



# basic education

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Department:  
Basic Education  
**REPUBLIC OF SOUTH AFRICA**

## **MECHANICAL TECHNOLOGY**

### **GUIDELINES FOR PRACTICAL ASSESSMENT TASKS**

**GRADE 10**

**2016**

**These guidelines consist of 41 pages.**

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## 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 out for himself/herself. Learning by watching should be kept to the bare minimum. Giving 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 **phases** and the 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 10 is externally set and moderated, but internally assessed.

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

The PAT (all phases) should be completed in the first three terms. The PAT should be completed under controlled conditions (refer to the *Mechanical Technology CAPS Grade 10–12*).

### **2.2 Assessment of PAT**

Frequent and developmental feedback is needed to guide and give support to the learner to ensure that the learner is on the right track.

Both formal and informal assessment should be conducted on the different phases that constitute the PAT. 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 phase tasks (phases 1–4), will be presented to the moderator with the assessment criteria and marks obtained.

Where required the moderator should be able to call on the learner to explain the functions and principles of operation. The learner may be requested to demonstrate the skills acquired through the capability tasks for 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.

### 3. LEARNER GUIDELINES

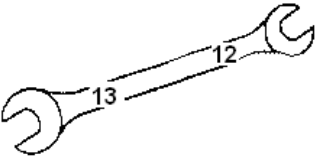

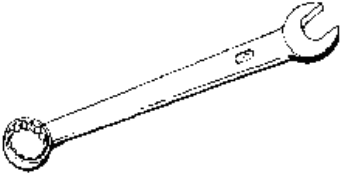
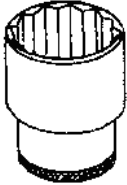

- The Practical Assessment Task (PAT) consists of a generic and a specialisation task in Fittings and Machining, Automotive and Welding and Metalwork. The practical work is spread over THREE terms, as set out in each of the specialisation areas.
- All tasks must be completed according to the time frames 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 removed from the workshop and given additional corrective tasks to improve their safety awareness.

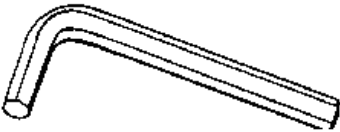

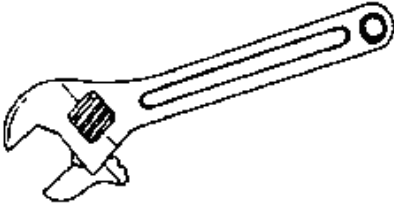
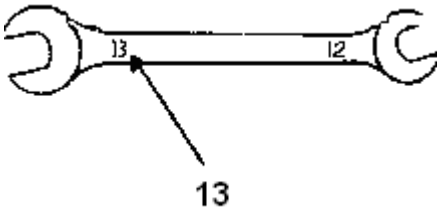

**4. PRATICAL ASSESSMENT GUIDELINES – GENERIC****4.1 TOOLS: BASIC HAND TOOLS**

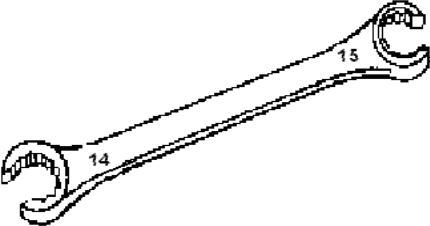

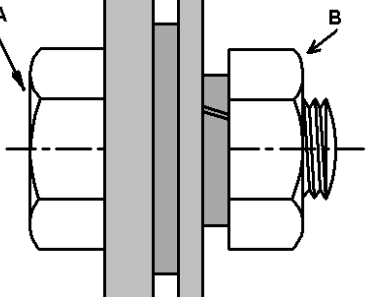
Term: 1  
 Start: January 2016  
 Completion: March 2016  
 Mark allocation: 20  
 Duration of assessment: 1 hour


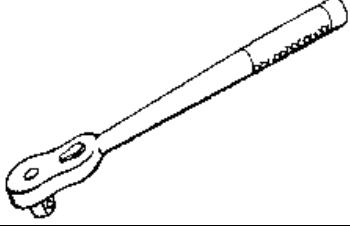
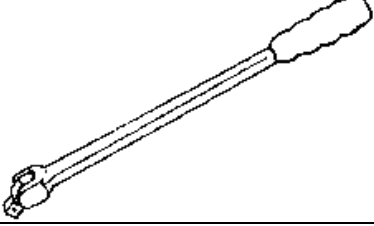
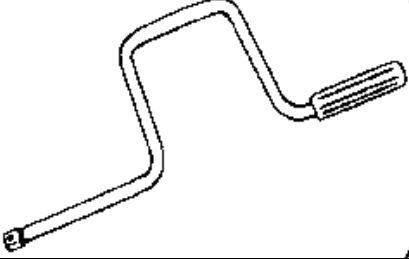
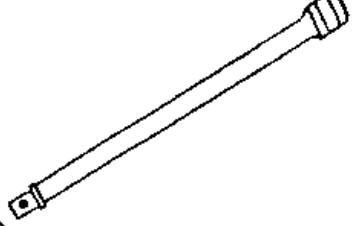
Learners need to identify the following tools and complete TABLE 1.

**TABLE 1: TOOLS**

QUESTION	DESCRIPTION	MARK
1	Name the type of tool illustrated below.	
a		1
b		1
c		1
d		1
e		1

QUESTION	DESCRIPTION	MARK
f		1
g		1
h		1
2	<p align="center"><b>Study the spanner diagram below and answer the questions that follow.</b></p>	
		
a	<p align="center">What is the size of the spanner?</p>	1
b	<p align="center">What is the unit of the spanner?</p>	1
c	<p align="center">Where does the size and unit originate from?</p>	1
3	<p align="center"><b>Study the tool below and answer the questions that follow.</b></p>	
		
a	<p align="center">What is the size of the tool?</p>	1
b	<p align="center">What is used it used for?</p>	1

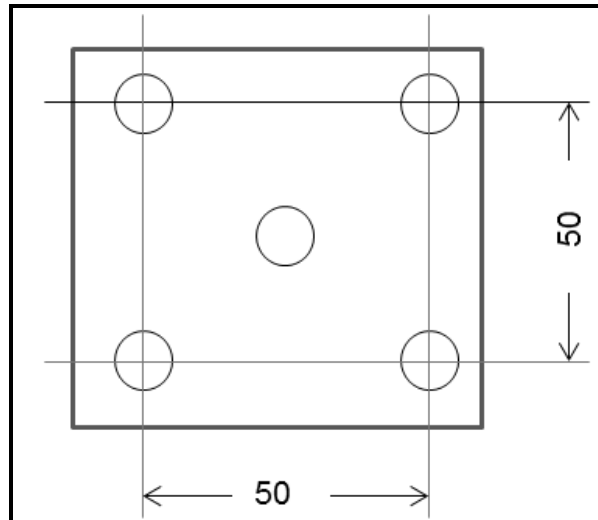
QUESTION	DESCRIPTION	MARK
4	<p align="center"><b>Study the spanner below and answer the questions.</b></p>	
		
a	<p align="center">What type of spanner is shown?</p>	<p align="center"><b>1</b></p>
b	<p align="center">What is it used for?</p>	<p align="center"><b>1</b></p>
c	<p align="center">What size is illustrated?</p>	<p align="center"><b>1</b></p>
5	<p align="center"><b>Describe the spanner shown below.</b></p>	
		<p align="center"><b>2</b></p>
6	<p align="center"><b>Loosening or tightening a nut and bolt combination with set of ring spanners.</b></p>	
		
a	<p align="center">To which part is the main force applied?</p>	<p align="center"><b>1</b></p>
b	<p align="center">State the nature of the applied force (pulling, shearing, etc.)</p>	<p align="center"><b>2</b></p>

QUESTION	DESCRIPTION	MARK
7	What is the advantage of a ring spanner compared to a flat spanner?	2
8	Name the socket attachments illustrated below.	
a		1
b		1
c		1
d		1
e		1
9	Briefly explain the difference between a 1/2 inch and a 1/4 inch drive type.	2
<b>TOTAL</b>		<b>30</b>

## 4.2 JOINING METHODS

Term: 2  
 Start: April 2016  
 Completion: June 2016  
 Mark allocation: 50  
 Duration of assessment: 3 hours

Use marking-off instruments to mark off 2 plates (at least 5 mm thick) with 5 holes.



