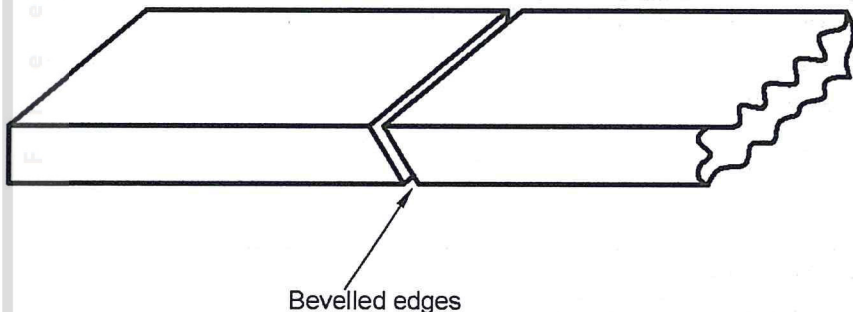


4.17 METALWORK (445)

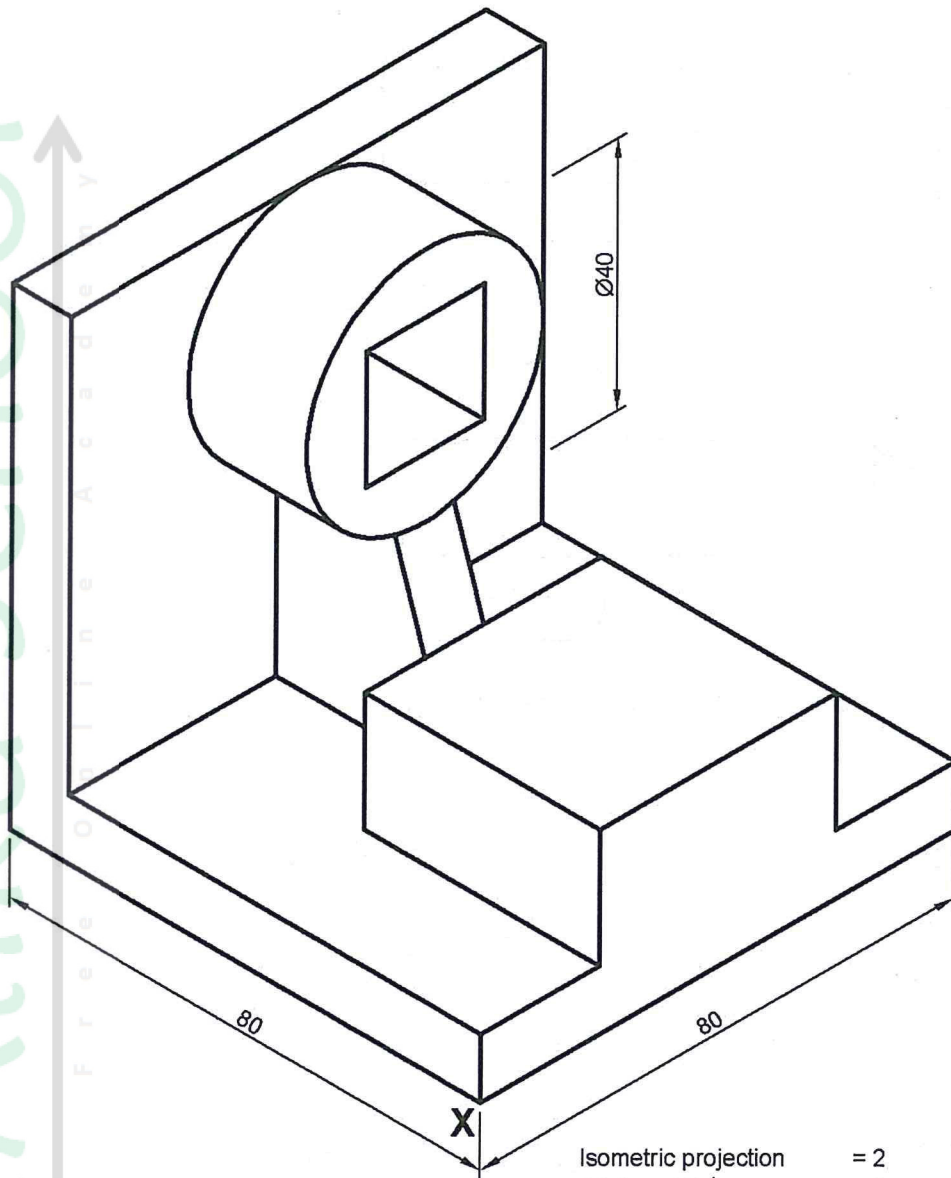
4.17.1 Metalwork Paper 1 (445/1)

