4.17 METALWORK (445)

4.17.1 Metalwork Paper 1 (445/1)

SECTION A

Answer ALL the questions in this section.

1. (a) Career training programmes in metal work
   - Welding and Fabrication
   - Refrigeration and Air conditioning
   - Mechanical production
   - Mechanical plant
   - Fitting

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

   (b) "Self employment" is when an individual <u>starts income</u> generating activities and the <u>profits</u> from the sale are utilised by the individual. (1 marks)

2. (a) Types of cold chisels

   - Cross-cut chisel - For cutting narrow square, grooves in metals.
   - Diamond - pointed chisel - for cutting v-shaped grooves in metals.
   - Half-round chisel - for cutting circular grooves in metals.
   - Flat chisel for general purpose.

   (3 x 1 = 3 marks)

   (b) - Drilling
   - Counter boring
   - Counter sinking
   - Spot facing
   - Reaming
   - Decorating surfaces

   (6 x $\frac{1}{2}$ = 3 marks)

3. (a) Reasons for avoiding
   (i) Long hair
   - Can be caught by moving machine parts.
   - Tends to obstruct the worker from seeing the work clearly during working operations.

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

   (ii) Long nails
   - can hurt the fingers and others.
   - make it difficult to handle a work piece.
   - can collect dirt which can be transmitted to food i.e unhygienic.

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

   (b) Factors to consider in order to obtain strong brazed joints:
   - Clean the parts to be joined.
   - Ensure the joint is well fitting.
   - Use the correct filler metal.

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- Apply sufficient heat i.e. heat to the correct temperature.
- Clean the joint after brazing to remove any excess materials.

$$(4 \times \tfrac{1}{2} = 2 \text{ marks})$$

4.   (a)   Vernier protractor - used for measuring and marking angles/checking angles.
             Vernier height gauge - use for measuring and marking parallel heights.

$$(4 \times \tfrac{1}{2} = 2 \text{ marks})$$

      (b)   Functions of:

- Ratchet - Ensures the correct pressure when measuring.
- Spindle - Contains very accurately cut threads which provide accuracy when reading. $$(2 \times \tfrac{1}{2} = 1 \text{ mark})$$

5.   (i)   Malleability is the ability of a metal to be hammered or rolled into thin sheets without cracking. Examples are; mild steel, aluminium, copper, brass, tin, gold, dead mild steel, wrought iron.

Definition - $\tfrac{1}{2}$
Example - $\tfrac{1}{2}$

      (ii)   Toughness is the ability of metal to resist fracture or deformation when subjected to external forces. Examples are; medium carbon steel, alloy steels.

Definition - $\tfrac{1}{2}$
Example - $\tfrac{1}{2}$

      (iii)   Plasticity is the property that makes a metal remain deformed or retain the new shape after the load has been removed.
Examples are; lead, copper, gold, aluminium.

Definition - $\tfrac{1}{2}$
Example - $\tfrac{1}{2}$ (3 marks)

6.   (a)   It can be used to join thin metals.

- It does not cause change in properties of the material.
- Due to the slow cooling process the joint is left ductile.
- The equipment is portable therefore can be used in various and confined places.
- Initial costs and maintenance are low where the gases are available.

(Any 3 x 1 = 3 marks)

      (b)   Reasons for rounded tip of a lathe cutting tool.

(i)   -   To produce a smooth finish
(ii)   -   To form an internal curve/groove.
(iii)   -   To avoid breakage of the tip of the tool.

$$(\text{Any } 2 \times \tfrac{1}{2} = 1 \text{ mark})$$

7. (a)