**FIGURE 4.1: JOINING METHODS**

### MATERIAL:

ITEM NO.	DESCRIPTION	MATERIAL	SIZE	QUANTITY
1	Marking-off plate	Mild steel	75 x 75 x 5	2

### Processes: Marking off plate and drilling

- File off sharp edges on mild steel plate
- Cut corners off away from marked-off line
- File metal until accuracy is obtained
- Drill and tap the centre hole with a M6 x 1,0 tap (Drill a  $\varnothing$  5 mm hole)
- Drill a  $\varnothing$  6 mm hole in each of the plates and positions
- Use a M6 x 1,0 bolt and join the plates together

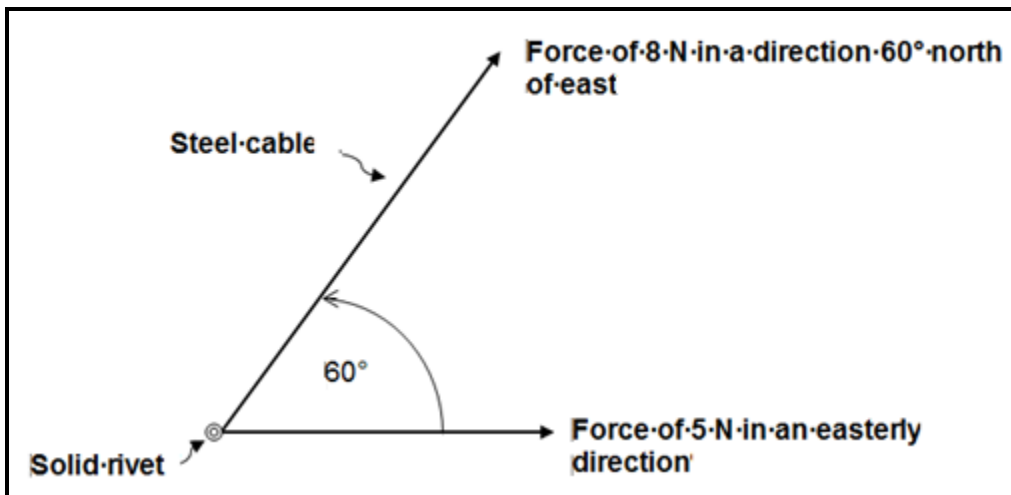
### Marking Rubric: Plate

Process		Mark allocation
1.	Cut and square off	5
2.	File to correct size	10
3.	Mark off holes	15
4.	Drill each hole	5
5.	Tap the centre hole	5
6.	Join the two plates	5
7.	Correct use of tools	3
8.	Safety precautions followed	2
<b>TOTAL</b>		<b>50</b>

**4.3 FORCES**

Term: 2  
 Start: April 2016  
 Completion date: June 2016  
 Mark allocation: 30  
 Duration of assessment: 1 hour

4.3.1 Study the vector diagram below relating to the parallelogram of forces and determine graphically the resultant and equilibrant forces.



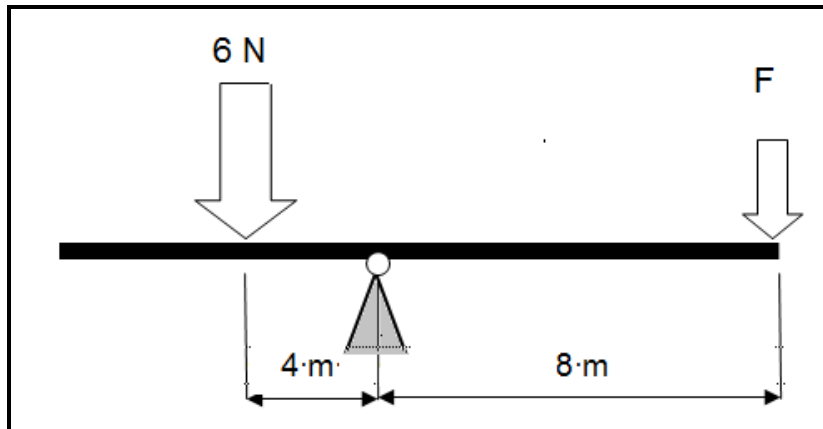
**FIGURE 4.2: FORCES**

Draw a force diagram using a scale of 10 mm = 1 N (10)

Resultant = \_\_\_\_\_ (5)

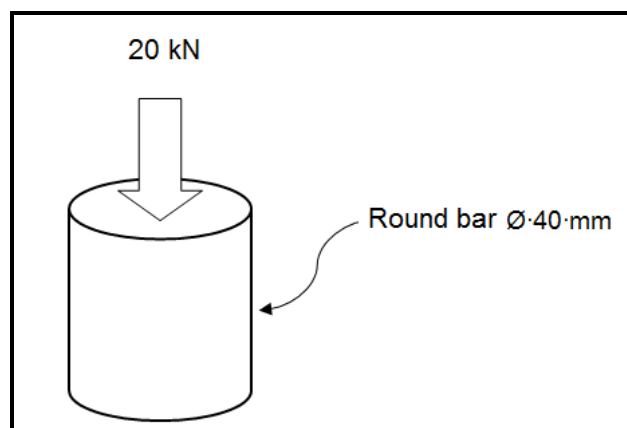
Equilibrant = \_\_\_\_\_ (5)

4.3.2 Calculate the load on the right-hand side of the beam. (5)



**FIGURE 4.3: MOMENTS**


4.3.3 Calculate the size of the compressive stress on the part, as shown in the diagram below. (5)



**FIGURE 4.4: STRESS**


**4.4 MAINTENANCE**

Term: 2  
Start: April 2016  
Completion: June 2016  
Mark allocation: 5  
Duration of assessment: ½ hour

Analyse and predict what could happen if the centre lathe, which is used daily in the workshop, is not regularly maintained? (5)


**4.5 MATERIALS**

Term: 3  
Start: July 2016  
Completion: September 2016  
Mark allocation: 20  
Duration of assessment: ½ hour

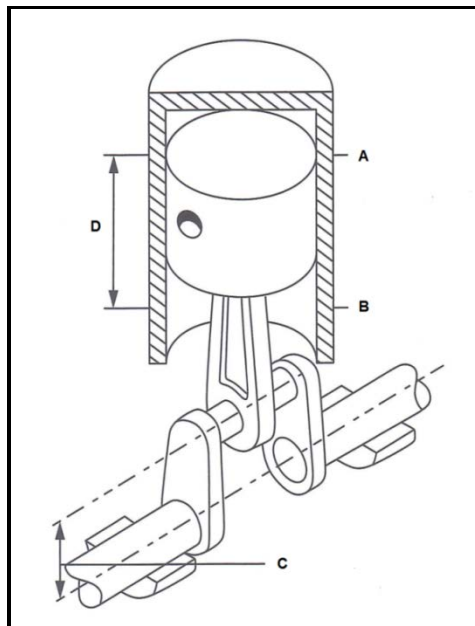
4.5.1 Name any FIVE non-ferrous metals used in mechanical engineering and state ONE use on each. (10)


4.5.2 State any FIVE non-ferrous alloys used in mechanical engineering and state ONE use on each. (10)


**4.6 ENGINES**

Term: 4  
 Start: September 2016  
 Completion: November 2016  
 Mark allocation: 10  
 Duration of assessment: ½ hour

The diagram below shows the position of a piston of an internal combustion engine. Describe the operating principles of the 2- and 4-stroke internal combustion spark ignition engines and label the parts shown in the diagram. (10)



