



**basic education**

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

# **MECHANICAL TECHNOLOGY**

## **GUIDELINES FOR PRACTICAL ASSESSMENT TASKS**

**GRADE 12**

**2018**

**These guidelines consist of 61 pages.**

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## 1. INTRODUCTION/BACKGROUND

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
- MBW: Life Orientation
- SCIENCES: Computer Applications Technology, Information Technology
- SERVICES: Consumer Studies, Hospitality Studies, Tourism
- TECHNOLOGY: **MECHANICAL TECHNOLOGY**, Civil Technology, Electrical 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% 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.

Any profession requires of its members a thorough grounding in both theory and practice and MECHANICAL TECHNOLOGY is no exception. It is emphasised that the goal of the practical assessment task is to produce a skilled learner in each specialisation field. A nation's true wealth is in its manpower and education that should aim to develop the talents of learners so that they can contribute to the well-being of the society by using and developing scientific and technological resources.

To prepare a learner in MECHANICAL TECHNOLOGY'S specialisation fields, one must focus on the following:

- An attitude where the learner can selectively use ideas, gather evidence and facts, to drawing logical conclusions to 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 sciences is essential to equip the MECHANICAL TECHNOLOGY learner with the necessary practical capabilities for the required processes. Practical training is the application of acquiring essential skills to bridge between trade theory and practice.

Practical application in the workshop must therefore be made an interesting and challenging experience to develop learners physically and mentally. Learners must show their initiative, curiosity and persistence in learning. 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 specialisation PAT documents. These documents need to be handed out to the learners at the beginning of the year. The practical assessment task for Grade 12 is externally set, internally assessed and externally moderated.

Teachers must attach due dates for the different facets of the PAT (refer to the *CAPS* document). In this way learners can easily assess their progress. Where 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 Grades 10–12*).

### **2.2 Assessment of the PAT**

Frequent and developmental feedback is needed to ensure necessary guidance and support to the learner.

Both formal and informal assessment should be conducted to ensure that the embedded skills are developed. Informal assessment can be conducted only to monitor progress of the learner. Formal assessment should always be conducted by the teacher and must be recorded.

### **2.3 Moderation of the PAT**

The tasks, projects, assessment criteria and the marks obtained must be presented to the moderator during moderation of the PAT.

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 upwards or downwards depending on the decision reached as a result of moderation.

### **2.4 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:

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NAME OF LEARNER:

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(FULL NAME(S) AND SURNAME)

NAME OF TEACHER:

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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

SCHOOL STAMP

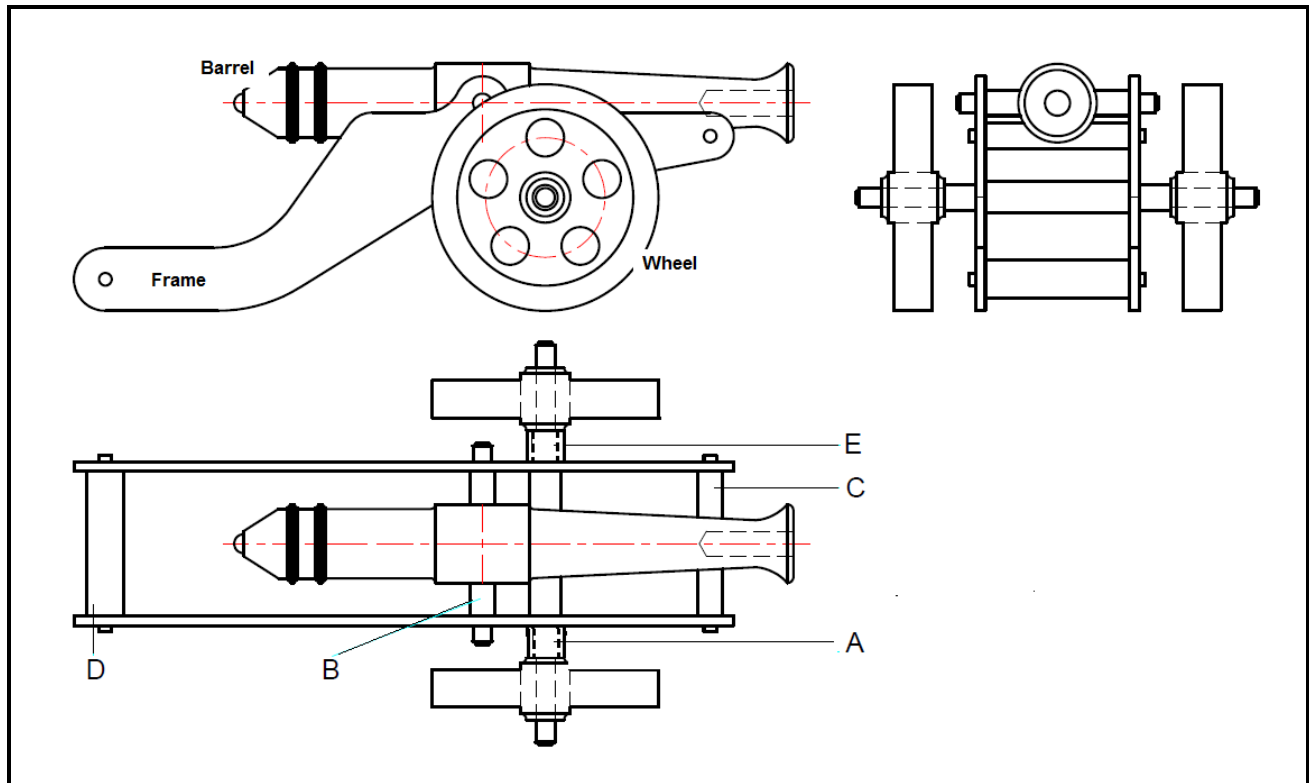
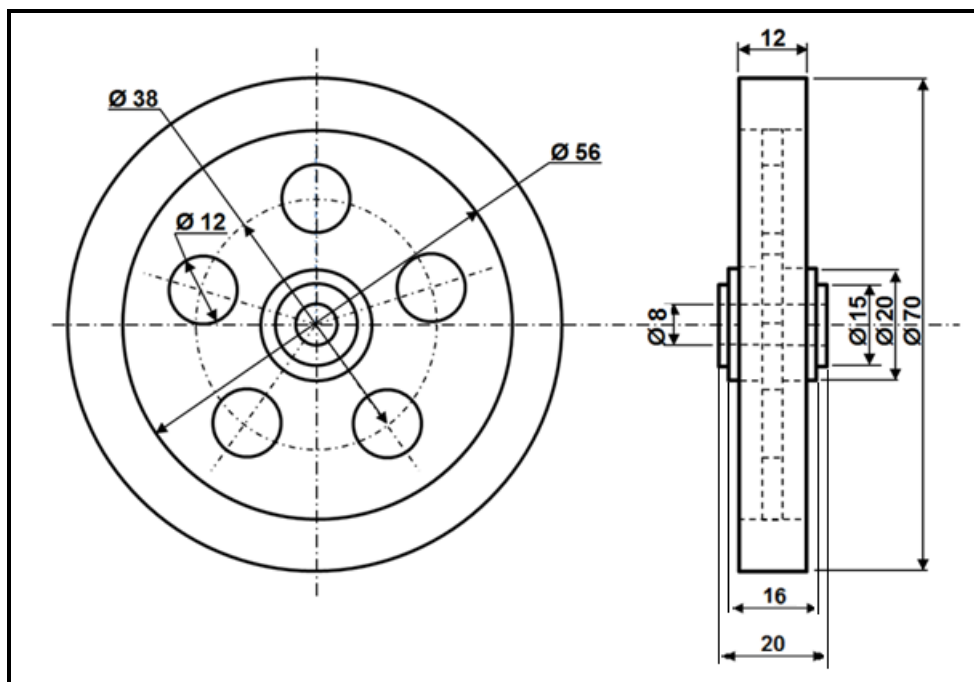
### 3. LEARNER GUIDELINES

#### Instructions to the learner

- The practical assessment task (PAT) consists of a specialisation task in FITTING 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 requested 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 unsafely in the workshop and place other learners in danger, will be given additional corrective tasks to improve their safety awareness.

