TEACHER'S GUIDE

MECHANICAL TECHNOLOGY

YEAR 1

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NOTES FOR THE TEACHER:

PLANNING

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

Once you have planned the broad term schedule for Sheet metal, start concentrating on the detailed planning for each topic and class session. Here you will have to consider:

- Content of activities
- Timing of activities
- Methods of teaching, learning and assessment
- Resources
- Facilitators-Teaching techniques

1. 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 learners' inputs to be shared e.g. raising a hand to speak

The purpose of this support resource

It aims to provide guidance in the teaching, learning and assessment, with the requisite balance in the cognitive levels and subject Specific Aims.

This support materials should be read in conjunction with the subject policy, to ensure that the process in the subject have integrity and yields high quality learners which can be relied on by all stakeholders.

2. LEARNER'S TEXTBOOK

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 • Learner Textbook
METHOD • 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 10 times (if you have total of 40). Group all the 1's together at Table 1, Group all the 2's at Table 2, Group all the3's at Table 3; Group all the 4's at Table 4; Group all the 5's at Table 5; Group all the 6's at Table 6; Group all the 7's at Table 7; Group all the 8's at Table 8; Group all the 9's at Table 9; Group all the 10's at Table 10. (Remember to make Table Numbers) *You may find it is useful to change groups/team 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 group/teams and your tables are numbered.

TEACHER'S INPUT

Individual Activity:

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

Group/Team Activity:

In their groups/teams learners 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) that are met as the lesson unfolds.

What is facilitation?

Facilitation means to do something that makes a lesson more effective and productive. Facilitation can also mean all the behaviours and actions of the teacher, advisor, lecturer, etc. positively influence the experience and learning of the learners and the groups/teams.

- Through the facilitation process a product can be developed 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 people to interact with each other in a safe and trusting environment.

When you conduct a lesson, you have a group of participants and you want that group to perform at the optimal level where there is maximum participation. It is important that the facilitator uses a variety of facilitation strategies.

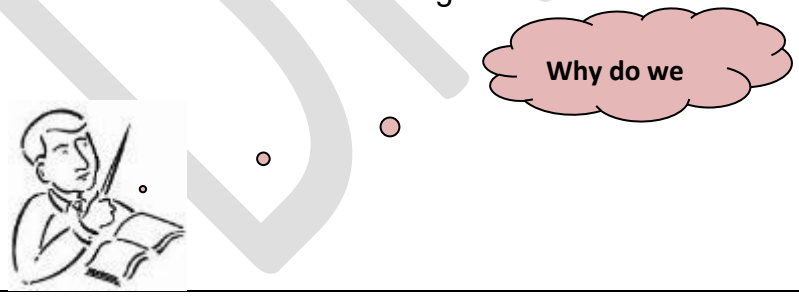
1.2 Understanding pedagogy

A pedagogically skilled teacher:

- **Plans** their teaching, learning and assessment processes well to achieve lesson objectives.
- Creatively **prepares** and **develops** lessons.
- Can make a **distinction** between **pedagogy** and **curriculum**.
- Can able to **deliver lessons effectively** and within the parameters of the curriculum and **assess** in a way that supports learning and measure learning reliably.
- Can use **open-ended questions** to break points down; critique them and applying 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 give each learner an opportunity 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 by the teacher posing questions, problems, or scenarios. Learners get better understanding from doing and discovering.
- **Classroom layout**: experience an increase in academic engagement, a decrease in disruptive behavioral, from a conducive setting.
- **Trimmed information**: small, manageable amount of information provide for effective assimilation of knowledge.



We make use of facilitation to:

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

The Facilitator/Teacher

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

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TOPIC

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SECTION 1:

INTRODUCTION TO THE CURRICULUM AND ASSESSMENT POLICY STATEMENT SKILLS AND VOCATIONAL

1.1 BACKGROUND

The *National Curriculum Statement Grades R-12 (NCS)* stipulates policy on curriculum and assessment in the schooling sector.

To improve implementation, the National Curriculum Statement was amended, with the amendments coming into effect in January 2012. A single comprehensive Curriculum and Assessment Policy document was developed for each subject to replace Subject statements, Learning Programme Guidelines and Subject Assessment Guidelines in Grades R-12.

1.2 OVERVIEW

(a) The *National Curriculum Statement Grades R-12 (January 2012)* represents a policy statement for learning and teaching in South African schools and comprises the following:

(i) *Curriculum and Assessment Policy Statements for each approved school subject;*

(ii) *The policy document, National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R-12; and*

(iii) *The policy document, National Protocol for Assessment Grades R-12 (January 2012).*

(b) The *National Curriculum Statement Grades R-12 (January 2012)* replaces the two current national curricula statements, namely the

(i) *Revised National Curriculum Statement Grades R-9, Government Gazette No. 23406 of 31 May 2002, and*

(ii) *National Curriculum Statement Grades 10-12 Government Gazettes, No. 25545 of 6 October 2003 and No. 27594 of 17 May 2005.*

(c) The national curriculum statements contemplated in subparagraphs b(i) and (ii) comprise the following policy documents which will be incrementally repealed by the *National Curriculum Statement Grades R-12 (January 2012)* during the period 2012-2014:

(i) The Learning Area/Subject Statements, Learning Programme Guidelines and Subject Assessment Guidelines for Grades R-9 and Grades 10-12;

(ii) The policy document, National Policy on assessment and qualifications for schools in the General Education and Training Band, promulgated in Government Notice No. 124 in Government Gazette No. 29626 of 12 February 2007;

(iii) The policy document, the National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF), promulgated in Government Gazette No.27819 of 20 July 2005;

(iv) The policy document, An addendum to the policy document, the National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF), regarding learners with special needs, published in Government Gazette, No.29466 of 11 December 2006, is incorporated in the policy document, National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R-12; and

(v) The policy document, An addendum to the policy document, the National Senior Certificate: A qualification at Level 4 on the National Qualifications Framework (NQF), regarding the National Protocol for Assessment (Grades R-12), promulgated in Government Notice No.1267 in Government Gazette No. 29467 of 11 December 2006.