**FIGURE 4.5: ENGINE**


A	
B	
C	
D	

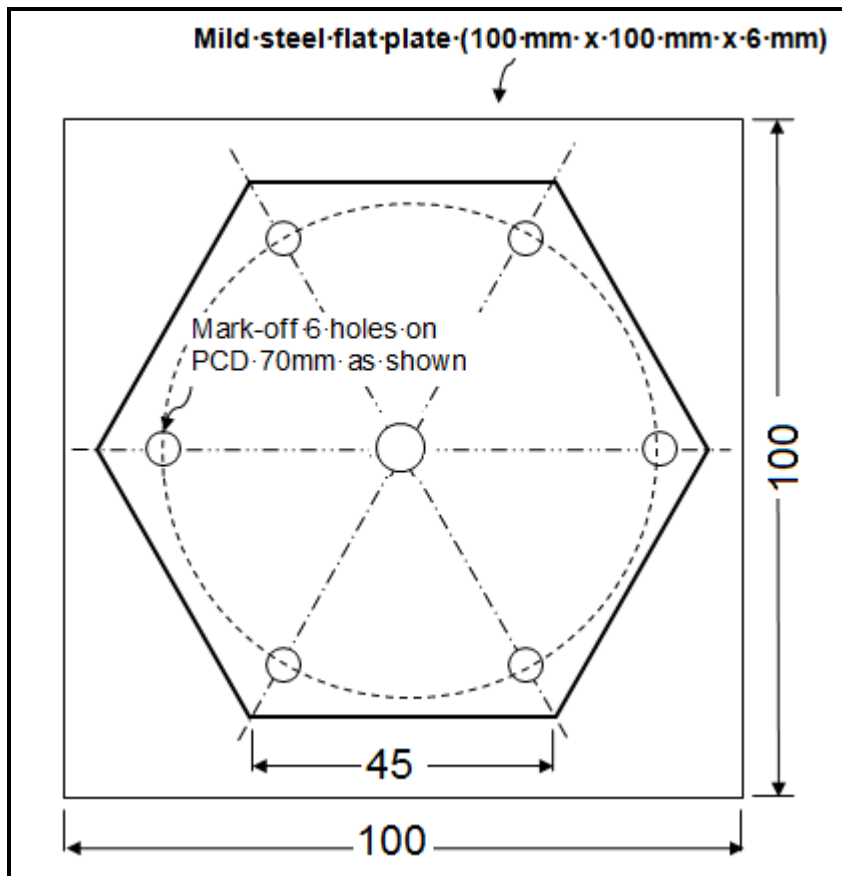
**5. PRACTICAL ASSESSMENT GUIDELINES – SPECIFIC**

**5.1 FITTING AND MACHINING – TERMINOLOGY**

**CANDLE HOLDER – BASE PLATE**

Term: 1–4  
 Start: January 2016  
 Completion: November 2016  
 Mark allocation: 70  
 Duration of assessment: 12 hours

**WORKING DRAWING:**



**FIGURE 5.1: BASE PLATE**

ITEM NO.	DESCRIPTION	MATERIAL	SIZE	QUANTITY
1	Candle holder base	Mild steel	100 x 100 x 6 mm	1

**Preparation of the candle holder base:**

- File off sharp edges on mild steel plate.
- Mark off hexagon.
- Cut off excess material. **NOTE:** Leave sufficient material for filing.
- File work piece to size as per sketch.
- Stamp NAME and YEAR on work piece.
- Remove all sharp edges.
- Drill  $\varnothing$  5 mm holes and tap the 6 holes M6, as per illustration.
- Drill centre hole  $\varnothing$  5 mm, as per illustration.
- Countersink hole on one side of the plate **ONLY**.
- Prime and paint base plate.

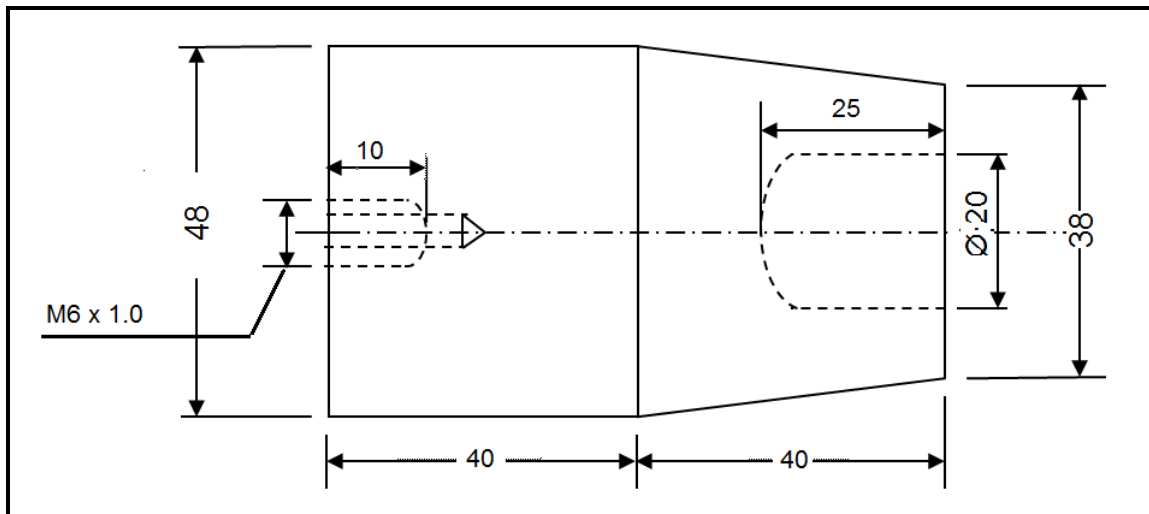
**Marking Rubric: Base plate for candle holder**

Process	Mark allocation
File off sharp edges on mild steel plate.	5
Mark-off hexagon.	15
Cut off excess material. <b>NOTE:</b> Leave sufficient material for filing.	5
File work piece to size as per sketch.	10
Stamp NAME and YEAR on work piece.	5
Remove all sharp edges.	5
Drill and tap 6 holes M6 as per illustration.	10
Drill centre hole $\varnothing$ 6.5 mm as per illustration.	5
Countersink hole on one side <b>ONLY</b> .	5
Prime and paint base plate.	5
Correct use of tools.	5
Safety	5
<b>TOTAL</b>	<b>70</b>

**CANDLE HOLDER – TURNING**

Term: 1–4  
 Start: January 2016  
 Completion: November 2016  
 Mark allocation: 100  
 Duration of assessment: 12 hours

ITEM NO.	DESCRIPTION	MATERIAL	SIZE	QUANTITY
2	Candle holder	Aluminium	Ø 50 x 85	1

**FIGURE 5.2: CANDLE HOLDER****Candle Holder: Processes**

- Step 1: Set-up work piece and facing tool in centre lathe.
- Step 2: Face both ends to length (as per working drawing).
- Step 3: Centre drill both ends.
- Step 4: Drill both ends as per working drawing.
- Step 5: Tap hole as per working drawing.
- Step 6: Set cutting tool to centre height.
- Step 7: Turn work piece according to specifications
- Step 8: Calculate included angle to cut taper.
- Step 9: Set compound slide.
- Step 10: Cut taper.
- Step 11: Polish work piece
- Step 12: Assemble parts.

Process		Mark allocation
1.	Set-up work piece and facing tool in centre lathe.	5
2.	Face both ends to length.	10
3.	Centre drill both ends.	5
4.	Drill both ends.	10
5.	Tap hole.	5
6.	Set cutting tool to centre height.	5
7.	Turn work piece.	15
8.	Calculate included angle to cut taper.	10
9.	Set compound slide.	10
10.	Cut taper.	15
11.	Polish work piece .	5
12.	Assemble parts.	5
<b>TOTAL</b>		<b>100</b>

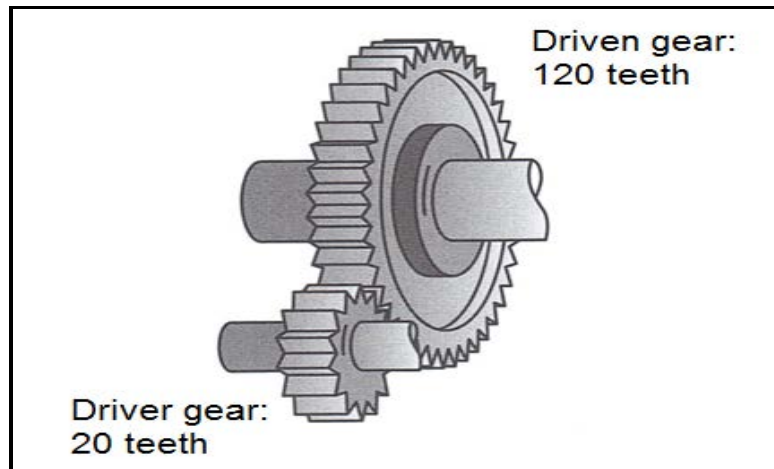
**Rubric for Fitting and Machining:**

TOLERANCE	TURNING		FILING	
	DIAMETER	LENGTH	Measured at 6 places	
	+ 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%

**5.2 FITTING AND MACHINING – SYSTEMS AND CONTROL**

Term: 1–4  
 Start: July 2016  
 Completion: November 2016  
 Mark allocation: 15  
 Duration of assessment: 1 hour

5.2.1 You are required to design a gear system which has a 20 tooth gear that rotates at 240 r/min. This gear must drive another gear with 120 teeth. Calculate the rotational frequency of the driven gear. (5)



**FIGURE 5.3: GEARS**


5.2.2 A shaft rotating at 780 r/min has a 250 mm diameter pulley which drives a second shaft with a diameter of 130 mm by means of a driving belt. In order for this to operate at a factory, the driven shaft must rotate at 1 800 r/min.

