

4.17 METALWORK (445)

4.17.1 Metalwork Paper 1 (445/1)

SECTION A

1. (a) Problems likely to occur as a result of:

(i) scribing a line using a dot punch - it will be difficult to reach the required corner and mark the line due to the thick point of the punch. **1 mark**

(ii) Dot punching using a scriber - the tip of a scriber can easily break. **1 mark**

(b) Methods of extracting a broken tap from a hole.

(i) The broken piece may be punched out backwards to unscrew.

(ii) The piece may be heated to soften and then drilled out.

(iii) Use a stud remover/tap extractor to remove the piece.

3 x 1 = 3 marks

2. (a) Uses of a template:

(i) For marking out repeated identical parts with minimum waste during mass production.

(ii) For checking angles, curves and contours when forming parts.

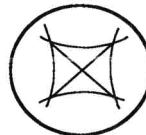
(iii) It serves as a guide for oxy-acetylene cutting of various profiles.

Any 2 x 1 = 2 mark

(b)



or



Sketch: $1 \times \frac{1}{2} = \frac{1}{2}$ mark

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

(i) Set the callipers to convenient radius.

(ii) Mark out a square/rhombus from four different positions using the radius approximately opposite each other.

(iii) Join the diagonals to locate the centre.

Steps 3 x $\frac{1}{2} = 1\frac{1}{2}$ marks

(c) (i) Reasons for painting metal surfaces:

- To prevent corrosion.
- To decorate articles/for aesthetics.
- For identification.

Any 2 x $\frac{1}{2} = 1$ mark

- (ii) Methods of painting
- By using a painting brush.
 - Spraying using a spray gun.
 - By dipping.
 - Electroplating.

Any 2 x $\frac{1}{2}$ = 1 mark

3. (a) Uses of a drift in forging:

- (i) To enlarge punched holes.
- (ii) To shape punched holes.
- (iii) To smoothen punched holes.
- (iv) To strengthen the edges of a punched hole.

Any 2 x $\frac{1}{2}$ = 1 mark

(b) Precautions to be observed when twisting a metal bar to avoid uneven twist.

- (i) Ensure even heating.
- (ii) The metal bar must be twisted straight.
- (iii) Secure the bar firmly.

Any 2 x $\frac{1}{2}$ = 1 mark

4. (a) Reasons for using hollow metals.

- (i) They are light in weight.
- (ii) They are easy to shape.
- (iii) They are cheaper than solid bars.

Any 2 x $\frac{1}{2}$ = 1 mark

(b) Precautions while using grinding machine:

- (i) Observe the tool rest space as per recommendation.
- (ii) Always use eye protection/goggles.
- (iii) Always cool the workpiece to avoid overheating.
- (iv) Avoid loose clothing while using the machine.
- (v) Use only the face of the wheel.

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

5. (a) Specifications of a rivet.

- (i) Length.
- (ii) Shank diameter.
- (iii) Material.
- (iv) Shape of head.

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

(b) Factors to consider when selecting spelter for blazing.

- (i) Thickness of the material to be brazed.
- (ii) The joint design.
- (iii) The method of heating the joint.
- (iv) The type of material to be brazed.

Any 3 x 1 = 3 marks

6. (a) Methods of holding a work piece on a lathe machine.

- (i) Three jaw chuck.
- (ii) Four jaw chuck.
- (iii) Face plate.
- (iv) Catch plate.
- (v) Between centres.

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

(b) Reasons for knurling.

- (i) Provide a firm grip.
- (ii) For aesthetic value.

7. (a) Functions of an electrode flux in arc welding:

- (i) It enables the arc to be struck and maintained easily.
- (ii) It shields the molten metal from the air.
- (iii) It removes the impurities from the molten metal.
- (iv) It forms the slag which helps to protect the weld and slow the cooling.
- (v) It provides iron powder to increase the depositing rate.
- (vi) It serves as an insulator for the core wire.

Any 3 x 1 = 3 marks

(b) Uses of metals

- (i) Construction materials in industries.
- (ii) For making tools and equipment.

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

8. (a) Sources of information related to career choice in a school setting.

- (i) Career master/mistress/resource person.
- (ii) Handbook for guidance and counselling.
- (iii) School career information booklet.
- (iv) Local newspapers and magazines.
- (v) Internet.

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

(b) Consideration for establishing a company:

- (i) Distance from target market/suppliers.
- (ii) Waste disposal/environmental concern - NEEMA.
- (iii) Availability of utility services like water, electricity and post office.
- (iv) Accessibility to the site.
- (v) Rental facilities for workers.
- (vi) Availability of capital.
- (vii) Security.

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

9. (a) Purposes of annealing metals.

To soften $\left(\frac{1}{2}\right)$ the metal so that it can be easy to be worked on $\left(\frac{1}{2}\right)$.

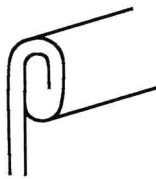
1 mark

(b) Process of annealing.

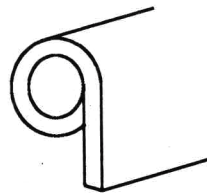
- (i) Heat the metal slowly to bright red.
- (ii) Cool slowly (by burying under hot ash).