**4. PRACTICAL ASSESSMENT GUIDELINES PER SPECIALISATION****SECTION A: FITTING AND MACHINING (SPECIFIC)****Term: 1 to 3****Starting date: January 2018****Completion date: August 2018****TASK A1: CANNON****RESOURCES REQUIRED FOR PAT:**

<b>CANNON</b>					
<b>Consumable materials and safety equipment required per learner</b>					
<b>Part</b>	<b>Any appropriate material like mild steel, brass, aluminium, bright steel</b>	<b>Length/Width</b>	<b>Quantity per learner</b>	<b>No. of learners</b>	<b>Total quantity</b>
Barrel	Ø25 – Round bar	185	1		
Wheels	Ø70 – Round bar	22	2		
Frame sides	3 mm sheet metal or 3 x 80 flat bar	215 x 80	2		
Frame spacer Top	Ø8 – Round bar	48	1		
Frame spacer Barrel	Ø8 – Round bar	58	1		
Frame spacer Bottom	Ø12 – Round bar	46	1		
Wheel shaft	Ø12 – Round bar	114	1		
Bolts (Allen round-head)	M6	10	6 (3 x 2 sides)		
Spacer bush	Ø15 – Round bar	12	2		

**FIGURE A1.1: CANNON – COMPOSITE VIEW****FIGURE A1.2: WHEEL**



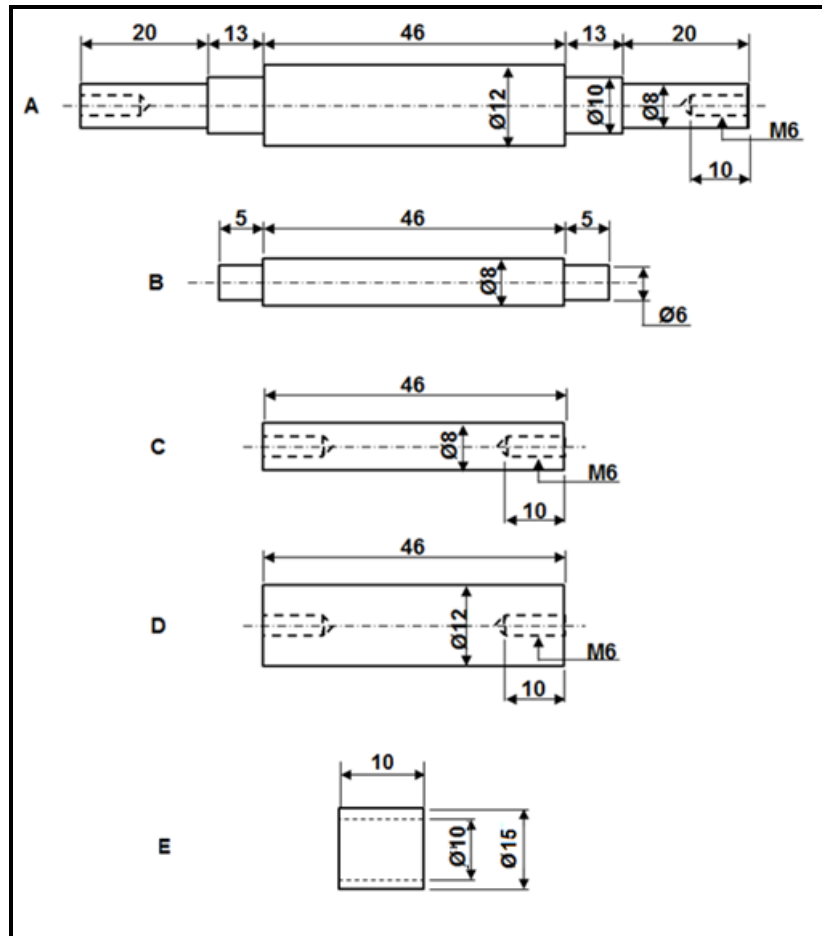


FIGURE A1.3: SPACERS

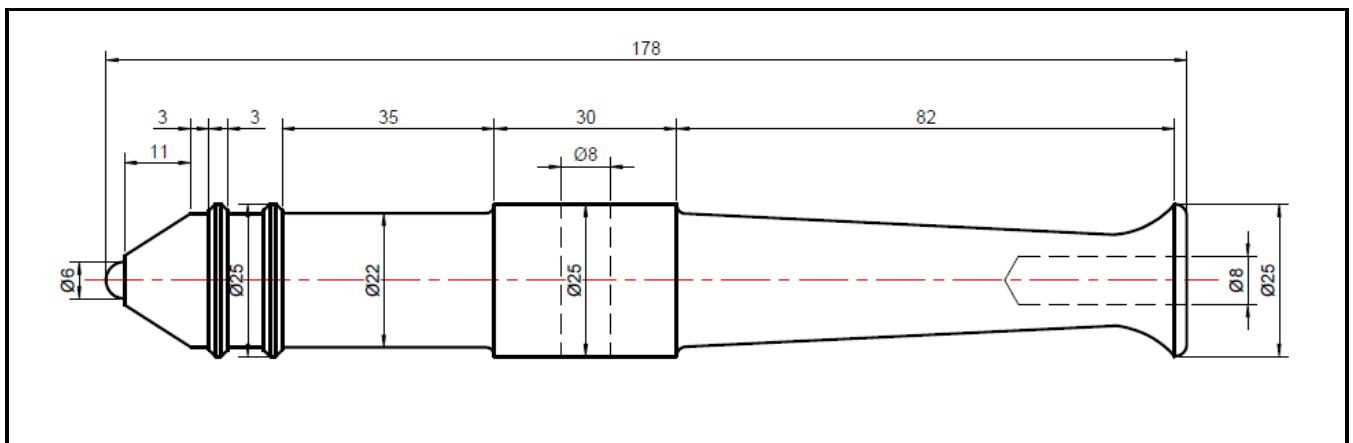
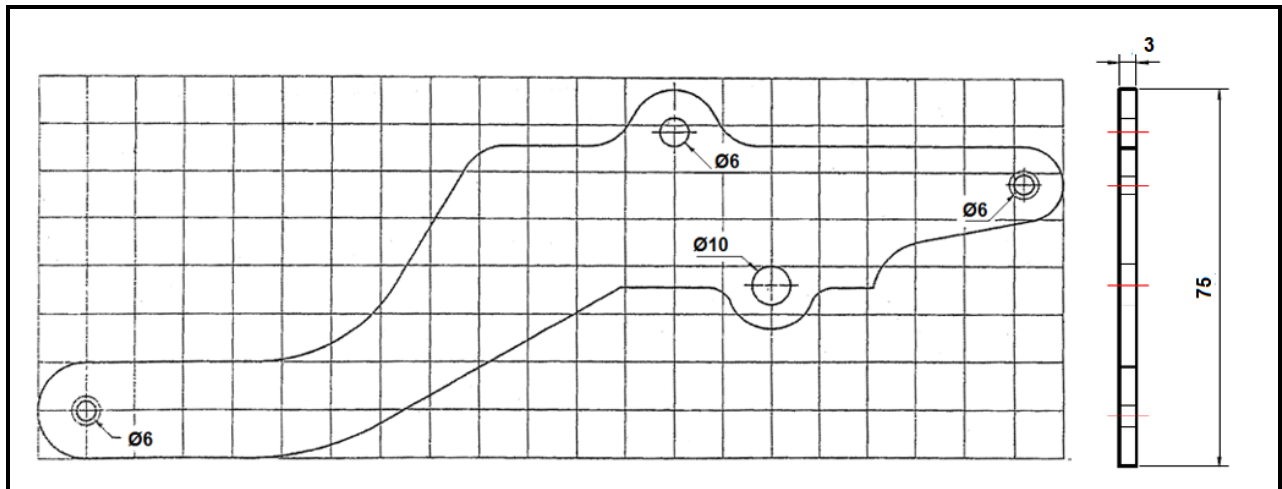


FIGURE A1.4: BARREL

**FIGURE A1.5: FRAME SIDES**

The drawing is to scale 1 block = 10 mm. Learners need to determine measurements according to scale themselves.

<b>MECHANICAL TECHNOLOGY</b>																
<b>FITTING AND MACHINING</b>																
<b>MARK SHEET – BARREL</b>																
<b>GRADE</b>		<b>12</b>		<b>DATE</b>												
<b>PROJECT:</b>		<b>CANNON</b>														
		<b>LEARNERS</b>														
<b>FACETS</b>	<b>MARKS</b>															
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>
Facing, length & centre hole	10															
Machine diameter 25 mm	10															
Machine mm	10															
Machine stepped radius	10															
Machine front taper	15															
Machine back taper	10															
Drill Ø8 mm hole	5															
Finish	5															
<b>TOTAL</b>	<b>75</b>															
<b>SIGNATURE OF TEACHER</b>																
<b>SIGNATURE OF SUBJECT HEAD</b>																

<b>MECHANICAL TECHNOLOGY</b>																
<b>FITTING AND MACHINING</b>																
<b>MARK SHEET – FRAME</b>																
<b>GRADE</b>		<b>12</b>		<b>DATE</b>												
<b>PROJECT:</b>		<b>CANNON</b>														
		<b>LEARNERS</b>														
<b>FACETS</b>	<b>MARKS</b>															
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>
Marking	10															
Saw profile	5															
File profile	10															
Drill holes	10															
Finish	5															
<b>TOTAL</b>	<b>40</b>															
<b>SIGNATURE OF TEACHER</b>																
<b>SIGNATURE OF SUBJECT HEAD</b>																

<b>MECHANICAL TECHNOLOGY</b>																
<b>FITTING AND MACHINING</b>																
<b>MARK SHEET – SPACERS &amp; SHAFTS</b>																
<b>GRADE</b>		<b>12</b>		<b>DATE</b>												
<b>PROJECT:</b>		<b>CANNON</b>														
		<b>LEARNERS</b>														
<b>FACETS</b>	<b>MARKS</b>															
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>
<b>PART – A</b>																
Ø8	5															
Ø10	5															
Ø12	5															
Holes & M6	5															
<b>Total – A</b>	<b>20</b>															
<b>PART – B</b>																
Ø6	5															
Ø8	5															
<b>Total – B</b>	<b>10</b>															
<b>PART – C</b>																
Ø8	5															
Holes & M6	5															
<b>Total – C</b>	<b>10</b>															
<b>PART – D</b>																
Ø12	5															
Holes & M6	5															
<b>Total – D</b>	<b>10</b>															
<b>PART – E</b>																
Ø10	5															
Hole Ø 8	5															
<b>Total – E</b>	<b>10</b>															
<b>TOTAL</b>	<b>60</b>															
<b>SIGNATURE OF TEACHER</b>																
<b>SIGNATURE OF SUBJECT HEAD</b>																

