basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

MECHANICAL TECHNOLOGY

GUIDELINES FOR PRACTICAL ASSESSMENT TASKS

GRADE 11

2017

These guidelines consist of 35 pages.

TABLE OF CONTENTS

1. INTRODUCTION

The 16 Curriculum and Assessment Policy Statements subjects which contain a practical component all include a practical assessment task (PAT). These subjects are:

- AGRICULTURE: Agricultural Management Practices, Agricultural Technology
- ARTS: Dance Studies, Design, Dramatic Arts, Music, Visual Arts
- SCIENCES: Computer Applications Technology, Information Technology
- SERVICES: Consumer Studies, Hospitality Studies, Tourism
- TECHNOLOGY: Civil Technology, Electrical Technology, **MECHANICAL TECHNOLOGY** and Engineering Graphics and Design.

A PAT allows the teacher to directly and systematically observe applied competence. The PAT comprises the application/performance of the knowledge, skills and values particular to that subject and counts 25% (i.e. 100 marks) of the total promotion/certification mark out of 400 for the subject. The PAT is implemented across the first three terms of the school year, which is broken down into different phases or a series of smaller activities that make up the PAT.

Any profession requires a thorough grounding in both practice and theory of its members and Mechanical Technology is no exception. It is emphasised that the goal of the practical assessment task is not to produce a skilled craftsperson, but a Mechanical Technology learner in the broadest sense. A nation's true wealth is in its manpower and education should aim to develop the talents of the learner so that he/she can contribute to the well-being of society by using scientific and technological resources with the greatest efficiency and by continuing to develop them.

To prepare a Mechanical Technology learner for one or more of these activities, his/her education should develop in him/her:

- An attitude where the learner can selectively assimilate ideas, gather evidence and facts, draw logical conclusions and put them to good use creatively and with imagination
- A capability to express ideas and information clearly by speech, writing, sketching or drawing
- A willingness and capability to accept and exercise responsibility, to make decisions, and to learn by experience

Attributes such as these cannot all be achieved in a classroom. A sound knowledge of engineering science is essential to equip the MECHANICAL TECHNOLOGY learner with the necessary practical capabilities for the required processes. There is no substitute for acquiring the feel of making things on the shop floor. Training in the art of making things is the essential bridge between trade theory and trade practice.

Practical application in the workshop must therefore be made an interesting and challenging experience, mentally and physically, with encouragement to the learner to use his/her initiative, curiosity and persistence in finding things. The giving of some degree of responsibility during practical application is very important as a stimulus and to develop self-confidence.

2. TEACHER GUIDELINES

2.1 Administration of the PAT

Teachers are requested to make copies of the different assessment criteria of the PAT document. These documents must be distributed to the learners at the beginning of the year. The practical assessment task for Grade 11 is internally set, assessed and moderated.

Teachers must attach due dates for the different phases of the PAT (refer to the *CAPS* document). In this manner learners may assess their progress easily. When formal assessments take place it is the responsibility of the teacher to administer assessment.

The PAT should be completed within the first three terms. The PAT should be completed under controlled conditions. (Refer to the *Mechanical Technology SPECIALISATION – CAPS Grade 10–12*)

2.2 Assessment of PAT

Frequent and developmental feedback is needed to guide and support the learner.

Both formal and informal assessment should be conducted in different terms to ensure that the embedded skills are developed. Informal assessment may be conducted only to monitor progress of the phase in which the learners are engaged. Formal assessment should always be conducted by the teacher and will be recorded.

2.3 Moderation of PAT

During moderation of the PAT the term tasks, assessment criteria and the marks obtained will be presented to the moderator.

The moderator should be able to call on a learner to explain and demonstrate the functions, principles and skills during the moderation purposes.

On completion the moderator will, if necessary, adjust the marks of the group up or downwards depending on the decision reached as a result of moderation.

2.4 Consequences of absence/non-submission of tasks

If a learner's practical assessment task is incomplete or unavailable for a valid reason, the learner will be given three weeks before the commencement of the final end-of-year examinations to submit the outstanding task. Should a learner fail to fulfil the outstanding PAT requirement such a learner will be awarded a zero (0) for that PAT component.

A learner's results are regarded as incomplete if he/she does not offer any component of the PAT task. He/She will be given another opportunity based on the decision of the Head of the Assessment Body.