$2 \times 1 = 2$ marks

10. (a)



Double hem



False wire

Sketches: $2 \times 1 = 2$ marks

(b) Resulting properties of alloying steel with:

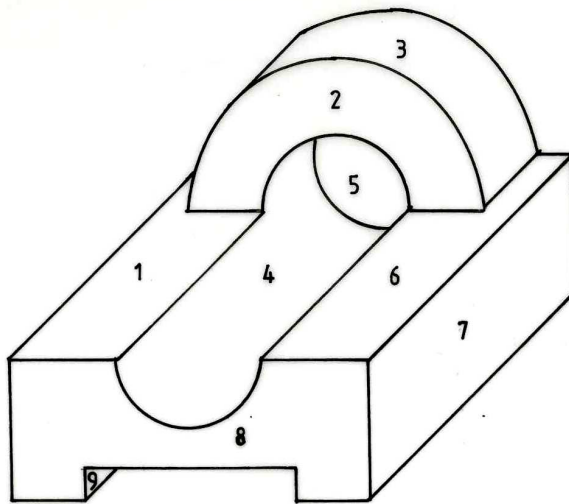
Manganese - increases resistance to wear and adds strength.

Chromium - increases hardness, toughness and resistance to corrosion.

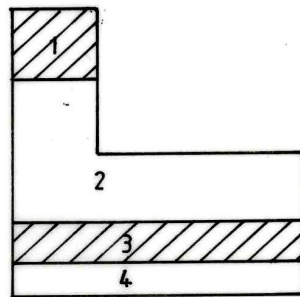
Nickel - increases strength, toughness and helps steel to resist corrosion.

$3 \times 1 = 3$ marks

11.



Faces	$9 \times 1 = 9$
Oblique	$= 1$
	<u>$= 10 \text{ marks}$</u>



Faces	$4 \times 1 = 4$
Hatching	$2 \times 1/2 = 1$
	<u>$= 5 \text{ marks}$</u>

12. (a) (i) Points to consider in order to obtain a strong brazed joint.

- Select appropriate joint design.
- Clean surface off dust, scales, oil and grease.
- Use appropriate filler metal.
- Apply correct flux.
- Joints to fit closely.
- The parent metal should be heated to the correct temperature.
- The brazed joint should be cleaned with warm water.

Any 4 x 1 = 4 marks

(ii) Safety precautions to be observed while brazing:

- Proper dressing must be observed eg. overalls, dust coats, gloves, boots etc.
- Brazing goggles with proper lenses must be worn.
- Use tongs to hold metal.
- Working area must be properly ventilated.
- Clean the working area.

- Keep off inflammable materials from working area.
- Do not use the gas for dusting overalls and clothing.

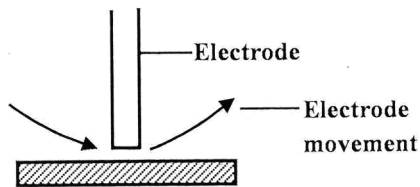
Any 4 x $\frac{1}{2}$ = 2 marks

(b) (i) Points to consider when selecting an electrode for arc welding:

- Base metal composition.
- Welding current.
- Welding position.
- Thickness and shape of base metal.
- Production efficiency and job condition.
- Base metal strength properties.
- Manufacturers recommendations.

Any 3 x $\frac{1}{2}$ = 1 $\frac{1}{2}$ marks

(ii) Two methods of starting an arc.



(I) Scratch method

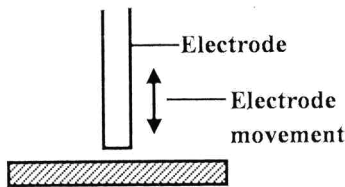
Correct drawing

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

Naming any 2 parts

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

TOTAL = 3 marks



(II) Tap method

Correct drawing

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

Naming any 2 parts

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

Naming the method = $\frac{1}{2}$ mark

TOTAL = 3 marks

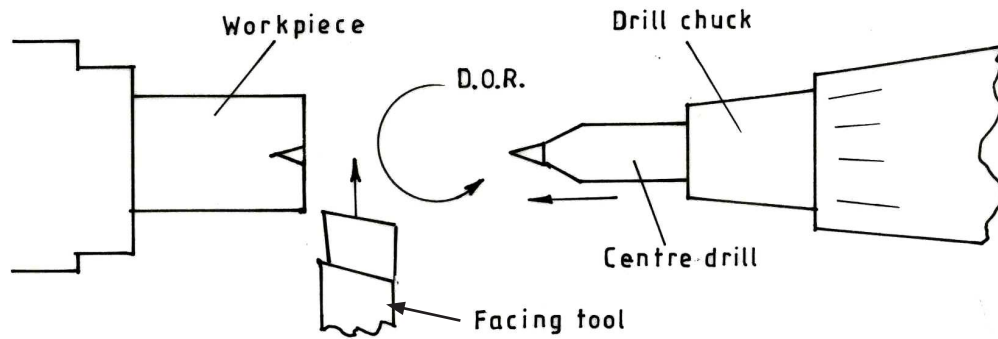
(iii) Methods of inspecting qualities of a weld:

- Visual.
- Fluid penetration.
- Bending.
- Application of load.
- Tensile.
- Impact.