(i) Determine, by means of calculations, whether the system will work. If not, what is a possible solution to ensure the proper drive? (5)

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(ii) Determine the belt speed in the system. (5)

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## 6. PRACTICAL ASSESSMENT GUIDELINES – SPECIFIC

### 6.1 AUTOMOTIVE – TERMINOLOGY

Term: 3  
Start: July 2016  
Completion: November 2016  
Mark allocation: 100  
Duration of assessment: 10 hours

#### REMOVING AND INSTALLING BRAKE PADS

##### TOOLS TO BE USED:

ratchet; breaker bar; assorted extensions; assorted sockets; assorted open-ended wrenches; G-clamp; hydraulic jack; jack stands; rubber mallet; wire brush; gloves

##### DISC BRAKE LAYOUT:

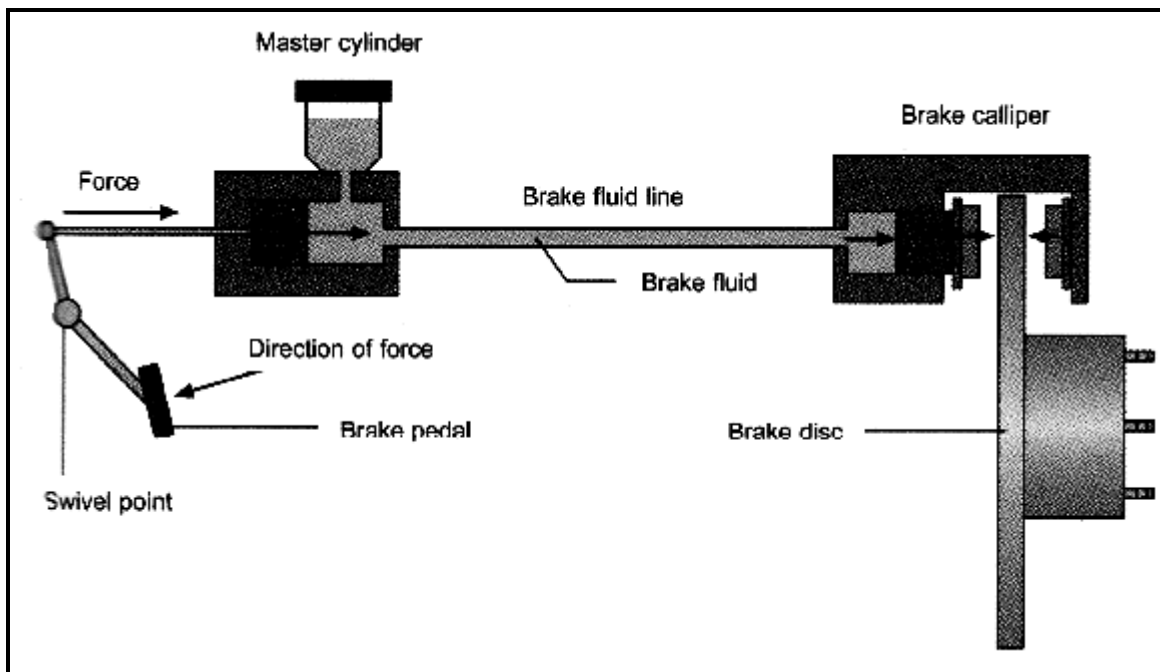
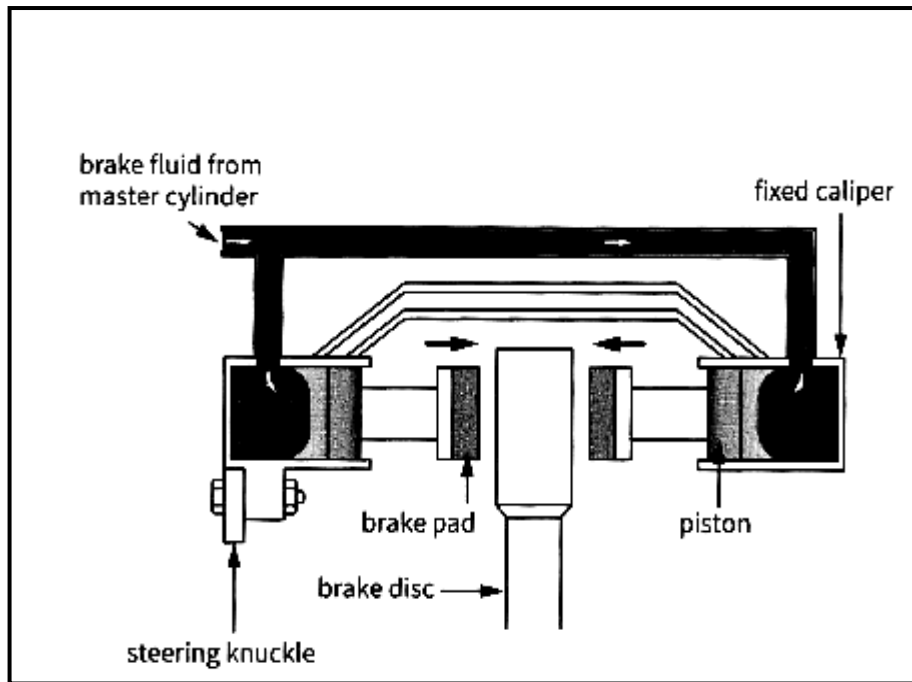
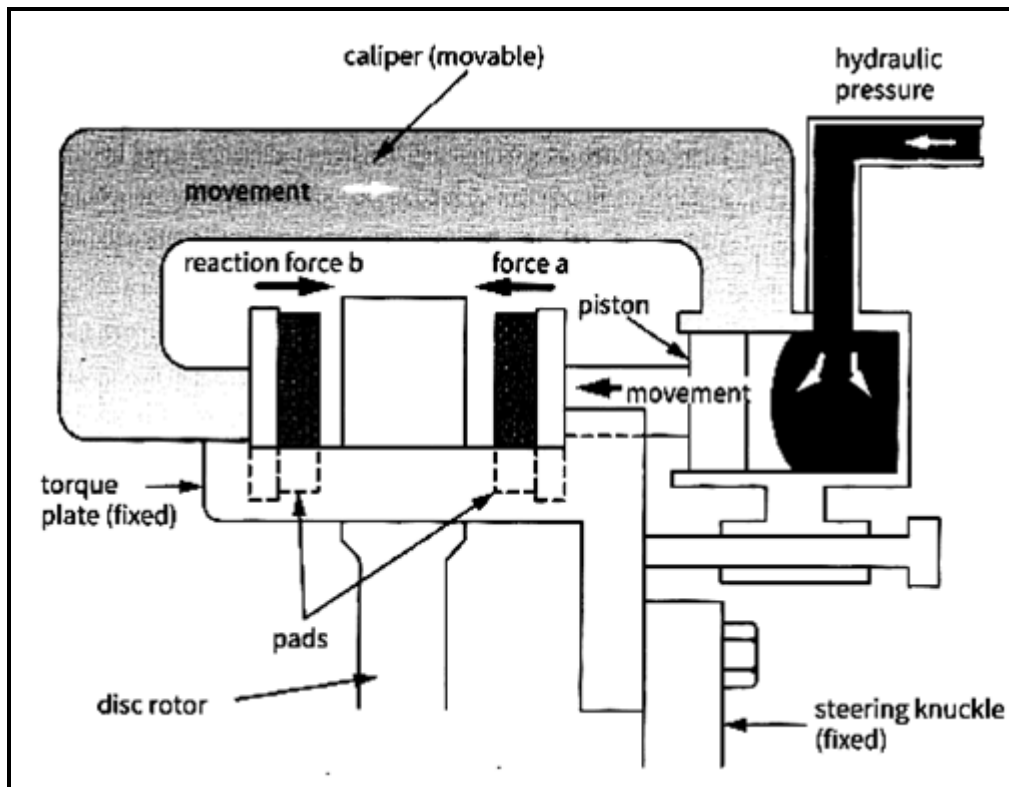


FIGURE 6.1: DISC BRAKE LAYOUT

**TYPES OF BRAKE CALLIPERS:**



**FIGURE 6.2: FIXED DUAL-PISTON BRAKE CALLIPER**



**FIGURE 6.3: FLOATING BRAKE CALLIPER**

**COMPONENTS REQUIRED:**

- Disc brake wheel assembly
- Brake pads
- Brake fluid
- Hand tools

**PROCESS: CHANGE BRAKE PADS**

- **Step 1:** Acquire brake pads.
- **Step 2:** Loosen wheel nuts or studs on wheel.
- **Step 3:** Raise car.
- **Step 4:** Remove the wheel from the vehicle adhering to all necessary safety aspects. Loosen calliper. Check the brake disc for heavy rust, scoring, cracks and uneven wear.
- **Step 5:** Unbolt and remove calliper carrier.
- **Step 6:** Place the calliper properly; do not allow it to hang on the brake hose.
- **Step 7:** Gently push back the piston to free the disc pads. Check the disc pad for wear. (Friction surface is still thick enough).
- **Step 8:** Compress the piston in the calliper.
- **Step 9:** Fit new disc pads.
- **Step 10:** Replace parts that were removed; repeat for all the wheels.
- **Step 11:** Bleed brakes to remove any air in the system.
- **Step 12:** Break in pads and braking system.

