

5.3 METALWORK (445)

5.3.1 Metalwork Paper 1 (445/1)

1. (a) **Reasons for teaching metalwork Secondary school level.**
- (i) To equip learners with knowledge, skills and attitudes relevant to the field to enable them pursue further training.
 - (ii) To enable the graduate/ student enter into gainful self or salaried employment after training.

Any 1 x 1 = 1 mark

(b) **Components of a business plan.**

- Executive summary
- Marketing
- Management and organizational
- Production/ operation
- Financial plan/ budget

Any correct 4 x $\frac{1}{2}$ = 2 marks

2. (a) **Safety precautions to be observed when using bench shears:**

- Always return hand to its normal position so as not to obstruct workshop users.
- Use to cut the recommended size of materials.
- The shears should be firmly fixed onto the bench.
- The jaws of the shears should be sharp enough.

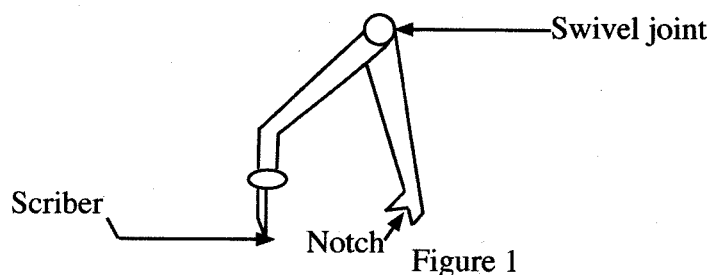
4 x $\frac{1}{2}$ = 2 marks

(b) **Importance of technical drawing in metalwork industry.**

- To enable the design and fabrication of articles.
- To enable people in the industry interpret existing drawings.

Any 1 x 1 = 1 mark

3. (i) **Odd-leg callipers**



Sketch - 1 mark

Labelling any 2 x $\frac{1}{2}$ = 1 mark

(ii) **Uses of odd-leg callipers**

- Scribing parallel lines
- Locating centres

2 x $\frac{1}{2}$ = 1 marks

Total = 3 marks

(b) **Uses of square head of a combination set.**

- Marking lines square to an edge.
- Testing for squareness.

- Marking out and checking depths.
- Marking of 45°
- Checking for 45°
- Checking the flatness of a workpiece using its spirit level.

5 x $\frac{1}{2}$ = 2 $\frac{1}{2}$ marks

4. (a) **Types of snips and their use:**

- Straight type - used for cutting straight edges
- Curved type - used for cutting internal curves
- Universal type - used for cutting almost any shape.

Types - 1 $\frac{1}{2}$ marks

Uses - 1 $\frac{1}{2}$ marks

Total = 3 marks

(b) (i) **Specifications to be considered when purchasing a rivet**

- (i) shank diameter
- (ii) shank length
- (iii) material used
- (iv) type of head

4 x $\frac{1}{2}$ = 2 marks

(ii) **Sketch a bifurcated rivet.**



Used for leather work

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

Use - $\frac{1}{2}$ mark

Total = 1 mark

5. (a) **Materials used for:**

- (i) ball peen hammer - medium carbon steel (M.C.S)
Property - it is tough
- (ii) twist drill bit - high carbon steel (H.C.S)
Property - it is hard and resists wear
- (iii) Body of aircraft - Aluminium alloy
Property - it is light, strong and non-corrosive.

Naming material - 3 x $\frac{1}{2}$ = 1 $\frac{1}{2}$

Property - 3 x $\frac{1}{2}$ = 1 $\frac{1}{2}$

Total = 3 marks

(b) **Methods of finishing metal articles**

- (i) brush painting
- (ii) spray painting
- (iii) bluing
- (iv) oil blacking
- (v) laquering
- (vi) etching
- (vii) planishing

Any 5 x $\frac{1}{2}$ = 2 $\frac{1}{2}$ marks

6. (a) File cut means the formation of the teeth of a file. (1 mark)

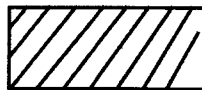
(b) **Types of file cuts**



Double cut



Rasp



Single cut

Naming any 2 x $\frac{1}{2}$ = 1 mark
Sketching any 2 x $\frac{1}{2}$ = 1 mark

(other types not shown to be accepted) Total = 2 marks

7. (a) **Disadvantages of cooling a brazed joint rapidly:**

- The joint ends up being weak
- Scaling is caused
- The joint may crack
- There is interference with the grain structure.