Blocking hammer

Bowl

Wood
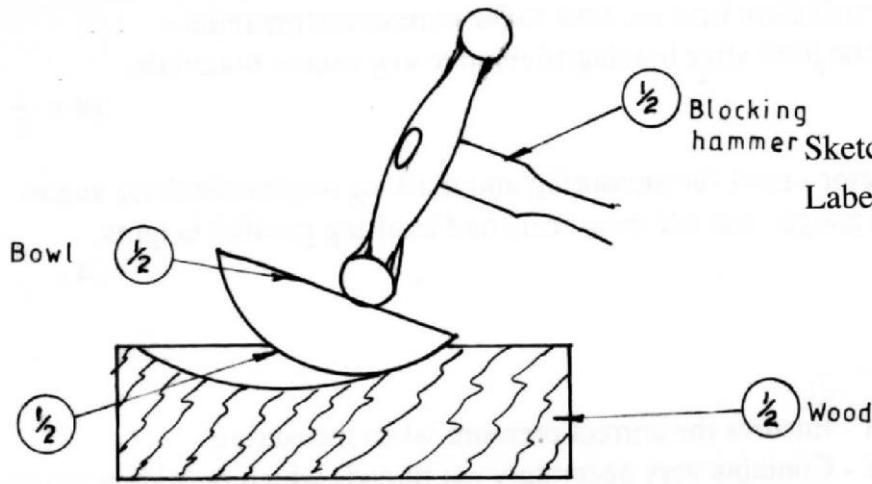
Sketch   = 2 marks

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

            = 4 marks

Hollowing on a round block using a blocking hammer.

     (b)   To enable markings on metal appear more clearly.   (1 mark)

- copper sulphate solution
- Blue vitiriol
- Chalk

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

8. (a)
- Open flame heating
- Hot plate tempering
- Sand box tempering

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

     (b)   "Point of recalescence" is the point where temperature remain constant while steel is being heated.   (1 $\frac{1}{2}$ marks)

9. (a)   Projection allowance = $1\frac{1}{2}$ D = $1\frac{1}{2}$ x 4 = $\frac{3}{2}$ x 4 = 6 mm   (1 mark)

     (b)   (i)   Failure to use rivet set - Rivet expanded between gap.   (1 mark)

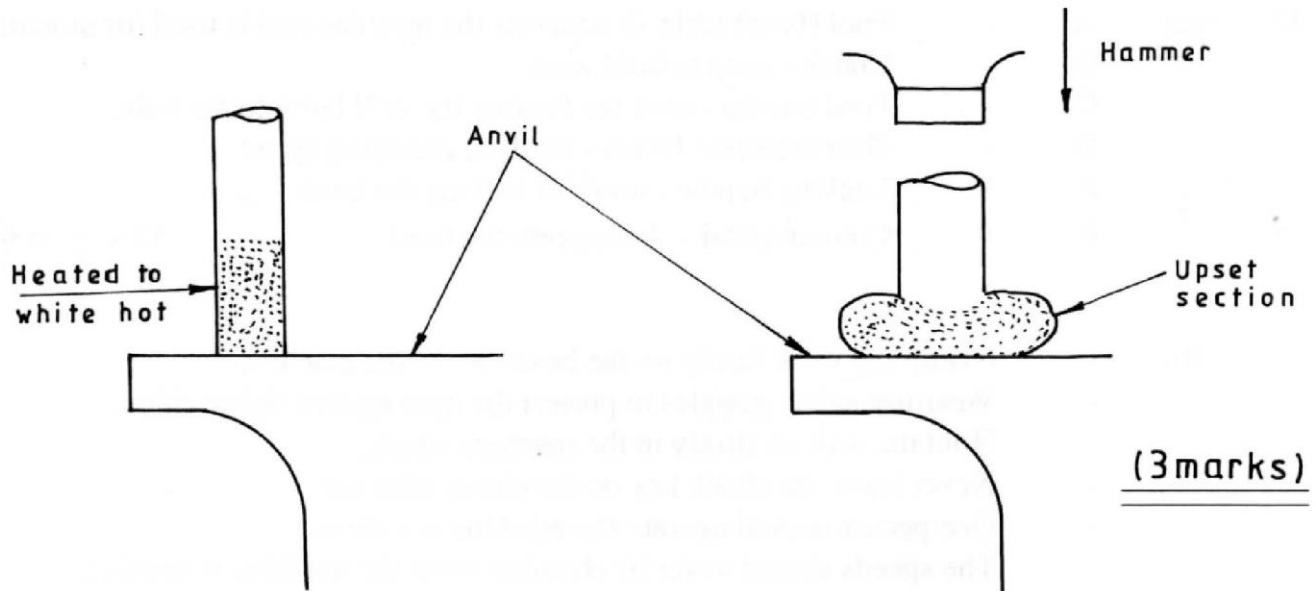   (ii)   Too much rivet shank projecting
- Rivet bends
- Mis-shaped head.