(d) The policy document, *National policy pertaining to the programme and promotion requirements of the National Curriculum Statement Grades R-12*, and the sections on the Curriculum and Assessment Policy as contemplated in Chapters 2, 3 and 4 of this document constitute the norms and standards of the *National Curriculum Statement Grades R-12.* It will therefore, in terms of *section 6A* of the *South African Schools Act, 1996 (Act No. 84 of 1996,)* form the basis for the Minister of Basic Education to determine minimum outcomes and standards, as well as the processes and procedures for the assessment of learner achievement to be applicable to public and independent schools.

1.3 GENERAL AIMS OF THE SOUTH AFRICAN CURRICULUM

(a) The *National Curriculum Statement Grades R-12* gives expression to the knowledge, skills and values worth learning in South African schools. This curriculum aims to ensure that children acquire and apply knowledge and skills in ways that are meaningful to their own lives. In this regard, the curriculum promotes knowledge in local contexts, while being sensitive to global imperatives.

(b) The National Curriculum Statement Grades R-12 serves the purposes of:

- equipping learners, irrespective of their socio-economic background, race, gender, physical ability or intellectual ability, with the knowledge, skills and values necessary for self-fulfilment, and meaningful participation in society as citizens of a free country;
- providing access to higher education;
- facilitating the transition of learners from education institutions to the workplace; and
- providing employers with a sufficient profile of a learner's competences.

(c) The National Curriculum Statement Grades R-12 is based on the following principles:

- Social transformation: ensuring that the educational imbalances of the past are redressed, and that equal educational opportunities are provided for all sections of the population;

- Active and critical learning: encouraging an active and critical approach to learning, rather than rote and uncritical learning of given truths;
- High knowledge and high skills: the minimum standards of knowledge and skills to be achieved at each grade are specified and set high, achievable standards in all subjects;

- Progression: content and context of each grade shows progression from simple to complex;

- Human rights, inclusivity, environmental and social justice: infusing the principles and practices of social and environmental justice and human rights as defined in the Constitution of the Republic of South Africa. The National Curriculum Statement Grades R-12 is sensitive to issues of diversity such as poverty, inequality, race, gender, language, age, disability and other factors;

- Valuing indigenous knowledge systems: acknowledging the rich history and heritage of this country as important contributors to nurturing the values contained in the Constitution; and

- Credibility, quality and efficiency: providing an education that is comparable in quality, breadth and depth to those of other countries.

(d) The National Curriculum Statement Grades R-12 aims to produce learners that are able to:

- identify and solve problems and make decisions using critical and creative thinking;
- work effectively as individuals and with others as members of a team;
- organise and manage themselves and their activities responsibly and effectively;
- collect, analyse, organise and critically evaluate information;
- communicate effectively using visual, symbolic and/or language skills in various modes;
- use science and technology effectively and critically showing responsibility towards the environment and the health of others; and
- demonstrate an understanding of the world as a set of related systems by recognising that problem solving contexts do not exist in isolation.

(e) Inclusivity should become a central part of the organisation, planning and teaching at each school. This can only happen` if all teachers have a sound understanding of how to recognise and address barriers to learning, and how to plan for diversity.

The key to managing inclusivity is ensuring that barriers are identified and addressed by all the relevant support structures within the school community, including teachers, District-Based Support Teams, Institutional-Level Support Teams, parents and Special Schools as Resource Centres. To address barriers in the classroom, teachers should use various curriculum differentiation strategies such as those included in the Department of Basic Education's *Guidelines for Inclusive Teaching and Learning* (2010).

To cater for inclusivity, the Curriculum and Assessment Policy Statement has been expanded to include learners participating in the General Education and Training (GET) Band. These are learners who have an interest and talent in applied knowledge in technical and vocational skills.

The Curriculum and Assessment Policy Statement: Year 1- 4 responds more effectively to the needs of learners who have been identified and assessed through the protocols approved by the Department of Basic Education. These learners will benefit from curriculum content that is aligned to Grades 8 and 9 of the General Education and Training Band at a more applied and functional level in accordance with their interest and aptitude.

1.4 TIME ALLOCATION

1.4.1 Year 1 - 4

(a) The instructional time in the Year 1 - 4 is as follows:

Instructional Time for the Year 1 – 4 is 27½ hours in a five-day cycle

<table>
<tr><th colspan="3">Subjects
Fundamental Subjects</th><th>Time</th></tr>
<tr><td colspan="3">Languages
(Home Language and First Additional Language)</td><td>3 Hours for Home Language</td></tr>
<tr><td colspan="3">All 11 official languages (Afrikaans, English, isiNdebele, isiXhosa, isiZulu, Siswati, Sesotho, Setswana, Sepedi, Tshivenda, Xitsonga)</td><td>2 hours for First Additional Language</td></tr>
<tr><td colspan="3">Mathematics</td><td>3 hours</td></tr>
<tr><td rowspan="5">Life Skills</td><td colspan="2">Areas of Study</td><td rowspan="5">6 hours</td></tr>
<tr><td>Personal and Social Well-being (including aspects of Life Orientation, Social Sciences and Economic and Management Sciences)</td><td>2½ hours</td></tr>
<tr><td>Physical Education</td><td>1 hour</td></tr>
<tr><td>Creative Arts</td><td>1 hour</td></tr>
<tr><td>Natural Sciences</td><td>1½ hours from year 2 onwards
This time to be used in year 1 to support Languages and Mathematics</td></tr>
<tr><td colspan="4">Information Communication Technology
ICT is a compulsory subject for all learners. It can be offered either as a stand-alone or integrated across various subjects. If offered as a stand-alone a school may use time allocated to the Technical Occupational programme. ICT does not count towards the qualification but is a necessary life-long skill. ICT is not to be confused with the Technical Occupational Subject “Office Administration” which is an elective.</td></tr>
</table>

In Year 1, a learner must be exposed to a minimum of two skills from the list below, whereas in Year 2 – 4 a learner must be exposed to a minimum of one skill. For continuity, it is recommended that where practicable a learner offers the same skill from Year 2 – 4.