Should the learner fail to fulfil the outstanding PAT requirement, the marks for these components will be omitted and the final mark for Mechanical Technology will be adjusted for promotion purposes in terms of the completed tasks.

2.5 DECLARATION OF AUTHENTICITY

NAME OF THE SCHOOL: ……..

NAME OF LEARNER: ……..……...

(FULL NAME(S) AND SURNAME)

EXAMINATION NUMBER: …….

NAME OF TEACHER: …….

SCHOOL STAMP

I hereby declare that the project submitted for assessment is my own, original work and has not been previously submitted for moderation.

_____ _____
SIGNATURE OF CANDIDATE DATE

As far as I know, the above declaration by the candidate is true and I accept that the work offered is his or her own.

_____ _____
SIGNATURE OF TEACHER DATE

3. LEARNER GUIDELINES

3.1 Instructions to the learners

- The Practical Assessment Task (PAT) consists of a generic and a specialisation task in Fittings and Machining, Automotive and Welding and Metalwork. The practical work is spread over THREE terms, as set out in each of the specialisation areas. (See *CAPS* document)

- All tasks must be completed according to the time frames set out in each of the tasks.

- Learners are required to actively engage in all practical assessment tasks.

- Learners who are un-cooperative will receive demerits or a zero mark allocation for that particular section of the work.

- Learners who act in an unsafe manner in the workshop and endanger other learners, will be given additional corrective tasks to improve their safety awareness.

4. PRACTICAL ASSESSMENT GUIDELINES PER SPECIALISATION:

SECTION A: FITTING AND MACHINING SPECIFIC

A1. SAFETY AND TOOLS

Term: 1–3
Start date: January 2017
Completion date: August 2017

GRADE 11 PAT	**YEAR: 2017**	**SCHOOL:**
DATE STARTED:		**DATE COMPLETED:**
SUBJECT: FITTING AND MACHINING		**LEARNER:**
TOPIC: SAFETY AND TOOLS		**EDUCATOR:**
1.1	Name FIVE important hand tools you are going to use to complete this task. (5)	
1.2	Name FIVE safety precautions that you must adhere to before working on the lathe. (5)	
1.3	Name FIVE safety precautions that you must adhere to while working on the lathe. (5)	
	TOTAL: /15	
	SIGNATURE OF EDUCATOR:	
	SIGNATURE OF HOD	

A2. TERMINOLOGY

MACHINE PART

Term: 1–3
Start date: January 2017
Completion date: August 2017

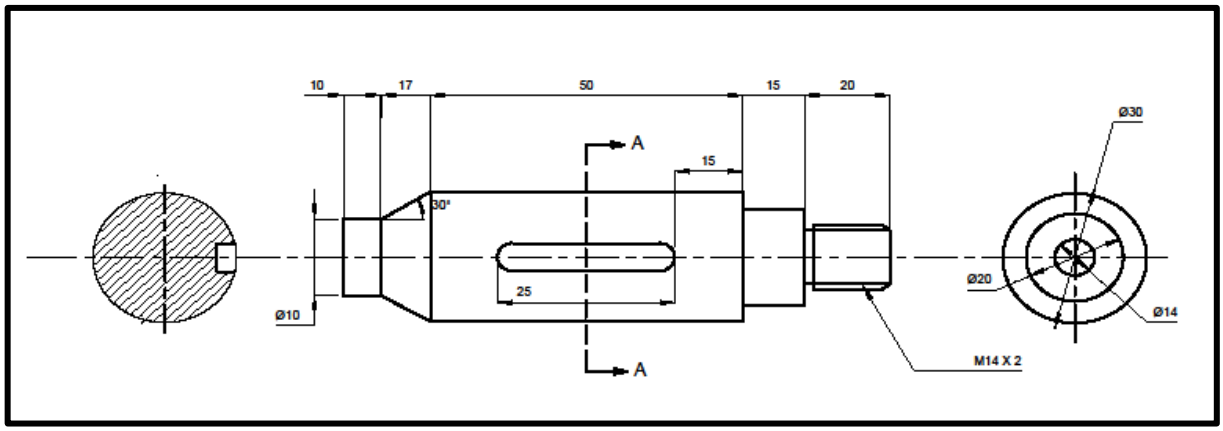


FIGURE 1: MACHINE PART

Rubric for Fitting and Machining:

TOLERANCE	TURNING			FILING Measured at 6 places
	DIAMETER		LENGTH	
	+ 0,03		+ 0,09	+ 0,09
	- 0,03		- 0,09	- 0,09
DEVIATION	7	0,05 = 100%	0,10 = 100%	0,10 = 100%
	6	0,10 = 80%	0,20 = 80%	0,20 = 80%
	5	0,15 = 70%	0,30 = 70%	0,30 = 70%
	4	0,20 = 60%	0,40 = 60%	0,40 = 60%
	3	0,25 = 40%	0,50 = 40%	0,50 = 40%
	2	0,30 = 20%	0,60 = 20%	0,60 = 20%
	1	0,35 = 0%	0,70 = 0%	0,70 = 0%

TABLE 1: TOLERANCES AND DEVIATIONS FOR FITTING AND MACHINING

GRADE 11 PAT	YEAR: 2017	SCHOOL:
DATE STARTED:		DATE COMPLETED:
SUBJECT: FITTING AND MACHINING		LEARNER:
PROJECT: LATHE AND MILLING		EDUCATOR:

MANUFACTURING		MARKS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.1 Tools		5															
1.2 Safety: before		5															
1.3 Safety: while		5															
Length 112		5															
Finish (faces x 2)		6															
Diameter 10		10															
Finish		2															
Length 10		2															
Diameter 20		10															
Finish		2															
Length 15		5															
Length of taper 17		10															
Finish		2															
Safety		10															
Tools		5															
Length 15 (Position of keyway)		2															
Keyway	Length 25	10															
	Calculation: Width	3															
	Calculation: Thickness	3															
	Depth	2															
	Skills	10															
	Finish	4															
Thread	Finish	10															
	Form	10															
Taper	Skills	10															
	Finish	2															
TOTAL		**150**															

SIGNATURE OF EDUCATOR:	
SIGNATURE OF HOD	

SECTION B: AUTOMOTIVE

B1. Engines – Valves

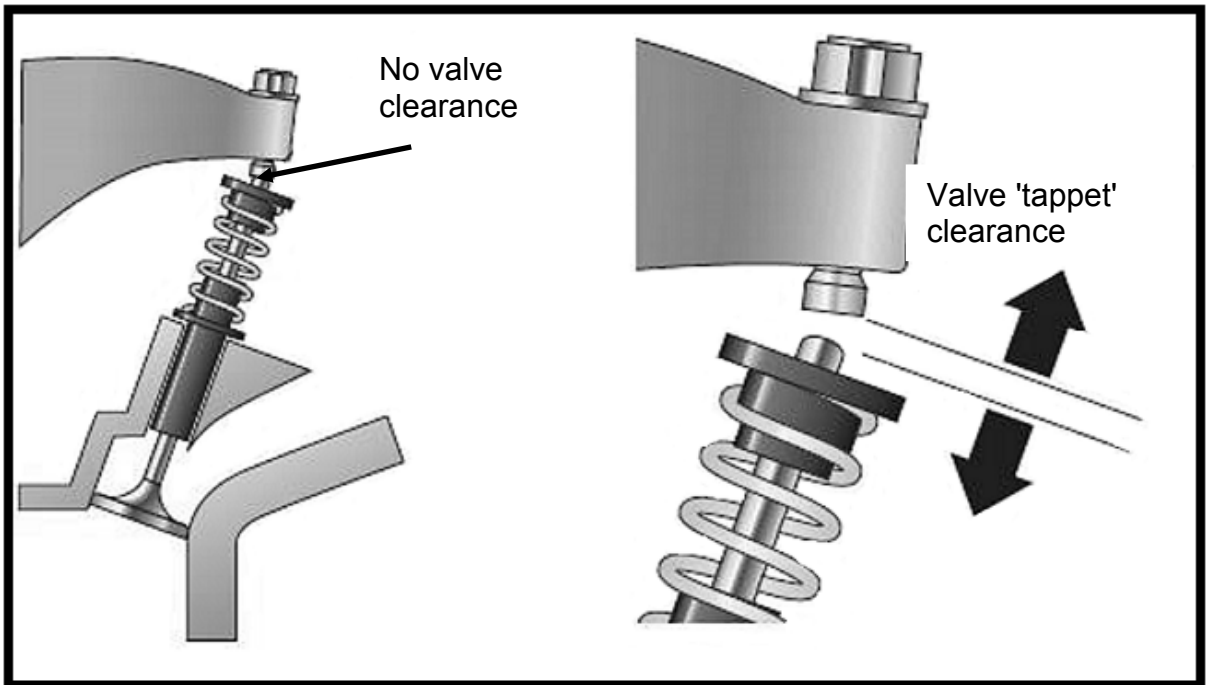
Term: 1
Start date: January 2017
Completion date: March 2017
Mark allocation: 50
Duration of assessment: 12 hours