1.	<ul style="list-style-type: none"> - The diversities of the environmental conditions where an individual lives. - The career inclination of an individual. - The individual's basic educational background. - The available training, opportunities. - The availability of jobs in the country. 	Any 4 x ½ =	(2 marks)
2. (a)	<ul style="list-style-type: none"> - The observations one has made. - The advice received from those with experience. - The knowledge and skills one has. - The initiative one has. - The articles which will likely sell and satisfy the needs of the consumers. - Amount of capital - Availability of materials - Infrastructure and services available 	Any 4 x ½ =	(2 marks)
(b)	<ul style="list-style-type: none"> - The type of tool or article to be made from the steel and their functions - The degree of hardness/toughness that the tool must receive in order to function properly. - The colour of oxide films 	4 x ½ =	(2 marks)
3. (a)	<ul style="list-style-type: none"> - Use equipment you are familiar with, if in doubt ask. - Do not use faulty equipment. - Handle equipment carefully. - Clean and oil equipment after use. <p>Accept any other correct response</p>	4 x ½ =	(2 marks)
(b)	(i) Turpentine	1 x 1 =	(1 mark)
	(ii) <ul style="list-style-type: none"> -As a thinner; making the paint less thick thus improve workability. -Clean the brush after use. 	2 x 1 =	(2 marks)
4. (a)	<ul style="list-style-type: none"> - The amount of material required. - The cost involved. - The availability of materials. 	Any 2 x ½ =	(1 mark)
(b)	<ul style="list-style-type: none"> - The type of material required. - The number of pieces of a particular part required. - Actual sizes, including cutting allowances for each piece. - Description of each part. 	4 x ½ =	(2 marks)

5.	<ul style="list-style-type: none"> - Clean the blades. - Choose the blade or combination of blades that fit the gap snugly. - Add the readings for each leaf to obtain the size of the gap. <p style="text-align: right;">3 x 1 = (3 marks)</p>	
6. (a)	<p>(i) Scribing block or surface gauge</p> <ul style="list-style-type: none"> - Used for scribing lines at given heights. <p>(ii) Angle plate – used for supporting work being marked.</p> <p>(iii) Vee block – used for holding round work pieces when marking or drilling.</p> <p style="text-align: right;">3 x 1 = (3 marks)</p>	
(b)	<ul style="list-style-type: none"> - Carriage wheel – For moving the carriage along the bed which allows for parallel turning. - Cross slide wheel – For moving the compound rest perpendicular to the bed. - Half – nut lever – engages the carriage to the lead screw for thread cutting. <p style="text-align: right;">3 x 1 = (3 marks)</p>	
7. (a)	<p>(i) Permits a little adjustment in its size.</p> <p>(ii) It can cut fine threads on large diameters.</p> <p>(iii) It is excellent in rethreading damaged screws or bolts.</p> <p style="text-align: right;">3 x 1 = (3 marks)</p>	
(b)	 <p style="text-align: center;">Bevelled edges</p> <p>The surface to be brazed can be increased by beveling the edges and hence increase the strength of the joint.</p> <p style="text-align: right;"> Sketch – 1 Explain - 1 </p>	(2 marks)

