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**

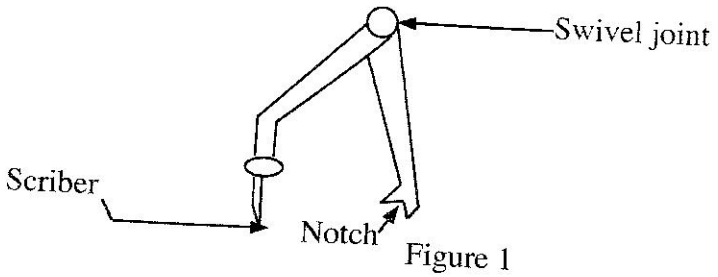


Figure 1

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.

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

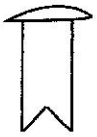
4. (a) **Types of snips and their use**:
   - Straight type - used for cutting straight edges
   - Curved type - used for cutting internal curves
   - Universal type - used for cutting almost any shape.

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) shark diameter
   (ii) shark length
   (iii) material used
   (iv) type of head

$4 \times \frac{1}{2} = 2$ 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 pein 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.

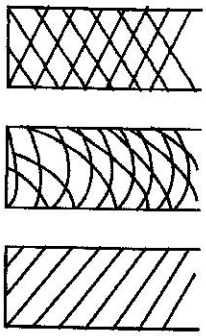
Naming material - $3 \times \frac{1}{2} = 1\frac{1}{2}$
Property - $3 \times \frac{1}{2} = 1\frac{1}{2}$
Total = 3 marks

(b) **Methods of finishing metal articles**
   (i) brush painting
   (ii) spray painting
   (iii) bluing
   (iv) oil blacking
   (v) laquering
   (vi) etching
   (vii) planishing

Any $5 \times \frac{1}{2} = 2\frac{1}{2}$ 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

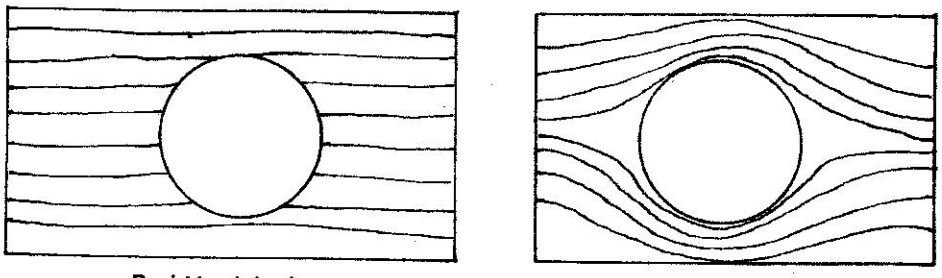
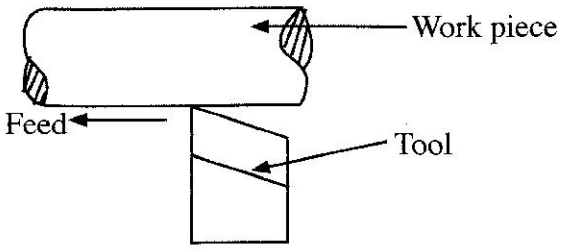


Fig. 4

9. **Operations on a lathe machine**

(i) **Parallel turning**



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

(ii) **Facing**

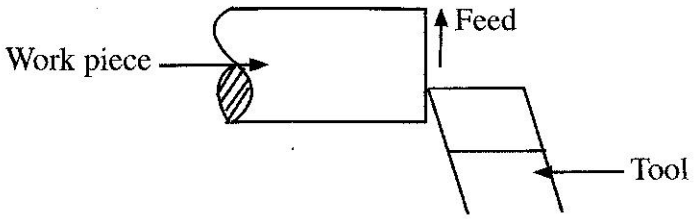


Figure 5

10. **Terms of arc-welding**

(a) Scratching is a method of striking an arc by scratching

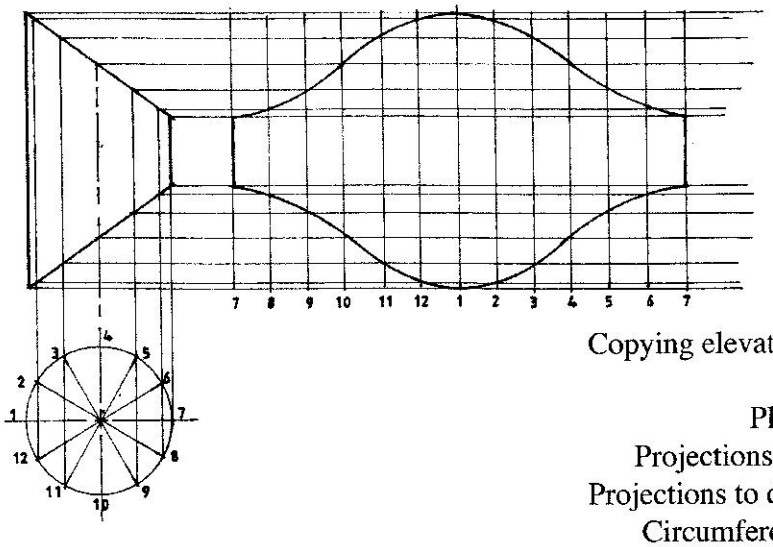
(b) Tapping is a method of starting an arc where the electrode is brought down until it is in contact with the metal to be welded.

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

(c) **Defects in arc welding**

(i) **Undercut**

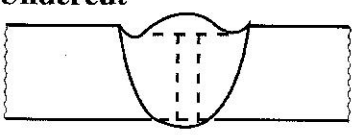


Figure 6

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**

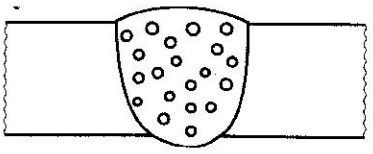


Figure 7

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.

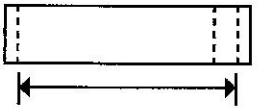
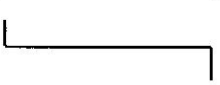
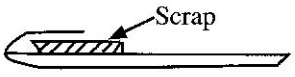
TOOL - ANGLE - round nosed up for heavy cut pointed tip for light cut.

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

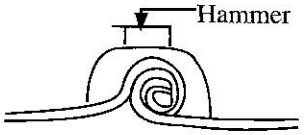
RIGIDITY OF CUTTING TOOL - Rigid for deep cut, unrigid for light cut.

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



- Hammer
- Stake
- Groover

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