PRACTICAL LEARNER ASSESSMENT WORK SHEET: VALVES

Name:_____

1. FIGURE 1 indicates the valve assembly in an internal combustion engine. Answer the following questions.

Valves:



1.1 Name the TWO types of valves and state the function of each.

	(2)
	(2)

1.2 Identify THREE different types of overhead valve arrangements for four-stroke four-cylinder engines with the aid of simple sketches/diagrams

Type	**Sketch/diagrams**	
		(3)
		(3)
		(3)

2. Obtain the specifications regarding the following:

2.1	Valve length		(1)
2.2	Valve diameter		(1)
2.3	Valve clearance		(3)

3. Setting of valve timing:

3.1	Position of the crankshaft		(1)
3.2	Position of the camshaft		(1)
3.3	State the THREE methods used to link the camshaft to the crankshaft.	• • •	(3)

4. Answer the following questions regarding setting of the valve clearance.

4.1	Why should the engine be at normal operating temperature?	
		(2)
4.2	Give FOUR reasons why the clearance of each type of valve differs.	
	• • • •	(4)
4.3	Why is the surface area of one valve larger than the other? State TWO reasons.	
	• •	(2)

4.4	What will be the harmful effect of excessive valve clearance? State THREE.	
	• • •	(3)
4.5	What will be the harmful effect of too small valve clearance? State THREE.	
	• • •	(3)
4.6	Describe the correct sequence to set valves.	
	• • • • • • •	(7)
4.7	State THREE safety precautions that need to be considered when adjusting the valves.	
	• • •	(3)

4.8	List THREE essential tools that will be used when performing this task.	
	• • •	(3)
	GRAND TOTAL:	**50**

B2. Conventional Ignition System (Teacher Guide)

Term: 2
Start date: April 2017
Completion date: June 2017
Mark allocation: 100
Duration of assessment: 20 hours