(Any 1 x 1 = 1 mark)

10. (a)
- Polish the article with an abrasive cloth.
- Heat the article with a clean flame until a blue colour appears on the surface
- Dip the article in clean light oil,
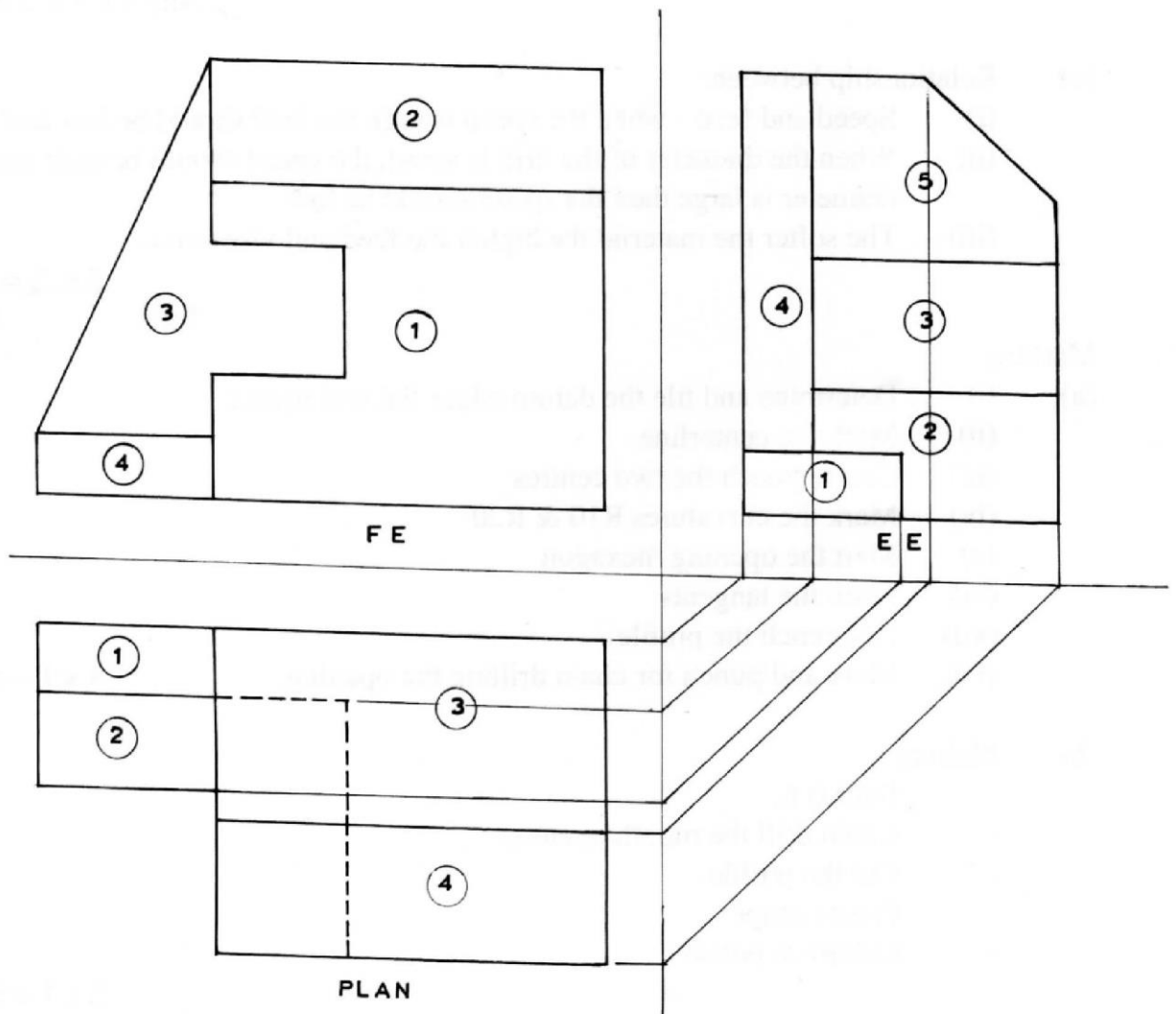- Wipe with a clean cloth after it has cooled.

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

(b)

Hammer

Anvil

Heated to
white hot

Upset
section

(3marks)

11.