8.	<p>(a) Notching means cutting or removing metal from corners of sheet metal before folding or forming.</p> <p>(b) Notching is done to:-</p> <ul style="list-style-type: none"> (i) Prevent overlaps. (ii) Improve the appearance of the end product. (iii) For safety Any 2 x 1/2 = 1 <p>(c) The size of the overlap depends on the following:</p> <ul style="list-style-type: none"> (i) Size of the article to be made. (ii) Thickness of the material (iii) Strength of joint Any 1 x 1 = 1 	(3 marks)
9. (a)	<ul style="list-style-type: none"> - Mark out the holes and other details on one of the pieces. - Clamp the plates together using a hand vice. - Drill one hole through both plates, the size of the rivet shank. <p style="text-align: right;">Total =</p>	<p>(1 mark)</p> <p>(1 mark)</p> <p>(1 mark)</p> <p>(3 marks)</p>
(b)	<ul style="list-style-type: none"> (i) Attempting to draw down a point in the round results in the tip becoming hollow and weak. (ii) Necking – Forming rounded grooves in metals. (iii) Hardie – the bottom tool when one is forging using a pair of tools. <p style="text-align: right;">3 x 1 =</p>	(3 marks)
10. (a)	<p>(i) Use of proper clothing provides protection against:</p> <ul style="list-style-type: none"> - sparks - excessive heat - arc rays <p style="text-align: right;">3 x 1/2 =</p>	(1½ marks)
(b)	<p>Check the surface for</p> <ul style="list-style-type: none"> - Evenness of the surface. - Improve skirting and stopping. - Proven fusion. <p style="text-align: right;">3 x 1/2 = 1½</p>	(1½ marks)

11.

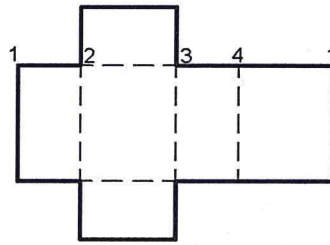
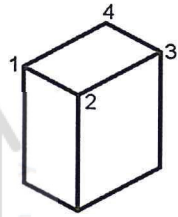


(15 marks)

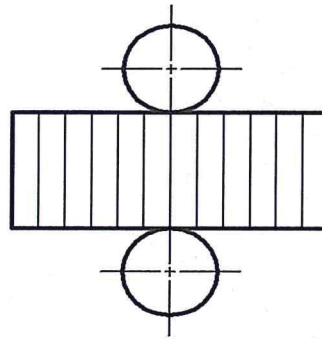
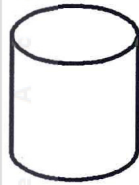
Isometric projection	= 2
16 faces @ $\frac{1}{2}$	= 8
2 curves @ 1	= 2
Correct X lowest point	= 1
Linework/neatness	= 2
<hr/>	
Total = 15 marks	

12.

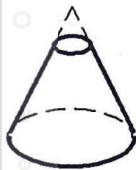
SOLUTIONS



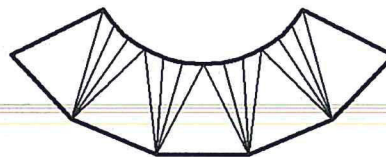
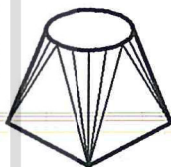
(I) STRAIGHT LINE OR ANGULAR PATTERN DEVELOPMENT



(II) PARALLEL LINE OR CYLINDRICAL DEVELOPMENT



(III) RADIAL-LINE OR CONE DEVELOPMENT



(IV) TRANSITION OR TRIANGULATION DEVELOPMENT

4 x 3 = 12 marks

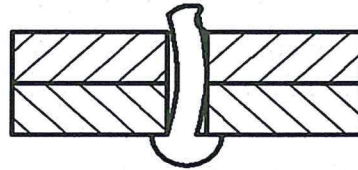
(12 marks)

