

19.0 METAL WORK (445)

The 2010 KCSE examinations for Metalwork consisted of two papers namely Paper 1 (theory) and Paper 2 (Practical Project). The theory was worth 60% while practical was worth 40% of the final mark.

19.1 CANDIDATES GENERAL PERFORMANCE

The table below shows candidates' overall performance for the period 2005, 2008, 2009 and 2010.

Year	Paper	Candidature	Maximum Score	Mean Score	Standard Deviation
2005	1	311	60	23.40	9.60
	2		40	34.90	3.24
	Overall		100	57.74	12.00
2008	1	89	60	23.62	6.96
	2		40	35.62	4.57
	Overall		100	59.24	9.38
2009	1	231	60	25.38	9.09
	2		40	35.34	3.38
	Overall		100	58.74	13.32
2010	1	222	60	22.60	9.09
	2		40	15.25	4.32
	Overall		100	37.70	12.58

From the above table, the following observations can be made.

- 19.1.1 The mean score for the year 2010 is the lowest compared to the means for the other years shown on the table. This is an indication that the paper was poorly performed in 2010 compared to previous years.
- 19.1.2 The number of candidates taking metal work decreased in 2010 compared to other years except 2008 when the number was 89.

19.2 PAPER 1 (445/1)

The questions which were reported to have been poorly responded to will be analysed with a view to pointing out candidates' weaknesses and propose suggestions on some remedial measures that would be taken in order to improve performance in future. The questions for discussions include 1, 4, 5, 10, 11&15 in Paper 1 (445/1).

Question 1

- (a) State four safety precautions to be observed when using a feller gauge
- (b) Distinguish between:
- gross pay and net pay
 - change and balance

Weaknesses

Many candidates saw the two transactions as similar.

Comment

The item of concern here is 1b (ii) which required the candidates to distinguish between the commonly used terminologies of change and balance.

Expected Responses

(a) SAFETY PROCEDURES

- Wipe the blade clean before use.
- Oil the blades fold into case after use
- Don't force blades into gaps.
- Avoid overtightening locking screw.
- Don't expose to heat or corrosive substances
- Do not detach blade from set.

- (b) (i) Gross pay is all payment due before any deductions while net pay is payment due after all deductions.
- (ii) Change is transaction involving exchange of different denominations of equal amount while balance is the amount due after purchase of good or payment of services.

Change is transaction involving exchange of different denominations of equal amounts, while balance is due after payment of goods or services.

Advice

Practical demonstration of the two concepts would help in comprehension. The terms change and balance are used in everyday life, but incorrectly.

Question 4

Use labeled sketch a to show the:

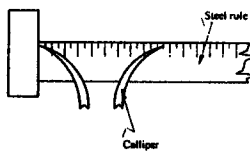
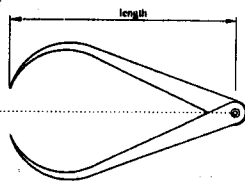
- (a) Length of an outside caliper
(b) Setting of an inside caliper using a rule.

Weaknesses

Whereas sketching the two measuring instruments is not a challenge, labeling of its features was key weakness.

Expected Responses

OUTSIDE CALIPERS



Advice

- In teaching of these instruments, emphasis should be put on identifying and naming their key features.
- Practical use through designed projects would enhance mastery of these key features.

Question 5

Explain the effect of clearance angle when chipping with a chisel.

Weaknesses

Candidates did not understand what clearance angle is, consequently explaining its effect proved challenging.

Expected Responses

(a) CHIPPING ANGLE

Too large clearance angle makes tool point to 'dig' into the work while too small clearance angle tend to cut thin material or slapping.

(b) TWIST DRILL WITH UNEQUAL LIPS

- Excessive wear
- Rough hole and out of round
- Overheating
- Breakage of drill
- Oversize hole

Advice

Concept of various tool angles need to be illustrated and practically demonstrated.

Question 10

Figure 2 shows an isometric drawing of a block.