2

5

3

1

4

3

2

4

1

FE

EE

1

3

2

4

PLAN

Correct angle of projection = 1 mark

F.E 4 faces@1   =   4 marks
E.E 5 faces 1   =   5 marks
Plan 4 faces 1   =   4 marks
Hidden details   =   1 mark
                    Total =   15 marks

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12. (a) A - Foot (base) table -It supports the machine and is used for mounting
B - Chuck - used to hold work
C - Feed handle - used for feeding the drill but into the hole.
D - Gear selection levels - used for changing speed
E - Locking handle - used for locking the head.
F - Column/pillar - It supports the head. $12 \times \frac{1}{2} = 6$ marks

(b) - Clamp the work firmly on the base/foot of the machine
- Wear/use safety goggles to protect the eyes against flying chips.
- Hold the drill bit firmly in the machine chuck.
- Never leave the chuck key on the chuck after use.
- One person should operate the machine at a time.
- The speeds should never be changed when the machine is running
Any $3 \times 1 = 3$ marks

(c) Relationship between:
(i) Speed and feed - when the speed is high the feed should be low and vise versa.
(ii) When the diameter of the drill is small, the speed should be high and if the diameter is large then the speed should be low.
(iii) The softer the material the higher the feed and vise versa.
$3 \times 2 = 6$ marks
Total   15 marks

13. Marking
(a) (i) Determine and file the datum edges flat and square.
(ii) Mark the centerline.
(iii) Centre punch the two centres
(iv) Mark the curvatures R10 & R20.
(v) Mart the opening /hexagon
(vi) Mark the tangents
(vii) Dot punch the profile
(viii) Mark and punch for chain drilling the opening. $8 \times 1 = 8$ marks

(b) Making
- Drill ϕ 6.
- Chain drill the mouth/opening.
- Cut the profile
- File to shape
- Deburr & polish
$5 \times 1 = 5$ marks

(c) Case hardening
(i) Heat the polished work to cherry red
(ii) Dip in casemite compund/carbon rich compound/use carburising flame
(iii) Re-heat until the compound melts
(iv) Quench in water $4 \times \frac{1}{2} = 2$ marks)

Total = 15 marks)

14. (a) Point A - Taper
Point B - Diamond knurling

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

(b)