<b>MECHANICAL TECHNOLOGY</b>																
<b>FITTING AND MACHINING</b>																
<b>MARK SHEET – WHEELS</b>																
<b>GRADE</b>		<b>12</b>		<b>DATE</b>												
<b>PROJECT:</b>		<b>CANNON</b>														
		<b>LEARNERS</b>														
<b>FACETS</b>	<b>MARKS</b>															
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>
Ø70	5															
Ø56	10															
Ø20	10															
Ø15	10															
Hole Ø8	5															
Holes Ø12	15															
Finish	5															
<b>TOTAL</b>	<b>60</b>															
<b>SIGNATURE OF TEACHER</b>																
<b>SIGNATURE OF SUBJECT HEAD</b>																

<b>MECHANICAL TECHNOLOGY</b>																
<b>FITTING AND MACHINING</b>																
<b>MARK SHEET – ASSEMBLE &amp; TOTALS</b>																
<b>GRADE</b>		<b>12</b>		<b>DATE</b>												
<b>PROJECT:</b>		<b>CANNON</b>														
		<b>LEARNERS</b>														
<b>FACETS</b>	<b>MARKS</b>															
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>
Safety	5															
Assembly	5															
Presentation	5															
<b>TOTAL</b>	<b>15</b>															
<b>TOTALS</b>																
BARREL	75															
FRAME	40															
SHAFTS	60															
WHEELS	60															
ASSEMBLY	15															
<b>TOTAL</b>	<b>250</b>															
<b>/100</b>	<b>100</b>															
<b>SIGNATURE OF TEACHER</b>																
<b>SIGNATURE OF SUBJECT HEAD</b>																

**SECTION B: AUTOMOTIVE (SPECIFIC)****Term: 1 to 3****Starting date: January 2018****Completion date: August 2018****INTRODUCTION:**

- This section contains FOUR practical tasks. Complete any TWO of the four tasks, namely the compression test (B1), the cylinder leakage test (B2), the gas analysing test (B3) and the wheel balancing test (B4).
- It also contains TWO COMPULSORY tasks, namely engines – valves (B5) and the conventional ignition system (B6).

The teacher must explain to the learners which knowledge and skills will be assessed when these tasks are being performed as well as the time frame in which to complete each task.

**Activity outcome:**

- Learners apply theoretical knowledge in practice
- Safety, tools, maintenance and systems and control
- Correct use of tools and equipment
- Use equipment to diagnose low compression or other faults in the engine cylinder

- NOTE:**
- Complete any TWO of the four tasks (B1, B2, B3, B4).
  - These tasks must be done under supervision of the teacher and the learners should be assessed while they are performing these tasks.
  - The learners should answer questions, record findings and give reasons for certain actions on the worksheet provided while they are performing these tasks.

**TASK B1: COMPRESSION TEST – QUESTIONS**

- Answer the questions on WORKSHEETS B1.1 and B1.2.

**TASK B1: COMPRESSION TEST – PROCEDURE**

- Use the specification booklets to obtain readings for the engine that you are using before conducting the compression test.
- Do a dry compression test on a four-cylinder, four-stroke petrol engine and record the findings on WORKSHEET B1.3.

- NOTE:** The learner must record and give reasons for certain actions when he/she completes this task.



**TASK B2: CYLINDER LEAKAGE TEST – QUESTIONS**

- Answer the questions on WORKSHEETS B2.1 and B2.2.

**TASK B2: CYLINDER LEAKAGE TEST – PROCEDURE**

- Use the specification booklets to obtain readings for the engine that you are using before conducting the cylinder leakage test.
- Do a cylinder leakage test on a four-cylinder, four-stroke petrol engine and record the findings on WORKSHEET B2.3.

**NOTE:** The learner must record and give reasons for certain actions when he/she completes this task.

**TASK B3: GAS ANALYSING TEST – QUESTIONS**

- Answer the questions on WORKSHEETS B3.1 and B3.2.

**TASK B3: GAS ANALYSING TEST – PROCEDURE**

- Use the specification booklets to obtain readings for the engine that you are using before conducting the gas analysing test.
- Do a gas analysing test on an internal combustion engine and record the findings on WORKSHEET B3.3.

**NOTE:** The learner must record and give reasons for certain actions when he/she completes this task.

**TASK B4: WHEEL BALANCING – QUESTIONS**

- Answer the questions on WORKSHEETS B4.1 and B4.2.

**TASK B4: WHEEL BALANCING – PROCEDURE**

- Perform the wheel balancing procedures on a wheel/tyre assembly and record the findings on WORKSHEET B4.3.

**NOTE:** The learner must record and give reasons for certain actions when he/she completes this task.

**TASK B1: COMPRESSION TEST – QUESTIONS****WORKSHEET B1.1****NAME:** \_\_\_\_\_

QUESTION	ANSWER	MARK	TOTAL
1. What is meant by <i>engine compression</i> ?		5	
2. Give FOUR reasons for low compression in an engine.		4	
3. What will be the effect of low compression on an engine?		2	
4. When should the compression in an engine be checked?		2	
5. Name the TWO compression tests that can be executed on an internal combustion engine.		2	
<b>TOTAL – Compression test – questions</b>		<b>15</b>	

**TASK B1: COMPRESSION TEST – PROCEDURE****WORKSHEET B1.2****NAME:** \_\_\_\_\_

PROCEDURE	REASON	MARK	TOTAL
Get engine to running temperature		2	
Remove spark plugs		2	
What action should take place before spark plugs are removed?		2	
Remove air filter		2	
Remove HT lead from coil		2	
Fully open accelerator		2	
Crank the engine		2	
Record readings		2	
Compare readings between cylinders		2	
Compare readings with manufacturer's specifications		2	
Execute a wet compression test on a cylinder with a low reading		5	
<b>TOTAL – Compression test – procedure</b>		<b>25</b>	

**TASK B1: COMPRESSION TEST – PROCEDURE****WORKSHEETB1.3****NAME:** \_\_\_\_\_

<b>Results of the cylinder compression test executed:</b>			
<b>PROCEDURE</b>	<b>RESULT</b>	<b>MARK</b>	<b>TOTAL</b>
Cylinder compression according to manufacturer's specifications		2	
Cylinder 1		1	
Cylinder 2		1	
Cylinder 3		1	
Cylinder 4		1	
Conclusion before and after wet compression test		2	
Procedure to follow		2	
<b>TOTAL – Compression test – procedure</b>		<b>Worksheet B1.3</b>	<b>10</b>
<b>TOTAL – Compression test – procedure</b>		<b>Worksheet B1.2</b>	<b>25</b>
<b>TOTAL – Compression test – questions</b>		<b>Worksheet B1.1</b>	<b>15</b>
		<b>GRAND TOTAL</b>	<b>50</b>

**TASK B2: CYLINDER LEAKAGE TEST– QUESTIONS:****WORKSHEETB2.1:****NAME:** \_\_\_\_\_

QUESTION	ANSWER	MARK	TOTAL
1. What is the difference between the <i>cylinder compression test</i> and the <i>cylinder leakage test</i> ?		5	
2. When is it necessary to execute a cylinder leakage test on an internal combustion engine?		2	
3. State FOUR causes of cylinder leakages on an internal combustion engine.		4	
4. Explain FOUR procedures used to determine the location of leakages on an internal combustion engine.		4	
<b>TOTAL – Leakage test – questions</b>		<b>15</b>	

## TASK B2: CYLINDER LEAKAGE TEST – PROCEDURE:

## WORKSHEET B2.2:

NAME: \_\_\_\_\_

[illegible]

**TASK B2: CYLINDER LEAKAGE TEST – PROCEDURE****WORKSHEET B2.3:****NAME:** \_\_\_\_\_

<b>Results of the cylinder leakage test executed:</b>			
<b>PROCEDURE</b>	<b>RESULT</b>	<b>MARK</b>	<b>TOTAL</b>
Cylinder pressure		<b>2</b>	
Cylinder 1 – Result		<b>2</b>	
Conclusion		<b>2</b>	
Cylinder 2 – Result		<b>2</b>	
Conclusion		<b>2</b>	
Cylinder 3 – Result		<b>2</b>	
Conclusion		<b>2</b>	
Cylinder 4 – Result		<b>2</b>	
Conclusion		<b>2</b>	
Procedures to follow		<b>2</b>	
<b>TOTAL – Leakage test – procedure (Results)</b>		<b>Worksheet B2.3</b>	<b>20</b>
<b>TOTAL – Leakage test – procedure</b>		<b>Worksheet B2.2</b>	<b>15</b>
<b>TOTAL – Leakage test – questions</b>		<b>Worksheet B2.1</b>	<b>15</b>
		<b>GRAND TOTAL</b>	<b>50</b>

**TASK B3: GAS ANALYSING – QUESTIONS:****WORKSHEET B3.1:****NAME:** \_\_\_\_\_

QUESTION	ANSWER	MARK	TOTAL
1. State the purpose of a gas analyser used on an internal combustion engine.		3	
2. When is it necessary to analyse the exhaust gases of an internal combustion engine?		2	
3. What influences the combustion under different operating conditions? List FOUR such influences.		4	
4. Give FOUR reasons for high CO readings.		4	
5. Give FOUR reasons for high HC readings.		4	
6. Give FOUR reasons for high CO <sub>2</sub> readings.		4	
7. State FOUR safety measures to be carried out when using the gas analyser.		4	
<b>TOTAL – Gas analysing – questions</b>		<b>25</b>	