Subjects	Time

Technical and Occupational Electives	
Agricultural Studies Art and Crafts Civil Technology: Bricklaying and Plastering Civil Technology: Plumbing Civil Technology: Woodworking and Timber Consumer Studies: Food Production Consumer Studies: Sewing Early Childhood Development Electrical Technology: Electrical Hospitality Studies Mechanical Technology: Body Works: Panel Beating and or Spray Painting Mechanical Technology: Motor Mechanics Mechanical Technology: Sheet Metal Work Mechanical Technology: Welding Mechanical Technology: Maintenance Office Administration Personal Care: Ancillary Health Care Personal Care: Beauty and Nail Technology Personal Care: Hairdressing Service Technology: Upholstery Wholesale and Retail	13½ hours
Total: General and Occupational	27½

1.5 The table below proposes the learner progression across the years at a School of Skills.

Year 1 Minimum of 1 year of orientation	**Year 2**	**Year 3**	**Year 4**
Base Line Assessment for Language and Mathematics ➢ **Intervention (ISP)** **<u>Fundamental Subjects</u>:** • **Home Language** • **FAL** • **Mathematics** • **Life Skills:** ✓ Personal Social Wellbeing ✓ Physical Education ✓ Creative Arts ➢ <u>ICT Enrichment</u> **<u>Electives</u>** **Minimum 2 x SKILLS Across the year** **Post Assessment** • **Analyse results** Progress to Year 2 with appropriate	**<u>Fundamental Subjects</u>:** • **Home Language** • **FAL** • **Mathematics** • **Life Skills:** ✓ Personal Social Wellbeing ✓ Physical Education ✓ Creative Arts ✓ Natural Sciences ➢ <u>ICT Enrichment</u> **<u>Electives</u>** **Minimum of 1 Skill**	**<u>Fundamental Subjects</u>:** • **Home Language** • **FAL** • **Mathematics** • **Life Skills:** ✓ Personal Social Wellbeing ✓ Physical Education ✓ Creative Arts ✓ Natural Sciences ➢ <u>ICT Enrichment</u> **<u>Electives</u>** **Minimum of 1 Skill**	**<u>Fundamental Subjects</u>:** • **Home Language** • **FAL** • **Mathematics** • **Life Skills:** ✓ Personal Social Wellbeing ✓ Physical Education ✓ Creative Arts ✓ Natural Sciences ➢ <u>ICT Enrichment</u> **<u>Technical Occupational</u>** **Minimum of 1 Skill** GCE: TO Qualification Or Certificate of Achievement

support for Languages and Mathematics			(External exam-results verified / moderated)

Note:

Year One is an orientation year and learners must be exposed to a minimum of two occupational skills to select a skill with which they will continue from Year Two. Schools that offer more than the minimum two skills in Year One may adapt the Annual Teaching Plan for Year One to accommodate their rotation system to expose learners to more skills e.g. schools may offer a skill per term for Terms 1, 2 and 3 and learners then select the skill they will specialise in and start it in Term 4. It is important that learners in Year One experience the core competencies of the skills so that an informed choice can be made.

Years Two, Three and Four are the critical years for learners. It is important that learners are exposed to all the Topics and Specific Aims per selected Occupational skill, acknowledging that not all learners will be successful in all of these.

Should FET Phase not be included for that learner who continues with Occupational 10-12?

SECTION 2:

INTRODUCTION TO MECHANICAL TECHNOLOGY: WELDING

2.1 What is Welding?

Welding is a fabrication or sculptural process that joins materials, usually metals and other materials, by causing coalescence. This is often done by melting the work pieces and adding a filler material to form a pool of molten material (the weld pool) that cools to become a strong joint, with pressure sometimes used in conjunction with heat, or by itself, to produce the weld.

Many different energy sources can be used for welding, including a gas flame, an electric arc, Includes welding (gas, electric, MIG/MAGS), developments, working with sheet metal and the manufacturing of structures. Modern welding techniques includes manual methods like shielded metal arc welding, now one of the most popular welding methods, as well as semi-automatic and automatic processes such as gas metal arc welding.

Metalworking is the process of working with metals to create individual parts, assemblies, or large scale structures. The term covers a wide range of work from large ships and bridges to precise engine parts and delicate jewellery. It therefore includes a correspondingly wide range of skills, processes, and tools. Metalworking is a science, art, hobby, industry and trade. Modern metalworking processes, though diverse and specialized, can be categorized as forming, cutting, or joining processes. Today's machine shop includes a number of machine tools capable of creating a precise, useful work piece.

2.2 Topics to be studied in Welding

1. Safety and first aid – Occupational Health and Safety (OHS) Act;
2. Workshop environment
3. Drawings (rough sketches, simple drawing ISO, Ortho and CAD welding related)
4. Tools and equipment (hand, power and machine)
5. Materials – ferrous and non-ferrous materials
6. Joining methods – permanent and semi-permanent.
7. Welding (operations/procedures and equipment).

2.3 Specific Aims:

The learner is able to:

1. Adhere to and identify safe working practices and demonstrate safe working conditions daily, also adopting proper safety and first aid procedures.
2. Demonstrate knowledge of the welding industry and its productivity requirements, by applying appropriate work-procedures.
3. Understand and interpreting work instructions and drawings for the completion of projects.
4. Apply welding technology, techniques, processes and skills, as applied in the fabrication and welding industry, using appropriate tools and measuring equipment.
5. Identify Ferrous & Non-Ferrous metals the differences, applications and uses of them.
6. Demonstrate the different welding processes: Arc (AC/DC), MIG, TIG, Brazing, Soldering and spot welding.
7. Apply a variety of fillet welding, oxy-fuel cutting and oxy-fuel joining processes.

.2.4 Requirements for Welding as a subject

2.4.1: Time Allocation

The total number of hours allocated for the subject in a five day cycle is 13 ½ hours. Sufficient time must be allocated in the school timetable for the practical work required to be done.

2.4.2 Resources

Human resources

Welding requires a trained subject specialist (should be a person that has at least 2 years industry experience). It is preferred that the Educator offering Welding is an artisan / technician/ technical educator that has been in the Welding industry. (NOTE: That Educator may be remunerated according to an REQV 13 Special salary range, see page 52 of PAM document / Government Gazette, February 2017)

Welding Educators are required to:

- Teach the subject content with confidence, professionalism and in a relaxed firm manner.
- Plan and execute Theory and Practical lessons/work in a manner that would be suitable for the learners.
- Provide workshop that is properly equipped, clean, safe/first aid friendly for learners.
- Keep proper records of all learners and results from all SBA and PAT.
- Implement innovative methods to keep learners interested in the subject.