**SPECIFICATION: REMOVE AND INSTALL BRAKE PADS**

STEPS	METHOD
<b>Acquire brake pads</b>	Ceramic tends to be the best, as they give the best brake feel and the longest protection against brake fade, although dust may accumulate on your wheel.
<b>Loosen nuts or studs on wheels</b>	Remember, you are loosening, NOT removing. Get the lugs loose enough that you'll be able to take them off with a regular ratchet. Release the parking brake when the wheel is off.
<b>Raise car</b>	Put the hydraulic jack underneath the frame rail or the factory jacking points of the car. Place jack stands underneath the car making sure that the weight cannot shift. Now remove the wheels.
<b>Remove calliper carrier</b>	Remove the two 17 mm or 19 mm bolts on the rear of the hub that keep the calliper carrier on. These are tight so use a breaker bar with a mallet if you can.
<b>Assemble calliper carrier</b>	Replace the carrier bolts and tighten them using an impact gun or breaker bar.
<b>Compress calliper</b>	Using the G-clamp and one of the old brake pads, compress the calliper piston until the piston is flush with the housing of the calliper. Make sure that the cap is not on the brake reservoir, as you do not want to risk blowing a line.
<b>Install pads and calliper</b>	Install pads in the carrier and use a little bit of anti-squeal grease on the outside of the pad to ensure smooth operation. Install the calliper bolts and ensure that the calliper moves without binding. Tighten the bolts and double check your work
<b>Put on wheels.</b>	Tighten the lugs hand tight when in the air, and torque them down when the wheels are on the ground using a torque wrench or breaker bar.
<b>Repeat for all 4 wheels</b>	
<b>Bleed the brakes</b>	You should feel pressure within THREE pumps of the pedal.
<b>Break in pads and braking system</b>	The brakes may squeal or make some noise during the first few kilometres. This is normal. To break in the new components accelerate to 60 km/h and gradually slow to 40 km/h, and repeat a few times, then 50–30 km/h a few times. After that simply drive normally.

**MARK ALLOCATION: CHANGING BRAKE PADS**

<b>PROCESS</b>	<b>MARK ALLOCATION</b>
<b>Step 1:</b> Acquire brake pads.	5
<b>Step 2:</b> Loosen wheel nuts or studs on wheel.	15
<b>Step 3:</b> Raise car.	5
<b>Step 4:</b> Remove the wheel from the vehicle adhering to all necessary safety aspects. Loosen calliper. Check the brake disc for heavy rust, scoring, cracks and uneven wear.	15
<b>Step 5:</b> Unbolt and remove calliper carrier.	5
<b>Step 6:</b> Place the calliper properly; do not allow it to hang on the brake hose.	5
<b>Step 7:</b> Gently push back the piston to free the disc pads. Check the disc pad for wear. (Friction surface is still thick enough).	15
<b>Step 8:</b> Compress the piston in the calliper.	5
<b>Step 9:</b> Fit new disc pads.	5
<b>Step 10:</b> Replace parts that were removed; repeat for all the wheels.	15
<b>Step 11:</b> Bleed brakes to remove any air in the system.	5
<b>Step 12:</b> Break in pads and braking system.	5
<b>TOTAL</b>	<b>100</b>

## 6.2 AUTOMOTIVE – TERMINOLOGY

### HOW TO PERFORM A RADIATOR TEST

Term:	3
Start:	July 2016
Completion:	November 2016
Mark allocation:	50
Duration of assessment:	6 hours (2 x 3 hours for each test)

#### BACKGROUND

When the engine temperature of your car rises, as evident by the temperature gauge in the console, a **radiator test** should be performed. External coolant leaks are relatively easy to spot, but internal leaks are a different story altogether. An overheating engine could be caused by many factors, such as low coolant levels due to leaks, faulty thermostats or a blown head gasket.

#### External Coolant Leaks

Check the engine bay for any leaks that may resemble the colour of your engine coolant. Most leaks stem from cracked radiator hoses due to old age or faulty installation. Replace the hoses if necessary. Remember that a hot engine will produce an extremely hot coolant in the radiator.

#### Blown Head Gasket

White smoke emitted from the tailpipe, brownish coolant in the reservoir, a change in colour of the engine oil or a rise in level of oil could mean a head gasket failure or a faulty engine cooling system. This can be diagnosed by a radiator test or coolant pressure test.

#### Radiator Pressure Test

A cooling system pressure tester is used to perform this test and is installed in place of the radiator cap. Take precaution when removing the radiator cap on a hot engine, because the pressure build-up could cause serious burns and scalds.

#### Procedure 1:

1. Install the pressure gauge and pump 69 kPa of pressure.
2. Check for leaks on external surfaces when the gauge indicates a loss of pressure.
3. Check the radiator hoses, water pump and the heater core. These are the common trouble spots susceptible to leaks.
4. Turn on the heater fans and observe the air coming out of the vents. A sweet smell indicates a leak on the heater cores.
5. Continue pressure testing until the cooling system holds pressure.

#### Procedure 2:

1. Start with a cold engine. Remove the radiator cap and install the pressure tester.
2. Start the engine with zero pressure on the gauge.
3. Observe the pressure build-up on the gauge. A properly operating cooling system will normally indicate 48 kPa to 55 kPa of pressure on the gauge.
4. If the gauge indicates a rise of 103 kPa or more of pressure, then an internal leak is evident on one of the cylinders. This is due to a faulty head gasket.

**Marking rubric for procedure 1:**

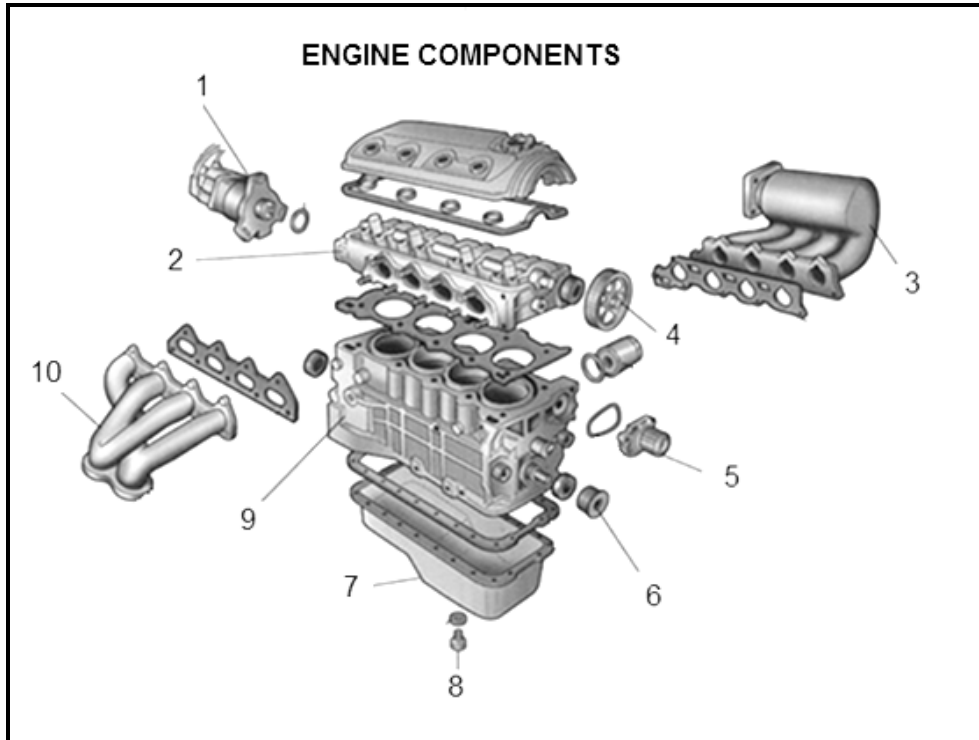
<b>STEPS</b>		<b>MARKS</b>
1.	Install the pressure gauge and pump 69 kPa of pressure.	10
2.	Check for leaks on external surfaces when the gauge indicates a loss of pressure.	10
3.	Check the radiator hoses, water pump and the heater core. These are the common trouble spots susceptible to leaks.	10
4.	Turn on the heater fans and observe the air coming out of the vents. A sweet smell will indicate a leak on the heater cores.	10
5.	Continue pressure testing until the cooling system holds pressure.	10
<b>TOTAL</b>		<b>50</b>

**Marking rubric for procedure 2:**

<b>STEPS</b>		<b>MARKS</b>
1.	Start with a cold engine. Remove the radiator cap and install the pressure tester.	10
2.	Start the engine with zero pressure on the gauge.	10
3.	Observe the pressure build-up on the gauge. A properly operating cooling system will normally indicate 48 kPa to 55 kPa of pressure on the gauge.	15
4.	If the gauge indicates a rise of 103 kPa or more of pressure, then an internal leak is evident on one of the cylinders. This is due to a faulty head gasket.	15
<b>TOTAL</b>		<b>50</b>

### 6.3 AUTOMOTIVE – ENGINES

Term: 1  
 Start: January 2016  
 Completion: March 2016  
 Mark allocation: 30  
 Duration of assessment: 4 hours



**FIGURE 6.4: ENGINE COMPONENTS**

Label and give the functions of the components of an engine.