**TASK B3: GAS ANALYSING – PROCEDURE:****WORKSHEET B3.3:****NAME:** \_\_\_\_\_

<b>Results of the gas analysing procedure on an internal combustion engine:</b>			
<b>PROCEDURE</b>	<b>RESULT</b>	<b>MARK</b>	<b>TOTAL</b>
CO reading		2	
Conclusion		2	
HC reading		2	
Conclusion		2	
CO <sub>2</sub> reading		2	
Conclusion		2	
Final conclusion		3	
<b>TOTAL – Gas analysing – procedure (Results)      Worksheet B3.3</b>		<b>15</b>	
<b>TOTAL – Gas analysing – procedure      Worksheet B3.2</b>		<b>10</b>	
<b>TOTAL – Gas analysing – questions      Worksheet B3.1</b>		<b>25</b>	
<b>GRAND TOTAL</b>		<b>50</b>	

**TASK B4: WHEEL BALANCING – QUESTIONS:****WORKSHEET B4.1:****NAME:** \_\_\_\_\_

QUESTION	ANSWER	MARK	TOTAL
1. Give THREE reasons for balancing the wheels of a motor vehicle.		3	
2. State FOUR effects of unbalanced wheels on a motor vehicle.		4	
3. Why must a wheel balancer be in a good condition?		2	
4. State THREE functions of the wheel-weight hammer		3	
5. List THREE pre-checks to be carried out when wheel balancing is done.		3	
6. Define <i>static balance</i> of a wheel and tyre assembly.		4	
7. Define <i>dynamic balance</i> of a wheel and tyre assembly.		4	

<p>8. FIGURE B4.1 shows different tyre conditions. State the cause of each condition.</p>	<div style="text-align: center;"> <p><b>A</b>                      <b>B</b>                      <b>C</b></p>  <p><b>FIGURE B4.1</b></p> </div> <div> <p>A -</p> <p>B -</p> <p>C -</p> </div>	<b>3</b>	
<p>9. State FOUR safety measures to be carried out when using the balancing equipment.</p>	<div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> </div>	<b>4</b>	
<b>TOTAL – Wheel balancing – questions</b>		<b>30</b>	



**TASK B4: WHEEL BALANCING – PROCEDURE:****WORKSHEET B4.3:****NAME:** \_\_\_\_\_

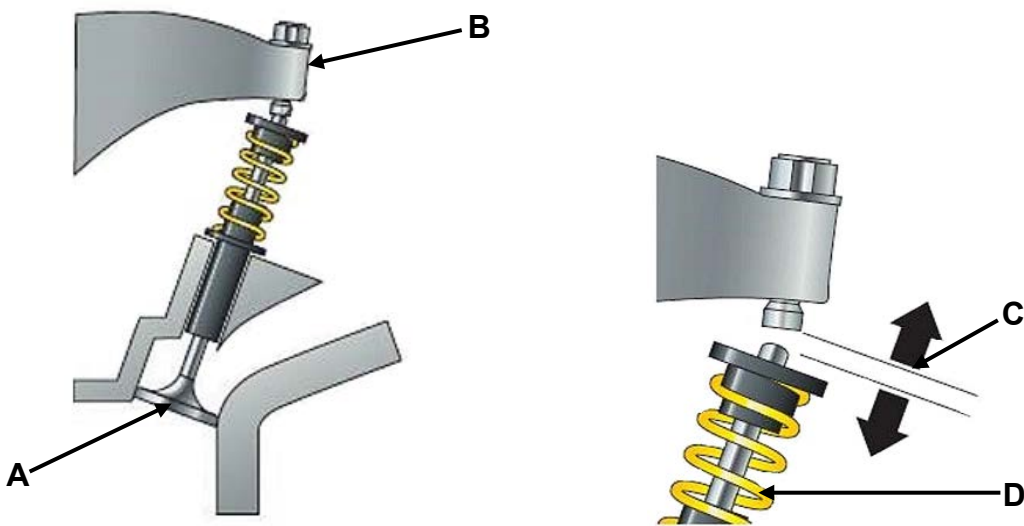
<b>Balancing of a wheel/tyre assembly:</b>			
<b>PROCEDURE</b>	<b>RESULT</b>	<b>MARK</b>	<b>TOTAL</b>
Condition of wheel tyre assembly		2	
Describe the lack of balance.		3	
Procedure to follow		3	
Final result		2	
<b>TOTAL – Wheel balancing – procedure (Results) Worksheet B4.3</b>		<b>10</b>	
<b>TOTAL – Wheel balancing – procedure Worksheet B4.2</b>		<b>10</b>	
<b>TOTAL – Wheel balancing – questions Worksheet B4.1</b>		<b>30</b>	
<b>GRAND TOTAL</b>		<b>50</b>	

**THE FOLLOWING TWO TASKS (B5 AND B6) ARE COMPULSORY.**

**TASK B5: ENGINES – VALVES – QUESTIONS (COMPULSORY)**

**WORKSHEET: B5.1:**

**NAME:** \_\_\_\_\_

1.	FIGURE B5.1 indicates the valve assembly of an internal combustion engine. Answer the following questions.		
			
<b>FIGURE B5.1: VALVE ASSEMBLY</b>			
1.1	Label the parts indicated in FIGURE B5.1 according to the letters A–D.		
	A -		
	B -		
	C -		
	D -		
			(4)
1.2	Name the TWO types of valves in an internal combustion engine and state the function of each.		
			(4)

2.	Setting of valve timing:		
2.1	Describe the position of the crankshaft.		
		(2)	
2.2	Describe the position of the camshaft.		
		(2)	
2.3	State the TWO common methods used to link the camshaft to the crankshaft.		
		(2)	

3	FIGURE B5.2 indicates the cam/crank shaft layout of an internal combustion engine. Answer the following questions.		
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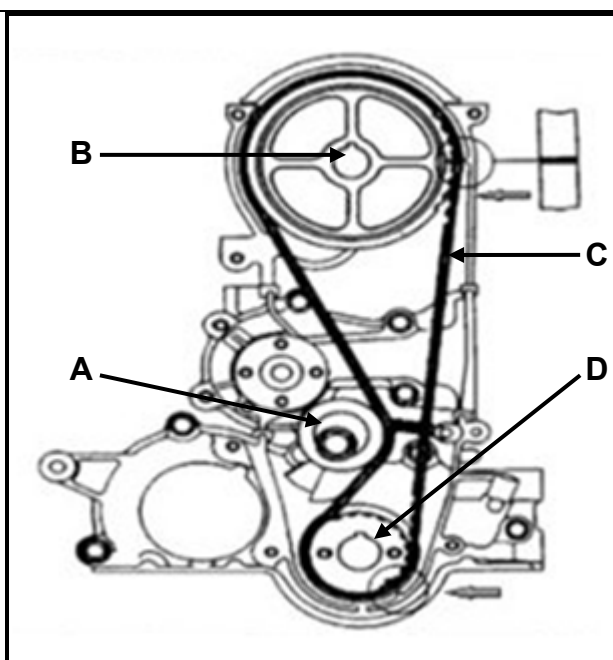


FIGURE B5.2

3.1	Identify the type of drive shown in FIGURE B5.2		
		(2)	
3.2	Label the parts indicated in FIGURE B5.2 according to the letters A – D.		
A -			
B -			
C -			
D -			
		(4)	



3.3	What is the function of part A in the system indicated in FIGURE B5.2?		
		(2)	
3.4	State FOUR advantages of the drive in FIGURE B5.2.		
		(4)	

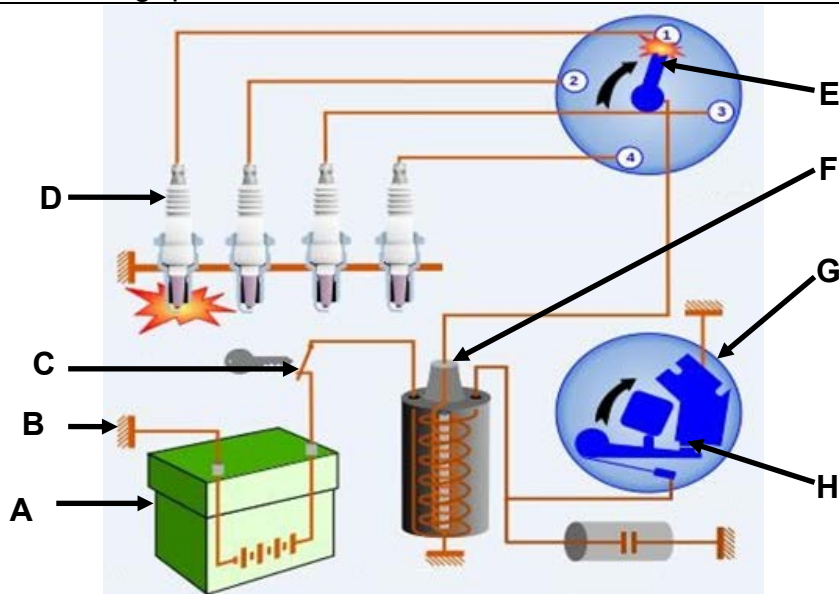
4	Answer the following questions regarding setting of the valve clearance.		
4.1	Why should the engine be at normal operating temperature?		
		(2)	
4.2	Give TWO reasons why the clearance for each type of valve differs.		
		(2)	
4.3	Give TWO reasons why the surface area for each type of valve differs.		
		(2)	
4.4	State TWO harmful effects of a valve clearance that is too large.		
		(2)	
4.5	State TWO harmful effects of a valve clearance that is too small.		
		(2)	
4.6	Describe the correct sequence for setting valves on an internal combustion engine.		
		(4)	
<b>Total – Engines –Valves – questions</b>		<b>40</b>	

**TASK B5: ENGINES – VALVES– PROCEDURE (COMPULSORY)****WORKSHEET: B5.2:****NAME:** \_\_\_\_\_

<b>Setting valves and timing</b>			
Describe the engine used, in terms of the following terms:			
<b>TERM</b>	<b>DESCRIPTION</b>	<b>MARK</b>	<b>TOTAL</b>
Camshaft position		2	
Number of valves		2	
Type of crank/ camshaft drive		2	
Firing order		2	
Valve clearance		2	
<b>TOTAL – Engine – Valves –procedure</b>		<b>Worksheet B5.2</b>	<b>10</b>
<b>TOTAL – Engine – Valves –questions</b>		<b>Worksheet B5.1</b>	<b>40</b>
		<b>TOTAL B5</b>	<b>50</b>

**TASK B6: CONVENTIONAL IGNITION SYSTEM (COMPULSORY)****WORKSHEET: B6.1****NAME:** \_\_\_\_\_

1. FIGURE B6.1 shows a conventional ignition system.  
Answer the following questions.

**FIGURE B6.1: CONVENTIONAL IGNITION SYSTEM**

- 1.1 Label the conventional ignition system shown in FIGURE B6.1 according to the letters A–H.