- Maintain and service the workshop, tools, and instruments as a whole.
- Produce working PAT projects for learners one for every term and scale at the learners ability.
- Educator must carry out SBA regularly, at the end of every term correct break down of learner's progress.

Learner Resources:

Each learner should be in possession of the following:

- Workbook.
- Overall.
- Safety steel cap boots.
- Welding helmet.
- Clear safety glasses.
- Leather gloves.
- Tape measure.

2.4.3 Infrastructure, equipment and budget.

Schools must ensure that teachers have the necessary infra-structure, equipment and financial resources for quality teaching and learning.

Infrastructure:

- Welding cannot be implemented in a school without an equipped workshop.
- Electricity supply to the workshop is crucial, preferably a three phase, four-wire supply, but at least single phase with a high current circuit breaker.
- Lighting and ventilation is of extreme importance and a workshop should ideally have multiple exits with doors that open outward.
- Tools and equipment should have sufficient storage and well developed storage management system with an up to date inventory. Shelves should be clearly marked and storage areas defined.
- Good housekeeping principles require that all workshops be cleaned regularly. A suitable waste removal system should be in place to accommodate refuse, off-cut materials as well as chemical waste. The requirements of the Occupational Health and Safety (OHS) Act 85 of 1993 need to be complied with at all times.
- Machinery on stands should be permanently affixed to the floor, with isolation switches for the mains supply. All machines should have working machine guards.

- Electrical motors should ideally be painted bright orange. Specification plates should be clearly legible.
- The workshop must have a lockable mains distribution board. The workshop must be fitted with an emergency cut of switch/s which is/are easily accessible at all times. The red, mushroom type, emergency switch should preferably be lockable to prevent accidental re-connection with mains in the case of it being activated.
- Safety rules must be displayed on posters in the workshop.

Equipment

SUGGESTED TOOLS AND EQUIPMENT

SAFETY			
MUST HAVE			• **Optional**
• 1or 2 piece Overall (1/ learner) • Steel capped safety boots (1/ learner) • Safety Glasses (1/ learner)	• Welding helmet (1/ learner) • Leather Apron (1/ learner) • Leather gloves (1/ learner)	• Leather apron (1/ learner) • Ear Muffs (1/ learner)	• Skull cap • Leather anklets • Auto dark welding helmet
• Fire extinguishers 300sqm workshop (5/workshop)	• Sand buckets (3/workshop)	• First Aid kit (wall mounted fully stocked)	
• Full Face clear grinding shield (5/ workshop)		• Water hose on reel (1/workshop)	

TOOLS AND EQUIPMENT			
MUST HAVE			Optional I of each item per workshop
Hand Tools	Hand Power Tools	Machine Tools	
• **Measuring Tools:** • Tape Measure (1/ learner) • Steel ruler (5/workshop) • Veneer Callipers (2/ workshop) • Allen keys set (3 sets / workshop)			• Height Gauge • Micro-meter • Laser line gauge
• **Marking Out Tools:** • Engineering Square Set (1/ workshop) • Scriber (5/workshop) • Boilers Marking Chalk (1box/ Term) • Blue marking ink (2x300ml/ Term) • Sliding bevel (5/workshop) • Callipers: Inside & Outside (1 set)			• Yellow Paint marker • Chalk line • Spirit level

• 200mm Dividers (3/ workshop) • 300mm Dividers (3/ workshop)			
• **Cutting:** • Hack saw (1/ learner) • Junior Hack Saw (5/workshop) • Hand held tin snips (5/workshop) • Cole chisel (5/workshop) • Body punches (1 set / workshop) • Hole Saws (1 set / workshop)	• Jig saw (1/ workshop) • 115mm Angle Grinder (15/workshop) • 250mm Angle Grinder (1/ workshop) • Oxy/Acetyl bottles 10kg (1/ workshop)	• Circular band saw (1/ workshop) • Plasma cutter (1/ workshop) • Heavy Duty-Cut Off Saw 450mm (1/ workshop) • Guillotine (1/ workshop) • Portable Band Saw (1/ workshop) • Hydraulic Break press 2.5 meter (1/ workshop)	• Portable Gas Bottles
• **Welding:** • Positive& Negative welding cables (1set/ machine) • Welding screen 3m (3/ workshop)		• Inverter AC/DC welder (15/workshop) • Core wire MIG welder (2/workshop) • Spot welder (1/ workshop)	• Oil cooled welder

		• TIG welding torch (1/ workshop)	
• **Grinding:** • 200mm wire brush (1/ learner) • Chipping hammer (1/ learner)	• 150mm angle grinder (15/ workshop) • 300mm angle grinder (2/ workshop) • Die grinder 250mm (1/ workshop)		• Sander on stand • Die grinder
• **Drilling:** • Jobber drill bit set (15/ workshop) • High speed Hole-saw (1 set/ workshop) • Multi stage drill bits (2 set/workshop)	• Hand held drill (2/ workshop) • Rotary SDS held drill (1/ workshop)	• Drill press (2 / workshop)	• Cross drill vice • Tap & die set
• **Joining:** • 150mm G clamps (3 sets/ workshop) • 300mm G clamps (3sets/ workshop) • C clamp grip plier (3sets/ workshop) • Welding magnets (4 sets/ workshop) • Corner jig clamp (2 / workshop) • Rivet gun (2 / workshop)			• Sheet metal clamps • Plate welding plier
• **Shaping / Forming:** • Bench grinder (15/ workshop)	• Finishing sander (1/ workshop)	• 100mm Belt sander (1/ workshop)	• Orbital sander