Any 2 x 1 = 2 marks

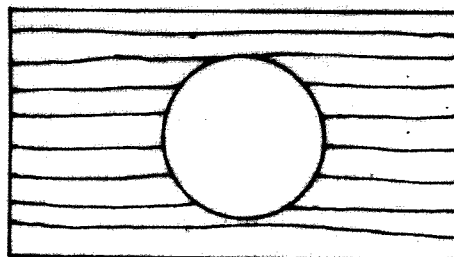
(b) Reasons for tempering a cutting tool is to remove brittleness/ excessive hardness and increase toughness. (1 mark)

Procedure for tempering:

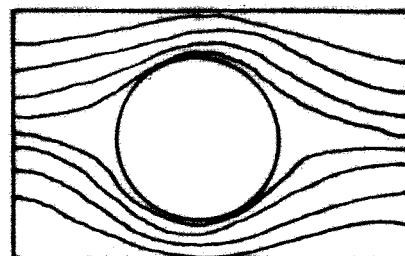
- Clean the work piece
- Heat the tool away from the cutting edge/point
- Observe the tempering colour while heating
- Quench appropriately

4 x $\frac{1}{2}$ = 2 marks

8. (a) Advantage of a forged hole over a drilled one - The grain flow strengthens the hole structure. 1 x 1 = 1 mark



Drilled hole

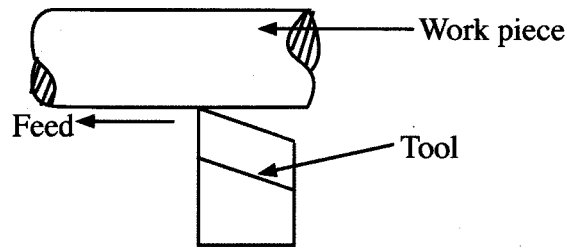


Forged hole

Fig. 4

9. **Operations on a lathe machine**

(i) **Parallel turning**



$3 \times \frac{1}{2} = 1\frac{1}{2}$ marks

(ii) **Facing**

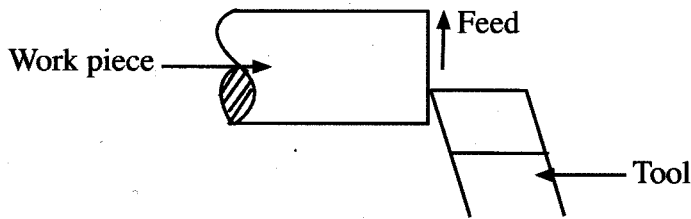


Figure 5

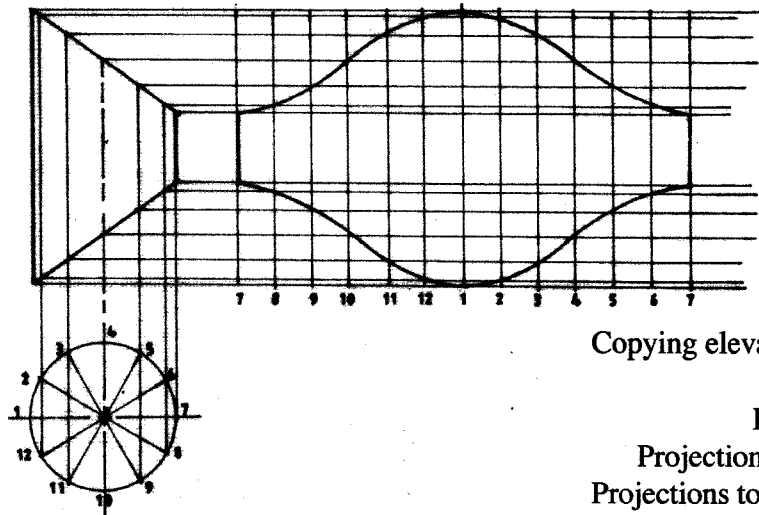
10. **Terms of arc-welding**

- (a) Scratching is a method of striking an arc by scratching
- (b) Tapping is a method of starting an arc where the electrode is brought down until it is in contact with the metal to be welded.
- (c) Freezing is the tendency of the electrode to stick on the metal being welded.

1 x 3 = 3 marks

SECTION B

Figure shows a truncated pipe of diameter 24 mm.



Copying elevation B - 1

Plan - 1

Plan divisions - 2

Projections to elevation - 2

Projections to development - 2

Circumference marked - 2

Points of intersection - 2

Joining of points - 3

15 marks

ACCEPT ALTERNATIVE OPENING POINT

12. (a) (i) **Naming parts labelled**
 A - metal core
 B - Flux/electrode covering
 C - Gaseous shield
 D - Slag
 E - Globules of molten core wire
 F - Parent metal

$6 \times \frac{1}{2} = 3$ marks

(ii) **The flux has the following functions:**

- (I) enable the arc to be struck and maintained easily.
- (II) floats the impurities out of the molten metal to form the slag.
- (III) provides iron powder to increase the rate of depositing.
- (IV) it forms a layer that makes the joint to cool slowly.

Any 1 x 1 = 1 mark

(iii) **The gaseous shield has the following functions:**

- (I) it helps protect the weld.
- (II) it slows down the cooling of the joint.

Any 1 x 1 = 1 mark

- (iv) The slag is the uniformly deposited molten electrode which forms the joint for decorative purposes. (1 mark)

- (b) (i) The term bead refers to the pattern formed in the welding process.