A -

B -

C -

D -

E -

F -

G -

H -

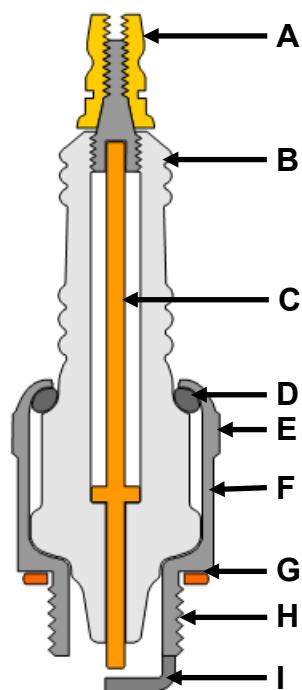
(8)

- 1.2 State FIVE safety precautions one needs to consider when working on an ignition system.

(5)



2.3 Label the spark plug shown in FIGURE B6.2.



**FIGURE B6.2**

A -

B -

C -

D -

E -

F -

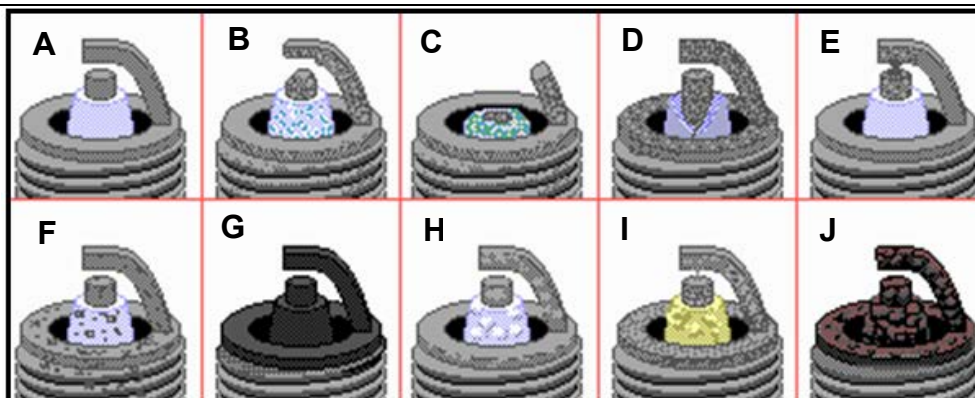
G -

H -

I -

(9)

2.4 FIGURE B6.3 indicates different spark-plug conditions. Complete the report on the condition of each of the spark plugs.



**FIGURE B6.3 (SHOW IN COLOUR)**

A -

B -

C -

D -

E -

F -

G -

H -

I -

J -

(10)

## 3. Practical application of the distributor

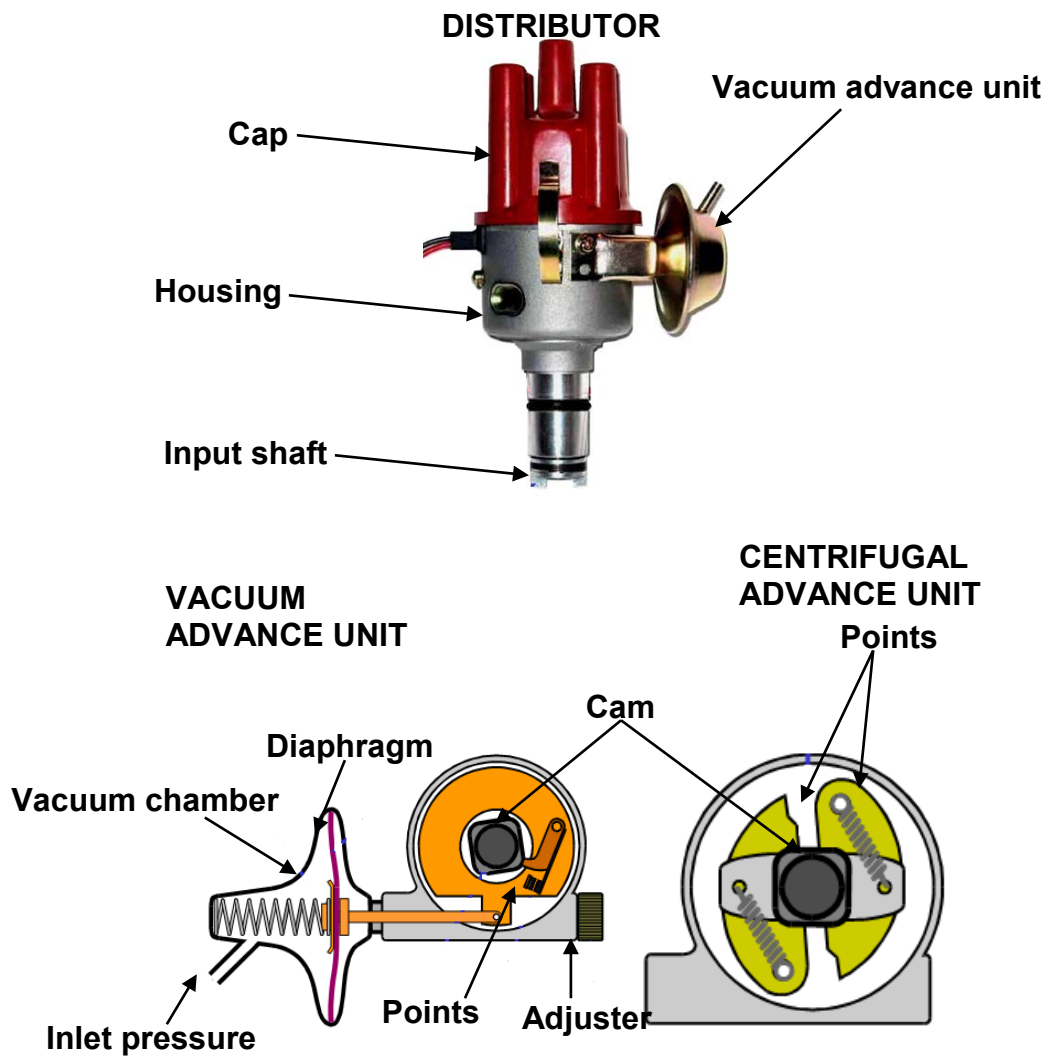


FIGURE B6.1

3.1 Explain the procedure to follow when removing the distributor.

(5)

3.2 Explain the procedure to follow when dismantling the distributor.

(5)

3.3	Complete a report on the condition when dismantling the distributor. Choose any FIVE parts.
1.	
2.	
3.	
4.	
5.	
	(10)
3.4	Briefly explain the procedure to follow when assembling the distributor.
	(5)
3.5	Explain the procedure to follow when replacing and adjusting the contact-breaker points.
	(10)





<b>MECHANICAL TECHNOLOGY</b>																	
<b>AUTOMOTIVE</b>																	
<b>MARK SHEET</b>																	
<b>GRADE</b>		<b>12</b>		<b>DATE</b>													
		<b>LEARNERS</b>															
<b>TASKS</b>	<b>MARKS</b>																
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	
<b>COMPRESSION TEST</b>	<b>50</b>																
<b>CYLINDER LEAKAGE TEST</b>	<b>50</b>																
<b>GAS ANALYSING</b>	<b>50</b>																
<b>WHEEL BALANCING</b>	<b>50</b>																
<b>ENGINES – VALVES</b>	<b>50</b>																
<b>IGNITION SYSTEM</b>	<b>100</b>																
<b>GRAND TOTAL</b>	<b>250</b>																
<b>/100</b>	<b>100</b>																
<b>SIGNATURE OF TEACHER</b>																	
<b>SIGNATURE OF SUBJECT HEAD</b>																	

**SECTION C: WELDING AND METALWORK (SPECIFIC)****Term: 1 to 3****Starting date: January 2018****Completion date: August 2018****INTRODUCTION:**

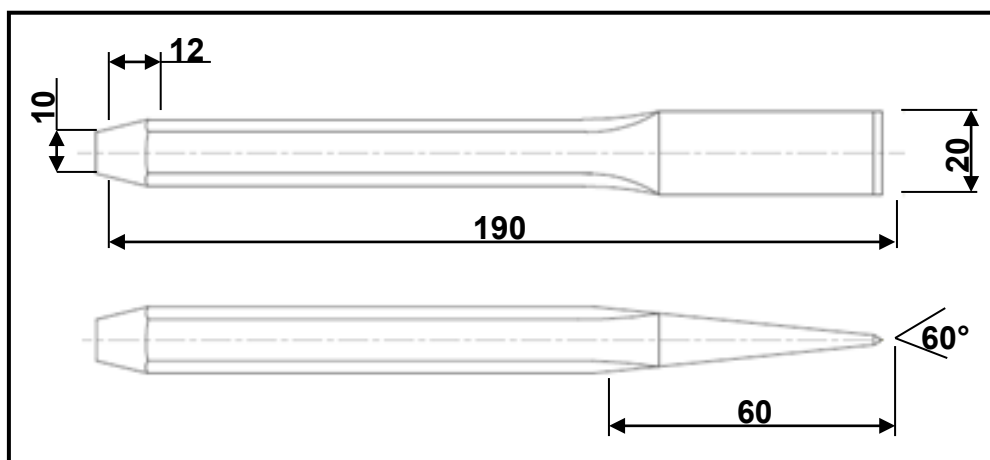
- This section contains TWO COMPULSORY tasks, namely cold chisel (C1) AND study lamp (C2).
- Choose any ONE of the remaining two tasks, namely braai stand (C3) OR fire place (C4).