• Hand held files (15/ workshop)			
• **Other Accessories:** • Bench vice (5/ workshop) • Work benches (3/ workshop) • Extension cords 10&20m (2/ workshop) • Screwdrivers set of 8 (3/ workshop) • Hammers-ball pin (1/ learner) • Bolts, nuts and washers • Self- tapers • Two pin adaptor (2/ workshop) • Multi plug adapter (3/ workshop)	• Radio (1/ workshop) • Computer (1/ workshop) • Projector (1/ workshop) • Colour Printer (1/ workshop) • 16 gig Flash drive (1/ workshop) • CAD Software- one of the following • Ally-CAD, Auto-CAD	• Extractor fan (1/ workshop) • Compressor 4 Bar 100lt tank (1/ workshop)	• Scroll bender • Roll slip bender • Sheet metal folder • Compressor • Spray gun & access • Drawing board • 1 Tera-byte Hard Drive

Consumable items: (minimum requirements)

Hand grit soap	Paper towels	Gas argon, oxygen, acetylene, cougar, LP	Grinding discs 115mm
Welding rods	Drill bits 1-10mm	Grinding discs115mm and 250 mm	Grinding discs 250mm
Steel brushes	Rags1/5kg/term	Boiler makers chalk	Masking tape 15,25 & 50mm
Cut-off discs 115-350mm	Flap discs 115mm	Hack saw blades	5kg of waste rags

Sand paper	Wire wheels	Purple scotch brite	Band saw blades
Flap wheels115mm	Sanding discs 115mm	Sanding discs 250mm	Bench grinder wheel fine grit
Anti-Splatter Spray	Oxy/Act cutting nozzles	Oxy/Act flash Backs	Bench grinder wheel course grit
Clear glass for welding helmet	Green glass for welding helmets	First Aid and safety Box	

Finances:

Budget and inventory

A budget must be allocated for the subject. The amount will be determined by the number of learners taking the subject across all the years and the nature of the practical work required as stipulated in the curriculum. The budget needs to be revised annually and must consider all resources needed per year. The funding must make provision for maintenance of equipment and the replacement over the years.

Resourcing could be sub divided into the following categories:

- Safety Equipment
- Tools and Equipment
- Consumable Materials
- Practical Assessment Task Resources (PAT)
- Teaching and Learning Support Material
- Maintenance

A stock inventory must be maintained by the teacher and verified annually by a Senior Management Team member.

2.5 Career opportunities

Career and occupational opportunities for learners with a foundation in Welding include but is not limited to:

- Continued studies at a college in the NC (V) in a vocational pathway.
- Working as an entrepreneur or working with one.
- Artisan assistant (Semi Skilled);
- Welder (Coded).
- Boiler maker.
- Pressure welder.

- Ship builder.
- Rigger.
- Pattern maker.

SECTION 3:

OVERVIEW OF TOPICS PER TERM AND ANNUAL TEACHING PLANS

3.1 Content overview

TOPIC	Year 1	Year 2	Year 3	Year 4
1. Safety & First Aid	General workshop safety and basic first aid workshop practices in to work area.	Safety and first aid workshop practices HIV/AIDS awareness, machine safety practices	Safety and first aid workshop practices HIV/AIDS awareness, machine safety practice	Safety and first aid workshop practices HIV/AIDS awareness, machine safety practices
2. Communications and Graphics	Implementation of Drawings in the workshop. (rough, ISO and ORTHO)	Implementation of Drawings in the workshop. (rough, ISO and ORTHO)	Communications and Graphics, rough sketches and orthographic drawings	Communications and Graphics, rough sketches and orthographic drawings
3. Workshop environ-ment	Layout of the workshop and the demarcated areas of operation. Cleaning and storage of tools and equipment	Layout of the workshop and the demarcated areas of operation. The proper procedure to cleaning and storage of tools and equipment	Layout of the workshop and the demarcated areas of operation. The proper procedure to cleaning and storage of tools and equipment	Layout of the workshop and the demarcated areas of operation. The proper procedure to cleaning and storage of tools and equipment

4. Tools and equipment	Hand and measuring tools	Hand, measuring tools, portable power Tools	Hand, measuring tools, portable power Tools and all related equipment for welding	Hand, measuring tools, portable power Tools and all related equipment for welding
5. Materials	Origin of steel, profiles	Origin of steel, Profiles and uses	Properties non and ferrous, profiles of metals	Properties and uses metals, profiles of metals
6. Joining methods	Different types of joining. Demonstrate: A Tack, butt and a fillet weld	Joining method (ARC)	Joining method (ARC and GAS)	Joining method (ARC, GAS MIG and TIG)
7. Welding operations	All the different types welding equipment, safety and storage. Different types of welding procedures and operations(ARC & GAS)	All the different types welding equipment, safety and storage. Different types of welding procedures and operations(ARC & GAS)	All the different types welding equipment, safety and storage. Different types of welding procedures and operations(ARC GAS, MIG and TIG)	All the different types welding equipment, safety and storage. Different types of welding procedures and operations(ARC, GAS, MIG and TIG)
8. Entrepreneurship			Introduce the Topic of being an Entrepreneur.	Introduce the Topic of being an Entrepreneur.

3.2 Content outlines per term

Year 1

WEE	TOPIC	CONTENT
1	Safety	Workshop Rules: • Demonstrate understanding of the purpose of workshop rules
2		Personal Protective Equipment (PPE): o Define what is PPE • Purpose and use of Personal Protective Equipment; o headgear o safety glasses; o dust mask; o ear protection o overalls o safety shoes
3		Workshop Orientation: • Observe and understand the purpose of; o Layout (Floor Plan);
4		Fire Prevention and Protection; • Elements of a fire; o Identify the types of fires
4		Housekeeping: • Identify and respond to potentially unsafe conditions, incidents or acts that may occur • Perform housekeeping duties
		Evacuation Plans and Drill: • Induction on the processes and procedures when performing an evacuation Practical 1: Workshop Evacuation Drill
		Basic First Aid: • Definition of First Aid • Types of injuries;

5		○ Cuts ○ Burns Practical 2: Demonstration – stopping a bleeding
6	Measuring Hand tools	Select use & care: Hand measuring tools. • Tape measure, • Steel ruler, • Meter stick
7	Hand tools	Identify and describe the caring and demonstrate the correct use and safety of the following hand tools: • Screw Drivers (flat / star) • Hammers • Files (Different shape files) • Spanners • Tin snip • Drill bits • Scriber • Engineers pliers • Hack saw • Vice
8	Materials	Identify: Ferrous and Non Ferrous metals (profile & use). Show the physical difference between non and ferrous metals • Mild steel. • Stainless steel. • Cast iron. • Copper • Show example and uses of the materials in the workshop.
9	Joining	Understand the following • Shielded metal arc welder (components of the machine and use) (AC/DC). • Demonstrate all the components of an Arc welder and the proper way to connect it before use.

