- a high viscosity index (vi) – serves to form a lubricating film, cool machine components, and seal and control oil consumption.
- a high boiling point and low freezing point – this is important so that the lubricant can stay liquid within a wide range of temperatures.
- thermal stability – refers to the ability of lubricants to resist breakdown at high temperatures. poor thermal stability can result in sludge, deposits, and increased viscosity.
- hydraulic stability – refers to a lubricant's ability to resist chemical decomposition when water is added.
- corrosion prevention – corrosion refers to the destruction of a solid body by electrochemical reactions. lubricants help machine parts to retain their original properties and avoid damage by corrosion.
- demulsibility – refers to the ability of a lubricant to separate from water.
- oxidation stability – refers to the ability of a lubricant to resist the chemical combination with oxygen. It can result in the creation of sludge and increased viscosity.

2. Fill in the missing words:
   Lubrication keeps _____ (that is metal-to-metal contact) to a minimum by forming a _____ over _____ _____ and allowing them to slide smoothly past one another. The application of _____ such as oil or grease in an engine or moving machine parts helps to reduce premature parts _____ and ensure _____ life and endurance of a machine.

### Model answer

Lubrication keeps friction (that is metal-to-metal contact) to a minimum by forming a film over moving parts and allowing them to slide smoothly past one another. The application of lubricants such as oil or grease in an engine or moving machine parts helps to reduce premature parts failure and ensure maximum life and endurance of a machine.

3. State whether the following statements are True or False: Lubrication of machines or equipment:
   a) reduces the life of the machines/equipment
   b) reduces wear
   c) acts as a sealing effect in different machine/equipment parts
   d) prevents dust from settling on machines/equipment.
   e) enhances the sealing effect of machines/equipment

**Model answer**

a) False, it prolongs the life of the machines/equipment

b) True

c) True

d) True

e) False, it enhances the performance of machines/equipment

## Activity 3 **Maintenance**

1. Which SIX (6) fluids should be checked during routine maintenance?

**Model answer**

Six fluids that should be checked during the routine maintenance:

- engine oil
- gearbox oil
- coolant
- brake fluid
- power steering reservoir
- windshield wiper reservoir

2. Identify FIVE (5) defects that need to be checked when servicing a vehicle.

**Model answer**

Five defects that need to be checked when servicing a vehicle.:

- radiator cap – check that it does not leak when closed and the pressure relief valve.
- wiper blades – check if they are not torn or cracked.
- fan belt – check if it is not worn or loose.
- pipes – check if they are not leaking and are properly clamped.
- hand brake - adjust to a maximum of 5 clicks.
- brake pads – check that they are not less than 3 mm.
- battery terminals – check that there is no deposit on terminals and that terminals are tight.

3. What are the TWO (2) colours of the battery terminals?

**Model answer**

The two colours of the battery terminals:

- negative – blue
- positive – red

4. State FOUR (4) ways to identify the correct size and type of battery for the vehicle.

**Model answer**

FOUR ways to identify the correct size and type of a battery for the vehicle:

- check the labelling on the current battery.
- check in the owner's manual in the car.
- ask the dealership for the correct type of battery size.
- ask the consultant at the battery shop.

5. Which parts must be changed when conducting the minor service?

**Model answer**

Parts that must be changed when conducting the minor service in a car engine:

- engine oil
- oil filter
- sump plug washer
- top-ups

## Practical task

Identify the vehicle's replaceable components and fluids and check if they need maintenance/replacement/top-up.

## Notes to educator

Divide the learners into groups of three to four learners.

Explain to the learners that they will use the template from page 127 in the Learner's Book to identify the vehicle's replaceable components and fluids and check whether they need maintenance/replacement/top-up.

These are the parts that need to be checked:

- engine oil level
- oil filter
- radiator cap
- battery terminals
- hand brake
- water pipes
- wiper blades.

Based on their findings, the groups then need to complete the condition or maintenance report.

Mark the work based on each groups' findings before learners continue to carry out the task of replacing or maintaining the different parts.

CHAPTER 9

# Body works and spray painting

## Practical task

Perform surface preparation on a body panel grind and feather edging operations.

### Model answer

Assist the learners with this task. You could arrange a demonstration on the correct way of performing the preparation and tasks.