**TASK C1 (COMPULSORY)****TASK C1: FORGING AND HEAT TREATMENT TO MANUFACTURE A COLD CHISEL****1. Drawing and dimensions:**

- 1.1 Use the drawing in FIGURE C1.1 to fabricate a chisel and apply heat treatment according to specifications.

**2. The following standards must be achieved:**

- 2.1 All the sizes must be within  $\pm 1$  mm of the required measurements.
- 2.2 Tools and equipment must NOT be damaged.
- 2.3 All appropriate safety procedures must be adhered to.
- 2.4 The chisel must be hard enough to cut mild steel. (Do the test.)

**FIGURE C1.1: COLD CHISEL****3. Material:**

- 3.1 1 piece of octagon tool steel 190 x 20 mm

**PROCEDURE:****4. Forging a chisel:**

- 4.1. Cut octagon steel to required length.
- 4.2. Heat the one end to a yellow colour and forge a taper for 12 mm.
- 4.3. Heat the other end and forge the slanted surfaces, as indicated in FIGURE C1.1. Forge SIX sides.
- 4.4. Forge the TWO remaining opposite sides parallel to each other, as shown.
- 4.5. Ensure that the chisel is straight with flat surfaces.



Blacksmithing Tools #1 Hand Forging a Hot Cut Chisel (EN9 Steel)



Blacksmithing for beginners: Forging and Heat Treating Carbon Steel - 3

**5. Hardening:**

- 5.1 Heat the chisel to a bright red colour and quench it in water.  
**NOTE:** Keep the chisel in an upright position when quenching, moving it up and down. This will prevent distortion. Also avoid pickled (salt) water to prevent rust.



Hardening and Tempering a Chisel

**6. Annealing: After hardening, the chisel is very brittle and may break easily when used. In order to avoid this, the following procedures are very important:**

- 6.1 Heat till cherry red and place it in lime or river sand to cool off slowly. This is called annealing and removes all internal stress caused by forging.



Annealing Process Most Widely Used Heat Treatment Process



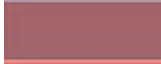
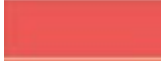







**7. Sharpening:**

- 7.1 Sharpen the cutting edge to an included angle of 60°.
- 7.2 The chisel is now ready to be tempered.

**8. Tempering: At this stage the chisel is still somewhat brittle and needs to be reheated to make it stronger (tougher) and also to ensure that the cutting edge does not break when used.**

**NOTE:** Clean the surface of the chisel with emery paper before reheating as it will be important to notice the colour change during tempering process.  
(See table for TEMPERING COLOURS.)

- 8.1. Heat the cutting edge (faint end) of the chisel to a blue-purple colour.
- 8.2. Allow the chisel to cool down in open air once the colour has been reached.

<b>TEMPERING COLOURS (SHOW IN COLOUR)</b>		
<b>316 °C</b>		<b>Scrapers</b>
<b>293 °C</b>		<b>Screwdrivers; Springs; Gears</b>
<b>282 °C</b>		<b>Cold chisels; Centre punches</b>
<b>271 °C</b>		<b>Taps (screw tread)</b>
<b>260 °C</b>		<b>Axes; Wood chisels; Taps and dies</b>
<b>249 °C</b>		<b>Twist drills; Knurls</b>
<b>238 °C</b>		<b>Punches; Reamers</b>
<b>232 °C</b>		<b>Heavy-duty twist drills</b>
<b>227 °C</b>		<b>Lathe tools; Milling cutters; Reamers</b>
<b>221 °C</b>		<b>Reamers</b>
<b>216 °C</b>		<b>Knives; Hammer heads</b>

**TASK C1: FORGING AND HEAT TREATMENT (COMPULSORY)****WORKSHEET: C1.1:****NAME:** \_\_\_\_\_

1.	<b>Forging and heat treatment to manufacture a cold chisel:</b>	
1.1	State FIVE safety precautions to be adhered to when fabricating a chisel.	
		5
1.2	Name SIX tools that you will be using during the heat treatment of the chisel.	
		6
1.3	List FIVE skills needed for heat treatment.	
		5
1.4	Explain FOUR processes to consider when heat-treating the chisel.	
		4
<b>Total – Chisel – questions</b>		<b>20</b>

<b>MECHANICAL TECHNOLOGY</b>																
<b>WELDING AND METALWORK</b>																
<b>MARK SHEET</b>																
<b>GRADE</b>		<b>12</b>		<b>DATE</b>												
<b>PROJECT:</b>		<b>COLD CHISEL</b>														
		<b>LEARNERS</b>														
<b>FACETS</b>	<b>MARKS</b>															
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>
Safety	5															
Tools	6															
Skills	5															
Processes	4															
Heating end to yellow	5															
Forge taper 12 mm	5															
Heating other end to yellow	5															
Forge six sides to taper	8															
Forge two sides parallel	5															
Hardening	5															
Annealing	5															
Tempering	5															
Sharpening	2															
Straightness of chisel	2															
Finish	3															
Test	5															
<b>TOTAL</b>	<b>75</b>															
<b>SIGNATURE OF TEACHER</b>																
<b>SIGNATURE OF SUBJECT HEAD</b>																

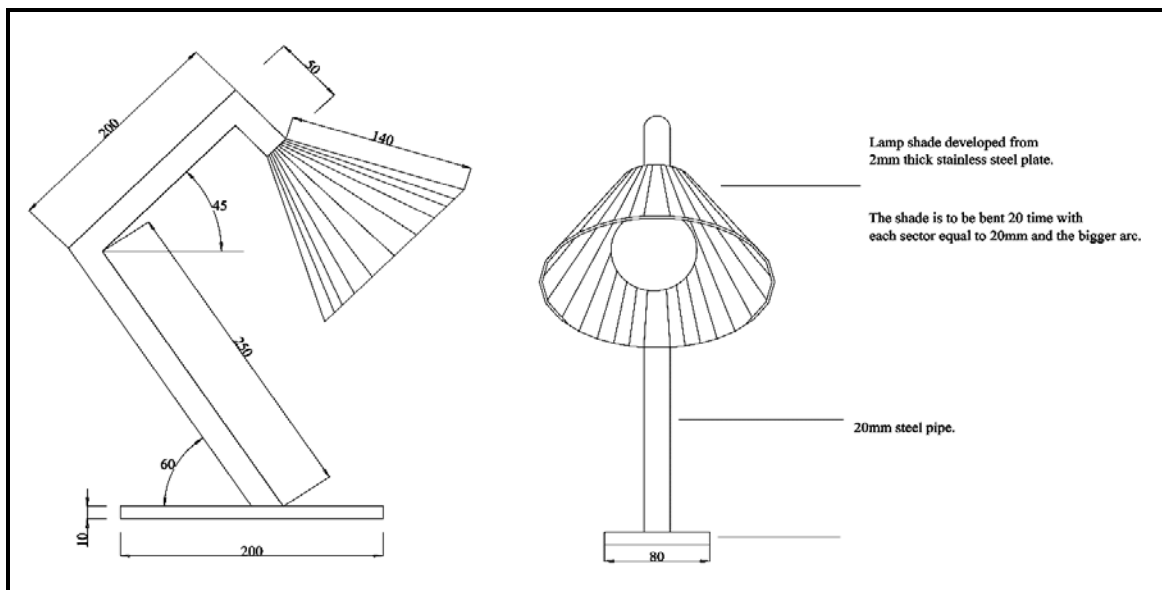
**TASK C2 (COMPULSORY)****TASK C2: WELDING – MANUFACTURING OF DESKTUDY LAMP**

Use your practical skills to manufacture the desk lamp, as indicated in FIGURE C2.1.