Any 3 x $\frac{1}{2}$ = 1 $\frac{1}{2}$ marks

13. Lathe operations

(i) Drilling



- Face the work.
- Centre drill.
- Fix twist drill.
- Move the tail stock close to the work piece and lock.
- Feed the twist drill into the rotating work.

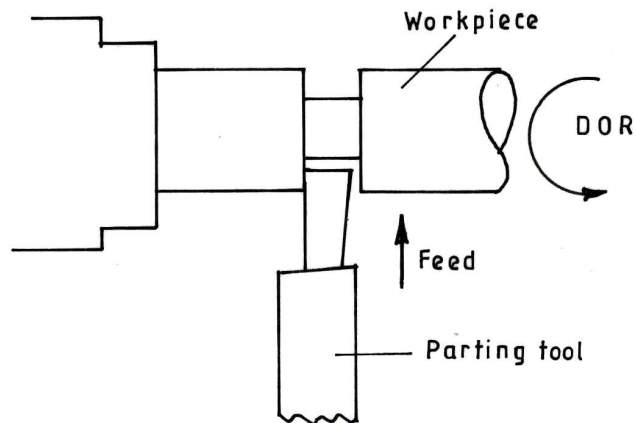
$$\text{Steps } 5 \times \frac{1}{2} = 2\frac{1}{2}$$

$$\text{Sketch } 4 \times \frac{1}{2} = 2$$

$$\text{Labels } 7 \times \frac{1}{2} = 3\frac{1}{2}$$

Total 8 marks

(ii) Parting off



- Fix workpiece securely in chuck.
- Mark parting point/width.
- Set machine to low speed.
- Set parting tool to correct position.
- Feed the tool slowly.
- Withdraw tool to allow chips to break off and feed again.

$$\text{Sketch} \quad - 2$$

$$\text{Labelling } 4 \times \frac{1}{2} \quad - 2$$

$$\text{Steps} \quad 6 \times \frac{1}{2} \quad - 3$$

Total 7 marks

14. (a) Cutting list

Part	Size	No. off
Legs	6 x 5 x 5	3
Base	205 x 85 x 4	1
Screw	Standard	3

3 parts x 1 = 3 marks

(b) Procedure of:

(i) Base

- Prepare datum edges.
- Mark off the profiles.
- Drill screw holes.
- Countersink the holes.
- Drill for slots.
- File slots to shape.
- Cut outer profile to shape.
- File to size..

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

(ii) Legs

- Prepare datum end.
- Mark out size.
- Cut to size.
- File to size.
- Mark for holes.
- Drill holes.
- Tap holes.

7 x $\frac{1}{2}$ = 3 $\frac{1}{2}$ marks

(iii) Assembly

- Align legs to base.
- Confirm screw length.
- Fasten with screws.

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

(c) Case hardening

- Heat to bright cherry red.
- Cover it with Kasenite compound.
- Heat again / re-heat to cherry red.
- Quench in water / brine.

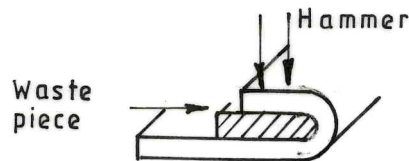
2 x $\frac{1}{2}$ = 1 mark

(d) Finishing

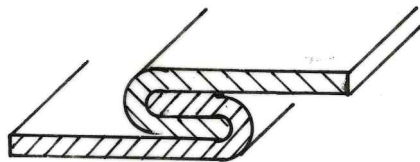
- Bluing.
- Sanding.
- Polishing/buffing.

$2 \times \frac{1}{2} = 1$ mark

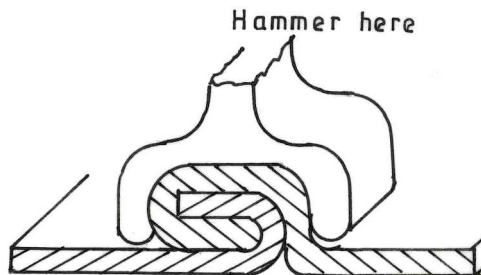
15. (a) (i) Square the edges that will be used for the joint, and remove burrs.
(ii) Mark the joint position.
(iii) Make folds on both pieces.



- (iv) Remove the waste piece and interlock the work pieces.



- (v) Align the pieces
(vi) Using a hand groover, groove the joint.



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

(b) Procedure for soldering.

- Clean joints appropriately.
- Tin the bit.
- Apply flux to the joint.
- Heat the joint.
- Apply solder in one direction, on both sides.
- Clean the joints

6 x 1 = 6 marks

(c) Examples of grooved soldering seams:

- Food cans.
- Water storage cisterns/tanks.
- Radiators.

Any 2 x $\frac{1}{2}$ = 1 mark

(d) Mark the 100 mm hole.

- Make a hole to accommodate the snips.
- From the hole towards the circumference, cut a smooth curve.
- Cut along the circumference to make the hole.

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

Note:

Accept an illustration as alternative answer.