(b)	<p>POINTS TO NOTE WHEN DEVELOPING PATTERNS.</p> <p>(i) Allowances for edges, seams and hems must be provided.</p> <p>(ii) While some pattern are directly made on the sheet materials, others are done on papers and transferred by carbon or tracing with a scribe or a dot punch.</p> <p>(iii) Where many articles of the same kind are to be made, a template is made of metal.</p> <p>The templates can be held firmly on sheet metal and can be traced.</p> <p style="text-align: right;">(3 x 1) = (3 marks)</p>	
13. (a)	<p>Aluminium</p> <p>Reason - the choice of the material depends on the materials to be joined.</p> <p style="text-align: right;">(2 x 1/2) (1 mark)</p>	
(b)	<p>(i) Rivet shank diameter D - $1\frac{1}{2}t$ where t = material thickness. Therefore, $D = 1\frac{1}{2} \times 3 = \frac{3}{2} \times 3 = \frac{9}{2} = 4\frac{1}{2} \text{ mm}$</p> <p>(ii) Projection to have a snap head - $1\frac{1}{2}D$ $= \frac{3}{2} \times \frac{9}{2} = \frac{27}{4} = 6\frac{3}{4} \text{ mm}$</p> <p>(iii) Distance from edge to hold centre $\Rightarrow 1\frac{1}{2}D$ $= \frac{3}{2} \times \frac{9}{2} = \frac{27}{4} = 6\frac{3}{4} \text{ mm}$</p> <p>(iv) Distance between 2 rivets $\Rightarrow 3D$ $= 3 \times \frac{9}{2} = \frac{27}{2} = 13\frac{1}{2} \text{ mm}$</p> <p>Calculations $4 \times 1\frac{1}{2} = 6$ marks</p> <p style="text-align: right;">(6 mark)</p>	

(c)

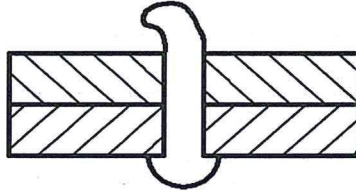
Riveting defects

(i)



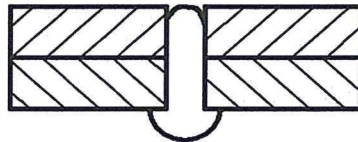
RIVET BEND

(ii)



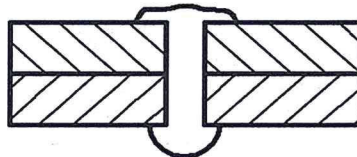
RIVET BEND

(iii)



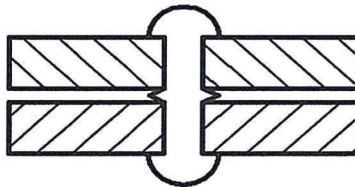
PARTIALLY FILLED COUNTERSUNK

(iv)



PARTIALLY FORMED ROUND HEAD

(v)

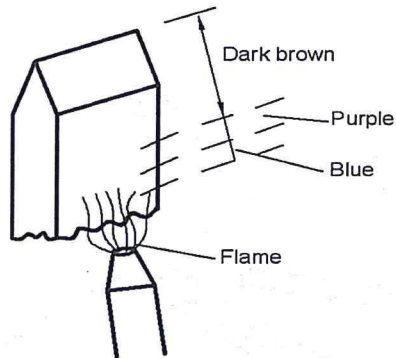


RIVET EXPANDED BETWEEN THE GAP

Any 4 x 2 =

(8 marks)

14. (a) (i)

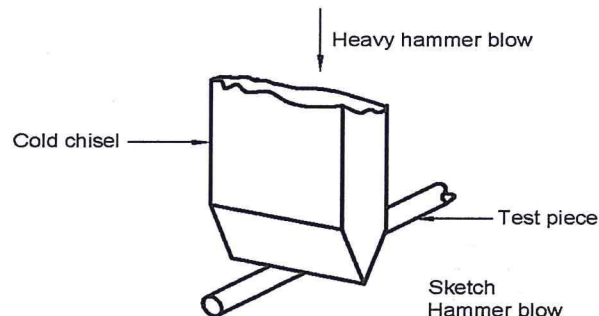


- (ii) The flame is positioned as shown in the sketch because if it is applied directly onto the cutting edge, rapid heating on the outside surface takes place. This causes the formation of oxide films while the inner structure of the steel is relatively not heated and therefore not tempered. The edge of the chisel will therefore be liable to shatter immediately it is subjected to pressure or blows.