**Procedure:**

1. Cut out different numbers from a piece of paper. Use A5 paper.
2. Paste the numbers on an engine.
3. Give the learners a worksheet to complete.
4. Explain the purpose of each of the components.

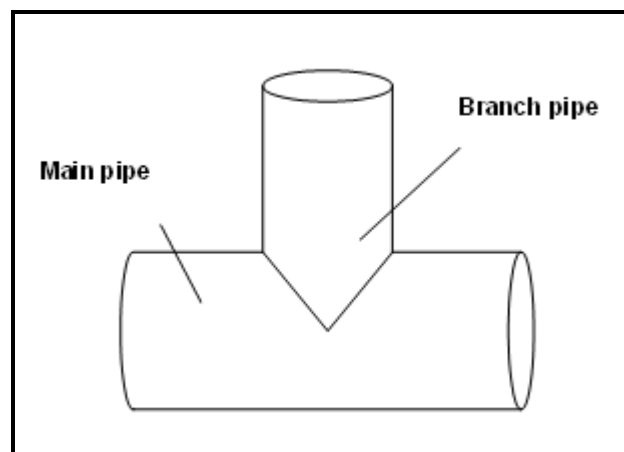
PART	FUNCTION	MARKS
Distributor		3
Cylinder head		3
Intake manifold		3
Camshaft pulley		3
Water pump		3
Timing belt pulley		3
Oil pan		3
Drain bolt		3
Engine block		3
Exhaust manifold		3
<b>TOTAL</b>		<b>30</b>

**7. WELDING AND METALWORK– TERMINOLOGY****7.1 T-PIECE**

Term: 1–4  
 Start: January 2016  
 Completion: November 2016  
 Mark allocation: 65  
 Duration of assessment: 12 hours

**DESCRIPTION**

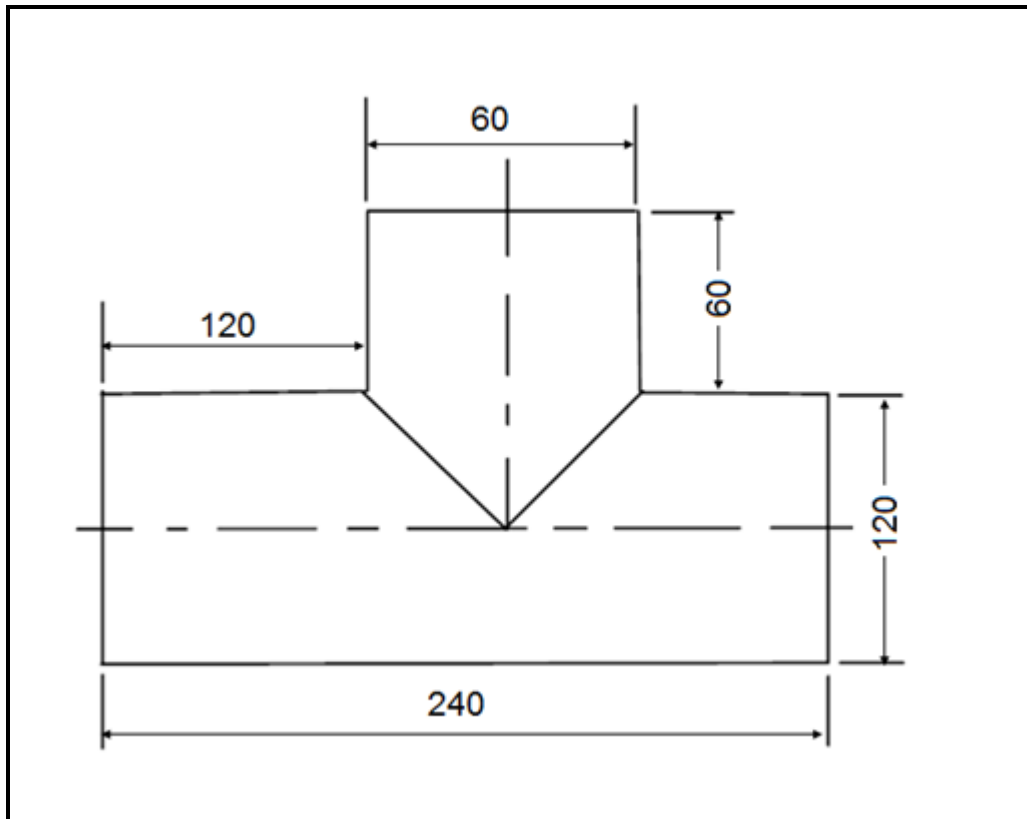
T-pieces are widely used throughout the mining industry where branches have to be taken from main columns for water or air supply. FIGURE 7.1 shows a typical T-piece with main and branch pipes that are equal in size.

**FIGURE 7.1: T-PIECE**

ITEM NO.	DESCRIPTION	MATERIAL	SIZE	QUANTITY
1.	Branch pipe	Mild steel (1,6 mm)/cardboard	120 x 60 x 1,6	1
2.	Main pipe	Mild steel (1,6 mm)/cardboard	240 x 120 x 1,6	1

**DEVELOP AND MANUFACTURE A T-PIECE WITH MAIN AND BRANCH PIPES THAT ARE EQUAL IN SIZE**

Use the drawing below to develop and manufacture a T-piece with main and branch pipes that are equal in size.

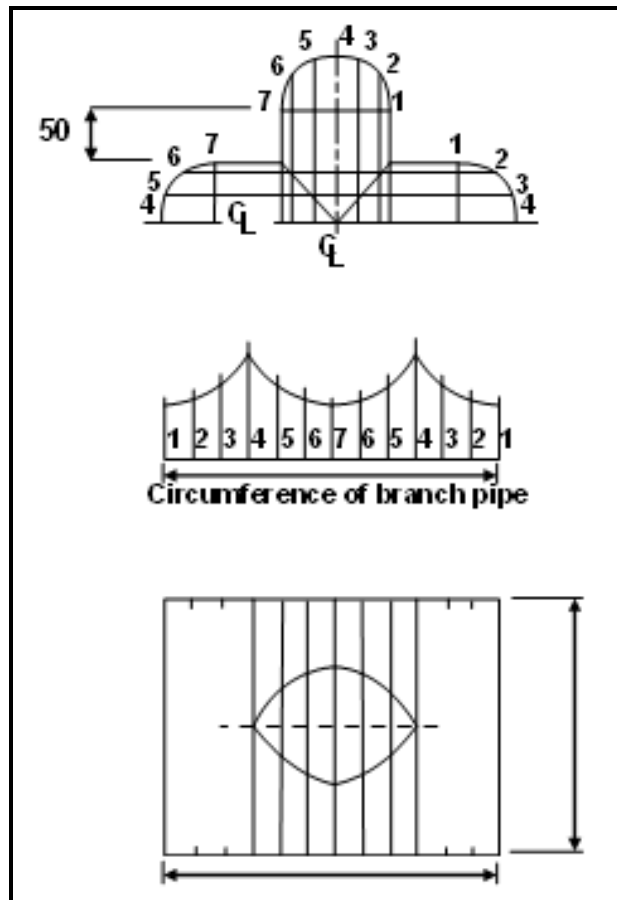


**FIGURE 7.2: T-PIECE**

**The following standards must be achieved:**

1. All of the layout angles must be within  $\pm 1^\circ$  of the required angles.
2. All the layout sizes must be within  $\pm 1,0$  mm of the required measurements.
3. All the measurements of the manufactured pipes must be within  $\pm 1,5$  mm of the required sizes.
4. All the angles of the manufactured pipes must be within  $\pm 1,5^\circ$  of the required angles.
5. There must be no damage to tools and equipment.
6. All the relevant safety procedures must be adhered to.