PRACTICAL LEARNER ASSESSMENT WORK SHEET: IGNITION SYSTEM

Name:_____

1. FIGURE 1.1 indicates a conventional ignition system. Answer the questions that follow.

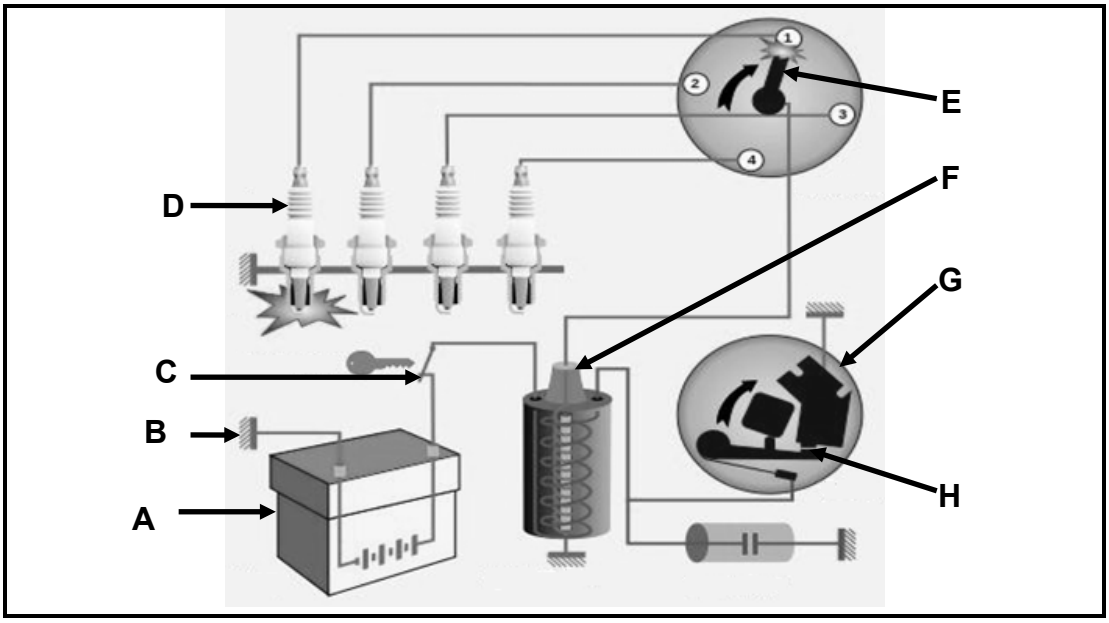


FIGURE 1.1: CONVENTIONAL IGNITION SYSTEM

1.1	Identify components A–H of the conventional ignition system shown in FIGURE 1.1.	
	A – B – C – D – E – F – G – H –	(8)

1.2	State FIVE safety precautions that need to be considered when working with an ignition system.		
	• • • • •		(5)
1.3	State the function of the following with reference to ignition systems:		
1.3.1	Firing order		(2)
1.3.2	Ignition timing		(2)
1.3.3	Spark plug		(2)
1.3.4	Mechanical advance unit		(2)
1.3.5	Vacuum advance unit		(2)

2. Practical application of the ignition system:

2.1	Explain the procedure to follow when removing a spark plug.	
	• • • •	(4)
2.2	List points to consider when cleaning and adjusting the spark plug gap according to the manufacturer's specification.	
	• • • • • •	(6)

3. Dismantling and assembling of distributor

FIGURE 3.1: DISTRIBUTOR

3.1	Explain procedure to follow when removing distributor from the engine:	
	• • • • • • •	(7)

3.2	Explain procedure to follow when dismantling the distributor.	
	• • • • • •	(6)
3.3	Complete a conditional report when dismantling the distributor. Choose any FIVE parts.	

No:	**Part**	**Condition**	
1			(2)
2			(2)
3			(2)
4			(2)
5			(2)

Assembling a distributor

3.4	Briefly explain the procedure to follow when assembling a distributor.	
	• • •	(3)
3.5	Explain procedure to follow when replacing and adjusting the contact breaker points.	
	Replacing:	
	• • • • • • •	(8)

	Adjustment	
	•	
	•	
	•	
	•	
	•	
	•	
	•	
	•	(8)

3.6	Explain the procedure to check and adjust the ignition timing using timing light.	
•		
•		
•		
•		
•		
•		
•		
•		
•		
•		
•		
•		
•		
•		
•		
•		
•		
•		
•		
•		
•		
•		
•		
•		
•		
•		(25)
	GRAND TOTAL:	**100**

B3. MAINTENANCE –Engine Lubrication

Term: 2
Start date: July 2017
Completion date: August 2017
Mark allocation: 50
Duration of assessment: 10 hours

PRACTICAL LEARNER ASSESSMENT WORK SHEET: ENGINE LUBRICATION

Name:_____

1. **Engine lubrication**

1.1	State the functions of the following components of the lubricating system.		
1.1.1	The oil strainer and filter		(1)
1.1.2	The relief valve		(1)
1.1.3	The oil pump		(1)
1.1.4	The oil seal		(1)
1.2	State the cause of the following problems in an engine:		
1.2.1	Low oil pressure		(1)
1.2.2	High oil pressure		(1)

1.3	FIGURE 1.1 shows an oil pump. Answer the questions that follow.	

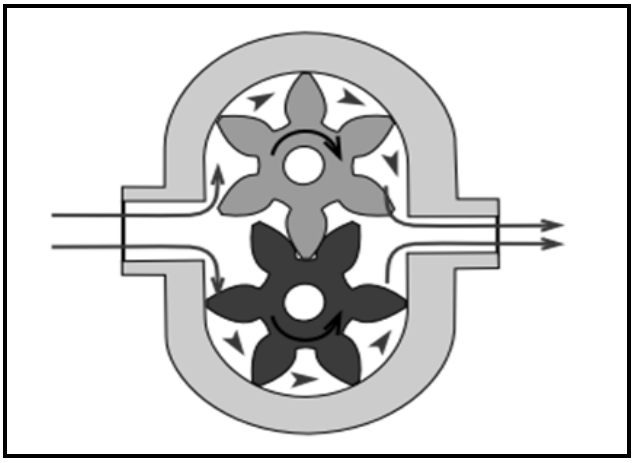


FIGURE 1.1

1.3.1	Identify the pump shown in FIGURE 1.1 above.	
		(1)
1.3.2	State ONE disadvantage of the bypass filter	
		(1)
1.3.3	Explain the operation of the pump shown in FIGURE 1.1.	
	• • • • •	(5)