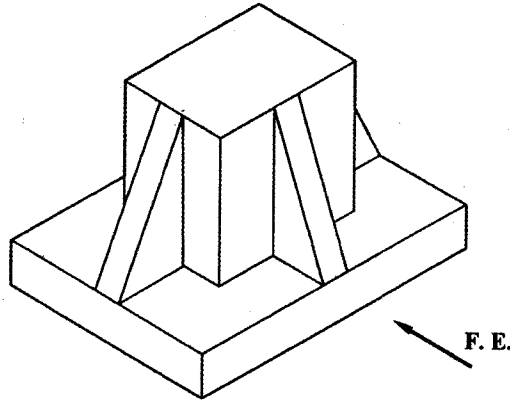


Figure 2

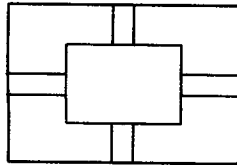
Sketch in third angle projection, the orthographic views of the block.

(5½ marks)

Weaknesses

- Perception of the three orthographic views of a multi-shaped block is an area of concern.
- Interpretation of 1st angle and 3rd angle projection is of concern too.

Expected Responses



Correct F. E., E. E. & Plan (3 x 1 ½)

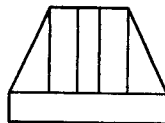
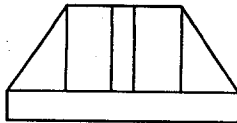
= 4 ½

Correct angle of projection

= ½

TOTAL

= 5 marks



Advice

In addition to clearly illustrating the connections of 1st angle and 3rd projection, it is essential that students are regularly taken through drawing of orthographic views of a block from isometric or oblique and also from orthographic to pictorial (isometric or oblique). Use of physical shaped blocks would help. Proportionality of the drawings should be emphasized.

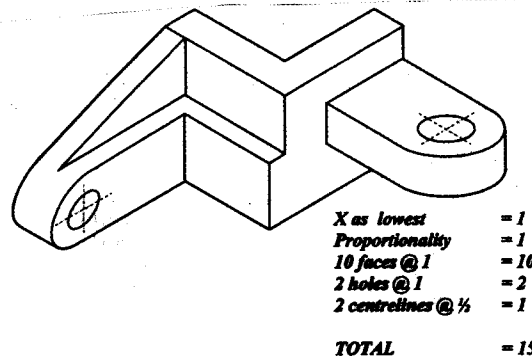
Question 11

On the isometric grid paper, provided, draw the isometric view of the block taking X as the lowest end.

Weaknesses

- Interpreting concept of lowest point, in this case point X, was ignored.
- Despite being a compulsory question, majority of the candidates did not attempt the question.
- Converting multishaped orthographic views to pictorial view is a key weakness.

Expected Responses



Advice

- Though only two views are given in this item, students should be encouraged to visualize or consider constructing the missing view taking into account the stated angle of projection.
- With all the three orthographic views in perspective, construction of the pictorial block would be cross-checked and ascertained.
- Special emphasis should be put on lowest point, while use of grid paper would ensure proportionality is obtained.
- Teaching of construction of isometric circles is necessary.

Question 15

(a) With aid of sketches, show and name two types of soldering bits.

(b) Outline the procedure of:

- (i) Marking opener
- (ii) Shaping opener
- (iii) Making opener resistant to wear.
- (iv) Finishing opener by oil blocking

Comment

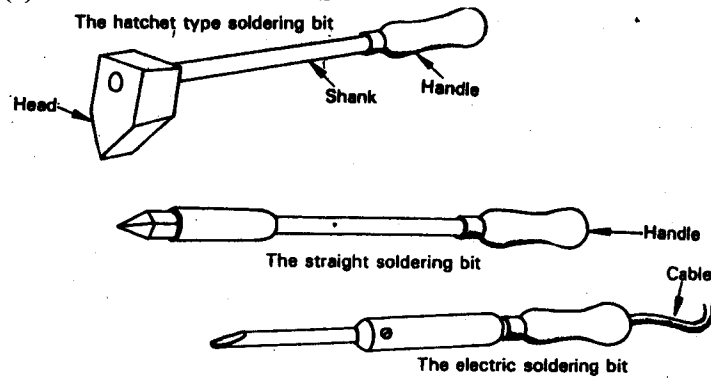
Concern here is on questions 15(b).