Workpiece   Direction of feed

Tool bit   Compound Slide
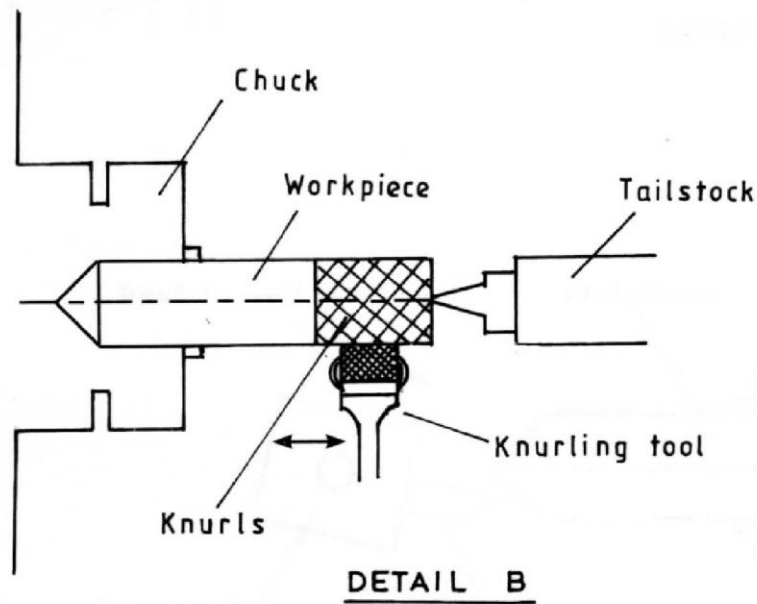
Chuck

DETAIL A
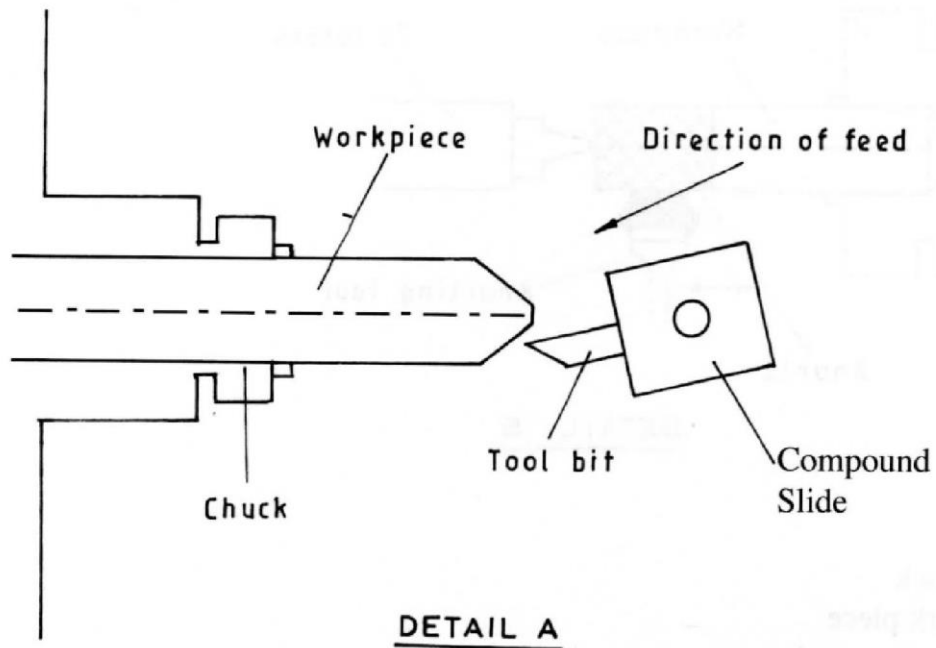
Label

- Chuck
- Work piece
- Toolbit
- Compound slide
- Feed direction

Sketched part

- Chuck
- Work piece
- Toolbit
- Compound slide

Labels   Any $5 \times \frac{1}{2} = 2\frac{1}{2}$
Sketched parts $4 \times 1 = $ 4 marks
Set up $\frac{1}{2}$
                    7 marks

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DETAIL B

Labelling
- Chuck
- Work piece
- Knurling tool
- Tailstock
- Knurling
- Direction of feed

Sketched parts
- Chuck
- Work piece
- Knurling tool
- Tail stock

Labels   Any 5 x $\frac{1}{2}$ = $2\frac{1}{2}$
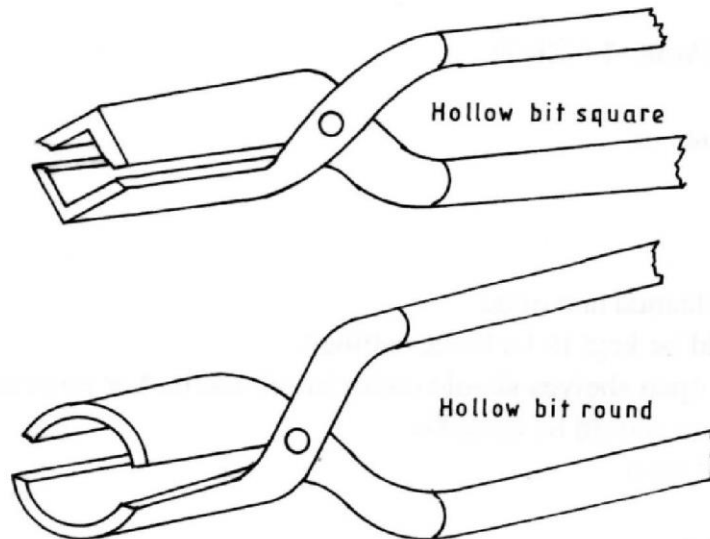Sketched parts 4 x 1 = $\overline{\text{4 marks}}$
Set up $\frac{1}{2}$
                         7 marks

Total   15 marks

15. (a)

Hollow bit square

Hollow bit round

Sketch — 2x2 ꞉ 4
Labelling — 2x1/2 ꞊ 1
                    ꞊ 5 marks

(b)   Uses of a swage block
        -    Punching
        -    Drifting
        -    Drawing down
        -    Flattening
        -    Swaging
        -    Holding swages and stakes   Any 4 x $\frac{1}{2}$ = 2

(c)   (i)   Lighting up
            1.   Open acetylene cylinder valve turn.
            2.   Open oxygen cylinder valve full turn
            3.   Ensure you turn off the needle valves at the torch
            4.   Open the acetylene needle valve to set the required working pressure
            5.   Close the acetylene needle valve
            6.   Open the oxygen needle valve to set the required working pressure.
            7.   Close the oxygen needle valve
            8.   Open the acetylene needle valve and light the torch.
            9.   Increase the acetylene gas until the flame is clear off the soot.
            10.   Open the oxygen torch valve and set the required flame.
                                                                    10 x $\frac{1}{2}$ = 5

        (ii)   Shutting down
            1.   Turn off the acetylene valve at the torch.
            2.   Turn off the oxygen valve at the torch.
            3.   Turn off the regulator valves each at time.
            4.   Turn off the cylinder valve each at time .
            5.   Open the torch valves to clear the pressure in the line.
            6.   Close the torch valve.   6 x $\frac{1}{2}$ = 3
                                                                    Total = 15 marks