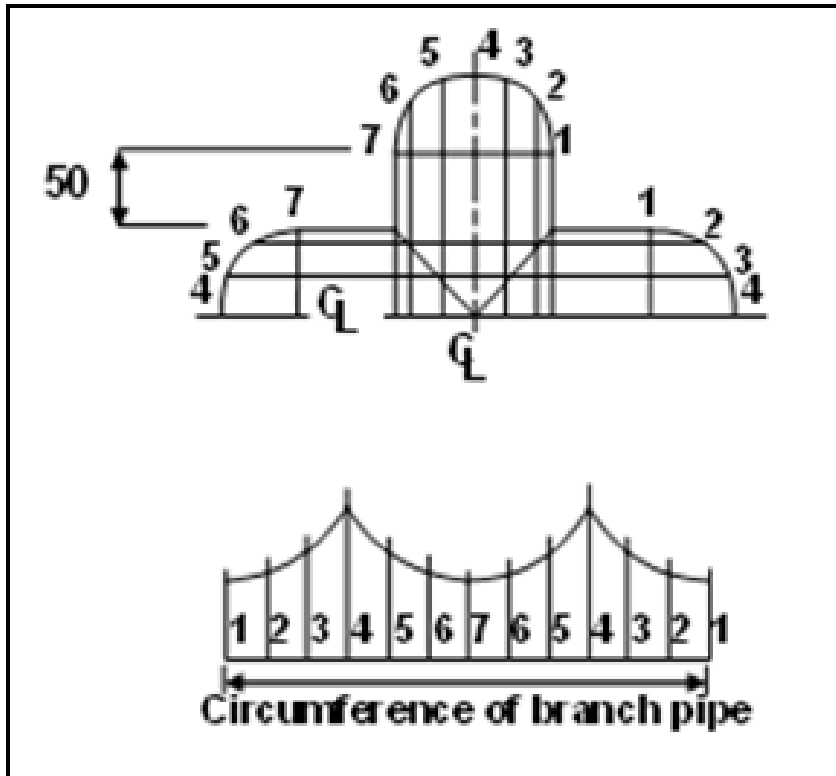
FIGURE 7.3 shows the complete drawing of a T-piece comprising the front elevation showing the geometry to develop the patterns for the branch pipe and the hole in the main pipe.



**FIGURE 7.3: DEVELOPMENT OF T-PIECE**

**METHOD OR PROCEDURE – DEVELOPMENT OF THE BRANCH PIPE**

- Draw the front elevation to size – FIGURE 7.4.
- Draw a half circle with a radius equal to half the diameter of the pipe, and divide it into six equal parts. Number these parts as shown.
- Project perpendicular lines downward from these points to cut the joint line.
- When the pipes have equal diameters the joint lines will appear as straight lines.



**FIGURE 7.4: DEVELOPMENT OF BRANCH PIPE PROCEDURE**

- Calculate the circumference of the pipe, using the **outside diameter (OD)** of the pipe: Circumference =  $\pi \times \text{OD}$ . The outside diameter is used to make a template from which all lines and points will be transferred onto the pipe.
- Draw a line equal to the circumference of the pipe. Divide this line into 12 equal parts and number them as shown in FIGURE 7.4.
- Draw perpendicular lines on these points
- Use dividers and transfer the lengths of the lines numbered 1 to 7.
- **NOTE:** Remember to measure from the end of the pipe and NOT from the half circle.
- Use a flexi-curve to join these points to complete the layout of the branch pipe.

### DEVELOPMENT OF THE MAIN PIPE

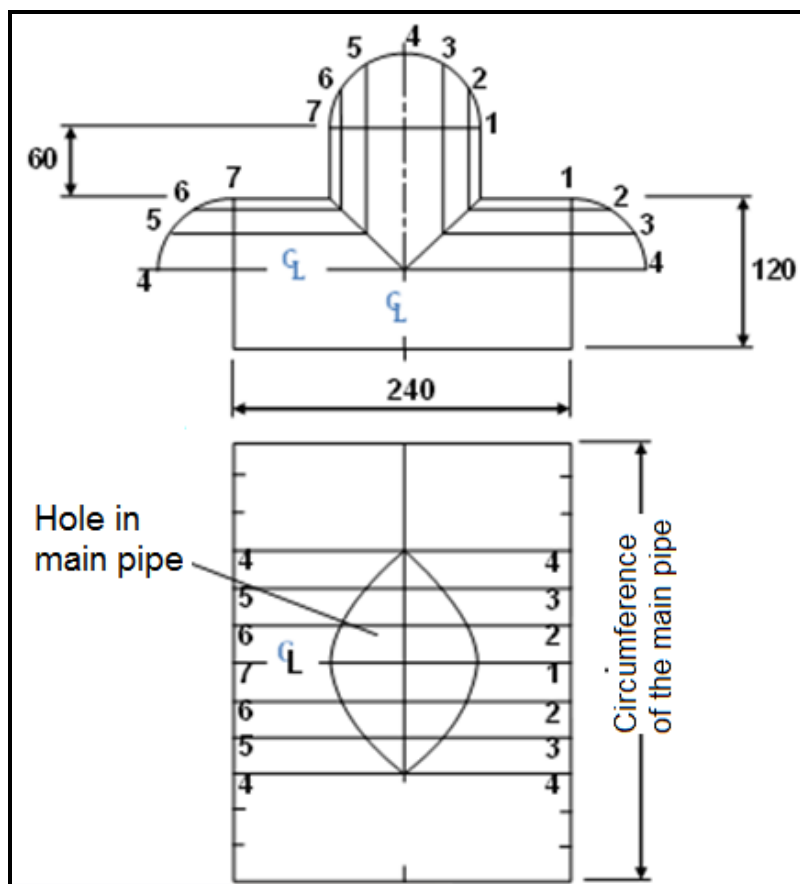


FIGURE 7.5: DEVELOPMENT OF MAIN PIPE PROCEDURE

**MANUFACTURING THE T-PIECE**

- Draw the two patterns on the correct thickness steel plate and use a prick punch to mark the cutting lines.
- Cut out all the patterns using oxy-acetylene equipment.
- Roll the two pipes.

**NOTE:** Remember to use the **mean diameter** to determine the circumference of the pipe to make provision for the thickness of the material, i.e.  $\text{circumference} = \pi \times \text{MD}$ , where MD = inside diameter of the pipe + thickness of the material.

**NOTE:** Roll both pipes before cutting the hole in the main pipe.

- Use an arc welder and tack-weld the pipe joints.
- Tack-weld the two pipes together and check for squareness.
- Check all sizes and make the necessary adjustments if necessary.
- Complete the welding of the T-piece.

<b>SUBJECT: MECHANICAL TECHNOLOGY</b>		<b>SCHOOL:</b>														
<b>YEAR: 2016</b>		<b>TEACHER:</b>														
<b>GR: 10</b>		<b>NUMBER OF LEARNERS:</b>														
<b>DATE STARTED:</b>		<b>DATE COMPLETED:</b>														
<b>PROJECT: PIPE T-PIECE WITH MAIN AND BRANCH PIPES THAT ARE EQUAL IN SIZE</b>		<b>PAGE:        OF</b>														
<b>NAMES OF LEARNERS</b>																
<b>FACETS</b>	<b>MARKS</b>															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
All <b>layout angles</b> are within $\pm 1^\circ$ of the required angles.	10															
All <b>layout sizes</b> are within $\pm 1,0$ mm of the required measurements.	10															
All <b>measurements</b> of the manufactured pipes are within $\pm 1,5^\circ$ mm of the required sizes.	20															
All the <b>angles</b> of the manufactured pipes are within $\pm 1,5$ those required.	10															
There is no damage to the tools or equipment.	10															
Four clear centre lines appear on the completed job.	5															
<b>TOTAL</b>	<b>65</b>															
<b>SIGNATURE OF TEACHER:</b>																
<b>SIGNATURE OF HEAD OF DEPARTMENT:</b>																
<b>SIGNATURE OF PRINCIPAL:</b>																
<b>SIGNATURE OF MODERATOR:</b>																

**7.2 WELDING – POT PLANT STAND/WALL BRACKET**

Term: 1–4  
 Start: January 2016  
 Completion: July/August 2016  
 Mark allocation: 100  
 Duration of assessment: 12 hours