Weaknesses

Candidates had a challenge of conceptualizing the sequential task of making the opener. The item itself has four key steps of making the opener, but candidates did not realize that each point stated has key details. Indeed this was the task.

Expected Responses

(a) SOLDERING BITS



(b) (i) MARKING OUT THE OPENER

Curved end: Establish the datum edge
Mark the round end
Mark R II and dot punch

Slot: Mark the two centres and dot punch
Mark and scribe curved ends
Joint the tangents and dot punch

Mouth: Mark centre and punch
Mark the mouth strip width (5 mm)

Curvatures: Prepare template
Align, mark and dot punch.

(ii) SHAPING

Curved end: Drill $\text{O } 10$ hole
Cut and remove excess materials
File to shape the curved end.

Slot: Drill $\text{O } 10$ holes on both ends
Chain drill
Chise out
File to size and shape

Mouth: Drill $\text{O } 12$ hole
Cut out
File strip to width and shape

Curvatures: Make relief cuts
Chise/cut
File to shape

(iii) RESISTANT TO WEAR

Heat to cherry red and dip in carbon rich solution
Quench in water/oil

- (iv) **OIL BLACKING**
Clean to obtain smooth surface
Heat to red hot
Coat with clean oil
Heat and let cool
Wipe to clean

Advice to Teachers

- In all project work, students should be encouraged to write step by step procedure of performing a task.
- Broadly each project involves marking, shaping and finishing. Each of these tasks would have detailed steps which need to be stated in point form and in a logical sequence.

29.17 METAL WORK (445)

29.17.1 Metal Work Paper 1 (445/1)



MANYAM FRANCHISE
Discover! Learn! Apply

SECTION A (40 marks)

Answer ALL the questions in this section.

- 1 (a) State **four** safety precautions to be observed when using a feeler gauge. (2 marks)
- (b) Distinguish between:
- (i) gross pay and net pay;
- (ii) change and balance. (2 marks)
- 2 (a) State the reason for applying chalk on a file when filing. (1 mark)
- (b) With the aid of a sketch explain the term “kerf” as applied to metal cutting. (1½ marks)
- 3 (a) Name **three** marking out tools required when setting a measurement on a scribing block. (1½ marks)
- (b) List **four** specifications required when purchasing rivets. (2 marks)
- 4 Use labelled sketch to show the:
- (a) length of an outside caliper;
- (b) setting of an inside caliper using a rule. (4½ marks)
- 5 (a) Explain the effect of varying the clearance angle when chipping with a chisel. (2 marks)
- (b) State **four** effects of using a twist drill bit with unequal lip angles. (2 marks)
- 6 (a) State the difference between tinplating and galvanising.
- (b) Explain **two** methods of galvanising materials. (2 marks)
- 7 (a) List **five** materials used in making soft hammer heads. (2½ marks)
- (b) Name **three** types of tinsmith hammers. (1½ marks)

8 (a) Define the following terms as applied to brazing;

- (i) spelter;
- (ii) capillary action.

(2 marks)

(b) Figure 1 shows a cross-section of a forge.