		• The different colours that is used to for the identification of positive and earth cables. • Do a tack weld on measured material

10	Assessment	The weeks allocated for formal assessment are integrated across the weeks planned for teaching and learning. The assessment will consist of Practical Task/s with a 75% weighting and a Theory test with a 25% weighting.

Activity 1- Practical Demonstration (Measuring, cutting and Tack Welding) = 25% of the Term mark.

The Learners must be able to demonstrate certain skills acquired during the term. This is in the form of a single task and not part of the Terms practical model.

Learner measures, cuts and prepare two pieces of material as per the drawing. The learner must produce

two tack welds that should be mechanically strong.

All three stages must be assessed.

- Measuring
- Mark off
- Cutting
- Cleaning off sharp edges
- Tack Weld

Total for Activity 1 Marks to be converted to 25% of the total term mark.

Activity 2 – PRACTICAL ASSESSMENT TASK – PAT (Practical Project) = 50% of term mark.

Fundamental knowledge = 25%

Practical learning areas = 25%

Learners must now produce a practical project (PAT) using the all the method of construction (in Weeks 1 – 10) which can be assessed to evaluate their acquisition skills. This project should involve the skills, techniques and knowledge of the theory component.

Assessments are done according to a rubric which includes all the skills acquired during the term.

- Examples of projects are in the Addendum.

Activity 3 – Formal written or Oral Theory assessment = 25%.

Scope of work that is done during the term.

Annexure A: Theory Assessment: Oral and /or Written Pages

Theory section: This section comprises of all the above work done in weeks 1 through 10inclusions should be pictures and questions with a multi answer block. Pictures should constitute a major part of this section.

Annexure B: Practical Assessment: Page

Practical section: learners are now assessed on their understanding of safety, standards and practices as well as measurement which forms the basis of the all practical work done in the workshop. Learners in the first year should be able complete a model (which should be at their level, but the ability to finish the model.

Assessment: consists of two sections theory 25% and practical 75% = 100%

Annexure C: Theory Assessment: Oral and /or Written Pages

Theory section: (oral or written) score allocation 25%: comprises of all the above work done in weeks 1 through 10 inclusions should be pictures and multi answer questions. Pictures should constitute a major part of this section.

Annexure D: Practical Assessment: Pages

Practical section: Learners should now be ready to for an assessment with a use of hand tools so that the theoretical aspect can be implemented. Measurement now plays a role as this is the foundation to which all work can commence in the workshop.

At the end of this term; A project should be completed as evidence of the learner's ability.

(NB! Not all learners will be able to produce an exact reproduction of the example the educator has provided)

HEALTH AND SAFETY

ACTIVITY 1:

Have you learnt something? Test your Knowledge….

1. **List any six workshop rules**

- Do not enter the workshop without permission.
- Do not enter or leave the workshop without teacher's permission.
- A workshop is not a playground therefore no playing and running around is allowed in the workshop.
- Know where the emergency stop buttons are positioned in the workshop.
- Always wear an apron or an overall as it will protect your clothes and hold loose clothing.
- Wear personal protective equipment all the time 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.
- Always use a guard when working on a machine.
- 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 an accident.
- No food or drink in the workshop.
- Wear the correct protective equipment for the tools you are using.
- Tie up long hair.
- Turn the machine off before cleaning it.
- Keep the workshop clean.
- No-one is permitted in a workshop under the influence of and illegal substances.
- No unauthorized person is allowed in the workshop.
- Never use a tool or machine without authority.

2. **Define an accident.**

- An accident is an unplanned and uncontrolled incident caused by unsafe acts and unsafe conditions

3. **List four main reasons for causes of accidents.**
    - Poor housekeeping
    - Loose clothing
    - Improper use of tool
    - Inaccurate setting of the machine
4. **Provide five examples of unsafe acts.**

- Fooling or teasing your fellow worker.
- 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 Personal Protective Equipment (PPE)
- Bypass or removal of safety device
- Unsafe position /posture
- Improper adjusting of machines while it is in operation.

5. **Provide five examples of unsafe conditions**.

- Overcrowding in the workshop.
- Unsafe and poor workshop ventilation.
- Poor lighting (dull) and unsafe workshop lighting (flashing).
- Poor housekeeping.
- Unsafe constructed buildings.
- Overcrowding in the workshop.
- Working without personal protective equipment.
- No machine guards on equipment.
- Wet sharp slippery floors
- Defective hand tools, equipment, machines, etc.
- Poor workshop layout or work flow

6. Collect five pictures and paste them in your class book showing different personal protective equipment needed in your workshop.

- Any relevant picture is allowed

7. Define house keeping

- Good housekeeping means working in an orderly way. Always return tools and materials to their correct places

8. Why is good housekeeping desirable?

- It saves time
- It cuts costs
- Ensures that the workplace is safe

ACTIVITY 2:

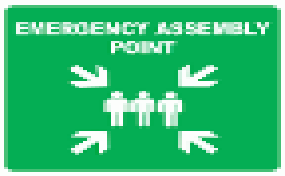
Have you learnt something? Test your Knowledge….

1. Explain why workshop floors need to be demarcated.
    - To prevent accidents, workshop floors must be levelled, free from dirt, water, oil, grease, objects lying around
2. What is the purpose of emergency stops on machines?
    - The purpose of such devices is to stop the machine in an emergency.
3. Provide the reason for first-aid stations in the workshop.
    - The reason for this is to assist a person in an emergency while waiting for professional help to arrive.