1.3.4	Dismantle the pump and give conditional report		
Item No:	**Part**	**Condition**	
1			(2)
2			(2)
3			(2)
1.3.5	Use the feeler gauge, check the clearance and compare it with the manufacturer's specifications.		(1)
1.4	**Filtering system**		
1.4.1	Explain the difference between the *full-flow* and the *bypass filtering systems*.		
	Full-flow filtering system:		(1)
	Bypass filtering system:		(1)
1.4.2	Identify the oil filter shown in FIGURE 1.2 below.		

FIGURE 1.2

		(1)

1.4.3	State ONE disadvantage of the bypass filter	
		(1)
1.4.4	Where will you find the specifications with respect to the recommended service intervals of a specific vehicle?	
		(1)
1.5	Explain why engine oil leakages should be prevented.	
		(1)
1.6	List THREE types of oil seals and state their practical application.	

Item No:	**Type**	**Application**	
1	(1)		(1)
2	(1)		(1)
3	(1)		(1)

1.7	**Oil change**	
1.7.1	What fluid levels must be inspected when carrying out the general service of a vehicle?	
•		(1)
•		(1)
•		(1)
•		(1)
•		(1)
•		(1)

1.7.2	List FIVE appropriate tools and equipment needed to change engine oil.	
•		(1)
•		(1)
•		(1)
•		(1)
•		(1)
1.7.3	Explain the procedure followed when changing engine oil.	
	• • • • • •	(5)
1.7.4	Which TWO areas must be checked for oil leaks?	
•		(1)
•		(1)
	GRAND TOTAL:	**50**

SECTION C: WELDING AND METALWORK

C1: ROOF TRUSS

Term: 1
Start date: January 2017
Completion date: March 2017
Mark allocation: 75
Duration of assessment: 12 hours

1. CONSTRUCTION OF A ROOF TRUSS

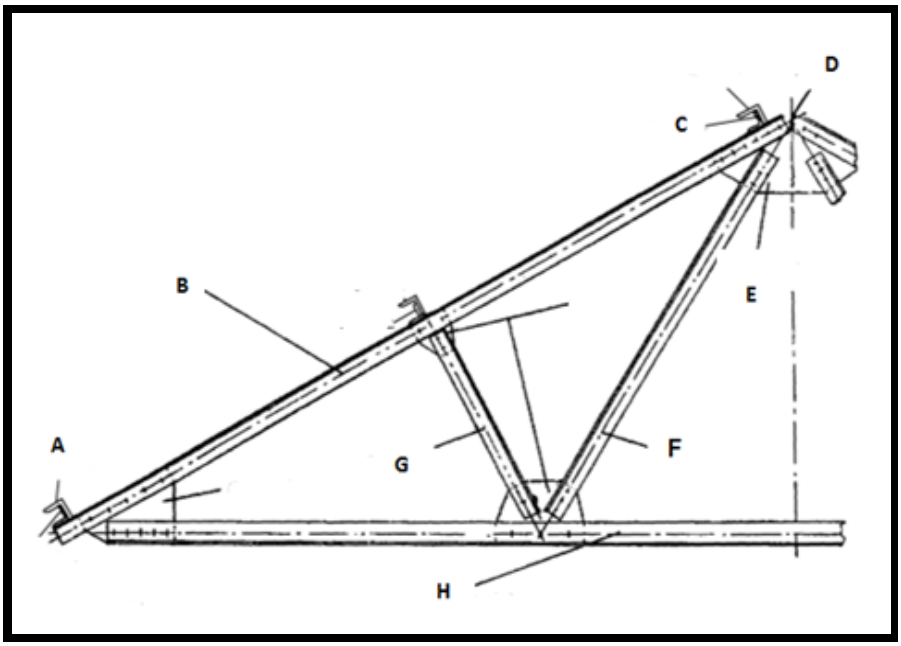


FIGURE 1.1

1.1 Use the following information to manufacture a roof truss:
- The span of a roof truss is 2 000 mm with a rise of 500 mm.