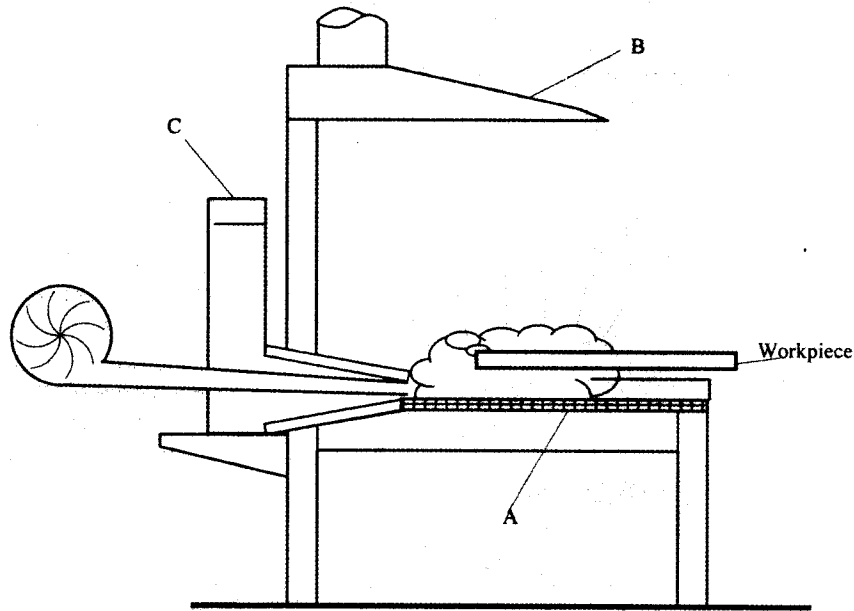


Figure 1

(i) Name appropriate material for constructing part A and state **one** reason for using it.

(ii) State what would happen if part B is faulty.

(iii) Name part C and state its function. (3 marks)

9 (a) Use a labelled sketch to show the rightward welding technique. (2 marks)

(b) State **three** advantages of using rightward over leftward welding techniques. (3 marks)

10 Figure 2 shows an isometric drawing of a block.

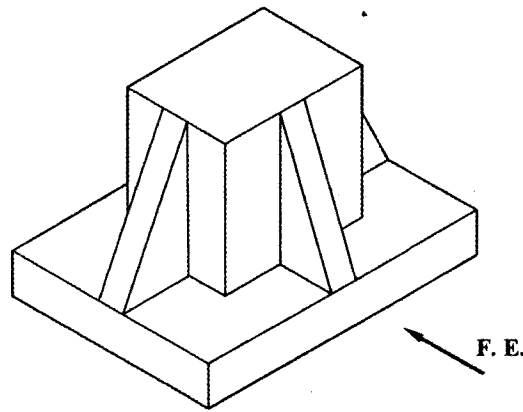


Figure 2

Sketch in third angle projection, the orthographic views of the block.

(5½ marks)

SECTION B (60 marks)

*Answer question 11 and any other **THREE** questions from this section.
Candidates are advised to spend not more than 25 minutes on question 11.*

- 11** Figure 3 shows orthographic views of a block drawn in first angle projection. On the isometric grip paper provided draw the isometric view of the block taking X as the lowest end. (15 marks)

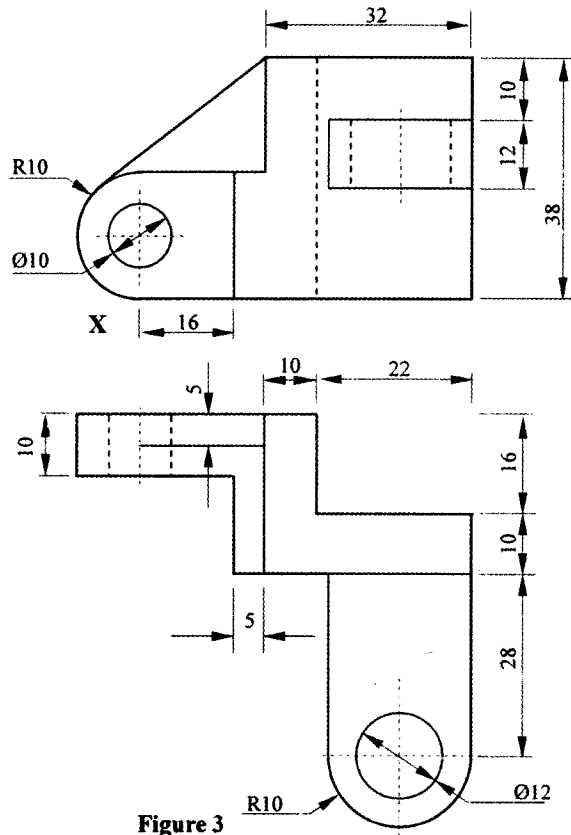


Figure 3

- 12** (a) Using labelled sketch, show and name the **three** commonly used types of fits. (9 marks)
- (b) Sketch and show the following readings:
- (i) a 12.65 mm on a micrometer scale;
 - (ii) a 46.98 mm on vernier scale of 0.02 mm accuracy. (6 marks)