	ACTIVITY 3 *You learnt something? Test your Knowledge….*

Aim: The learner will demonstrate an understanding and an ability to correctly differentiate between information signs, protection signs and Prohibiting signage

1. By referring to safety signs, classify each sign below with its related group.

	Mandatory (Compulsory) signage
	Informative signage
	Fire prevention signage
	Fire prevention signage
	Danger signage

2. Discuss why good ventilation is needed in workshops.
    - The importance of ventilation is the process of replacing stale air with fresh air.
3. Why should flashing lights being replaced in workshops?
    - Lights that are flashing need to be replaced immediately as it creates a stroboscopic (flashing) effect that can be very dangerous to people with epilepsy.
4. When do you report damaged electrical cords?
    - Immediate you see the damaged cords

ACTIVITY 4:

you learnt something? Test your Knowledge….

1. What is the purpose of first aid?
    - First aid is the assistance (help) given to a sick or injured person to save life and prevent the condition from worsening

2. Name the three stages when first aid is being conducted.
    - Examination
    - Diagnosis
    - Treatment

3. Name five injuries that can occur in the work place.
    - Cuts
    - Burns
    - Fractures
    - Electrical shock
    - Trauma

4. List at least seven items that must be included in a first-aid box.
    - Adhesive Bandages
    - Adhesive Tape
    - Antibiotic Ointment
    - Antiseptic
    - Burn Treatment:
    - Cold Pack:
    - Eye Covering (with attachment)
    - Hand Sanitizer:
    - Medical Exam Gloves:
    - Scissors:
    - Triangular Bandage:

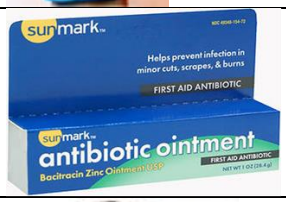
5. Explain how you would conduct first aid to a person with a cut on his/her arm.

- Take away the cause of accident to avoid further injuries
- Give attention to loss of blood and breathing
- Check the pulse and the pulse rate
- Investigate broken limbs and apply the necessary treatment
- Respect the injured person private parts when clothes must be removed
- Make sure that the injured person is comfortable
- Call an ambulance or the injured person's doctor and relatives as soon as possible
- Never remove anything stuck on the wound
- Never apply plaster on the wound
- Don't use oily substances or lotions on wounds

ACTIVITY 5

1. Explain what basic first aid is
2. Complete the following work sheet by identifying and giving the purpose of the equipment found inside a first aid kit. (Orally)

NAME	ITEM	PURPOSE
Bandage		2.1 Covering open wounds and controlling bleeding wounds

	2.2 Surgical gloves		Providing isolation from bodily fluids when assisting an injured person.	
	Antibiotic Ointment		2.3 Preventing infections in minor cuts, scrapes, or burns and Cleansing wounds prior to applying a bandage	
	2.4 Eye pads		Providing protection to an injured eye.	
	Coldpack		2.5 Reducing swelling and cooling burns to reduce damage done to soft tissue.	

TOOLS AND EQUIPMENT

	ACTIVITY 1 (TOOLS)
Aim: The learner will demonstrate an understanding and ability to correctly use the tools in the workshop	

Exercise 1:

1. Name three hammers that are used in welding workshop.
    - Chipping hammer
    - Ball peen hammer
    - Rubber mallet hammer
2. Draw a neat freehand sketch of a ball- peen hammer using a pencil.
3. Give uses of the ball peen hammer.
    - The most important use of the cross-peen hammer is forging and riveting.
4. What are the uses of the rubber mallet hammer?
    - A soft-face hammer is good for working on gearboxes, final drive components and surfaces that may be damaged by using metal hammer.

ACTIVITY 2 (TOOLS)	
Aim: The learner will demonstrate an understanding and ability to identify different files	
1. Identify the following files and write its name next to it	
	Triangulation file
	Square file

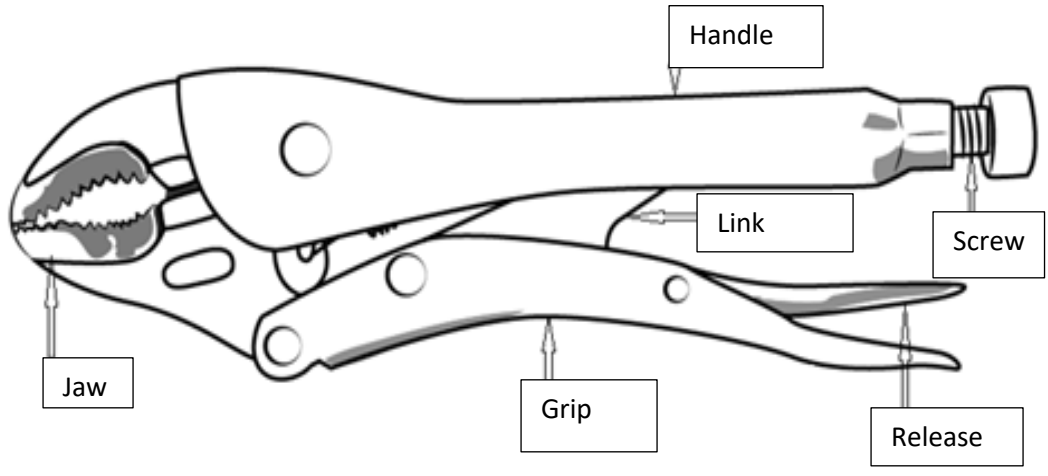
	Round file
	Flat file
	Half-round file

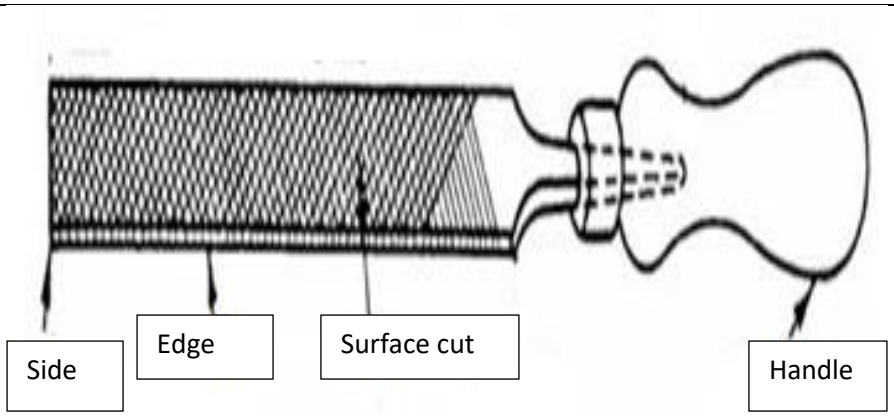
ACTIVITY 3

Aim: The learner will demonstrate an understanding and ability to correctly use the tools in the workshop