1. Split the learners into groups of 3 – 4.
2. Inform learner's that they will:
   - wash panels by following the workshop procedures.
   - conduct grinding, sanding and feather edging operations on a scratched panel.
3. Here are the model answers for the questions in the Learner's Book:

   Safety:
   - » do not apply too much pressure while sanding.
   - » use the correct sanding disc.
   - » hold the sanding disc with two hands.
   - » wear safety goggles.
   - » electric grinders must be properly earthed.
   - » before plugging in the machine, ensure that the wall plug and machine are turned "off".

   Tools
   - » sanding block
   - » disc sander

   Sandpaper grit:
   - » P80 sandpaper
   - » P180 sandpaper
   - » P150 Hookit disc
   - » P320 Hookit disc

Steps:

- properly clean the surface.
- grind or sand the area (newer thin metal should remove the coating using a disc sander with 80-grit sandpaper). This will reduce the amount of metal removed throughout the repair process.
- properly mix the body filler using a spreader and a mixing board.
- blow the repair area off with compressed air and apply the body filler to the metal. do not allow your body filler to overlap with the painted surface.
- block sand the filler before completely drying with a cheese grater or 80-grit sandpaper. this will reduce the amount of sanding. once completely hardened, shape the surface with 80 grit leaving the surface slightly higher than the substrate. this will allow additional sanding with the finer grit to remove the 80-grit scratches.
- apply a guide coat to the repair area to help identify low areas.
- sand the repair area using 120 grit sandpaper to remove the rough 80 scratches.
- now you're ready to feather edge the surrounding paint edges as mentioned above. you must use 150 – 320 grit on a disc sander to level or layer the surrounding paint edges and scratches.
- next, you will be ready to apply the finish glaze and have the repair ready for prime and block.

**Notes to educator**

Demonstrate the procedure to learners before learners attempt the practical. They must first practice before performing the actual tasks.

## Activity 1 **Spraypainting**

1. Define etch primer.

**Model answer**

To cut, bite, or corrode with an acid or the like; engrave with an acid or the like, as to form a design in furrows that when charged with ink will give.

2. What is a plastic primer designed for?

**Model answer**

Plastic Primer is designed to be applied to bare plastic surfaces such as polypropylene, fibreglass and vinyl plastics such as vehicle bumpers.

3. State the precautions that must be taken after applying primers.

## Model answer

The following precautions must be taken after applying primers:

- the spray gun should always be cleaned well using thinners after each use
- under no circumstances must the material be left in the gun for longer than 20 minutes – it will harden, and after 2 hours, will render the gun useless
- primers contain isocyanides that are poisonous and a derivative of cyanide gas. Ensure that you wear the correct breathing apparatus, and work in a spray booth to protect those working around you.
- apply 3 – 4 light cross-coats
- primer/filler dries hard so do not overspray other vehicles or panels
- allow two and a half hours for air drying, or force dry in 20 minutes at 40 °C before flatting
- do not mix more primer/filler than is necessary
- read technical data sheet for mixing ratio and drying times.
- 1K primers: grey primer is a single-pack product that can be used to prevent overnight rust or short-term deterioration. It is not a filler so spot putty must be used to fill scratches otherwise you run the risk of sinkage in the topcoats because of the solvent evaporation. Black etch primer is the same and is only good enough as a primer.

4. Describe how you would conduct masking on a panel that needed to be sprayed with primer.

## Model answer

How you would conduct masking on a panel that needed to be sprayed with primer:

- plan where you will start and end, and whether you will use the paper long ways or sideways.
- prepare the one edge of your paper by folding it over and applying masking tape and start at a corner or long section.
- remember to use large pieces of paper instead of lots of little ones.
- make sure that there is no masking touching the paint when you have finished masking.
- make sure that all masking has been firmly pressed down and stuck to prevent overspray from going in under the paper or masking tape.
- make sure also that you have used the correct thickness of the tape. if masking stripes or lines, use plastic tape as it is thinner and does not leave such a higher edge. it can also be bent around corners or shapes.

## Practical skills tasks

- Educator to assist with task and simulation.
- Prepare a panel for primer by applying masking.
- Demonstrate the correct use of Primers following manufactures manuals.

**EDUCATOR NOTE:**

Educators to demonstrate the procedure to learners before learners attempt the practical. They must first practice before the actual practice is being conducted.

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**Other books in the series**

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