- 13 (a) Outline the procedure of:
- (i) lacquering a surface using a brush;
 - (ii) preparing a ready-made article for planishing;
 - (iii) planishing the article in a(ii).
- (8½ marks)
- (b) With respect to oxy-acetylene welding equipment:
- (i) use labelled sketches to show the three types of welding flame;
 - (ii) outline the procedure of testing the equipment for leaks.
- (6½ marks)
- 14 Figure 4 shows a garden trowel with a curved blade and a tang to be made from 1.6 mild steel sheet and 8.0 diameter mild steel rod respectively.

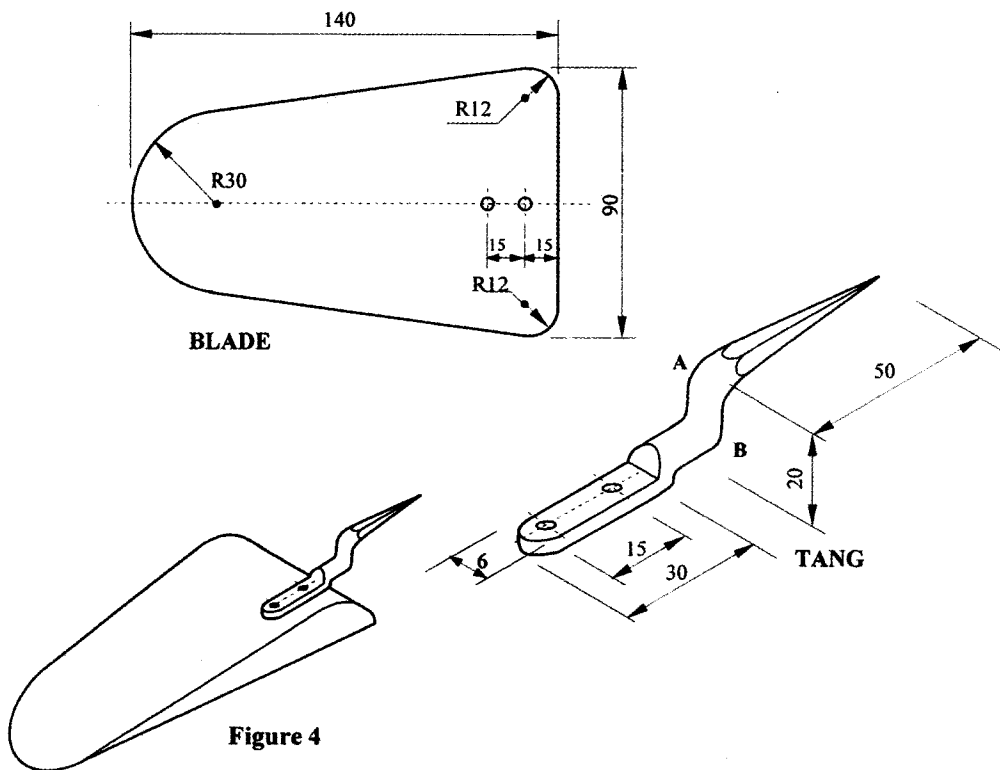


Figure 4

With the aid of five different sketches, outline the procedure of making the trowel and list all the tools used in each step. (15 marks)

- 15 (a) With the aid of sketches, show and name **two** types of soldering bits. (3 marks)
- (b) Figure 5 shows a bottle opener made from a 3.0 mild steel plate 105 x 25 x 3.

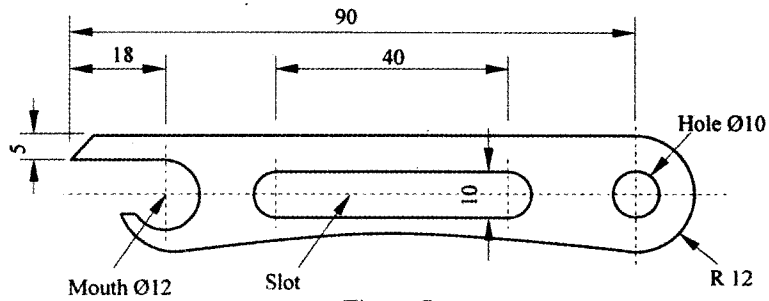


Figure 5

Outline the procedure of:

- (i) marking the opener to the required size;
- (ii) shaping the opener to size;
- (iii) making the opener resistant to wear;
- (iv) finishing the opener by oil blacking.