1 x 1 = 1 mark

- (ii)
- (I) Prepare the plate to be welded
 - (II) Draw the required path of the bead with a piece of chalk
 - (III) Position the work ready for welding - earth the workpiece
 - (IV) Select the correct electrode.
 - (V) Set the correct welding current.
 - (VI) Add the electrode slanting at an angle of 75° in the direction of travel.
 - (VII) Wear protective gear.
 - (VIII) Strike the arc.
 - (IX) Momentarily raise the electrode after establishing the arc.
 - (X) Lower the electrode to the correct arc length.
 - (XI) Start building up the desired bead.

$10 \times \frac{1}{2} = 5$ marks

(c) **Defects in arc welding**

(i) **Undercut**

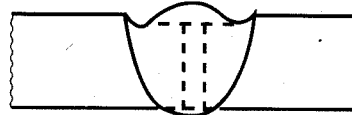


Figure 6

Causes:

- Use of excessive current
- Improper angle of electrode to the base metal.

Sketch - 1 mark

Any 1 cause - $\frac{1}{2}$ mark

$\frac{1}{2}$ marks

(ii) **Porosity**

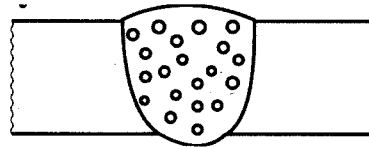


Figure 7

Causes

- Excessive moisture in the electrode or joint.
- High rate of metal freezing.
- Oil, paint or rust on the surface of the base metal.
- Improper arc length, current or manipulation.

Sketch - 1 mark

Any 1 cause - $\frac{1}{2}$ mark

$1\frac{1}{2}$ marks

13. (a)
- | | | | |
|---|-------------------|---|-------------------------------------|
| A | Head stock | - | carries the driving mechanism |
| B | Headstock spindle | - | hold the chuck or live centres |
| C | Bed | - | supports the carriage and tailstock |
| D | Dead centre | - | supports the tailstock |
| E | Tail stock | - | for feeding the drills |
| | | | for securing the work |
| F | Tool post | - | holds the cutting tool |

correct name $6 \times \frac{1}{2} = 3$

correct function $6 \times 1 = 6$

Total = 9 marks

- (b) TYPE OF FINISH - Fine finish will require slight cut.
Rough finish will require deep cut.

HARDNESS/SOFTNESS - Soft material require deep cut.

- Hard materials slight cut.

TOOL - ANGLE - round nosed up for heavy cut pointed tip for light cut.

MACHINE STABILITY - Stable allows deep cut unstable for light cut.

RIGIDITY OF CUTTING TOOL - Rigid for deep cut, unrigid for light cut.

Stating any $4 \times \frac{1}{2} = 2$ marks

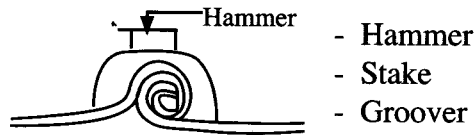
Explaining any $4 \times 1 = 4$ marks

6 marks

14. **Steps followed in making a grooved seam joint of an open cylinder.**

Steps	Sketch	Tools used
(i) Mark out seam allowances		- Try square - Steel rule - Scriber
(ii) Bend the flaps		- Folding bars - Mallet
(iii) Fold both sides to same size		- Anvil - Mallet
(iv) Hook the ends and tighten the joint		- mallet - anvil/stake

(v) Close down or groove the joint



Steps well outlined = 5 marks

Sketches 5 x 1 = 5 marks

Tools 5 x 2 x $\frac{1}{2}$ = 5 marks

Total 15 marks

15. (a) (i) **Causes of drill breakages**

- too high feed rate.
- speed too high.
- incorrect alignment.
- drill jamming in the hole.
- workpiece not properly clamped.

Any 4 x $\frac{1}{2}$ = 2 marks

(ii) **Causes of weak riveted joint**

- too short rivet head allowance
- too large hole diameter
- gap between plates/failure to deburr close plates.
- misaligned holes.
- too long rivet allowance.

Any 4 x $\frac{1}{2}$ = 2 marks

(b) (i) **Stock**

- file datum edges
- mark out rivet holes
- centre punch holes position
- debur

4 x $\frac{1}{2}$ = 2 marks

(ii) **Blade**

- file datum edges
- mark out profile
- cut out profile
- file profile to size
- mark out blade hole
- centre punch hole
- drill hole
- mark out stock position (6 mm)

8 x $\frac{1}{2}$ = 4 marks

(b) **Assembling the parts**

- align and clamp the two parts together.
- drill through and put the rivets in the holes.
- drill the remaining rivet holes.
- countersink the holes.
- deburr the plates/parts.
- insert rivets and close plates.
- rivet to fill the countersunk holes.
- file all surfaces to size.
- mark and cut out notch.
- finish with emery cloth.

10 x $\frac{1}{2}$ = 5 marks