1.1.1 Calculate:
- The rafter length of a truss
- The pitch of a truss

1.1.2 Method:
- Use a scale drawing to draw a roof truss according to your calculations.
- Manufacture a roof truss according to the scale used.
- All joints must be fitted with gussets plates.
- The joints can be welded or riveted or bolted.
- The final product may be painted.

1.1.3 Materials:
- 25 x 25 x 3 angle iron
- 25 x 3 flat bar
- Rivets, bolts and nuts and/or welding electrodes.

1.1.4 Criteria
- Overall, sizes must be within ±3 mm of the required measurement.
- Pitches and back mark sizes must be within ± 1 mm of the required measurement.
- All the angle iron ends must be squared off.

GRADE 11 PAT	YEAR: 2017	SCHOOL:
DATE STARTED:		DATE COMPLETED:
SUBJECT: WELDING AND METALWORK		LEARNER:
ROOF TRUSS WORK SHEET		EDUCATOR:

1.1 State FIVE safety precautions to be observed when laying out a roof truss. (5)

1.2 Name SEVEN tools that you will use during fabrication of a roof truss. (7)

1.3 Identify A–H of the roof truss in FIGURE 1.1. (8)

A –
B –
C –
D –
E –
F –
G –
H –

TOTAL: /20

SIGNATURE OF EDUCATOR:	
SIGNATURE OF HOD:	

GRADE: 11	YEAR: 2017	SCHOOL:
DATE STARTED:		DATE COMPLETED:
SUBJECT: WELDING AND METALWORK		
PROJECT: LAYOUT ROOF TRUSS		EDUCATOR:

NAMES OF LEARNERS																
FACETS	**MARKS**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
1.1 Safety	5															
1.2 Tools	7															
1.3 Labels	8															
1.4.1 Calculations	12															
1.4.2 Scale drawing	4															
MANUFACTURING																
The angle iron and flat bar sizes are within ± 1,5 mm of the required sizes.	6															
Pitches, gusset plates and back marks are within ± 1 mm of those required.	8															
All braces and cleats as shown on the drawing.	5															
No damage to tools or equipment.	5															
All angle irons are assembled	10															
Finish	5															
TOTAL	**75**															

SIGNATURE OF TEACHER:	
SIGNATURE OF HOD :	

C2. WELDING AND METALWORK: SQUARE TO ROUND

Term: 2–3
Start date: April 2017
Completion date: August 2017
Mark allocation: 75
Duration of assessment: 20 hours

1. Use your practical skills and manufacture the BOMA, as shown in FIGURES 1.1 and 1.2:

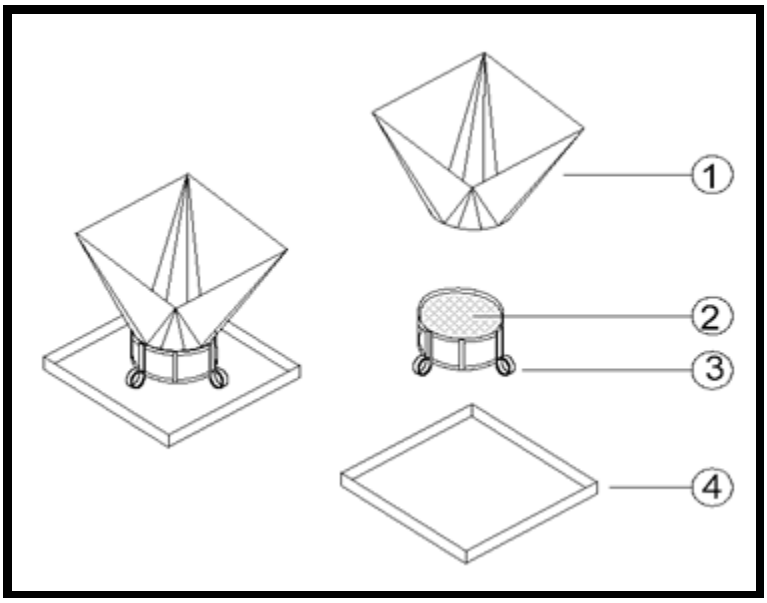


FIGURE 1.1

MATERIAL LIST

ITEM NO.	DESCRIPTION	MATERIAL	QUANTITY
1.	Square to round transition piece	Mild steel/Stainless steel ± 3 mm plate	1 off
2.	Grid	Diamond mesh or expanded metal	1 off
3.	Legs and frame	Flat bar 25 x 3 mm and 6 mm round bar	4 off
4.	Base	Mild steel or stainless steel sheet metal ± 2 mm	1 off