(12 marks)

30.17 METAL WORK (445)



MANYAM FRANCHISE
Discover! Learn! Apply

30.17.1 Metal Work Paper 1 (445/1)

1. (a) **SAFETY PROCEDURES**
Wipe the blade clean before use
Oil the blades fold into case after use
Don't force blades into gaps
Avoid overtightening locking screw.
Don't expose to heat or corrosive substances
Do not detach blade from set.

Any 4 x ½

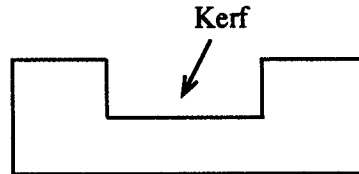
- (b) (i) Gross pay is all payment due before any deductions while net pay is payment due after all deductions.
(ii) Change is transaction involving exchange of different denominations of equal amount while balance is the amount due after purchase of good or payment of services.

2 x 1

2. (a) **REASON**
To minimize clogging the teeth of the file

1 x 1

- (b) **KERF**



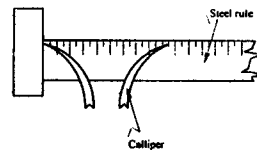
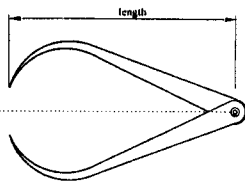
Is the width of a cut produced by the setting of the teeth of a saw blade.

(1½ marks)

3. (a) **MARKING OUT TOOLS**
Surface plate or scribing block
Steel rule
Angle plate.

3 x ½

4. **OUTSIDE CALIPERS**



5. (a) **CHIPPING ANGLE**
Too large clearance angle makes tool point to 'dig' into the work while too small clearance angle tend to cut thin material or slapping.

2 x 1

- (b) **TWIST DRILL WITH UNEQUAL LIPS**
Excessive wear
Rough hole and out of round
Overheating
Breakage of drill
Oversize hole

Any 4 x 1

6. (a) **TINPLATING AND GALVANISING**
 Tinplating is coating mild steel sheets with tin while galvanizing is coating mildsteel sheets with Zinc. 2 x 1

(b) **METHODS OF GALVANIZING**
 Hot dipping where cleaned and flux coated sheets are dipped in bath of molten tin/zinc.
 Spraying with metallic coating of tin or zinc. 2 x 1

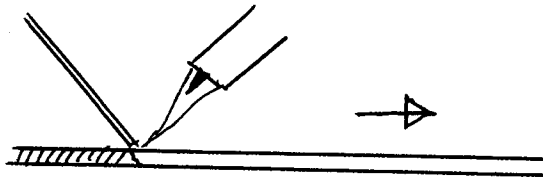
7. (a) **SOFT HAMMER HEADS**
 Copper
 Lead
 Raw hide
 Plastic
 Wood Any 4 x 1

(b) **TYPES OF HAMMERS**
 Stretching hammer
 Raising hammer
 Planishing hammer 3 x ½

8. (a) **DEFINITIONS**
 Spelter: the copper and zinc alloy used in joining.
 Capillary Action; the attraction of molten metal into the joint.

(b) **FORGE**
 (i) Bricks for good heat retention
 (ii) Sparks and smoke would not be arrested causing discomfort in working areas.
 (iii) Water bosh containing water for cooling the tuyeres. 3 x 1

9. (a) **RIGHTWARD WELDING TECHNIQUE**

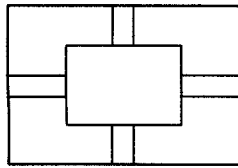


(b) **ADVANTAGES** 2 Marks

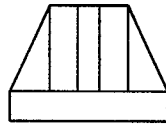
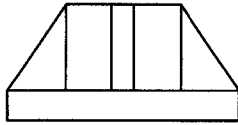
Provides better view while welding hence better joint
 Produces less brittle joint as flame anneals joint
 Provides better penetration as parent metal is pre-heated
 Faster than leftward hence less gas used.