Exercise 1:

1. Name the types of hand tools below used in the welding workshop.
    - Vice grip
    - File
2. Label the following tools used in the workshop



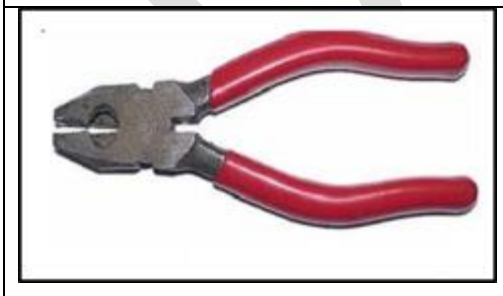


ACTIVITY 4

Aim: The learner will demonstrate an understanding and ability to correctly use the tools in the workshop

Exercise 1:

Identify and name the following hand tools

Tools	**Name of the tool**
	Open-ended spanner
	Combination Plier

		Long-Nose Plier
		Side-Cutter
		Tin-Snip
		Flat Screwdriver
		Rubber Hammer

ACTIVITY 5

Tools	What is the use of the tool below
	Measuring Tape
	Scriber
	Hand hacksaw
	File
	G-Clamp

MATERIALS

ACTIVITY 1

Take a look at the pictures below and say what are they made of metal, wood

Made of.	**Materials**
Metal	 1
Metal	 2
Wood and metal	
Wood	 3
	4
Wood and Metal	

ACTIVITIES 2

Sort the materials according to their place

Copper	
Brass	
Zinc	
Aluminium	
Carbon Steel	

Stainless steel	

JOINING METHODS

	ACTIVITIES 1 (JOINING METHODS)

Name the kind joints given below

What is the name of the tool you see below:	**ACTIVITIES (Joining Methods)**
	Rivets
	Rivet gun

 	Bolts and Nuts

	ACTIVITY 2 *BASIC JOINING PROCESSES*
Aim: The learner will demonstrate the correct skill of joining metal plates together using pop riveting.	
Exercise 1 Join TWO pieces of sheet metal plate using pop riveting. Materials needed • 1.6 x 75x 75 mm sheet metal plate (drilled) • 5 mm drill bit • Steel ruler • scriber • 6 x rivets	

- 5 mm drill bit
- 1 x Rivet gun

https://en.wikipedia.org/wiki/Sustainable_energy
https://eagletube.com/about-us/news/stainless-steel-characteristics
https://en.wikipedia.org/wiki/Stainless_steel
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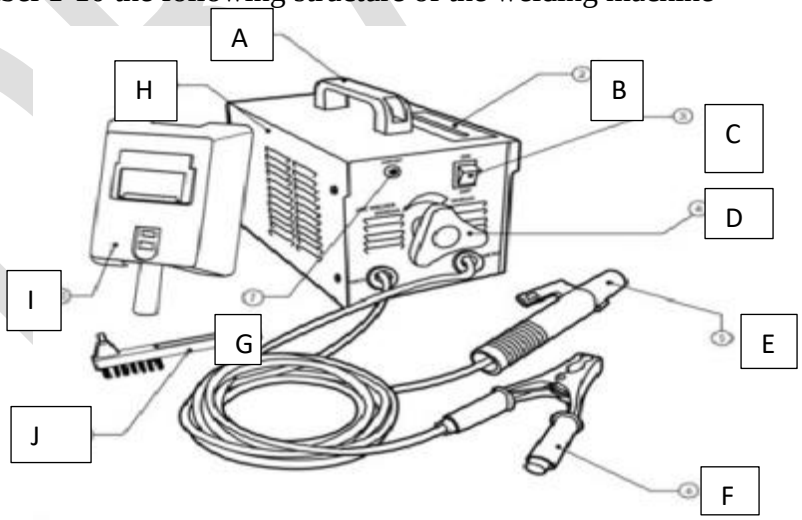
https://me-mechanicalengineering.com/stakes-type
https://www.grainger.com/.../tools/crimping-tools-and-dies/metal-crimpers/hand-seamers
https://www.answers.com/Q/What_is_a_cold_rivet
https://www.mechanicalbooster.com/2018/04/what-is-soldering.html
*https://***www.harborfreight.com***/3-inch-***hand-seamer***-66654.html*

ACTIVITY 3

Aim: The learner will demonstrate an understanding of the welding components used in the welding workshop

Exercise 1: Label 1-10 the following structure of the welding machine



A. Machine Handle
B. Current gauge
C. On/Off switch

D. Regulating knob
E. Electrode holder (Positive terminal)
F. Work lead/Earth clamp
G. LED (Overload)
H. Cooling fan
I. Helmet
J. Wire brush

ACTIVITY 4

Aim: The learner will demonstrate an understanding of the welding components used in the welding workshop

1. **Exercise 1:** Give the function of the following tools.

A. Electrode lead and electrode holder
- It holds the electrode

B. Work lead/earth clamp
- negative side and will be attached to parent metal by means of a clamp

C. AC or DC machine
- welding machine that uses electricity to function

D. Chipping hammer
- used to chip the slag off the weld bead before a new weld run

E. Wire brush
- used to remove any traces of slag or impurity on a weld

F. Electrodes/Welding Rods
- coated with flux which melts under the heat of welding

2. Name the following components or part of the machines below

A. Electrode holder	**B.** Earth clamp	**C.** Welding machine	**D.** Chipping hammer	**E.** Wire brush

SUBJECT:								SCHOOL:				
YEAR:								TEACHER:				
PROJECT:								NUMBER OF LEARNERS:				
		NAMES OF LEARNERS										
		1	2	3	4	5	6	7	8	9	10	11
FACETS	MARKS											
Cutting												
Measuring												
Marking off												
Cleaning												
Tack weld												
Drilling												
Grinding												
weld												
Finish												
Total												