**The following standards must be achieved:**

- All the sizes must be within  $\pm 1$  mm of the required measurements.
- Tools and equipment must not be damaged.
- Adhere to all appropriate safety procedures.
- The lamp must be electrically safe and operational

Description	Material
Cone (lamp shade)	1 or 1,6 mm stainless-steel/mild-steel sheet metal
Support	16 mm stainless-steel/mild-steel round tubing
Base	200 x 100 x 6 mm stainless-steel/mild-steel flat bar



**FIGURE C2.1: DESK LAMP**



**TASK C2: WELDING – DESK LAMP (COMPULSORY)****WORKSHEET: C2.1:****NAME:** \_\_\_\_\_

1.	<b>Welding – manufacturing of desk lamp</b>	
1.1	State FIVE safety precautions to be adhered to while manufacturing a desk lamp.	
		(5)
1.2	Name SIX tools that you will use during the manufacturing of the desk lamp.	
		(6)
1.3	List FIVE skills needed for the manufacturing of the desk lamp.	
		(5)
1.4	Explain FOUR processes to consider during the manufacturing of the desk lamp.	
		(4)
<b>Total – Desk lamp – questions</b>		<b>20</b>

<b>MECHANICAL TECHNOLOGY</b>																
<b>WELDING AND METALWORK</b>																
<b>MARK SHEET</b>																
<b>GRADE</b>		<b>12</b>		<b>DATE</b>												
<b>PROJECT:</b>		<b>DESK LAMP</b>														
		<b>LEARNERS</b>														
<b>FACETS</b>	<b>MARKS</b>															
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>
Safety	5															
Tools	6															
Skills	5															
Processes	4															
Template for cone (includes calculation)	15															
Cone	10															
Support	10															
Base	5															
Product assembly	5															
Finish	5															
Presentation	5															
<b>TOTAL</b>	<b>75</b>															
<b>SIGNATURE OF TEACHER</b>																
<b>SIGNATURE OF SUBJECT HEAD</b>																

**NOTE:** Learners must complete ONE of the following tasks, EITHER TASK C3: braai stand OR TASK C4: fire place.

**Braai stand:**

- A square-to-round-transition piece

**Fire place:**

- Lid with square or rectangular openings

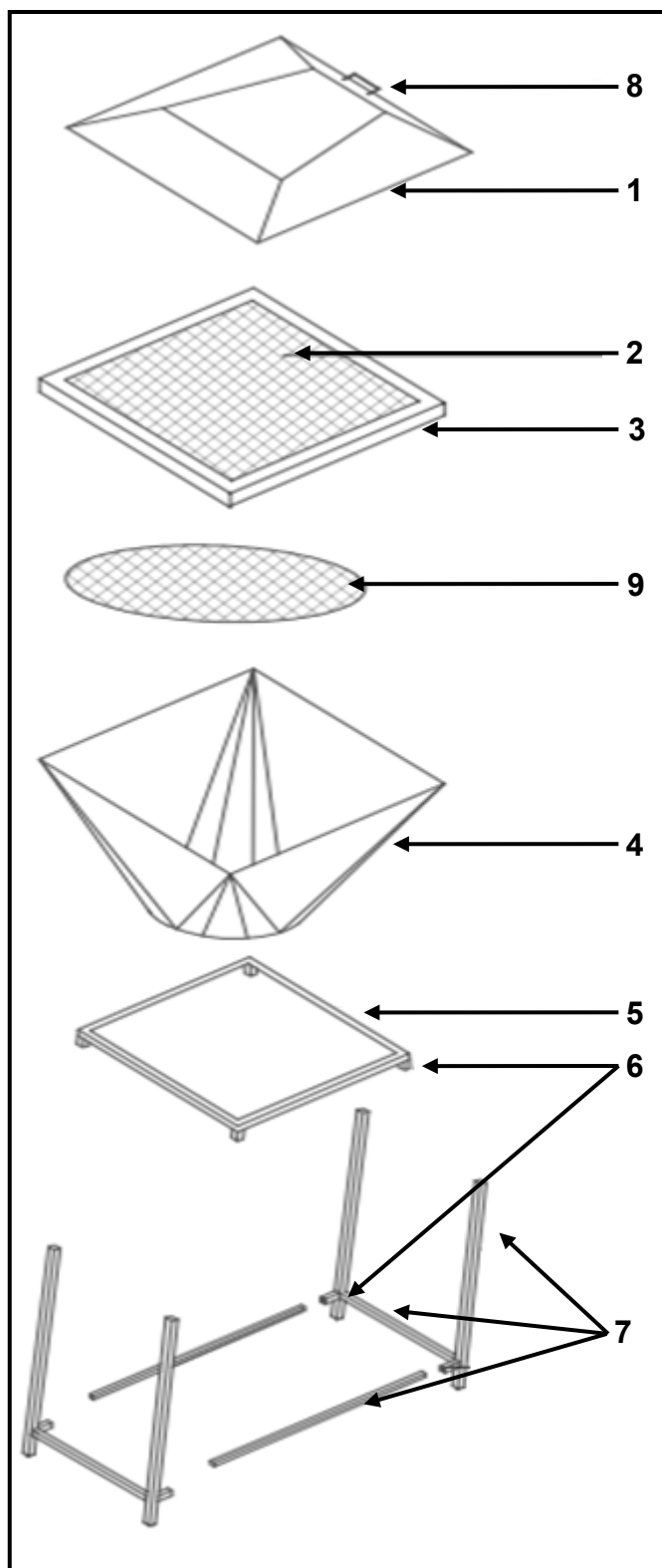
### TASK C3 – WELDING – MANUFACTURING OF BRAAI STAND

Use your practical skills and manufacture the braai stand, as indicated in FIGURES C3.1; C3.2 and C3.3

**The following standards must be achieved:**

- All the sizes must be within  $\pm 1$  mm of the required measurements.
- Do NOT damage tools and equipment.
- Adhere to all appropriate safety procedures.
- The braai stand must be safe and operational.

Item no.	Description	Material	Qty
1.	Lid	2 mm stainless-steel/mild-steel sheet metal	1
2.	Diamond mesh for braai grid	2 mm stainless steel/mild steel	1
3.	Angle iron	25 x 25 x 2 mm stainless steel/mild steel	1
4.	Square-to-round-transition piece	2–3 mm stainless-steel/mild-steel sheet metal	1
5.	Frame	25 x 25 x 1,6 mm stainless-steel/mild-steel square tubing	4
6.	Leg sockets	30 x 30 x 1,6 mm stainless-steel/mild-steel square tubing	8
7.	Detachable legs	25 x 25 x 1,6 mm stainless-steel/mild-steel square tubing	8
8.	Handle	10 mm stainless-steel/mild-steel round bar	1
9.	Diamond mesh for base-grid	2 mm stainless steel/mild steel	1

**FIGURE C3.1**

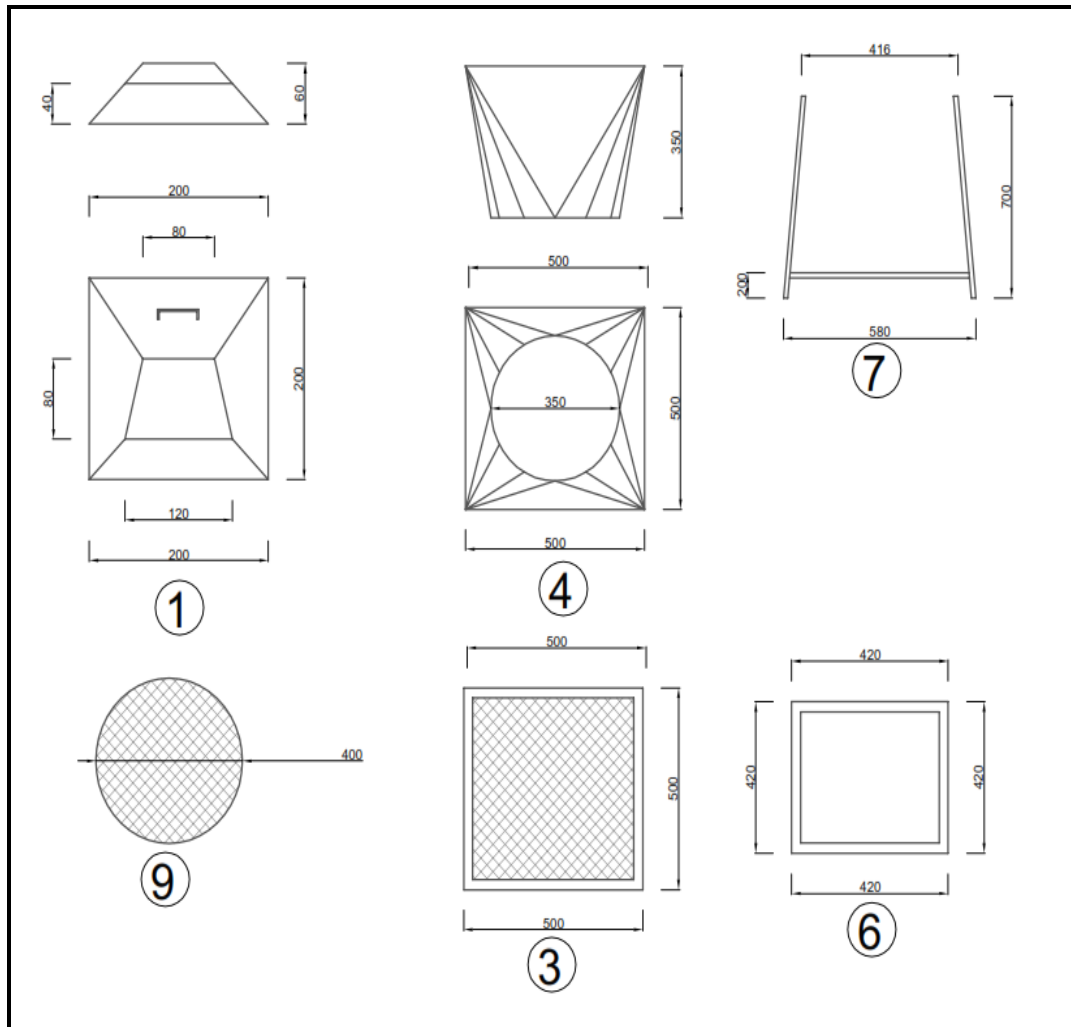


FIGURE C3.2: COMPONENTS OF BRAAI STAND



FIGURE C3.3: ISOMETRIC VIEW

**TASK C3: WELDING – BRAAI STAND (CHOICE)****WORKSHEET: C3.1:****NAME:** \_\_\_\_\_

1.	<b>Welding – manufacturing of a braai stand</b>		
1.1	State FIVE safety precautions to be adhered to when manufacturing the braai stand.		
			(5)
1.2	Name SIX tools that you will use during the manufacturing of the braai stand.		
			(6)
1.3	List FIVE skills one needs to use during the manufacturing of the braai stand.		
			(5)
1.4	Explain FOUR processes to consider when manufacturing the braai stand.		
			(4)
<b>Total – Braai stand – questions</b>			<b>20</b>