Sketch – 3 marks
 Explanation – 3 marks
6 marks

(6 marks)

(b)



Sketch = 2
 Hammer blow = 1
 Labelling = 1
 Explanation = 2
Total = 6 marks

(6 marks)

If the hardening and tempering have been done properly, there will be no damage to the tool

(c)

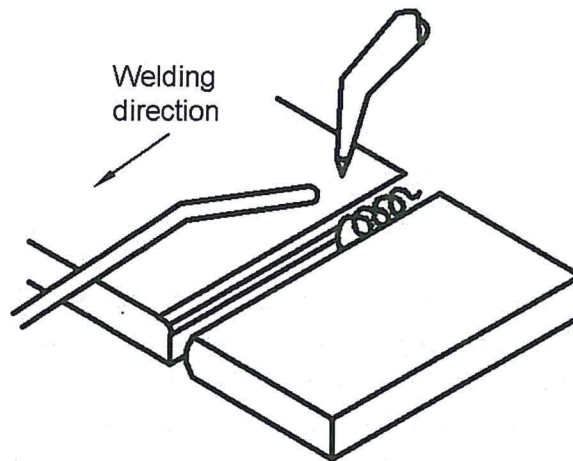
- Observing the correct colour which is usually cherry red.
- A magnet, where the steel is heated until there is no magnetic attraction. This is because steel loses its magnetism at the critical temperatures.
- A pyrometer, which is an electric thermometer attached to the furnace to give correct temperatures of the heating chamber.

(3 x 1) = (3 marks)

15. (a)

SOLUTION

(i)



LEFTWARD WELDING

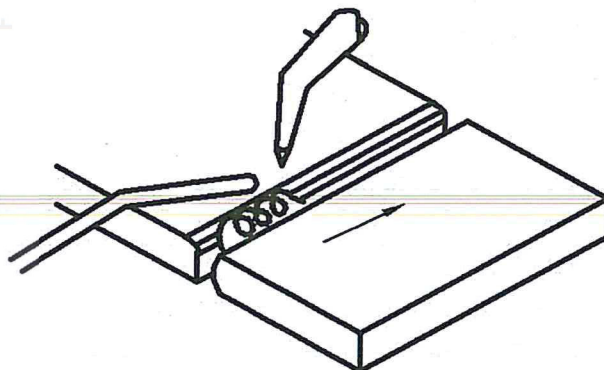
This type of welding technique refers to the method of holding the blow pipe in the right hand, the filler rod in the left hand, and moving in a leftward direction. In this technique, the filler rod precedes the blow pipe in the direction of travel.

(4 marks)

Sketch - $2\frac{1}{2}$

Explanation - $1\frac{1}{2}$

(ii)



RIGHTWARD WELDING

The weld is started at the left hand side to the right side and the torch always precedes the filler rod in the direction of travel.

(4 marks)

Sketch = $2\frac{1}{2}$

Explain = $1\frac{1}{2}$

(b) (i)	Common methods in non-destructive testing (i) Visual inspection. (ii) Penetrate fluid. (iii) Application of load. (iv) Radiography (v) Magnetic dusting <div>3 x ½ =</div>	(1½ marks)
(ii)	Common methods is destructive testing (i) Bending (ii) Tensile (iii) Impact (iv) Application of a load <div>3 x ½ =</div>	(1½ marks)
(c)	Advantages of rightward welding method: (i) It is faster than leftward welding. (ii) Less gas is used when welding. (iii) No bevel is required for steels up to 8mm, so less filler metal is used. (iv) Because the flame is always facing the weld, the cooling rate is lower, so the weld is more ductile. <div>4 x 1 =</div>	(4 marks)