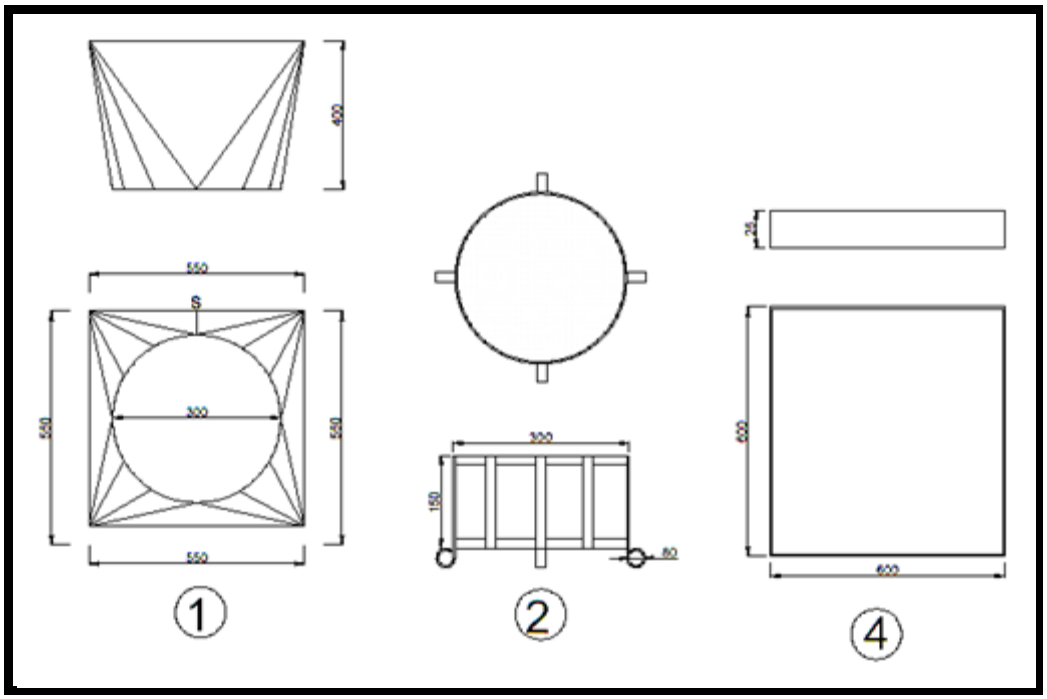


FIGURE 1.2

DEVELOPMENT OF A BOMA:

1.1 The following standards must be achieved:

- All sizes of fabrication must be within ± 1,5 mm.
- There must be no damage to tools and equipment.
- All appropriate safety procedures must be adhered to.

GRADE 11 PAT	YEAR: 2017	SCHOOL:
DATE STARTED:		DATE COMPLETED:
SUBJECT: WELDING AND METALWORK		LEARNER:
WELDING WORK SHEET		EDUCATOR:

2.1 Name TEN tools that you will use during the manufacturing of a practical project. (10)
2.2 List FIVE skills one needs to apply when making the project. (5)
TOTAL: /15

SIGNATURE OF EDUCATOR:	
SIGNATURE OF HOD:	

GRADE: 11 PAT	YEAR:2017	SCHOOL:
DATE STARTED:		DATE COMPLETED:
SUBJECT: WELDING AND METALWORK		
PROJECT: MAKING OF BOMA		EDUCATOR:

NAMES OF LEARNERS																
FACETS	**MARKS**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
2.1 Tools	10															
2.2 Skills	5															
CONSTRUCTION																
Template of square to round transition	10															
Development of square to round transition	20															
Development of a base	10															
Development of an ash tray	10															
Assembled BOMA	5															
Finished	5															
TOTAL	**75**															

SIGNATURE OF TEACHER:	
SIGNATURE OF HOD:	

5. CONCLUSION

On completion of the practical assessment task, learners should be able to demonstrate their understanding of the industry, enhance their knowledge, skills, values and reasoning abilities as well as establish connections to life outside the classroom and address real world challenges. The PAT furthermore develops learner's life skills and provides opportunities for learners to engage in their own learning.