<b>MECHANICAL TECHNOLOGY</b>																
<b>WELDING AND METALWORK</b>																
<b>MARK SHEET</b>																
<b>GRADE</b>		<b>12</b>		<b>DATE</b>												
<b>PROJECT:</b>		<b>BRAAI STAND</b>														
		<b>LEARNERS</b>														
<b>FACETS</b>	<b>MARKS</b>															
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>
Safety	5															
Tools	6															
Skills	5															
Processes	4															
Lid	20															
Braai grid	5															
Base grid	5															
Transition piece	25															
Base frame	10															
Product assembly	5															
Finish	5															
Presentation	5															
<b>TOTAL</b>	<b>100</b>															
<b>SIGNATURE OF TEACHER</b>																
<b>SIGNATURE OF SUBJECT HEAD</b>																

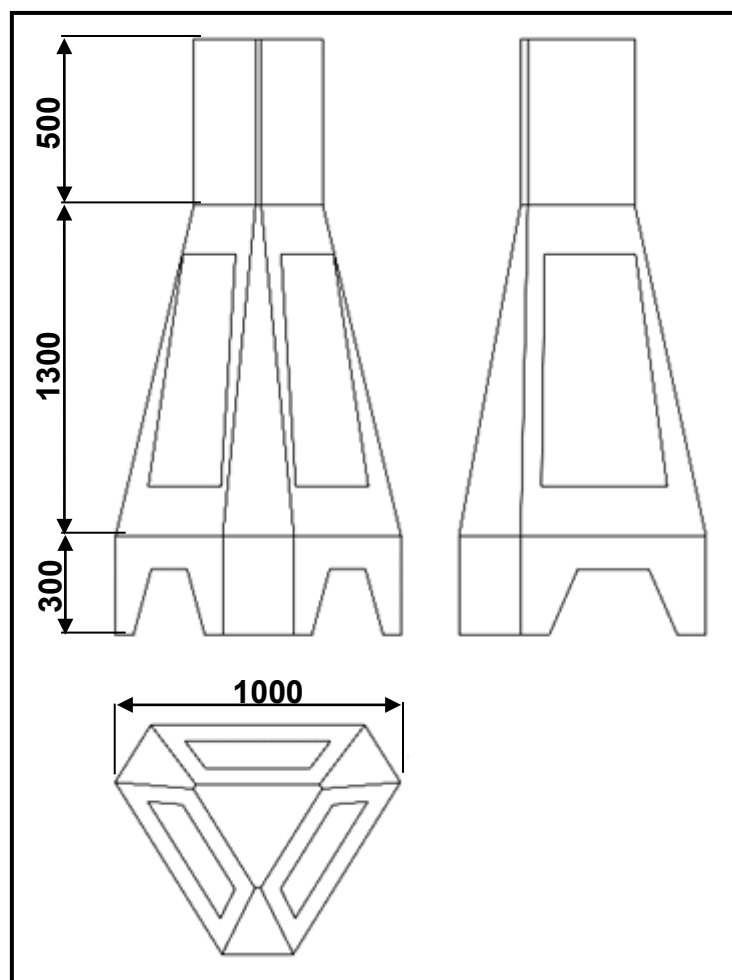
**TASK C4 – WELDING – MANUFACTURING OF FIRE PLACE**

Use your practical skills and manufacture the fire place, as indicated in FIGURES C4.1; C4.2 and C4.3

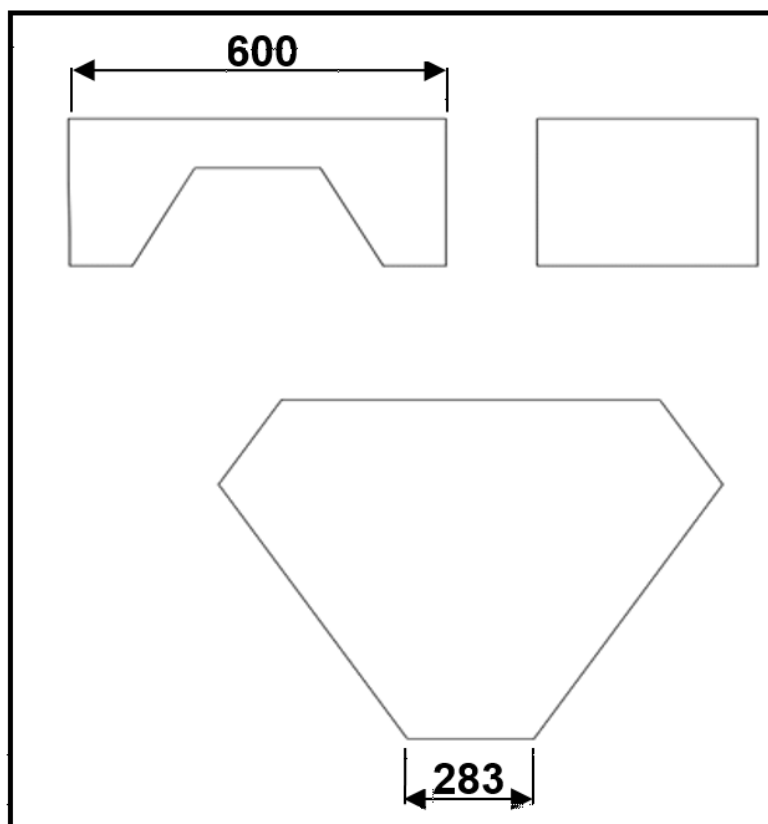
**The following standards must be achieved:**

- All the sizes must be within  $\pm 1$  mm of the required measurements.
- Do NOT damage tools and equipment.
- Adhere to all appropriate safety procedures.
- The fire place must be safe and operational.

Description	Material
Chimney	2 mm stainless-steel/mild-steel sheet metal
Irregular hexagon hearth	2 mm stainless-steel/mild-steel sheet metal
Ash tray	2 mm stainless-steel/mild-steel sheet metal
Base	2 mm stainless-steel/mild-steel sheet metal

**FIGURE C4.1: FIRE PLACE**



**FIGURE C4.2: ASH TRAY AND BASE****FIGURE C4.3: FIRE PLACE**

**TASK C4: WELDING – FIRE PLACE (CHOICE)****WORKSHEET: C4.1****NAME:** \_\_\_\_\_

1.	<b>Welding – manufacturing of a fire place</b>	
1.1	State FIVE safety precautions to be adhered to when manufacturing the fire place.	
	(5)	
1.2	Name SIX tools that you will use during the manufacturing of the fire place.	
	(6)	
1.3	List FIVE skills one needs to use during the manufacturing of the fire place.	
	(5)	
1.4	Explain FOUR processes to consider when manufacturing the fire place.	
	(4)	
<b>Total – Fire place – questions</b>		<b>20</b>

<b>MECHANICAL TECHNOLOGY</b>																
<b>WELDING AND METALWORK</b>																
<b>MARK SHEET</b>																
<b>GRADE</b>		<b>12</b>		<b>DATE</b>												
<b>PROJECT:</b>		<b>FIRE PLACE</b>														
		<b>LEARNERS</b>														
<b>FACETS</b>	<b>MARKS</b>															
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>
Safety	5															
Tools	6															
Skills	5															
Processes	4															
Chimney	15															
Hearth	25															
Base	15															
Ashtray	10															
Product assembly	5															
Finish	5															
Presentation	5															
<b>TOTAL</b>	<b>100</b>															
<b>SIGNATURE OF TEACHER</b>																
<b>SIGNATURE OF SUBJECT HEAD</b>																

<b>MECHANICAL TECHNOLOGY</b>																	
<b>WELDING AND METALWORK</b>																	
<b>MARK SHEET</b>																	
<b>GRADE</b>		<b>12</b>		<b>DATE</b>													
		<b>LEARNERS</b>															
<b>TASKS</b>	<b>MARKS</b>																
		<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	
<b>COLD CHISEL</b>	<b>75</b>																
<b>DESK LAMP</b>	<b>75</b>																
<b>BRAAI STAND</b>	<b>100</b>																
<b>FIRE PLACE</b>	<b>100</b>																
<b>GRAND TOTAL</b>	<b>250</b>																
<b>/100</b>	<b>100</b>																
<b>SIGNATURE OF TEACHER</b>																	
<b>SIGNATURE OF SUBJECT HEAD</b>																	

## **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 learners' life skills and provides opportunities for learners to engage in their own learning.