Any 3 x 1

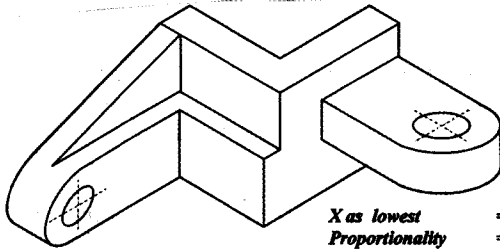
10.



Correct F. E., E. E. & Plan (3 x 1 ½) = 4 ½
Correct angle of projection = ½
TOTAL = 5 marks

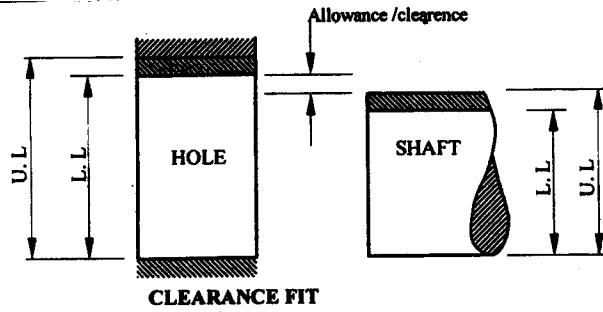


11.

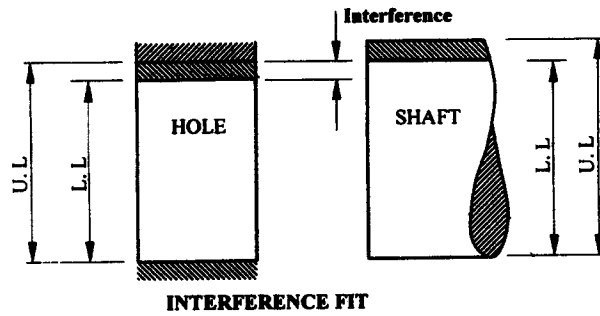


X as lowest = 1
Proportionality = 1
10 faces @ 1 = 10
2 holes @ 1 = 2
2 centrelines @ ½ = 1
TOTAL = 15

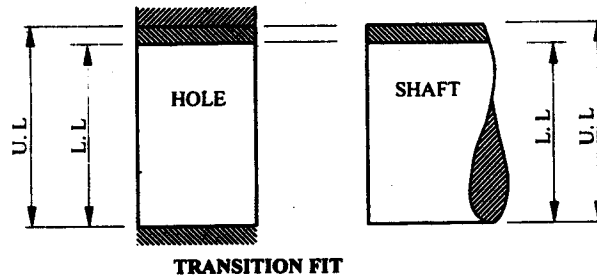
12. (a) TYPES OF FITS



CLEARANCE FIT
(3 marks)



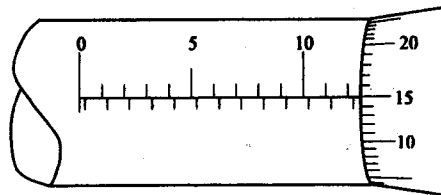
INTERFERENCE FIT
(3 marks)



TRANSITION FIT
(3 marks)

(b)

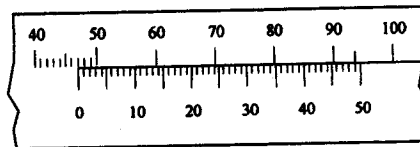
(i)



Main scale 1 mark
Thimble 1 mark
Correct reading 1 mark

(ii)

Main scale 1 mark
Vernier scale 1 mark
Correct reading 1 mark



13. (a)(i) LACQUERING

- Clean the surface/article $\frac{1}{2}$
- Warm the article $\frac{1}{2}$
- Apply the lacquer using brush from centre endwards $\frac{1}{2}$
- Apply to dry in a warm dust free room $\frac{1}{2}$
- Apply a second coat and allow to dry $\frac{1}{2}$