**DESCRIPTION**

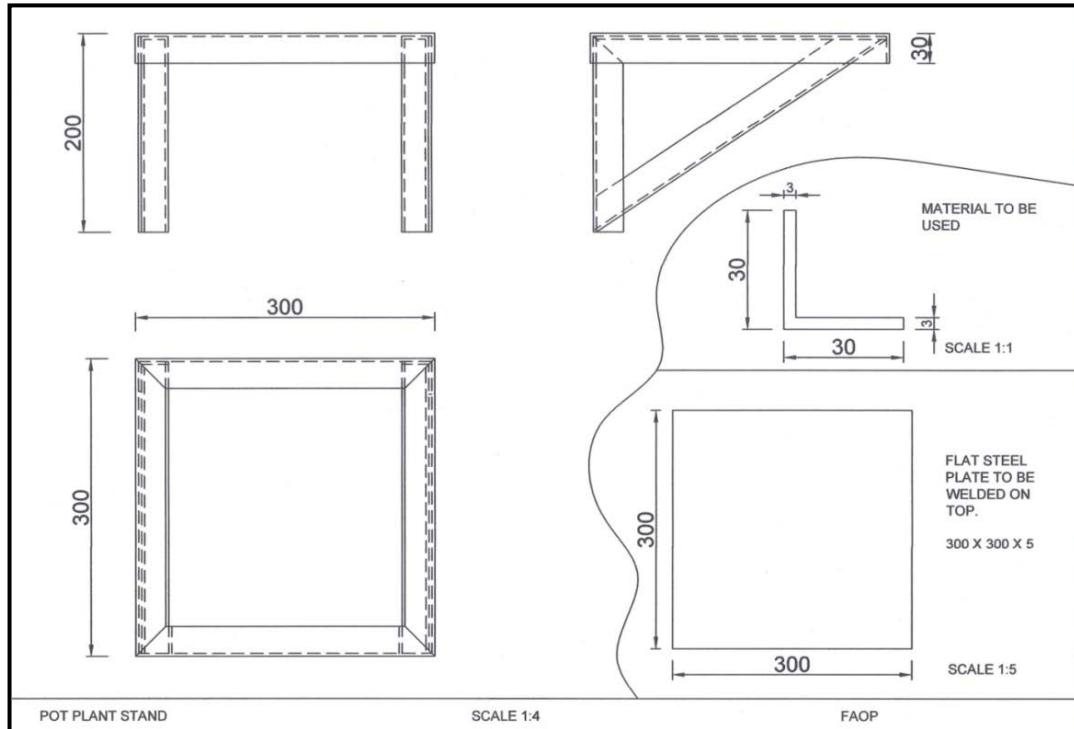
Pot plant stands are used in many homes to support flower pots. FIGURES 7.6 and 7.7 show the working drawing in first-angle orthographic projection and the isometric view of the product.

**MATERIAL LIST AND SPECIFICATIONS**

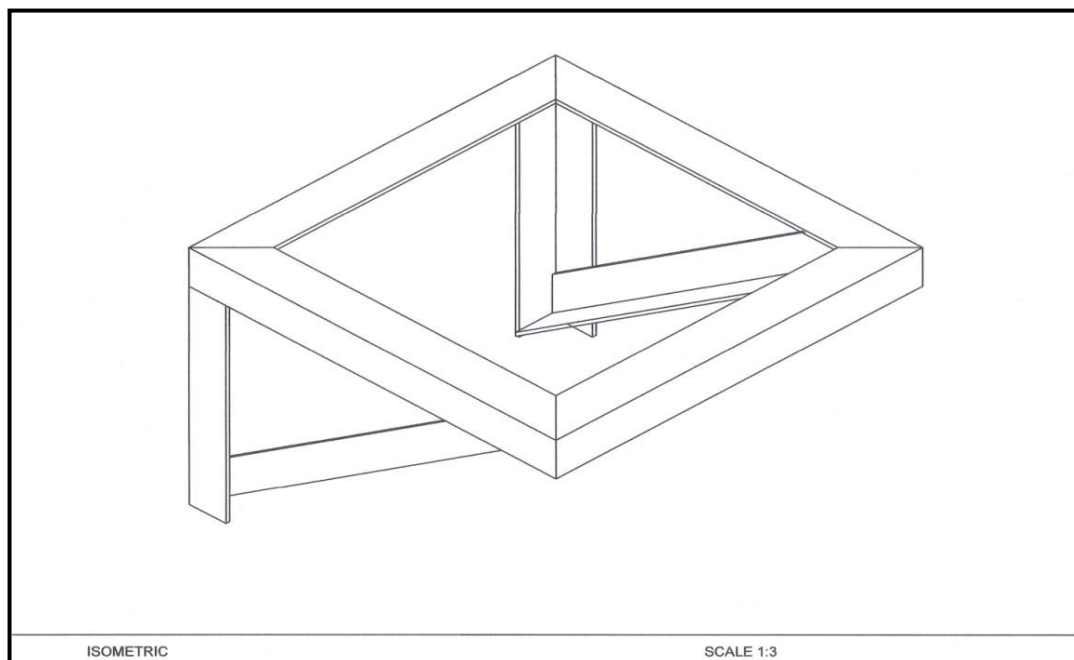
ITEM NO.	DESCRIPTION	MATERIAL	SIZE	QUANTITY
1.	Frame	Angle iron	30 x 30 x 5	4 off
2.	Base	Mild steel plate	300 x 300 x 5	1 off
3.	Wall bracket	Angle iron	200 x 5	2 off
4.	Brace	Angle iron	300 x 5	2 off

**The following specifications are applicable:**

- All layout angles must be within  $\pm 1^\circ$  of the required angles.
- All layout sizes must be within  $\pm 1,0$  mm of the required measurements.
- All the measurements of the manufactured pot plant stand must be within  $\pm 1,5$  mm of the required sizes.
- All the angles of the manufactured pot plant stand must be within  $\pm 1,5^\circ$  of the required angles.
- There must be no damage to tools and equipment.
- All the relevant safety procedures must be adhered to.



**FIGURE 7.6: EXPLODED VIEW OF THE POT PLANT STAND**



**FIGURE 7.7: ISOMETRIC VIEW OF THE POT PLANT STAND**

**METHOD OR PROCESS OUTLINE****UPPER FRAME**

- Mark off angle iron, four pieces of 300 mm.
- Bevel the ends at an angle of 45° at 300 mm marks.
- Bend at the bevelled marks so that pieces are at 90° to each other.
- Weld the bent pieces together to complete the frame.

**WALL BRACKET**

- Mark off and cut two pieces of angle iron 200 mm in length.

**BRACES**

- Mark off and cut two pieces of 300 mm angle iron.

**FRAME TOP PLATE**

- Mark off and cut one piece of 300 x 300 x 5 mild steel plate according to size.

**ASSEMBLY**

- Weld frame to wall bracket, braces and frame top plate, as shown on the working drawing.

<b>SUBJECT: MECHANICAL TECHNOLOGY</b>		<b>SCHOOL:</b>														
<b>YEAR: 2016</b>		<b>TEACHER:</b>														
<b>GR: 10</b>		<b>NUMBER OF LEARNERS:</b>														
<b>DATE STARTED:</b>		<b>DATE COMPLETED:</b>														
<b>PROJECT: POT PLANT STAND</b>		<b>PAGE:        OF</b>														
<b>NAMES OF LEARNERS</b>																
FACETS	MARKS															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
All <b>layout angles</b> are within $\pm 1^\circ$ of the required angles.	15															
All <b>layout sizes</b> are within $\pm 1,0$ mm of the required measurements.	25															
All the <b>measurements</b> of the manufactured pot plant stand are within $\pm 1,5$ mm of the required sizes.	25															
All the <b>layout angles</b> of the manufactured pot plant stand are within $\pm 1,5^\circ$ of the required angles.	25															
There is no damage to tools and equipment.	10															
<b>TOTAL</b>	<b>100</b>															
<b>SIGNATURE OF TEACHER:</b>																
<b>SIGNATURE OF HEAD OF DEPARTMENT:</b>																
<b>SIGNATURE OF PRINCIPAL:</b>																
<b>SIGNATURE OF MODERATOR:</b>																

**8. 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.

**9. TIME FRAMES****9.1 GENERIC**

January–March	Basic hand tools
April–June	Joining methods Forces Maintenance
July–September	Materials
September–November	Engines

**9.2 SPECIFIC – FITTING AND MACHINING**

January–November	Terminology – Base Terminology – Candle holder
July–November	Systems and Control

**9.3 SPECIFIC – AUTOMOTIVE**

January–March	Engines
July–November	Terminology – Brakes Terminology – Radiator

**9.4 SPECIFIC – WELDING AND METALWORK**

January–November	Terminology – Development Terminology – Pot Plant stand
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**10. DECLARATION OF AUTHENTICITY**

NAME OF THE SCHOOL: .....

NAME OF LEARNER: .....

(FULL NAME(S) AND SURNAME)

EXAMINATION NUMBER: .....

NAME OF TEACHER: .....



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

## **11. 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.