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

(ii) PREPARING FOR PLANISHING

- Anneal the article ½
- Pickle the article ½
- Buff with polishing compound ½
- Wash and dry the article. ½

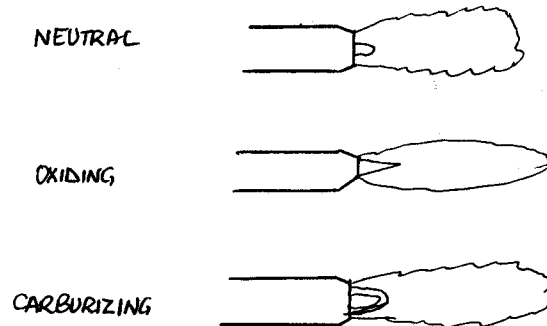
4 x ½

(iii) PLANISHING

- Position the article on planishing stake
- Gently hammer from centre of article outward
- Rotate article while hammer continues
- Ensure hammer marks overlap slightly.

4 x 1

(b)



1½ x 3

(ii) TESTING EQUIPMENT FOR LEAKS

- Close the torch needle valve ½
- Pressurise the system by opening the valves ½
- Apply soapy water on all the valves and any other suspected areas ½
- Look for bubbles to determine any leakage. ½

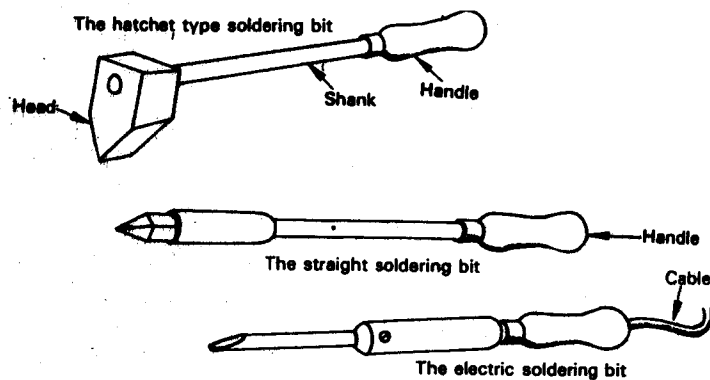
4 x ½

14. MAKING TROWEL

- Mark out the holes and other dimensions
- Cut out the blade and file to shape.
- Drill one hole on the blade
- Form the blade to shape on the anvil beak
- Heat and draw down the tang
- Bend the tool position of the tang to required measurement
- Head and flatten the end to be riveted to 3 mm thick
- File and mark for drilling
- Centre punch the two holes and drill
- Align blade to tongue and rivet on hole
- Drill the remaining hole and rivet
- Debur the work

Steps	12 x ½
Appropriate sketches	Any 5 x 1
Corrected tools listed	8 x ½
TOTAL =	15 marks

15. (a) SOLDERING BITS



ANY 2

Sketches 2 x 1
Labelling 2 x ½

(b) (i) MARKING OUT THE OPENER

Curved end: Establish the datum edge
Mark the round end
Mark R II and dot punch

Slot: Mark the two centres and dot punch
Mark and scribe curved ends
Joint the tangents and dot punch

Mouth: Mark centre and punch
Mark the mouth strip width (5 mm)

Curvatures: Prepare template
Align, mark and dot punch.

4 marks

(ii) SHAPING

Curved end: Drill ϕ 10 hole
Cut and remove excess materials
File to shape the curved end.

Slot: Drill ϕ 10 holes on both ends
Chain drill
Chise out
File to size and shape

Mouth: Drill ϕ 12 hole
Cut out
File strip to width and shape

Curvatures: Make relief cuts
Chise/cut
File to shape

4 marks

(iii) RESISTANT TO WEAR

Heat to cherry red and dip in carbon rich solution
Quench in water/oil

1½ marks

(iv) OIL BLACKING

Clean to obtain smooth surface
Heat to red hot
Coat with clean oil
Heat and let cool
Wipe to clean

2½ marks